Cattle, Food, and the Rise of Early Ireland

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Dedication

To Alexander, for your love, support, and inspiration today and every day. I love you most of the most.

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Abstract

In Ireland, at the end of the Developed Iron Age, the large regional centers that had come to significance were closed and communities that had coalesced during this period, dispersed. The Late Iron Age (1-431 AD) lacks the hallmarks of a highly stratified society. In the centuries that followed (432-1179 AD), social and political relationships were mediated through cattle and dairy products in a system referred to as a ‘dairying economy’. The mechanisms for the development of this system, however, are not well understood. This project examines the role of agricultural economies in the development of social organization and political economies across the 1st millennium AD. I address these questions using zooarchaeological methods, comparing taxonomic diversity and evenness across faunal assemblages and the analysis of the faunal remains from Ninch, Co. Meath. The comparative analysis demonstrates a greater diversity of animal husbandry practices during this broad period, including beef herding, mixed strategies, and provisioning, in addition to dairy herding. The analysis of the faunal assemblage from Ninch also demonstrates the wide variety of animal species exploited during this period and how one community negotiated social and economic change. These data reveal the valorization of cattle and the development of a system of cattle wealth in the Late Iron Age and the shift to dairy wealth in the early medieval period as a wealth management strategy.

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Chapter 1

Introduction

In the Irish Iron Age (~5th century BC-5th century AD) large central monuments (civic-ceremonial centers formerly called the ‘royal’ sites) were constructed and high-status art objects were produced, but with – until recently – few recorded settlement sites, we know little about exchange, political organization, and economy in late prehistoric society. With the advent of written texts and a proliferation of settlement construction, we know considerably more about the early medieval period (431–1179 AD). This later period is characterized by a dairying economy, one in which social and political interactions are negotiated through cattle, milk, cheese, and butter. It has been assumed that the dairying economy was a product of contact with Roman Britain, however the development of this system is not well understood. This project seeks to better understand the interrelationships between agricultural and political economies in the 1st millennium AD.

The second half of first millennium AD, agricultural economies in Ireland shifted to emphasize livestock husbandry but with a gradual increase in cereal grain production (Kerr et al 2011; Kerr et al 2013; McCormick 2007b, 2008, 2013; McCormick et al 2011; O’Sullivan and Nicholl 2011; Soderberg 1998). The lack of recorded settlement sites prior to this in the late Iron Age was initially thought to demonstrate demographic collapse, caused by poor environmental conditions for grain production. Recent paleoenvironmental research, however, suggests that environmental conditions were favorable to grain production but that agricultural activities focused on pastoral practices, or raising livestock (Hall 2011; Chique, Molloy, and Potitio 2017; O’Carroll and Mitchell

2017). The suggestion that Iron Age agricultural practices were pastoral is compelling and needs to be corroborated with other kinds of archaeological evidence, including faunal assemblages which can reveal animal husbandry strategies and faunal economies.

Analyzing animal husbandry and faunal economies can help us to understand social and political structures. The economic elevation of animals and animal products results in specialized husbandry practices and the production of certain animal products. For instance, the ritual consumption of animals and animal products creates demand for domestic production. By ritual, I mean regularly repeated acts that embody the beliefs of a group of people and creates a sense of community or belonging (Guest 2018) and by *ritual consumption*, I mean practice of eating special foods during a ritual performance. Rowley-Conwy (2018) described the material evidence of such consumption as 'ritually charged garbage.' Husbandry practices employed to meet these demands shape the ways that people use and move across the landscape, relate to one another, and form communities. Hastorf (2016) demonstrates how the procurement and production of food defines economic pressures and constructs social difference. Hastorf's work builds off a body of research (Dietler 1999; Dietler and Herbich 2010; Geertz 1980; Twiss 2007; 2012) that explores the role that food and food choice play in constructing community and identity, our understanding of ourselves and our worldview.

Previous investigations of Iron Age economies in Ireland have focused on zooarchaeological evidence solely from ceremonial centers. Increased cattle consumption at these sites suggests a social and ritual function of these animals. To reconstruct Iron Age economies, however, we must compare these data to other site types, such as settlements and industrial sites that have been excavated in recent years ahead of road construction and housing developments. Through this project I investigate the role of animal husbandry practices during periods of social and political change.

Research Objectives

Our understanding of Irish archaeology has suffered under the belief that there is insufficient evidence to understand the nature of Iron Age society in Ireland. However, development led research has made more evidence available and new analytical frameworks will allow us to reconsider the questions that this period poses. There is much we can learn from examining previously excavated materials that may fundamentally alter our perception of this period. Through the study of Iron Age Ireland, we may better understand the interconnections between faunal economies and political economies, and identity construction and change.

Research into the animal and political economies of the early medieval period in Ireland suggests that a dairying economy developed through contact with Roman Britain. However, no comprehensive research has been conducted that examines the relationship between animal economies and political economies in Ireland. It is important to note that I use the terms ‘animal economies’ and ‘faunal economies’ to represent the use of animals in economic systems (their production, consumption, and exchange) that extend beyond consumption or subsistence. This is similar to the use of the term ‘dairying economy’ to represent more than the production of dairy products but the importance of the exchange value of dairy products in Irish society. By examining the herd demographics, represented in the bone assemblages from late Iron Age sites, this study seeks to understand the role that animal economies played in the development of political economies of the late Iron Age and an early medieval dairying economy. To understand this, I have developed three hypotheses and predictions:

Hypothesis 1: Husbandry practices in the late Iron Age focused primarily on cattle for dairying.

Cross-comparative analysis of Iron Age faunal assemblages will have evidence of dairy herds. Dairy herds will be represented morphologically by high proportions of juveniles and older individuals with few prime age individuals, a dominance of females over males, and low levels of heterogeneity and evenness.

Prediction 1: If animal husbandry practices in the Iron Age focused primarily on cattle for dairying, then most sites would demonstrate herd demographics favoring the production of cows for milk production.

Hypothesis 2: Animal economies in the late Iron Age were focused on cattle; indicating a system of cattle wealth.

Archaeological faunal assemblages from Iron Age sites will have a higher proportion (%NISP) of cattle than other species with low levels of heterogeneity and evenness. Cattle husbandry strategies will neither be strongly suggestive of dairy production or beef production but will represent mixed strategies.

Prediction 2: If animal economies in the late Iron Age were focused on accumulating cattle wealth, then faunal assemblages will have low levels of heterogeneity and evenness, high proportions of cattle but cattle husbandry strategies that neither fit the expected proportions for either dairy or beef herding.

Hypothesis 3: Cattle became less economically important over the course of the 1st millennium AD, rather than suddenly in the 9th century; suggesting the longevity of the economic strategy.

Prediction 3: If agricultural economies changed slowly over the course of the 1st millennium AD, then a comparison of sites from across this period would show gradual increases in diversity and evenness in faunal assemblages. Increased heterogeneity and evenness indicate that a wider variety of animals were exploited and there was not a particular focus on one species.

By determining the desired animal products reflected in the livestock demographics, we may determine more generalized animal husbandry practices. For instance, a greater emphasis on dairy would reflect pastoral practices whereas a greater emphasis on traction or mixed agricultural practices would reflect a greater concern for grain cultivation (Sherratt 1981, 1982; Greenfield 2010**)**. This assumes, however, that depositional practices were consistent over time. To limit the impact of compressing different occupational phases and agricultural strategies, only faunal assemblages that can be dated to either the late Iron Age or the early medieval period were used (by dividing individual faunal assemblages by occupational phase). Sites that contain multiple phases of activity will further be analyzed to measure change in taxonomic heterogeneity and evenness across different phases of occupation (as determined by stratigraphic and radiocarbon analysis). These hypotheses address additional research questions posed by this study, such as: How did the nature of cattle husbandry shape social and political structures in the Iron Age? Different animal husbandry strategies structure social organization.

By identifying agricultural strategies in the Iron Age, we will be able to understand the nature of Iron Age social organization. How and in what ways did the animal economies affect ritual behavior? Understanding domestic economic strategies will help to clarify the relationship between domestic economies and ritual economies. For instance, we can compare consumption practices (by species proportion and cut marks) at sites with evidence for settlement and sites with evidence of ritual practice (i.e., burial sites) as well as impact on depositional practices (e.g., bog butter). How and in what ways did animal husbandry practices shape identity in Iron Age society? Through faunal analysis, we can understand the importance of animal husbandry practices in society and the relationship that people had to their animals (through human-animal burial practices and carnivore modifications on animal bone). And how and in what ways do animal or commodity economies affect political economies? By examining animal husbandry strategies and the importance of secondary products (through herd demographics), we can understand the role of these strategies in the production, consumption, and exchange of goods.

Cattle Life History and Domesticated Animal Research

Interpretations of cattle exploitation and husbandry strategies are based on cattle life histories and expected agricultural demographics. While domestic cattle today reproduce year-round, this is due to human intervention and modern husbandry strategies. Premodern cattle husbandry strategies would have been reproduced seasonally. Feral cattle and European bison, without human intervention, typically give birth in the spring between from May to July (Gron, Montgomery, and Rowley-Conwy 2015) and some modern breeds that give birth seasonally will calf between February and April (Gillis 2017).

Cows give birth to just one calf a year, with a 9-month gestation period. With a minimum drying-up period of 2-months to allow for recuperation of the udder (Gron, Montgomery, and Rowley-Conwy 2015), cows bred intensively would have to wean their calves at 10 months old. Gillis (2017) found that there was a wide age range at which cattle breeds are weaned, however there are modern methods to stimulate the let-down response (a biological response in cows to produce milk in the presence of young). Still, some modern breeds and semi-wild cattle will wean their young between 9-15 months old.

Cattle later become sexually mature around 10-24 months old, with bulls becoming sexually mature earlier than females, and both finally reach their full adult sizes between 2-2.5 years old (Gillis 2015; and Halstead and Isaakidou 2017). Then, without human intervention, domestic cattle can live up to 20+ years (Jones and Sadler 2012). Jones and Sadler (2012) found that age estimates for young cattle to be, "…precise and very useful data for cattle up to three years old" (9). This is beneficial as mandibular age estimates may be used to identify both slaughter of juveniles around the time of weaning and individuals as they reach their full adult size around 2-2.5 years.

In 1973, Sebastian Payne developed a series of expected mortality profiles for milk and meat sheep husbandry strategies. These profiles were based on expectations for market economies. As such, according to Payne (1973), mortality profiles reflecting dairy herds should have a peak of slaughter of juvenile-early subadults (mostly males) and very old age (mostly females). This is because once the young have been weaned, juveniles would compete for fodder with adults and many males are not required for herd maintenance. Alternatively, herds raised for meat would expect to have a peak of slaughter at the age when livestock reach their full adult size. After this point, livestock add less meat per amount of fodder and so the returns on the investment for that animal decrease. In a meat herd, there might be more males slaughtered at prime age than females, as a greater number of females would be required to replenish the herd than males.

Many scholars have used Payne's models to identify dairy production among early farming communities. This includes studies by Davis (1984), Gilbert and Steinfeld (1977), Whitcher *et. al.* (1998), Greenfield (1984, 1988, 2005, 2010), Legge (1989), Sakelardis (1979), Halstead (1987), and Rowley-Conwy (2000), all identifying early dates for dairy production. There have been some caveats, particularly based on the inability for cows to produce milk in the absence of young due to the let-down response, which would mean that rather than high infant mortality, zooarchaeologists should expect a post-lactation peak of slaughter (Balasse *et al* 2000; and Vigne and Helmer 2007). Halstead (1998) drew on ethnographic studies of Greek sheep herders and historical accounts of British milking practices to demonstrate that environmental and nutritional stress could also impact the let-down response. And McCormick (1992) cites documentary evidence from seventeenth century Ireland, corroborating this timeline and therefore suggests that calves slaughtered at less than 9-12 months of age would not be sufficient evidence for dairy production.

Such economic interpretations of mortality profiles have been critiqued for their inability to account for non-specialized subsistence practices. Redding (1984), Cribb (1987), and Stein (1989) all argue that subsistence herders often seek to increase their flocks to insure survival in the face of natural and/or accidental catastrophic losses. Additionally, Cribb (1987) contends that, to some degree, specialized herding practices are difficult to assume from mortality profiles because meat and wool would be natural biproducts of increased milk production as individuals are raised and slaughtered to achieve an ideal herd composition. For these reasons, analysts should consider the possibility of alternative husbandry practices, including mixed product strategies (achieving both milk and meat).

Nerissa Russell (2012) cautions that, "…the wealth value of animals may also have encouraged the maximization of herd size at the cost of optimal production" (225). Therefore, the social role of animals as wealth may also impact herd structure and composition. For instance, while one species may dominate the faunal assemblage, smaller livestock species will also be raised on the same site. Small stock may be exchanged in the absence of large livestock and small stock may also be slaughtered for consumption in lieu of large livestock as large livestock slaughter is wealth destruction. Cattle will also be bred smaller and will overstock pasture to prioritize the number of cattle over the quality of beef. As a result, cattle in the assemblage will tend towards older individuals and may be smaller in stature.

In the archaeological literature of the early medieval period sites in Ireland, zooarchaeological analyses of agricultural practices (cattle husbandry, specifically) discuss sites in terms of 'dairy' herds, 'beef' herds, or 'provisioned' sites, focusing on the division between producer and consumer sites. Dairy herds are represented in faunal assemblage age-at-slaughter data with a high proportion of juveniles and older individuals, with the older individuals mostly represented primarily by females. Beef herds are represented in faunal assemblage age-at-slaughter data with peaks around 24-30 months. 'Provisioned' site faunal assemblages present herd demographics that neither fit the expected model for dairy nor beef production, but more closely resemble assemblages from urban sites, particularly early medieval Dublin, for which cattle have been brought in from the hinterland. At these sites, most cattle were slaughtered at 36+ months.

Drawing comparisons to urban settlements runs counter to the narrative that Ireland was an island without cities and towns prior to the settlement of the Norse. However, rather than representing early towns or proto-urbanization, the diversity in cattle production practices represents a complex system of cattle wealth and exchange rather than, necessarily, local agricultural practices. The herd demographics that are considered evidence for provisioning are also the herd demographics that Russell (2012) identifies as evidence for cattle wealth. The presence of 'provisioned' sites might therefore represent sites that represented local seats of power for which cattle would have been brought as tribute and taxes, as indicated by the early Irish law tracts, rather than as purely consumer sites.

Geographic and Temporal Context

Ireland is an island at the furthest reaches of northwestern Europe. The island itself is ringed with upland regions (its highest peak, Carrauntoohil, 1,038m high) with low-lying lands in the middle, including 12,000km² of bogland. To the east, Ireland is bordered by the Irish Sea, with the western Scottish coast, its nearest terrestrial neighbor, 20 kilometers away (the Isle of Man is 34 kilometers away). To the south, it is bordered by the Atlantic Ocean, with Wales, Cornwall, and Brittany beyond. And to the west and north, Ireland is bordered by the Atlantic Ocean for hundreds of kilometers. Because of its proximity to the Atlantic Ocean, and the warm Gulf Stream current, Ireland's modern climate is mild, with annual temperatures averaging between 6-12.8℃ (43-55°F), with summer highs around 19℃ (66°F) and winter lows near 2.5℃ (37°F). Annual precipitation in Ireland ranges from 750-1400mm (30-55"), with the southwest of Ireland receiving more rain than the east.[1]

This, however, has not always been the case. During the last glacial maximum, Ireland was underneath the ice sheet that extended across Northern Europe. As the ice began to retreat, plants and animals recolonized the island via a land-bridge connecting Ireland to the other British islands and to Continental Europe. Arctic plants and animals

[1] Data collected and archived by Seirbhís Náisiúnta Meitéareolaíochta na hÉireann (MET Éireann) - Ireland's national weather service.

arrived first, finding Ireland's steppe tundra environment hospitable. During this period, the sea level rise flooded the land-bridge connecting Ireland to the Continent, trapping wild species, including wild pig, bear, wild cat, hare, *Canis sp.* (wolf and fox), and lynx, and creating a barrier to widespread human migrations until the Mesolithic period (McCormick 2007b). Due to the periods of glaciation and relative isolation from the Continent in later periods, Ireland has fewer freshwater fish species than can be found in Continental Europe (McCormick 2007b; Searle 2008).

During the post-glacial period, Ireland's temperature continued to increase. Ireland reached a climatic optimum around 6000 BC, lasting several thousand years, with temperatures 1-2℃ warmer than today (Waddell 2010). The increase in temperatures encouraged the growth of pine, elm, oak, and hazel trees, outcompeting prior birch woods. Warmer temperatures and rich woods and coastline also encouraged the migration of human populations around 8000 BC. There is some evidence that there was a Paleolithic human occupation of Ireland, though it is not yet known how extensive this occupation once was (Dowd and Carden 2016).

In the Mesolithic (8,000-4,000 BC), human colonists arrived via sea routes from Britain, foraging along coasts and estuaries. These hunter-gatherer groups took advantage of wild species, particularly the rich marine resources and wild pig. Evidence suggests that these groups moved across the landscape to exploit seasonally available food sources (Woodman 2015). Sites of this period are found along the coasts, such as Mount Sandel (Co. Derry) and Ferriter's Cove (Co. Kerry), consisting of small seasonal or intermittently occupied sites, stone tool manufacturing sites, and shell middens. This period is characterized by hunter-gatherer subsistence strategies, microlith technology, and the development of Bann flakes. Bann flakes are leaf-shaped bifacial, butt-trimmed, projectile points, first identified near the Bann River. In the later Mesolithic, groups began to establish more permanent settlements and exploit imported domesticated species.

The introduction of livestock and arable agriculture in Ireland led to the development of a series of major cultural changes, famously including the development of megalithic burial monuments. The Neolithic period (4,000-2,500 BC) is characterized by land clearance, settled semi-permanent farmsteads, as well as a proliferation and elaboration of ritual practice and material culture. During this period, there was significant regional variation in settlement strategies and ritual practice, as well as distinct changes over time. Rather than being static, this period saw considerable fluctuations in archaeological visibility, suggesting cultural changes or a population decrease during the Middle Neolithic to the Bronze Age transition (Stevens and Fuller 2012; McClatchie et al. 2016; McLaughlin et al. 2016). Common sites of this period include permanent farmsteads and enclosures, field systems, pit and spread complexes, trackways, early timber circles, as well as several forms of megalithic tomb structures (portal, court, passage, and Linkardstown type).

Following the Neolithic, the Bronze Age in Ireland (2,500-700 BC) is characterized by the introduction of metalworking technologies. This new material and these new technologies were accompanied by changes in the social landscape, with increased social differentiation and the development of a hierarchy of site types and fortified settlement forms, including embanked enclosures, hilltop settlements, and hillforts. Ritual practices changed during this time, shifting from megalithic monuments and collective burial to cremation cemeteries and individual urn burials, and the development of stone circles and henge monuments. The use of metal resulted in the development of new utilitarian objects, weapons, and personal ornamentation, with bronze predominately being used for weapons and gold being used for a variety of objects of personal adornment.

The Iron Age (~800 BC – AD 431) like the preceding Bronze Age, is also defined by the introduction of new metalworking technologies. The introduction of iron working was expressed in several utilitarian object types, though many more may have once existed but have since decomposed (corroded to nothing). During this period there were also significant changes in domestic and ritual expression as well as increased contact with Britain and the Continent. Contact with the Continent is particularly notable in the appearance of several Continental object types and La Tène design, which originated in central Europe around the 5th century BC. This design style is known for its use of spirals, triskeles, lentoid designs, and stylized anthropomorphic and zoomorphic figures and, in Ireland, appears on high status metal objects, often found in ritual contexts (metalwork hoards and burials) rather than domestic contexts. During this period, large ceremonial sites suggest consolidation of political power and increased social complexity that began in the Bronze Age. Until recently, little was known about the Iron Age beyond what was evident at some of the large civic-ceremonial centers (Rathcrogan, Navan Fort, the Hill of Tara, and Dún Ailinne), preserved bog trackways and structured deposits in watery places.

The arrival of Christianity is considered the marker of the beginning of the early medieval period (AD 431-1179) and the arrival of Strongbow and the Anglo-Normans, the marker of the end. The mission of Bishop Palladius to the Irish is thought to have begun in AD 431, sent by Pope Celestine. St. Patrick was said to arrive in Ireland the next year, AD 432, to convert the Irish as well, per his *Confessio*. Settlement during this period became much more visible on the landscape with the development of fortified enclosed settlements called ringforts or native enclosed settlements. These small settlements consist of an annular bank and ditch system (from one to three concentric rings) enclosing an open space used for habitation or industrial activities. There are 47,000 of ringforts recorded in Ireland (O'Sullivan et al 2013), though only a small proportion of these sites have been scientifically excavated. Other forms of settlement included *crannógs*, or lake settlement sites. The economy and social structure focused on raising cattle for dairy production. During this time, there was a shift to a greater dependence on arable agriculture and the production of barley, oats, and wheat, with animal husbandry still playing a role, albeit to a lesser extent than it did at the beginning of this period (McCormick 2008; McCormick et al. 2011).

Periodization has, traditionally, been based on the perceived introduction of a new technology, such as the three-age system initially as described by C.J. Thomsen in the 19th century. This system, however, presents a problematic view of the past. People in the past likely did not identify with these changes nor did they recognize that such a difference meant a significant change in their lives or worldview. Social change occurred slowly, often over generations, rather than in sudden fits and starts. While such terminology can be useful as a mnemonic for remembering very broad changes in the past, such distinctions break down when examining specific social features, such as ritual practice or exchange relationships. The introduction of written history makes periodization no less problematic. For instance, changes in settlement patterns and burial practices occurred over the first several centuries of the first millennium AD, rather than suddenly in AD 431. The belief that there were dramatic changes starting in the 5th century AD has led researchers to examine the first four centuries separately and apart from the other six centuries, constraining their view of changes across the entire first millennium AD. The idea that the 5th-7th centuries AD is a *transitional period* reinforces that particulate understanding of the past. That is why, for this study, while the terms "Iron Age" and "early medieval" are used for their mnemonic value or when discussing prior research, change will be discussed in terms of centuries rather than periods.

Prior Research Concerning Animal Use in Iron Age and early medieval Ireland

It has been suggested that the dairying economy of the later first millennium AD in Ireland developed as part of a suite of wide-ranging changes from the 1st century BC through the 5th century AD, catalyzed by contact with the Roman Empire (Wailes 2004; McCormick 1995; 2013). By assessing the validity of this statement and gaining a better understanding of the role of cattle at the end of the prehistoric period, we may also gain a better understanding of the broader changes in socio-political and settlement structure at this time.

There has been significant debate concerning the role of cattle in Iron Age Ireland. Initially, Pam Crabtree (1986) argued that the cattle assemblage from Dún Ailinne (Knockaulin, Co. Kildare, one of the former 'royal' sites) most closely modeled a dairying economy with a high proportion of juveniles and the older individuals consisting primarily of females. Finbar McCormick, however, argued that dairying practices were different then than they are now, and this could change our interpretation of the faunal assemblages and we could not say for certain if domestic economies focused on cattle husbandry for meat or dairy (1992). More recently, both Crabtree and McCormick have agreed that the faunal assemblage at Dún Ailinne may not be indicative of the Iron Age economy because it was a high-status civic-ceremonial site, and so was more suggestive of ritual feasting behavior (Crabtree 2007, 2017; McCormick 2009). The role of feasting in the Iron Age may have an impact on our understanding of the faunal economies, as assessed from high-status sites, but may also provide insights into the social, political, and ritual activities. The question then remains, if there was a dairying economy in Ireland in the early medieval period (McCormick 2008, 2014), when did it develop and what was the faunal economy of the Iron Age (McCormick 2007b)?

Since it is now understood that the faunal assemblages from the well-studied civic-ceremonial centers in Ireland better represent ritual feasting behavior than the general faunal economy, we must examine how feasting functioned in late prehistoric Ireland. McCormick (2009) examines the potential for ritualized feasting in Iron Age Ireland, through a comparative analysis of central civic-ceremonial centers (Dún Ailinne, Navan Fort, and Tara) and concludes that ritualized feasting was an important component of Iron Age society. Furthermore, McCormick explains how these practices were continued through the early medieval period and were later modified to conform to Christian traditions. Additionally, McCormick (2002) examines the distribution of meat in a hierarchical society and explains how we might better understand the structure of a society through analysis of the distribution of prime meat. These suggestions influence our understanding of the role of such activities with regards to the development of the social relationships in Ireland during this period. Considering the role of feasting in late Iron Age society allows us to reconsider the analyses of Dún Ailinne by Crabtree and McCormick vis-à-vis the role of these functions and these sites in political formation during this period.

Paleoenvironmental research has contributed to our understanding of land use and change in the late Iron Age and early medieval period. Early pollen studies demonstrated a decrease in open environments and rapid woodland regrowth from AD 1-500, referred to as the 'late Iron Age lull', and was interpreted as evidence for widespread population decline (Raftery 1994). More recent studies, however, challenge this claim and suggest that changes in land use was due to localized social changes rather than demographic changes. Newman *et al* (2007) and Coyle-McClung (2013) demonstrate that, with better radiocarbon data, the 'late Iron Age lull' likely dated to 200 BC-AD 200, rather than AD 1-500. Additionally, research reanalyzing the pollen data and woodland land use suggest that the decrease in arable agriculture and woodland regrowth (or regrowth of scrubland) was due to agricultural practices that favored pasturage rather than grain cultivation (Hall 2011; Chique, Molloy, and Potitio 2017; O'Carroll and Mitchell 2017). Concerning the early medieval period, Kerr et al (2009) demonstrate an increase in cultivation with regards to paleoenvironmental data and the increased prevalence of 'corn drying kilns' archaeologically. This work correlates the shift in agricultural activity from a cattle-based economy to primarily cultivation with the emergence of a proto-feudal system in the region, further demonstrating the relationship between agricultural management and socio-political developments.

Analysis of the role of cattle in the later 1st millennium AD helps to contextualize both the potential role of animal husbandry in the preceding centuries as well as to understand changes in husbandry practices as they relate to social changes. McCormick (2008) demonstrates that the value of cattle in the early medieval period was comparable (and he argues greater than) the value of currency due to the prevalence of ‘flat rath’ type ringforts. McCormick argues that the design of the flat rath, with external ditches and internal banks, was intended to prevent cattle raiding (2008). McCormick supports his argument by highlighting the importance of dairy products in early Irish law, which is itself supported by O’Loan’s (1959) study of the treatment of livestock in the early Brehon Laws. More recently, Peters (2015) provides an examination of the value of dairy products (cheese and butter) in the early law tracts and how an individual’s right to certain products was an expression of their place in society. McCormick (2014) further demonstrates how the decline of the cattle-based economy in the later part of the early medieval period reflected a shift in social practices, as evidenced by the shift from ‘flat rath’ to ‘raised rath’ type settlement forms, claiming that the raised rath, which eschewed internal banks, provided less protection for cattle, signaling a shift away from cattle as a primary form of commodity currency.

The Early Medieval Archaeology Project (EMAP), spearheaded by Aiden O’Sullivan with specialist support from Finbar McCormick, Thomas Kerr, and Lorcan Harney demonstrated, through multiple lines of evidence, the change in agricultural production at the end of the 1st millennium AD (2013). O’Sullivan *et al* claim that the 9th century AD was a significant turning point in Irish agricultural history, with the construction of raised as well as the proliferation of horizontal mills, highlighting the intensification of grain production at this time. The importance of arable agriculture, however, clearly increased starting in the 1st-4th centuries AD, with the increased construction of cereal drying kilns and then increased efficacy through design improvements in the 8th century. Part of their argument is that faunal economies demonstrate increased diversification of species, and therefore the decline of the cow, starting around the year 800 AD (McCormick and Murray 2007; McCormick 2011; O'Sullivan et al 2013). These studies, however, did not include sites that predated the 5th century AD and only relied on %MNI and %NISP as measures of assemblage diversity, rather than more robust measures of diversity or evenness.

So, while their study should have included sites that pre-date the 5th century AD and their measures should have included more robust measures, the research conducted by EMAP provides a theoretical framework and methodological comparison with which to consider the interrelationship between animal economies and political economies. In Report 5.1, Kerr et al (2011), demonstrate that changes in cattle husbandry practices (based on the age-at-death data) from the 8th-10th centuries reflect increased urbanism with the settlement of Norse sites along the coast (e.g., Waterford). In Report 7.1, Kerr, McCormick, and O'Sullivan (2013) discuss a framework for understanding the early medieval economic system, 'command economy', based on gift-giving and exchange. Prior to a developed market economy, agricultural surplus was traded in a system of reciprocal exchange, which acted to reinforce social bonds and connections. Though the form of agricultural activity was different during the Iron Age, such a framework allows us to better understand the relationship between agricultural economies and political economies and the formation of social identities during this time, as such practices were likely to have developed prior to AD 400.

Finally, in recent years, the Heritage Council and the Discovery Programme (a government research and funding agency for archaeological and heritage studies) has been more concerned with studies of the Iron Age. This body has funded the “Iron Age Ireland: finding the invisible people” project from 2007-2008, the “Late Iron Age and Roman Ireland” (LIARI) project from 2013-2015, and the “Seeing Beyond the Site” project from 2015-2018. The “Iron Age Ireland” project collected radiocarbon data from unpublished reports and developed a list of the Iron Age sites known up to 2008. The LIARI project examined previously excavated artifacts and conducted geophysical surveys to examine late prehistoric exchange with the Roman Empire. Finally, the “The ‘Seeing Beyond the Site’ project, coordinated by Katharina Becker and Meriel McClatchie, examined the Iron Age archaeological evidence from the southeast of Ireland. This project conducted spatial analyses of site types and reexamined archaeobotanical and zooarchaeological reports from excavations ahead of commercial development to gain a better understanding of the visibility of the Iron Age in the southeast.

The study of faunal economies in the Irish Iron Age have focused on the civic-ceremonial centers, whose faunal remains represent feasting and ritual activity more so than domestic economies. With the addition of many more settlement sites from the first centuries AD, discovered through expansion of the national road systems, archaeologists can now analyze and discuss economic development in the past. Subsistence studies of the early medieval period through settlement analysis, faunal analysis, and analysis of textual references demonstrate the dependence and value of cattle during the middle and later centuries of the 1st millennium AD and demonstrate how the shift from a cattle-based economy to a primarily agricultural economy affected the social and political landscape. The structure of the subsistence economies and social structure formed through these economies provides valuable reference for the development of these structures during the late Iron Age and helps to contextualize our consideration of these subsistence and political economies.

Methodology

To reconstruct livestock husbandry, herd composition, and management in the Iron Age, I have evaluated and compared faunal analyses from commercial excavation reports maintained by Transportation Infrastructure Ireland (TII) and analyzed the faunal assemblage from Ninch, Co. Meath. I use these two methods in tandem to understand animal economies of Irish society from the 1st-10th centuries AD from both a broad, regional perspective, and from a specific, discrete perspective.

The comparative method uses already analyzed faunal data, primarily from commercial archaeological investigations. These sites were excavated by commercial archaeological companies ahead of road construction and housing development projects. All archaeological excavations in Ireland are required to submit final, unpublished, excavation reports to the National Monuments Service, where they are archived as “grey literature”. Transportation Infrastructure Ireland (TII), the nation’s road authority, has worked in collaboration with the Digital Repository of Ireland (DRI) to curate their Digital Heritage Collections, which consist largely of the archaeological grey literature.

From these collections, I’ve examined 335 archaeological reports and compiled a set of 31 sites that have faunal assemblages with more than 300 identified specimens, dated from the 1st century BC to the 10th century AD. While there are many more sites that date to the end of this period, I have limited the number of later sites so that there is more even representation over time.

The faunal reports were assessed to determine the proportions of species represented in the assemblage and whether each assemblage is varied or dominated by one species. To compare across sites, I measured %NISP, %MNI (whenever possible), and assemblage heterogeneity and evenness. By comparing different sites across this period, I reveal intra-site variability as well as change in husbandry practices from the 1st-10th centuries AD. Additionally, I compare these data to the faunal remains from Ninch, Co. Meath. This site had several phases of occupation during this period, with distinct changes in the architecture of the major features. This site contains evidence for settlement in the form of boundary ditches and slot trenches for houses; evidence for industrial activity in the form of hearths and waste iron debris; and evidence for ritual in the form of a community cemetery during the 6th-7th.

By examining the fauna from each of the individual occupation phases, it is possible to observe changes to the ways in which herds were maintained and changes in the production of other products (meat vs. milk vs wool vs traction). Commodity production and food choice can be inferred from the herd demographics and the cuts to the bones. Certain sexually dimorphic traits in cattle, such as the distal breadth of the distal forelimb (metapodia), and age-related changes to the bone and tooth structure make it possible to reconstruct the ratio of males to females and young to old individuals.

Demographic ratios of young:old and male:female reveal animal husbandry practices, as different animal products require different herd demographics. Using these data, I reconstruct the animal use and food choices from this site and calculate the assemblage diversity and evenness, not just for the site, but for each individual phase of occupation.

Outline of Chapters

In the following chapters, I will discuss the relationship between animal economies and political economies and then demonstrate how these function in Irish society from the 1st to 10th centuries AD. In Chapter 1, I have described the research question, my hypotheses, provided a brief overview of the geographic and temporal context for this study, and outlined the prior research in this research area.

In Chapter 2, I will discuss the archaeological and historical context of the first millennium AD in Ireland. This will include a review of the known archaeological context of the Iron Age and the early medieval period with a particular focus on agriculture and agricultural technologies. In this chapter I will also discuss the role of literature during this period and the ways in which cattle and food are portrayed in the sagas and law texts.

In Chapter 3, I will discuss the theoretical approaches to animals in society, or the theoretical lens through which this study examines the roles of animals in Irish society. This chapter will outline the ways in which animal economies are identified and how production and trade in animals forms and transforms political economies.

In Chapter 4, I will review the methods for quantifying the role of animals in society. This includes both primary and secondary faunal analyses, or the quantification of animal remains and reconstruction of animal husbandry practices. These methods are employed in this study to relate the data to the theoretical frame discussed in the previous chapter.

In Chapter 5 I will discuss and review the results of the comparative study of faunal reports from this period. In this chapter, I provide the criteria for the sites selected for this study, a gazetteer of the sites included, and a review of the results. For this study, I compared NISP, %NISP, MNI, %MNI, the Shannon-Weiner heterogeneity index, and taxonomic evenness across faunal reports from the first century BC through the 10th century AD. I used these measures to compare animal husbandry practices and food production from across this period.

In Chapter 6, I discuss the results from the analysis of the animal remains from Ninch, Laytown, Co. Meath. By examining the remains from one site, with phases of occupation spanning this period, I examine livestock management and food production practices on a more minute scale of shorter periods of time rather than the aggregate total of occupation phases for the site. By comparing livestock management practices from each occupation phase, I can relate changes in livestock management to changes in architecture and site use.

Finally, in Chapter 7, I will discuss changes in animal economies in Irish society in the first millennium AD, the ways in which the community at Ninch was formed and reformed through these changes, and the animal and political economies of Late Iron Age Ireland.

Chapter 2

Archaeological and Historical Context of the 1st Millennium AD in Ireland

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This chapter explores changing patterns of livestock husbandry in northern Europe and Britain, then provides a background overview of the archaeology of the Irish Iron Age, and the archaeology of the 1st Millennium AD in Ireland.

Archaeology in Ireland has a long and storied past, beginning with the Antiquarian tradition, through political upheaval, to scientific study and later proliferation during the Celtic Tiger. Shifts in conceptualization of Irish archaeology are also reflective of political and social contemporary issues and, in many cases, have been central to identity formation in modern Ireland. Prior to actions of the early Antiquarians, Irish folk tradition and taboo was key to the protection of archeological sites for centuries. Serious academic study of Irish archaeology did not begin until the 1930s, after the formation of the new Republic of Ireland and there was interest in archaeology and heritage to form a new Irish identity, particularly one that was divorced from the British Empire and glorified the late prehistoric "Golden Age."

The mid-1990s to the mid-2000s is known as the 'Celtic Tiger,' the period of rapid economic development in Ireland, which led to increased public works projects and road construction. The expansion of public projects led to a reciprocal increase in archaeological projects and the expansion of commercial and professional archaeology in Ireland. Excavations during this period revealed many previously unrecorded sites and allowed for the investigation of other known sites, increasing our understanding of settlement patterns in prehistory. However, the global economic downturn, beginning in

2008, effectively killed the Celtic Tiger and many projects were left unfinished in post-excavation analysis. Through government funding (via government sponsored programs like the Discovery Programme and the Heritage Council) and concerted efforts by private and public organizations, research has begun to work through and synthesize the literature accumulated during this period, creating a more dynamic understanding of Irish archaeology. Such projects as the EMAP (Early Medieval Archaeology Project) are now helping to rewrite the book on Irish archaeology (Kerr *et al.* 2013). Ireland is at a point now where the data and materials are becoming available for analysis and the production of knowledge. To explore these possibilities, let us first consider the current understandings of life in Ireland from the 5th century BC through the 10th century AD.

Livestock Husbandry in a Northern European Context

The first domesticated livestock species were brought to Europe through contact with and migration of farming communities from Anatolia, starting around cal. 7000 BC. Cattle, caprines (sheep/goats), and pigs were all domesticated in the Near East and transported north and westwards along with crops and communities. In Europe, some Neolithic farming communities continued some hunting and foraging practices (Rowley-Conwy and Legge 2015), bred domesticated cattle with wild aurochs (Schibler *et* al 2014; Whitehouse and Kirleis 2014), and re-domesticated pigs (Larson *et al* 2007). Along the loess plains, communities settled, constructed long houses, and began to produce pottery with a recognizable line pattern. Linearbandkeramik (LBK) farmers grew emmer wheat and barley and raised domestic livestock, producing meat and dairy products. In southern Scandinavia, above the loess zone, the adoption of farming was slow and Ertebølle communities continued to predominately subsist on hunting, gathering, and fishing for another 1,500 years (Rowley-Conwy and Legge 2015).

The introduction of agriculture in Ireland (around 4,000 BC) led to the development of a series of major cultural changes, famously including the development of megalithic burial monuments. Rather than being a period of progressively increasing agricultural exploitation and complexity, there are considerable fluctuations in archaeological visibility, suggesting cultural changes or a population decrease during the Middle Neolithic to the Bronze Age transition (Stevens 2012; McClatchie et al. 2016; McLaughlin et al. 2016). Pollen evidence, sourced from bogs, suggest that in the Early Neolithic there was a decrease in old growth forests starting around 4,000 BC, with the disappearance of birch, pine, elm, and hazel and a commensurate increase in grass and weed pollens, indicating early farming practices.

In Ireland, wheat and barley were, by far, the most common crops produced. Among identifiable samples, several varieties of both wheat and barley have been recorded, however the most common crop was emmer wheat (*Triticum dicoccum*), at least until the Late Neolithic, when there is a dramatic increase in the production of naked wheat (*T. aestivum/durum/turgidum*) (McLaughlin *et al.* 2016; McClatchie *et al.* 2016). In addition to the production of cereal grains, Neolithic farmers also practiced animal husbandry, raising cattle, pigs, and sheep (McCormick 2007b). The earliest evidence of domesticated animals being cattle remains from Ferriter's Cove, Co. Kerry (Woodman *et al*. 1999). Analysis of Neolithic pottery also demonstrates the consumption of dairy products, as well as meat, fish, and bee products as either honey or wax as a sealant (Smyth and Evershed 2016). The Neolithic diet, however, was not confined to domesticated produce but was also supplemented by foraged wild products. Many Neolithic sites also demonstrate exploitation of wild resources such as hazelnut and crab-apples (McClatchie *et al.* 2016) as well as exploitation of freshwater and marine resources, as evidenced by Neolithic shell middens. While animal husbandry was practiced during this period, with sites such as Lough Gur, Co. Limerick demonstrating a predominance of cattle exploitation (95-99% of the faunal remains), hunting also continued to be practiced with evidence of red deer, brown bear, wild cat, hare, and birds at occupation sites (McCormick 2007b).

By the end of the Neolithic, most communities in northern Europe primarily subsisted by agricultural practices. On average, faunal assemblages from European Bronze Age sites consisted of 30-60% cattle, 27.3% caprovine, 17.9% pig, and 10-20% other species, including horse, dog, and wild game (Bartosiewicz 2013). Cattle were used for traction as well as for beef. It appears that most cattle were elderly when they were slaughtered, suggesting that they were consumed after their usefulness for traction or dairy production had subsided (Bartosiewicz 2013). Other animals were key to the development and maintenance of social stratification, such as the horse. Artifactual and zooarchaeological evidence indicate that horses were, “an indispensable high-status military device” (Bartosiewicz 2013, p. 9). Evidence of dog burials from Bronze Age Europe suggest that they, too, were important social symbols in addition to occasionally being eaten.

The Bronze Age in Ireland is characterized by the introduction of metalworking technologies to the region. This new material and these new technologies were accompanied by changes in the social landscape, with increased social differentiation and the development of a hierarchy of site types and fortified settlement forms such as embanked enclosures, hilltop settlements, and hillforts. It has been suggested that fortified settlement during this period demonstrates an increased importance of cattle, predominantly for meat; though some sites, like the island site Dun Aonghasa, demonstrate a preference for sheep/goat, though this may partly be a result of environmental factors. (McCormick 2007b). During this period, horses are believed to have been introduced to Ireland, however this assertion is debated due to some possible evidence for horse remains at Neolithic passage tombs (McCormick 2007a). By the end of the Bronze Age, most sites demonstrate a balanced livestock economy, with even proportions of cattle, sheep/goat, and pigs (McCormick 2007b).

During the Iron Age in northern Europe, husbandry practices were focused on cattle. Iron Age cattle were quite small and slender (Groot 2018). In the Netherlands, there was an emphasis on raising livestock (as opposed to a mixed economy with arable agriculture). Cattle dominated at lowland sites, representing up to 66% of faunal assemblages, followed by sheep/goats. Roymans (1999) suggests that cattle were both economically and socially important and were considered a valuable medium of exchange. Groot (2018) emphasizes that, if cattle were important items for social transactions, "…then their value would be as living animals rather than meat or producers of milk" (12).

Outside of Ireland, at the end of the first millennium BC and the beginning of the first millennium AD, there were sweeping changes in agricultural production across northern continental Europe and Britain. While these changes were unique in the specific, broadly, there was an intensification of arable agriculture and pastoral production. To some degree these changes can be attributed to Roman expansion, with communities engaging with new markets beyond the local level and accessing new commercial niches made lucrative through exchange with the Roman military. There is evidence of engagement with these new markets often prior to Roman invasion with the importation of exotic foodstuffs such as wine and the adoption of a coin-based economy.

In the Pyrenees, communities shifted from generalist, self-sufficiency driven livestock husbandry practices to specialized wool production centers during the time of Roman expansion (Colominas, Palet, and Garcia-Molsosa 2020). And at Feddersen Wierde, in Germany, an increase in the number of cattle stalls constructed from the 1st century BC to the 3rd century AD is attributed to increased trade in beef to support the Roman army (Methany and Beaudry 2015). Across northern Europe, specialization and intensification and improvement are common features of pre-Roman and Roman era agricultural change. Livestock improvement, referring to the selective breeding of local cattle with larger imported cattle, provides a greater meat-yield for local herds and is suggested, by Roman writers, to also improve milk yield for imported cattle, and herd improvements demonstrate engagement with increased demand for provisioning the Roman military and urbanized settlements (Trixl, Steidl, and Peters 2017).

We can see the effects of these agricultural changes is more than just intensification. Using isotopic methods, it is possible to observe how local communities were engaging with broader markets and how they were shifting their provisioning and distribution strategies. At Houten-Castellum, in the modern Netherlands, 87Sr/86Sr isotope analysis indicates that cattle were brought to the site from up to 150km away and at Heerlan isotope studies indicate that prime-meat aged cattle derived from at least four different locations between 20-110km away (Groot, Evans, and Albarella 2020) and there was increased non-local provisioning at Owslebury in Britain just prior to Roman invasion and throughout the Roman period (Minniti *et al* 2014). In comparison, at Roman sites in Britain, including Worcester (Gan *et al* 2018), Ferry Fryston (Jay and Richards 2007), and Caerleon (Madgwick *et al* 2019), all demonstrate diverse provisioning of beef cattle.

In Britain, husbandry practices drastically changed over this period. While cattle were more frequent in the earlier part of the Iron Age, most later Iron Age sites indicate a greater investment in generalized sheep husbandry (Albarella 2007). A "generalist" husbandry practice means that mortality profiles across sites do not indicate a preference for milk, meat, or wool, and therefore the animals were likely raised to produce all three.

At the end of the Iron Age, just prior to and at the time of Roman invasion in the 1st century BC to the 1st century AD, British sites, including Owslebury, Dragonby, and Elms Farm, demonstrate an increased importance of cattle. This is evident in a greater percentage of cattle remains at these sites as well as an increase in the size of cattle, potentially with the introduction of larger breeds from the Continent (Albarella 2007; Rizzetto, Crabtree, and Albarella 2017). The higher proportion of males among these assemblages suggest that cattle were being raised for beef production, but it is also likely that they were raised for traction/plowing as indications of land clearances suggest a simultaneous intensification of grain production. Prior to the Roman invasion, in addition to agricultural intensification, there is also evidence for an intensification of salt production, ironworking, and changes in pottery styles. Cunliffe (1991) and Haselgrove

(1999) suggest that these changes are the result of increased trade in exotic foodstuffs from the Continent, also related to Roman expansion.

To understand agricultural change in Ireland during this period, it is important to compare earlier evidence for agricultural production, including the zooarchaeological record, archaeobotanical record, and material record.

Settlement and Agriculture in Iron Age Ireland

In traditional periodization, the Iron Age spans 1,000 years between approximately the 6th century BC to the 5th century AD, beginning with the introduction of new metalworking technologies and ending with the arrival of Christian missionaries. Within this broad chronological period are three sub-periods: the early Iron Age (700-300 BC), the Developed Iron Age (300-1 BC), and the late Iron Age (AD 1-450). The early Iron Age is characterized by the introduction of iron working technologies and the dissolution of Late Bronze Age polities, the Developed Iron Age is characterized by the development of large ceremonial centers and the introduction of La Tène design, and the late Iron Age is characterized by the cessation of activity at large ceremonial centers.

During this period, there were significant changes in domestic and ritual expression as well as increased contact with Britain and the Continent, identified by the appearance of several Continental object types and, notably, La Tène design. This design style is known for its use of spirals, triskeles, lentoid designs, and stylized anthropomorphic and zoomorphic figures and, in Ireland, appears on high status metal and stone objects. It was also during this period that the development of large civic-ceremonial sites suggests consolidation of political power and increased social complexity that began in the Bronze Age (Plunkett 2009). The Iron Age has, historically, been thought of as an "enigma" after Barry Raftery's book *Pagan Celtic Ireland: the enigma of the Irish Iron Age* (1994). This was not entirely an exaggeration, because, until recently, little was known about the Iron Age beyond what was evident at some of the four large civic-ceremonial centers: Rathcroghan, Co. Roscommon (*Cruachan*), Navan Fort, Co. Armagh (*Emain Macha*), the Hill of Tara, Co. Meath (*Teamhair*), and Knockaulin, Co. Kildare (*Dún Ailinne*), as well as preserved bog trackways, structured deposits in watery places, and what was potentially implied from the Ulster Cycle. With increased research since the publication of Raftery's text, there is new evidence not only from these sites, but also from smaller hilltop enclosures and enclosed and unenclosed settlements providing a better understanding of the Iron Age society.

Settlement

Settlement during this period, when it has been identified, is largely characterized by dispersed unenclosed farmsteads and metalworking sites. Until recently, there were fewer than 30 identified Iron Age settlement sites, however with greater archaeological excavation and better dating, there are approximately 300 sites (McCormick 2007b; Becker *et al* 2009). The increased number of settlement sites is partly due to the expanded definition of 'settlement' during this period, encompassing isolated hearths or post holes in addition to post alignments and slot trenches. Excavation at some early medieval ringforts, such as at Millockstown, Co. Louth and Rathnadrinna, Co. Tipperary, have also demonstrated pre-ringfort settlement activity in the late Iron Age, suggesting that at least some of the early medieval ringforts developed from earlier, unenclosed settlements. Stakeholes and settlement debris has also been found in isolation at sites such as Dunsilly Co. Armagh and Lisdoo, Co. Fermanagh. Lake settlement sites, *crannógs*, are also known from this period, including first-hand accounts from peat cutters at Lisnacrogher, Co. Antrim. These sites consist of a base of timbers and brushwood and layers of earth, stone, and more brushwood to create an artificial platform or island for occupation and industrial activities, such sites became even more common in the early medieval period.

When structures have been identified, Iron Age houses were generally timber constructed roundhouses, with a diameter between 6-9m, and usually with evidence of hearths and pits external to the structure. Timber built circular to sub-rectangular structures have been excavated at Ballydavis, Co. Laois; Killoran 16, Co. Tipperary; Ballinaspig More, Co. Cork; Carrickmines Great, Co. Dublin; Killydonoghoe, Co. Cork; Claristown, Co. Meath; Magheraboy, Co. Sligo; and Muckridge, Co. Cork (Becker 2008; Waddell 2010). The presence of cereal-drying kilns, features associated with agricultural activity, have been considered indicators of settlement at sites such as Tullyallen and Dundalk, Co. Louth (Linnane 2007; Mossop 2004).

There might be additional unidentified Iron Age settlement sites that have been classified as burials. Cremation was the primary burial rite in the Irish Iron Age, with inhumation becoming more common from the 2nd century AD. Most cremation burials were deposited within the central area at ring ditch and ring barrow sites, but they were occasionally deposited in the ditch fill or were deposited in unenclosed areas. While Iron Age cremations are usually found at ring ditch sites, the presence of token cremations might not discount the possibility that some of these sites might also have been settlements. Ring ditch sites are defined by the presence of at least one circular or penannular ditch that may or may not have an associated bank. While the definition of the feature itself is based on its morphology, the presence of cremations at some, though not all, has inevitably linked the feature morphology to particular functions. As such, ring ditch sites that do not have evidence for cremations are burial sites and not settlements, even if there are post holes, hearths, and pits indicative of habitation. What might be considered settlement evidence (i.e., the presence of post holes, hearths, and pits) have been found at Ardsallagh 1, Co Meath; Ballydavis Site 1, Co. Laois; Ballyvass, Co. Kildare; Claristown 2, Co. Meath; Cookstown Site 2, Co. Meath; Rathcash East 1, Co. Kilkenny; and Ballyboy 1, Co. Galway.

This is not to say that the deposition of token cremations at Ardsallagh, Ballydavis, Ballyvass, and Ballyboy should be ignored or discounted, but the presence of cremations associated with settlement suggests more complex treatment of the dead and living spaces and potentially more complex relationships between kinship and concepts of the “house.” Indeed, recently Katharina Becker (2019) has suggested that the timber structures at the large civic-ceremonial centers may be representations of houses and that Irish Iron Age society might be considered a ‘house’ society.

Scholars have suggested that the general paucity of settlement evidence could be the result of a more mobile society (Newman 1998; Armit 2007; Johnston *et al.* 2014; Dolan 2014). Structural elements designed for more mobile communities would also leave less of an archaeological footprint, such as possible wicker walls (Lynn 2003) or ‘huts’ and ‘tents’, like the interpretation of the structures at Carrickmines Great, Co. Dublin. Rather than discrete categories, there is a spectrum of pastoral practices in which communities may be more or less settled. Differences include long mobile ranges (hunter-gatherers and multi-resource nomadism) or short mobile ranges (semi-nomadic pastoralism, tethered pastoralism, and short range semi-mobility); there also exist different relationships with adjacent settled communities (enclosed nomadism and peripheral nomadism); there are differences in seasonal geographic shifts (vertical vs. horizontal transhumance); and the degree to which the communities practice arable agriculture in addition to pastoral agriculture or agropastoralism (Wendrich and Barnard 2008). It may be that pastoralism was a strategy of adaptation to environmental and political climates in state-level societies (Chang and Koster 1986). Given the broad range of pastoral practices, and the evidence from Ireland, it is possible that Iron Age society was more mobile than the preceding Bronze Age or later early medieval period.

Civic-Ceremonial Centers

The Irish Iron Age has been largely understood through study of Dún Ailinne, Co. Kildare, the Hill of Tara, Co. Meath, Rathcroghan, Co. Roscommon, and Navan Fort, Co. Armagh, the four largest civic-ceremonial centers from this period. These hilltop sites, previously referred to as the 'royal sites' based on their descriptions in early medieval texts, have evidence for large enclosing banks and ditches, complex palisade structures, and evidence for feasting but lack evidence for long term occupation (e.g. round houses) and, therefore, are interpreted as 'ritual' or 'civic-ceremonial.' However, these are just one type of Iron Age hillfort. Barry Raftery (1994) described 4 classes of hillfort: Class 1, a univallate (single bank and ditch) enclosure of approximately 3.5 ha; Class 2, multivallate forts between 3-20 ha; Class 3, inland promontory forts; and coastal promontory forts, which although not considered a class of hillfort, are included in this site typology. Such focus on higher elevations and monumentalization began in the late Bronze Age with hillfort construction, however these sites typically contain more evidence of settlement than sites from the Iron Age. Hillforts typically also enclose earlier prehistoric monuments such as Neolithic passage tombs or Bronze Age barrows and demonstrate little occupation debris, therefore suggesting that these sites were only used periodically.

The large civic-ceremonial centers demonstrate focused construction at sites including or near concentrations of prehistoric monuments, ritual practice, and feasting activities. These so-called ‘royal sites’ loom large in the early medieval literature and mythology as the seats of power of early kings and queens, with suggested association to early medieval kingship rituals (Newman 1998). Early medieval sources such as the *Táin Bó Cúailnge (‘The Cattle Raid of Cooley’),* and the *Felire Oengusso (’the Martyrology of Oengus’)* identify sites such as these as important prehistoric loci of political and ritual activity. Archaeologically, these sites represent long reoccupations of prehistoric monuments and ritual activity, often including Neolithic and Bronze Age monuments included within later prehistoric earthworks. Where geophysical survey and excavation has taken place at Dún Ailinne, Navan Fort, Rathcrogan, and the Hill of Tara, there has been evidence of construction of complex timber structures, including round structures and paired round structures known as ‘figure-of-eight’ structures, and distinct northeast oriented entrances defined by rows of posts. Ceremonial or ritual activity is interpreted at Dún Ailinne by the extensive evidence of faunal remains of feasts and, at Navan Fort, the additional evidence at Loughnashade, a former small lake at the site where four bronze horns with La Tène design and a part of a human skull were discovered.

In addition to the large ceremonial centers, there are also smaller hilltop centers that may have potentially served similar purposes, such as Raffin Fort, Co. Meath (Newman 2007; Becker 2019) and Lisknaskea, Co. Fermanagh (Waddell 2010). Both sites were constructed on top of prominent drumlins (hills of sediment formed by glaciers) and consist of an external bank and internal ditch. Sites with external banks and internal ditches are considered less defensible than those with external ditches and internal banks and are therefore thought not to be domestic but rather ritual or ceremonial. Raffin Fort, additionally contained an internal timber palisade structure like those excavated at Dún Ailinne and Navan Fort, dating to the 1st-2nd century AD. Conor Newman considers such sites to be lower-tier 'Royal Sites' and represented the reconstruction of regional power structures on a local level (Armit 2007; Becker 2019).

Linear Earthworks

Another monumental feature of the Iron Age was the construction of long linear earthworks. These structures, such as the Black Pig's Dyke, which stretches discontinuously across the northern half of the country through Counties Leitrim, Cavan, Monaghan, Armagh, and Down, consisted of banks and ditches with some evidence of palisades. At the Dorsey, Co. Armagh, a site considered part of the Black Pig's Dyke, the earthworks and palisades form an irregular rectangle enclosing 1.2 km^2. The enclosure at the Dorsey is also discontinuous, however it includes natural obstacles such as rivers and boggy terrain. If the two earthworks are related, it would represent a long period of importance, with radiocarbon dates for a section of the Black Pig's Dyke dating from 390-370 BC and dendrochronological dates from the Dorsey suggesting construction between 140 and 100-90 BC, depending on the part of the site. It has been suggested (Waddell 2010) that these sites may have been ceremonial roadways, territorial markers, or frontier defenses. The construction of these earthworks may also relate to shifting community organization and concepts of landownership related to the large civic-ceremonial centers, such as Navan Fort, which is not far from the Dorsey (Becker 2019).

Agriculture

Due to the low numbers of well reported settlement data from the Iron Age, there has not been an extensive study of the animal economies of the Iron Age. The known, and widely discussed, evidence from the Iron Age comes from the excavations of the large ceremonial centers at Dún Ailinne, Tara, and Navan Fort. These data are, however, inconclusive as there is a preponderance of young cattle at Dún Ailinne, older cattle at Tara, and pigs were the most represented species at Navan Fort. While these results can tell us about the role of ritual economies at the time, and ritual economies relate to domestic economies in important ways (see Chapter 4, *Animal Economies and Political Economies*), there has not yet been a study that corroborates these data with data from smaller ceremonial sites and domestic sites (see Chapter 5). Prior scholars (Raftery 1994; McCormick 2007b; Waddell 2010) have, however, described Iron Age animal economies as mixed agricultural economies with cattle for meat, dairy, and traction; pigs for meat; and sheep for meat, dairy, and wool; in approximately that order of representation in the assemblages. All the large centers show a higher percentage of horse remains than had been measured in the preceding Bronze Age, potentially related to the increased importance of transportation via wheeled vehicles and the development of more extensive networks of roadways (Waddell 2010).

The ceremonial and economic importance of cattle and dairy products is supported by a higher instance of butter deposition in bogs during the Iron Age. There are over 500 recorded samples of the so-called 'bog butter' found in Ireland and recent research indicates that the practice of deposition of butter in bogs has some antiquity in Ireland with the earliest samples dated to the Bronze Age but the highest proportion of bog butter dates to the Iron Age (Synott 2003; Cronin *et al* 2007; Smyth *et al* 2019). Most of the butter in these samples derived from cattle, though a small portion appears to have also derived from caprines, or sheep and/or goats (Smyth *et al* 2019; Mattiangelia *et al* 2020). Mixing dairy therefore must not have been taboo and might represent small farms or local communities producing and depositing butter collectively. Bog butter has also been found in a variety of containers, including animal skins, bark wrapping, cloth, and in wooden vessels. Smyth *et al* (2019) found that over 50% of the butter that they sampled and dated to the Iron Age had been found in wooden vessels, including a decorated wooden vessel from Killeenan More, Co. Galway. It is unclear if the practice was intended as a ritual or ceremonial practice (much like the deposition of metal objects or the sacrifice and deposition of elite individuals) or was a practice related to the preservation of the butter in a period before refrigeration (Synott 2010). It is likely that depositional practices served several purposes and the purposes and intentions shifted over time (Smyth et al 2019).

Eamonn Kelly (2006) suggested that the deposition of objects in bogs during the Iron Age was entangled in concepts of authority, territoriality, and ritual. His work primarily focused on the ritualized mutilation and sacrifice of elite individuals that were deposited in the same areas as butter. He suggests that the 'bog bodies' represent either deposed authority figures or failed contenders for authority. Without a clear indicator of shifting political loyalties and the result of power shifts -- both possibilities are equally likely outcomes. Related to shifting power relations, Kelly suggests that the location of these depositions relate to territorial boundaries. Sacrifice, in its many forms, would reinforce social and political boundaries and relate to political land claims. Should these depositions represent ritual/ceremonial actions, then the deposition of large quantities of (valuable) material would also reinforce political boundaries and contribute to group identification to a place or boundary. By proxy, therefore, the similar deposition of bog butter, metal objects, and human remains, would indicate that butter had value in society.

During the Iron Age, bogs were loci of particular social concern, with the construction of significant trans-bog trackways, such as the Corlea trackway in Co. Longford. Bog trackways demonstrate a concern for access through these landscapes and the importance of transportation during this time. Though there have been trackways dated to the Bronze Age, they became more important during the Iron Age. The Corlea trackway consisted of a 2 km stretch of timbers, split radially, and secured by wooden pegs, overtop brushwood, creating a secure road surface across the bog. Dendrochronological dates from this site suggest construction just after 148 BC. Favorable, waterlogged, anaerobic conditions at this site also preserved several wooden artifacts such as wooden vessels and what might have been a part of a wagon (Raftery

1994, 102). The presence of wooden serving vessels might represent the remains of work-party feasts related to the construction of the trackway. A wooden ard-head, a component of a plow, was also found underneath the timbers at Corlea, highlighting the importance of traction in Iron Age agriculture (Raftery 1994). Finally, evidence of spindle-whorls and a set of iron sheers from Carbury Hill, Co. Kildare all indicate the exploitation of wool during this period (Raftery 1994).

The elaboration of horse equipment, metal components used in the bridling and harnessing of horses, also highlights the importance of mobility and transportation. Elaborate bridal bits, Y-pendants, and cart or chariot fittings are some of the more common artifact categories from this period and are the most common object types found in collective depositions. Of the 27 provenanced metalwork hoards, more than half are from lakes, rivers, and bogs and nearly three-quarters of the provenanced Y-pendants are from similarly watery places. Bronze bridle bits consist of three links (the central link generally smaller and figure-eight shaped and the two-side links longer) and two side rings for attachment to reigns. These objects are occasionally elaborately ornamented with cast designs. Use wear analysis indicates extensive wear on the bits as well as evidence of repair before deposition. Associated horse equipment, Y-pendants, are a particular object of Irish horse equipment. Over 100 have been found in Ireland but none have been found outside of Ireland. These objects are made of bronze (with one iron example), 28-32cm long, with symmetrical prongs, 12-16cm apart with, separately cast, expanded, round terminal ends. Pairs of Y-pendants, such as those from Attymon, Co. Galway, suggests that they were intended to be in sets for use with draught teams for carts or chariots (Maguire 2014). A bronze terret, a guide for reigns mounted on a yoke known from the Continent, was found in Co. Antrim, further supporting the suggestion that carts and chariots were used during this time. Most of the surviving examples of these objects are bronze, however iron, leather, bone, or wooden examples may have once existed but did not preserve. The elaboration of horse equipment and its association within structured deposition suggests a greater concern with horse usage, management, and representation during this period, claims supported by the higher proportion of horse remains in faunal assemblages.

Due to the poor preservation of cereal grains, direct evidence for arable agriculture, or the production of crops, is even less productive than the zooarchaeological evidence. There are, however, grains occasionally found at archaeological sites, including 13 identifiable barley grains from Dún Ailinne (Waddell 2012). Table 1 (below) lists the predominant macrofossil remains from archaeological sites in this study dated from the 1st century BC to the 5th century AD, in order of prevalence in the assemblage:

Site	*Identified plant remains present in the archaeobotanical assemblage*					
Rathcash East 1 (E3892), Co. Kilkenny	Hazelnut shells					
Ballydavis Site 1 (03R0151), Co. Laois	Emmer wheat	Hulled barley	Oat	Hazelnut shell	Sloe stone	
Moone (E2980), Co. Kildare	Oat	Wheat	Hulled barley	Hazelnut shell		
Baronstown 1 (09E3070), Co. Meath	Hulled barley	Oat	Wheat (inc. emmer and bread wheat)	Rye	Hazelnut shells	Peas
Rathcash East 1 (E3892), Co. Kilkenny	Barley	Oat	Flax			
Ballydavis Site 1 (03R0151), Co. Laois	Oat	Hulled barley	Wheat	Hazelnut shells		

Table 1 Archaeobotanical remains from Late Iron Age and early medieval sites

Not listed in this chart, but also evident at these sites were weed seeds commonly found in grain fields, including goosefoot, and other wild products like cherry, bramble, and elder. These data show a predominance of barley and oats with occasional wheat and frequent harvesting of while hazelnut shells but otherwise limited exploitation of wild plants. Both emmer wheat and bread wheat are present in these assemblages, with emmer wheat having been introduced to Ireland in the Neolithic and bread wheat becoming a more common variety of wheat in the Medieval period.

Pollen studies, however, have provided greater insight into agricultural change in the later prehistoric period. Pollen analyses from Red Bog, Co. Louth and Littleton Bog in Co. Tipperary indicates that there was decreased agricultural activity and woodland regrowth from the 3rd century BC to the 3rd century AD, after which there was dramatic expansion of arable agriculture (Raftery 1994). The phenomenon of forest regrowth during this period has been called the ‘late Iron Age lull.’ Other studies have suggested that this agricultural ‘lull’ may have occurred from the 1st to 5th centuries AD, though the exact timing shifts by several centuries, depending on the where the soil cores were obtained (Newman *et al* 2007; Coyle-McClung 2013; Molloy and O’Connell 2016).

The variability of forest regrowth and the expansion of arable agriculture during this period may have had less to do with broad agricultural change but shifts in local economies, with communities experimenting with different forms of agriculture at different times. Research examining the pollen data and woodland land use suggest that the decrease in arable agriculture and woodland regrowth (or regrowth of scrubland) was due to agricultural practices that favored pasturage rather than grain cultivation (Hall 2011; Chique, Molloy, and Potitio 2017; O’Carroll and Mitchell 2017). All the pollen studies, however, demonstrate a rapid increase in land clearance and arable agriculture after the 5th century AD in all localities. This rapid increase in cereal grain production coincides with the construction of cereal drying kilns and settlement enclosure.

Post-harvesting processing of cereal grains is an important step in food production and storage, particularly in the damp European northwest. Aside from its preservative properties, Monk (1981) demonstrated that drying cereal grains decreased grinding time when using a rotary quern, the type of grinding technology in use during the late Iron Age. Monk also demonstrated that grain drying could take place on a smaller scale, citing ethnographic evidence from northern Scotland, in which grain is occasionally dried in a pot over a fire (McCormick *et al* 2014). Cereal drying kilns, generally, consist of two chambers: a furnace and a drying chamber with a flue connecting the two. Despite its simplicity in concept, cereal drying kilns can come in a variety of shapes but the most common form during the late Iron Age was the ‘figure-of-eight’ kiln. Better dating of kilns has demonstrated that there was a rapid increase in the construction and use of cereal drying kilns from the 2nd century AD onward (Cahill Wilson, Standish, and O’Brien 2014). In fact, “apart from a possible Bronze Age example (Hackett 2010), drying kilns are absent in Ireland prior to the late Iron Age…” (McCormick *et al* 2014). The development of more efficient grain processing technologies was likely influenced by land clearances and the increasing importance of cereal grain production in the first half of the first millennium AD.

After the grains have been dried, the next stage in grain processing consists of grinding the grain into flour, and grain processing technologies during the Iron Age include beehive and flat disc quern stones. Both forms are known as rotary quern stones, meaning that the grain is placed between two stones and the upper stone is rotated to grind the grain. Beehive quern stones appeared in Ireland around the 1st century BC and consist of two circular stones, each with one flat side and the upper stone also having a domed side and slot or projecting lug for a handle to be inserted either vertically or horizontally. The upper stone also has a central chute for grain to be poured in to be ground. Flat disc quern stones, defined by their non-domed upper stone, appear around the 1st century AD, and later completely replace the beehive querns. Over 200 beehive quern stones have been recorded, most distributed across the northern half of the country, and some stones can be dated stylistically to the 2nd century BC to the 4th century AD by their curvilinear La Tène decoration. Most rotary querns have been found in bogs and no beehive querns have been found in association with settlement sites. The proliferation and elaboration of these objects predates widespread increase in arable farming practices, as suggested by pollen analyses (Weir 1993; Molloy 2005; Caseldine *et al*. 2005; Molloy and O'Connell 1993; and Jelčić and O'Connell 1992; Coyle-McClung, 2013).

Cauldrons, Cooking, and Serving Ware

Post-processing, cooking and consuming food in Iron Age Ireland was an important social affair. The Irish Iron Age is, unfortunately, aceramic (Raftery 1994; Waddell 2010). While the concept of ceramic technology was not lost, as there are crucibles and clay moulds dating to this period, ceramics were neither produced for storage or serving, nor were they imported in any significant numbers until the mid-6th century AD (Edwards 1990). There is, however, evidence for specialized cooking implements as well as wooden serving wares. Bronze cauldrons were elaborate and important objects during this period. Twelve cauldrons have been found that date to the Iron Age. These objects were constructed of sheet iron or bronze and riveted either in a globular form, such as the example from Drumlane, Co. Cavan, or in a projecting-bellied form, which consists of a globular lower portion riveted to a cylindrical upper portion. A wooden cauldron is also known from a bog in Altartane Glebe, Co. Monaghan also had two ribbed suspensory lugs and a dot-and-line decorative motif. In addition to their material value and decoration, bronze cauldrons were treated with special care, with many demonstrating evidence of extensive repairs prior to final deposition in a bog or river. Bronze and wooden bowls are also known from this period, including the bronze bowl with a soldered bird head handle from Keshcarrigan, Co. Leitrim. Two round-bottomed, handled bowls are known from Co. Armagh and Co. Leitrim. A stave-built tankard, secured by a bronze band and with a bronze handle decorated with curvilinear design, was found in Carrickfergus, Co. Antrim. Other wooden serving wares from the Iron Age include platters, a wooden trough, and several fragments of tub-shaped vessels were found along the Corlea trackway, as well as the 1.3m long, 60 cm wide Pallasboy Vessel from Co. Westmeath (Murray 2000). Cooking and serving vessels of this period demonstrate a concern for public or communal eating, with large cauldrons, wooden tubs, and large wooden serving platters. This evidence and the evidence of periodic feasting at the large ceremonial centers provide a clear indication that food was a locus of community effort, and that communal eating was an important component of social relationships and cohesion.

Social Structure and Social Organization

The role of communal eating and feasting in Iron Age Ireland is woven into broader debates about the nature of social structure and organization during this period. There are those that suggest, largely based on early medieval mythology, that society in Iron Age Ireland was hierarchical, with power based in sacral kingship (Lynn 1992, 1994; Doherty 2005; Waddell 2014, 2018). In early medieval mythology, feasting was closely associated with kingship rituals, such as the *feis Temro*, or the Feast of Tara. The implication that Iron Age society was highly hierarchical depends on early medieval tales having greater antiquity and that they were largely unaffected by Christian influences to represent a true Iron Age past, or at least one that was largely unchanged between the Iron Age and the early medieval period. Despite the perseverance of such concepts of Iron Age society, there have been several other forms offered. For instance, Bernard Wailes (1995) interpreted Iron Age Irish society as being heterarchical, drawing from Carol Crumley's (1995) term referring to an alternative form of unranked social structure in which power is distributed across several interdependent units. T.L. Thurston (2019) has theorized that a heterarchical Iron Age European society would consist of, "...several different but equal, internally hierarchical structures that collectively create an orderly sociopolical setting and acts as checks and balances on each other…" (57). A heterarchical Iron Age has gained support among scholars of Irish archaeology as it accounts for the lack of clear status differentiation among individuals such as high-status grave goods (Dolan 2014).

Though neither in support of nor in opposition to the hierarchy/heterarchy debate, alternative theories examine the evidence from the large central monuments/civic-ceremonial centers as representative of the internal function of society. Johnston, Crabtree, and Campana (2014) explain how the performance of repeated construction/reconstruction events at Dún Ailinne formed and reformed social relations. This action of collective and communal work strengthened community bonds and reaffirmed group identity. The work of constructing the palisades may have been at the behest of or coercion of a strong central authority, but the absence of elite single burials still suggests that this might not be the case. Becker (2019) posited that Irish Iron Age society should be thought of as a house society and that the structures at Dún Ailinne, Navan Fort, and Tara represented symbolic or physical large houses and were the locus of regional fictive kin-based identities (a "house" in the sense of "the House of Bourbon" or "the House of Windsor"). In Becker's assessment, the reconstruction of structures at these sites also represents events that required restructuring the community, possibly when new groups were integrated into the "House." In this way, the house could be the manifestation of the ruling elites but is more a representation of the "...conceptual framework that unified communities… (300)" with the "House" representing the primary unit of socio-political identity.

The Irish Iron Age, once considered an enigma, has been illuminated through recent research, to a degree. Though this period is less archaeologically visible than the earlier Bronze Age or the later early medieval period, some general conclusions may be drawn. This period can be defined by widely distributed small farmsteads producing some cereal grains as well as raising livestock. This period is also marked for being aceramic, with a greater emphasis on wooden vessels, even though ceramic production and clay working continued to be used in metalwork production. Additionally, this period is also striking for the large ceremonial centers constructed and elaborated, potentially relating to ritual activities as well as political consolidation. During this period, there is also a proliferation of La Tène decoration, primarily on metal objects (largely weapons and personal ornamentation) as well as stone carvings. The media on which we see the La Tène decoration suggests that this style may have been reserved for elites. Additionally, there is a continuation of depositional practices during this period focused on weapons and personal ornaments, however to a much smaller extent than in the preceding Bronze Age. This period concludes with the arrival of Christianity in Ireland, bringing with it ecclesiastic systems, political change, and literacy.

Settlement and Agriculture in the Early Medieval Period

The "Roman Package," consisting of Christianity, writing, and dairying, is considered the primary marker for the beginning of the early medieval period in Ireland (Wailes 2004; Cahill Wilson 2014). The earliest documentary evidence for Christianity in Ireland is the letter from Pope Celestine to Bishop Palladius, ordering him to minister to the Christians living in Ireland in AD 431 and the arrival of St. Patrick in AD 432, per his *Confessio*. Though the conversion of the Irish likely began prior to these dates and took several centuries more to accomplish, the mid-5th century has been considered the start of the early medieval period (McCormick *et al* 2014). Christianity certainly altered the social and political structure in Ireland with the development of the monastic system and a new literary tradition and encouraging greater trade and communication between Ireland, Britain, and the Continent. Other changes occurred in Ireland during this time, including the widespread settlement of the landscape in fortified farmsteads and the political division of the land among local kings.

Settlement

While still ultimately rural in nature, settlement during this period becomes much more visible on the landscape with the development of enclosed settlements sometimes referred to as ‘ringforts.’ These small settlements consist of an annular bank and ditch system (from one to three concentric rings, or *univallate, bivallate, trivallate, or multivallate*) enclosing an open space used for habitation or industrial activities, averaging 28-35 meters in diameter. In Irish, a fortified settlement is a *dún*, the earthen bank is a *ráth*, and an enclosure with a stone outer wall is a *caiseal* (“cashel”) or *cathair* (“caher”). These terms are common in place names and can sometimes be key indicators to the presence of archaeological sites. Some estimate that there are 47,000 recorded settlement enclosures in Ireland (McCormick *et al* 2014), but there could be as many as 15,000 additional unknown settlement enclosures (McCormick *et al* 2014), including cashels/cahers which are more common in the west of Ireland, where stone is abundant. Though only a small proportion of these sites have been scientifically excavated, excavation at some ringforts demonstrate early pre-ringfort occupation and so many may have originally been unenclosed farmsteads at the beginning of this period. There are, of course, other settlement types from this period, including dispersed unenclosed farmsteads, raised raths (enclosed settlements with a raised central settlement platform), non-circular enclosed settlements (ranging from ‘plectrum-shaped’ to ‘sub-rectangular’) and *crannógs* (or lake settlements), which are known from earlier periods but become common and more elaborate with submerged causeways, jetties, and craftworking areas.

Another form of settlement evidence during this period are sites known as settlement-cemeteries (Stout and Stout 2008; Ó Carragáin 2009; Kinsella 2010; McCormick *et al* 2014). Settlement-cemeteries are defined by inhumation burials within an enclosing ditch and evidence of settlement debris, including evidence of craftworking, crop processing and food waste, within the ditch fill. Stout and Stout (2008) suggested that the remains of animal bones at these sites represent funerary feasts, and it might be likely that the faunal assemblages represent both special feasting events as well as more quotidian food remains (O'Sullivan 2014). The differentiation between the two would be difficult to differentiate between, given the regularity with which these sites were used (Rowley-Conwy 2018). Radiocarbon dates of settlement-cemetery sites demonstrate an increase in construction around the fifth century AD (much like other enclosed settlements) and they generally went out of use in the eighth century AD, though there are settlement-cemeteries that demonstrate greater longevity, starting earlier and continuing use through the medieval period.

Major construction of enclosed settlements took place during the sixth and seventh centuries AD, with the earliest construction events dated to the late fourth century. Construction across different settlement forms, unenclosed settlement, univallate raths, multivallate raths, non-circular raths, raised raths, and cashels, took place around the same time with only some minor variation. According to McCormick (2013), radiocarbon dates from the construction of multivallate raths appear to be slightly earlier than other forms of enclosed settlement and cashel and raised rath construction dates starting slightly later during the latter half of the seventh century.

There are several competing theories as to why enclosed settlements became important seemingly quite suddenly. Mytum (1992) suggested that changing perspectives on private rather than communal land ownership might relate to the introduction of Christianity and changing worldviews. This theory, however, lacks specific evidence linking private land ownership and Christianity, therefore the two are considered coincidence rather than causal (Lynn 2005; McCormick *et al* 2014). Lynn (2005) suggested that increased disease and subsequent political instability during this period might have encouraged elite individuals to construct enclosures as a form of self-quarantine. Lynn points to increased defensive structures around settlements as evidence for social and political unrest and increased violence, however Mallory and McNeill (1991) previously noted that entrance design and a lack of a palisade overtop the bank made enclosed settlements rather poorly defensive. The enclosure banks might not have been designed to keep intruders out but rather to keep valuable livestock in. McCormick (1991) and McCormick and Murray (2007) have argued that the rise of enclosed settlements is a consequence of the increased value of cattle and, therefore, the increased risk of cattle raiding. Increased concern for cattle raiding is also reflected in the early medieval literature, as the *tain* was a genre of Irish literature that specifically relates to cattle raids. Alternatively, the siting of enclosed settlements in particularly fertile farmland (O'Sullivan 2014) suggests that an enclosure may have had less to do with livestock and more to do with cereal grain production. Finally, O'Sullivan and Nicholl (2011) suggest that changes in domestic architecture reflected broader ideological changes that highlighted the importance of separating domestic space from the kin-land of the wider community.

Construction of and use of enclosed settlements began to decline in the ninth century and then faced another period of sharp decline in the 11th century (McCormick *et al* 2014). Though it is unclear exactly what precipitated the decline of enclosed settlements, Kerr (2007) suggests that the shift away from a cattle-based economic system in favor of increased arable agriculture resulted in different relationships to land and place.

Burial

Inhumation burials reappeared in Ireland in the first century AD (after having been replaced by cremation burial in the Bronze Age). Some of these early inhumation burials might have been individuals who had been raised in a Roman or Romano-British context but buried in Ireland (O'Brien 1990; Cahill Wilson 2014). Inhumations in the first half of the first millennium AD are rare but become more common by the fifth to sixth century AD, at which point complete east-west oriented, supine, inhumations without grave goods became the primary burial rite in Ireland. O'Brien (2009) asserted that, though the burial rites appear to conform to Christian practices, it would be inappropriate to assume that this indicates that the individuals thought of themselves as Christian. The re-use of earlier burial monuments and the use of settlement-cemeteries, considered to be communal or collective familial burial grounds (known as *ferta*), has been cited as evidence of slow or resistant practices against Christian conversion, highlighting the importance of kin-relationships rather than religious belief (O'Brien 1999).

The term *ferta* comes from early Irish literature and translates to "burial mound" or "rounded ditch." In Tírechan uses the term in his *Life of Patrick* to describe pre-Christian burial practice. Scholars have described these forms of burial as collective or kin-based burial places and suggest that they were likely important territory or boundary markers in the late Iron Age through the early medieval period (O'Brien 1992; Charles-Edwards 1993; McCormick *et al* 2014). There is evidence that many early medieval burials from the 5th-7th centuries were inserted into earlier burial places, including Iron Age ring ditches and even earlier Bronze Age barrows or Neolithic tombs. There were, of course, unenclosed burial sites not associated with earlier monuments and deviant burials unassociated with other inhumations, such as in ditches or defunct cereal-drying kilns (McCormick *et al* 2014).

In the 8th century AD, ecclesiastical authorities declared that baptized individuals were required to be buried on consecrated ground rather than in family burial grounds. This, however, did not prevent the occasional burial in a *ferta* or settlement-cemetery but did broadly cease the practice. Further, because of this edict, communities would bury their unbaptized children in cemeteries called *cillíni*. Many early medieval burial grounds continued to be used as *cillíni* and, after the dissolution of the Catholic Church under King Henry VIII, children were often buried on the grounds of deconsecrated monasteries.

Houses and Other Features

While enclosed settlements are prolific across the landscape, structures dating the mid- to later part of the first millennium are not common. Despite increased development, there have only been about 550 structures excavated that date to this period (McCormick *et al* 2014, 89). McCormick *et al* (2014) suggest that the surprising lack of structures from this period might relate to the means of construction for these buildings, with drip gullies and stakeholes for wattle, leaving a smaller archaeological footprint than more substantial buildings. Of the structures that have been excavated, the majority are circular wattle-walled structures (roundhouses) with either internal or external hearths, occasional internal divisions, and benches along the walls and, presumably, thatched or otherwise organic roofs. These roundhouses had an average internal diameter of 4-5 meters, but some are as large as 6-10 meters (McCormick *et al* 2014). Other house shapes are known from this period, including rectilinear and figure-of-eight shaped buildings. The figure-of-eight shaped buildings occasionally include a second hearth in the smaller side room and have been interpreted as potential kitchen or a family sleeping area, creating a clear division between the more public main structure and a private domestic structure (McCormick *et al* 2014).

In addition to houses, settlements during this period occasionally also include other features such as craftwork areas, pens for animals, external field systems, and *souterrains*. Most settlements during this period were self-sufficient and craftwork, including metalwork, would have taken place within or near to settlements. Metalworking areas are often found external to settlement enclosures, presumably due to the increased risk of fire.

As farmsteads, animal pens and field systems are also often associated with settlement enclosures and occasionally structures have been found in relation to field systems (defined by low stone walls), such as at Carrigoran, Co. Clare and Ballyutoag, Co. Antrim. These structures have been interpreted either as houses for lower status individuals, including free tenant farmers, semi-free individuals, and slaves, or as settlements related to seasonal transhumance (McCormick et al 2014).

Souterrains are semi-subterranean to subterranean passageways and chambers found in later settlements, with the majority constructed from the 9th-12th centuries AD. Relatively common, there are 3,500 recorded souterrains in Ireland (Clinton 2001). Their function has been debated as either area for food storage or as places of protection when the settlement was attacked (Mallory and McNeil 1991). In practice, these structures were likely used as both, under the necessary circumstances. Some souterrains contained larger chambers to keep food cool and slow spoiling, like at Lowpark, Co. Mayo and others appear to have had a more defensive design, such as the souterrain at Cahercommaun, Co. Clare which led from the interior of a roundhouse and exited out along a nearby cliff face.

Social and Political Structure

Written records from this period describe a society that Fergus Kelly called, "...hierarchical and inegalitarian" (Kelly 1988, 7). The early law tracts frame a social and political system that was based on clientage, in which those of lower social status would pay food rents and provide services to those of higher social status. There were various ranks of free individuals including tenant farmers, clerics, poets, lawyers (both *brithem*, judges, and *aigne*, or advocates), physicians, carpenters, blacksmith, other craftworkers, entertainers, ritual specialists, and servants. During this period slaves were also common, and a person could be taken into slavery as a prisoner of war, captured by slave-traders, due to unpayable debts, or they could be sold into slavery by their parents. Slaves had none of the protections but all the restraints of free individuals under the law and, though slaves could be freed, this was not recommended (Kelly 1997).

As clients of their lord, free individuals would pay their food rents and provide their services to their lord (*flaith*), who would provide them with land in return. The difference between a client and a lord was, generally, the number of cattle that they possessed and the difference between the varying grades of lords was an increasing number of cattle and clients. Above the lords were the kings (*rí túaithe*), who controlled a *túath*, a political unit roughly equivalent to a petty kingdom, of which there were approximately 150 between the 5th-12th centuries AD. The *túatha* were organized into five provinces: *Ulaid* (Ulster), *Laigin* (Leinster), *Mumu* (Munster), *Connachta* (Connacht), and *Mide* (Meath) (Ó Cróinín 2005), each of which was ruled by the highest grade of king, the *rí cóicid*. There is very little archaeological evidence for this complex social system. Lynn (1989) related differences in the number of banks surrounding a settlement and the size of the enclosed area as an indicator of status, but Soderberg (1998) found that these differences were insignificant, especially in comparison to contemporary hierarchical settlements in Britain. Soderberg also found that there was no difference in the use of animals between these different sites, not in their species ratios, skeletal part frequencies, nor their age structure (1998).

Soderberg concluded that the hierarchical system described in the historical texts masked more cooperative economic strategies and that an economic system based on the accumulation of cattle (rather than coins) limited the economic difference between lords and clients (1998). Based on the historical evidence, the distribution of meat was tightly controlled in early medieval societies, but Finbar McCormick (2002) similarly could not find zooarchaeological evidence for hierarchical distribution. McCormick concluded that feasting was used as an effective means of redistribution of resources and that the communal aspect of feasting made it impossible to identify hierarchical distribution.

Another means of resource distribution was the market-fair or assembly. These events, which occurred at several levels of society, are referred to by many names, but one of the most highly discussed is the *óenach* (pl. *óenaig*). At such events, taxes and tributes could be paid and trade conducted (Swift 2000) but, importantly authority and community identity were reaffirmed (Gleeson 2015). The frequency and scale of the assembly depended on the level of social organization represented, whether it was the local (petty kingship), regional (overkingship of several petty kings), or even broader (overkingship of several overkings). Importantly, these events represented the economic, political, and social dimensions of early medieval Irish society.

Agriculture

The early medieval period emerges with an economy and social structure focused on the production of dairy and dairy products. Later, before the arrival of the Vikings, there is a shift to a greater dependence on arable agriculture and the production of barley and wheat, with animal husbandry still playing a role, albeit to a lesser extent than it did at the beginning of this period (McCormick 2008; McCormick *et al.* 2011).

Archaeobotanical, palynological, and zooarchaeological analysis of remains from settlements in the mid-to-late first millennium AD demonstrate that Ireland was characterized by an open landscape with scrubby woodland and mixed farming

(McCormick *et al* 2014). Law tracts from this period list the primary cultivated cereals as: bread wheat, rye, spelt wheat, two-rowed barley, emmer wheat, six-rowed barley, and oat (Kelly 1997). These texts indicate that wheat was considered a higher status cereal and oat was regarded as the lowest grain. Muriel McClatchie *et al* (2011), however, found that barley, oats, and wheat were produced in approximately similar proportions during this period, yet rye was relatively uncommon. Most sites also produced a single type of grain until the 8th century, after which there was increased agricultural diversity. McClatchie *et al*. also found many non-cereal cultivars, including broad bean, garden pea, flax, apple, plum, lentils, cabbage, turnip, and mustard seed, and wild fruits including hazelnut, raspberry, bramble, dewberry, sloe, and wild plum (2011).

Increased production of cereal grains during this period was either supported by or catalyzed by improved agricultural technologies. Despite earlier scholarship that suggested that the coulter was not introduced to Irish plowing until the 10th or 11th century (Brady 1993; Kelly 1997), two possible coulters have been found during excavation at Ballynakelly, Co. Dublin and Ratoath, Co. Meath, both sites dating to the mid-seventh to mid-eighth centuries. During this period, keyhole-shaped cereal drying kilns also became more common than the earlier figure-of-eight shaped kiln. Keyhole-shaped kilns are more efficient and have a larger capacity than figure-of-eight shaped kilns, allowing for increased production. Interestingly, there are fewer of these kinds of more sophisticated kilns and O’Sullivan *et al.* (2014) suggests that this might indicate the growing power of elite control over important stages in grain production and surplus grain management.

Milling technology during this period also became more advanced and prepared for grain processing on a larger scale. While most grain processing was likely done by hand, a claim supported by an increase in rotary quern stones found at settlement sites, between 750-850 AD there was a period of increased construction of both vertical and horizontal watermills. Most of these mills relied on water from rivers or streams but Nendrum, Co. Down, Little Island, Co. Cork, and Knocknacarrage, Co. Galway are all tidal mills. At this time, grain production and cereal drying kilns were associated with settlements, yet most of the early mills were found at monastic sites, such as at Nendrum, Co. Down, which indicates changes in trade and distribution of grain and the effect of ecclesiastic sites in the political economy of food production. Raystown, Co. Meath was the only site where cereal drying kilns and watermills were found together. Raystown, with its series of eight watermills, kilns, souterrains, and cemetery, is a truly exceptional example of grain production during this period (Seaver 2016).

The literature and law tracts suggest that livestock production was of the utmost importance. In fact, "the cow was the basic unit of wealth, and an individual's social status in this rigidly hierarchical society was dependent, to a large extent, on the number of cows at one's disposal" (McCormick 2014, 121). The accumulation of cattle and the production of dairy products was necessary to enter contracts, pay taxes, fines, tributes, and bridewealth. Bridewealth, is paid by the kin group of the groom to the kin group of the bride and is distributed through the bride's relations, in exchange for the bride's labor and reproductive future. The children of such a union would therefore join the groom's kin group, establishing patriliny. In early medieval Ireland, either or both the bride and groom could bring property to the union but, regardless, the children would be the responsibility of the groom and the groom's kin group. In this way, inheritance was tightly controlled and the value of animals in the social exchange maintained.

Zooarchaeological evidence from this period supports the primacy of cattle in agricultural economies, with cattle comprising 40-50% of most assemblages (based on the minimum number of individuals). Sites with cattle age-at-slaughter peaks at 24 months and then again at 36+ months, are considered evidence for producer/consumer sites, and sites that have only older cattle are interpreted as consumer sites, including monastic sites and towns (e.g., Clonmacnoise, Co. Offaly and Dublin) (McCormick 2014). In addition to meat and dairy products, cattle also provide other important products, such as tallow, leather, and horn.

Following cattle, the next most important livestock animal was the pig, averaging between 30-40% of faunal assemblages and caprovines (sheep and goats) comprising the final 10-30%. Age-at-slaughter data for pigs show a general trend towards slaughter between 18-24 months, or prime meat age, and sheep were mostly slaughtered around 28 months, though some were kept much longer, indicating that sheep were being slaughtered for meat, fleece, and dairy (McCormick 2014). McCormick and Murray (2007) found "remarkable consistency" in livestock distributions from the 7th-9th century, but then increasing faunal diversity after AD 800. This date coincides with the increase in the production of milling as well as the increased importance of silver. The production and accumulation of both grain and silver is easier to control and elites during this period may have invested more in these commodities as a means of increasing their wealth and increasing wealth disparities between different strata of society (McCormick *et al* 2014).

Aside from the cattle/pig/caprovine distributions, other domesticates are known from settlement sites of this period. Horses generally comprise a very small proportion of faunal assemblages of this period but were important for transportation and traction (i.e., pulling plows). Horse remains from this period demonstrate pathologies consistent with traction and transport (e.g., osteoarthritis in the joints and spine) and occasionally have evidence of cut marks, indicating that they were also sometimes eaten (Edwards 2005). Commensal animals, including dogs and cats, were important contributors to agricultural communities. The law tracts indicate that, in addition to their role as pets, dogs were used in herding, hunting, and protecting the farmstead and the local champion (*ánruth*) would have a hound (*árchú*), who was capable of tracking, seizing, and attacking (Kelly 1997). Cats were not provided as much reverence in the law tracts but were considered useful pets for their role in protecting food from vermin. Zooarchaeological evidence also indicates that cats were, on occasion, skinned for their pelts and early literature suggests that they were also kept as companions. Domestic fowl (i.e., chickens, geese, and ducks) are relatively rare on sites from this period but were useful for their feathers (down) and eggs. The Roman Empire introduced chickens to Britain and in Ireland not long afterwards (Edwards 2005).

Hunting and fishing also contributed to subsistence and trade during this period, though to a much lesser extent than domesticates. The use of deer antlers was common at sites of this period, especially for use in craftwork, though postcranial skeletal elements are less common. This might suggest that deer antlers were collected after being shed more often than deer were being hunted, but it confirms that hunting was still taking place. Soderberg (2004) demonstrated an interesting and opposite trend at ecclesiastic sites, whereby there were more postcranial elements than antlers, suggesting that the monastic communities were supplementing their diet with venison more than at other settlements. Similarly, ecclesiastic sites demonstrate increased consumption of fish, such as the large quantity of salmon and eel remains from Clonmacnoise, Co. Offaly. Textual and zooarchaeological evidence indicates some exploitation of marine resources such as fish, sea birds, and sea mammals (including whales) but these mentions are rare. Several coastal shell middens ("shell heaps") have been dated to the first millennium AD. While the exploitation of shellfish and nearshore resources has been thought of as a *marginal* subsistence strategy, the presence of dog whelk in shell midden assemblages, which is not edible but used to produce valuable purple dye, and copper alloy pins suggests that this is likely a misinterpretation (McCormick and Murray 2007). Largely, however, there has been little work done to explore the exploitation of wild resources during this period and the relative invisibility of wild resources in the archaeological literature is more a matter of misidentification than practice.

Cattle and Food in Literature and Historical Texts

Ireland benefits from one of the largest corpora of vernacular texts from the early medieval period. These texts range from copies of Christian works, saints' lives, Easter annals, to myths, sagas, poetry, and legal prescriptions. These texts provide a unique perspective on life in Ireland during the early medieval period. The myths likely derive from a pre-existing oral tradition and Kenneth Jackson asserted that they also provided a "window on the Iron Age" (1964), however that window might be somewhat obscured.

For years it was assumed that the myths and sagas provided an unfettered view into the Iron Age. Today, there is debate among archaeologists about the extent to which the myths may be understood as representations of a prehistoric past. John Waddell, in *Archaeology and Celtic Myth* (2014), suggests that the themes present in the early Irish myths derive from an even older, Indo-European, tradition and so provide insights into the cosmology of Bronze Age Ireland and, indeed, Europe. Themes such as sacral kingship, the role of sovereignty goddesses, warriors, and mead drinking appear frequently in the Irish sagas as well as mythological traditions from the Continent. This bold assertion about the antiquity of the Irish myths has been challenged by J.P. Mallory in, *In Search of the Irish Dreamtime: archaeology and early Irish literature* (2016). In this text, Mallory demonstrates that the material culture represented in the early literature clearly represents early medieval objects, not early counterparts, especially burials, which are often mentioned in the literature with reference to monuments to heroes, however single inhumations were uncommon in Ireland until the 6th century AD.

While most archaeologists would neither claim direct access to a prehistoric past through the literature nor would they dismiss them as irrelevant to discussions of late prehistory. The two camps make two separate, but related, arguments. Waddell claims that the *themes* of the myths may reflect a connection to an Indo-European tradition whereas Mallory demonstrates that the *material culture* described in the texts better reflects the time in which they were written. The texts themselves should be scrutinized for the intrusion of early medievalisms, with an understanding that the tales were transcribed in a medieval monastic context for a medieval Christian audience for centuries but may provide some perspective on the late prehistoric Irish worldview, particularly with respect to the role of food and feasting and the value of animals. To understand the ways in which early medieval texts may help us to better understand such cultural values during the first millennium AD, let us first examine the context of writing in Ireland and the source of the texts.

The earliest references to Ireland come from Classical authors including Julius Caesar, Strabo, Pliny the Elder, Tacitus, Solinus, and Ptolemy. Much of these early texts describe the size, shape, and natural features of Ireland, especially Ptolemy, whose description in his *Geographia* (c. 150 AD) included important settlements as well as the major interior waterways. Tacitus (c. 78-84 AD) in *Agricola* provides some context for Roman familiarity with Ireland, noting that the "...approaches and harbors are tolerably well-known from merchants who trade there," and, additionally, that "...a single legion with a few auxiliaries could conquer and occupy Ireland" (Benario 1991, 41). A few sources also provide valuable information about the agricultural practices in late prehistoric Ireland with Solinus (c. 3rd century AD) - likely paraphrasing from an earlier work by Isidorus - mentioning that, "...*Hibernia*...is so rich in fodder, that the cattle, if not removed from the fields from time to time, would happily gorge themselves to a dangerous point" (Koch and Carey 2003). These small clues provide us with an idea of the agricultural economies of Ireland, suggesting mixed agricultural practices with the general preeminence of cattle, in so much as they were the primary animal of concern to the Classical commentators.

In Ireland, prior to the introduction of Christianity and its tradition of written texts, the only native script in Ireland was *ogham*. Lasting from the 3rd/4th-7th centuries AD, ogham was a notation system of 20 symbols composed of linear marks across a central axis line that could be transliterated into Latin letters to represent Old Irish words. It is likely that a single individual trained in Latin and Greek developed *ogham* as a kind of cipher for Latin, representing the Latin alphabet and aspects of Latin grammar but used to write the vernacular language (Johnston 2017). There are 400 known *ogham* inscriptions, with most on standing stones. *Ogham* stones are found throughout Ireland, with a concentration in the southeastern part of the country, as well as in Cornwall, the Isle of Man, Wales, and Devon (UK). Inscriptions on *ogham* stones consist of personal names, demonstrate familial relationships, or ownership of the stone. These non-narrative texts reveal two interesting features of Irish society during this period: (1) the role of interpersonal relationships and association with particular ancestors and (2) the growing importance of land claims and personal/familial ownership.

After the arrival of the first missionaries to Ireland in the mid-5th century, there was a precipitous increase in the number of written texts in Ireland. The earliest suggested text in Ireland is the *Cathach* of St. Columba from Co. Donegal (Herity and Breen, 2002). This text, composed in Latin supposedly between 561-600 AD, includes Psalms XXX-CV, was used to bless soldiers in battle (the word '*cathach'* means 'battler' in Irish) and was enshrined in the 11th century. Other texts from this early period include the Springmount tablets (7th-8th century, Co. Antrim), wax tablets with evidence of Latin and literacy instruction, and the Book of Durrow (7th-8th century, Co. Offaly). During this early period, literacy was reserved for monks and spread and preserved by the monastic system in Ireland. These early texts were written in Latin and represented Christian texts, however, shortly thereafter, texts began to be written in Irish and represented local mythological and legal traditions.

The representations of feasting and cattle in the early literature and law texts might provide scholars with a sense of the value of cattle in the early medieval period and even perhaps into late prehistory when these systems may have taken shape. The primary texts examined are the *Táin Bó Cúailinge* (The Cattle Raid of Cooley) and *senechas* (legal texts), with supplementary evidence provided from other myths and sagas. In the literary sources, not only are cattle well-represented, dairy products, too, are especially highlighted.

Indeed, milk was appreciated fresh, diluted with water, or thickened with rennet and was considered a particular food for the sick (Kelly 1997) and an important component of hospitality (Peters 2015). Annual milk-yield was a great concern for early Irish farmers and, according to the law texts, the price of milk was set at ¼ of an ounce of silver, or six *scruples* (Kelly 1997). Dairy products such as milk, buttermilk, butter, and cheese are described in various ways in early Irish literature and there are prescriptions on who may consume what products (Kelly 1997; Peters 2015). In these texts, dairy and cattle play a central role in the negotiation of personal power and social status, as representations of "monetary" wealth and are additionally important in ritual.

The *Táin Bó Cúailinge* is the best known of the *táin* genre. A *Táin Bó* is a tale about a cattle raid ("*táin"* meaning raid and *"bó"* meaning cattle*)*, other *tána* include the *Táin Bó Flidaise, the Táin Bó Fraich, and the Táin Bó Regmna*. The *Táin Bó Cúailinge* was preserved in its most complete form in the 12th century Book of Leinster, though another 12th century version, in the *Lebor na hUidre* or Book of the Dun Cow, contains language that indicates that it was first compiled between the 6th-8th centuries AD (Kinsella 1969). In the *Táin Bó Cúailinge,* cattle are valued in exchange as well as ritual, and are frequently used as metaphors representing humans. There is some hesitancy in describing their value as monetary because Ireland did not have coins until after the Scandinavian settlement of Dublin in the 9th century, therefore trade and exchange was performed differently, however for these purposes, conceptualizing value in this way is sufficient. Regardless, not only does the action of the *Táin* focus the social significance on the value of cattle but an inherently political act that is used to increase one's power and status within society. Additionally, the role of cattle in ritual and prophesy and as representations of humans is supported by additional early medieval texts.

In the *Táin*, cattle are used as a measure of wealth. In the initial scene, 'the Pillowtalk', Medb and Ailill compare their personal goods, which include their livestock with reference to their cattle herds. All appears equal except that, "...there was one great bull in Ailill's herd…. Medb couldn't find in her herd the equal of this bull, and her spirits dropped as though she hadn't a single penny" (Kinsella 1969, 54-54). From this discrepancy comes the primary action of the tale - the war with Ulster over Donn Cuailnge, the Brown Bull of Cooley, the only bull equal to Finnbennach, Ailill's great white bull. This not only suggests the high exchange value placed on cattle but also demonstrates how cattle could have been leveraged to increase one's power and status, which is Medb's objective throughout the tale. Medb later elaborates on the specific value of the bull in her offer to Dáire mac Fiachna, the keeper or owner of Donn Cuailnge, that a year with the bull was equal to a quantity of land, an expensive chariot, and sexual access to Medb herself. Later, cattle are valued as the spoils of war (Kinsella 1969, 100-101; 159), as enticement for Cúchulainn to abandon Conchobor (Kinsella 1995, 114; 116), as offer aid from the Morrígan (Kinsella 1969, 132), as repayment for damages (Kinsella 1969, 163; 219), and as an aphorism for future security and prosperity (Kinsella 1969, 211).

The high value of cattle in exchange is also reiterated in other tales. For instance, in *Togail Bruidne Dá Derga* ("the Destruction of Dá Derga's Hostel"), Conaire remarks that he once gave Dá Derga, "...a hundred cows from the herd…" (Koch and Carey 2003, 171-172) among other goods. Conaire considers this sufficient to maintain their exchange relationship, therefore allowing him to request hospitality. Finally, in the *Lebor Gabála Érenn* ("the Book of Invasions"), the Formorians are paid their annual ransom with "...Two thirds of the children and grain and milk of the men of Ireland… (Koch and Carey 2003, 241-242)" Though not a direct reference to cattle, milk acts as a synecdoche for cattle and cattle-wealth. Therefore, as recognized throughout the *Táin*, and other early medieval texts, the primary social purpose of cattle in early Ireland was as an object for exchange.

Aside from their exchange value, cattle in the *Táin* also function to leverage or gain power and status. Medb's primary motivation in the tale is to increase her personal power by the acquisition of Donn Cuailnge. In a battle of wits between Fergus and Ailill, Medb interjects with: "...a wise judge / bears no grudge / have no more / to do with those / who keep their cattle / with a vengeance / men's eyes downcast / and Fergus cleared" (Kinsella 1969, 106). In other tales, close association with cattle and cowherds, outside of the exchange system, is seen as a juxtaposition to high status and royal power. In *Togail Bruidne Dá Derga*, the king Cormac orders his daughter's death, though she is rescued by cowherds. In that tale,

> "...Cormac weds again his wife, namely Étaín, and this was his desire, that the daughter of the woman who had before been abandoned [i.e., his own daughter] should be killed…. Then his two slaves took her to a

> pit, and she smiles a laughing smile at them as they were putting her into it. Then their [kindly] nature came to them. They carried her into the calf shed of the cowherds of Eterscél, descendant of Iar, king of Tara, and they fostered her till she became a good embroideress; and there was not a king's daughter dearer than she was in Ireland" (Koch and Carey 2003, 167).

In the tale, the cowherd is a named position in the court, particularly one of some standing. So, although fosterage by cowherds is constructed as a fall from status for royal-born children, the role of the cowherd was clearly valued in this society. From this we see that cattle in the literature were constructed as a means of negotiating power and status through acquisition.

Apart from exchange, cattle play a central role in rituals related to the inauguration of kings. In *Togail Bruidne Dá Derga*,

> "...the king, namely Eterscél(e), died. A bull-feast was convened by the men of Ireland (in order to determine their future king), that is, a bull used to be killed by them and one man would eat his fill of it and drink its broth and a spell of truth was chanted over him in his bed. Whoever he would see in his sleep would be king and the sleeper would perish if he uttered a falsehood" (Koch and Carey 2003, 168-9).

Additionally, such an event may also be related to the *feis Temro*, or the Feast of Tara, which was also used in the selection and inauguration of kings, as mentioned in the *Tochmarc Étaín* (Koch and Carey 2003). In these rituals, cattle are used to select the rightful king, thus, again, as a negotiation of status and power. The association with power, particularly royal power, is one of the driving motivators for Medb's action in the *Táin*. Furthermore, the representation of cattle and their use in these rituals demonstrates the important social role that they played in society.

Representations of cattle in the early medieval Irish literature demonstrate a high degree of value that is placed on cows, bulls, and oxen, to a level that suggests cattle were used as a social identifier. On one level, cattle represent a form of currency in a pre-monetary society. As we have seen, there is a negotiable value placed on cattle in the represented exchange system, yet a high value, nonetheless. Those that can acquire and leverage goods and services to increase their herds or the quality of the cattle (i.e., royalty such as Medb, Ailill, and Conchobor), are therefore able to attain political power and higher social rank. This gives cattle not only a ‘monetary’ value but also a social and political value.

The high social and political value placed on cattle is then also reflected in the role of cattle in ritual practices, especially those related to the inauguration of kings. This suggests that the use of cattle as a valued exchange item, and their associated secondary products (i.e., milk, cheese, butter, traction, etc.), was so important in society that cattle were interwoven in complex social and political negotiations and ritual. Texts such as the early medieval mythology and tales of the Ulster Cycle, some of the earliest vernacular texts in Ireland, may shed some light on the role and value of cattle in the later Iron Age. Other written sources from this period, such as the legal tracts, also suggest that cattle played a key role in the construction of society and political associations in the early medieval period.

The early Irish law texts, or *senechas*, provide key insights into the value of cattle in early medieval society. Most of the law texts were collected in the collection *Senechas Mór* and pertain to the structure and role of social institutions and civil regulations, listing offenses against individuals and property, inheritance, contracts, and taxes. The texts were preserved in manuscripts dating to the 14-16th centuries, but linguistic evidence suggests that they may have been copied down as early as the 7th-8th centuries. Much like the myths and sagas, the law texts may have derived from an earlier legal tradition in Ireland that was originally transmitted orally by individuals who were legal specialists

(Charles-Edwards 2005). In his *Confessio*, written during the 5th century, St. Patrick remarks that he paid local judges a hefty amount during the course of his mission (Bieler 1993). Fergus Kelly (1988) even claims, on a linguistic basis, that the legal tradition in Ireland may extend back to the end of the Bronze Age (around 1000 BC). Perhaps not quite that old, the law texts in Ireland do present an interesting admixture of Christian and non-Christian influences. The tension between the Christian influences on the non-Christian legal tradition is most notable concerning payments owed to the Church and issues of polygyny (Kelly 1988). As such, the early medieval law texts provide interesting insights into political and legal concepts of value during this period.

Throughout the law texts there are references to cattle, their value, and the role of dairy products. For instance, the basic unit of measure for many legal actions is a milch ('milk') cow. The value of other cattle is measured against the milk cow with their value increasing with regards to their ability to produce milk, with the least valuable form being a yearling bullock, valued at only ⅛ the price of a milk cow (Kelly 1988). Other measures of commodity currency in the law texts include *cumals* ('female slaves'), ounces of silver, and *séts* (translated to 'treasure' or 'valuable' -- the exchange value of a *sét* appears to be regionally mutable). According to the texts, prices may be interchangeable between forms of currency depending on the status of the awardee. For example, it is appropriate that an offense to a king measured in milch cows to be paid in silver (Kelly 1988). Land itself was priced in *cumals*, however the value of a *cumal* of land was variable depending on its quality and measured in cattle: a *cumal* of good-quality arable land might cost 24 milch cows whereas a *cumal* of bogland might cost only 8 dry cows (Kelly 1988). The status of non-*nemed* (non-privileged) free individuals was determined by the size of their land and the number of cattle that they possessed. Annual land rents were additionally paid in cattle. For instance, an *ócaire*, or a small free farmer is required to provide his lord with a pat of butter one fist-width wide and two fist-widths long and a *bóaire*, or a 'cow-freeman', was required to pay one milch cow (Peters 2015).

Preserved only in legal commentaries in the *Annals of Innisfallen* and the *Annals of Ulster,* the *Bóslechta* ('cow-selections') is a text that dealt specifically with offenses committed to and by cattle, especially crimes such as theft and killing (Kelly 1988). Although the *Bóslechta* has not been preserved in any complete form, laws related to cattle and the value of dairy products are interspersed throughout the remaining texts. For instance, the *Críth Gablach*, or 'Branched Purchase' (a text particularly concerned with rank, status, and property), provides legal advice for disputes raised from cooperative farming and joint-herding, including rightful ownership of calves in cooperatively herded cattle (Kelly 1988). Offenses committed against cattle include unlawful killing, unauthorized use, distraint, and especially theft. The law texts additionally provide advice for judgements on offenses committed by cattle, including attacks on humans, grazing-trespass, damage to crops, defecation, and theft of food (Kelly 1997). Offenses against cattle are harshly punished under early Irish law and, frequently, the guilty party must pay the honor-price of the owner of the cattle for unlawful actions against the animal.

Concerns for rightful ownership and legal status of cattle underscore the importance of cattle and dairying in early Irish society. This, in addition to the measure of individual status and land in cattle, demonstrates the value of cattle as a commodity product, a currency, and means of achieving rank and status. The complex accounting that Early Medieval Irish society took with respect to cattle and dairy products demonstrates the importance of the dairying economy in Early Medieval society. The suggestion that these texts may stem from a late prehistoric legal tradition gives greater weight to the suggestion of a late Iron Age origin to the development of the Early Medieval dairying economy.

Conclusion

The archaeology of late Iron Age and early medieval Ireland provides fertile ground for the study of agricultural production and social organization. With little evidence for substantial settlements, much less high-status graves, we must rely on the sources of evidence that we do have. Zooarchaeology provides that connective tissue between data and narrative about the late prehistoric past. From a zooarchaeological perspective, we can observe shifts in economic practices and social behaviors that can provide key insights into social behavior and identities.

Chapter 3

Theoretical Approaches to Animals in Society

This chapter focuses on how the role of animals in economic practices, either as products themselves or as producers, shape social relationships. First, I will demonstrate the different ways that economic practices shape animal husbandry practices. Second, I will describe the role of animals and the relationship between domestic and ritual economies. Finally, I will explore the relationship between animal economies and political economies. The nature of these relationships will help us to understand the role of animals in the Irish Iron Age and Early Medieval transition and allow us to understand the ways in which assemblages of animal remains may be used to infer complex social relationships.

Understanding the reciprocal relationship between animal economies and social and political relationships allows us to expand our understanding of political relationships in the Iron Age based on our understanding of the role of animals. The production, exchange, and consumption of animals creates demand for those animals or animal products. Such a system is not purely economic but also social. By reconstructing both domestic and ritual economies, we can better understand the ways in which the demands of domestic and ritual practice affect social relationships. To understand the role of animal economies in Iron Age Ireland, we must compare the animal bone assemblages across Iron Age sites. The animal bone assemblages demonstrate the importance of certain animal products. Domestic sites demonstrate production and consumption at non-specialized and ritual sites demonstrate the importance of production and specialized consumption. Together, comparisons of the relative importance of animal products reveal interrelated systems of production and consumption and the value of these products in society. Also, the specific requirements to support these systems of production structure social and political organization as some agricultural practices require close relationships to place.

I argue, however, that we understand that the production of assemblages at ritual sites are imbued with meaning and entangled in a system of domestic production and not removed from it. Acknowledging production within this context allows us to activate these assemblages and situate them within a broader system of production, consumption, and exchange that structures political economic systems. Therefore, it is important to understand the cultural foundations of zooarchaeological assemblages as they relate to social and political behavior and then, how this evidence is reflected in the Irish material to construct a coherent model for economic practices during this period.

Animal Economies

The basis of agricultural economic systems in late prehistoric and early medieval Ireland is the use of animals. Literary evidence from early medieval texts emphasizes the role of cattle in agricultural production and excavations from this period typically consist of anywhere from 40-60% cattle remains among the faunal remains (EMAP 2011). To understand the implications and interpret these data, we must understand the ways in which animals are exploited in an agricultural society. The basic unit of an agricultural economic system is the animal economy.

Animal economies refers to the ways that humans use animals and animal products, this includes the husbandry practices involved in producing and maintaining livestock for these purposes. This can refer to the ways that humans exploit wild and/or domesticated animals. Animals are agriculturally unique in that they have many uses, including food, clothing, and transportation -- as opposed to other agricultural products, which have narrower utility. Muscle, bone marrow, and organs all provide valuable nutrients. Bones themselves can then be boiled down to extract additional fats or to produce adhesives, providing additional resources from these materials. Because bones are both tough and malleable, bones can also be used to produce other objects such as projectile points or beads, pins, and buttons. Sinews from ligaments can be dried and used as a stiff fiber for lashing materials. Furs can be used for textiles and skins can be tanned and used for leather objects. Even animal teeth may have holes drilled into them and used as beads or pendants. All these uses are considered primary products, or those that can only be exploited once and are key economic features of subsistence economies, or systems of resource procurement needed for individual, family, or community survival.

Secondary products refer to those that may be exploited many times during an animal's lifetime. Secondary products associated with domesticated animals include wool, dairy, and traction, though wild animals may be exploited for their secondary products, such as antlers (which are shed every year), honey, and eggs. Commensal animals, too, provide secondary advantages. Cats, for instance, reduce the threat of pests to grain stores and dogs, the first domesticated animal, aid in hunting, protection from other predators, as well as companionship.

Andrew Sherratt (1981) proposed that exploitation of secondary animal products was the driver for social complexity in the European Bronze Age, in what he called the 'Secondary Products Revolution'. Legge (1981) and Chapman (1982) challenged this assumption, citing the exploitation of secondary products during the Neolithic Period. Indeed, Ingold (1980) and Vigne and Helmer (2007) argue that the increased value of animals in their ability to provide continued resources provides a clear economic motivation for animal domestication, stressing the importance of secondary animal products during the late Mesolithic and Eneolithic. Later scholarship (Bogucki 1993; Copely et al 2003; Evershed et al 2008; Greenfield 2010; Russell 2012) has both confirmed the exploitation of secondary animal products during the Neolithic through analysis of lipid residues on ceramics and the emphasized the contributions of secondary animal products to social complexity during the Neolithic and Bronze Ages. The development and exploitation of these goods have contributed to social complexity, and it is therefore important that we explore the production, consumption, and exchange of these products archaeologically.

By studying contemporary herding communities, and in comparison, to archaeological assemblages of animal bone remains, Payne (1973) suggested that we can infer the intended uses for animals, or the animal economies, of a community by considering the demographics of the animals represented archaeologically. This analysis begins with the species represented, then a mortality profile can be developed based on the age-at-slaughter and sex of individuals in the assemblage. Mortality profiles describe the demographics of the herd in death, which can be used to infer the demographic structure of the living herd. For instance, pigs do not produce milk or wool and so are primarily used for meat, however, cattle, sheep/goats, and horses all have the potential to produce other products and those products can be inferred by the demographic structure for the age-at-slaughter and sex of the individuals in the living herd. Interpretations of the mortality profiles can then be used to describe the economic practices of a community, particularly regarding production of secondary animal products, including wool, traction, and dairy.

Animals and Worldview

In their 2013 'manifesto for social zooarchaeology' Overton and Hamilakis called for a shift away from anthropocentric approaches to zooarchaeological interpretations. Rather than thinking of animals as economic or symbolic resources, they urged analyses to acknowledge the agency of non-human animals in their 'co-shaping' of interactions with humans. Their manifesto builds on a post-human approach to zooarchaeology, recognizing and negotiating the ways in which animals are quantified and analyzed as objects but, in life, they co-constructed society with humans (Overton 2010; Hill 2013; Recht 2019). Such a lens offers a means by which to explore human-animal relationships and the impact of animals on human society while avoiding anthropocentrism and anthropomorphism (Russell 2012).

Humans and animals have an inherently long entangled history. We have necessarily lived besides, lived with, hunted, hunted with, and engaged in domestication with animals. The presence of animals, and often certain *kinds* of animals, impacts our understanding of the known world and how the world is intended to function. In Ireland, though there is no post-glacial evidence of deer prior to human colonization, there is evidence of exploitation of deer from the Neolithic through the Modern Period. It has been suggested that red deer were introduced to Ireland during the early Neolithic by incoming groups from Britain and the Continent as a means of worldmaking (Carden *et al* 2012; Warren *et al* 2013). This suggestion relies on evidence of the social and ritual importance of deer in the earlier Mesolithic Britain, as sites such as Starr Carr (Conneller 2004), though there is no evidence for similar ritual use of deer remains in Mesolithic Ireland. That is not to say that deer were not introduced during this period, but the introduction may have been for subsistence purposes.

Peter Bogucki (1993) argues that a primary product-focused analysis is too narrow and ignores much of the complexity in human-animal relationships, particularly the role of animals as assets in an economic system. In complex societies, such as those present in Ireland in the late Iron Age and early medieval period with institutions and social differentiation, animals have the potential quality of being able to be commodities (meat, hide, bone, marrow) and produce commodities (dairy, wool, traction). As such, animals in complex society act as assets in trade and in concepts of wealth. The accumulation of animals demonstrates an exponentially increased earning potential for secondary products.

Secondary Animal Products

Dairy

The social and political organization of early medieval Ireland s characterized as having a dairying economy (McCormick 1992). A dairying economy is one in which social negotiations are mediated through dairy products, such as paying taxes in butter and providing a certain amount of cheese to guests as an act of socially regulated hospitality.

The conversion of milk into dairy products such as cheese and butter allow for the storage and preservation of important fat and mineral resources. This means of resource storage allows for greater access to nutrients during the winter months (Russell 2012). Additionally, milk production is a more economical use of pastureland than beef, allowing for greater population sizes (Ingold 1980; Russell 1988). As milk is produced by all mammals, dairy products can be derived from a variety of sources, including cattle, sheep, goats, and horses. According to Payne (1973) and Russell (2004), the optimal dairy herd would consist primarily of adult females and juveniles for milk production and few adult males for breeding stock (based on sheep and goats, but generally optimal for all primary-dairy exploitation). A dairy-specific mortality profile would, therefore, consist of a very high proportion of infants and juveniles (to induce the let-down response in females in order that they produce milk), several adult females, and few adult males. This model is based on modern herding societies. Finbar McCormick (1992) warns, however, that artificial means of encouraging the let-down response might confuse the data, when working with premodern societies. The let-down response, or the biological process in female mammals to produce milk in response to the presence of young, is manipulated in modern herds by methods that were not used in premodern times (McCormick 2002; Ryan 2005). Particularly, McCormick uses documentary sources from medieval Ireland, in which calves were required during the lactation period of the cow, therefore being kept for longer (between 6-9 months old) than optimal models for the female to continue to produce milk (McCormick 1992). McCormick (1992) adds that historical sources mention that females fatten more quickly than males, therefore requiring less investment and care than males in terms of meat production and were the choice for beef cattle; this would result in several older female individuals present in the faunal assemblage. The presence of older females, who might have been dry milk cows but were later consumed for their meat, highlights Payne's (1973) cautionary note that premodern animal husbandry practices eschewed all but one objective but capitalized on multiple opportunities.

Caution should always be used when making inferences about animal economies as many domesticated animals can have multiple uses. For instance, sheep may be used for both their wool, meat, and milk; cattle can be used for milk, meat, and traction; and horses may be used for transportation, traction, meat, and milk. It is the role of the zooarchaeologist, then to identify the most desired products, based on herd demographics, with the understanding that additional products may be exploited as a windfall.

Archaeologically, cheese and butter production may be suggested by the morphology of certain ceramic and wooden vessels. Peter Bogucki (1984) demonstrated that perforated ceramic vessels from Neolithic Europe could have been used for cheese production to separate the curds from the whey. This would have been an important development as whey removal reduces the amount of lactose in the resultant product, making it easier to digest in populations that do not demonstrate high levels of lactose tolerance (Bogucki 1984). Lipid analysis of archaeological ceramics from the Neolithic have demonstrated the presence of dairy lipids, indicating that these objects stored milk or dairy products (Dudd and Evershed 1998). Using these methods, research has determined the early exploitation of dairy products in the Near East (Evershed et al 2008) and in the British Isles (Copley et al 2003; Smyth and Evershed 2016).

In Ireland, however, the Iron Age is aceramic - therefore direct molecular methods cannot be used to identify dairy consumption. There are, however, other artifactual data that point to the importance of dairy production during this time. For instance, in waterlogged environments, objects identified as butter churns have been recovered (Raftery 1994: 116). Most directly, however, has been the identification of butter deposits in bogs (Synott 2010; 2018; Smyth et al 2019). Due to the anaerobic environment in bogs, organic material preserves quite well. Occasionally, during peat cutting in Ireland, butter has been found, usually contained within a wooden vessel, or wrapped in bark. The National Museum of Ireland currently has a collection of over 500 samples of so-called 'bog butter' in their collections (Synott 2010). There has been debate concerning reasons behind these depositional activities, whether it was for preservation or for ritual (Synott 2010); but just as a herd may be used for multiple reasons, butter may have been deposited for a variety of reasons as well. Regardless of the reasons, deposition of butter provides the most direct evidence for dairying in the Iron Age. In the early medieval period, while the practice of bog butter deposition persisted to a lesser degree, the greatest evidence for dairy production consists of faunal remains, with assemblages from typical settlement sites containing between 40-60% cattle remains (EMAP 2013). In addition to the faunal remains, cattle are also highlighted as socially important in the literature and law tracts from the period. Social distinctions were made between lower class farmers and upper-class farmers based on the number of milk cows that they possessed (Kelly 1998).

Wool

Several livestock species were bred for their ability to produce wool for textiles, such as sheep and alpacas. While animal skins and leather were likely to have been used early for clothing, flax appears to have been the material of choice in the Neolithic for textile production (Sherratt 1982). Later, there is a shift in the production of wool from sheep during the Neolithic, emphasizing and reinforcing their importance as a commodity. In South America, camelids were bred for their wool and exploited for textile production (Moore 2016). According to Payne (1973) and Russell (2004), the optimal mortality profile for wool production consists largely of adults, juveniles being produced for replacement as the older individuals die. In this strategy, the emphasis lies on adult individuals (without concern for sex), though it is noted that juvenile wool may have been considered a specialty or luxury object and may have been sought while the wool quality of older individuals decreases, therefore there might be slightly more juvenile individuals in specialty flocks and few elderly individuals (Payne 1973).

Unlike the milk and dairy production, there is more direct evidence for wool exploitation. Archaeologically, in arid conditions, the textiles themselves preserve -- such as in the Andes and in the Near East. In fact, the oldest example of a textile that we currently have dates to the Upper Paleolithic in the Levant (Russell 2011). Production of textiles is a labor-intensive occupation and requires several objects that may be archaeologically visible, even when the textiles themselves have disintegrated. For instance, impressions of textiles have been known from some Neolithic ceramics (Russell 2004) and metal cutting shears have been associated with wool exploitation at Roman sites in Britain (Albarella 2007). Spindle whorls made of stone, bone, ceramic, and occasionally wood are known to have been associated with thread production. In the Iron Age, weaving beaters made of bone are also known to have been associated with the production of woven textiles (Raftery 1994). Throughout the early medieval period, the importance of sheep in agricultural communities increased, as evidenced by the increase in the percentage of sheep and goat faunal remains (EMAP 2011). At the end of this period, sheep's wool was important to produce rope and sails for shipping and trade, particularly for the Norse community in Dublin (Ryder 1969).

Traction

Equids, bovids, and camelids are used for transportation and plowing both today and in the past. The ability to effectively move people and things allowed for greater mobility and expanded trade routes. According to Russell (2004), the expected optimal mortality profile for traction would preference adults, particularly males. Moreover, there would be a higher degree of castrated males (oxen), which may be identified by morphological differences in their long bones (e.g., oxen having longer and narrower limbs) and horn cores (Armitage and Clutton-Brock 1976; Russell 2004). Due to the nature of the secondary product, only a few animals would need to have been kept for traction, which, due to issues of survivorship, could make their identification difficult in the archaeological record. Alternatively, however, due to skeletal stress, livestock used for traction tend to develop pathologies to the limbs, spine, and skull, which may help in the identification of traction and transportation.

Due to their increased longevity and continual stress, animals used for traction tend to acquire pathologies such as bone deformation by repetitive strain syndrome and damage due to harnessing (Bartosiewicz 2008; Upex and Dobney 2012). Pathologies associated with traction can include osteoliths, lipping, expansion of the metapodial trochlea, and arthropathies, particularly in the lower limbs, pelvis, and spine. It is important, however, not to conflate age-related and stress or work-related arthropathies (Upex and Dobney 2012) -- however domesticates exploited for meat, milk, or wool are rarely kept to old age. Additionally, among individuals used in paired harnesses, skeletal deformation may be apparent on only one side of the body. Evidence for harnessing for riding may be seen in biting damage to the anterior occlusal corner of the lower second premolars (Bendrey 2007) as well as nasal bone deformation due to harnessing (Taylor et al 2016). Levine et al (2000) have also identified key skeletal deformations to the thoracic, lumbar, and caudal vertebrae indicative of horse riding.

Artifactual approaches to traction include representations of traction, the development of carts, yokes, plows, plow marks, and horse-riding gear. Sherratt (1982) and Greenfield (2010) both remark that sculptural imagery of donkeys and pack animals are known from the Near East from the fifth millennium BC and there is evidence for ard (plow) marks beneath megalithic tombs in Denmark from the third millennium BC. Evidence for the domestication of the horse dates to 3500 BC on the Eurasian Steppe, identified through metrical analysis of equid remains as well as through the identification of cranial modifications that indicate that the horses were bridled (Anthony 2007; Outram et al 2009). Indeed, the first evidence for the wheel in Europe dates to the early Bronze Age, indicating the spread of the use of traction for mobility. Using artifactual and zooarchaeological evidence, David Anthony (2007) demonstrated the relationship between farming, metallurgy, trade, and the spread of language through western Eurasia related to horse domestication – first for meat and then for riding/assistance in herding. The importance of the horse, socially, may be seen in its inclusion in ritual activities, such as kurgan burials on the Eurasian Steppe (Anthony 2007; Törbat et al 2009), burial tombs at Hsi-Pei Kang in China dated to the Shang Dynasty, and in burials in later prehistoric periods in Europe, particularly the wagon burials from Vix, Hochdorf, and Grafenbühl. Additionally, particularly in later prehistory, indirect evidence for traction takes the form of specialized riding equipment.

During the Iron Age in Ireland, highly decorated bronze alloy bits, terrets, and leaders (Y-pendants) were associated with high status individuals, as horses were not common (Raftery 1994). These special objects are known from depositions in lakes, rivers, and bogs such as at Killeevan, Co. Monaghan (Raftery 1994). In addition to these special objects, evidence for wheeled chariots or carts from the Iron Age are known from Doogarymore, Co. Roscommon and bog trackways were constructed to connect communities across difficult terrain, such as the famous Corlea trackway from Co. Longford. During the early medieval period, the image of the horse looms large. Early literature and mythology describe the consumption of horseflesh as a highly symbolically charged act associated with sacral kingship (Newman 1998; Gleeson 2012). The slaughter and consumption of horses reflected the king's dedication to the land. From an economic perspective, horses were a prized commodity, and their loss would have inhibited the individual's ability to plow and transport goods and, therefore, the slaughter would have been imbued with deep meaning.

Domestic and Ritual Economies

Understanding the demographic structure of herds and the use of animals on the level of individual sites allows us to demonstrate relationships between sites by comparing the use of animals in these different contexts. Domestic economies focus on the ways that individual households or communities structure their economic practices for domestic consumption as well as for surplus and trade. Studying animal economies helps us to understand social and political organization (Crabtree 1990; Siracusano 2002; Bray 2003; Twiss 2012; DeFrance 2009; Russell 2012; Hastorf 2016). Production and exchange of animals and animal products through systems of consumption and redistribution structures social and political as well as economic relationships between individuals and groups.

Different animal husbandry practices will contribute in different ways to the social complexity that we see in modern and premodern populations. For instance, the requirements of pastoralism (nomadic, transhumant, agropastoralism) result in different settlement structuring, seasonal patterning, relationships to settled societies, and participation in exchange networks. As communities shift from self-sufficient subsistence practices to surplus or specialized practices, their needs will change. Specialization in animal economies and surplus drives exchanges and later encourages the development of more complex markets and concepts of value (Holmes 2013). Animal economies were and are integrated into the structure of society.

The accumulation of animals in many societies was a marker of status and value, this form of social and economic value is called animal wealth (Russell 2012). It is the concept of animal wealth and the rise of surplus production (or accumulation) that differentiates ‘subsistence’ economies from ‘animal’ economies. Concepts of animal wealth led to the increased value of herds and herding, social differentiation, social fissioning, and patron-client relationships (Russell 2012; Vining 2016). How communities relate to each other can also be dictated by concepts of animal wealth and communicated through concepts such as bridewealth (Russell 2012) and hospitality (Peters 2015). Finally, concerns about the accumulation of animals can lead to illicit or violent means of acquiring animals such as cattle raids, horse rustling, and warfare. The importance of animal wealth in early medieval Ireland is born out in the importance of accumulation in social mobility and a literary concern for cattle stealing.

Though some have argued that faunal assemblages produced through ritual practice does not reflect domestic economies (McCormick 2009), there is a clear connection and reciprocal relationship between ritual and domestic economies. For example, ritual events create a demand for certain animal products, supplied through domestic production. The use of animals in ritual practice also elevates the value of those animal products, creating demand and establishing a basis for a standardized commodity exchange utilizing that product.

Recent scholarship has focused on the role of foodways in identity construction, going beyond the role of animal husbandry practices in the structure of social interaction to the ways in which these choices construct identity (Nyerges 2004; Twiss 2007; Russell 2012; Hastorf 2016). Issues of social boundary maintenance (Thomas 2007) and colonialism (Dietler 2007) may be examined in through the lens of food choice. What is more, foodways, food choice, and animal economies plays a role in the ritual importance of animals.

Foodways

Foodways studies examines the methods by which a community secures food resources and how food choice may, reflexively, structure community identity. This includes domesticated, hunted, and foraged food for both plant and animal materials. Beyond acquisition, foodways studies examine the role of preparation and distribution of food in the different social situations that may occur, from household use, community-level, to large feasting events. Foodways studies have shed light on the interconnected roles of production, distribution, and power. Agricultural production and surplus can be used to support community endeavors or could be exploited by those of a higher status to maintain power relationships through taxation and tribute. Power can also be increased or maintained through strategic accumulation and redistribution of agricultural products (Twiss 2007).

The ways that communities acquire food will impact the ways that communities move across the landscape to exploit seasonal resources (seasonal scheduling). Among settled complex societies, the seasonal requirements for planting, growing, and harvesting became integrated into their cosmology. In Ireland, during the Iron Age, there is evidence to suggest that community events were scheduled to according to agricultural events. At Dún Ailinne, one of the ritual and ceremonial centers from the Iron Age, the age-at-slaughter for the juvenile cattle indicated that large communal feasting events took place in the spring -- around the time that dairy products would begin to be able to be produced (Johnston and Wailes 2007). At a smaller hilltop enclosure, the Hill of Ward, age-at-slaughter data suggests that feasting events took place in the autumn (Carden 2015). Slaughter during the autumn would have provided meat through the winter (with proper preservation) and would have been used to manage the herd so that there might be enough fodder available. In later folklore, associated with medieval literature, these seasonal celebrations became associated with Bealtaine (May 1) and Samhain (November 1).

Ritual Economies

Ritual economies refer to agricultural or other economic practices that support ritual activities. These practices include the production of materials for ritual consumption as well as for sacrifice. In the past, the division between what was considered ritual and what was considered domestic was less clearly defined than it is today. The production of materials for ritual or ceremonial purposes comes at a cost to the individuals involved in the production in societies in which it is important to make an offering of individuals that are healthy and constitute a significant component of their economic system. Alternatively, Veenman (2002) described ritual economies as those in which rituals were performed to benefit the economy. This may be understood functionally through the redistribution of goods among the community and symbolically, in which sacrifices were made to negotiate with the supernatural for good harvests or other economic benefits.

Ritual economy can also be considered a form of redistributive control. Ceremony, sacrifice, or tithe, there are many ways that individuals in a community may desire, be expected, or coerced into participation in ritual activities. Ideology has long been considered a means of increasing social control and exerting power by elites (Demerest 2013). Animal sacrifice had a direct social and economic impact in agricultural communities. Animal sacrifices could entail entire economic loss of the value of the animal or partial economic loss by consuming part of the animal and sacrificing non-edible portions. In either form of sacrifice, the individual making the sacrifice gains social equity and the performance of the ritual, when public, increases group cohesion (Geertz 1980; Demerest 2013). Ritual economies also encourage intensification in production and exchange networks as Spielmann (2002) noted that ritual consumption of goods encouraged the accumulation of exotic trade goods, such as obsidian and copper, and agricultural products at Hopewell mound sites. Ritual economies are intrinsically political economies, both directly and indirectly. Groot (2008) notes that ritual and economics were not separate entities in the past and, therefore, whatever meat or trade value was lost in a sacrifice would not have been considered a loss, "...but an investment" (110).

The economic importance of animals also affects their social and ritual function in society. Animal sacrifices, primarily intended for ritual purposes, have an economic function by redistributing animal wealth among the community -- whether the sacrifice is in the form of structured deposits, including burials (with or without human skeletal material). or feasts. Animal sacrifices and animal burials highlight the importance of these species in the cultural and economic life of the community (Rofes 2002; Sykes 2014) especially if they are curated as trophies (Russell 2012). It would be inappropriate to separate the ritual and economic significance of animals and animal products. We can, however, consider the use of animals within the context of the site and the events involved in the creation of the assemblage within a broader and interconnected domestic and ritual economic system.

In Ireland, previous scholarship has discredited the use of faunal assemblages from ritual sites for interpretations of domestic economies (McCormick 1992). Though, scholarship since McCormick has suggested that ritual economies, such as those shaping the assemblage at Dún Ailinne, are embedded in domestic economies. Understanding the relationship between ritual economies, domestic economies, and political economies, however, can allow us to better integrate these data sets and develop dynamic models of production and community development.

Feasting

Feasting, the communal sharing of food and drink, is a common act of ritual celebration and has been discussed in anthropology as a commensal act (Dietler 1996, 1999, 2001; Hayden 2001; Herbich 2001; Bray 2003; Hayden and Villenueve 2011). Through these events, resources may be pooled and redistributed, or feasts may be used as a means of creating social debt through reciprocal competition. In this way, social status is conferred based on demonstrations of generosity. Feasts may also be performed to commemorate events, such as annual holidays, or to commemorate individuals, such as funerary feasts. Feasting events may involve large assemblages of people or small family groups. Despite the diversity of type and purpose of feasting, what is important is that feasting events create community through food sharing and the ritualization imbues value in the foods that are consumed.

Anthropologically and archaeologically, feasts have been studied for their role in social construction. Michael Dietler (2001) and Brian Hayden (2001) have explored the commensal politics of feasts, in the ways that they construct and reproduce political structures through the leveraging of power among social unequals. Feasting was used as a means of taxation and redistribution of wealth, or as a means of mobilizing labor through ‘work-party’ feasts. Among social equals, however, feasting may also function as reciprocal aid or in celebration. Feasting can strengthen social bonds among social equals or increase social distances between social unequals. Adams (2004) and Twiss (2008) both highlight the role of ‘the feast’ as a means of social integration. During these events, power can be consolidated or enhanced among elites while, through resource pooling, simultaneously create community among the non-elite participants. Similarly, Dietler has demonstrated that food sharing and feasting may be used to increase social cohesion among community members and maintain social relationships. For example, work-party feasts, in which food is shared among individuals involved in the completion of a construction project, are an effective way to address community projects.

Feasting may be used as a means of establishing or challenging social organization. By offering, or hosting, a feast, individuals may be able to leverage the feast to increase their social standing. In the case of the *moka*, as practiced in Papua New Guinea, competitive feasting is used to create and reinforce social hierarchies (Strathern 1971). The individual, typically a male head of household, who hosts the *moka* demonstrates their wealth and ability to mobilize resources by hosting increasingly extravagant feasts. During these events, the individual hosting slaughters livestock, prepares dishes, and gives gifts to his guests. These events come at a great financial cost to the host but, in return, it increases their social standing within the community.

Archaeologically, there is not only concern for what a feast is and what it does, but how to identify feasting activity or what constitutes evidence of feasting activity. Traditionally, feasting activity has been identified by volume, species consumed, and context. Large assemblages of food waste (typically animal bones and ceramic sherds) have been an indicator of feasting events, however this may be the weakest evidence, as habitual consumption may also result in large accumulations of waste. The consumption of unique or special animals has, therefore, also been offered as an indicator of feasting activity. Animals that may be exotic trade items or animals identified with special rank or status that are not eaten as part of typical consumption patterns, such as horses in early medieval Ireland, demonstrates special consumption typically associated with specialty foods consumed at feasts. Finally, site context has been considered the third criteria for identifying feasting activity. Waste materials at sites that lack evidence of habitual occupation or have special features that have been identified as ceremonial, has been identified as feasting waste. Such sites might include burial sites and the remains considered evidence of funerary or commemoratory feasting. Simply considering each of these elements in isolation, much feasting activity may be misidentified. Rowley-Conwy (2018) integrates these three elements and offers an interpretive framework for understanding feasting evidence at smaller sites. These smaller feasts would provide local communities the opportunity to come together to participate in a commemorative or funerary act, perhaps slaughtering and consuming one or two animals and then making a special deposit of the remains. The process of performing small-scale feasting increases sociality and group cohesion for local communities or extended family groups.

Evidence of feasting refuse Dún Ailinne has been considered evidence of work-party feasting. Recent re-dating of animal remains from this site demonstrate that feasting events occurred throughout the use-life of the site and, particularly, in association with construction and dismantling of large palisade structures on the site (Johnston, Crabtree, and Campana 2014). Feasting during these events may have been used as a reward or incentive for participation in significant construction projects. Smaller feasting events are identified at sites known as ring ditches. Feasting events as these smaller ceremonial sites represent the reproduction of ritual and ceremonial acts in a local context. Considering the role of these ritual behaviors and their relationship to economic practices help to link faunal remains to social relationships.

Animal Economies to Political Economies

Political economic theory demonstrates the implicit connection between economic systems and political organization in society. Political economy in archaeological theory or ‘archaeological political economy’ is the “...materialist approaches to ancient state economies that are empirically grounded and share a concern with variability in the relationship between politics and economics” (Smith 2004). Archaeological political economy employs anthropological theory, ethnographic analogy, and economic theory to understand the relationship between economic systems and social organization.

Much discussion in archaeological political economy has been based in debates on how economies functioned in the premodern world. Formalists understand economics as functioning based on invisible market forces whereas substantivists understand economics as socially situated forms of interaction that are culturally dependent (Polanyi 1957; Skyre 2007). In archaeological contexts, this debate is translated into ‘modernists vs. primitivists’, in which modernists understand ancient economies to function as modern economies do and primitivists understand ancient economies to function fundamentally differently than modern economies (Smith 2004). The modernist vs. primitivist debate assumes, then, that modern economies function by invisible market forces (formalist) and that primitive economies are more subject to cultural forces (substantivist). This suggests that we engage in only one form of exchange and ignores the possibility that modern economies are subject to social and cultural forces and that the so-called ‘primitive’ economies were influenced, in some ways, by market forces. For this reason, it is more appropriate to think of economies as both formalist and substantivist and, by understanding the role of social negotiations in economic interactions, we may better study the diverse ways in which societies organize and change.

Production

Production of goods considers both agricultural goods and specialized crafts. Traditional theories have suggested that factors such as increased population size (Fried 1967; Service 1971, 1975; Childe 1950) or technological advancement (Schiffer *et al* 2001) lead to surplus agricultural goods and therefore allowed for craft specialization. Craft specialization, in turn, contributed to social differentiation as craft specialists obtained and contracted out specialized knowledge, setting themselves apart from agricultural labor. As new positions within society became available and too many people to fill all the roles, there was disproportionate access to goods and services, creating elites and non-elites (Fried 1967). As social distance increased and power centralized, architectural features of state-level control associated with production entered the archaeological record, such as storage facilities, irrigation systems, and workshops in palace complexes (Flannery 1998). It has been suggested, however, that in most premodern societies, household economies could sufficiently maintain their members through underproduction (Sahlins 1972) and craft specialists could have been more mobile, therefore the role of agricultural surpluses and craft specialization in social complexity may have been more varied and the role of production must be socially situated and nested within cycles of production, trade, and consumption, rather than the beginning of a unilinear trajectory.

The basic unit of production is the household economy. Evolutionary theories on social organization suggested that increased population pressures and increased productive output led to early forms of social differentiation and political centralization (Service 1967). Indeed, Polanyi (1974) indicated four mechanisms for which surplus goods from production could be reallocated: reciprocity, redistribution, nonmarket trade, and market trade. The problem becomes, how might individuals be induced to create surpluses? As mentioned above, Sahlins (1972), demonstrated that household level production, outside of social pressure to produce surplus, will tend to underproduce. According to processual theory, external environmental factors may contribute to differential production. For instance, Feinman and Nicholas (2004) suggest that differential rainfall amounts could have encouraged exchanges between groups in the Valley of Oaxaca and increased trade throughout Mesoamerica. Alternatively, post-processual theoretical approaches emphasize the social value of production to participate in exchange systems. Kowalewski (2016) asserts that households cannot produce all the goods and services that they require and therefore produce to enter into exchange systems. Similarly, Ensor (2013) suggests that the requirements of social relationships necessitated surplus production in Hohokam society, such as gift exchanges and feasting.

In this way, it is the desire to form and maintain social relationships that encourage surplus production, the mechanisms for which in turn necessitate increased production.

Craft specialization, as well, is a socially situated form of goods production which contributes to social complexity. Archaeological evidence for specialization exists on the regional level and site level. Some sites suggest regional specialization, such as Hallstatt as a salt production settlement or the arid southern and eastern Valley of Oaxaca as a stone tool production region (Feinman and Nicholas 2004). These interpretations are made both by associations with natural resource deposits and archaeological evidence for manufacture. On the site level, specialized production may be identified by areas with evidence of manufacture, such as representations of several production stages, tools associated with object production, or features associated with craft production (e.g., kilns).

Archaeological theory in social complexity suggests that when evidence of such production occurs within large residential structures (e.g., palaces), then this demonstrates higher levels of control over craft production by elites and administrative centralization, and therefore more complex social organizations (Flannery 1998). However, artisans attached to patrons (elites) and independent artisans are found in most complex societies in varying contexts (Smith 2004). Modes of production may also be used to exert control over craft production by elites employing several artisans for different stages of production so that none know the whole production method (Hirth 1996). Kuijpers (2008), however, has demonstrated that in Bronze Age Netherlands, the process of concealing and revealing information of the production method was exerted by the craftsperson and not necessarily by the local elites. Charles Maisels (2010) explains how kin-related and supply networks had the capacity to encourage distribution and standardization of goods without a dominant central authority controlling production. While elite control of craft production may have operated in some societies, it was not the only way in which craft specialization developed or was maintained.

While traditional theories of premodern political economy suggested that regulated surplus increases and craft specialization were necessary for increased social complexity, new frameworks demonstrate how social situatedness was also an important factor in production. Control over surplus and craft production likely did exist, it is important to understand the social relationships involved in these systems which contributed to production intensification. Without considering the social motivations for production, much of the complexity in premodern society would be misinterpreted.

Trade, Exchange, and Distribution

At their most basic level, trade and exchange relationships ensure that goods can move from places of production to places of consumption. Traditionally, trade and exchange systems have been thought of as systems of control for elites and niches for the emergence of middlemen and merchants in complex societies. This formalist understanding that markets are expected economic forces ignore the social context for exchange and market activity (Feinman and Gerraty 2010). While tax and tribute were certainly ways in which goods were collected and redistributed, they were likely not the primary exchange system and contributed to other systems of interactions that were socially important. The foundational principles of trade relationships demonstrate the social mechanisms at play in these exchanges. From these social relationships, both goods and ideology can be exchanged, therefore making exchange relationships critical for our understanding of culture change and diffusion. Social exchange is no less important in complex societies and so must be considered.

Understanding ways in which objects are imbued with value is particularly important in the late Iron Age and early medieval period. Prior to the introduction and use of a coin economy, trade was conducted in, and taxes were paid in commodities such as cattle, dairy products, and grains (Kelly 1998). However, the production of cattle in the Iron Age could indicate the increasing social value of dairy before the early medieval period and provide insights into the development of the dairying economy. Archaeological political economic theories focus on the processes of social organization and explore the diversity of social systems and social complexity through the three pillars of political economy: production, exchange, and service and how animals can be the material by which these social negotiations are mediated.

The act of exchange creates a social relationship between the two parties involved in the exchange. In fact, the social relationship that is formed through exchange is the most valuable component of the exchange, not necessarily the goods or services being traded (Urban 2010). Previously, among economists, there was a myth that early trade developed from barter systems in which commodity goods were exchanged for commodity goods (Graeber 2011). Anthropology has, instead, demonstrated that trade developed from social systems of exchange, in which commodities are of secondary importance to the act of exchange itself. For instance, in the *hxaro* system among the !Kung San in the Kalahari, goods such as beads and blankets are exchanged to establish systems of reciprocity so that, in dry years, exchange partners from different areas may be relied upon for aid and assistance (Wiessner 1982). In the *dzamalag* ceremonial exchange among the Gunwinggu in northern Australia, the exchange of goods comes at the end of a series of ceremonial performances. The complete process of the exchange is necessary for building the social relationships between different groups, increasing systems of reciprocity, and decreasing possibly violent tensions (Graeber 2011). In each exchange, there is a series of social and economic negotiations that are constrained by cultural conditions and reify social relationships that may be utilized later.

In the previous examples, exchange systems are established to create or increase equity among the exchange partners, however it would be inaccurate to suggest that all exchanges operate in such a manner. Gift exchanges are one such system in which the act of exchange creates disproportionate social esteem or prestige (Cronk 2000). Marcel Mauss demonstrated the social role of gift exchanges, particularly exchange systems such as the *kula* system in Melanesia and the *potlatch* in the Pacific Northwest (1990). Public displays of gift giving demonstrate the social power that one party has over the other and creates the expectation of reciprocity among the receiving party. In competitive feasting, the expectation continues that the receiving party not only matches but exceeds the value of the gift received, to regain their prestige and then to increase it with a demonstration of generosity with an even more extravagant gift. Such exchanges, particularly the *potlatch*, not only build social relationships and increase social difference, but also act as redistributive systems through ceremonial performances integral to the exchange.

The transition, therefore, from a gift to a commodity represents the mutual creation of a system of value and allows for objects to enter exchange networks and increase their social value though circulation. The act of gift exchange is highly ritualized, and it has been recognized that a ritual function allows objects to enter the exchange system cross culturally (Skre *et al* 2008; Graham-Campbell and Sheehan 2009; and Haselgrove and Krmnicek 2012). In a commodity economy elites may gain social power through redistribution of goods (through taxes, tribute, and feasting).

Trade is another form of exchange relationship, though operationally like the exchanges discussed above in their social role in relationship formation, it is considered structurally different. Several types of trade have been described by Colin Renfrew (1975), including: down-the-line trade, directional trade, freelance trade, and prestige-chain trade. The ability to differentiate between the different types of trade was contingent on the percentage of material was identifiable by distance from the source.

Other archaeologists have considered trade to be contingent on higher forms of social organization because of its formalization, for instance some consider trade to be the 'material-economic' component and exchange as the interactional component (Oka and Kusimba 2008). Trade could then be identified in the archaeological record by the presence of administrative architecture, specifically marketplaces. Others, however, consider exchange systems to operate both informally and formally, while trade systems are formalized (Agbe-Davis and Bauer 2010). Another way to say, all trade is exchange but not all exchange is trade. In this sense, archaeological evidence for non-local goods or styles therefore represents both formalized trade and exchange systems. What is generally agreed today is that both trade and exchange systems can operate simultaneously and are linked in their roles in forming social relationships.

Desire for an object drives systems of exchange, to conduct this exchange, however, both parties must agree upon a standard of value. Substantivist perspectives on economic and exchange theory suggests that, because of the social nature of exchange, in every interaction, value is mutually constructed by the participants and is shaped by their personal worldviews (Askjem 2011). Munn (in Graeber 2001) states that value emerges through actions, that it is act of exchange and circulation that imbues objects with value. Weiner (1992) explains that the material objects capable of becoming currency can acquire value because of their *inalienable* properties, meaning their ability to acquire a history and identity through circulation.

For materials to enter systems of exchange and gain value, objects must first have a performative function in ritual (Skre *et al* 2008). Often this includes exchanging objects through gift exchange. Such interactions are influenced by both parties' attempts to achieve social power through the exchange as giver and receiver (Burns et al 2003). As the receiver, that individual obtains on object that has gained value through its rarity and through the action of transfer as well and therefore gains social power within their own cultural milieu (Graeber 2001). The giver, on the other hand, gains social power in the interaction through making the receiver indebted to them (Kopytoff 1986). The act of transfer both gives the object social value, and it also transforms the object into a commodity (Skre *et al* 2008). The act of gift exchange creates social inequality between the participants but, in doing so, it also creates a system of reciprocity by which the receiver then gives something to the giver to gain social power over them. This reciprocal system forms a social bond between the individuals participating in the exchange relationship. Similar exchange relationships have been studied in modern communities, such as the! Kung san *h'xaro* system (Cronk 2000), the kula exchange system in the

Trobriand Islands (Appadurai 1994), and the exchange of wampum among the Iroquois (Graeber 2001).

Examination of the processes of exchange allows for a broader understanding of the role of exchange in political organization. In complex premodern social systems, the role of trade and exchange had the capacity to facilitate cultural change through the social relationships that are formed through exchange networks. By creating social bonds with trade partners through reciprocity and cooperation, acephalous political systems may be formed. Alternatively, through asymmetrical and competitive exchanges, social difference may increase between exchange partners. Social difference may increase as compulsory forms of exchange are enacted, such as tax, tribute, and even illicit activities (Smith 2004; Harnett and Dawdy 2013). What must be clear, however, is that societies participate in multiple forms of exchanges and monocausal approaches to trade and exchange that suggest that barter systems lead to trade systems lead to monetary systems failing to account for multiple layers of complexity in social exchange.

Consumption and Service

The third component of social and economic relationships that serve as the basis for political economy in archaeological contexts is consumption or redistribution of goods. While production and exchange produce significant mechanisms for building social relationships, consumption and commensal politics can encourage increased production and controlling circulation of goods. In this way, objects and goods are constrained through organized or ritualized systems of disposal that regulate exchange networks. Traditionally, discussions of consumption have focused on elite exchange in luxury goods and accumulation of major factors in regulating pre-state and state level economies (Hirth 1996). Other means of regulation, however, exist that may have also acted to control exchange economies through redistribution.

Services and expertise may also be commodified in social exchanges (Hirth 1996). Services become institutionalized in feudal systems, in which taxes are paid in goods and services to an elite in exchange for protection and other material and immaterial benefits. Such services include specific activities, such as providing storage facilities or for management functions and leadership roles. Archaeologically, the former may be implied by the distribution of architectural features, however the latter can only be assumed through identification of elite accumulation of goods (Hirth 1996). Beyond the exchange of goods for services (actual or potential), redistribution and ritual economies are two mechanisms by which culture constrains economic growth.

Consumption sites have been identified in the archaeological record by several means. Regarding the distribution and consumption of animals, consumption sites are identified both contextually and through faunal analysis. Often, sites that are associated with ritual functions are considered consumption sites, with the production or raising of the animals elsewhere. Further, urbanized settlements (towns and cities) are considered consumption sites, or ones that would have required goods to have been brought in through exchange relationships for consumption. For example, medieval Dublin is considered to be a consumption site for some animal products, like beef. Unlike smaller stock like sheep/goats and pigs, there is not enough available space to raise cattle in the settlement itself. Animal bone assemblages of consumption sites will contain a higher proportion of appendicular elements (meat-bearing limb bones) as opposed to cranial or axial elements (Tourunnen 2008). Cut marks associated with cranial and axial elements are often associated with slaughter and particular butchery practices (e.g., skinning, tongue acquisition). From a herd demographic perspective, consumption sites often have a higher proportion of much older individuals, who often have outlived their utility to provide secondary products (McCormick and Murray 2007).

Redistribution is a means by which goods may be removed from commercial exchanges. One of the primary means of redistribution was through communal feasting (Dietler 1999). As mentioned before, feasts mobilize large quantities of food, resources, and finished products, to be shared among all group members over a brief period. Feasts differ from other consumption methods because of the quantities and varieties of foods served, the number of participating members, the tableware used, the setting or location, and the performance (Groot 2008). There are several different types of feasts, including, work-party feasts, diacritical feasts, competitive feasting, and celebratory feasting (Dietler and Herbich 2001). According to concepts of elite control and regulation of economies, the use of a feast to redistribute goods also limits the ability of elites to increase their economic power by reducing their ability to accumulate wealth. In societies that do not typically trade in non-perishable goods, however, feasts are a means of expressing conspicuous consumption and increasing the host's social value in society. In this way, feasts reify political-social difference between individuals related to gender, age, and class (Twiss 2012).

The redistribution and consumption of goods may be interpreted as a means for elite control or may be examined from a group construction perspective. Research in premodern political economy typically examines the mechanisms by which elites regulate consumption of goods through prestige goods trade, accumulation of material, control of resource acquisition (matrix control), and ideology (Hirth 1996). Elites then may be expected to provide services and architectural support for increased production. Other forms of consumption, however, also function to control economic resources that also provide more direct benefits to non-elites. Redistributive economies and ritual economies may require non-elite participation but also function to increase social equity among group members and provide social investment in the group that direct elite control does not.

Heterarchy

Importantly, concepts of political economy and social organization have diversified from traditional discussions of hierarchical social organization and divisions of labor. In 1995, Carole Crumley introduced the concept of heterarchy as a reaction to reductive categorizations, exploring ways in which complexity could develop outside of previous typologies of social complexity and particularly emphasizing the role of individual actors in society. A heterarchical system is considered an ‘acephalous’ system, in which power is held or shared by several individuals, rather than one. In this system, the different heads are “...unranked or may be ranked in a number of different ways… (Crumley 1995, 3**)** and so may perform different roles in society, such as governing different settlements, military, manufacturing, and/or religious life. This concept has been applied to several societies in Iron Age Europe (Crumley 1995, 2003; Dietler 1999; Ehrenreich et al. 1995; and Gonzalez-Ruibal 2006), including Ireland (Thurston 2009; and Wailes 1995). Heterarchical perspectives have allowed archaeologists to conceive of non-hierarchical systems in prehistory as well as discuss cultural change and a decentralization of power without discussing a true social collapse.

Animal Wealth

Animal wealth is the social value of animals beyond nutrition. To be considered wealth, animals need to be exchanged for subsistence items and provide access to human labor and reproduction. It is possible to identify animal wealth through zooarchaeological remains due to economic and biological needs of both the human communities and the livestock. For instance, while there will be a dominance of one species in the assemblage, there may be several smaller livestock species also raised on site. Small stock, such as caprovines and pigs, can operate as “change” in exchange in the absence of large livestock (or to exchange up to large stock) and small stock may also be slaughtered to meet the dietary needs of the community. Cattle remains in the assemblage will tend towards older individuals and may be smaller in stature. Cattle will be kept longer than may be optimal for meat or dairy production because slaughter is tantamount to wealth destruction. In systems of animal wealth, cattle tend to be bred smaller and will overstock pasture to maximize the number of individuals over the quality of beef. Before animal wealth may be identified in faunal assemblages, however, animals must first accrue value in society (Russell 2012).

There are several ways in which animal wealth can be redistributed through a community, including taxation, exchange, feasting, and sacrifice. As previously mentioned, objects or commodities accrue value in society through their function in ritual exchanges, such as gift exchange. Feasting and sacrifice function in similar ways to gift exchange, operating as other forms of ritualized exchange that valorize commodities.

Feasting creates community through the commensal actions. In addition to creating community through commensality, feasting is an important means of social exchange that can be used to flatten social differences through the redistribution of goods or to increase social differences between hosts and guests (or patrons and clients). Feasts, in general, construct communities through mutual sacrifice and risk assumption. In forms of feasts that Michael Dietler (2001) termed “empowerment” feasts, the host performs acts of conspicuous generosity that economically impoverished them, but in doing so, increase their prestige by indebting their guests to them. Alternatively, “patron-role” feasts increase economic difference between patrons and clients by provisioning the patron with materials for the feast (thus sacrificing their economic power). Similarly, the importance of a sacrifice is to demonstrate economic loss. The value of a sacrifice is based on the equivalent value of the thing which you give up. In terms of livestock, individuals lose both the actual value of the animal in terms of meat but also the imagined value of the animal in terms of secondary products (such as wool, dairy, or traction) and their reproductive value. Therefore, the loss of livestock is felt both immediately but is also conceived of as a loss in future investment.

Animal wealth, particularly cattle wealth, without very careful management, is a risky form of wealth accumulation. Livestock are a particularly vulnerable commodity, especially larger stock such as cattle. Larger stock requires more space, fodder, and produces fewer young each year than smaller stock such as pigs. The loss of a single animal due to drought, epidemic, or raiding is therefore a greater setback and a wealthy household can quickly become a poor one. On the other hand, with good planning and good fortune, a poor household may build up their herds and become wealthy. According to Nerissa Russell (2012), these qualities make it difficult to maintain a high degree of animal wealth over time, and therefore it is difficult to create and maintain extreme social distance between classes. For these reasons, cattle wealth during the Iron Age could limit the development of extreme social distance through mutual losses associated with feasting. Systems of animal wealth, however, are not inherently egalitarian and can reproduce strict social hierarchies if the risks associated with the accumulation of livestock can be mitigated. Explicitly, these risks can be mitigated and controlled by elites by diversifying agricultural economies (by both producing enough small stock to act as "change" and to control the production of fodder), the institution of "patron-role" feasts, and developing a system of bridewealth to control inheritance.

Animal and Political Economy in Late Iron Age and Early Medieval Ireland: a model

Given our foundational knowledge of the function of economies and their relationship to political economies, what can we say about Irish animal and political economies of the late Iron Age and early medieval period? Due to the volume of archaeological evidence as well as historical and literary evidence, we know that political organization during the early medieval period consisted of clearly defined social strata from slaves and landless farmers, through various levels of landed farmers, craftspeople, and elites. Upward mobility was possible through the acquisition of land and cattle and the intentional or unintentional loss of land and cattle resulted in the loss of social status. In the past decade, the Early Medieval Archaeology Project (EMAP), a collaboration by scholars in various disciplines and institutions in Ireland, has investigated and developed a model for understanding the economic structure of the early medieval period. Their findings concluded that the early medieval economy functioned in two spheres with commodities exchanged in a system of obligation and gift-giving (substantivist) controlled by elites and prestige goods traded according to market forces (formalist). Occasionally commodity goods could be exchanged for prestige goods, but this often incurred a social penalty (EMAP 2013). EMAP has also suggested that this seemingly dual economy could be the consequence of a *transitional* economy, from an economy structured by social forces (substantivist or primitive) to one controlled by market forces (formalist or modern).

Without an understanding of how the Iron Age economy functioned, however, this alternative hypothesis cannot be supported and given current theories of premodern economies, it is unlikely that early Irish economies followed a unilinear trajectory from socially constructed forms to market constructed forms. The current state of the archaeological evidence, however, suggests that economies of the Iron Age may have functioned in the same multi-sphere system, with commodities circulated and controlled by elites, livestock produced for ritual production, and prestige crafts produced by itinerant craftspeople and circulated among elites.

High status metalwork from this period has typically been found in structured depositional contexts and not associated with elaborate burials (Raftery 1994). This suggests ceremonial significance and collective identity associated with these prestige goods unassociated with individual ownership by elites, though their relative scarcity suggests that not all members of the community had access to these goods. In this way, local production may be overseen by local leaders and embedded in ritual production controlled by religious leaders and craft production could be controlled by craftspeople and prestige goods then circulated among elites and religious leaders for eventual disposition in charged locations.

Due to the relative paucity of known settlement sites from this period, scholars have suggested that there was a higher degree of mobility during this period **(**Dolan 2014; Johnston 2017; MacDonald 2018). Several of the known settlement sites from this period suggest temporary structures and tents were common (Raftery 1994). Craft production sites also appear to be temporary, with one or two kilns occasionally associated with habitation (Dolan 2014).

Higher degrees of mobility would also account for the lack of ceramics used in everyday storage and culinary practices as well as the construction of bog trackways and the importance of transportation. In a heterarchical social system, dispersed and mobile communities could be organized by lower-level community leaders as well as regional social or religious leaders.

Animal economies of the Iron Age appear to be focused on the production and distribution of cattle as a form of animal wealth. Large faunal remains from high status ceremonial sites, such as Dún Ailinne, the Hill of Tara, and Navan Fort, suggest that large communal feasting events occasionally took place in these locations. At Dún Ailinne and Tara, a high proportion of cattle suggest a focus on the consumption of beef and at Navan Fort a high proportion of pigs suggest a focus on pork consumption. Such large feasting events without evidence for local habitation would suggest a regional concern to produce these animals and their high social value as part of the ritual and ceremonial activities at these sites. Evidence of feasting at ring ditch sites reinforces the importance of feasting in Iron Age society.

In addition to the faunal evidence to support the social value of feasting, evidence of large bronze alloy cauldrons from bogs with repeated use and repair highlights the social importance of large-scale food production. A high proportion of bog butter depositions during this period also suggest that this item was socially important. Not only were communities concerned with the production of dairy products, but they were also concerned with its preservation (either as a ritual sacrifice or as a means of preservation and wealth protection). The development of cattle wealth would have lent itself to the development of social hierarchies, however, these hierarchies would have been limited by the alienability of the commodity.

As mentioned, cattle wealth is a risky form of wealth accumulation. That is, unless the risks associated with cattle wealth could be mitigated. During the Late Iron Age, there is increasing evidence for such systems of mitigation, including increased production and control of grain production and the institution of social systems, such as bridewealth. Controlling the production and accumulation of grain allowed elites to provision for their herds, increasing their wealth, and control the distribution of grain and fodder to their clients.

Chapter 4

Quantifying Animals in Society

This chapter describes the methods that I have used to connect the animal bone assemblages from late Iron Age and early medieval archaeological sites to their broader social meaning.

This project has two primary objectives: to examine one site with phases of occupation spanning the first millennium AD to determine change over time and to compare faunal assemblages across sites. Investigation of the faunal assemblage from Ninch, Co. Meath was done using traditional macro-scale faunal analysis methods in which all bones were identified to element, side, and to the highest taxonomic level possible and examined for modifications. These data were used to determine the minimum number of individuals (MNI) as well as to reconstruct butchery and culinary practices based on location of cut marks and level of burning. To examine change over time, I relied on the stratigraphic report to understand the phases of activity on the site as well as incorporating radiocarbon dates (obtained by myself and the Mapping Death project). The comparative analysis consisted of reported faunal assemblages and comparing relative frequencies of species and measuring and comparing relative taxonomic diversity and evenness.

The study of human-animal relationships in archaeology has focused on the role of animals as products, producers, and ritual commodities. Subsistence studies' view of economy suggests small-scale production, focused on the household, and limited to survival. Peter Bogucki (1993) argues, however, that this view is too narrow and ignores much of the complexity in human-animal relationships, particularly the role of animals as assets in an economic system. In complex societies, animals have the unique quality of being able to be commodities (meat, hide, bone, marrow), produce commodities (dairy, wool, traction), and act as assets in trade and in concepts of wealth. The importance of the role of animals in society, therefore, cannot be overstated. In this chapter, I review the faunal quantification methods used in this study, discuss models for reconstructing animal husbandry practices for primary and secondary animal products, discuss both the faunal remains and artifactual evidence for different means of animal exploitation, and finally discuss the social role of animal economies.

Animal economies became driving forces in social complexity in the Neolithic (Bogucki 1993), when livestock were first domesticated, as part of what is known as the 'Neolithic Revolution'. Andrew Sherratt (1981) described what he coined the 'Secondary Products Revolution' which, much like the Neolithic Revolution, resulted in increased social complexity and differentiation through increased exploitation of secondary animal products during the Bronze Age in Europe and the eastern Mediterranean. Secondary products include those commodities that can be exploited multiple times throughout the life of the animal, such as milk, wool, and traction, as opposed to primary products which can only be exploited once, such as meat, skin, and bone. Arguments counter to Sherratt have claimed that these products were exploited prior to the 4th millennium BC (Chapman 1982), however defense of the Secondary Products Revolution argues that the theory does not claim earliest exploitation but, rather, increased exploitation and importance of these products (Greenfield 2010). The development and exploitation of these goods have contributed to social complexity, and it is therefore important that we explore the production, consumption, and exchange of these products archaeologically.

An understanding of the demographics of the living herd allows us to develop interpretations concerning the exploitation strategies of the community. Importantly, these different economic strategies play a significant role in settlement, trade and exchange, and the structure of society. Reconstruction of animal husbandry practices begins with faunal assemblage or assemblages (depending on the scope of the study) analysis. Doing so allows for the development of mortality profile models, or a representation of the age-at-slaughter for the living herd, which provides insights into the manner of animal exploitation. Analysis of faunal remains relies on the correct quantification of the assemblage. Identification and quantification consist of determining the number of specimens and skeletal elements present and identifying the elements to the highest taxonomic level.

Methods of Faunal Analysis

Identification and Quantification

Primary analysis of the faunal assemblage includes counts of the number of animal bones and fragments (specimens), recording age and sex based on gross morphological features, measurements of the bones, recording modifications to the bones (such as cut marks, carnivore gnawing, and burning) and weight of the assemblage. After the primary data have been collected, secondary data may be calculated, including the number of identified specimens (NISP) and minimum number of elements (MNE). Using MNE, it is then possible to calculate minimum number of individuals (MNI), minimum number of animal units (MAU, ‘animal units’ meaning expected whole animals), %MAU and %Survivorship, age and sex estimates based on comparative measurements, and specimen live weight and size estimates (Bunn and Kroll 1986; Lyman 1994a, 2008; Reitz and Wing 2008).

After making gross observations, including identifying fragments to element and taxa, secondary faunal analysis consists of all the analytical products. This includes determining age classes, sex ratios, relative element frequencies, determining butchery patterns, relative dietary contributions, and agricultural strategies. For instance, NISP describes the abundance of specimens per taxon in the assemblage, calculated by identification of the specimens, categorization by taxon, and determining the total number of specimens per taxon (Lyman 1994a). Taxa are determined up to the highest taxonomic level, which may be to class size, family, genus, or even species level. NISP indicates the range of animals exploited and %NISP indicates the relative importance of each species based on proportional representation.

MNI is a measure of the minimum number of individuals necessary to account for all the skeletal material on site per taxon. This measure is determined by identifying the specimens (element and side), categorizing them by taxa, and selecting the most abundant element represented. If the element is side-specific, then only the most abundant side will be counted. Minimum number of elements (MNE) is a similar measure of abundance calculated by the minimum number of skeletal elements present in the assemblage, or "…the number of skeletal parts or portions necessary to account for the specimens under study…" (Lyman 2008). MNE differs from MNI in the use of portions of skeletal elements that have distinguishing features. MNE calculations may be determined by the number of fragments with one or more articular surfaces and the number of shaft fragments (Bunn and Kroll 1986).

Arguments have been made against relying on NISP and MNI to calculate relative frequencies of abundance (Chaplin 1971; Gautier 1984; Grayson 1973; Higham 1968; O'Connor 2001; and Payne 1972). There are methodological issues of identifiability and replicability of quantifications. Some of these issues are the result of natural site formation processes (e.g., post-depositional fragmentation), some are a result of cultural formation processes (e.g., transportation, body part preference and distribution, and culinary practices) and some relate to collection and calculation (e.g., sieve size biasing against small vertebrates). For example, fragmentation of large mammals (because of trampling, decay, or cultural practices such as grease extraction) would bias the results in favor of those larger individuals by NISP count. While all zooarchaeologists should be able identify bone fragments with relative fidelity, this is not always the case (Gobalet 2001), and the choices by the analyst related to which elements may be identified, "considerably skew NISP and limit opportunities to compare NISP among collections, sites, or research groups" (Reitz and Wing 2008, 204). Morin *et al* (2017a) found that, while both NISP and MNE were reproducible and accurate measures for whole assemblages and non-long bones, NISP was a poor (even negatively correlated) measure for long bones and long bone fragments.

MNI, on the other hand, as a derived measure, considers physiology and excavation context to estimate the minimum number of individuals, to prevent counting the same individual more than once. MNI, however, is also not without its pitfalls, the first being that it suffers from definitional differences between analysists. There have been at least 16 different published definitions for MNI (Lyman 2008, 40), which can lead to different analysts using different methods, reducing comparability. Also, while

MNI helps to mitigate issues related to fragmentation in some assemblages, in highly fragmented assemblages, MNI also suffers from decreased identifiability (Lyman 1994b). Finally, MNI over emphasizes the importance of minor species (those represented by low NISP) and because MNI values are minimums, ratios of taxonomic abundance cannot be calculated (Lyman 2008).

As a result, scholars have developed other measures to reduce bias in assemblage calculation. Binford (1978) first introduced "Minimum Animal Units" (which he initially referred to as "Minimum Number of Individual"), in which the total count of each element for each taxon was then divided by the total expected number of that element per animal (assuming each quadrupedal vertebrate has two humeri, two femora, etc). Another means to reduce interdependence (a single individual being represented by multiple fragments in the assemblage), is to employ restrictive counts, either by element or by landmarks. Dobney and Reilly (1988) devised a method of recording faunal remains by diagnostic zones, hoping to improve accuracy in recording fragmentation and modifications. Marean *et al* (2001) described the "overlap" method, in which each skeletal element of a given taxon (both right and left if symmetrical) are laid out and checked for refitting pieces and anatomical overlaps. Morin *et al* (2017b) devised a new approach counting diagnostic landmarks represented in a sample of the same skeletal elements for a given taxon, termed the "Number of Distinct Elements" (NDE). And McCormick and Murray (2007) developed a system of diagnostic zone assessment for identification of large assemblages of early medieval Irish faunal assemblages.

For this study, data were collected using a custom-designed collection application in FileMaker Pro 16. Digital collection allows for faster data collection and the ability to download the data directly as a Microsoft Excel file for quantification and analysis. Similar programs have been described by Gifford-Gonzalez (2018). In the analysis of the faunal material from Ninch, Co. Meath, each specimen was given a unique identifier (OID, or Object ID), identified, and recorded according to taxa, skeletal element, side, portion, epiphyseal fusion, sex, and any additional modifications (e.g., taphonomic or purposeful alterations to the bone) wherever possible. For comparison in identification, Schmidt (1972) was utilized at the National Museum of Ireland. Photos were taken and comparisons made against the comparative collections at the University of Minnesota Department of Anthropology, the Bell Museum of Natural History (University of Minnesota), and the University of Southern Maine zooarchaeology lab for specimens that were difficult to identify.

Mammal specimens that could not be assigned to a species were recorded using generalized size categories including “large mammal,” “medium mammal,” and “small mammal” according to Harland et al (2003). Large mammals could belong to cattle or horse, while medium mammals could belong to caprovine, pig, or large dog, and small mammals could belong to smaller dogs, cats, hare, or rabbits. Specimens that could not be identified to a size category were classified as “unidentified.”

The quantification of the assemblage was done by NSP, NISP (Grayson 1984; Reitz and Wing 2008), MNE (Lyman 2008), and MNI (Grayson 1984; O’Connor 2000). Whenever possible, bone fragments were refitted and counted as separate fragments in NSP but as single MNE units to calculate MNI. This resulted in a modified version of the selective methodology described by McCormick and Murray (2007). McCormick and Murray (2007) limit recordable fragments to those which contained at least 50% of diagnostic features. In this study, for example, scapular blade fragments were included in the NSP but not in MNE or MNI. Such methods are commonly employed by zooarchaeologists in Ireland, including the analysts who examined the assemblages in the comparative analysis. Use of these measures, therefore, allows for these data to be more easily comparable to other data from other Irish sites.

Aging

To develop mortality profiles, one must determine the age and sex of the livestock at the site. Traditionally, observation of gross bone shape (morphology) and measurement (osteometric) methods have been employed to estimate age and sex. Age is estimated in two ways: through analysis of epiphyseal fusion and tooth eruption and wear. Studies of modern species' growth and development have allowed us to record the ages at which juveniles meet certain growth benchmarks. Therefore, when long bones are present in the faunal assemblage, it is possible to make age estimates for juveniles, based on the fusion rates of the shaft (diaphysis) to the ends (epiphyses). Estimating age based on a single bone would limit age-at-death to pre- or post-age-at-fusion because bones fuse at different ages. Such broad age ranges may still be useful in developing mortality profiles and may provide information on age and stress related pathologies to the long bones, which may provide additional information concerning economic strategies. This method would be beneficial in smaller assemblages in which mandibles are less well represented.

Alternatively, age estimates are commonly made by tooth eruption and wear patterns. In ungulates, occlusal enamel surfaces begin to wear after tooth eruption, revealing dentin and cementum, however wear may vary with diet, exploitation (such as damage due to bridling), and environment. In livestock species such as cows, sheep, and goats, for which there have been several studies, wear stages may be correlated to age in months, providing an approximate age-at-slaughter for the individual (Grant 1982; Grigson 1982; Higham 1967; Payne 1973; Silver 1969). Mandibular age estimations are more accurate in juvenile individuals by charting tooth eruption phases. Particularly useful are observations on the wear on the deciduous fourth premolar (dP4), eruption of the fourth premolar (P4), and wear on the first and second molars (M1 and M2). Observations concerning tooth wear may be made qualitatively through description of the relative tooth wear (Boessneck & von den Driesch 1975) or quantitatively by measuring crown height (Klein et al 1981) or tooth root growth, by counting the annual banding patterns of tooth material, known as cementum annuli (Chaplin 1971; Lieberman 1994).

Taphonomic issues must also be considered when determining mortality profiles. Small or juvenile bones are more prone to destruction by scavenger gnawing (such as by rodents or dogs) or by soil chemistry. Some bones are denser than others, and therefore survive taphonomic stress more effectively (Lyman 1994a: 236). Therefore, an underrepresentation of juvenile skeletal material may not be clearly indicative of certain animal husbandry practices, or a higher proportion of certain skeletal elements may not be indicative of a specialized butchery practice, but indicative of the taphonomic environment (e.g., high levels of acidity in the soil, impacts of weathering, consumption by scavengers, etc.).

In this study, age estimation was established for cattle, caprovine, and pigs by epiphyseal fusion and tooth wear stages. Epiphyseal fusion assessment was performed according to Silver (1969) and Reitz and Wing (2008). Tooth eruption and wear stages were recorded according to Grant (1982) for cattle, caprovine, and pigs. Higham (1967) was used to assign age categories for cattle mandibles and mandibular loose M3.

Sex Estimation

Sex in animals may be estimated by sexually dimorphic skeletal features or through DNA analysis. Except for the presence of the *os baculum* in some mammals, most sexually dimorphic traits present along a continuum of shape and robusticity. As such, morphological analysis may be qualitative or quantitative. Qualitative descriptions of elements such as the skull, atlas and axis (first two vertebrae), pelvis (Ruscillo 2003), and astragalus and calcaneum (bones of the ankles) demonstrate some differences between males and females, particularly in cattle (Grigson 1982). Metrical analysis in sex estimation of acetabuli (socket where the femur articulates with the pelvis) has also been demonstrated to differentiate between males and females (Greenfield 2006). More commonly, however, metrical analysis of distal metacarpals has been the preferred sexing method in zooarchaeology (McCormick 1997). Metapodia are preferred for sex estimation because they are dense, robust, and tend to have a higher survivorship rate in a variety of soil conditions (Lyman 1994a). Molecular sex determinations (aDNA) also offer highly accurate analysis, though this process may be expensive and destructive in comparison to morphological comparisons. Optimally, age and sex estimation would be combined with molecular techniques using mandibulae (McGrory et al 2012). Mortality profiles developed using this method may have the highest fidelity by pairing age and sex per individual, particularly with special consideration to MNI.

Sex estimation was made for cattle and pigs. Maximum distal metacarpal was used to estimate sex in cattle according to McCormick (1997), by which females are identified as having a maximum distal metacarpal breadth less than 56mm and males as having a maximum distal breadth greater than 57.5mm (individuals who fell between 56-57.5mm were counted as 'indeterminate'). For pigs, root morphology of canines was used to estimate sex according to Schmidt (1972) and McCormick (1997).

Pathology

Pathological modifications were recorded in detail and assessed according to their effects on the bone. Identification and analysis of pathological modifications were made according to Bartosiewicz and Gál (2013).

Measurements and osteometry

Measurements were taken according to von den Driesch (1976). Additional height estimates for dogs were made according to Harcourt (1973).

Bone Modifications and Butchery Patterns

The recognition of any bone modifications such as gnawing (carnivore and rodent), burning (roasting and calcination), butchery marks, or artifact production (including polishing, shaping, and decoration) was made according to Lyman (1994), Reitz and Wing (2008), and Gifford-Gonzalez (2018). All bone modifications were recorded in a FileMaker Pro application and photos were taken for a representative sample as well as for unusual modifications.

Detailed analysis of butchery patterns was facilitated by recording the portion of the bone in which the modification was made (e.g., proximal or distal, epiphysis vs. diaphysis). Relative element frequencies (by %NISP) and the relative frequencies of where bone modifications were identified (%MOD) were imported into QGIS for analysis according to Orton (2010).

Animal Husbandry Reconstructions

Using the demographic data described above to develop mortality profiles for livestock species allows us to interpret the animal husbandry practices and economic strategies. For instance, Sebastian Payne (1973) developed idealized models of meat, wool, and dairy exploitation based on the relative proportions of males, females, juveniles, adults, and older adults. These idealized models were developed with an economic understanding of animal husbandry -- optimizing product exploitation without depleting the resources necessary to maintain the herd. These models provide a functional benchmark for understanding the role of animals in the local and regional economy; however, they generally do not account for ceremony, ritual, or personal choice.

Methods of Comparative Faunal Analysis

For the broader comparative study, I collected 335 site reports from excavations conducted by the National Roads Authority (or Transportation Infrastructure Ireland) and submitted to the National Monuments Service, the government authority for the protection of cultural heritage and archaeology. Of these 31 had over 300 identifiable bone fragments, the minimum number of fragments for quantitative analysis as per

Hambleton (1999). To compare economic diversity of the faunal assemblages, I used the Shannon-Wiener Index for Ecological Diversity and the Shannon Index of Evenness. These measures, initially developed to examine the biodiversity of different environments, demonstrate relative proportions of species rather than ultimate proportions. Since all the sites that I examined were agricultural, rather than environmental, these measures demonstrate the diversity in livestock economies rather than biodiversity.

Taxonomic Diversity and Evenness

Measures of taxonomic diversity and evenness were initially developed in ecology to determine biodiversity for a given region. Taxonomic diversity (also referred to as taxonomic heterogeneity) and evenness are used to describe the structure and composition of faunal assemblages in greater detail than species lists (often referred to as taxonomic richness, denoted as NTAXA). Taxonomic diversity is a measure of the relative proportions (or “importance”) of taxa represented in the assemblage while taxonomic evenness is a measure of the distribution of individuals across taxa. Though related, measures of taxonomic diversity are impacted by the number of taxa and measures of taxonomic evenness scales diversity values by heterogeneity. Both indices are important to measure together to adequately demonstrate the structure of faunal assemblages. Assemblages with even distributions of fauna across taxa will have a higher diversity than assemblages with the same number of taxa but varying abundances (Reitz and Wing 2008). For example, an assemblage may have a high diversity but be actually quite homogenous while an assemblage with the same number of taxa that is more heterogenous will have a lower level of diversity (McClure and Welker 2017). These measures have been used in archaeological research to differentiate between 'generalist' and 'specialist' subsistence strategies (Cleland 1976). Generalists exploit a wide variety of animals (high diversity) in relatively even proportions (high evenness), whereas specialists exploit a narrower range of animals (low diversity) more intensively (low evenness) (Reitz and Wing 2008).

For the comparative study, taxonomic diversity and evenness measures were determined for the phases of occupation corresponding to the period of interest and for Ninch, diversity and evenness was measured across the entire assemblage as well as for each individual phase of occupation, using NISP. Taxonomic diversity was calculated using the Shannon-Wiener index ($H = -\Sigma P_i(\ln P_i)$), where P_i is the proportion of a given taxon in the assemblage. Taxonomic evenness was calculated using the Shannon index of evenness ($e = H/\ln S$), where S is taxonomic richness, NTAXA, or the count of different taxa represented in the assemblage (Lyman 2008). Measures for heterogeneity (H) using the Shannon-Wiener Index of Heterogeneity fall between 0-5, with 0 being entirely homogeneous and 5 being entirely heterogenous. Similarly, measures of evenness (e) using the Shannon Index of Evenness, fall between 0-1, with 0 being completely uneven and 1 being completely even.

The Shannon-Wiener index measures the sum of the relative proportions of (or importance of) each taxon in the assemblage. The Shannon index of evenness divides the H value by the natural log of the NTAXA (the number of taxa identified in the assemblage), a measure of taxonomic richness, to measure the distribution of individuals (e.g., identified fragments) across all taxa. A regression analysis is used to determine if *H* is a function of logNISP (sample size), as per Lyman (2008).

Animals and Society

Recent scholarship has focused on the role of foodways in identity construction (Nyerges 2004; Twiss 2007; Russell 2012; Hastorf 2016). Foodways studies examine the role of animal husbandry practices in the structure of social interaction and the ways in which these practices construct identity through diet choice. Diet has been identified as a marker of social differentiation in terms of rank (Crabtree 1990; Ervynck 2004; Piegiere 2004; McCormick 2002). When identity construction in food choice is considered, issues of social boundary maintenance (Thomas 2007) and colonialism (Dietler 2007) may be examined through this lens. Foodways, food choice, and animal economies play a role in the ritual importance of animals.

The economic importance of animals also affects their social and ritual function in society. Animal sacrifices, primarily intended for ritual purposes, also have an economic function by redistributing animal wealth among members of the community -- whether the sacrifice is in the form of burial (with or without human skeletal material), feasting, or structured deposit. Animal sacrifices and animal burials highlight the importance of these species in the cultural and economic life of the community (Rofes 2002; Sykes 2014), especially if they are curated as trophies (Russell 2012). The role of animals in ritual performance demonstrates the value of animals in society, both physically in the materials that they could produce and symbolically.

The accumulation of animals in forms of animal wealth was a marker of status and value. It is the concept of animal wealth and the rise of surplus production (or accumulation) that differentiates ‘subsistence’ economies from ‘animal’ economies. Concepts of animal wealth leads to the increased value of herds and herding, social differentiation, social fissioning, cooperation, and patron-client relationships (Russell 2012; Soderberg 1998; Vining 2016). How humans relate to one another can also be determined by concepts of animal wealth, in such issues as bridewealth (Russell 2012) and hospitality (Peters 2015). Finally, concerns about the accumulation of animals can lead to illicit or violent means of acquiring animals such as cattle raids, horse rustling, and warfare.

Ultimately, the study of animal use and animal economies helps us to understand social and political organization (Crabtree 1990; Siracusano 2002; Bray 2003; Twiss 2012; DeFrance 2009; Russell 2012; Hastorf 2016). Production, exchange, consumption, and redistribution of animals and animal products structures social and political as well as economic relationships between individuals and groups. Different animal husbandry practices will contribute in different ways to the social complexity that we see in modern and premodern populations. For instance, the requirements of pastoralism (nomadic, transhumant, agro-pastoralism) result in different settlement structuring, seasonal patterning, relationships to settled societies, and participation and cooperation in exchange networks (Honeychurch and Makarewicz 2016; McClure 2015). As communities shift from self-sufficient subsistence practices to surplus or specialized practices, their needs will change. In animal economies, as in other forms of economies, specialization, and surplus drive exchanges. Increased exchanges encourage the development of more complex markets and concepts of value (Holmes 2013). Animal economies were and are so integrated into the structure of society -- to understand past societies, we must understand their animal economies.

Chapter 5

Comparative Analysis 1st Century BC - 10th Century AD Faunal Assemblages

In this chapter, I describe the results of archaeological investigations for each of the sites as well as summarize the analysis of the faunal assemblage and compare the distribution of species (for NISP and MNI) and calculated taxonomic diversity and evenness for all the sites to compare between sites and across time.

Figure 1 Map of sites included in the comparative analysis

Geographic and Archaeological Context (Gazetteer)

Claristown 2, County Meath (360-30 BC)

This site, located at the summit of a low hill or mound in undulating farmland, was excavated ahead of road construction in 2001. Archaeological investigations revealed at least nine phases of activity, starting in the Neolithic period, and extending through the post-Medieval period, with the primary phases of activity consisting of the construction of two structures and 15 burials dating to the late Iron Age and early medieval periods.

The earliest phase of activity consisted of the construction of a metaled surface and sub-circular structure. The metaled surface may have served as a working or living surface composed of small cobbles and gravel. This feature was cut by an interrupted sub-circular ditch feature. The ditch measured 0.3-0.5 meters wide by 0.12 meters deep and had an internal diameter of 12.9 meters. Within the ditch, excavators found a chert scraper and flint debitage as well as animal bone, which returned a radiocarbon date of 3710-3620 BC or the Early Neolithic. The next phase of activity consisted of a series of seven pits and two deposits, containing charcoal, burnt bone, and flint and chert debitage. Bone from these pits, interpreted as cooking waste, returned a radiocarbon date of BC 2650-2340, still within the Neolithic period. The only evidence of human activity during the Bronze Age consisted of an outlying pit, which contained a sherd of coarse Late Bronze Age pottery.

There were two phases of activity during the Iron Age at Claristown 2. The first phase of Iron Age activity consisted of a series of postholes, which may represent a 6 meter diameter structure, two external hearths, and various pits. Charcoal from the pit features returned radiocarbon dates of 370-100 BC and 360-280 BC/ 240 BC-AD 20, respectively. Artifacts from these pits included a possible stone tool, a fragment of worked chert, and a piece of iron that may represent a horse bit. Burnt and unburnt animal bone also came from these features, including cat remains with evidence of skinning.

The second phase of Iron Age activity consisted of a central burial within the earlier ring ditch structure and the construction of a cairn or mound over the burial. The central burial (Burial 14) of an older adult male within a stone-lined grave dated to AD 60-420. A low mound was constructed overtop this burial, consisting of three distinct stratigraphic layers. The lowest layer was roughly circular in plan, measured 30 meters in diameter, and to a thickness of 0.05-0.12 meters. Artifacts from this layer consisted of flint and chert debitage, flint and chert convex scrapers and side scrapers, a flint core, and several unidentified iron objects. The next two layers of mound material contained animal bone, flint debitage and scrapers, a flint core, two possible loom weights, a gaming peg, a blue glass fastener, a blue glass bead and a blue dumbbell shaped bead, and a worked bone point. The flint and chert objects may have been residual from the disturbed Neolithic working area and structure. Material from the mound returned a radiocarbon date of 370 BC-AD 30.

During this period a ring ditch was constructed, cutting through the mound layers. The ditch measured 0.4-0.5 meters wide by 0.21 meters deep and had an external diameter of 14 meters and contained 18 postholes. Artifacts from the ditch included a flint scraper, a half of a stone bead, and a stone with possible drill holes, along with animal bone. Material from the ditch returned a radiocarbon date of BC 360-80. After the construction of the mound, nine individuals were interred at its northeast periphery. These burials were oriented northeast-southwest and included two double burials. Bone from one of these burials returned a radiocarbon date of AD 330-580. A group of four burials were revealed 10 meters south of the mound. Bone from one of these burials returned a radiocarbon date of AD 420-620.

After the period of burial at this site, the land appears to have been used for agricultural purposes. Stones from the cairn were removed to construct field drains and the mound was largely plowed down.

The faunal assemblage from Claristown 2 amounted to 2,241 fragments, of which 506 were identifiable to species. Of the identifiable fragments, 399 derived from Iron Age contexts and so were used in this study. The assemblage included cattle (57.4%), caprine (sheep/goat, 16.8%), pigs (11.5%), horses (5.5%), cats (0.5%), hare (0.5%), and birds (7.8%) (Table 2). Due to the composition of the assemblage and presence of butchery marks, the analyst concluded that it represented food waste. Butchery marks included a chop to a cattle scapula indicating disarticulation and cuts to a caprine metacarpal, indicating skinning. A longitudinally split cattle metacarpal, transverse cut horse metacarpal, and transverse cut caprine indicates that bone marrow was consumed. Cut marks to cat remains indicate that cats were either consumed or skinned. Bird bone was found in several contexts but was not identified further.

Table 2 Taxonomic distribution for Claristown 2, Co. Meath

Taxa[2]	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	229	67	46	22	0	2	2	0	31	0	0	0	399
%NISP	57.4	16.8	11.5	5.5	0	0.5	0.5	0	7.8	0	0	0	100
MNI	5	5	3	2	0	1	1	0	4	0	0	0	21
%MNI	23.8	23.8	14.3	9.5	0	4.8	4.8	0	19	0	0	0	100

Table 3 Diversity and evenness measures for Claristown 2, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.28	*7*	*0.66*

Rathcash East, Co. Kilkenny (37 BC-AD 123)

This site, located in a low-lying area with low hills to the north, was excavated ahead of road construction in April 2007. The archaeological features revealed during the excavation include two curvilinear cuts that formed a penannular ditch with two entrances, to the south-east and northwest sides. The cuts were a maximum of 0.57 meters wide and 0.20 meters deep. Though interpreted as a ring ditch based on the morphology of the feature, the excavators suggest that this might represent a roundhouse as there was no evidence of cremated remains in the cuts. There was charcoal recovered from the cuts but there was no evidence of burnt features within the cuts or the enclosed space, these remains are interpreted as redeposited hearth material. Some of the ditch

[2] The names of the taxa have been shortened for space. 'Bos' represents cattle (*Bos taurus*), 'Cap.' represents caprovine, 'Sus' represents pigs (*Sus scrofa*), 'Eq.' represents horse (*Equid*), 'Can.' Represents dogs (*Canid*), 'Fel.' represents cat (*Felid*), 'Lep.' represents hares/rabbits (*Leporid*), 'Cer.' represents deer (*Cervid*), 'Aves' represents birds, 'Fish' represents fish, 'Rod.' represents rodents, and 'Misc.' represents other, wild, or uncommon species.

material was radiocarbon dated to 38 BC-AD 73. Eight meters to the northwest of the enclosed space was a hearth and a possible refuse pit, approximately two meters in diameter and 0.5 meters deep. The pit (C10) contained domestic waste, including charcoal, burnt and unburnt animal remains with evidence of butchery, a charred hazelnut shell, one piece of slag, and evidence of in situ burning. Radiocarbon dates from the pit returned a date of 37 BC-AD 123.

The faunal assemblage consisted of 1,097 fragments, of which 785 were identifiable to skeletal element and side and 518 were identifiable to species. 67.3% of the total faunal assemblage was recovered from the possible pit feature (Table 4). Eight different species were identified among the skeletal fragments, including: cattle, sheep, goat, pigs, horse, deer, mouse, and another rodent. 52 fragments of cattle bone had evidence of butchery (including chops through the mandible and spine of the scapula and cuts to the posterior side of two humeri shafts), 65 fragments had evidence of rodent gnawing, only 4 fragments had evidence of carnivore (dog) gnawing, and 10 cattle bone fragments had evidence of burning/roasting. Evidence of mild eburnation and polishing to the proximal end of a cow ulna was also recorded. Cattle aging data based on tooth eruption indicates that 24% of individuals were slaughtered between 1-8 months, 36% between 8-18 month, 32% between 18-30 months, and 8% were old or senile.

Butchery and taphonomic data from the other animal species at the site include 11 pig bone fragments with evidence of butchery (including cuts to the acetabulum, a chop to the occipital bone, and a chop through a metapodial shaft), 33 fragments with evidence of rodent gnawing, 1 rib with evidence of carnivore (cat) gnawing, and 6 bones with evidence of burning/roasting. 10 caprine (sheep/goat) bone fragments had evidence of butchery (including a cut to the medial radius shaft, a cut to the mandible, and a chop to the anterior proximal tibia), 14 bone fragments had evidence of rodent gnawing, and none had evidence of burning/roasting. 22 deer bone fragments had evidence of butchery (the majority of which included cuts and sawing to the antlers but also include modification to a femoral shaft and a chop mark on the lateral side of a radius shaft), and 20 bone fragments had evidence of rodent gnawing. None of the horse or mouse remains had evidence of modification, neither butchery nor burning/roasting.

Evidence of cuts to all parts of the skeleton suggest that all stages of carcass processing, including slaughter (e.g., the chop to the pig occipital), disarticulation (e.g., the chop through the cattle scapula spine), and secondary butchery (e.g., chop to the caprine anterior proximal tibia), all took place on site. Cuts related to skinning and antler working suggest that other crafts were being made at Rathcash 1, including possible leatherworking and antler tool production. Eburnation to the proximal cattle ulna is pathology evidence in older individuals and suggests stress to that joint, likely the result of the individual used in traction/plowing fields for cereal grains. Evidence of extensive rodent activity suggests that the bones were left exposed for a time after disposal but prior to being covered in soil. Evidence of low levels of burning (roasting or blackening as opposed to calcination), suggests that this assemblage represents the remains of cooking waste and that at least some meat was cooked on the bone. The cattle aging data was collected using dental wear stages, with a total of 25 individuals (N = 25). These data indicate that most individuals were slaughtered around 2 years of age (N = 8), which is the optimal age for meat production and is evidence for beef production.

Table 4 Taxonomic distribution for Rathcash East, Co. Kilkenny

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	290	38	112	6	0	0	0	68	0	0	1	3	517
%NISP	55.9	7.3	21.6	1.2	0	0	0	13.1	0	0	0.2	0.6	100
MNI	6	3	6	1	0	0	0	3	0	0	1	1	21
%MNI	29	14	29	5	0	0	0	14	0	0	5	5	100

Table 5 Diversity and evenness measures for Rathcash East, Co. Kilkenny

Heterogeneity	*NTAXA*	*Evenness*
1.17	*8*	*0.56*

Ballydavis Site 1, Co. Laois (43 BC-AD 240)

This site, situated at the summit of a low hill with views of the surrounding landscape, was excavated ahead of the construction of the Monasterevin Town By-Pass from March-July 2003. The site was adjacent to a previously excavated Iron Age ring ditch that contained a La Tène bucket burial (Keeley 1995, 1998). The first phase of activity at the site in the 2003 excavations consisted of an Early Bronze Age cremation pit (2031-1885 cal. BC) and associated features. A single flint tanged-and-barbed projectile point was recovered from this phase. The second phase of activity consisted of a Late Bronze Age (910-800 cal BC) posthole and associated pit features. These features were truncated by later Iron Age activity and the finds from this area of excavation include a pale green glass bangle fragment, a perforated dog tooth pendant, and an unidentified iron object suggesting that these artifacts are related to the Iron Age rather than Bronze Age activity.

The third phase of activity consisted of an Early Iron Age roundhouse (390-190 cal. BC) defined by 16 postholes arranged in a circular pattern measuring 9 meters in diameter, there was no internal hearth feature identified. A concentration of external postholes was interpreted by the excavator as a possible porch or annex structure. A large associated burnt pit contained a "considerable amount of burnt seeds and grains" indicating investment in grain production (Stevens 2011). Artifacts associated with the roundhouse include an iron whittle tang knife handle. A series of small pits to the south of the roundhouse structure produced large amounts (1853g) of metal slag and flake hammerscale, indicating iron smithing.

The main phase of activity Ballydavis consisted of a large enclosure ditch and internal circular features. The large enclosure ditch measured 100 meters in diameter, V-shaped in profile with a maximum depth of 1.4 meters and width of 4 meters, and with a causewayed entrance to the southeast. A small number of postholes associated with the There was no external bank and the proximity of internal features suggested that there was never an internal bank. The fills of the ditch contained a considerable amount of animal bone with evidence of butchery and roasting. Hearths/fire spots from in situ burning in the enclosure ditch produced radiocarbon dates from cal AD 70-240.

Features contained within the enclosure ditch consisted of three ring ditch features (C105, C125. & C140), iron-working hearths, pits, postholes, hearths, and circular slot trenches, and inhumation burials. Ring ditch C105 was 8.2-8.5 meters in diameter, U-shaped, 0.3 meters deep and contained two cremation deposits (43 cal BC-AD 62) in the base of the ditch circuit and in the upper backfill consisting of at least three individuals. Ring ditch C125 was larger with an internal diameter of 15 meters and depth of 0.6

meters and an internal circuit of postholes and large central post. Cremated bone from the primary ditch fill from C125 returned dates between 18 cal BC-cal AD 125. Artifacts associated with this feature include an iron lozenge-shaped mount, a sandstone whetstone, a bone pin, and an unidentified iron bar. Ring ditch C140 consisted of a circular ditch, 8.8 meters in internal diameter and 0.1 meters deep, enclosing an interior concentric slot trench (6.3-6.5 meters in diameter), which in turn enclosed a central burial pit. Artifacts from the ditch fill consisted of high-status objects including: a copper alloy bead, copper alloy rod-bow fibula with silver inlay, a coiled length of thick copper alloy wire, a copper alloy mount composed of two sheets fastened together by three copper alloy rivets, and a heat-treated flint barbed and tanged projectile point. The central burial pit measured 3 meter long, 2.1 meters wide, and 1 meter deep and contained animal bones, a polished shale stone ax, three corroded ferrous objects, and the disarticulated remains of a young adult male and adult female human, radiocarbon dated to AD 250-430. Additional inhumation burials were inserted in and around the ring ditch features, including three infant burials, a young adult possible male burial, and two additional adult male burials. Later features at this site consist of agricultural field boundaries and furrows.

The faunal assemblage consisted of over 1,000 fragments, of which 855 were identifiable to species (Table 6). Much of the assemblage came from the large V-shaped enclosure ditch, the fill of the northernmost ring ditch (C125), and the later circular enclosure (C140). Eight different animal taxa were identified, including: cattle, pig, caprine (sheep or goat), dog, horse, bird (corvid and one wild fowl), and red deer. Cattle dominated the assemblage with evidence of complete carcass processing (e.g., cut marks to the hyoid, chop marks on the pelvis, and cut marks on the neck of the scapula). Chop marks on metapodia shafts indicates hide processing as well. There were few mandibles recovered from the site, therefore aging depended on evidence of epiphyseal fusion (which is problematic). 90% of late fusing (36-42 months) were fused, indicating a strong presence of older individuals. Pigs were the next most common taxa among the assemblage, represented primarily by mandible, maxilla, and scapula fragments. Only one mandible fragment had evidence of butchery. There was butchery evidence noted on some of the 89 sheep bone fragments, with evidence of carnivore (dog) gnawing on one distal tibia.

Cattle aging data based on mandibulae (*N* = 5) and epiphyseal fusion (*N* = 148) suggests that most individuals were slaughtered around 18-24 months, likely for meat. There is limited evidence for hunting at Ballydavis, including one wild fowl bone fragment, as all the red deer remains consist of antlers which might have been shed naturally.

Table 6 Taxonomic distribution for Ballydavis Site 1, Co. Laois

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	584	89	113	9	13	0	0	26	10	0	8	0	852
%NISP	69	10	13	1	2	0	0	3	1	0	1	0	100
MNI	-	16	23	-	-	-	-	-	-	-	-	-	-

Table 7 Diversity and evenness measures for Ballydavis Site 1, Co. Laois

Heterogeneity	*NTAXA*	*Evenness*
1.03	*8*	*0.50*

Moone, Co. Kildare (AD 130-350)

The site, situated at the top of a small glacial hillock (kame), had views of the Wicklow mountains to the north, east, and south and up to Mullamast hill to the west. The site was excavated as part of the Kilcullen to Moone and Athy Link Road from April-May 2007. The first phase of activity at this site consisted of a Neolithic penannular ring ditch and internal pit (3520-2250 cal. BC) which contained three lithic artifacts, including a leaf shaped flint point, a possible flint core or blank, and a retouched unifacial flint blade or knife.

Phases 2-4 consisted of a Bronze Age flat cemetery, containing 14 crouched inhumations (including one cist grave), four multiple graves, and one urned cremation. The cemetery dates from 2280-2030 cal. BC (skeleton 10) to 1940-1680 cal. BC (urned cremation 234). Artifacts associated with the cemetery include tripartite food vessel fragments, flint flakes and flintknapping debris, flint cores, hammerstones, a bronze awl, leaf-shaped points, a plano-convex knife, fossil shell fragments, and some animal remains, including a marine shell.

Phases 5-7 date to the Iron Age, consisting of pits and an enclosure ditch. Pit 139 (Phase 5), 400-200 cal. BC, contained worked lithic objects (scrapers, chert, quartz smoothing stone, mudstone whetstone, sandstone hone stone, and limestone work-surface slabs), prehistoric pottery, a polished bone object, hulled barley, animal bone, and a small amount of disarticulated human bone. Pit 93 (Phase 6), 50 cal. BC-cal. AD 80, contained an iron whittle tang knife blade, worked lithic material, an iron nail, cereal grains, animal bone, and fragments of disarticulated human bone.

The main phase of activity at Moone consisted of a 33-meter diameter penannular ditch (056), enclosing the summit of the hilltop, with an entrance to the northeast. The ditch fill contained a large animal bone assemblage, cereal grains (including hulled barley), a worked and decorated bone knife/sword handle, a decorated bone pin head, copper objects of unknown function, worked lithic material (including a concave scraper), a worked bone spoon/spatula handle, a worked antler needle, unfinished worked antler, an iron needle, a bone piece, a bone needle, and an extensively cut whale scapula (examples of whale vertebrae used as butcher blocks are known from medieval contexts from the Continent). Unburnt animal bone from this feature returned a radiocarbon date of cal. AD 130-350. A large ‘teardrop’ shaped cereal drying kiln was located external to the enclosure ditch, dated to cal. AD 130-380, contemporaneous with the enclosure. There was very little in the kiln deposits, suggesting that the kiln was cleaned out after use. Later activity at the site consisted of a later large figure-of-eight shaped cereal drying kiln (cal. AD 340-580), containing abundant hulled barley and some wheat remains as well as burnt and unburnt animal bones. A third undated kiln was situated 3 meters to the east of the figure-of-eight shaped kiln containing animal bone remains, a coppery alloy barrel padlock key, and a polished bone needle.

The animal bone assemblage from Moone consisted of 7,478 fragments, of which 73.1% were unidentifiable to species (Table 8). Only samples from Phases 6-8 were selected, resulting in 1191 identifiable fragments. Among this sample, 17 specimens were charred/roasted, 30 were calcined, 7 were gnawed by carnivores (dogs), and 61 had evidence of butchery. Of the butchered bone, 24 were cattle, one was a horse atlas (evidence of decapitation), and three were pigs. The butchery evidence suggests that complete carcass processing took place on site, including slaughter, skinning, dismemberment, and fileting. The orientation of some of the remains suggests that they were articulated and fleshed at the time of deposition (e.g., partial cattle spine and pig ankle). Evidence of skinning and worked deer antler also suggests leather and antler craftwork. There was one whale scapula found at the site with considerable chop and cut marks. As the cuts do not appear to conform to expected patterns for fileting, this specimen might have been used as a work surface or cutting board. Osteometric analysis of the pig remains from this site indicate that the individuals were very large and might have been wild boar, wild boar-domestic pig hybrids, or feral domestic pigs.

Among the cattle remains, there was evidence of lots of calves (based on tooth wear). This could be evidence for dairy production but the evidence of deposition of articulated limbs and the evidence of very large domestic pigs or wild boars might suggest that the use of animals at this site might have been ritual in nature (Tourunen 2009). Mandibular wear stages were recorded for 5 individuals (N = 5), which derived from two juveniles, one sub-adult, and two elderly individuals. Wear stages were also recorded on loose deciduous premolars (Pd4) and third permanent molars (M3), increasing the sample size to 30 (N = 30).

Table 8 Diversity and evenness measures for Moone, Co. Kildare

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	588	28	539	12	3	0	1	5	5	4	6	1	1191
%NISP	49	2	45	1	0.25	0	<0.01	0.4	0.4	0.3	0.5	<0.01	100

Table 9 Diversity and evenness measures for Moone, Co. Kildare

Heterogeneity	*NTAXA*	*Evenness*
0.90	*10*	*0.39*

Collierstown 1, Co. Meath (AD 401-609)

This site, excavated between September 2006 and April 2007, contained a series of concentric enclosures and a community inhumation cemetery. The site was previously truncated by Collierstown Road and had been farmed since the medieval period. The first phase of activity, Phase 1, consisted of the inhumation of the central burial, Burial 48, and the construction of a series of segmented ditches ("Enclosure 1"). The segmented ditches were truncated by later ditches at the site. Burial 48 was an adult female in an east/west aligned grave cut, buried with an unidentified iron object. Burial 48 was capped with a low earth mound into which the first group of 11 adult inhumations were inserted (burial phases 1 and 2). Enclosure 1 was sub-rectangular and measured 15 meters north/south by 17 meters east/west. A sherd of Bii ware pottery was found in an upper fill of this feature, Bii ware pottery is known to have been produced in the eastern Mediterranean and imported to Ireland in the late 5th-mid 6th centuries AD (Doyle 2009).

Phase 2 consisted of a series of segmented ditches (Enclosure 2) and maintenance of those ditches (evidence of recuts). Charcoal from these features returned radiocarbon dates of cal. AD 401-596 and cal. AD 427-609, respectively. Artifacts from these features included: unidentified iron objects, flint flakes, a bone gorge, copper-alloy objects, a complete whalebone sword hilt (of Rynne's sub-Roman form, which dates to the fourth to seventh centuries AD), and sherds of Phocaean Red Slip Ware (PRSW) and E-ware. PRSW was produced in western Turkey from the mid-fifth to mid-sixth centuries and E-ware was produced in Francia from the late sixth to early eighth centuries. To have both pottery forms represented in the assemblage indicates a mid-sixth century date for this phase. The majority of the 61 burials at the site took place during this phase (phase 3). These burials appear to be more formally laid out than prior phases of burial and include three double burials.

Phase 3 consisted of the construction of a large circular enclosure (Enclosure 3) and continued burial at the site. The Enclosure 3 ditch was significantly truncated by later activity, but the surviving segments indicate that it was 40 meters in diameter and was 2.3 meters wide and 1.5 meters deep. Charcoal from this feature returned radiocarbon dates of AD 569-671 and AD 559-663, respectively. Artifacts from Enclosure 3 included fragments of iron objects and Bii ware pottery. Burials during this phase included the first non-adults at the site, including three neonates and one juvenile. Enclosure 3 was later replaced and extended in Phase 4, enclosing an area 80 meters north/south by 35 meters east/west. The lower deposits of this feature, dated to AD 569-663, retained water and therefore preserved organic material including animal bone and a wooden stave fragment. Other artifacts from this feature include flint debitage, a flint end scraper, a copper-alloy spiral-headed ring-pin, Bii ware pottery, and an iron spur fragment and late medieval pottery (Dublin ware). Evidence of late medieval and post-medieval artifacts from this feature suggest that the ditch was open for a significant period. There were also a series of undated features enclosed within the Phase 4 enclosure including 14 pits, a hearth, and two shallow ditches.

The faunal assemblage from Collierstown 1 consisted of 1,185 countable specimens. For this study, I have only used the fragments from phases 1 and 2 (NISP 553), which dates to AD 401-609 (Table 10). The assemblage represents 7 taxa including: cattle, caprine (sheep/goat), horse, pig, dog, cat, and red deer. Cattle dominated the assemblage (73% NISP and 44% MNI), followed by caprine and pigs. There was surprisingly little evidence of butchery at Collierstown 1, with chop marks on one sheep, one pig, and three cattle specimens and cut marks to the proximal surface of one cattle radius. Chop marks on cattle remains were consistent with evidence for skinning and filleting but there was no evidence for dismemberment (chop marks to the vertebrae or pelvis), suggesting that this was not a butchery-kill site. Similarly, there were only three instances of burning, all of which were noted on cattle lower limb elements (metapodials and a phalanx). Two specimens had evidence of rodent gnawing, and none had evidence of carnivore (dog or cat) gnawing. Four pathologies were noted in the assemblage, including eburnation on a horse pelvis and phalanx (likely due to old age) and blastic lesions on a cattle phalanx and metacarpal (due to infection or trauma).

Cattle aging data suggest that animals were raised for meat consumption. Most cattle were slaughtered around 24 months old, the optimal age for meat consumption (*N* = 23 for phases 1 & 2, 8 of which were estimated to be >40 months old). Caprine and pigs had similar slaughter patterns, though sheep slaughter might have been influenced by decreasing quality of wool as the individuals age. The aging and butchery data suggests that the assemblage represents food waste.

Table 10 Diversity and evenness measures for Collierstown 1, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	403	75	42	16	14	1	0	2	0	0	0	0	553
%NISP	73	13	8	3	2	0.2	0	0.4	0	0	0	0	100
MNI	18	11	6	3	2	1	0	1	0	0	0	0	42
%MNI	44	26	14	7	5	2	0	2	0	0	0	0	100

Table 11 Diversity and evenness measures for Collierstown 1, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
0.92	*7*	*0.48*

Faughart Lower Site 116, Co. Louth (AD 390-641)

This site is located on a natural rise in an undulating landscape to the south of the Mourne Mountains and north of two streams that empty into a tidal inlet 1km away from the site. The site was excavated ahead of road construction between Newry and Dundalk between June 2005 and April 2006. Archaeology phasing at the site begins with a possible Neolithic palisaded enclosure dated to 2569-2515 cal. BC. The possible enclosure was preserved as two gullies, 0.6 meters wide and 0.3 meters deep. The gullies extended outside of the limit of excavation, but if they were to continue, then the possible palisade would measure 30 meters in diameter and encircle the highest part of the site. No artifacts were found associated with this phase of activity. The next phase of activity consisted of two fire pits and a small gully dated to the late Iron Age (cal. AD 25-129 and cal. AD 52-208, respectively). The linear gully was 0.3 meters wide and 0.2 meters deep and was interpreted as a windbreak or fence. Charcoal from the fill of the gully returned a radiocarbon date of cal. AD 72-214, contemporaneous with the fire pits. The most significant phase of activity at the site consisted of an early medieval enclosure with four subphases of construction and burial.

The first phase of construction during the early medieval period included two concentric ditches. The outer ditch enclosed an area of 40 meters in diameter (3.5 meters deep and 1.3 meters wide) and the second ditch formed an interior sub-circular enclosure, 29 meters in diameter with a 5-meter-wide entrance. It is likely that burial at the site commenced during this phase as well and this phase of enclosure is dated by an early burial in a natural break in the ditch (cal. AD 390-550). Stratigraphic analysis of the ditch fills indicates that the ditches were allowed to infill with natural siltation and slumped bank material, except for the eastern extent of the ditch, which appears to have been deliberately backfilled. Most sections of the ditch had little evidence for refuse deposit during this period, except for the western section of the ditch, which produced iron smithing debris (slag, a hone stone, and four iron knives including one with a bone handle), an antler spindle whorl, a piece of cut antler, and a copper alloy pin. The rest of the ditch produced only a small amount of animal bone, a single sherd of Souterrain Ware pottery, and a rectangular iron strip.

The second phase of activity at the site consisted of reuse and recutting of the enclosure ditches and modification of the outer enclosure ditch in the seventh to early eighth centuries AD. The outer enclosure was expanded by 5 meters in the northeastern part of the ditch, likely to increase the area available for burial. Both the inner and outer enclosure ditches were partially stone lined during this phase. Artifacts from the outer ditch include a socketed knife with traces of a wooden handle, an iron knife, a socketed antler handle with a piece of iron in it, a bone beater, and a grinding stone. A small bowl furnace, associated with this phase and dated to 671-866 cal AD was dug into the basal fills of the outer enclosure ditch, containing a smithing hearth bottom and iron slag. Again, both ditches appear to have been allowed to infill naturally and contained several fills. Artifacts from these fills included: sherds of Souterrain Ware pottery, five bone pins, a copper needle, a set of copper tweezers, a stone bead, four loop headed pins, iron smithing slag and nine iron smithing hearth bottoms, an iron rod, an iron pin, strip, and nail, two stone spindle whorls, and a fragment of an iron axe. A date from the upper fill of the inner enclosure suggests that the ditches were largely filled by cal. AD 582-652 and a radiocarbon date from an upper fill of the outer enclosure returned a date of cal. AD 664-868.

The third phase of enclosure consisted of an expansion of the enclosure (55 meters in diameter), though no evidence of an internal enclosure, and the construction of a small souterrain dug into the backfill of the Phase 2 outer enclosure. This phase is dated to cal. AD 672-777, from a pit containing domestic refuse. Phase 4, the final phase of occupation at the site consisted of the construction of a stone embankment around the western edge of the outer enclosure (a cashel wall). The wall construction was dated to cal. AD 678-776, by charcoal contained within the packing material.

The site also contained a large cemetery, consisting of 771 burials, (65% adults, 34.6% juveniles, adults: 125 males and 133 females). Most of the burials were extended inhumations in earth cut or cist graves, though there were two prone burials (an older female and a child) and three crouched burials. The only division evident among the burial population was the later burial of 50 sub-adult/infant burials near the core of the cemetery, suggesting that the cemetery was used as a *cillín* (a place of burial for unbaptized children) after it had fallen out of use. The earliest burial was dated to cal. AD 390-550 and the latest burials were dated to cal. AD 790-1000.

The faunal assemblage comprised 39,614 fragments, of which 20% (7,951) could be identifiable to species. 47% was assigned to occupation Phase 2 and only 7% (n=2,773, NISP=670) of the total assemblage could be assigned to Phase 1 and this is the phase included in the study (Table 12). The mammal assemblage consisted of cattle, caprine (sheep and goat), pigs, horses, dogs, cats, hare, deer, and fox. Additionally, the bird bone assemblage contained domestic fowl, pigeon/dove, teal/garganey, guillemot, and sparrowhawk and the fish assemblage consisted of only cod. Domestic fowl (*Gallus gallus*) is suggested to have been introduced to Ireland during the early medieval period. The inclusion of cod remains are interesting because cod would have been fished offshore and is thought to have not been a common feature of local economies until the 9th century, with the arrival of the Norse. Though not included in this study, an upper caudal vertebra from a *delphinid* (killer whale or long-finned pilot whale) was identified in Phase 2 and indicates that the carcasses of beached whales were also occasionally exploited. In general, domestic species were much more important to the local economy at the site, with cattle representing >50% of all species for all phases. It is interesting to note, however, that cattle become less important during Phase 4, at the same time as there is an increase in the exploitation of woodland and wetland (waterfowl) resources at the site.

Butchery marks were noted on several bones, with over half being chop marks made with a heavy cleaver, 79% of which occurred on cattle bones, and knife cuts accounted for an additional 34% of butchery marks. Saw marks were also identified, but these were mostly related horn and antler processing. Most butchery marks to cattle consisted of slaughter (cuts to cranium, atlas, and axis) and primary dismemberment (pelvis and vertebrae), though fillet marks were noted on some long bones and the scapula. Skinning marks were identified on four cattle bones, suggesting that leather processing was not a major industry at this site. Butchery marks were also identified on sheep, pig, horse, red deer, and cat remains (and the whale vertebra from Phase 2). From these marks, sheep and goat horns were also utilized, and that horse meat was consumed on occasion. The cut marks to the cat mandible indicate that cats were occasionally skinned for their pelts.

Age data from the cattle remains indicates that, during Phase 1, 40% of cattle were culled in their first year (8-13 months), 20% were culled in their second year, and 25% survived beyond 36 months. Compared to other studies by McCormick, the analyst suggests that this pattern indicates that cattle were primarily managed for secondary products, such as dairy. Interestingly, this pattern shifted in Phase 2, with only 13% of cattle slaughtered at 8-13 months and 42% surviving past 36 months (with the main peaks at 40 and >50 months). The analyst notes this distinction between the phases of activity but concluded that dairy was likely the primary product produced at this site. Unfortunately, the data tables were not included in the report and so sample size could not be evaluated.

Table 12 Taxonomic distribution for Faughart Lower Site 116, Co. Louth

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	360	74	156	13	29	10	0	9	7	11	0	1	670
%NISP	54	11	23	2	4	2	0	1	1	2	0	<0.2	100

Table 13 Diversity and evenness measures for Faughart Lower Site 116, Co. Louth

Heterogeneity	*NTAXA*	*Evenness*
1.30	*16*	*0.47*

Baronstown 1, Co. Meath (AD 382-655)

This site, situated on the summit of a low rise above the floodplain of the river Gabhra and 2.5 km east of the Hill of Tara, was excavated head of the M3 Clonee-North of Kells Motorway between September 2006 and April 2007. Archaeological features at this site have been divided into four phases of occupation, beginning with the construction of a circular enclosure (ringfort) and subsequent additions and modifications.

The first phase of occupation was identified by the construction of a 40-meter diameter circular enclosure ditch, 4 meters wide and 2 meters deep. This ditch was re-cut several times, indicating regular cleaning and maintenance of the enclosure ditch, as the deposits formed rather quickly. The basal fills of this ditch were waterlogged, which preserved several wooden and leather objects as well as pollen and seeds. Wooden remains from this feature included worked and unworked brushwood, split timbers, rods, pegs/dowels, possible handles, staves from a bucket and barrel, and a turned bowl and scoop/ladle. Three leather objects were preserved in this feature as well, including two cow leather pieces with knife cuts and one piece that could not be identified. The seeds and pollen preserved from this feature included barley, hazel, alder, birch, elm, oak, burnt rhizomes/tubers (possibly from burning turf for fuel), and charred flax. Other artifacts from this feature include: a possible loom weight, a bone spindle whorl, six knife blades, an iron bridle ring, an iron plate, an iron mount, a copper-alloy ring ping, a copper-alloy bracelet, iron slag, an oval-shaped smithing hearth cake, a bone single pointed pin-beater, three bone needles, and a zoomorphic penannular ring pin with interlace decoration on the bird head-shaped terminals (from a cut within the ditch). Radiocarbon dates from this feature returned dates of cal. AD 230-420 and cal. AD 540-650, respectively. There were several additional features related to the enclosure ditch, including pits dug into the ditch and pits and postholes on the interior of the enclosure, though there were no alignments of postholes that proved to be representative of a structure. Exterior to the ditch, there was an oval enclosure (8 meters east/west and 6 meters north/south), that contained charred grains and chaff dated to cal. AD 390-550. Three hearths were associated with this enclosure, dating to cal. AD 240-550, and are interpreted as cereal drying kilns.

The second phase of activity at this site consisted of the construction of an outer enclosure ditch (70 meters east/west and 30 meters north/south), 2.7 meters wide and 1.4 meters deep, with a bridged entrance with a possible gatehouse feature and horse skull burial associated with the possible gatehouse. A primary fill from the outer enclosure returned a date of cal. AD 680-890. Phase 3 and 4 of occupation at this site consisted of the construction of internal divisions in the outer enclosure and annex features. These features may have been used for penning livestock or growing grains or vegetable crops. There was also a cereal drying kiln associated with divisions in Phase 4. Although there was not convincing evidence for a structure in the interior of the inner ditch, 29 pits and depressions had evidence of *in situ* burning and therefore might represent hearth features. While there was no datable material from Phase 3, Phase 4 returned dates from the sixth-ninth centuries AD.

The faunal assemblage consisted of 6,443 specimens, of which 74.2% came from Phase 1, the phase used for this analysis (Table 14). The species represented in the assemblage include cattle, caprine (sheep and goats), pig, horse, dog, cat, red deer, hare, and badger. Evidence of butchery and cooking is sparse at Baronstown 1, even in Phase

1. Between 1-2% of the assemblage had evidence of modifications, with chop marks being the most common and representative of dismemberment. Only three specimens from Phase 1 had evidence of burning, including a cattle radius (burning/blackening at the epiphyses) and two pig phalanges (calcined). The blackening of the cattle radius suggests that a small component of the meat cooked at this site was cooked on the bone over low heat. The majority (27 of 29 specimens) of the evidence for gnawing (carnivore) was noted from Phase 1. Only 16 specimens from the entire assemblage show evidence of pathologies and the majority (8) were degenerative joint disease to cattle and equid limbs, suggesting use in traction.

Age-at-slaughter data was determined via mandibular wear stages and (*N* for Phase 1 mandibles = 112). The cattle age data for cattle in Phase 1 shows two peak ages for slaughter, between 15-30 months (42.8%) and >36 months (56.3%, with nearly a quarter of these older than 50 months). Biometrical data indicates that 63.8% of the adults in the herd were female. Other assemblages along the M3 motorway project had similar age-at-slaughter results, suggests that there were likely a variety of livestock management practices during this period.

Table 14 Taxonomic distribution for Baronstown 1, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	3015	790	627	200	107	39	1	0	0	0	0	1	4780
%NISP	63	17	13	4	2	1	<1	0	0	0	0	<1	100
MNI	110	51	47	9	9	7	1	0	0	0	0	1	235
%MNI	46.8	21.7	20	3.8	3.8	3	0.4	0	0	0	0	0.4	99.9

Table 15 Diversity and evenness measures for Baronstown 1, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.11	*8*	*0.54*

Parknahown 5, Co. Laois (AD 410-650)

This site, located on low ground below Cullahill Mountain, north/northeast of the river Goul and one of its tributaries, was excavated as part of the Portlaoise to Cullahill Motorway Scheme from July 2005-October 2006. The first phase of occupation at this site consisted of an early Bronze Age burnt mound dated to 2470-2270 cal. BC. This feature contained an earth cut trench and heat shattered sandstone with animal bone and a flint scraper. A series of later Bronze Age pits dated to 1220-970 cal. BC were excavated at the southern extent of the site.

The second phase of occupation consisted of several early medieval enclosure ditches, a possible structure, pits, deposits, and a cemetery. The double-ditches enclosed an area of 60x80 meters with a northwestern entrance. Radiocarbon dating evidence demonstrates that this enclosure was occupied from AD 410-600 and AD 960-1220. Archaeological evidence from the ditch fills provided evidence of domestic and industrial activity with artifacts including animal bone, iron slag, iron nails, knives, wedges, a rotary quern, whetstones, an iron ring pin, lignite bracelet, and decorated antler comb. Bank deposits, dated to AD 420-660, protected the site from flooding by a nearby stream, and contained animal bone, slag, a crucible fragment, an iron awl, a whetstone, a copper-alloy stick pin, pin shank, and copper-alloy penannular brooch. The initial ditches were deliberately infilled and new ditches were dug in AD 589-655 and were in use until AD

770-980. Artifacts from these ditches include animal bone, a flint scraper, a stone disk, a bone weaving implement, an iron knife, a copper-alloy ring pin, a decorated bronze bead, and a copper-alloy zoomorphic penannular brooch. Geophysical survey indicates that linear features associated with these ditches extended beyond the limit of excavation and were likely field systems associated with the occupation in the enclosure.

The cemetery at Parknahown 5 contained 425 individual burials and "800 litres of disarticulated human remains" (O'Neill 2009). Burial took place between the fifth and sixth centuries before ceasing and starting again between the twelfth and thirteenth centuries. The later burials were neonates and suggests that this site was used as a *cillín*. Several artifacts, or grave goods, were found associated with the burials including copper-alloy pins, a copper-alloy ring fragment, a decorated enameled copper-alloy mount, glass and amber beads, a lignite bracelet, an antler gaming piece, a boar tusk, a dog tooth, and an infant was interred with an antler bead, a perforated horse tooth, and a quartz pebble. Within the area of the cemetery, there was a shallow (0.13-0.3m deep, 0.2-0.45m wide) penannular boundary with a posthole in the southern terminal dated to cal. AD 310-450. A few pits and postholes near to the burials suggests that there was occupation evidence pre-dating burial at this site.

The faunal assemblage from Parknahown 5 consisted of 3,877 countable fragments, of which 452 derived from features dated to between AD 400-650 (Table 16). The species represented in the Phase 2, part 1 assemblage include: cattle (47%), caprine (sheep/goats, 13%), pigs (17%), horse (6%), dogs (8%), cats (3%), deer (3%), and domestic fowl (1%). A high proportion of the assemblage contained evidence of modifications, including cut marks, chop marks, burning, and gnawing. While there were chop marks evident on some fragments and there is evidence for decapitation and dismemberment, cut marks or fileting marks were the most frequent form of butchery mark. Of the chop marks, however, the majority found on cattle remains were noted on crania/horncores, indicating that horn craftwork took place on site. Limited evidence for butchery of dog and cat remains suggests that only occasionally were dogs and cats skinned for their pelts. Burning or blackening was a more common heat treatment than calcination, indicating that meat was cooking on the bone frequently. Several bones also displayed evidence of carnivore (dog) gnaw marks, more often than rodent gnaw marks. Pathological evidence indicates the use of cattle for traction (e.g., eburnation and exostosis and bit wear damage on molars) and horses for traction or riding (evidence of spondylosis and osteoarthritis due to advanced age and biomechanical stress). Non-pathological double paired horncores were noted on two sheep specimens. The presence of postcranial deer elements indicates that hunting took place in addition to collecting shed antlers.

The cattle aging data from Phase 2 part 1 has two peaks, the first at 30-31 months (19%) and the second after 50 months (35%). Given the aging data and sexing data, displaying a preponderance of females (83% female), the analyst concluded that cattle were bred at Parknahown 5 for dairy production (*N* = 48).

Table 16 Taxonomic distribution for Parknahown 5, Co. Laois

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	211	61	78	28	38	15	0	15	6	0	0	0	452
%NISP	47	13	17	6	8	3	0	3	1	0	0	0	100

Table 17 Diversity and evenness measures for Parknahown 5, Co. Laois

Heterogeneity	*NTAXA*	*Evenness*
1.59	*8*	*0.77*

Dowdstown, Co. Meath (AD 420-660)

This site, located on the top of an east-west oriented moraine above the Boyne River floodplain 80 meters to the north, was excavated ahead of road construction from September 2005-December 2006. Excavation revealed extensive early medieval enclosures and associated field systems that were damaged by land reclamation efforts in the post-medieval period. Evidence for prehistoric activity, specifically a hearth with charred barley dated to the Middle Bronze Age (1630-1450 BC) and 361 unstratified Early Mesolithic (7000-5500 BC) worked flint and quartz tools, suggests that there was periodic occupation in the area, if there was extensive habitation, this was destroyed by the early medieval settlement.

The first phase of early medieval occupation consisted of a circular enclosure with an associated rectangular annex. The circular enclosure measured 35 meters in diameter and the ditch was V-shaped, 1.8 meters wide and 1.6 deep. Both the enclosure and the annex ditches had at least two re-cutting events, indicating regular maintenance of the enclosure. Animal bone and charred cereal grains (oat, barley, and wheat) were found within the enclosure ditch and radiocarbon dated to AD 420-620. Few internal features could be attributed to this phase of occupation, except for an internal C-shaped division. Artifacts from the enclosure ditch included metal objects including an iron knife; bone and antler objects, including a bone knife handle and a decorated antler gaming piece; a quern stone fragment; and three sherds of Souterrain ware.

The second phase of early medieval occupation at the site consisted of the construction of a large D-shaped enclosure and associated field systems, replacing the earlier enclosures. Radiocarbon dates from this enclosure indicate that it was constructed around AD 670-890. Artifacts from this feature include iron knife fragments, a copper-alloy strap, a comb fragment, bone spindle whorl, pin fragments, and a fragment of a lignite bracelet. Nine cereal drying kilns were associated with this phase of occupation, several dating to between AD 650-970. Enclosure 6, located within the Boyne floodplain associated with this phase of occupation is interpreted as an enclosure for cattle summer pasturage (the winter floods would enrich the soils within the enclosure, which would provide pasturage during the drier summer months). While there was no evidence for extensive occupation at this site after the 10th century, one human burial (northwest-southeast aligned flexed inhumation) of a young adult dated to AD 1010-1170 was uncovered in the backfilled ditch. The bird bone assemblage includes domestic fowl, goose, goosander (a type of diving bird), and a duck.

The faunal assemblage from Dowdstown 2 was divided into 5 phases, with most of the identifiable fragments in phases 2 (AD 420-660), 3 (AD 680-920), and 5 (18th-20th centuries). Only the 1,966 fragments from Phase 2 were included in this study (Table 18). Taxa represented in Phase 2 include cattle, caprine (sheep/goat), pig, horse, dog, dog/wolf, cat, hare, and birds. Of the three identified canids, two were estimated to be 31-32 centimeters tall at the shoulder (“small” domesticated dogs). One of the canids was estimated to be 71.6 centimeters tall, which is at the uppermost height range for large dogs during this period but also falls within the height range for wolves (wolves are endemic to Ireland and were hunted to extinction in the 18th century). For an assemblage of this size, there was limited evidence for butchery and cooking, all of which was noted on cattle bones. Of the seven butchery marks, two were chops to proximal femurs and three radii with chop/saw marks -- all of which indicate disarticulation. The final two butchery marks were knife marks to a metacarpal (skinning) and an astragalus (skinning or fileting). Burning evidence (three - two femurs and one metacarpal) indicates that some meat was roasted on the bone. Pathological evidence suggests that some cattle may have been used for traction (two cattle femora with eburnation). There also was one split sheep horncore, which is a genetic trait.

Cattle aging data from Phase 2 indicated two peaks of slaughter, at around 17 months and over 40 months (as determined by mandibular wear stages, $N = 24$). Of the 14 metapodia that could be measured, 12 fell within the size range for females and 2 fell within the size range for males. The analyst concluded that this likely represents a herd kept for secondary products.

Table 18 Taxonomic distribution for Dowdstown, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	1202	392	257	39	34	6	3	0	16	0	0	0	1966
%NISP	61	20	13	2	2	<1	<1	0	<1	0	0	0	100
MNI	40	23	18	3	3	2	1	0	4	0	0	0	94
%MNI	43	24	19	3	3	2	1	0	4	0	0	0	100

Table 19 Diversity and evenness measures for Dowdstown, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.10	*11*	*0.46*

Killeany 1, Co. Laois (AD 430-650)

Excavation at this site, from November 2005-June 2006 ahead of road construction, revealed an early medieval enclosure and cemetery. The exterior ditch encloses a low-lying hill, bounded by poorly drained forestland to the north and northeast and the river Gully to the northwest (150 meters) and south. The earliest phase of occupation at the site consisted of postholes and slot-trenches representing two structures of a probable prehistoric date (Late Bronze Age).

The main phase of activity on the site consisted of the construction of a large enclosing ditch around the summit of the hill, kilns external to the enclosure, and cemetery. One-third of the ditch was excavated, and the full extent of the ditch was estimated to be 180x150 meters in diameter, 3 meters wide, and 1.5 meters deep, with a 3.3-3.4-meter-wide break in the circuit of the ditch, interpreted as a southeast facing entrance. Postholes at the entrance gap suggest that there was initially a gate structure. The fills of the ditch indicate that the ditch gradually silted up, rather than being intentionally backfilled. A burial in the upper fill of the ditch (Burial 68) was radiocarbon dated to the 7th-9th century, suggesting a date by which the enclosure was abandoned. An inner ditch within the enclosure (Ditch 2) defined the extent of the cemetery at Killeany, this ditch was 1.2-1.8 meters wide with a northeast facing entrance.

There were six kilns external to the outer enclosure ditch, including Kiln 5, which was a stone-lined keyhole-shaped kiln. All the kilns were aligned along a north-south axis and were evidently constructed respecting the other kilns (suggesting that, if they were not contemporaneous, that the older kilns were visible when the newer kilns were constructed). There were 68 complete inhumations in the cemetery at Killeany with additional disarticulated human remains, dated to the 6th-10th centuries. The burials were oriented east-west or northeast-southwest and there were four associated grave goods, including a bone disk paternoster, a bone bead/composite gaming piece, a quartz crystal, and an iron ring or disk. Most of the burials were concentrated in the northeast portion of the enclosure, except for one burial, which was uncovered in the upper fill of the outer ditch. The final phase of activity at the site consisted of the closing and abandonment of the enclosure and the use of the area for tillage.

The faunal assemblage from Killeany consisted of almost 500 fragments of bone, of which 379 were identifiable and dated to the earlier phase of occupation and burial (Table 20). The assemblage included cattle, caprine (sheep/goat), pigs, horses, dogs, cats, hare, deer (roe and red deer), and birds. Cattle were the most common species (60.4% NISP), followed by caprine (13.2%), horses (12.4%), dogs (6.1%), pigs (5.5%), deer (2%), cats (<1%), hare (<1%), and birds (<1%). The presence of a roe deer scapula in the assemblage indicates that hunting occurred, though it would have been rare. There was relatively little evidence for modifications on the remains, but a chop mark on a cattle femur indicates that some dismemberment occurred and cut marks on a *Bos* astragalus suggests that skinning also took place on site. Pathological evidence of using cattle for traction consisted of circular wear (lytic activity) on the medial facet of the proximal articular surface of two metacarpals and notching in one molar (bit wear damage). Cattle aging shows that most of the herd were kept until they were more than 40 months old, which the analyst interprets as use primarily for meat but also for secondary products such as milk, leather, and labor. Age-at-slaughter was determined by epiphyseal fusion (N = 16).

Table 20 Taxonomic distribution for Killeany 1, Co. Laois

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	229	50	21	47	23	1	1	5	2	0	0	0	379
%NISP	60.4	13.2	5.5	12.4	6.1	<1	<1	2	<1	0	0	0	100
MNI	12	3	2	3	5	1	1	3	2	0	0	0	32
%MNI	37.5	9.4	6.3	9.4	15.6	3.1	3.1	9.4	6.3	0	0	0	100

Table 21 Diversity and evenness measures for Killeany 1, Co. Laois

Heterogeneity	*NTAXA*	*Evenness*
1.39	*9*	*0.63*

Bushfield, Co. Laois (AD 420-665)

Excavation at this site, from October 2005-February 2007 ahead of road construction, revealed an early medieval enclosure and cemetery. Unlike most of the sites in this study, this enclosure was constructed in relatively low-lying ground not near a waterway. The excavators suggest that the location may have been selected as it was along a medieval overland routeway. There was limited prehistoric activity uncovered at this site, but the activity that was identified included an Early Bronze Age (2350-2130

BC) burnt mound, an Iron Age feature (260-50 BC), and an Iron Age iron slag furnace (90 BC-AD 80).

The main phase of activity at this site consisted of an early medieval enclosure, dated to the early 5th-early 8th centuries. The D-shaped ditch measured 85.5 meters WNW-ESE by 70 meters NNE-SSW and averaged 2-3.5 meters wide and 1.1 meters deep with a 5-meter wide north-facing entrance. The cemetery, located in the northeast quadrant of the enclosure consisted of 60 individuals in 56, mostly east-west aligned, graves. Several of the burials were radiocarbon dated and all the dates clustered tightly around AD 550-650. Additional pits were excavated within the enclosure, including pits, postholes, and linear features, were assumed to have been associated with the early medieval occupation. Artifacts from this phase of occupation include: a copper alloy blade, a copper alloy tweezer fragment, iron objects, slag, iron rings, an iron buckle, iron knife blade, a lignite stylus, quern stone fragment, whetstone, a glass ring, glass bead, and a highly polished stone pin sharpener.

The faunal assemblage was divided into two parts (Phases 1 and 2 and Phase 3). The entire assemblage consisted of 469 fragments and most of the assemblage (422 fragments) could be associated with Phases 1 and 2 and were radiocarbon dated to between AD 420-665 (Table 22). The assemblage included cattle, pig, caprine (sheep), deer (roe and red deer), horse, dog, and cat. Cattle were the most frequent species represented in the assemblage (73.9 %NISP), followed by sheep (6.4%), pigs (9%), deer (7.4%) and horses (2.7%). Dogs and cats comprised less than 1% of the assemblage. Modifications to the bones showed a high frequency of gnawing (carnivore and rodent) but very little burning or cut marks. The analyst suggested that this was evidence for waste disposal. What cut marks there were showed skinning (cuts to the astragalus) and filleting (cuts to the scapula), all noted on cattle remains. The presence of some meat-bearing bones from deer in addition to antler indicates that occasionally hunting took place and venison was consumed on site. Pathological evidence from cattle indicate that some individuals were used for traction, including circular wear/a lytic lesion to the proximal medial facet of the articular surface of the metapodia, eburnation on a femoral head, and bit wear damage to two molars.

Cattle age was determined by tooth wear and mandibular wear stages (N = 35). The cattle age-at-slaughter data showed a significant peak of slaughter of individuals over 50 months old but with many individuals slaughtered periodically between ages 17-40 months. The sexing data indicated that there was a preference for keeping female adult individuals (88.8% female to 11.1% male). The analyst interpreted these data as evidence for a mixed livestock economy in which some individuals were slaughtered for their meat while others were kept much longer for their secondary products.

Table 22 Taxonomic distribution for Bushfield, Co. Laois

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	312	27	38	10	3	1	0	31	0	0	0	0	422
%NISP	73.9	6.4	9	2.4	0.7	0.2	0	7.4	0	0	0	0	100
MNI	15	4	3	1	1	1	0	2	0	0	0	0	27
%MNI	55.6	14.8	11.1	3.7	3.7	3.7	0	7.4	0	0	0	0	100

Table 23 Diversity and evenness measures for Bushfield, Co. Laois

Heterogeneity	*NTAXA*	*Evenness*
0.95	*7*	*0.49*

Johnstown 1, Co. Meath (AD 430-665)

Excavation at this site, from April-October 2002 ahead of construction of the M4 Kinnegad-Enfield-Kilcook motorway, revealed a ditched early medieval enclosure, field boundaries, and cemetery. The interior of the enclosure contained several features, including cobbled or mettled surfaces, smelting pits, hearths, refuse pits, and postholes and five kilns were identified outside of the enclosure. The site was initially identified as an oval or sub-rectangular level area on ordnance survey maps during desk survey and was known locally as a *cillín*. The site itself was situated on the flat top of a low rise in undulating agricultural fields.

The first phase of activity at the site consisted of the construction and modification of enclosure ditches around the top of the hill. The first enclosure ditch was visible at the base of a later enclosure ditch and measured approximately 59 meters in diameter (external). Where the ditch was not truncated by later activity, it measured 1.4-2 meters wide and 0.8 meters deep. Artifacts from this feature included iron fittings, an iron pin, and slag. Animal bone from this feature returned a radiocarbon date of AD 430-660. Charcoal from a smelting pit in the interior of the enclosure returned a radiocarbon date of AD 240-540.

This ditch was superseded by a later oval enclosure ditch (Phase 2), which measured 53-54m in diameter (external), 1.5-2.5 meters wide and 1-1.5 meters deep. This feature included two entrances, one in the southeast and the other in the north-northeast part of the ditch. A posthole cut into one of the terminals of the southeast-facing entrance might have served as a gatepost. Artifacts from this feature included bone pins, sherds of Souterrain Ware and Leinster Cooking Ware, iron sheeting, an iron rod, a copper alloy pseudo penannular ring-pin, a small (cobbler/jeweler's) hammer, a socketed arrowhead, and worked antler. Animal bone from this feature returned a radiocarbon date of cal. AD 440-670.

The third phase of activity at the site consisted of the construction of a third oval enclosure ditch, cutting the two earlier ditches. This feature measured 47.5-61 meters in diameter (external) and 3.4-5.3 meters wide by 0.9-1.4 meters deep. No entrances were identified for this enclosure. Some maintenance of this ditch as it naturally infilled was evident in at least one re-cutting event. Artifacts from this feature included sherds of Souterrain Ware and North Leinster Cooking Ware, a possible iron arrowhead, polished bone pins, iron rods and nails, iron knife blades, worked stone, an iron handle, a shell fragment, a flint scraper, a few sherds of late medieval green glazed pottery, and 297.65 kilograms of slag. Animal bone from the base of this feature returned a radiocarbon date of AD 990-1255. A smelting pit from the interior of the enclosure contained burnt soil, charcoal, and slag inclusions, suggesting *in situ* burning. Charcoal from this pit returned a radiocarbon date of AD 1030-1280, or within the third phase of occupation. Several other pits (including refuse pits) and postholes were identified in the interior space of the enclosure; however, none could be attributed to a particular phase.

Associated with this phase was the construction of a rectangular timber structure. The structure would have been approximately two meters below the ground surface and measured 4.1 meters long by 2.92 meters wide. The structure was interpreted as the wheelhouse of a vertical watermill. The timbers were uncovered *in situ* and despite their degradation, analysts were able to obtain a dendrochronological date of AD 1125 +/- 9.

Two separate areas of burial were identified during the excavation, one within the boundary of the enclosure ditches and the other was located within a gravel bank. The first area of burial contained 398 burials with the earliest burials underneath a small burial mound. The three burials included two females in individual burials, dated to AD 370-640 and AD 430-680 respectively, and the final burial included the disarticulated remains of up to three males dated to AD 370-640. The latest burial in this part of the cemetery dates to AD 1500-1665. The second burial ground consisted of 61 infants and two adults and was recognized locally as a *cillín*, or a burial ground for unbaptized children. Shroud pins, nails, and bits of timber indicate that some of the children were interred in coffins. A radiocarbon date obtained from one of the burials returned a date of AD 1650-1960.

The faunal assemblage from Johnstown 1 phases 1 and 2 (AD 430-665) consisted of 8,742 fragments, of which 2,977 could be identified (Table 24). The assemblage included cattle (65.5% NISP), pig (23.2%), caprine (6.9%), horse (0.9%), dog (1%), cat (1.1%), hare (0.07%), deer (0.6%), and bird (0.6%). While the bird assemblage included several wild species, the most common bird was the domestic fowl, including a hen. Among the pig remains, two large male tusks indicate the presence of wild pigs included in the assemblage. Deer remains from Phase 1 were exclusively post-cranial remains, suggesting that deer were hunted for venison at this time. During Phase 2, however, 73% of the deer remains were antler, mostly worked. This suggests that, while venison was still consumed, deer antler became much more important and shed antlers were also collected.

Butchery data was not robustly reported but there was evidence for disarticulation of cattle (cut marks to astragali and a distal humerus), roasting the shoulder on the bone (roasting at the distal scapula), and horn working. There is also evidence of bone working (cut and polished bone fragments), antler working, and bone decoration. A cut to a pig radius highlighted the value of pigs for their meat. Age-at-slaughter data of the pig remains suggests that pig slaughter took place in the autumn (August-October), after they had been fattened on mast and before the winter. Age-at-slaughter data for sheep demonstrated that they were likely exploited for their wool and meat but not for their milk. Cut marks to the caudal surface of a cat tibia from Phase 2 indicates that the exploitation of cats for their pelts occasionally occurred. Paleopathological data indicates that both male and female cattle were likely used for traction (eburnation of the acetabulum, exostoses at a proximal metatarsal, and the fusion of second and third tarsal bones called spavin). Spavin was also noted on horse tarsals/metatarsals, suggesting that horses were also used for traction.

The cattle age-at-slaughter data, based on tooth eruption and wear, showed that nearly all (N = 11) the cattle slaughtered in phases 1 and 2 were between six months and 2.5 years old (N = 12). The remaining individual was greater than 40 months. The epiphyseal fusion data, which was more abundant, demonstrated that the majority of those slaughtered were mature adults. Analysis of the distal breadth of cattle metacarpals and shape of the pelvis, both sexually dimorphic traits, indicated a higher percentage of female individuals (12:7). A high frequency of sub-adults and some very old female individuals is indicative of a specialized dairying economy.

Table 24 Taxonomic distribution for Johnstown 1, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	1951	204	691	28	30	34	2	18	19	0	0	0	2977
%NISP	65.5	6.9	23.2	0.9	1	1.1	0.07	0.6	0.6	0	0	0	99.87
MNI	39	10	26	2	3	4	1	3	4	0	0	0	92
%MNI	42.4	10.9	28.3	2.2	3.3	4.3	1.1	3.3	4.3	0	0	0	100.1

Table 25 Diversity and evenness measures for Johnstown 1, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.01	*11*	*0.42*

Boyerstown 3, Co. Meath (AD 434-671)

Excavation at this site, from June 2006-March 2007 ahead of road construction, revealed two early medieval enclosures and associated field systems. The first phase of activity at this site consisted of a Bronze Age roundhouse (slot trench and postholes) and an associated external fence or windbreak. Six sherds of domestic cordoned ware, dated to the Middle Bronze Age, were uncovered in association with this feature.

The early medieval occupation at this site began with the construction of a large sub-circular enclosure with internal features and exterior annex features. Enclosure 1 measured 23 meters by 60 meters with an entrance in the southwestern part of the enclosure. The Enclosure 1 ditch averaged 2.4 meters wide by 0.5 meters deep. Artifacts from this feature include an iron knife and another fragment of metal. The internal features within Enclosure 1 consisted of three internal divisions, a hearth, two linear features, and a small posthole or pit. A few charred cereal grains were uncovered in the internal division ditches and include oat, hulled barley, and wheat. The absence of chaff and reduced amounts of weed seeds indicated that the grain had been cleaned prior to being brought into the enclosure. There were also two curvilinear ditched features exterior to the enclosure that intersect with the enclosure ditch, indicating that they were contemporaneous annex features that were likely used for specialized gardens. One of these ditch features was dated to AD 598-767.

The second sub-rectangular enclosure, Enclosure 2, uncovered during excavation measured 22 meters by 43 meters and partially cut through Enclosure 1 and contained several internal pit features. Artifacts associated with the enclosing ditch feature include a bone pin/needle, polished worked bone, fragments of metal, and a retouched flint end scraper. Animal bone from this feature was radiocarbon dated to AD 687-937. External to this enclosure were a series of related features, including a possible hearth, seven postholes, two possible stakeholes, and a possible structure. The possible structure was defined by a penannular ditch measuring about 9.4 meters in diameter, and 0.37 meters wide by 0.53 meters deep. An oak charcoal sample from this feature returned a radiocarbon date of AD 650-806. Within this structure were the remnants of a possible figure-of-eight shaped kiln with charred barley grains associated with the feature.

There was an additional large circular enclosure (26 meters in diameter), or possible ringfort, detected in geophysical survey that was not fully excavated as much of it extended out beyond the limit of the road take. A portion of the enclosure ditch was excavated (10 meters long by 1.8 meters wide and 0.8 meters deep) and revealed a significant quantity of animal bone. Bone from the lower fill of this feature returned a radiocarbon date of AD 434-644. A series of linear features radiated from this circular ditch, which have been interpreted as contemporary field systems.

The faunal assemblage from Boyerstown 3 was divided into six phases of activity based on their stratigraphic relationships, though phases 1 and 2 were combined based on their overlapping radiocarbon dates (AD 434-644 and AD 436-649, respectively). Phase 1 consisted of the possible ringfort, Phase 2 was a series of associated field systems, Phase 3 was Enclosure 1 and its associated annex features (AD 650-806 and AD 635-774), Phase 4 was Enclosure 2 (AD 687-937), Phase 5 consisted of a series of ditches/drains/and small enclosures with no datable material, and Phase 6 consisted of long linear ditches with no datable material.

The faunal assemblage consisted of 2,012 countable fragments, of which 717 were associated with Phases 1 and 2, which were the phases considered in this study (Table 26). The species represented in this assemblage include cattle, caprine (sheep/goat), pigs, horses, dogs, and cats. None of the fragments from Phases 1 or 2 showed evidence of butchery and only two had evidence of gnawing (rodent).

Age-at-slaughter was calculated using mandibular wear stages for cattle (N = 18). Cattle aging data revealed two peaks in slaughter, at 12-24 months and at more than 36 months. Importantly, 16.7% of calves 1-13 months old were also slaughtered. Only two metacarpals could be measured for sex determination, and both were female. The analyst suggests that the herd demographics suggest that the community at Boyerstown 3 were a small, self-sufficient community producing cattle dairy products and supplementing their diet with caprine dairy and mutton and pork.

Table 26 Taxonomic distribution for Boyerstown 3, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	397.5	164.5	105	24	19	7	0	0	0	0	0	0	717
%NISP	55.4	22.9	14.6	3.3	2.6	1	0	0	0	0	0	0	100
MNI	11	6	9	2	3	1	0	0	0	0	0	0	31
%MNI	35.5	19.4	29	6.5	9.7	3.2	0	0	0	0	0	0	100

Table 27 Diversity and evenness measures for Boyerstown 3, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.20	*6*	*0.67*

Borris Site AR 33, Co. Tipperary (AD 400-772)

Excavation at this site, from September 2006-October 2007 ahead of road construction, revealed a multi-period settlement and cemetery, from the Middle Bronze Age through the 12th Century AD. This site was located on the crest of a small ridge above the Black River, in slightly undulating land.

Prehistoric activity at this site began with burnt pits dated to the Middle Bronze Age, through the construction of a D-shaped enclosure in the Late Bronze Age, and iron smithing activity in the Iron Age. The Middle Bronze Age activity on the site consisted of six sub-rectangular pits with heat-shattered stony fills, several had associated postholes or stakeholes, dated to 1754-1636 BC. The Late Bronze Age occupation consisted of the construction of a large sub-oval enclosure, measuring 106 meters by 78 meters, with an entrance at the southeast. Several features were associated with this enclosure, including entrance postholes, a central pit and posthole cluster (not representing a structure), hearth pits, and an undated bovine burial pit. Some disarticulated human remains, including an adult cranial fragment, and several chert blades were uncovered in the ditch near to the entrance. Charcoal throughout the ditch fill and evidence of *in situ* burning suggests that upright posts in the ditch were burned, either successively or in one event. Animal bone from this basal fill of the enclosure ditch returned a radiocarbon date of 800-510 cal. BC and charcoal from one of the internal pits returned a radiocarbon date of 764-417 cal. BC. The final phase of prehistoric activity at the site consisted of metallurgical waste and charcoal dated to 203-56 cal. BC in the uppermost fills of the Late Bronze Age enclosure.

Early medieval occupation at the site consisted of the construction of a plectrum-shaped enclosure, a circular enclosure, and a rectangular expansion of the circular enclosure. The plectrum-shaped enclosure ('Enclosure B') measured 48 meters long by 38 meters wide with an entrance to the southeast and the ditch measured about 1.4 meters wide and 0.75 meters deep. Animal bone from the basal fill of the enclosure ditch returned a radiocarbon date of AD 400-560 and bone from an upper fill returned a date of AD 646-772. The enclosure ditch had evidence of defensive features, including an entrance structure and partial internal palisade. Other internal features associated with this phase of occupation include: a circular structure; 45 pits, postholes, and stakeholes; and a linear gully. Artifacts from this phase of activity include unidentified iron objects, iron slag, a pin sharpener stone, a fragment of sheet copper, a pyramidal-shaped crucible, a cow horn with an incised groove, and a piece of worked red deer antler.

The next phase of early medieval settlement consisted of the construction of a circular enclosure ('Enclosure A'), interpreted as a ringfort, and internal features including up to four house structures, a smithing hearth, and additional pits and postholes.

The enclosure measured 27.7 meters in diameter with an entrance at the northeast, and the enclosure ditch measured about 1.25 meters wide and 0.75 meters deep. Bone from the basal fill of the enclosure ditch returned a radiocarbon date of AD 677-774, providing a construction date. Artifacts from the ditch fill included residual prehistoric lithic artifacts (including a polished stone ax placed on the base of the ditch), a hone stone, carved antler pin, a bone pin, and an imported Anglo-Saxon annular glass bead (of a type dating to the 5th-8th centuries). Internal postholes and slot trenches represent the remains of four circular house structures, averaging about 6m in diameter. These structures were dated to AD 648-765 by charcoal within the slot trench fills. External features associated with Enclosure A include: a cereal-drying kiln with charred barley, oat, and wheat; additional burnt pits and kilns dated to AD 673-856; and a smithing hearth and oxidized pit with metallurgical waste, dated to AD 680-774.

The next phase of early medieval occupation included the construction of the ringfort annex enclosure ditch. The annex comprised a sub-rectangular ditch extending beyond the ringfort ditch and measured 1.36 meters wide and 0.84 meters deep. Bone from a middle fill of this ditch returned a radiocarbon date of AD 686-870, making the construction and use of the annex features soon after the construction of the ringfort enclosure ditch and contemporaneous with the internal roundhouse structures. Artifacts from this feature include an iron key, iron nails, metallurgical waste, a copper alloy pin, a rotary quern fragment, an antler key, a bone needle, a bone comb fragment, a decorated copper alloy cylinder, a whetstone, and an 11th-12th century Viking silver coin. The annex features are interpreted as a possible field system associated with the ringfort occupation.

The final phase of early medieval occupation comprised an inhumation cemetery exterior to the ringfort but contained within the ringfort annex (and contained with the earlier Enclosure B ditch). Of the 18 burials, 17 were east-west oriented and one was northwest-southeast oriented; all of the burials were supine; 14 were extended, two were flexed, and two were crouched; ten were adults, one was an adolescent, and seven were juveniles and infants; and few included grave good such as a rounded quartz pebble, an animal tooth, and the grave of one female included a large piece of slag and a copper ring pin.

The faunal assemblage from Borris Site AR 33 comprised 59,352 fragments, 11.1% of which could be identified. The faunal material was analyzed by phase; for this study, only the fragments from Phase 2, the plectrum-shaped enclosure, dated to the 5th-6th Century AD, were included (Table 28). The species represented in the assemblage include cattle, caprine (sheep/goat), pig, horse, red deer, dog, cat, rodent, and bird. Domestic fowl were included in the bird sample, primarily leg and wing bones, and included a tarsometatarsus from a male, indicating that poultry were bred on site. Cattle represented the most common species across all periods, but none more so than in Phase 2. Butchery evidence was noted on fragments from all species, as well as evidence of marrow access and bone working. Few bones were burnt. There was an increased incidence of horncore (and horncores with cut marks) from Phase 2 and the excavators remarked that there were parts of the enclosure ditch that had much more cattle skull fragments than others. Pathological data from all phases demonstrated age-related illnesses such as ante-mortem tooth loss and degenerative joint disease (which may also be related to using cattle for traction). Evidence of post-cranial deer remains, and including a skull fragment from a doe, indicates that hunts supplemented the diet at this site, in addition to the use of shed antlers in craftwork.

Age-at-slaughter was determined via mandibular wear stages (*N* for Phase II = 31). Cattle aging data shows a very high percentage of cattle slaughtered between 15-30 months of age during Phase 2 (58%), which the analyst interprets as indication of a dairying economy. The later Phase 3 has a marked shift, not just in a decrease in the percentage of cattle in the assemblage, but also in the age-at-slaughter with many older adults being kept. The analyst compares these data to medieval urban sites such as Clonmacnoise and Fishamble St. in Dublin, suggesting that during this period, Borris Site AR 33 was being provisioned with cattle in a semi-urban manner.

Table 28 Taxonomic distribution for Borris Site AR 33, Co. Tipperary

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	1039	158	263	22	142	16	0	78	17	0	7	0	1742
%NISP	60	9	15	1	8	1	0	4.5	1	0	0.5	0	100
MNI	27	6	11	1	3	2	0	1	0	0	1	0	52
%MNI	51.9	11.5	21.2	1.9	5.8	3.8	0	1.9	0	0	1.9	0	100

Table 29 Diversity and evenness measures for Borris Site AR 33, Co. Tipperary

Heterogeneity	*NTAXA*	*Evenness*
1.30	*10*	*0.56*

Coldwinters, Co. Dublin (No C14)

Excavation at this site, from September 2001-February 2002 ahead of the Airport-Balbriggan Northern Motorway scheme, revealed a settlement cemetery of likely early medieval date. This site was located on the summit of a low hill in a landscape of low undulating hills. The site produced no easily datable material (except for two Mesolithic flint flakes which are considered residual), specifically no pottery, but the morphology of the site and the presence of multiple east-west aligned supine inhumations suggest that this is a settlement cemetery, dating approximately to the 6th/7th century AD.

The earliest activity on the site consisted of residual evidence of Mesolithic and Bronze Age settlement. A Bann flake (leaf-shaped projectile point) and a second large triangular flint projectile point were found within the circular ditches and may have been disturbed during the construction of the circular enclosure. A significant quantity of flint waste flakes and tools (such as scrapers) were also found throughout the site and might indicate Bronze Age activity that was disturbed by later settlement. Two burnt mounds, or *fulachta fiadh*, were excavated as part of the same construction project, approximately 200-400 meters from the site and this material may relate to that phase of occupation in the area. Burnt mounds, commonly referred to as *fulachta fiadh* ("cooking place of the hunting band"), are sites that consist of a trench, hearth, and cairn of fire cracked rock. Most burnt mound sites that have been excavated have been radiocarbon dated to the Bronze Age and may represent multi-purpose sites for activities that require boiling water, such as cooking, fulling wool, brewing beer, or producing steam for sweat houses.

The major phase of occupation at the site consisted of an early medieval period settlement cemetery. During this phase of activity, a large circular enclosure was constructed, 39 meters in diameter and with an enclosing ditch 2.5 meters wide and 1-1.5 meters deep (F2). Within the interior of the enclosing ditch there were a series of smaller concentric ditches, which respected the exterior ditch and therefore must have been contemporaneous with the construction of the exterior ditch. A large amount of unburnt animal bone was recovered from the exterior ditch. Artifacts associated with this phase of occupation included: a quern stone fragment, a rounded stone made from coral, iron slag, a possible stone mold, an iron nail or pin, unidentified iron objects, two spindle whorl fragments, a small mudstone or lignite ring, a half of a small yellow stone bead. There were no features within the enclosed area that indicated domestic structures, but there was a sub-rectangular structure to the west of the enclosure that may represent domestic settlement. An associated pit contained within the sub-rectangular structure had a high concentration of grain and was interpreted as a grain storage or drying pit.

There were six grave cuts within the large enclosure ditch. The cemetery population includes both males and females and adults and juveniles, suggesting that this represents a community cemetery. All the graves were aligned east-west and contained no grave goods. The final phase of activity consisted of the construction of a semi-circular ring ditch, 13 meters in diameter, to the west of the main circular enclosure with a single stone-lined grave of an adult male (36-45 years old). The enclosing ditch cut the upper layers of a ditch associated with the earlier enclosure, placing it stratigraphically later.

The faunal assemblage from Coldwinters, comprised 28,172 fragments, of which 4,207 (15%) were identified to species. Much of the assemblage derived from the large enclosure ditch (F2) (Table 30). The species represented in the assemblage included cattle (56%), caprine (sheep/goat, 23%), pigs (9%), birds (4%), horses (3%), dogs (2%), cats (2%), and hare, deer, and fish (all <1%). The fish remains consisted of a cod bone with cut marks, this is not reported in the final excavation report but was identified during this study. Also not included in the faunal assemblage but oyster shells were noted throughout the site report, including a small midden layer in the F2 ditch, suggesting robust exploitation of marine resources, at least 12 km to the east.

Chop and cut marks were identified on cattle, sheep, horse, and pig remains, indicating skinning, dismemberment, fileting, and bone marrow extraction. Filleting marks on the long bones and scapulae indicate food preparation on site. Cut marks on cattle crania and horn cores also suggests the removal of the horns for craft production. Most deer remains consisted of antler fragments, indicating craft production, and the non-antler remains indicate that some hunting occurred to supplement the diet. A cat axis also had cut marks, consistent with skinning. The bird assemblage included domestic fowl/chicken remains and a chicken femur and tibiotarsus had cut marks. Many of the bones in the assemblage had evidence of animal gnawing, mostly carnivore (dog) but also some rodent gnawing.

Pathologies were noted on many bones. Among cattle remains, healed fractures to ribs were noted on two fragments, there was one tibia with osteomyelitis, five phalanges had evidence of eburnation and osteoarthritis was noted on three acetabula. Spavin, a condition of draught cattle in which tarsals and metatarsals fuse, was noted in one specimen and expansion of the medial, distal condyle and eburnation was noted on another specimen. These data suggest that cattle were used in plowing. Among sheep remains, an articulated scapula, humerus, and ulna had evidence of osteophytic lipping, another humerus had periostitis, and a metatarsal had osteomyelitis. These data indicate that older individuals were kept in the herd. A pig radius and ulna had fused after trauma and a pig mandible exhibited periodontal disease, possibly because of trauma. A horse calcaneus had evidence of periostitis. And a cat femur had a displaced femoral head, resulting in the foreshortening of the limb.

Age-at-slaughter was determined for cattle by mandibular wear stages (N = 30). Cattle aging data indicate that most cattle were slaughtered between 8-18 months (43.3%). 26.9% of cattle were slaughtered between 1-8 months, 10% between 18-30 months, and 3.3% of cattle were kept beyond 30 months. The analyst suggests that the high proportion of cattle slaughtered between 8-18 months and the absence of very old individuals indicates that the cattle at Coldwinters were kept for meat production. In addition to the aging data, the analyst suggests that the presence of articulating bones in the F2 assemblage, including radii and ulnae and metatarsals and phalanges was a result of the specific butchery practices at this site.

Table 30 Taxonomic distribution for Coldwinters, Co. Dublin

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	2364	982	398	116	96	72	12	19	147	1	0	0	4207
%NISP	56	23	9	3	2	2	0.2	0.5	4	<0.1	0	0	100
MNI	31	46	20	3	3	3	2	2	12	1	0	0	123
%MNI	25	37	16	2	2	2	1.5	1.5	10	0.8	0	0	100

Table 31 Diversity and evenness measures for Coldwinters, Co. Dublin

Heterogeneity	*NTAXA*	*Evenness*
1.30	*17*	*0.46*

Coonagh West Site 4, Co. Limerick (AD 570-680)

Excavation at this site, from April and September 2005 ahead of the Limerick Southern Ring Road scheme, revealed a Bronze Age burnt mound, settlement, and trackway, an Iron Age furnace, and an early medieval enclosure. This site was located on a small glacial drumlin surrounded by pastureland and above the edge of the former flood plain of the River Shannon. The earliest phase of activity consisted of residual evidence of Mesolithic/Neolithic occupation. Artifacts from this period of occupation include an early Neolithic chert leaf-shaped projectile point, five cores, seven blades, two projectile points, four scrapers, a plano-convex knife, a lozenge-shaped projectile point, and a large ground stone ax.

The next phase of activity at the site consisted of Bronze Age burnt mounds, a structure, a timber post line, and a stone and brushwood trackway. The most complex burnt mound, or *fulachta fia*, had a crescent-shaped dump of fire cracked stone and a timber lined trough. A stake from the trough returned a radiocarbon date of 2286-2043 cal BC. The partial remains of the structure consist of a sub-circular gully (0.25-0.35 meters wide, 0.15 meters deep) and two postholes forming a possible doorway. Charcoal from one of the postholes returned a radiocarbon date of 1745-1612 cal BC. Artifacts from the structure include a tanged projectile point, domestic pottery, vitrified hearth lining, a worked stone object, and a small stone ax. A line of 20 timber stakes and posts was discovered leading from the dry ground to the edge of a silted-up stream (it is assumed that, at the time of construction, the stream was navigable).

Dendrochronological dates from the preserved timbers returned a date of 1507/1506 BC. The stone and brushwood trackway lay northwest and approximately parallel to the timber post line. The trackway consisted of worked brushwood, 6.5 meters long and 2.5 meters wide, covered by a layer of stone cobbles, which extended beyond the brushwood base (8.4 meters long and 3.1 meters wide). Dendrochronological dates from the brushwood indicate that the wood was felled after 1577 BC. Finally, sub-circular a hearth, 1.3 meters in diameter, contained domestic pottery, and a concentration of barley grains dated to 1518-1427 cal. BC.

Later Iron Age activity at the site consisted of the construction of a linear ditch, a pit, and a metalworking furnace. The ditch measured 38.8 meters long, 0.9-2.2 meters wide and 0.08-0.5 meters deep, and a deep oval pit-like portion at the southwestern end. Waterlogged seeds from the deposits in this feature returned a radiocarbon date of 792-418 cal. BC. The pit from this period was circular in plan, 1.02 meters in diameter and 0.65 meters deep. Animal bone was deposited at the base of this pit, particularly cattle mandibulae. The mandibulae were laid flat, suggesting that this was an intentionally structured deposition. Charcoal from the pit returned a radiocarbon date of 388-208 cal. BC. Finally, a small metalworking furnace, 0.37 meters in diameter and 0.21 meters deep, was excavated. This feature contained 1.9 kg of iron slag and fragments of the furnace walls. Charcoal from this feature returned a radiocarbon date of 39 cal. BC – cal. AD 75.

The major phase of activity at this site consisted of an early medieval enclosure complex. Initial construction during this phase consisted of three concentric gullies on the western side of the summit of the drumlin. The inner and middle gully were about 1 meter wide and 0.5 meters deep and the outer gully was 0.67 meters wide and 0.37 meters deep. Charcoal from these features returned radiocarbon dates of AD 580-659 and

AD 605-670 and a penannular ring brooch and pin were found in the inner gully. A small rectangular structure (4 meters by 1.8 meters) and pits were associated with the initial phase of construction and charcoal from one of the pits returned a radiocarbon date of AD 420-576.

Later, a large circular enclosure ditch was constructed around the summit of the drumlin. The enclosure ditch was 37 meters in diameter and 2.6-3.6 meters wide and 0.77-1.26 meters deep with a shallow 2.4 meter wide north-facing entrance. Deposits in the enclosure ditch included a large amount of animal bone (which returned three radiocarbon dates between AD 577-685), working bone, a bone spindle whorl, a whistle, a bone handle, iron slag, several smithing hearth bottoms, a wooden stake, whetstones, a stone disc, a stone spindle whorl, a copper alloy penannular brooch, pin shaft, ringed pin, and a copper alloy disc. Several large postholes and stakeholes were excavated on the interior of the enclosure ditch at the entrance, suggesting the presence of a gate feature. Charcoal from two ditches along the southern side of the enclosure returned radiocarbon dates between AD 695-887, suggesting occupation during this later period.

The faunal assemblage from Coonagh West Site 4, comprised 19,206 fragments, of which 2,921 (15%) were identified to species (Table 32). Most of the assemblage derived from the large enclosure ditch (92%). The species represented in the assemblage included cattle (71%), pigs (12%), caprine (sheep/goat, 5%), deer (5%), fish (3%), horses (2%), dogs (2%), birds (0.2%), cats (0.07%), hare (0.07%), and badger (0.07%). The fish remains consisted of unidentified fish and eel remains and the bird assemblage consisted of both domestic fowl and goose (possibly also domestic). While there were some post-cranial deer remains in the assemblage, the majority consisted of cut antler fragments.

The analyst noted that there was very little identifiable burned animal bone, suggesting that roasting on the bone was an uncommon practice at this site. While cut marks were noted on cattle, sheep, pig, dog, horse, deer, and rabbit, there was a low incidence of butchery marks in the assemblage, including heavy chopping disarticulation marks. The analyst also noted that there were fewer vertebrae and distal limb elements in the assemblage than would have been, suggesting that while whole carcass butchery took place on site, some elements may have been brought in having been butchered elsewhere.

Cattle aging data were derived from epiphyseal fusion and indicated that there was preponderance of mature adults in the assemblage. The peak age-at-slaughter for animals in the assemblage was between 36-42 months. The analyst suggests that this indicates slaughter at prime meat age and therefore meat production. These conclusions were supported by age-at-slaughter data derived from tooth wear stages (N = 80). According to McCormick and Murray (2007) this is beyond prime meat age and more like mortality profiles from medieval Dublin, this might therefore suggest that the site was being provisioned by nearby communities.

Table 32 Taxonomic distribution for Coonagh West Site 4, Co. Limerick

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	1928	149	344	53	56	2	2	130	5	79	0	2	2684
%NISP	71	5	12	2	2	0.07	0.07	5	0.2	3	0	0.07	100.41

Table 33 Diversity and evenness measures for Coonagh West Site 4, Co. Limerick

Heterogeneity	*NTAXA*	*Evenness*
1.00	*11*	*0.42*

Owenbristy, Co. Galway (AD 580-682)

Excavation at this site, from December 2007-March 2008, ahead of construction on the N18 Oranmore to Gort road scheme, revealed an early medieval cashel and cemetery. This site was in a low-lying area, on a promontory in a turlough (a "disappearing lake" in the dry karstic landscape of the west of Ireland), surrounded by low undulating hills. The turlough was prone to flooding throughout the course of the excavation. A cashel is an early medieval settlement surrounded by a circular stone enclosure. Pre-cashel or pre-enclosure activity included a large oval pit with evidence of *in situ* burning and ash. This pit was in the line of the original cashel wall and was cut by another pit with charcoal radiocarbon dated to cal. AD 883-985, suggesting that the large oval pit predated the cashel and may have been a result of land clearance in advance of the cashel construction. Other evidence of pre-enclosure activity consisted of residual Beaker Period (Early Bronze Age) material that may have been the result of the disturbance of a Bronze Age burial. Artifacts associated with this activity included a chert flake, a flint knife, a roughout for a projectile point, two faience beads, and a possible sandstone wrist guard fragment.

The main period of activity at the site consisted of the cashel construction and burial. The cashel enclosure originally measured 44 meters in diameter and the enclosure wall was made from drystone construction and the surviving sections measured 2 meters in maximum height and had a basal width of 1.6 meters. Several pits and postholes within the enclosure that were later cut but early medieval burials may indicate pre-burial settlement activity or, as the excavator suggests, may have been early attempts at gravedigging. To the south of the burial activity, a series of 11 postholes (including four with packing material) suggest the presence of a roughly rectangular wooden structure. Nine of the early medieval burials were contained within the possible structure area. One quern stone fragment was found within one of these postholes and charcoal from one of the postholes returned a radiocarbon date of cal. AD 580-687. Several pits, postholes, and a possible hearth feature were found towards the center of the enclosure. Animal bone fragments, charcoal flecks, slag, and evidence of *in situ* burning in these features suggest that, while these features do not form a cohesive structure, they likely represent domestic activity. Artifacts from the interior of the enclosure included metal fragments, a possible socketed arrowhead, and a blue glass bead.

Burial at Owenbristy was relegated to the eastern and southern sections of the enclosure and consisted of two phases of burial: the first phase consisted of a community cemetery from cal. AD 548-972 and a *cillín* (burial ground for children/infants) from cal. AD 1219-1445. The early phase of burial included 75 individuals within 26 slab-lined graves and 25 simple cut grave pits. Artifacts from the burials include both grave goods and possible later intrusions, including two bone pins, an iron nail, five pottery sherds, a complete shell (suggested to have been worn around the neck), a retouched flint, and a fragment of a rotary quern. One late-middle aged adult male, dated to cal. AD 548-651, was interred in a tightly flexed position, wearing an iron neck ring. The later phase of burial included 17 burials in 16 graves, the majority of which were for children (one fetal burial, five neonates, six infants, and three older children) but also included two adults. The disarticulated remains of one adult male were deposited in the core of the enclosing wall, likely representing a later disturbance that was redeposited. After the period of burial, the site was used as an agricultural field for ridge-and-furrow cultivation.

The faunal assemblage from Owenbristy, comprised 2,588 fragments, of which 776 could both be identified to species and attributed to settlement features (Table 34). The species represented in the assemblage included cattle (76%), caprine (sheep/goat, 14%), pigs (8%), horses (1%), dogs (0.5%), and deer (0.5%). There was limited butchery data from these features but the butchery evident included a chop to a sheep proximal humerus, suggesting dismemberment took place on site. There was also limited cattle aging data, however some unfused epiphyses indicate that some cattle were slaughtered around 2.5-3.5 years old. These data suggest that the community at Owenbristy practiced a small, self-sustaining agricultural economy.

Table 34 Taxonomic distribution for Owenbristy, Co. Galway

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	595	105	60	9	3	0	0	4	0	0	0	0	776
%NISP	76	14	8	1	0.5	0	0	0.5	0	0	0	0	100

Table 35 Diversity and evenness measures for Owenbristy, Co. Galway

Heterogeneity	*NTAXA*	*Evenness*
0.77	*6*	*0.43*

Castlefarm 1, Co. Meath (AD 434-870)

Excavation at this site, from November 2005-September 2006, ahead construction on the M3 Clonee-North of Kells Motorway Scheme, revealed a multi-period complex with Neolithic occupation, a Bronze Age well, an Iron Age ring ditch, and an early medieval ditched enclosure. This site was located on a low ridge in an undulating pastureland, just south of the River Tolka. The earliest evidence of human occupation at the site consisted of later Neolithic lithic artifacts found within later features, including two plano-convex knives and a petit tranchet derivative projectile point. It is likely that there was a Neolithic occupation at the site that was disturbed by later activity.

The earliest features on the site consisted of a well and linear ditch feature. The sub-circular pit, interpreted as a well by soil and insect analysis, measured 3 meters wide by 3 meters long by 2.28 meters deep. The well contained a small amount of animal bone, charcoal, burnt stone, and a 0.86 meter long alder trunk. Material from within the well returned a radiocarbon date of 2131-1886 BC, in the Early Bronze Age. In the northeast part of the site, there were three linear ditch features, all approximately 0.4 meters wide and 0.1 meters deep. One of the ditches contained a bronze disc-headed pin, dated stylistically to the Late Bronze Age (1000-800 BC).

The next phase of occupation at the site consisted of the construction of a ring ditch in the Iron Age. This curvilinear feature extended beyond the limit of the road take and the excavated portion measured 8.5-meter-long by 1.6-2 meters wide, and 0.6-0.8 meters deep. The ditch contained five stratigraphic layers, of which four contained fragments of burnt and cremated bone. None of the bone fragments could be positively identified as human and the only fragments that could be identified included dog, indeterminate animal, and indeterminate tooth enamel. The ditch also contained two corroded iron objects, which could have been fragments of metallurgical waste. Charcoal from one of the middle layers returned a radiocarbon date of 781-417 BC and charcoal from the final layer returned a date of 161 BC-AD 68.

The main phase of occupation at the site consisted of the construction of a double-ditched enclosure and annex complex that dated to the early medieval period. The initial enclosure of the complex was D-shaped, measuring 60 meters north-south by 90 meters east-west, with a 3.2-meter-wide entrance in the southeast part of the enclosure ditch. The ditch measured 2.1-2.7 meters wide and 0.95-1.25 meters deep. A wide variety of artifacts were found within this ditch including iron knife blades, two bone knife handles (one decorated with a ring and dot design), worked bone pins and needles, decorated bone fragments, a gaming piece, a lignite bracelet fragment, bone comb fragments, a glass bead, a spindle whorl, a quern stone fragment, iron pins, sewing needles, nails, slag, a copper alloy ring, a copper alloy spiral-ringed loop-headed pin, and fragments of a smithing hearth. Animal bone from one of the filling layers of the ditch returned a radiocarbon date of AD 434-640. The morphology of the stratigraphic layers suggests that the ditch was allowed to fill naturally and three re-cuts to the ditch indicate regular maintenance of the enclosure ditch. The first re-cut was dated to AD 653-750, the second re-cut dated to AD 678-774, and the third re-cut was undated.

The ditch also contained two human burials, a young adult male dated to AD 428-607 and a young adult female dated to AD 668-870. Seven additional burials were associated with this phase of activity. These burials were grouped together just external to the enclosure ditch and included both men and women, adults, and children. All the burials were supine, east-west oriented, and several appear to have been shrouded. One burial returned a radiocarbon date of AD 410-576.

The next phase of early medieval occupation was defined by the construction of a larger outer enclosure ditch and ditched annex features. The expanded enclosure (concentric with the earlier enclosure) measured 110 meters east-west by 90 meters north-south and the ditch measured 2-2.75 meters wide by 0.75-0.95 meters deep. An annex feature was also constructed at this time, enclosed by a ditch measuring 0.5-1.75 meters wide by 0.47-0.85 meters deep. This feature was likely related to the associated field systems at the site, defined by linear ditches. The interior of the outer enclosure ditch contained several large stones, which may have been placed in the ditch to facilitate drainage. Artifacts from this ditch consisted of iron and copper alloy objects including iron knife blades, an iron omega pin, and a copper alloy spiral-headed baluster-headed pin and bone and stone objects including bone pins and a spindle whorl, as well as other objects such as glass beads, a large amount of animal bone, and slag. The base of the ditch was waterlogged, which also helped to preserve organic material including some leather pieces, wooden bucket staves, wooden handles, and a wooden barrel binding loop. Animal bone from the base of the ditch returned a radiocarbon date of AD 720-875. The outer enclosure ditch was re-cut four times (dated to AD 779-930, AD 816-960, AD 881-1013, and AD 1030-1400 respectively), before it was deliberately backfilled and two child burials were inserted into the backfilled ditch, suggesting that the site was used as a *cillín* after the site was abandoned.

A series of external features appear to have been contemporary with both the inner and outer enclosure (7th-10th centuries AD). These include eight wells, two cereal drying kilns, three smithing hearths, a charcoal production pit, and agricultural drainage channels.

The faunal assemblage from Castlefarm 1, comprised 5,927 countable fragments, of which 2,319 derived from the inner/initial enclosure ditch used for this study (Table

36). The species represented in the assemblage included cattle (51.4%), caprine (sheep/goat, 8.5%), pigs (29.8%), horses (1.6%), dogs (5.7%), cats (1.3%), hare (0.04%), deer (0.6%), birds (1.1%), and one fragment from a fox (0.04%). One of the dogs from this phase of occupation measured approximately 62.7 cm at the shoulders, which would have represented a very large dog, similar in size to some of the largest dogs in the medieval settlement at Knowth. All the red deer represented in the assemblage NISP derives from postcranial elements, as there was a significant amount of antler off cuts from craft production (87 fragments from this phase of occupation), the analyst felt that to include the antler fragments would have biased the final NISP count. Therefore, this indicates that hunted was practiced at least some of the time at Castlefarm 1. There was limited evidence for butchery at Castlefarm 1, with only four incidences noted -- three occurred on cattle elements, including two chops and a cut and one sheep tibia had a hole through the distal shaft, a modification consistent with hanging the element during butchery. Burning evidence was also limited to one calcined sheep acetabulum and one calcined pig astragalus. Pathological evidence included degenerative joint disease and osteoarthritis noted on two cattle first phalanges and a cattle acetabulum and a dental abscess on a pig mandible.

Cattle aging data was collected from mandibular wear stages and epiphyseal fusion. The mandibular wear stage data indicated that there was an even distribution of slaughter across all age stages, with slight peaks at ~12 months, 35 months, and more than 50 months (N = 76). The epiphyseal fusion data suggested that no individual was slaughtered before the age of 7-10 months, but that several were slaughtered around 12-

18 months. With peaks of slaughter around older juveniles and older adults, the analyst suggests that cattle were used for dairy production.

Table 36 Taxonomic distribution for Castlefarm 1, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	1191	196	692	36	132	31	1	13	26	0	0	1	2319
%NISP	51.4	8.5	29.8	1.6	5.7	1.3	0.04	0.6	1.1	0	0	0.04	100.08
MNI	44	16	50	4	6	3	1	2	8	0	0	1	135
%MNI	32.6	11.9	37	3	4.4	2.2	0.7	1.5	5.9	0	0	0.7	99.9

Table 37 Diversity and evenness measures for Castlefarm 1, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.28	*14*	*0.49*

Ballintotty Site 2, Co. Tipperary (AD 620-690)

Excavation at this site, from February-May 2007, ahead of construction on the N7 Nenagh to Limerick High Quality Dual Carriageway, revealed two sub-rectangular ditched enclosures of early medieval date. This site was located on the summit of a low rise in an undulating landscape. The low-lying areas around the site were poorly drained and frequently damp. The earliest occupation activity consisted of two postholes and three pits, which produced a Neolithic polished stone ax and charred grains radiocarbon dated to the Bronze Age.

The first phase of early medieval activity on the site consisted of the construction of a large sub-rectangular ditched enclosure (35x32 meter, “Enclosure A”) and associated interior features, including a cereal drying kiln and a large sunken structure or storage pit.

The enclosure ditch averaged 2.08 meters wide, 1.07 meters deep, and had a 4.5-meter-wide entrance to the north. Several pits and linear features associated with the entrance may represent a gateway structure, but their stratigraphic relationships were difficult to discern. Charcoal and animal bone was encountered throughout the excavation of the enclosure ditch and as well as several knife blades and a complete ram's skull with curved horns was deposited at the base of the ditch. The interior of Enclosure A contained a contemporary cereal drying kiln (dated to AD 620-690), a possible sunken structure or storage pit, other pits and linear features including two groups of three slot trenches which may have represented additional structures. The Enclosure A ditch appears to have been deliberately backfilled at the end of the 7th century, just prior to the construction of Enclosure B.

The second phase of early medieval activity consisted of the construction of a larger sub-rectangular ditched enclosure (58x59 meters, "Enclosure B") with an entrance to the east and an annex to the north, three stone-lined cereal drying kilns (dated to AD 1160-1280 and AD 1030-1220), a possible penannular oval structure, and several other associated features. The entrance was defined by two rounded terminals and lacked evidence of internal features, suggesting that there was not a gateway feature associated with this phase of occupation. The enclosure ditch averaged 2.52 meters wide and 1.1 meters deep. Artifacts from the enclosure ditch include an iron nail, an iron arrowhead, a knife blade, and a barrel padlock. The annex ditch to the north enclosed an area of 60x20 meters and measured 1.8 meters wide by 1.01 meters deep. A fragment of a quern stone was recovered from the annex ditch. The possible penannular structure survived as a series of postholes and stakeholes, measuring 11.13x7.28 meters, as well as pits. Exterior to the enclosure ditch was a pit which contained a large amount of iron slag, indicating that smelting and smithing took place on site. An additional enclosure, "Enclosure C", returned radiocarbon dates of 1160-1270 AD, making it contemporary with this phase of activity, but much of this feature lay outside the limit of excavation.

The final phase of activity on the site consisted of the burial of three individuals in two graves. A double grave with a child and an adult female truncated the upper layers of the northern annex structure (dated to AD 1440-1630) and a separate burial of a young adult female was found just external to the entrance to Enclosure A (dated to AD 1450-1650). Several animal "burials" were associated with this phase of activity, or the post-Enclosure B phase. One of the burials in the upper stratigraphic layers of the Enclosure B ditch included remains from cow, sheep, lambs, and a dog and another pit included a partial horse skeleton. The animal remains from the enclosure ditch were found between layers of stone, probably to keep other animals from disturbing them, and were interpreted by the excavator as a measure to stop the spread of disease.

The faunal assemblage from Ballintotty Site 2, comprised 2,479 fragments, of which 1,140 could be identified to species (46%). 864 fragments were associated with the Enclosure A ditch and associated features and 467 (53%) could be identified to species, which was used for this study (Table 38). The species represented in the assemblage included cattle (27%), caprine (sheep/goat, 25%), pigs (6%), horses (18%), and dogs (24%). The high percentage of dog remains derived from one context and likely just one individual. Butchery marks on cattle demonstrate dismemberment and fileting on site (heavy chops to the upper limb bones, ribs, vertebrae, and pelvis and fine cut marks on the mandible for removal of the tongue) as well as marrow extraction and hide preparation (fine cut marks to the astragalus and phalanges). Elements from all parts of the sheep were represented in the assemblage, with most slaughtered between 2-3 years of age, and butchery present on the meat bearing elements. Pig was not common on site and evidence for butchery was confined to one cranial fragment, likely to access the brain. Horseflesh appears to have been consumed on site as well, with heavy chop marks at the proximal articulation of the radius and iliac region and evidence of marrow access.

Cattle aging data was determined by epiphyseal fusion. Although the data was limited in this assemblage, they indicate that 68% of cattle reached 3-4.5 years of age. The analyst suggests that this represents a herd maintained for milk and draught purposes as these individuals are beyond what might be expected for "prime meat" age.

Table 38 Taxonomic distribution for Ballintotty Site 2, Co. Tipperary

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	124	114	30	82	112	0	0	0	5	0	0	0	467
%NISP	26.5	24.4	6.4	17.5	24	0	0	0	1	0	0	0	100

Table 39 Diversity and evenness measures for Ballintotty Site 2, Co. Tipperary

Heterogeneity	*NTAXA*	*Evenness*
1.57	*7*	*0.81*

Roestown 2, Co. Meath (AD 530-780)

Excavation at this site, from September 2005-March 2007, as part of the M3 Clonee-North of Kells Motorway, revealed extensive evidence for high-status settlement from the mid-sixth through 11th centuries AD. In addition to settlement, there was evidence for agricultural activity and craftwork, including carpentry, textile production, bone working, and ironworking. There was evidence of very fine metalworking daring to the seventh century AD. While there was residual evidence of prehistoric activity on the site in the form of Mesolithic through Neolithic stone tools, none of these objects were found in well-dated, stratified contexts. It is likely that there had been an early Neolithic settlement that was entirely disturbed by the early medieval occupation.

The main phase of activity during the early medieval period consisted of the construction of a large sub-rectangular enclosure ('Enclosure 1'), measuring 76 meters by 53 meters, and two series of recuts. The ditch was approximately 2.5 meters wide and 1.3 meters deep. Paleoenvironmental evidence from the ditch demonstrated that the ditch was waterlogged during all phases of occupation, leading to the preservation of organic materials such as wooden staves. A cattle bone from the basal layer of the ditch returned a radiocarbon date of AD 530-650, indicating a mid-sixth century date for the initial construction of the ditch. In its first iteration, the enclosure was a complete circuit without an entrance, but during the later reconstruction events, a 2-meter-wide causewayed entrance was constructed in the northeast part of the ditch with a single large posthole suggesting the presence of a gate feature. During later phases (2 and 3) of occupation within Enclosure 1, several ditches were dug to partition the interior space. Several of these later partitions truncated circular structures (approximately 4 meters in diameter) and rectangular structures (7m x 4m), interpreted as domestic structures and workshops. Some of the partitions may have been related to cereal processing during later occupations, as several cereal drying kilns, both 'figure-of-eight' and keyhole-shaped, were uncovered in the southern part of the enclosure.

Artifacts from the enclosure ditch included utilitarian objects as well as many personal objects. Utilitarian objects included iron nails, 33 iron blades (of which 3 were socketed), horseshoes, E-ware pottery fragments (imported Gaulish pottery), hone stones and whetstones, a stone lamp, a bone spearhead, stamps, and an iron firestarter. Personal, even high-status, objects found in association with Enclosure 1 included a fragment of an amber bead, seven lignite bracelet fragments, 25 bone pins, 16 iron ring pin or ring pin fragments, 16 copper alloy ring pins or pin fragments, and four decorated antler comb fragments.

A drystone souterrain was also uncovered within Enclosure 1, consisting of three chambers connected by 3 short passageways. There was evidence that the chambers were roofed by corbelled drystone construction. Several features in the passageways were interpreted as defensive features by the excavators, including a narrowing of the passage in conjunction with a step feature described as a 'trapdoor'. Pits in each of the chambers suggest that the primary function of the souterrain was for food storage. A copper-alloy stud-headed pin, dating to the 11th century, suggests a date when the flagstones over the passageways were removed and the souterrain was backfilled.

There was extensive evidence for metalworking at Roestown 2. Iron slag was evident in all layers of the Enclosure 1 ditch, a crucible was found in one of the internal structures, and there was a high proportion of copper-alloy object fragments and a fragment of silver. In total, three crucibles (including two pyramid shaped crucibles associated with non-ferrous metalworking), a bar-ingot stone mold, and five incised bone motif pieces were found associated with Enclosure 1. Some of the crucible fragments bore evidence of glazed/glassy residues on their interior, suggesting that glass beads may have also been produced at this site (of which, 11 glass beads were found on the site). The incised bone motif pieces (interpreted as trial pieces) each had one or more motif panels carved into them, including interlace designs such as cord plait, triquetra and paired knot motifs and were radiocarbon dated to AD 530-650. Evidence of other forms of craftwork at Roestown included a spindle whorl, copper alloy, bone, and iron needles, and a possible antler knitting needle, all used in textile production, and an iron awl and chisel are evidence for carpentry.

Further evidence of status at Roestown 2 included three stone-incised game boards. Two of these boards were used to play a *-tafl* game such as *hnefatafl* (a common Scandinavian game) or an Irish variant called *Ard-Rí,* and the third was used for "merels" or "Nine-Men's-Morris". The game boards derive from a mid-late seventh century context, nearly a century prior to the first recorded Viking raids on Ireland, knowledge of the game likely came through trade relationships with the British Isles and Northern Isles.

After the site had gone out of use, the land was used for small-scale occupation and agricultural activity. One structure, Enclosure 4, had evidence of prolonged use and final siltation layers of the drip gully returned a radiocarbon date of AD 1440-1640. Finally, plow furrows crossed the enclosure, indicating intensive farming practices that may have removed some evidence of the earlier medieval occupation.

The faunal assemblage from Roestown 2, comprised 10,238 fragments. Due to its large size and the complexity of the site, the assemblage was divided into 9 occupation phases, of which only phases 1A, 1B, and 2A were included in this study, as they could be dated to the mid-6th to mid-7th centuries AD. There were 4,437 fragments from these phases of activity, representing 11 species (Table 40). The species represented in the assemblage included cattle (56%), caprine (sheep/goat, 20%), pigs (15%), horses (3%), dogs (4%), cat (0.09%), deer (0.02%), and bird (0.5%). Five species of birds were identified in the bird bone assemblage, including goose, domestic fowl, corncrake, raven, and passerine in addition to indeterminate bird remains. Several of the domestic fowl bones had evidence of butchery as well as gnawing by a cat. There were three articulated dog skeletons found in the 6th-8th century contexts, including one large dog with an estimated shoulder height of 61.8 cm. This individual also had evidence of healed infected traumatic injuries to the left humerus and phalanges as well as two cut marks on the right distal femur, indicating that the skinning of dogs took place during this time. Pathologies, primarily degenerative joint disease (DJD), were also noted on cattle (9) and horse (4) elements. While DJD on the pelvis, femur, metatarsals, and phalanx may indicate use in traction, evidence of DJD on two cattle mandibles was more likely due to the advanced age of the individuals. Exostosis to a horse metacarpal, third carpal, and two metacarpals suggests a disease known as spavin, which is common in draught animals. Other pathologies, including antemortem tooth loss, healed trauma, and bone infections were also noted in the assemblage. There were also several non-metric traits noted in the assemblage, including the presence of one specimen from a four-horned, or polycerate, sheep.

Cattle butchery was uncommon at this site, with only 10% of the cattle remains showing evidence of chop or cut marks. Most of the butchery marks were heavy chop marks on meat-bearing elements, splitting the metapodia (for marrow), and chops around horncores (to remove the horn for craftwork). Evidence of chops on vertebra and the pelvis led the analyst to conclude that butchery was systematic. One cattle metatarsal had extensive evidence of chopping and modification and was interpreted as a possible bone skate. There was generally less evidence for butchery on caprine and pigs, but there was still evidence of chopping at the meat-bearing bones and fine cuts to a caprine calcaneus, suggesting skinning as well. 59 specimens had evidence of gnawing, with the majority done by carnivores, though six were gnawed by rodents. Just as there was little evidence for butchery, there was less evidence for burning with only 16 instances of burning (both calcined and blackened). This might suggest that meat was chopped into pieces that could be stewed in a pot, rather than over an open flame.

Cattle epiphyseal fusion data suggest that there was a peak age-of-slaughter for individuals over 3 years old and very few calves slaughtered. Examination of cattle mandibular tooth wear supported these results (N = 49). Biological sex data, estimated from the distal breadth of cattle metacarpals, demonstrated an equal number of adult males and female during this phase. Drawing comparisons between Roestown 2, Knowth, and medieval Dublin, the analyst concluded that the mortality profile, with a predominance of very old individuals, at Roestown 2 most closely resembled medieval Dublin and the later occupation at Knowth, both of which have been interpreted to have been provisioned communities. The analyst therefore suggests that, while the raising of some cattle took place on site, Roestown 2 was provisioned with beef from client communities.

Table 40 Taxonomic distribution for Roestown 2, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	2490	928	666	149	178	4	0	1	21	0	0	0	4437
%NISP	56	20	15	3	4	0.09	0	0.02	0.5	0	0	0	98.61

MNI	65	41	41	8	10	3	0	1	7	0	0	0	176
%MNI	37	23	23	5	6	2	0	0.6	4	0	0	0	100.6

Table 41 Diversity and evenness measures for Roestown 2, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.21	*11*	*0.51*

Navan 1, Co. Meath (AD 427-899)

Excavation at this site, from April-June 2006, ahead of construction on the Navan Inner Relief Road, revealed two areas of archaeological interest along the slopes of a low hill. The upper part of the site contained an enclosed settlement dating from the 5th-9th centuries and the downhill part of the site contained field boundaries and craftworking areas, including metalworking.

Archaeological features of the upper area of the site consisted of a series of curvilinear ditches enclosing the top of the hill. The main enclosing ditch measured 1.22 meters wide and 0.61 meters deep, was filled with small, packed stones at its base, and extended beyond the limit of excavation to the north and ending in a square-off terminal to the south. A slot trench between the two termini might have functioned as a gate feature. An inner ditch followed the course of the outer enclosing ditch but was smaller, measuring 0.72 meters wide by 0.31 meters deep. A deep slot trench (1.02 meters wide by 0.37 meters deep) in the interior of the enclosed space may have represented a rectangular structure, material recovered from this trench returned a radiocarbon date of 587-664 AD. The enclosed area also contained five fire pits (one dating to 427-584 AD), a dump of burnt material, and a single large posthole.

Downhill, a craftworking area consisted of separate spaces defined by a T-shaped ditched complex and a curvilinear ditch. The two intersecting ditches that defined the T-shaped ditch complex measured approximately 2 meters wide by 0.8 meters deep and contained slump material with inclusions of gravel, charcoal, burnt clay, and animal bone. One of the ditches also contained a human tibia. A series of four intercutting pits were found at the junction of the two ditches and one of the pits contained metalworking waste. A curvilinear ditch enclosing this area measured 1.7 meters wide by 0.63 meters deep and had a set of four postholes associated with it. Artifacts found within the ditch included a bone pin/needle, two iron nails, and three tanged iron knife blades with one including a wooden handle. Material from the curvilinear ditch returned a radiocarbon date of 668-899 AD and material from one of the associated postholes returned a date of 768-899 AD, confirming a later early medieval date for this complex.

There were deep gullies on either side of the ditch and a deep (0.8 meter deep) pit in the center of the enclosed space. To the west of the ditch, there was a pit with evidence of multiple *in situ* burning events (lens of charcoal and burnt red sandy-clay). There was also a cluster of three circular structures in this area, all defined by a drip gully and measuring approximately 4.22 meters in diameter, with structures 2 and 3 forming a possible ‘figure-of-eight’ shaped structure. Two small pits, also found in the downhill area, contained iron slag and one also contained a mid-sized flat-topped stone that likely would have supported a bellows.

The faunal assemblage from Navan 1, comprising 655 countable fragments, including 45 from three semi-articulated prenatal sheep (Table 42). A final NISP for this study comprised 601 fragments from cattle (65%), caprine (sheep/goat, 16%), pigs (9%), horses (5%), dogs (2%), cats (2%), deer (0.3%), birds (0.2%), and wild animals (fox, 0.3%). While almost all elements were represented, there was a lower number of horncores present in the assemblage (for both cattle and caprine) than would be expected, suggesting that the horncores were removed and horn craft production took place elsewhere. There were twice as many bones with evidence for butchery in the upper area than in the downhill area, further suggesting that the upper area may have been domestic, and the lower area may have been for craftwork. The butchery in the upper area consisted of heavy chop marks on cattle crania, mandible, ulna, femur, tibia, and calcaneus and a pig pelvis consistent with disarticulation. Fine cut marks on a cattle astragalus were consistent with skinning and fine cuts to the ribs consistent with removal of meat for cooking. In addition to cooking, two sawn shed deer antlers were evidence for antler working on site. In the lower part of the site, a large mammal radius and sawn sheep metatarsal were considered craftwork offcuts. Evidence for burnt bone included cattle long bone fragments, mandible, and foot fragments, a singed sheep tooth, rib, and long bone fragments, and a pelvis from a medium mammal, indicating that some meat was cooked on the bone. All the gnawing evidence (11 fragments) appears to have been done by carnivores, likely dogs.

Cattle aging data via tooth wear (N = 30) indicate that 45% of cattle were slaughtered between 1-2.5 years of age. There was a difference in age distribution between the upper and lower areas of the site, with the upper area demonstrating a secondary peak slaughter age around 6-7 months (30%) and the lower area demonstrating a secondary peak between 2.5-4 years (35%). These data suggest that cattle were kept on site for meat production. Alternatively, the epiphyseal fusion data suggest that near 70% of cattle were over 4 years old, suggesting dairy production.

Table 42 Taxonomic distribution for Navan 1, Co. Meath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	391	98	57	29	10	12	0	1	1	0	0	2	601
%NISP	65	16	9	5	2	2	0	0.3	0.2	0	0	0.3	99.8
MNI	13	6	5	1	2	2	0	1	1	0	0	1	32
%MNI	41	19	16	3	6	6	0	3	3	0	0	3	100

Table 43 Diversity and evenness measures for Navan 1, Co. Meath

Heterogeneity	*NTAXA*	*Evenness*
1.11	*10*	*0.48*

Killickaweeny, Co. Kildare (AD 540-800)

Excavation at this site, from July-November 2002, ahead of construction of the M4 Kinnegad-Enfield-Kilcock Motorway Scheme, revealed a large 'heart-shaped' ditched enclosure with several internal features including four structures, refuse pits, and two metalworking areas. The site was first identified as an 18-meter-long crescent-shaped feature in a large, flat low-lying field, ahead of geophysical survey.

The earliest phase of activity at this site consisted of two large ditches (Ditches C & B) that formed a somewhat 'L-shaped' feature. Both ditches measured approximately 1.5 meters wide and 1 meter deep and contained evidence of domestic and industrial waste. Ditch C is interpreted by the excavators as potentially an annex feature associated with the Ditch B enclosure as it contained less material that might be considered “domestic” and more metallurgical waste. Ditch B contained a large quantity of animal bones, bone pins, and two whittle-tanged knives. Material from the basal level of the ditch returned a radiocarbon date of 540-660 AD. These features were cut by the larger Ditch A, ‘heart-shaped’ enclosure ditch.

The large ‘Ditch A’ enclosure ditch measured 60 meters southeast-northwest and 80 meters southwest-northeast, measured approximately 2.5 meters wide by 1.2 meters deep, and lacked evidence for an entrance. Evidence of a re-cut in the northern part of the site shows evidence of maintenance of the enclosure ditch during occupation. The northern part of the interior of this feature had evidence of metalworking areas and the area to the south had evidence of habitation and textile working. Artifacts from this feature include two wooden staves and a wooden vessel base, a large amount of metallurgical waste (in the northern part of the ditch, immediately outside of the metalworking area), several knife blades, an animal-tooth awl, and a possible roofing slate. The interior of the enclosure contained pits and postholes that suggest the construction of four structures, interpreted as habitation structures and workshops, and a cistern that filled with water throughout the excavation. Refuse pits associated with these structures included animal bone, charcoal, metallurgical waste, and artifacts including knife blades, bone pins, an antler spindle whorl, a copper-alloy ringed pin, two decorated antler combs, a fragment of a weaving tensioner, and a blue glass bead. Material from these pits returned a radiocarbon date of 610-730 AD. Material from the upper part of Ditch A (abandonment layer) returned a radiocarbon date of 890-1010 AD.

Post medieval and modern activity on the site post-dating the enclosure included the construction of field boundaries and drainage ditches. This suggests that after the abandonment of the settlement, the site was primarily used as agricultural land.

The faunal assemblage from Killickaweeney, comprised 9,043 fragments, of which only 3,565 were identifiable, representing 2,284 anatomical units (Table 44). The assemblage included fragments from cattle (58%), caprine (sheep/goat, 19%), pigs (12%), horses (1.4%), dogs (5.4%), cats (0.4%), hare (0.3%), deer (0.04%), birds (3%), and rodents (0.1%). While the bird assemblage was not identified to species, most appear to have been Galliformes (domestic fowl, geese, and pheasants) and most came from the wing or leg. The high percentage of wing elements might suggest the exploitation of feathers for fletching. Butchery marks on cattle remains was relatively common (19% of the cattle assemblage had evidence of modification) and indicated that slaughter (from a blow to the head), whole carcass butchery (from disarticulation through cuts to remove meat), and skinning/leather production took place on site. Butchery on caprine and pigs was less common (12% and 10%, respectively) but also showed evidence for whole carcass butchery. One horse metacarpal with cut marks suggests that horse hides were also exploited. Pathological data from the cattle remains suggests that the population was quite old, with evidence of osteoarthritis and degenerative joint disease observed on one phalanx and a mandible at the temporomandibular joint. Generally low incidences of gnawing suggests that food waste was not made accessible to carnivores or rodents.

Cattle aging data was collected via both epiphyseal fusion as well as by tooth eruption and wear. The bone fusion data indicates that older individuals dominated the herd, with 59% of late fusing bone completely fused. Mandibular wear (N = 42), however, revealed a higher proportion of juveniles, but also confirmed many older individuals in the herd. Sexing data were derived from pelvis shape, horncore shape, and the breadth of the distal metacarpal. All three methods indicated a predominance of females in the herd (11:5; 10:2; and 11:2, respectively) The analyst interpreted these data as evidence for a dairy herd with meat production as a secondary benefit.

Table 44 Taxonomic distribution for Killickaweeny, Co. Kildare

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	1330	440	267	31	123	10	7	1	71	0	3	0	2283
%NISP	58.2	19.3	12	1.4	5.4	0.4	0.3	0.04	3.1	0	0.1	0	100.24
MNI	27	18	14	3	4	1	2	1	6	0	1	0	77
%MNI	34.6	23.1	17.9	3.8	5.1	1.3	2.6	1.3	7.7	0	1.4	0	98.8

Table 45 Diversity and evenness measures for Killickaweeny, Co. Kildare

Heterogeneity	*NTAXA*	*Evenness*
1.25	*10*	*0.54*

Rochfort Demesne, Co. Westmeath (AD 610-770)

Excavation at this site, from September 2005-January 2006, ahead of construction of the N52 Mullingar-Belvedere Road realignment, revealed a double ditched enclosure. Excavation determined that the site initially began as a 7th-10th century settlement but then was disturbed by 18th century quarrying and then the construction of a 19th century mock ringfort, or folly. The site itself was situated on the slope of a hill in an undulating landscape. Land to the north and south was boggy and may have been even wetter during the early medieval period. This site was also situated above Lough Ennell, which also may have been slightly closer during the main period of occupation. The earliest occupation at the site consisted of artifacts in disturbed contexts, including three flint scrapers and an Iron Age ring headed pin (dated to approximately the 3rd-1st centuries BC). The pin, of Type 7, which is common in the Irish midlands, is thought to have been accidentally discovered during the early medieval period and intentionally deposited in a pit near the entrance of the settlement.

The first phase of occupation during the early medieval period is defined by the construction of a single sub-circular enclosure ditch (c10) with a 2.6-meter-wide causewayed entrance to the east. The interior of the enclosure measured 41 meters east-west and 36 meters north-south, with the ditch itself measuring 2.4 meters wide and 1.55 meters deep. The ditch contained charcoal, mollusk shells, and animal bones, including two partially articulated medium sized ungulates. Material from the basal layer of the c10 enclosure returned radiocarbon dates of AD 610-770 and AD 655-769.

The second phase of early medieval occupation is defined by the deliberate infilling of the c10 ditch and the construction of a larger sub-circular enclosure ditch (c12) with a 5.75-meter-wide eastern causewayed entrance. The interior of the new enclosure averaged 53.7 meters in diameter and the ditch measured 3.1-3.95 meters wide and 1.7-1.82 meters deep. Material from the basal layer of the c12 enclosure ditch returned a radiocarbon date of AD 690-950. Further radiocarbon dates from three pits associated with the entrance returned dates of AD 778-949 and AD 865-960, suggesting a broadly 8th-10th century date for this phase of occupation. One of the pits contained an Iron Age ring headed pin and another contained a bronze needle. A Dublin-style decorated ringed pin, which broadly dates to the period that the c12 ditch was in use, was found in the topsoil.

Several cut features (pits, postholes, and slot trenches) and hearths from the interior of the enclosure could have been associated with either of the enclosure ditches and the excavators could not determine how they formed discrete structures. A fragment of a composite double-sided decorated bone comb, fragments of a metalworking mould, and animal bones were found in one feature, a ‘tear-drop’ shaped pit (3.24 meters long and 1.48 meters wide), which also had evidence of insects found in rotting or putrefying matter, indicating that it was likely a latrine. Another interior pit contained the remains of four articulated sheep legs.

Post-medieval activity at the site severely disturbed most of the interior features as well as the c12 enclosure ditch. In the 18th century, the interior of the enclosure was used as a limestone quarry. The quarry cut measured 13 meters east-west, 22 meters north-south, and 2 meters deep (to the bedrock). The final phase of activity at the site included the construction of a mock ringfort or folly in the 19th century. The folly enclosure measured 49.8 meters in diameter and partially cut the early medieval c12 ditch.

The faunal assemblage from Rochfort Demesne, comprised 8,672 fragments, of which 4,770 were identifiable. For the purposes of this study, the assemblage from the c10 enclosure ditch was studied, including 3,043 fragments, of which 1263 were identifiable (Table 46). The assemblage represented cattle (55%), caprine (sheep/goat, 13%), pigs (8%), horses (2%), dogs (17%), cats (4%), hare (0.2%), deer (0.08%), birds (0.08%), and rodents (0.4%). Butchery data indicates that some small-scale whole carcass butchery of cattle took place on site with a disarticulation chop to the posterior ulna and knife cuts to the femoral head. The presence of a single red deer humerus indicates that hunted occasionally supplemented the diet but was not a significant part of the daily diet at the site. Two cattle bone fragments had evidence for pathology, including porosity at the proximal articulation for the metacarpal and distal articular surface of a tibia.

Cattle aging data was collected via both mandibular wear stages and epiphyseal fusion. The mandibular wear stage data (*N* = 17) revealed a large proportion of adults and older adults in the herd and few juveniles. The epiphyseal fusion data, however, showed that there were several individuals under the age of 12 months. The analyst did not interpret these results, but the general distribution suggests dairy production.

Table 46 Taxonomic distribution for Rochfort Demesne, Co. Westmeath

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	693	170	105	21	216	49	2	1	1	0	5	0	1263
%NISP	55	13	8	2	17	4	0.2	0.08	0.08	0	0.4	0	99.76
MNI	15	6	7	2	3	3	1	1	1	0	1	0	40
%MNI	37.5	15	17.5	5	7.5	7.5	2.5	2.5	2.5	0	2.5	0	100

Table 47 Diversity and evenness measures for Rochfort Demesne, Co. Westmeath

Heterogeneity	*NTAXA*	*Evenness*
1.32	*10*	*0.57*

Borris AR Site 36, Co. Tipperary (AD 636-771)

Excavation at this site, from November 2006-January 2007, ahead of construction of the M8/N8 Cullahill to Cashel Road Improvement Scheme, revealed an Early Bronze

Age flat cremation cemetery, an early medieval V-shaped linear ditch and circular enclosure. The site itself was situated on the slope of a hill in an undulating landscape. The site is located on a broad low-lying plain adjacent to the River Black.

The first phase of occupation at the site consisted of an unenclosed Early Bronze Age flat cremation cemetery. The cemetery contained 18 pits, 13 of which contained cremation burials and 5 contained no identifiable human remains and are interpreted as cenotaphs. There were no artifacts related to these features but material from two of the cremations returned radiocarbon dates of 2204-2038 BC and 2024-1896 BC, respectively, suggesting an Early Bronze Age date for all the cremations.

The next phase of occupation consisted of a large early medieval east-west oriented linear ditch (c80). The ditch measured 105 meters long, 2.6 meters wide, and between 2.3-2.6 meters deep. One of the lower levels (not the basal level) of this feature produced material that returned a radiocarbon date of cal. AD 639-771. Archaeological material discovered in this ditch included animal bone, antler, charcoal, and slag.

The linear ditch joined with a large curvilinear enclosure ditch, measuring 20 meters long, 2.8-3.4 meters wide, and 1.6 meters deep. Animal bone from a localized basal layer (that did not extend through the entire feature) returned a radiocarbon date of cal. AD 894-991. Artifacts from this feature included a piece of copper alloy and two iron knives. Seven poorly preserved iron working features were found in relation to this feature, including one pit containing bog ore, despite not returning reliable radiocarbon dates. Metalworking debris, including fragments of tuyères, were found in association with these hearth features. Later post-medieval and modern linear ditches demonstrate that this area was used for agricultural purposes after the early medieval settlement.

The faunal assemblage from Borris AR Site 36, comprised 2,385 fragments, of which 1,431 were identifiable. For the purposes of this study, the assemblage from the linear ditch was studied (c80), including 781 fragments, of which 446 were identifiable (Table 48). The assemblage represented cattle (66%), caprine (sheep and goat, 8%), pigs (4%), horses (4%), dogs (18%), and deer (0.07%). Butchery data indicates that butchery of cattle took place on site with disarticulation chops to a femur, pelvis, and scapula. All the butchery marks on cattle were heavy chop marks and most were to the cranium, likely to remove the horncore for craft production. A chop mark to a caprine horncore also suggests the caprine horn craftwork. One filet mark (light cut mark) was noted on a pig humerus). While all the deer remains had evidence of butchery, they were also all antler pieces and may have been collected from shed antlers for craftwork rather than hunted. Pathological evidence from cattle indicates the presence of older individuals (three fused vertebrae from spondylitis and eburnation to a distal articulation of a metacarpal).

Cattle aging data was collected via both mandibular wear stages and epiphyseal fusion. The mandibular wear stage data (N = 13) revealed a large proportion of juveniles under the age of 3 years (7 of 13). The epiphyseal fusion data, however, showed that most individuals were older adults (>3 years old). The analyst concluded that the high proportion of adult individuals and the low proportion of juveniles indicated that cattle were kept on site for meat production.

Table 48 Taxonomic distribution for Borris AR Site 36, Co. Tipperary

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	292	34	18	16	63	0	0	3	0	0	0	0	446
%NISP	66	8	4	4	18	0	0	0.7	0	0	0	0	99.7

Table 49 Diversity and evenness measures for Borris AR Site 36, Co. Tipperary

Heterogeneity	*NTAXA*	*Evenness*
1.07	*7*	*0.55*

Coneykeare 1, Co. Carlow (AD 651-764)

Excavation and geophysical survey at this site, from September-October 2007, ahead of construction of the N9/N10 Kilcullen to Waterford Scheme, revealed a penannular enclosure with an entrance on its east side, a cluster of postholes to the south of the enclosure, and two possible kilns to the east of the enclosure. Geophysical survey indicates that only 15% of the enclosing ditch was within the road take, the rest was left unexcavated (preservation *in situ*). The site itself was situated in flat fertile pastureland.

The first phase of occupation at the site consisted of the construction of a penannular enclosure with an entrance to its east side. This ditch was largely truncated by the later, larger ditch, to the north but survived in the south. The ditch was narrow, measuring only 0.7-1 meter wide and 0.35-0.53 meters deep. Archaeological material in this ditch consisted of charcoal, a single cow molar, and slag. A piece of pomaceous fruitwood charcoal was selected for radiocarbon dated and returned a date of cal. AD 429-568, indicating a late Iron Age/early medieval date for initial settlement at the site.

The next phase of occupation consisted of the construction of a larger enclosure ditch with associated postholes and kilns. The ditch measured 2.2 meters wide and 1.1 meters deep and had an entrance to its east side. Because the ditch respected the earlier entrance and the earlier ditch to the south, the later ditch is interpreted as an expansion of the initial enclosure. The ditch contained charcoal, metallurgical waste (including a 3kg possible smithing bloom), animal bone, and a single hone stone. Charcoal from the larger ditch returned a radiocarbon date of AD 651-764. Five postholes just to the interior of the entrance are interpreted as a gate or entrance feature. An additional seven postholes, exterior to the initial ditch and truncated by the later ditch may have represented a 2 meter diameter circular structure. A radiocarbon date from the interior of one of these postholes returned a date of AD 656-766.

Two kiln features were excavated 50 meters to the east of the enclosures. The first kiln feature was approximately oval but was truncated by a later, figure-of-eight shaped kiln. Charred barley, oat, and rye grains were found within these features. A charcoal fragment from the later kiln feature returned a radiocarbon date of AD 650-764. The final phase of activity at this site consisted of the construction of a post-medieval or early modern field boundary. It is evident that, after the abandonment of the settlement, the site was used as agricultural fields.

The faunal assemblage from Coneykeare 1, comprised 696 fragments, of which 357 were identifiable, and 354 derived from the early medieval enclosure ditch (Table 50). The assemblage from the enclosure ditch included cattle (71.8%), caprine (sheep/goat, 10.7%), pigs (14.4%), horses (0.3%), and deer (2.8%). Elements from all parts of livestock skeletons were present, suggesting that whole carcass butchery took place on site.

Butchery data from cattle indicate a high percentage of heavy chopping disarticulation marks (to the pelvis and mandible) but still some lighter fileting marks (distal, posterior radius). Butchery to pigs also showed a preference for chopping (to the tibia, calcaneus, and pubis) and only three caprine bones had evidence of butchery, a chop through a distal radius, filet marks on a rib, and a cut on a scapula. Several bones (11% of cattle remains) showed evidence of roasting, indicating that some meat was cooked on the bone. Five of the ten deer elements recovered from the site had evidence of butchery, including cuts and chops to the metatarsals and pelvis, as well as evidence of roasting on three metatarsals. Evidence of postcranial, butchered, and cooked deer remains suggests that hunting was an important supplement to the local diet. Also, several bones had evidence of rodent gnawing and some carnivore gnawing (dog), indicating that scavengers had some access to food remains post-processing.

Cattle aging data was collected from tooth wear patterns and the presence of permanent 4th premolars, 1st/2nd/3rd molars, and deciduous 4th premolars (N = 21). Most cattle were slaughtered before the age of 2.5 years old, with the greatest peak of slaughter between 18-30 months. According to the tooth wear data, very few adults were kept beyond 2.5 years old. The predominance of prime age individuals and few older adults indicates a focus on meat production.

Table 50 Taxonomic distribution for Coneykeare 1, Co. Carlow

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	254	38	51	1	0	0	0	10	0	0	0	0	354
%NISP	71.8	10.7	14.4	0.3	0	0	0	2.8	0	0	0	0	100
MNI	7	3	2	1	0	0	0	2	0	0	0	0	15
%MNI	41	20	20	6	0	0	0	13	0	0	0	0	100

Table 51 Diversity and evenness measures for Coneykeare 1, Co. Carlow

Heterogeneity	*NTAXA*	*Evenness*
0.87	*5*	*0.54*

Carnmore West, Co. Galway (AD 576-856)

Excavation and geophysical survey at this site, from September-October 2007, ahead of the N6 Galway to Ballinasloe Scheme, revealed a settlement complex enclosed by a stone wall (*cashel*) with evidence of interior structures and two cereal drying kilns external to the cashel. The site is situated in a well-drained, low-lying agricultural landscape with a carboniferous limestone/karstic bedrock.

The circular cashel enclosure measured 55 meters in diameter with an entrance to the southeast and had a sub-rectangular annex, measuring 35 meters by 45 meters, with an entrance on the western side where the cashel and annex joined. The walls of the cashel and the annex were constructed of two rows of drystone limestone blocks with a stone rubble core. Two postholes cut into the bedrock flanking the entrance to the cashel may represent a gate feature. Charcoal from one of the postholes returned a radiocarbon date of AD 576-665. Artifacts associated with the collapsed cashel walls include two pieces of a clay mold, an iron knife blade, an iron arrowhead, and two fragments of decorated quern stones. There were a small number of internal features excavated inside the cashel, including a sub-rectangular slot trench, a circular cut feature, two hearths, and a series of postholes in the western site. These features may have represented internal structures, but the ultimate design of these structures was unclear through excavation. A souterrain was excavated in the interior of the cashel, measuring 2 meters wide, 2 meters high, and 15 meters long before turning right to a dead end. There was no evidence for a chamber in the souterrain, but it is possible that one existed beyond the limit of the excavation. Material from the interior of the souterrain returned a radiocarbon date of AD

641-856. Beside the pit-drop entrance to the souterrain was a square hearth cut into the bedrock, which returned radiocarbon dates of AD 720-948 and AD 772-965.

30 meters to the west of the annex was a large cereal drying kiln complex. Excavation revealed what was believed to be a large cairn was, in fact, the remains of two dumb-bell shaped cereal drying kilns, truncated by a later L-shaped kiln. Later evidence of occupation at the site consisted of a 20th century concrete-lined animal well.

The faunal assemblage from Carnmore West, comprised 2,577 fragments, of which 57% were unidentifiable. Many of the remains came from the topsoil and unreliable contexts (for example, a nearly complete horse skeleton at the top of the souterrain, interpreted as a modern intrusion) so, correcting for those fragments, the assemblage from the settlement contained 762 fragments including cattle (45.5%), caprine (sheep/goat, 33%), pigs (7.5%), horses (10.4%), dogs (1.5%), birds (0.8%), rodents (0.7%), deer (0.3%), and wild/amphibians (0.3%) (Table 52). There were no butchered cattle remains but there was one caprine humerus with both chop and cut marks. Additionally, there were no recorded burnt bones and just one cattle metapodia with early signs of osteoarthritis to the proximal articulation of the metacarpal. Evidence of a deer calcaneus, however, provides evidence of occasional hunting.

Cattle aging data was collected primarily from epiphyseal fusion (there was only one mandible with an available tooth row for aging). The fusion data (N = 44) showed that the herd was dominated by older individuals, over the age of 7 months, with most of the slaughter occurring between the ages of 24 and 42 months. Sex data was derived from just two metacarpals, one being a male (bull) and the other a female (cow). Due to the small sample size available, the analyst tentatively suggests that cattle were exploited for their meat, rather than secondary products.

Table 52 Taxonomic distribution for Carnmore West, Co. Galway

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	347	252	57	79	12	0	0	2	6	0	5	2	762
%NISP	45.5	33	7.5	10.4	1.5	0	0	0.3	0.8	0	0.7	0.3	100
MNI	6	4	2	1	1	0	0	1	2	0	1	1	19
%MNI	31.5	21	10.5	5.2	5.2	0	0	5.2	10.5	0	5.2	5.2	99.5

Table 53 Diversity and evenness measures for Carnmore West, Co. Galway

Heterogeneity	*NTAXA*	*Evenness*
1.27	*10*	*0.55*

Rahally, Co. Galway (AD 661-773)

Excavation at this site, from March 2005-November 2006, ahead of road construction, revealed a late Bronze Age hillfort and an early medieval univallate ringfort with associated burials. In November 2006, the hillfort was designated a National Monument and excavations were allowed to continue. The site was situated at the summit of a prominent hill, 1.75 kilometers from the Radford River, in a landscape with other known archaeological monuments, including other early medieval ringforts (fortified farmsteads).

The first phase of occupation at the site consisted of the construction of a large hillfort during the late Bronze Age. This included an outer double ditch (the two outermost ditches are spaced close to each other), a middle ditch, and an inner ditch.

There appears to also have been a partial extant bank between the outer double ditches, serving as a boundary between the Rahally and Cloonyconaun townlands. The maximum diameter of the hillfort is 450 meters, and it encloses a total area of 14.4 hectares. Twelve breaks in the enclosure ditches are interpreted as entrances and several are aligned through all four ditches. The outer ditches measured 2-4.5 meters in width and 0.5-1.5 meters in depth. The ditches had evidence of regular maintenance in the form of re-cuts. Charcoal from the interior of the ditches returned radiocarbon dates of 770-550 BC (outer ditches), 1015-925 BC (middle ditch), and 994-827 BC (inner ditch). Artifacts from these features include a chert blade, flint scrapers, a late Neolithic shale groundstone ax, fragments of Late Bronze Age pottery (6 individual vessels), red deer antlers (likely used as picks in the construction of the ditches), a whetstone, bone pins, a late La Tène fibula fragment, slag, and unidentified ferrous objects. The presence of the fibula fragment, slag, and ferrous objects are interpreted as intrusive evidence of Iron Age occupation at or use of the site.

In addition to the metalwork evidence, several features also suggest some use of the site during the Iron Age (phase 2) including a drainage gully, slot trench, and a bowl furnace. The drainage gully measured 19 meters long, 0.6-1.5 meters wide, and 0.3 meters deep. Charcoal from the gully returned a radiocarbon date of 380-180 BC. Associated with the gully was a slot trench (8 meters long, 0.6 meters wide, and 0.4 meters deep) which could have represented the footing to a structure but there were no other extant features to support this interpretation. Finally, a circular bowl furnace (0.7 meters in diameter), containing two burnt fills with rye grains and a copper/copper alloy lump returned a radiocarbon date of 200-40 BC.

The third phase of occupation at the site consisted of the construction of a univallate ringfort and associated features and an annex feature for a previously known bivallate ringfort that lay outside the limit of the excavation. The univallate ringfort was defined by a single curvilinear ditch averaging 2 meters wide and 0.9-1.25 meters deep with an 8-meter-wide entrance, enclosing an area 32 meters in diameter. The ditch contained a moderate amount of animal bone and cut antler fragments and artifacts including iron knife blades, a nail shaft fragment, a melon bead, bone comb fragments, a flint scraper, and a base-metal finger ring. Charcoal from the ditch returned a radiocarbon date of AD 680-890 and a burial inserted into the base of the ditch returned a radiocarbon date of AD 890-1030, likely soon after the ditch was filled. Features within the enclosed space included a series of small circular gullies interpreted as drainage ditches and drip gullies from structures as well as four pits. There were no artifacts from the pits, but charcoal found within them returned a radiocarbon date of AD 680-880.

Stratigraphically later features at the site consisted of a curvilinear annex ditch and human burials. The annex ditch measured 3 meters wide by 1.2 meters deep and enclosed an area approximately 38 meters by 40 meters. This ditch was likely associated with an adjacent bivallate ringfort that was outside the limit of the excavation. Two radiocarbon dates from charcoal from the interior of the ditch returned radiocarbon dates of AD 661-773 and AD 1020-1180. Artifacts found in this feature include a glass bead, a flint scraper, a penannular brooch, and an iron tanged knife blade. Two inhumation burials were inserted into this ditch, one, a juvenile, returned a radiocarbon date of AD 1020-1200 and the other, poorly preserved burial, returned a radiocarbon date of AD 990-1160.

Late medieval features associated with the site include a dumbbell-shaped cereal drying kiln, a burnt spread, and a series of furrows. The kiln contained charred oats and other indeterminate cereal grains and returned a radiocarbon date of AD 1215-1285. The burnt spread contained charcoal and burnt stone and returned a radiocarbon date of AD 1043-1218. These features, along with the plow furrows, suggest that after the medieval settlements were abandoned, the site was used for agricultural production.

The faunal assemblage from Rahally, comprised 5,305 fragments. Most of the remains derived from either the Late Bronze Age occupation or the early medieval occupation. The assemblage from the early medieval settlement contained 2,339 fragments, of which 944 fragments were identifiable (Table 54). The species represented in this assemblage include cattle (51%), caprine (sheep and goat, 10.5%), pigs (5.4%), horses (5.7%), dogs (10.7%), hare (0.2%), deer (15.5%), and birds (1%). The dog remains represent three individuals, one immature and two adults (the adults measured 50.9 cm and 51.5 cm at the shoulder), considered "medium-large" dogs. The bird remains include bones from a goose with evidence of butchery (a chop through the radius shaft). The large number of deer remains is partially due to the inclusion of several antler off cut pieces (evidence of craftwork), but the assemblage also includes postcranial and cranial evidence for hunting and cut marks consistent with skinning. Deer at Rahally were likely exploited for their antlers, meat, and hides. Unfortunately, other information about butchery and burning/food production was not reported.

Pathology data from the assemblage includes evidence for osteoarthritis in cattle. One cattle distal metapodial fragment showed extreme eburnation and wear, consistent with heavy loading of the feet as seen in draught cattle. A separate cattle cuboid bone and smaller tarsal were also found fused and an acetabulum showed evidence of eburnation, considered age-related pathologies.

Cattle aging data was collected primarily from epiphyseal fusion (N = 155). These data indicate that few individuals were slaughtered before 10 months of age and there was a peak in slaughter at 24-23 months of age (20%) but that most individuals lived to over 48 months. This older-skewed population with some juveniles slaughtered, is indicative of a dairy herd.

Table 54 Taxonomic distribution for Rahally, Co. Galway

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	482	99	51	54	101	0	2	146	9	0	0	0	944
%NISP	51	10.5	5.4	5.7	10.7	0	0.2	15.5	1	0	0	0	100

Table 55 Diversity and evenness measures for Rahally, Co. Galway

Heterogeneity	*NTAXA*	*Evenness*
1.49	*10*	*0.65*

Ballyvass, Co. Kildare (AD 660-890)

Excavation at this site, from July-November 2004, ahead of construction on the N8/N10 Kilcullen to Waterford Scheme (Kilcullen to Carlow), revealed occupations from the early Iron Age through the early medieval period. Features associated with these occupations included a small metalworking area, a ring ditch with a cremation burial, a large early medieval enclosure and souterrain, two cereal drying kilns, and pits, postholes, and linear/curvilinear ditch features. The site is located at the summit of a gravel ridge, gently sloping to the north, and bordered by a working gravel quarry to the northwest.

The first phase of occupation at Ballyvass consisted of an early Iron Age iron smelting furnace and associated pit features. The smelting furnace was sub-circular in plan, measuring 0.36m x 0.32m and 0.22m deep, and contained four fills with burnt red silty clay, oak charcoal, and slag. A radiocarbon date from this feature returned a date range of 360-110 cal BC. Excavation in the vicinity revealed a cluster of 11 shallow pits, all containing charcoal, burnt and unburnt unidentified animal bone, and one pit (496) also contained a moderate amount of burnt grains, including oat, hulled barley, and wheat.

The second phase of activity at this site consisted of a ring ditch and cremation burial. The enclosure ditch itself was subcircular in plan, with an external diameter of 5.8m and a maximum internal diameter of 4.25m. The single enclosure ditch measured between 0.72-1.1 meter wide and between 0.4-0.76 meter deep. The internal stratigraphy of the ditch suggests that the ditch filled through natural siltation. A token cremation (44g) was deposited in the ditch and returned a radiocarbon date of 60 cal. BC-cal. AD 80. Animal bone from beneath this deposit returned a radiocarbon date of AD 680-890, but the excavators suggest that this later intrusion may have been the result of animal burrowing. The ditch fills contained unidentified animal bone, charcoal, four unidentified iron objects, two iron nails, and a large whetstone. Excavation also revealed three postholes in the internal enclosed space of the ring ditch, two of which were next to each other in the center of the feature and the third was 1.5m southeast of the central postholes. Additionally, there were features external to the ring ditch, including an additional posthole 0.80m to the north-northeast of the ring ditch, a cluster of nine pits and postholes 8.3m to the northeast of the ring ditch, and a second cluster of pits and stakeholes 45m north of the first cluster of features. The first cluster of pits and post holes contained charcoal, unidentified animal bone fragments, and some stone inclusions; except for posthole 611, which contained oat, hulled barley, and wheat and posthole 573, which contained identifiable bone (cattle, pig, and sheep/goat), two miscellaneous stone objects, and a whetstone.

The primary phase of activity at this site consisted of the construction of a large enclosure ditch with associated internal features. The enclosure ditch was sub-circular in plan and enclosed an area 39m in diameter. The ditch measured between 2.6-4.5 meter wide and 1.25-2.2 meter deep. The earliest fills of the ditch appear to have resulted from subsidence and weathering of the cut during initial stabilization and subsequent fills appear to have resulted from natural siltation with evidence of one recut to maintain the ditch. The basal fills contained charcoal and animal bone as well as a miscellaneous bone object, a possible whetstone, and a bone/antler cylinder. An animal bone from the basal fill returned a radiocarbon date of cal. AD 660-810 (2σ), suggesting initial construction during the early medieval period. Subsequent fills in the enclosure ditch produced similar kinds of materials, including charcoal, grains (hulled barley, bread/club wheat, oat, and spelt wheat), animal bone, a flint flake, a hammerstone, two possible weaving tools, a bone/antler cylinder, an iron knife, as well as miscellaneous bone and iron objects. The upper fills also produced several sherds of pottery, including Kildare-type ware, Dublin-type wear, Leinster cooking ware, and a sherd of post-medieval pottery.

Excavation revealed several internal features, including an 11 meter long souterrain, a cereal drying kiln, and additional pits, postholes, and stakeholes. The souterrain was rectangular in plan, measuring 3.5 meter wide, 3.6 meter deep, and 11 meters in visible length (this feature extended beyond the limit of excavation). There was also evidence to suggest that there once was a timber revetment on the interior of the souterrain. The souterrain was truncated by several features, including pits, postholes, and a kiln structure. The kiln structure measured 1.1m x 1m and 0.45 meters deep and the fill of the feature contained charcoal, animal bone, four iron nails, a miscellaneous stone object, a hammerstone, a roof slate, burnt grains (oat, hulled barley, bread/club wheat, and rye), as well as burnt linen textile (a ribbed tabby cloth and a 'veil-like' cloth). A hazelnut shell from the basal fill of the kiln returned a radiocarbon date of cal. AD 690-890. Across all the features there was evidence of charcoal, grains (oat, hulled barley, wheat, and rye), other plant material (hazelnut, pea seeds, wild radish siliqua, and sedge nutlets), animal bone (livestock, domestic and wild birds, fish, mouse, and rabbits), slag, and metal, stone, and bone artifacts. The artifacts included iron nails and knives, compound bone combs, copper alloy fragments, a copper alloy bucket rim and escutcheons, a copper wire ring, worked flint, a convex scraper, whetstones, a socketed iron arrowhead, bone pins, weaving tools, a fragment of a lignite bracelet, a copper brooch-pin, as well as a zoomorphic drinking horn terminal mount. The zoomorphic drinking horn terminal mount additionally came from a pit from which charred material returned a radiocarbon date of cal. AD 770-980.

There were also several external features associated with the early medieval enclosure, including two posthole alignments as well as several pits and linear and curvilinear features. The two posthole alignments consisted of an inner arc of 10 postholes and an outer arc of 9 postholes, possibly representing a palisade structure. The associated pits and linear features contained charcoal, burnt grain, identified and unidentified animal bone, and 202g of slag from iron smithing.

Several post-medieval features truncated the early medieval features, including leveling deposits and field drains. The fills of these features contained flint flakes, two iron nails, a clay pipe stem, and possible architectural stone.

The faunal assemblage from Ballyvass, comprised 15,836 fragments. Most of the remains derived from the early medieval occupation. 77.6% of the assemblage was unidentifiable to any taxonomic level due to high fragmentation rates, resulting in 2,127 identifiable fragments (Table 56). The species represented in the early medieval assemblage include cattle (34.2%), caprine (sheep and goat, 27.1%), pigs (11.2%), horses (2.3%), dogs (0.8%), cat (0.3), hare (0.2%), deer (0.1%), birds (1.5%), fish (15.2%, and rodents (7%). The bird bone assemblage included both wild and domestic species such as Galliformes (including either domestic fowl or wild species such as capercaillie, black grouse, or pheasant), geese, crane, and passerines, suggesting both breeding, hunting, and trapping. The majority of the fish bone assemblage could not be identified, however salmonid and trout were identified, suggesting freshwater exploitation. Additionally, postcranial red deer elements indicate that deer were occasionally hunted for their meat but also for their antlers for craft material. Butchery on all the livestock species indicates slaughter and consumption on site. There was a high proportion of cattle appendicular skeletal material to axial skeletal material, highlighting the importance of beef consumption during the early medieval period.

Cattle age at slaughter data was collected through mandibular wear and epiphyseal fusion. 19 mandibulae (*N* = 19) were available for aging, seven individuals between 0-12 months, eight between 16-32 months old, and four over 50 months old. The analyst interprets these data as evidence of beef production at Ballyvass.

Table 56 Taxonomic distribution for Ballyvass, Co. Kildare

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	728	576	238	49	17	6	4	2	32	323	150	2	2127
%NISP	34.2	27.1	11.2	2.3	0.8	0.3	0.2	0.1	1.5	15.2	7	0.1	100
MNI	28	16	10	1	2	2	2	2	4	2	4	1	74
%MNI	37.8	21.6	13.5	1.4	2.7	2.7	2.7	2.7	5.4	2.7	5.4	1.4	100

Table 57 Diversity and evenness measures for Ballyvass, Co. Kildare

Heterogeneity	*NTAXA*	*Evenness*
1.49	*13*	*0.46*

Leggetsrath West, Co. Kilkenny (AD 610-990)

Excavation at this site, from May-September 2004, ahead of construction on the N77 Kilkenny Ring Road extension, revealed double ditched early medieval enclosure and peripheral activity downslope consisting of field boundaries, pits, postholes, and two cereal drying kilns. The site is located at the summit of a gravel hillock with commanding views of the local landscape and is just west of the Fennell stream.

The primary phase of activity at the site consisted of the construction of a double ditched enclosure. The inner ditch enclosed the summit of the hillock, measuring 34 meters east-west by 32 meters north-south, and the ditch measured 1.7 meters wide by

1.1 meters deep. A 3-meter-wide entrance in the northeast part of the ditch was flanked by slot trenches, which might represent a gate structure. The stratigraphy of the layers within the ditch indicated that the ditch infilled over a short period of time. As such, the only artifacts from this feature were two body sherds of imported Bii ware pottery (dated to the mid fifth to mid sixth centuries AD). Charcoal from this feature returned a radiocarbon date of AD 610-780. The outer ditch measured 1.5 meters wide by 1 meter deep and enclosed an area 54 meters in diameter. The ditch was semi-circular and open to the north. A single line of medium sized cobbles along the outer edge of the ditch formed a simple stone revetment. Artifacts from this feature included a bone needle, iron knife blades, an iron rod, a copper alloy rod, and sherds of Saintonge pottery (likely a later intrusion). Charcoal from the outer ditch returned a radiocarbon date of AD 690-990. Post medieval gravel quarrying truncated parts of both enclosure ditches. The only major feature within the enclosure was a large pit (5m x 2.5m x 3.2m deep) that contained gravel matrices with charcoal and bone inclusions and artifacts including a decorated composite bone comb, a gaming piece, an iron knife blade, and a perforated stone.

Evidence of occupation exterior to the enclosure included linear field boundaries, pits postholes and stakeholes, and two cereal drying kilns. The linear field boundaries formed a field system that likely related to the occupation in the enclosure. The collection of pits and postholes did not appear to form coherent structures but may have been structural supports for various types of structures. Finally, the keyhole-shaped cereal drying kilns appear to represent slightly later agricultural activity. Charred grains from the first kiln returned a radiocarbon date of AD 790-1030 and the other returned a date of AD 1000-1270.

The faunal assemblage from Leggetsrath West comprised 574 identifiable fragments (Table 58). The assemblage included cattle (32%), caprine (sheep/goat, 16%), pigs (17%), horses (6%), dogs (18%), cats (8%), hare (0.3%), deer (3%), bird (0.17%), and fish (1.2%). The bird bone was unidentifiable, but the fish bone assemblage represents both trout and eel, locally obtainable freshwater fish. The bird and fish remains all derived from the large interior pit and were discovered during sample flotation. Only five cattle bones had evidence of butchery, including evidence that horn was removed, likely for craftwork. And only five bones had evidence of burning, including three cattle bones and two pig bones, indicating that meat was occasionally cooked on the bone. All the burnt bone was found in the field boundary ditches, suggesting that when meat was cooked on the bone, it happened away from the primary settlement. 13 bones had evidence of gnawing by carnivores, supporting the skeletal evidence that dogs were kept in the settlement. As all elements of the main domesticates were present in the assemblage, it is likely that the animals were slaughtered at or near to the site, rather than portions being brought into the site already prepared.

Cattle age at slaughter data was collected through mandibular wear and epiphyseal fusion. Six mandibles were available for aging (N = 6), four individuals between 15-30 months and two greater than 50 months old. This supplements the fusion data (N = 44), which showed several individuals slaughtered younger than 18 months and a peak of slaughter at 36-48 months. The analyst interprets these data (some juveniles and most adults slaughtered after their second year) as evidence of dairying at Leggetsrath West.

Table 58 Taxonomic distribution for Leggetsrath West, Co. Kilkenny

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	184	92	98	34	103	46	1	17	1	7	0	0	582
%NISP	31.6	15.8	16.8	5.8	17.7	7.9	0.17	2.9	0.17	1.2	0	0	100.04
MNI	6	5	6	1	2	1	1	3	1	2	0	0	28
%MNI	21	18	21	4	7	4	4	11	4	7	0	0	100

Table 59 Diversity and evenness measures for Leggetsrath West, Co. Kilkenny

Heterogeneity	*NTAXA*	*Evenness*
1.76	*11*	*0.73*

Rathmorrissy, Co. Galway (AD 672-1013)

Excavation at this site, from May-June 2010, ahead of construction on the M17 Galway to Tuam road, revealed a single ditched early medieval enclosure (ringfort) with internal structures. Prior to excavation, part of the associated bank was visible, measuring 5.5 meters wide at the base and surviving to a height of 1.1 meters. The site was situated on an elevated ridge in a relatively flat area in a landscape characterized by low undulating hills.

The primary phase of activity consisted of the construction of and habitation within the ringfort. The enclosure had an external diameter of 63 meters and the ditch measured 4.4-3.3 meters wide and 2.15-1.87 meters deep. A single layer of large stones at the base of the ditch were interpreted by the excavators as evidence of a stone-faced external façade. Artifacts found within the ditch included iron nails, an iron knife blade, a whetstone fragment, and nondiagnostic slag. Charcoal from the basal layer returned a radiocarbon date of AD 722-888 and charcoal from the cultural layer within the ditch returned a radiocarbon date of AD 883-985. The ditch had a cobbled causewayed entrance to the northeast flanked by two large postholes and two smaller postholes, which likely formed an entrance feature or gate. Two iron holdfasts (or clench bolts) were found within one of the large postholes and may have been related to this structure. A radiocarbon date derived from charcoal from one of the postholes returned a date of AD 888-1013.

Features within the enclosure included cobbled work surfaces, pits, postholes, and two structures. The first structure survived as a penannular slot trench with a northeast facing entrance, measuring 5.6 meters in diameter. Artifacts associated with this structure include an iron sheet, an iron nail, a tanged iron knife, and a copper alloy fragment. Charcoal from the slot trench returned a radiocarbon date of AD 779-965. The second structure also survived as a penannular slot trench, measuring 6.32 meters in diameter, with two opposing entrances. Two stakeholes at one of the entrances may represent a door feature. The additional pits and postholes did not appear to form a coherent structure, but they could have represented other structures within the enclosure.

Three inhumation burials were located immediately inside the bank of the enclosure in the eastern side. The burials consisted of an adult female (dated to AD 678-864) adjacent to a child (dated to AD 780-973), and another adult female nearly 6 meters to the north (dated to AD 672-857).

The faunal assemblage from Rathmorrissy comprised 1,883 fragments, of which 627 were identifiable to species. The assemblage included cattle (57%), caprine (sheep/goat, 9%), pigs (6%), horses (8%), dogs (17.5%), hare (0.5%), deer (2%), and fish (0.6%) (Table 60). The high proportion of dog remains in the assemblage was due to the disposal of whole individuals, as evidenced by semi-articulated skeletons. One of these individuals had evidence of extensive bone growth on the calcaneus, indicating arthritis. Most of the deer remains in the assemblage are antler off cuts (the rest being loose teeth), indicating local craft working but is not evidence of hunting or venison consumption. Four fish otoliths were included in the assemblage and, while species could not be determined, there are several freshwater sources near to the site. Butchery evidence from this site was limited, including a cattle astragalus with fine cut marks (skinning) but the element survival rate, with all skeletal elements represented, suggests the slaughter and butchery took place on site. In fact, a slight overabundance of cranial and distal limb elements might suggest that there was more slaughter than butchery/consumption practiced at this site.

Cattle age at slaughter data was collected through mandibular wear (N = 24) and epiphyseal fusion. While the assemblage included elements from calves and older adults, the peak age for slaughter was between 18-42 months. The analyst interprets these data as representing beef production.

Table 60 Taxonomic distribution for Rathmorrissy, Co. Galway

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	359	58	31	52	110	0	3	10	0	4	0	0	627
%NISP	57	9	6	8	17.5	0	0.5	2	0	0.6	0	0	100.6

Table 61 Diversity and evenness measures for Rathmorrissy, Co. Galway

Heterogeneity	*NTAXA*	*Evenness*
1.29	*8*	*0.62*

Newtownbalregan 6, Co. Louth (AD 790-940)

Excavation at this site, from March-September 2003, ahead of construction of the Dundalk Western Bypass (DWB), revealed a single ditched early medieval enclosure (ringfort) and external souterrain. The site was situated on a well-drained plateau with views of the surrounding pastureland.

The primary phase of activity at the site consisted of the construction of a penannular ditched enclosure, 46 meters in diameter, with an entrance to the east. The ditch measured 3 meters wide by 1.5 meters deep with 17 internal layers comprising occupational debris as well as natural siltation. The distribution of animal bones and artifacts throughout the ditch suggested that there were certain areas within the enclosure dedicated to specific tasks. For example, the greatest concentration of animal remains, and butchery debris was found in the northwestern part of the ditch, suggesting that animal slaughter and butchery took place in this area, and a quantity of domestic artifacts were concentrated in the southern part of the ditch, suggesting that this was the main living area. Artifacts from the ditch included slag, sherds of medieval pottery, decorated glass beads, two decorated copper alloy stick pins, and a decorated copper alloy penannular brooch. The sealing layers of the ditch were deliberately backfilled and, later, a pit was cut into the upper fills of the ditch. An early medieval iron ringed pin and sherds of souterrain ware (pottery) were found within this pit, suggesting an early medieval date for the sealing of the ditch, and digging of the pit. Features within the enclosure included pits and postholes, including four that appear to have formed the corners of a small structure (3.1m x 1m) and a linear arrangement of postholes (3.5m long) that may have formed one wall of another structure.

An extensive souterrain was constructed 5 meters to the southwest of the enclosure ditch. The souterrain measured 46 meters in length and included four galleries and two chambers and internal features including luminary alcoves, an internal door with bolt holes, two air vents, a drop hole, and one capstone with incised decoration. Features like the internally locking door, air vents, and drop hole suggest that the souterrain may have been designed as a place of refuge in addition to being a storage facility. One of the capstones included an incised design with spiral, trumpet, and 'teardrop' motifs as well as diffuse pecking on three of its six sides. The analyst interpreted the art as megalithic art, potentially related to a disturbed Late Neolithic burial but may also have been produced in the Iron Age, as the motifs on the stone resemble motifs from both periods. Artifacts from the interior of the souterrain include sherds of unclassified medieval pottery, dating from when the souterrain was deliberately backfilled. A clay and timber lined pit was constructed immediately north of souterrain with a channel connected to Gallery 1. The pit had evidence of *in situ* burning and was interpreted as a hearth feature to use Gallery 1 as a smokehouse or malthouse after the souterrain had been abandoned. Charcoal from this pit returned a radiocarbon date of AD 790-940.

The faunal assemblage from Newtownbalregan 6 amounted to 439 fragments, comprising 348 anatomical units, of which 319 were identifiable to species (Table 62). The assemblage included cattle (74.6%), caprine (sheep/goat, 7%), pigs (15%), horses (1.3%), dogs (1.6%), cats (0.3%), and deer (0.3%). While all cattle elements were present, a slight overabundance of mandibulae, teeth, and metapodials suggests that either some meat that was butchered on site was transported elsewhere for consumption or that cattle hides (with the metapodia still attached) were brought to the site. Similarly, the predominance of older caprine and the underrepresentation of meat bearing limbs (scapula, humerus, radius, and femur) but evidence of cranial fragments and metapodials suggests that caprine were slaughtered and butchered on site but that the meat was taken elsewhere to be cooked and consumed. Butchery on cattle remains (10.5% of total) indicates that disarticulation and fileting (heavy chops and light cut marks) took place on site. Cuts around the base of a horncore also indicate that horn was used in craft production at this site. Butchery of pig remains suggests meat at the shoulder and upper forelimb was referenced in the faunal report.

Evidence of eburnation and osteoarthritis at the glenoid fossa (articular surface of the scapula) suggests that some of the cattle were used as draught animals. Gnawing on animal remains appears to have primarily been by dogs, supporting the skeletal data that dogs were kept on site. As the only evidence for deer was a single antler fragment, it cannot be concluded that hunting took place at the site or contributed to the diet of the community.

Cattle age at slaughter data was collected through mandibular wear (N = 2) and epiphyseal fusion (N = 10). The assemblage included two juveniles (1-1.5 years old), two semi-mature adults (2-4 years old), one adult (5-8 years old), and one mature individual (8+ years old). The analyst interpreted these data as indicative of a dairy herd.

Table 62 Taxonomic distribution for Newtownbalregan 6, Co. Louth

Taxa	*Bos*	*Cap.*	*Sus*	*Eq.*	*Can.*	*Fel.*	*Lep.*	*Cer.*	*Aves*	*Fish*	*Rod.*	*Misc.*	*Tot.*
NISP	238	22	48	4	5	1	0	1	0	0	0	0	319
%NISP	74.6	7	15	1.3	1.6	0.3	0	0.3	0	0	0	0	100.1
MNI	6	2	5	1	2	1	0	1	0	0	0	0	18
%MNI	33	11	27	6	11	6	0	6	0	0	0	0	100

Table 63 Diversity and evenness measures for Newtownbalregan 6, Co. Louth

Heterogeneity	*NTAXA*	*Evenness*
0.84	*7*	*0.43*

Results

Data Set

The final sample includes data from 31 sites, representing 11 counties, dating from 195 BC to AD 1013. The data for the comparative analysis derives from faunal reports submitted with final excavation reports submitted to the National Monuments Service. Faunal reports were obtained through the archival unit at the National Monuments Service as well as through the Digital Repository of Ireland (DRI). The collection of excavation reports resulted in a corpus of 335 reports from 26 of 32 counties in both the Republic of Ireland and Northern Ireland, UK. Not all the reports resulted in usable data for this study. Therefore, this sample consists only of sites that contain over 300 identifiable fragments of animal bone, from secure contexts that were radiocarbon dated to Iron Age or early medieval period (500 BC – AD 1100), with an emphasis on sites dating to the early to middle part of the first millennium AD, resulting in a sample with a variety of site types and geographic locations. The only exception was Coldwinters, Co. Dublin, for which there were no radiocarbon dates, however the morphology of the site type (settlement-cemetery) is typically confined to the 6th-8th centuries AD.

Site Types

The site types represented in the comparative study fall into three categories: ring ditches, settlement-cemeteries, and enclosed settlements. Ring ditches are defined by an annular or penannular ditch (Waddell 2010). These sites generally fall within a range of 5 and 20 meters in diameter and may contain other features such as banks, mounds, human remains, associated postholes, and hearths, though many contain none of these features. While human remains are not abundant in the Iron Age, the vast majority that are found in the context of features associated with ring ditches, either within pits in the interior space or within the ditches themselves. This has led to the speculation that ring ditches are funerary monuments and that, where human remains are not found, it is because they have been dispersed through later activity (e.g., ploughing). Ger Dowling (2014) has suggested that ring ditches might represent multi-use sites, where settlement and burial both occurred. This suggestion drew on the work of Cooney and Grogan (1994), Brück (1999) and Bradley (2005). The abundance of faunal remains associated with these features might indicate domestic activity but may also represent the remains of funerary feasts. The differentiation between regular domestic activity and small-scale feasting can be difficult (Rowley-Conwy 2018), particularly as ritualized feasting and husbandry practices may mutually reinforce each other in the context of community practices.

Similarly, settlement-cemetery sites contain an abundance of evidence for domestic and industrial debris as well as burial. Limited evidence for postholes at these sites might suggest that their primary function was funerary, however the limited evidence for domestic structures in later enclosed settlements creates further tension between the domestic-ritual dichotomy. Finally, in this study, I refer to any site that is enclosed and does not have evidence for burial of any kind as an enclosed settlement. In some of the literature, later enclosed settlements are referred to as ‘ringforts’ but may also be called ‘*ráth*,’ *dún*,’ or ‘cashels’ (see Chapter 2 for a discussion of the naming convention for these site types). All these terms, in English or in anglicized Irish, highlight the enclosing banks and ditches as fortifications (i.e., ring*fort*). Due to the relative low height of the banks associated with these sites, scholars have debated their efficacy as defensive features (Mallory and McNeill 1991) and so I have chosen to identify these sites as settlements, regardless of their defensive structures.

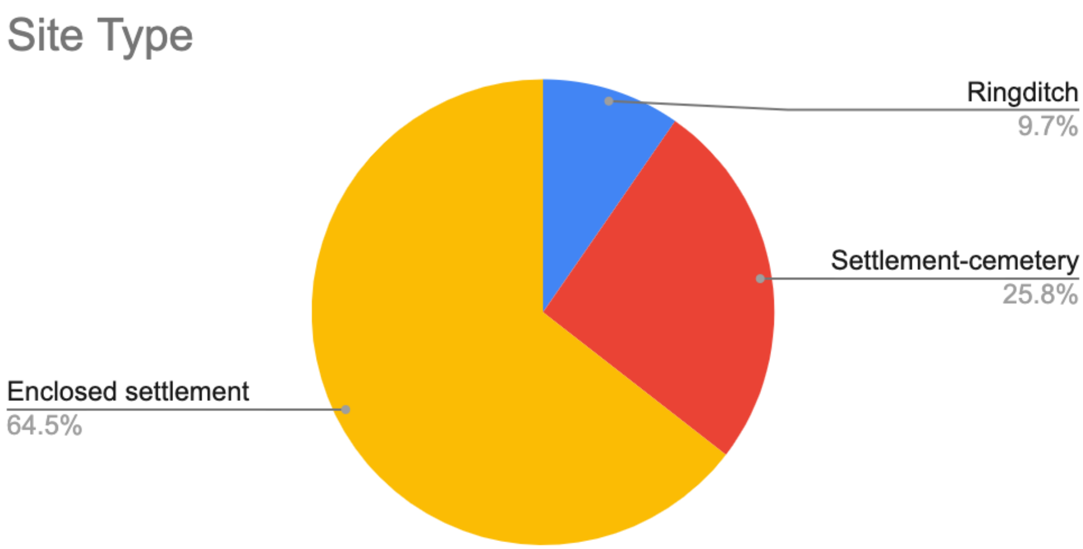

Figure 2 Percentage of site types in the comparative analysis

Of the sample, 9.7% are classified as ring ditches, 25.8% as settlement-cemeteries, and the remaining 64.5% represent enclosed settlements (without evidence of burials). The skew towards enclosed settlements reflects the increased representation of domestic debris in later sites (Figure 2).

Date Ranges

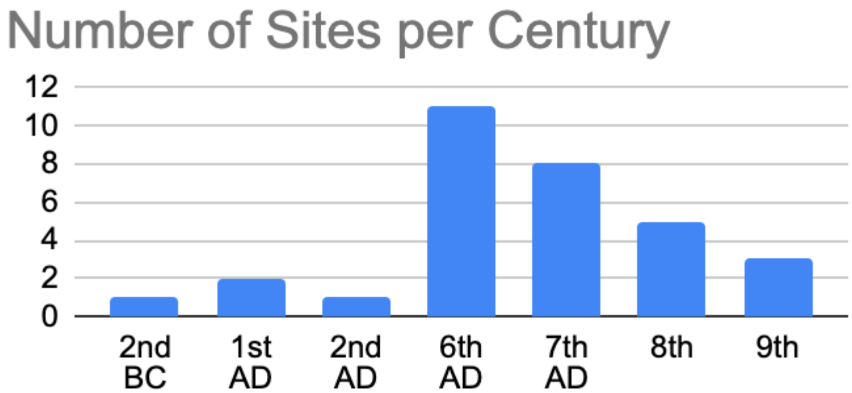

Figure 3 Distribution of sites in the comparative analysis by date (century)

The sites in the sample represent a range of dates from the 2nd century BC through to the 9th century AD. This wide spread of dates is skewed towards the latter end of this range, with most sites dated to the 6th century AD (Figure 3). This is partially due to low numbers of surviving faunal material dating to the 1st-5th centuries AD. While there were several sites that contained animal remains from this period, their total NISP fell below the 300-fragment threshold and so were excluded from the final analyses.

NISP & MNI

To understand the distribution of livestock across sites, and therefore husbandry practices, I have calculated the %MNI and %NISP of the three primary livestock species, cattle, caprovines, and pigs.

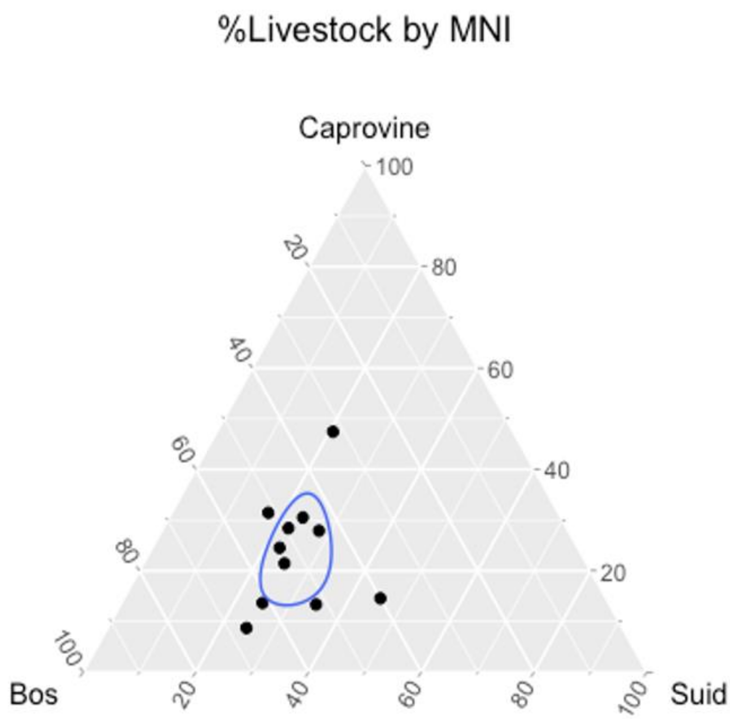

Figure 4 Relative proportions of major livestock species in each site in the comparative analysis by %MNI

This image shows (Figure 4) the distribution of livestock based on the %MNI of the three major livestock species. Following McCormick and Murray (2007), this sample represents only those sites with a total MNI of 40 or greater (11). These sites range from AD 504-690. As McCormick and Murray (2007) found, %MNI shows that these assemblages are cattle dominated (50-60%), followed by nearly equal proportions of pigs and caprovines (20-30%, respectively). These results are also well clustered around the geometric mean, represented by the blue ellipsis.

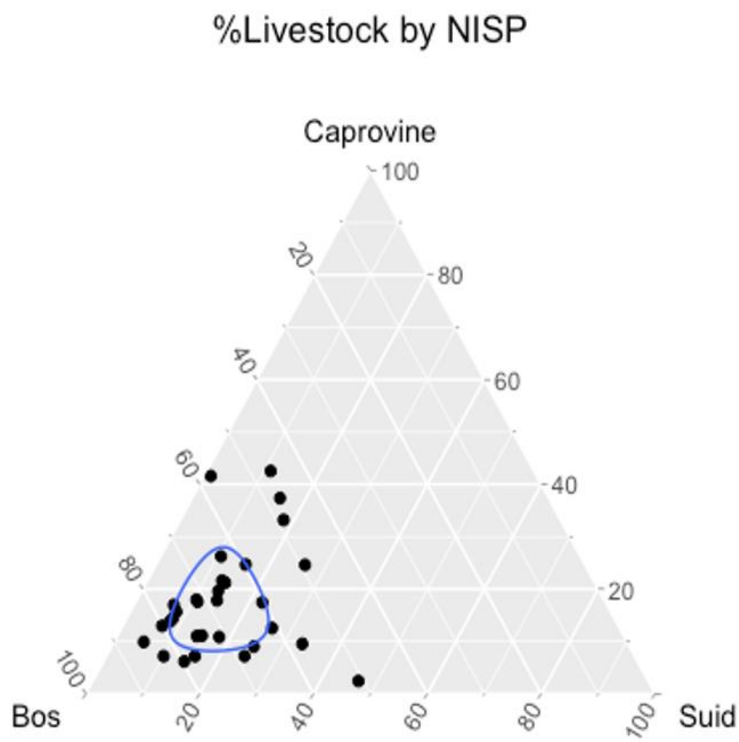

Figure 5 Relative proportions of the major livestock species in each site in the comparative analysis by %NISP

The distribution of individuals across species changes with the use of %NISP rather than %MNI. This graph includes all the sites in the sample as all sites, more than just those that (a) reported MNI counts and (b) had a total MNI of more than 40 individuals. The distribution using %NISP is more skewed to cattle and represents a greater variety of husbandry practices, as evidenced by the greater spread of points and a larger ellipsis (representing the geometric mean of the points) (Figure 5). One possible explanation for the increased representation of cattle using %NISP may be related to fragmentation rates as well as cattle being larger animals, in general. However, the comparison of representation of all three primary livestock species, suggests a greater amount of diversity in husbandry practices.

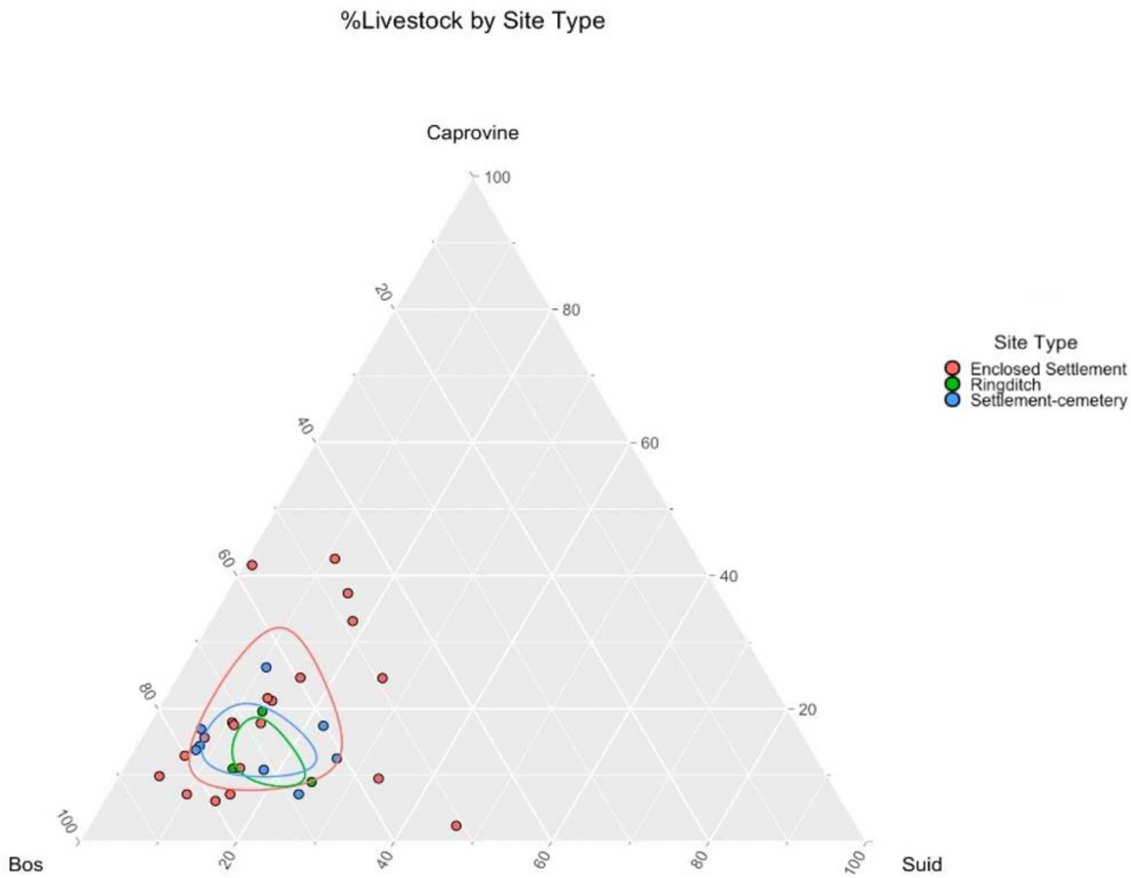

Figure 6 Relative proportions of the major livestock species by %NISP per site in the comparative analysis, differentiated by site type (enclosed settlement, ring ditch, or settlement-cemetery)

When characterized by site type, the distribution shows a distinction in geometric means between ring ditches, settlement-cemeteries, and enclosed settlements. Figure 6 shows that the distribution of livestock at ring ditch and settlement-cemetery sites clusters quite close together. Both site types are cattle dominated (70-80% cattle) with very low percentages of caprovine and pig (10-20%), respectively. Enclosed settlements, however, while still cattle dominated (60-80% cattle), demonstrate a greater variety of animal husbandry practices with caprovine and pigs representing 10-30% of the assemblages, respectively.

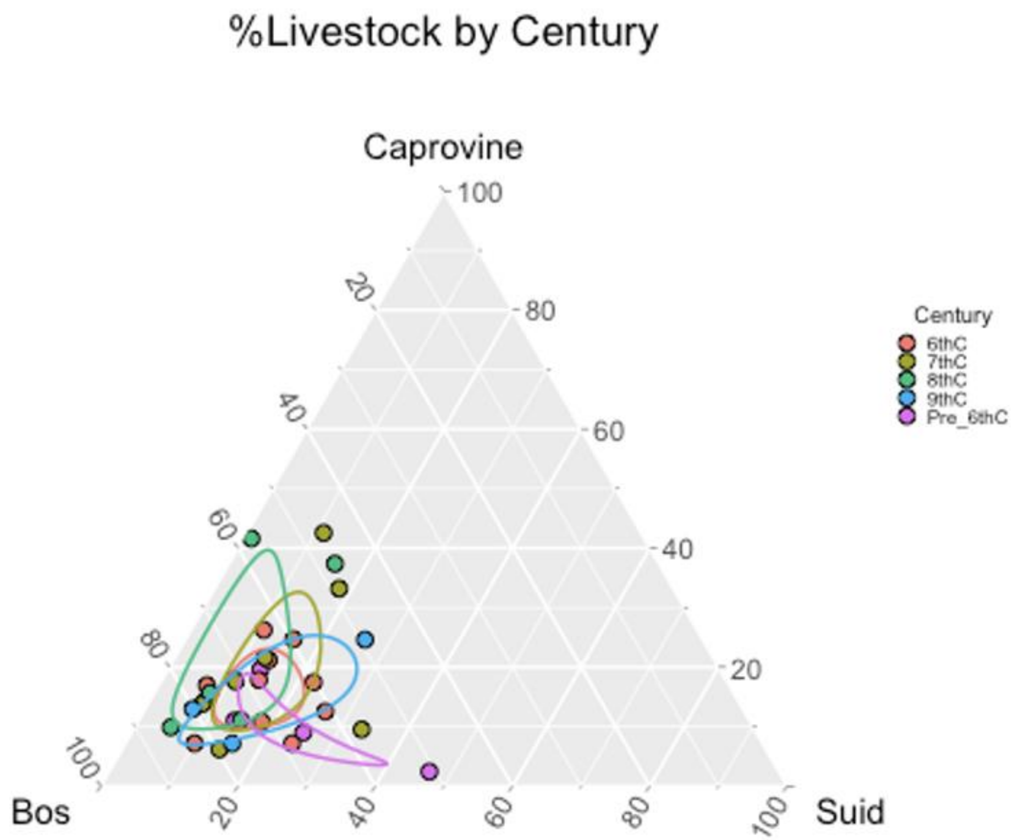

Figure 7 Relative proportions of the major livestock species by %NISP per site in the comparative analysis, differentiated by century

When we compare distribution across time, there are differences in the geometric mean (Figure 7). The earliest sites (pre-6th century) have a greater proportion of pig and are slightly less-cattle dominated than later periods. Sites of the 6th century are tightly clustered around 60-75% cattle, 10-20% caprovine, and 10-25% pig. In the 7th century, there was greater variation in the proportion of cattle (55-80%) and an increase in the proportion of caprovines (10-35%), and the relative proportion of pigs is like the 6th century. In the 8th century, there was even greater variation in the proportion of cattle (55-85%) and caprovines (10-40%). Finally, in the 9th century, cattle represented 75-85% of assemblages, with caprovines only representing 10-35% and pigs representing 10-30% of assemblages. The increase in the proportion of caprovines during the 7th-8th centuries may represent communities supplementing their diet with mutton while exploiting cattle for secondary products.

Heterogeneity and Evenness

Number	*Site*	*Dates*	*∑NISP*	*H*	*e*
1	Claristown 2, Co. Meath	360 – 80 BC	399	1.28	0.66
2	Rathcash East, Co. Kildare	37 BC – AD 123	517	1.2	0.58
3	Ballydavis Site 1, Co. Laois	43 BC – AD 240	852	1.08	0.52
4	Moone, Co. Kildare	AD 130-350	1191	0.95	0.41
5	Collierstown 1, Co. Meath	AD 401-609	553	0.92	0.48
6	Faughart Lower Site 116, Co. Louth	AD 390-641	670	1.37	0.5
7	Baronstown 1, Co. Meath	AD 382-655	4779.5	1.12	0.54
8	Parknahown 5, Co. Laois	AD 410-650	452	1.59	0.77
9	Dowdstown, Co. Meath	AD 420-660	1966	1.1	0.46
10	Killeany 1, Co. Laois	AD 430-650	379	1.39	0.63
11	Bushfield, Co. Laois	AD 420-665	422	0.95	0.49
12	Johnstown 1, Co. Meath	AD 430-665	2977	1.01	0.42
13	Boyerstown 3, Co. Meath	AD 434-671	717	1.2	0.67
14	Borris Site AR 33, Co. Tipperary	AD 400-772	1742	1.32	0.57
15	Coldwinters, Co. Dublin	6th-7th C AD	4207	1.3	0.46
16	Coonagh West Site 4, Co. Limerick	AD 570-680	2763	1.1	0.46
17	Owenbristy, Co. Galway	AD 580-682	776	0.77	0.43
18	Castlefarm 1, Co. Meath	AD 434-870	2319	1.23	0.47
19	Ballintotty Site 2, Co. Tipperary	AD 620-690	467	1.57	0.81
20	Roestown 2, Co. Meath	AD 530-780	4427	1.21	0.51

21	Navan 1, Co. Meath	AD 427-899	601	1.13	0.49
22	Killickaweeny, Co. Kildare	AD 540-800	2283	1.26	0.55
23	Rochfort Demesne, Co. Kildare	AD 610-770	1263	1.35	0.58
24	Borris AR Site 36, Co. Tipperary	AD 636-771	446	1.07	0.55
25	Coneykeare 1, Co. Carlow	AD 651-764	354	0.87	0.54
26	Carnmore West, Co. Galway	AD 576-856	762	1.32	0.57
27	Rahally, Co. Galway	AD 661-773	944	1.49	0.65
28	Ballyvass, Co. Kildare	AD 660-890	2127	1.19	0.46
29	Leggetsrath West, Co. Kilkenny	AD 610-990	582	1.75	0.73
30	Rathmorrissy, Co. Galway	AD 672-1013	627	1.32	0.64
31	Newtownbalregan 6, Co. Louth	AD 790-940	319	0.84	0.43

Table 64 Diversity and evenness measure for all the sites in the comparative analysis

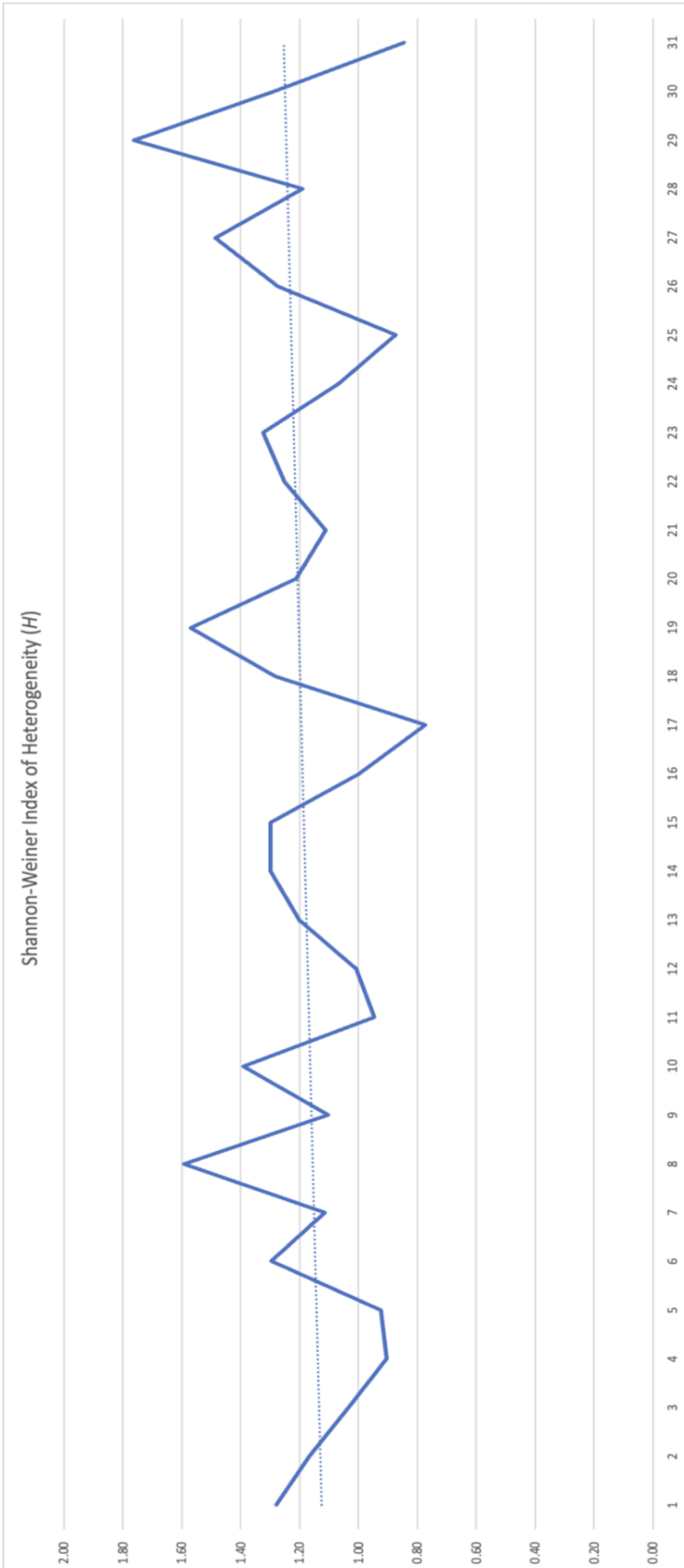

Figure 8 Diversity measures for each of the sites in the comparative analysis in chronological order

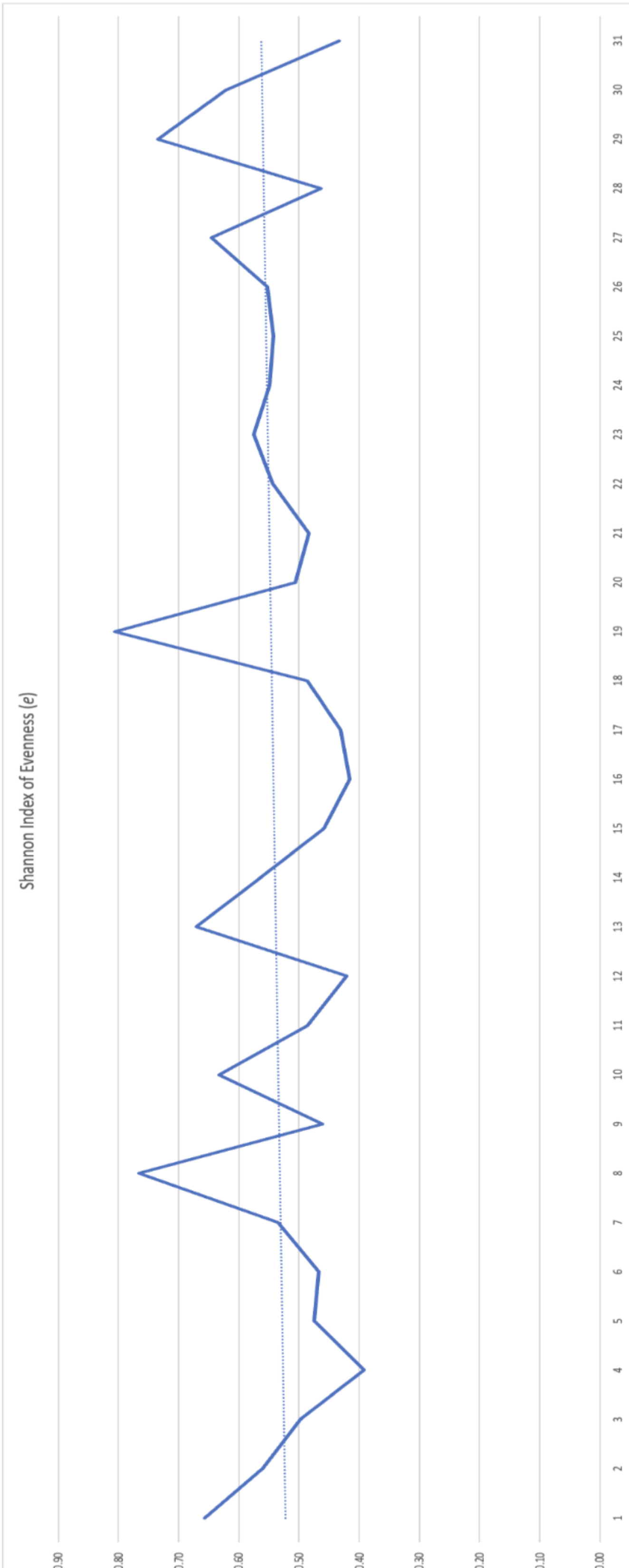

Figure 9 Evenness measures for each of the sites in the comparative analysis in chronological order

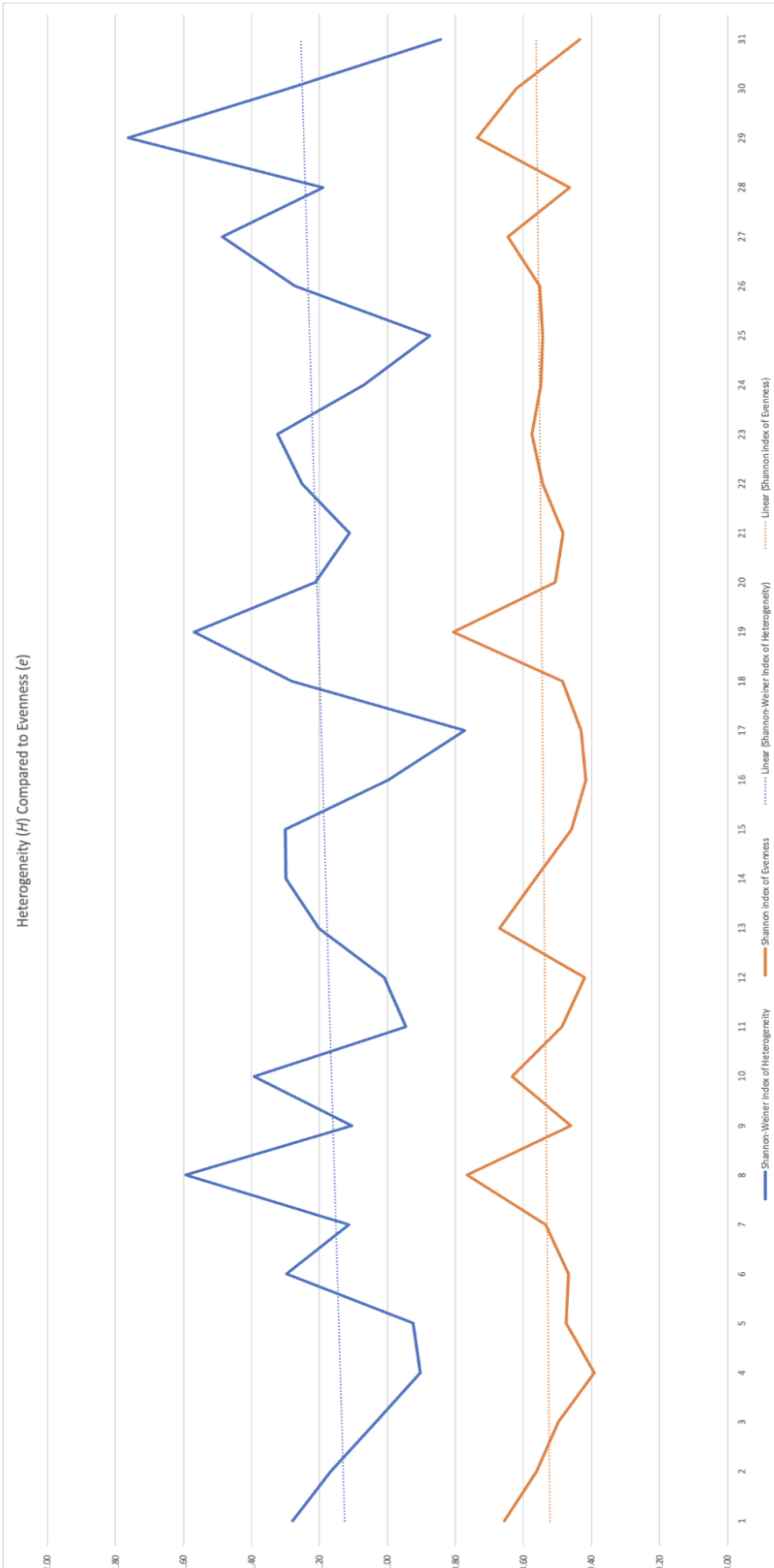

Figure 10 Comparison of diversity measures (above) and evenness measures (below) for each site in the comparative analysis in chronological order

Taxonomic diversity and evenness measures were calculated for each site to understand change in agricultural practices over time (Table 64). These measures, developed in ecology to calculate relative biodiversity, describe the distribution of individuals across the range of identified species, using the Number of Identified Specimens (NISP) as a representation of individuals, as per Lyman (2008). It would be expected that assemblages that have low levels of heterogeneity (less diverse) and low levels of evenness (less even) represent animal economies that are more specialized and assemblages that are more diverse and more even represent animal economies that practiced generalized animal husbandry strategies.

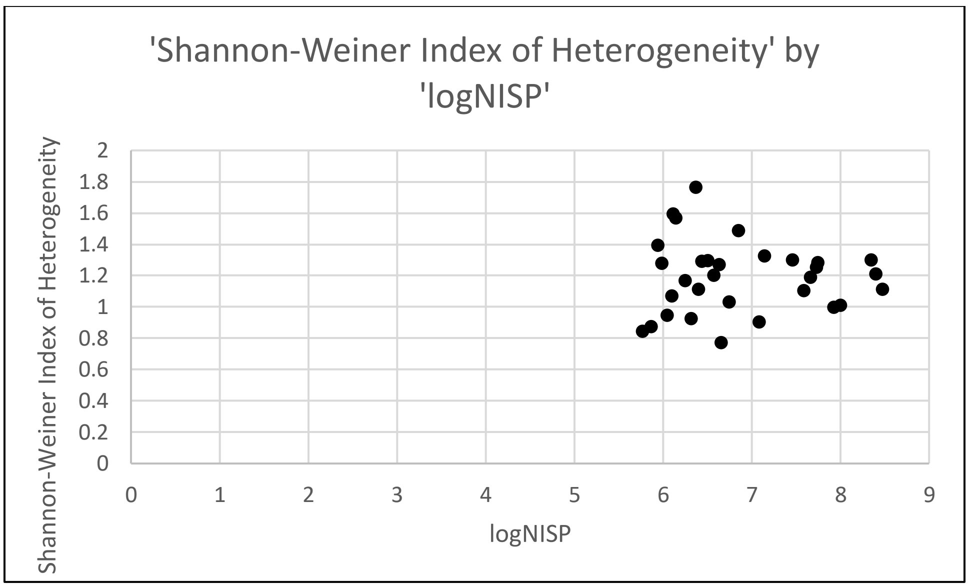

Figure 11 Relationship between the Shannon-Weiner Index of Heterogeneity and logNISP

As heterogeneity and evenness are a function of taxonomic richness, which may be affected by sample size, it is important to test that there is not a significant relationship between sample size and heterogeneity (*H*). As per Lyman (2008), I used regression analysis to ensure that the H values for the comparative sample were not influenced by sample size ($\sum NISP$) (Figure 11). The regression analysis demonstrated that there was no significant influence of $\sum NISP$ on H ($p = 0.876$). Therefore, differences in H are more likely to be a result of differences in practice rather than sample size.

The mean H for the comparative study was 1.2 and the mean e was 0.549. The minimum H was 0.77 and the maximum was 1.75 (therefore a range of 0.98). The minimum e was 0.41 and the maximum was 0.81 (therefore a range of 0.4). While all the values for heterogeneity and evenness fell within a narrow range, this is to be expected in a fully agricultural society that primarily relied on livestock husbandry. Within that narrow range, however, there is some variation in heterogeneity and evenness. When arranged in broadly chronological order, there is a slight trend increase in diversity and increased evenness as observed in the increasing slope in both the measures of heterogeneity and evenness (Figure 8, 9, & 10). This trend is correlated, however, since the regression is not statistically significant for either the Shannon-Weiner Index of Heterogeneity ($p = 0.544$) or the Shannon Index of Evenness ($p = 0.720$). This could reflect a low sample size ($N = 31$). This suggests that, over the course of the first millennium AD, communities exploited a greater variety of species, and their agricultural practices became generalized. There is, however, variability between sites, so rather than representing a direct path to agricultural diversity, there is, instead, greater experimentation in agricultural practices.

Sites with Multiple Occupations

Site	*Dates/Phase*	*∑NISP*	*H*		*e*		*Interp.*
Ardsallagh 1, Co. Meath	Late Iron Age	37.5	1.07		0.77		
	*Early Medieval	101.5	0.95	-0.12	0.69	-0.08	Specialization
Baronstown 1, Co. Meath	AD 172-655	4770.5	1.12		0.52		
	AD 643-937	1011	1.09	-0.03	0.56	+0.04	Mixed
	Phase 3	243.5	1.01	-0.09	0.56	0	
	*Phase 4	183.5	1.01	0	0.56	0	
	*Phase 5	76.5	1.01	0	0.63	+0.07	Mixed
Castlefarm 1, Co. Meath	*161 BC-AD 68	96	1.25		0.77		
	AD 434-870	2316	1.28	+0.03	0.56	+0.21	Mixed
	AD 716-991	1466	1.36	+0.08	0.66	+0.1	Mixed
	AD 1030-1400	598.5	1.26	-0.1	0.57	-0.09	Specialized
Claristown 2, Co. Meath	Iron Age	399	1.14		0.58		
	*Early Medieval	156	0.7	-0.44	0.51	-0.07	Specialized
Dowdstown 2, Co. Meath	AD 420-660	1966	1.1		0.53		
	AD 680-920	2071	1.26	+0.16	0.55	+0.02	Mixed
Parknahown 5, Co. Laois	AD 400-650	452	1.59		0.77		
	AD 650-850	1701	1.43	-0.16	0.69	-0.08	Specialized
Boyerstown 3, Co. Meath	AD 434-671	717	1.2		0.67		
	AD 687-937	685	1.06	-0.14	0.54	-0.13	Specialized
Borris Site AR 33, Co. Tipperary	AD 400-772	1742	1.32		0.6		
	AD 650-856	1945	1.32	0	0.53	+0.19	
	7^{th}-10^{th} C	1533	1.72	+0.4	0.72	+0.19	Mixed
Ballintotty Site 2, Co. Tipperary	AD 620-690	467	1.57		0.88		
	Enclosure B	560	1.43	-0.14	0.69	-0.19	Specialized
Roestown, Co. Meath	AD 550-710	467	1.57		0.88		
	AD 700-900	3863	1.14	-0.43	0.59	-0.29	Specialized
	AD 900-1100	575	1.36	+0.22	0.76	+0.17	Mixed
Rochfort Demesne, Co. Westmeath	AD 610-770	1258	1.33		0.6		
	AD 700-950	1337	1.41	+0.08	0.68	+0.08	Mixed
Johnstown 1, Co. Meath	Ad 430-660	896	0.92		0.47		
	AD 430-660	2081	1.04	+0.12	0.47	0	
	AD 1420-1650	3135	1.33	+0.29	0.55	+0.08	Mixed

Table 65 Relative change in diversity and evenness in sites with multiple phases of occupation. Interpretation based on the relative change in diversity and evenness.

Exploring change in agricultural economies at each site, with some granularity, allows for greater understanding of how individual communities negotiated agricultural change. For sites that contained more than one occupational phase, regardless of sample size, I calculated assemblage diversity and evenness to approach these changes. 13 sites included in the comparative sample had phases of occupation spanning the first millennium AD, rather than just a single phase in the late Iron Age or early medieval period.

Of that 13, five sites had more than one identifiable occupational phase (by radiocarbon dating and stratigraphic analysis), meaning that 32 phases of occupation were analyzed. The interpretations provided in the table above (Table 65) reflect the changes in agricultural strategies relative to stratigraphic changes (occupational changes). If heterogeneity and evenness both decreased, that site was characterized as more specialized, but if taxonomic evenness increased, that site was categorized as more 'mixed' in agricultural strategies. Across all the sites and phases of occupation, four sites became more agriculturally specialized between the 1^{st}-5^{th} centuries AD and four became less specialized. Similarly, between the 5^{th}-10^{th} centuries AD, three sites became more agriculturally specialized, and two sites became less specialized. Finally, between the 15^{th}-17^{th} centuries AD, the one site that had a phase of occupation, Johnstown 1, became less specialized than in the preceding phase of occupation (5^{th}-7^{th} centuries AD).

Five of the phases analyzed did not contain the minimum fragment value threshold (NISP of 300). If those phases that did not contain the minimum threshold value are removed from the sample, then only two sites from the 1^{st}-5^{th} centuries AD became more specialized and four sites became less specialized. Despite the small sample size, and despite the limitation of not being able to determine *in what way* were agricultural strategies specialized (i.e., dairy herding or wool production, etc.), the data above might suggest that there is no clear, island-wide shift in agricultural strategies. Rather, individual communities negotiated agricultural change locally.

Cattle Husbandry

Site	*Dates*	*Site Type*	*N*	*Husbandry*
Claristown 2, Co. Meath	360 – 80 BC	Ring ditch	Unreported	Undetermined
Rathcash East, Co. Kildare	37 BC – AD 123	Ring ditch	25 (MWS)	Beef
Ballydavis Site 1, Co. Laois	43 BC – AD 240	Enclosure, roundhouse, and ring ditches	5 (MWS)	Beef
Moone, Co. Kildare	AD 130-350	Enclosure	30 (MWS)	Dairy
Collierstown 1, Co. Meath	AD 401-609	Settlement-cemetery	23 (MWS)	Beef
Faughart Lower Site 116, Co. Louth	AD 390-641	Settlement-cemetery	Unreported	Dairy
Baronstown 1, Co. Meath	AD 382-655	Enclosed settlement	112 (MWS & TWS)	Mixed/Beef
Parknahown 5, Co. Laois	AD 410-650	Settlement-cemetery	48 (MWS)	Dairy
Dowdstown, Co. Meath	AD 420-660	Enclosed settlement	24 (MWS)	Dairy
Killeany 1, Co. Laois	AD 430-650	Settlement-cemetery	16 (fusion)	Mixed/Dairy
Bushfield, Co. Laois	AD 420-665	Enclosed settlement	35 (MWS)	Mixed
Johnstown 1, Co. Meath	AD 430-665	Settlement-cemetery	12 (MWS)	Dairy
Boyerstown 3, Co. Meath	AD 434-671	Enclosed settlement	18 (MWS)	Mixed
Borris Site AR 33, Co. Tipperary	AD 400-772	Settlement-cemetery	31 (MWS)	Provisioned
Coldwinters, Co. Dublin	6^{th}-7^{th} C AD	Settlement-cemetery	30 (MWS)	Beef

Coonagh West Site 4, Co. Limerick	AD 570-680	Enclosed settlement	80 (TWS)	Beef
Owenbristy, Co. Galway	AD 580-682	Settlement-cemetery	Unreported	Mixed
Castlefarm 1, Co. Meath	AD 434-870	Enclosed settlement	76 (MWS)	Dairy
Ballintotty Site 2, Co. Tipperary	AD 620-690	Enclosed settlement	Unreported	Dairy
Roestown 2, Co. Meath	AD 530-780	Enclosed settlement	49 (MWS)	Provisioned
Navan 1, Co. Meath	AD 427-899	Enclosed settlement	30 (MWS)	Dairy
Killickaweeny, Co. Kildare	AD 540-800	Enclosed settlement	42 (MWS)	Mixed/Dairy
Rochfort Demesne, Co. Kildare	AD 610-770	Enclosed settlement	17 (MWS)	Dairy
Borris AR Site 36, Co. Tipperary	AD 636-771	Enclosed settlement	13 (MWS)	Beef
Coneykeare 1, Co. Carlow	AD 651-764	Enclosed settlement	21 (MWS)	Beef
Carnmore West, Co. Galway	AD 576-856	Enclosed settlement	1 (MWS) 44 (fusion)	Beef
Rahally, Co. Galway	AD 661-773	Enclosed settlement	155 (fusion)	Dairy
Ballyvass, Co. Kildare	AD 660-890	Enclosed settlement	19 (MWS)	Mixed
Leggetsrath West, Co. Kilkenny	AD 610-990	Enclosed settlement	6 (MWS) 44 (fusion)	Dairy
Rathmorrissy, Co. Galway	AD 672-1013	Enclosed settlement	24 (MWS)	Beef
Newtownbalregan 6, Co. Louth	AD 790-940	Enclosed settlement	2 (MWS) 10 (fusion)	Dairy

Table 66 Cattle husbandry strategies for each site in the comparative analysis as interpreted by the faunal analyst

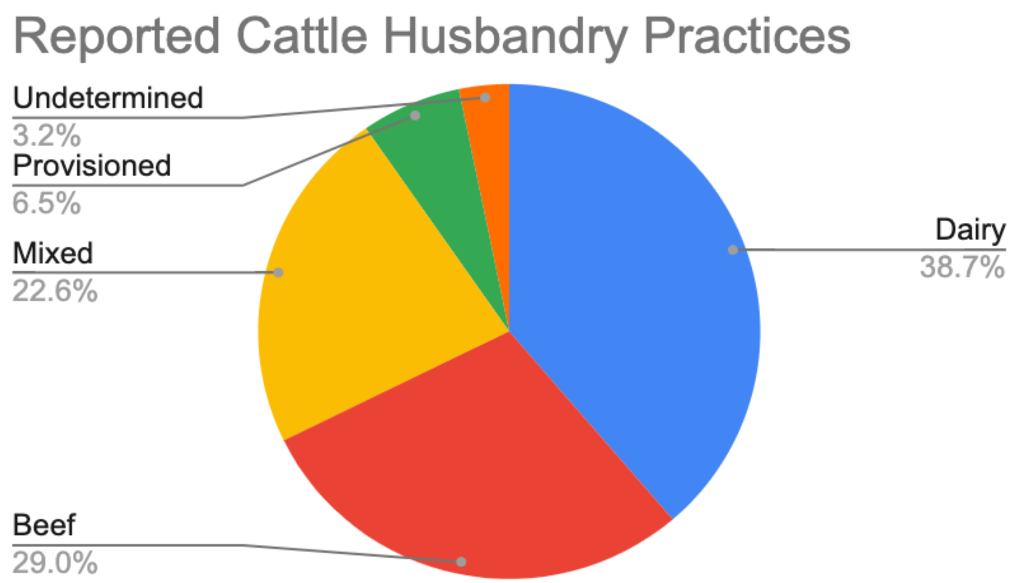

Figure 12 Percentage of cattle husbandry strategies represented in the comparative analysis as interpreted by the faunal analyst

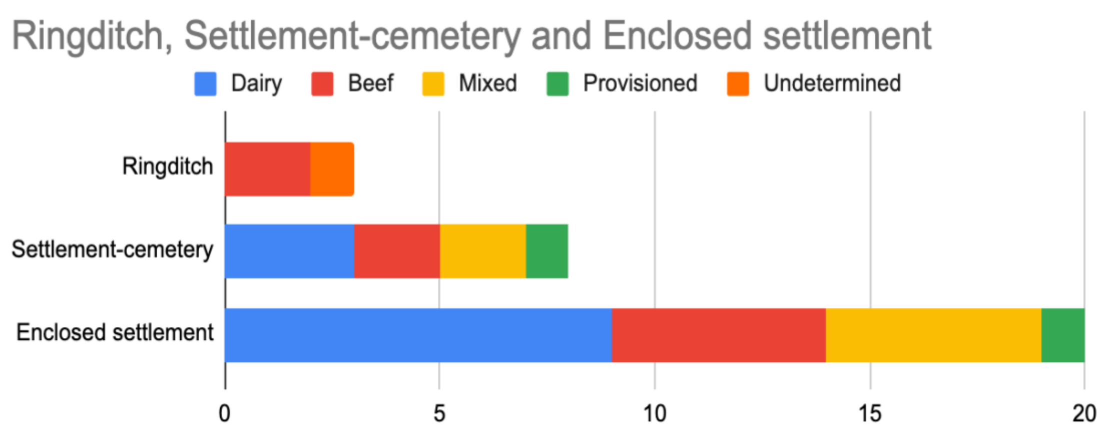

Figure 13 Distribution of sites in the comparative analysis by site type (ring ditch, settlement-cemetery, and enclosed settlement)

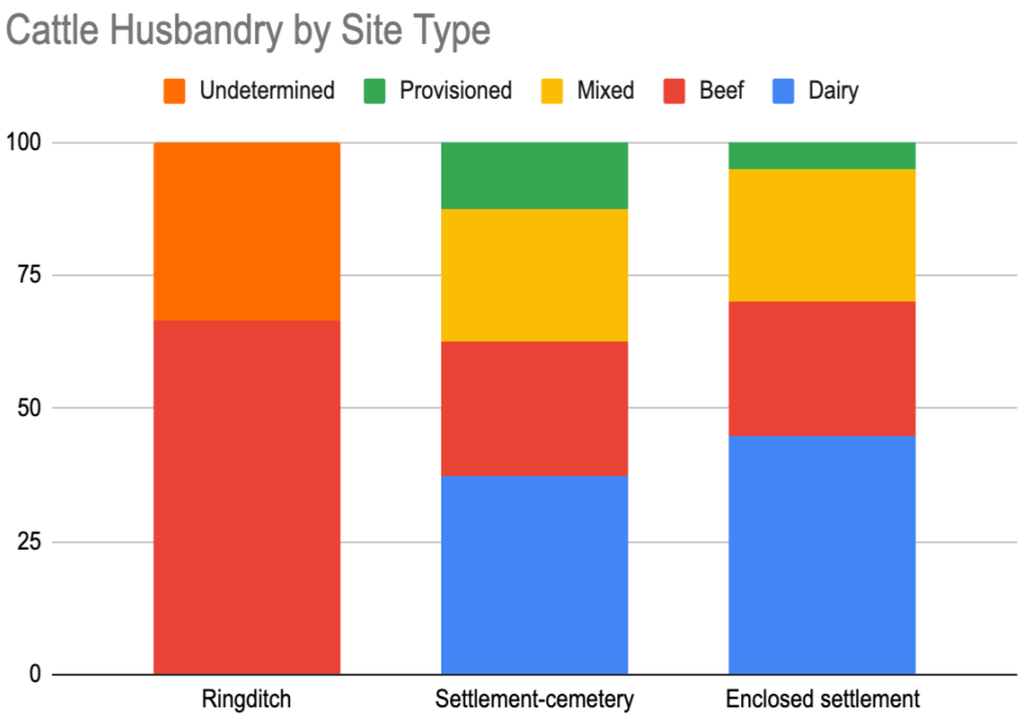

Figure 14 Percentage of cattle husbandry strategies per site type represented in the comparative analysis

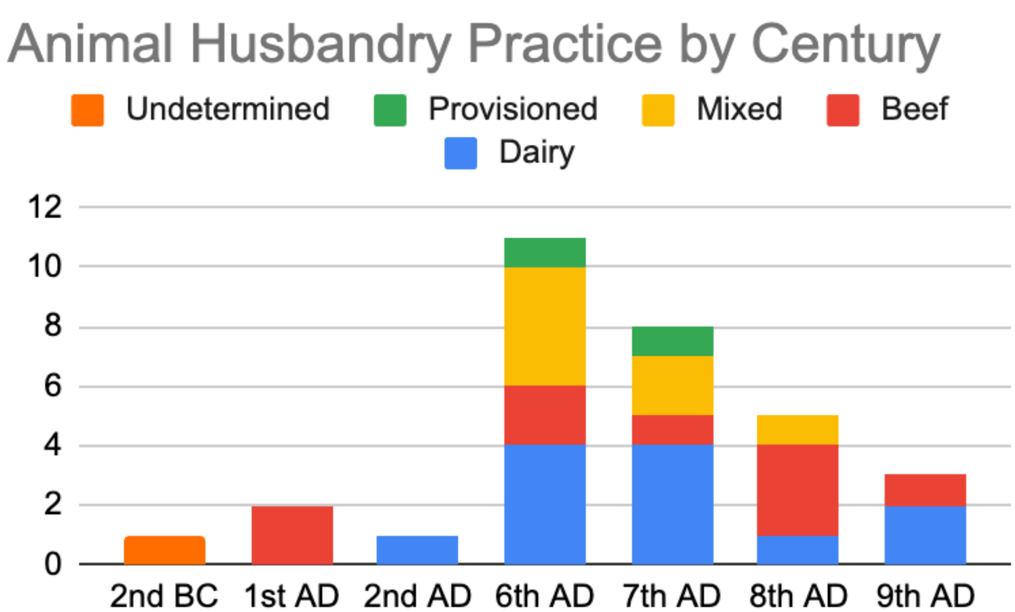

Figure 15 Cattle husbandry practices per century (number of assemblages represented in the comparative analysis)

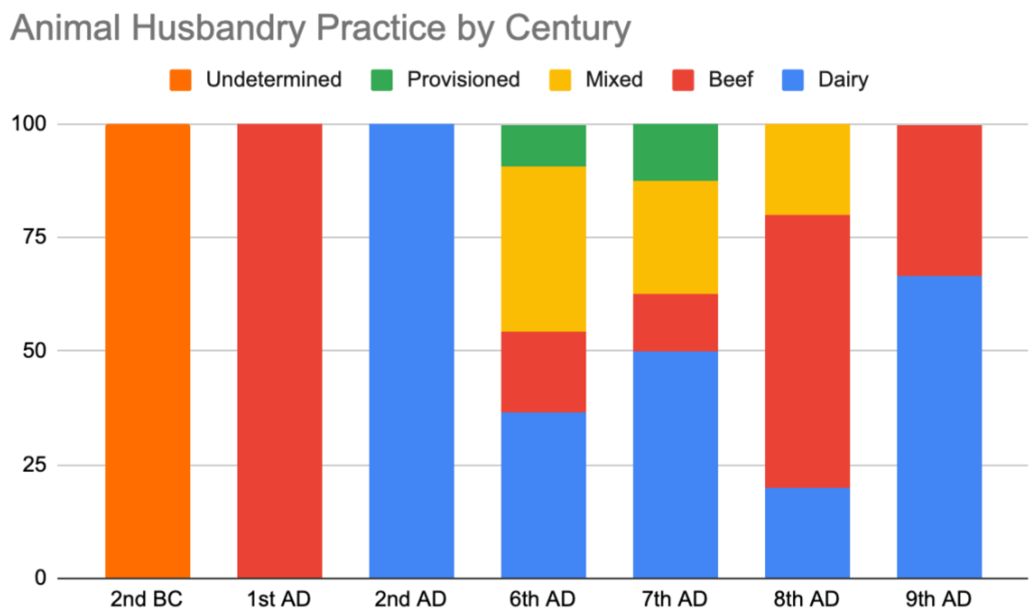

Figure 16 Figure 15 Cattle husbandry practices per century (percentage of assemblages represented in the comparative analysis)

For each faunal assemblage, the analyzing zooarchaeologist interprets the herd demographics in relation to published data as well as in comparison to other sites that they have analyzed to determine the primary agricultural strategy (Table 66). These data allow for cross comparison based on social and temporal context. The reported cattle husbandry strategies include 38.7% dairy herds, 19% beef herds, 22.6% mixed strategies, 6.5% provisioned sites, and 3.2% undetermined (Figure 12). In this context, 'provisioned' sites indicate assemblages that neither represent beef or dairy herding well, but the herd demographics more closely model urbanized sites for which cattle were brought in from the hinterland, rather than being raised on site. Provisioned sites are dominated by mature adults.

These data also show an increase in the visibility of domestic activity in the 6th century AD, which is to be expected, based on the sampling strategy and number of enclosed settlements identified. Over time there are fewer sites that have been identified as representing mixed strategies and provisioned sites. These data suggest that there was increased diversity in agricultural strategies in the 6th and 7th centuries AD, but then less diversity in later centuries. Interestingly, in the 8th century AD, there was an increase in the number of beef herds in comparison to dairy herds (Figure 15).

By site type, these data indicate that ring ditch sites are more likely to be associated with beef herds and none are associated with what might be called a 'provisioned' faunal assemblage. Approximately one-third of settlement-cemeteries are associated with dairy, but the remaining two-thirds include beef herds, mixed strategies, and provisioned sites. Finally, enclosed settlements have a higher proportion of dairying and lower proportion of provisioned sites (Figure 14).

Conclusions

These data set provides some support for prior studies of agricultural change in Ireland during the first millennium AD, but also provides interesting new insights. First, the study of faunal assemblage heterogeneity and evenness suggests that there was increased experimentation in agricultural strategies over time, leading to less specialization in husbandry practices (i.e., exploiting a greater number of species and there was less focus on one species). The comparison of herd demographics suggests that there was increased diversity in cattle husbandry strategies during the 6th and 7th centuries AD, but less so in later centuries. While these two conclusions might seem at odds, the measures of diversity and evenness consider all the species represented in the assemblage whereas the herd demographic data only examines the use of cattle. Therefore, as cattle became less important in the later centuries of the first millennium, there was less concern for specific husbandry strategies.

There are, at this point, perhaps too few sites from the early centuries AD to draw strong conclusions, but the analyzed sites suggest that there were generally low levels of diversity and evenness in each individual assemblage and that, across assemblages, there was some diversity in cattle husbandry strategies. This might suggest that there was a generalized concern for the accumulation of cattle. Further, it is possible that the association with beef consumption at ring ditch sites might represent funerary feasts. Though the relationship between funerary and domestic practices are potentially more complex at ring ditch sites, as many ring ditch sites also have features commonly associated with habitation (pits, postholes, slot trenches, and hearths). These data suggest, however, that there might have been a system of cattle wealth that developed in the later Iron Age, that changed in character during the early medieval period. This change may also be evident in the increased number of mixed and provisioned sites during the 6th and 7th centuries AD.

Together, these data indicate that there was a system of cattle wealth that existed in the Iron Age though the nature of that system changed in the early medieval period. During the 6th and 7th centuries, at the time when most enclosed settlements were constructed, there was a diversity in cattle husbandry strategies, including sites that likely represented seats of power that collected cattle through redistribution efforts. After this period, however, there was decreasing concern for cattle and specific husbandry strategies.

Chapter 6

Faunal Analysis of Ninch, Laytown, Co. Meath

The faunal assemblage from this site primarily consists of terrestrial livestock species (cattle, sheep/goats, pigs, and horses) and commensal species (dogs, cats, and chickens) in addition to wild game, marine fish, and mollusks. For this study, a sample of approximately 50% of the faunal assemblage was analyzed. Random sampling from across the occupation phases provides a representative sample of the fauna at the site. After providing a description of the site, the excavation, other evidence from the site, and the faunal assemblage, I will also describe the demographic characteristics of the livestock species, analysis of pathologies, butchery patterns, and food practices. Finally, I will reconstruct the shifting faunal economies at this site from the late Iron Age through the early medieval period.

Geographical and Archaeological Context

Ninch, Co. Meath is situated on the east coast of Ireland, 150 meters west of the Irish Sea, 300 meters north of the mouth of the river Nanny, and 37.5 kilometers north of Dublin. The site sits on the slope of a low hill overlooking the sea. To the west of the site are low-lying, fertile agricultural lands, producing wheat and pastureland for livestock (primarily cattle).

Archaeological Sites in the Townland and Adjoining Townlands

Ninch sits in an archaeologically rich environment, surrounded by archaeological sites spanning the Bronze Age through the Early Modern Period. In the same townland (Laytown) and in the adjoining townlands, there are 63 recorded archaeological sites and monuments (Archaeological Survey Database – National Monuments Service). These sites include Bronze Age cist burials, burial mounds of unknown prehistoric origins (could be Bronze Age or Iron Age), *fulachta fiadh*, and a short earthwork.

Late prehistoric and early medieval features include several ring ditches that have been identified as cropmarks via aerial photography. Ring ditches are features that consist of at least one annular or penannular ditch and earthen bank. It is generally understood that these features are plowed out burial monuments from the late prehistoric period (Waddell 2010), though there is evidence to suggest that these might have been multi-purpose sites. There is a series of six ring ditches and two enclosures along a low ridge on the south side of the River Nanny, directly opposite an earthwork and burial mound. There are also several enclosures of unknown date in the agricultural fields to the west of Laytown. The medieval landscape includes six ringforts, one souterrain, one kiln, churches, graveyards, and a tower house. These sites suggest an increase in the fortification and consolidation of power in the region. Finally, early modern archaeological features of the region consist of a battery and battlefields.

Excavations at Ninch 3 (02E0017) revealed an unenclosed cemetery containing 37 inhumation burials surrounding a small penannular ring ditch, enclosing five burials. Radiocarbon dates from this cemetery indicate that the primary (enclosed) burials date to the fifth/sixth century AD. An isotope study of two of the primary burials (a male, B28, and a female, B25) suggested that the female burial originated in northeast Ireland, though not from County Meath, and the male originated in central or eastern Europe (Cahill Wilson 2014).

Prior Research

In 1999, during routine archaeological monitoring and excavation of a previously known burnt mound, or *fulachta fiadh*, in advance of the Inse Bay Housing Development, excavators identified a large multi-ditched enclosure and additional associated ditch features. Phase 2 excavations at Ninch began later that year (license number 98E0501ext) to identify the extent of the archaeological features and to mitigate the site. The project was undertaken by Archaeological Development Services Ltd. (ADS) and was directed by James Eogan and Martin Reid from 1998-2000 (Reid 1999, 2000a, 2000b; Reid and Eogan 2000) and Cia McConway from 2000-2001 (McConway 2001, 2002).

Phase 2 excavations expanded the excavation in two areas, North and South, around an unexcavated area that was preserved as a central green space or park. Archaeological features contained within the green space were preserved *in situ* underneath 1m of imported topsoil. Each of the excavated areas were divided into 14 grids of 20x20 meters, totally 156,800m^2. During topsoil stripping, the investigators determined that the multi-ditched enclosure measured 100m north-south and 80m east-west and included additional ring ditches, postholes, gullies, two souterrains (stone lined subterranean passages and chambers) and an inhumation cemetery with cut and stone lined graves. The ditches themselves were waterlogged, preserving organic materials including leather and wooden artifacts. Phase 2 excavations in the South side of the site were carried out from May-August 2000 and excavations in the North side were carried out from March 2001-May 2002.

Archaeological monitoring in the area was carried out by ADS/Cia McConway to the west of the site in August-October 2002 and December 2002-January 2003. 33 areas of archaeological activity were identified, including charcoal spreads, fire-reddened earth, linear features, pits, and two ring-ditches, one of which contained a cremation burial. Artifacts from these investigations included three convex flint scrapers. Excavation in these areas were conducted under excavation license numbers 01E0723ext. and 03E0024. There is a potential that the features uncovered during these investigations may have been related to the archaeological complex at Ninch, but there is no direct stratigraphic or radiocarbon evidence to substantiate those claims.

Like many of the "Celtic Tiger" era archaeological excavations, when excavation was complete at Ninch, ADS began work on other projects prior to full analysis of the archaeological materials. The Celtic Tiger refers to a period of rapid economic growth in Ireland from the late 1990s to 2010. Economic growth during this time also led to development and infrastructure projects, which necessitated archaeological investigation, leading to thousands of excavation licenses being issued every year with little legal oversight to ensure their completion. Requisite post-excavation analysis of archaeological materials was expected to take place in the preceding months and years but the pace of commercial archaeology at the time necessitated that those final analyses were delayed. In 2010, in the wake of global economic crises, the rate of development and construction projects in Ireland dramatically decreased. This had a traumatic effect on commercial archaeological firms, and many went into liquidation. ADS was one such casualty and, in 2014, they disbanded. Unable to continue to curate the archaeological collections in their possession, ADS surrendered all the materials to the National Museum of Ireland. The materials are currently being held at the Swords Collections Resource Centre in Swords, Co. Dublin.

The Cemetery and Burial Population

While most of the archaeological materials have not been fully analyzed, the human remains were analyzed and included as part of the INSTAR Mapping Death: People, Boundaries, & Territories in Ireland project (2008-2010). This project brought together scholars and specialists to gather data on burials in Ireland from the 1st-8th centuries AD. Using these data, the team, headed by Dr. Edel Bhreathnach, sought to interpret burial practices in Ireland, incorporating archaeological, historic, and isotopic information, to better understand the social, religious, and cultural contexts for the different burial practices in Ireland at this time. The osteological analyses were carried out by Laureen Buckley, Mara Tesorieri, and Victoria Park in 2008 and a report on their findings was submitted to the National Museum of Ireland in October 2008 and published in *Death and Burial in Early Medieval Ireland: in light of recent excavations* (ed. Corlett and Potterton) in 2010. In addition to osteological analysis of the human remains, the Mapping Death project obtained C14 dates and isotope analyses for two of the burials at Ninch and these results were published by Jacqueline Cahill Wilson, Christopher Standish, and Elizabeth O'Brien in *Late Iron Age and 'Roman' Ireland* (2014).

At Ninch, excavators identified 79 inhumation burials and a minimum number of 99 individuals. Most of the inhumation graves at Ninch were two stone-lined (linteled), some partially stone-lined, some simple cut graves, and one grave with evidence of wood lining. Most of the graves contained single inhumations, though extended use of the site meant that some graves intercut earlier graves. Much of the inhumations lay in supine positions, oriented east-west or northwest-southeast with the heads in the western end of the grave cut (except for one child that was buried prone and oriented northeast-southwest and one adult in a crouched position). The position and orientation of the burials might suggest that the community followed Christian burial customs, but, during this period in Ireland, the extent to which communities observed Christian traditions was variable (O'Brien 1999).

Buckley, Tesorieri, and Park found that the burials at Ninch consisted of generally incomplete and poorly preserved remains (2008; Buckley 2010). Buckley (2010) suggested that the poor level of preservation was largely due to accidental recutting of graves and later plowing but the underlying high-clay content of the soil also contributed to water retention and increased rates of skeletal decomposition. It is also likely that later reconstruction of ditch features at the site disturbed these burials. This theory is substantiated by the recovery of human remains in other archaeological features of the site and, additionally, from the faunal assemblage.

The burial population was surprisingly older, with juveniles and infants representing only 6% of the total population. The only infant remains were found in the pelvic area of an adult female, though the poor preservation of the remains means that the fetus' developmental stage could not be determined. Among adults, there were slightly more females than males (35% males to 38% females). Biological sex could not be determined for 21% of the burial population. The adult female population appears to have two periods of higher mortality, at young adulthood and older adulthood -- this is consistent with mortality associated with childbirth and aging. The adult male population appears to have only one period of increased mortality in older adulthood, consistent with aging.

The population at Ninch suffered from age-related diseases consistent with an older population. 30% of the individuals at Ninch had evidence of such diseases, including degenerative joint disease and osteoarthritis to the vertebra, wrists, hips, knees, and feet. Such pathologies are often the result of stress on the joints due to physical labor, as is common in an agricultural society. Among those at Ninch, there was also evidence for vertebral compression fractures, which can be caused by lifting heavy weights and some of the individuals with compression fractures also had scoliosis, or a lateral curvature of the spine (Buckley 2010). Aside from age-related diseases, the population at Ninch demonstrated rather few oral diseases (only 14 individuals with dental caries and 5 with tooth abscesses), though evidence of periodontal disease was inhibited by the low levels of preservation, and an antemortem tooth loss rate of 5.6%. Nine individuals also had evidence of enamel hypoplasia, a condition caused by a period of poor health in childhood or nutritional stress that leaves permanent lines on the teeth. Similarly, poor nutritional health, particularly iron deficiencies in the diet, can lead to lesions on the eye orbits or on the parietal bone. These diseases are known as cribra orbitalia and porotic hypoplasia, respectively. There were 11 complete crania (seven male; four female) with examples of cribra orbitalia and 180 crania fragments with evidence of either disease (Buckley, Tesorieri, and Park 2008).

Though the population at Ninch suffered from strenuous physical labor and periods of nutritional stress, there was little evidence of traumatic injury among those buried and Buckley, Tesorieri, and Park (2008) conclude that the rate of interpersonal violence among the burial population at Ninch must have been low. Only 11% of the burial population displayed evidence for bone fractures. Based on the location (to the shoulder, clavicle, and humerus) and type of fracture, most of these fractures can be attributed to accidental falls. That is not to say that such injuries did not cause severe injury, as at least one older male individual had evidence for osteomyelitis, or a bone infection, resulting from a healed fracture due to a fall and anther male individual who suffered a fall, which resulted in permanent damage to his femur and spine and would have inhibited his gait (Buckley 2010).

In their investigations of the cemetery at Ninch, the Mapping Death Project with Jacqueline Cahill Wilson, obtained radiocarbon dates and conducted isotope analyses for two of the burials at Ninch (98E0501ext), a female (F770) and a male (F856). These two individuals were selected because they were the two most geographically central burials and, therefore, likely the two oldest. Both burials dated to the mid-sixth to mid-seventh centuries AD. The female (F770) dates to 562-641 AD and the male (F856) dates to 605-660 AD (Wilson, Standish, and O'Brien 2014). Isotopic analysis of these individuals suggests that neither was raised in the vicinity of Ninch, much less on the island of Ireland. Both individuals had oxygen isotope signatures that were most consistent with central or eastern Europe, though F770 fell just within the acceptable range for Britain as well.

This was consistent with the results from Ninch 3 (02E0017), a penannular ring ditch located 0.6 km away from Ninch 2 (98E0501ext). This site contained 37 inhumation burials, including four individuals (one male, one female, and two juveniles) buried in a single central grave that had been recut and expanded to add additional burials. The male (B25) and the female (B28) were dated to AD 411-538 and AD 478-533, respectively. While the female (B28) had isotopic signatures most consistent with northeastern Ireland, the male, (B25) had isotopic signatures comparable to those in central and eastern Europe. Included in this study was a crouched male burial (F181) from Bettystown, Co. Meath (1.5km north of Ninch), dated to AD 416-538, whose isotopic signature suggests an origin in eastern Europe or even Scandinavia (Wilson, Standish, and O'Brien 2014). These analyses suggest that there were close connections between these populations in eastern Ireland, Britain, and the Continent during this period.

Stratigraphic Analysis

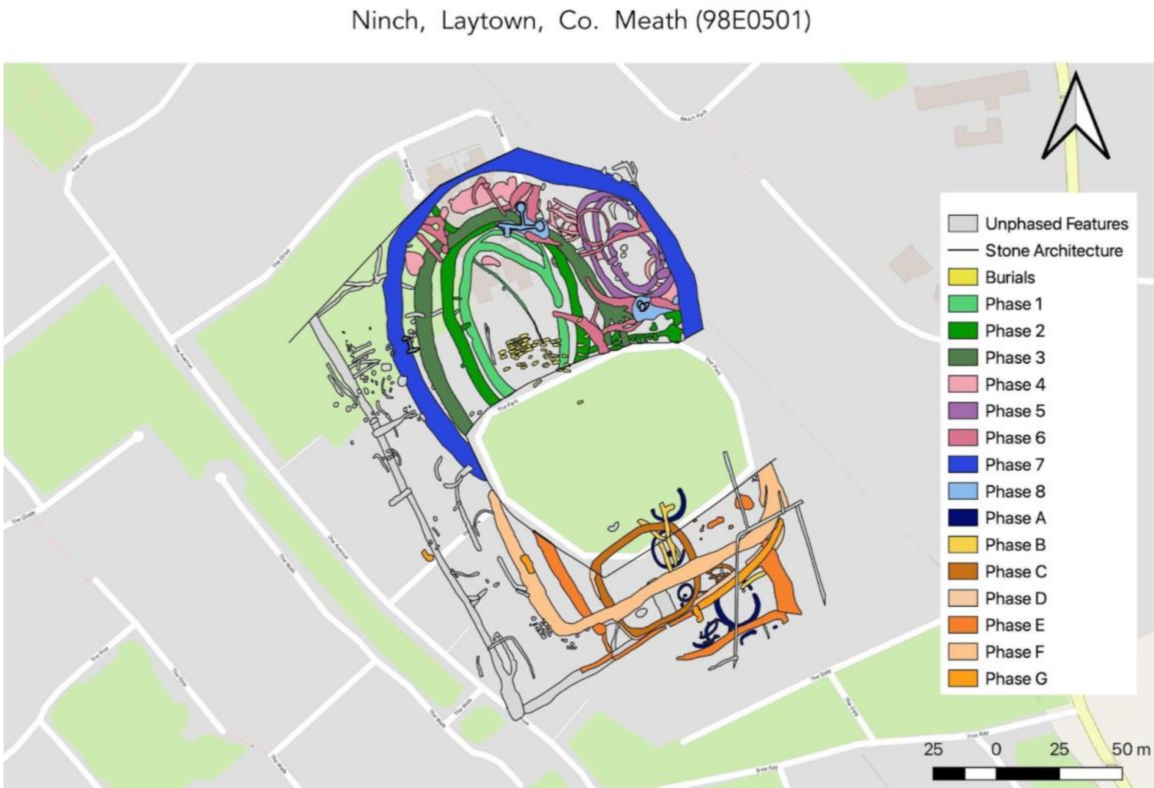

Figure 17 Site plan of Ninch, Co. Meath. Adapted with permission from McConway (2010, Fig. 12.4)

Excavations at Ninch, Laytown, Co. Meath uncovered a large complex of archaeological features from the Late Iron Age to the end of the early medieval period (Figure 17). Features in the North side of the site include several phases of ditch construction, an inhumation cemetery, evidence of habitation and industrial activity, and the construction of a substantial enclosing ditch and two souterrains. Features in the South side of the site consist of several circular ditches and two phases of construction of a sub-rectangular ditched feature. The morphology of the large enclosing ditches in the South side of the site and several Dublin-style ringed pins found in these ditches suggest that this part of the site may have been occupied in the 10th-11th centuries and had a relationship with the Hiberno-Norse communities in Dublin.

Northern Area (Pre-phase 1-Phase 8)
Prehistoric (McConway 2002 preliminary report phase 9)

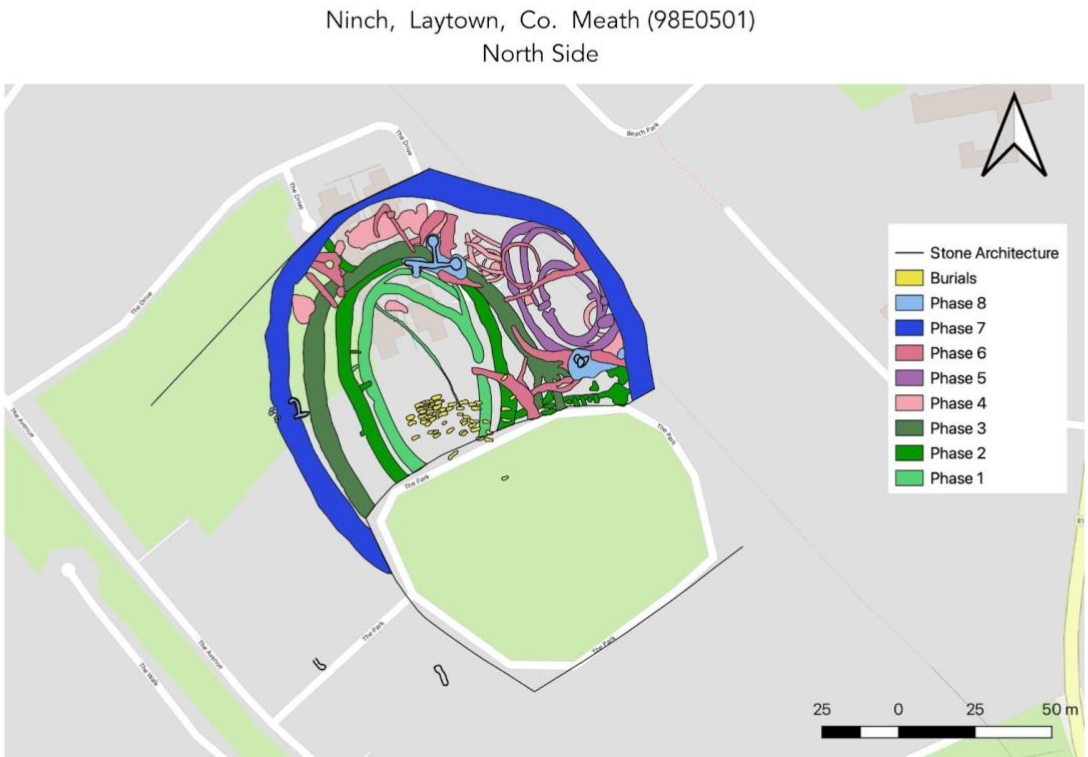

Figure 18 Site plan of Ninch, Co. Meath, Pre-phase 1-Phase 8. Adapted with permission from McConway (2010, Fig. 12.4)

In the north side of the site (Figure 18), the earliest activity on the site consists of a series of curvilinear slots, gullies, pits, and a north-south oriented linear ditch. Bronze Age pottery (Grooved Ware) and animal bone reported from these features but without radiocarbon dates or clear stratigraphic relationships to other features at the site, the phasing of these features is unclear. Early reports suggest that this activity might represent a late Neolithic/early Bronze Age encampment.

Late Iron Age/Transition Period, AD ~300-650, settlement activity (McConway 2001 preliminary report phases 1-3)

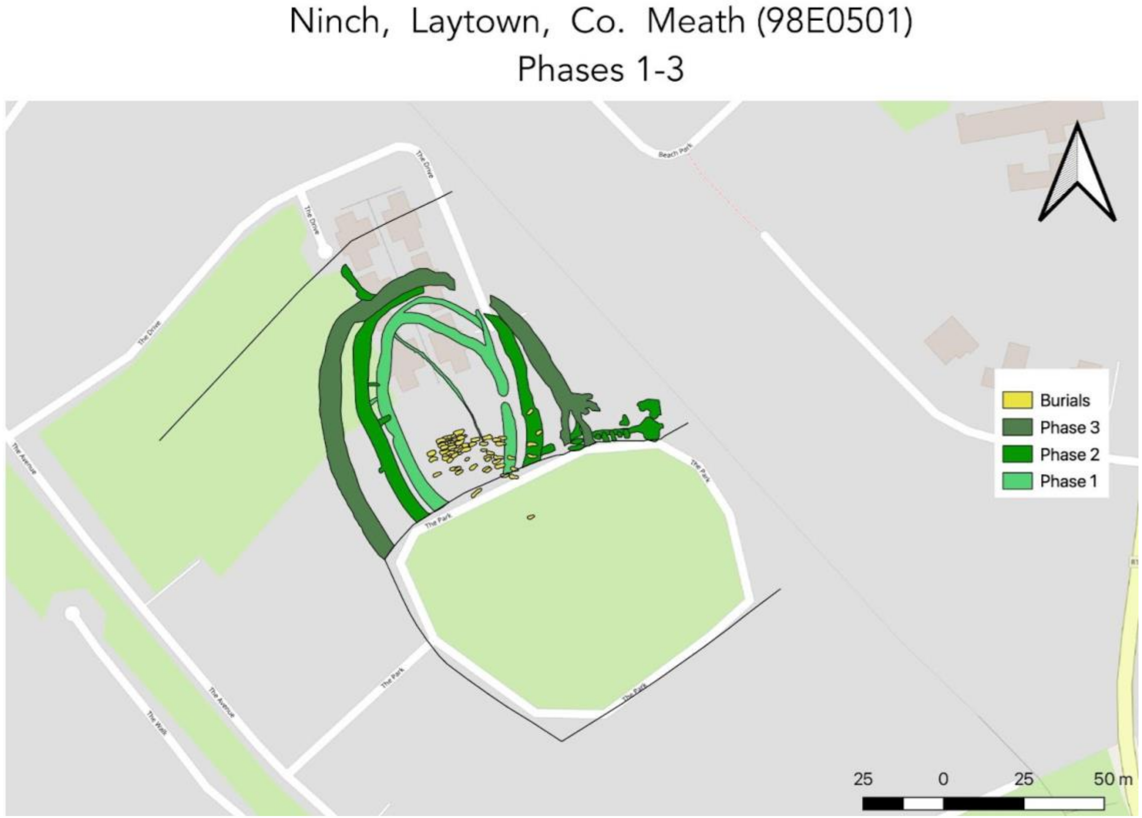

Figure 19 Site plan of Phases 1-3, Ninch, Co. Meath. Adapted with permission from McConway (2010, Fig. 12.4)

Features from periods 1-3 consist of the construction of three largely concentric subcircular ditches and later animal enclosures and settlement evidence (Figure 19). The earliest and innermost ditch (F3449) consists of several linear and curvilinear ditches, measuring 38m N/S by 25m E/W, with an eastern facing entrance, 1.5m wide (McConway Phase 1). This ditch also had a significant recut (F3010). The recut also included the addition of a western facing entrance. Earlier reports indicate that the fill of the inner ditch contained bone comb fragments, fragments of bone points and needles, a corroded knife blade, and E ware pottery in the upper fills (indicating mid-sixth to mid-seventh century AD use). During this project, a cattle tibia from Phase 1 was radiocarbon dated to 545-642 AD (Beta 551679), corroborating the dates indicated by the artifactual remains.

Following the initial ditch construction, an enclosing ditch (F3145) was constructed (McConway Phase 2). The second ditch measures 39m north-south by 34m east-west. The ditch contained fills of thin bands of friable, red/orange and ash-like deposits. The fill of this ditch contained a large quantity of animal bone, shell, metal slag, and fragments of E ware pottery. Pits exterior to the enclosure with similar fills are considered contemporaneous to the construction of the second ditch. One of these pits (3.5m east-west x 1.2m north-south) contained iron slag, burnt clay, burnt bone, and worked wood, suggesting industrial activity.

After construction of the second ditch and evidence for industrial activity, a third enclosing ditch was constructed (F3538) (McConway Phase 3). This ditch measured 43m N/S by 50m E/W, with the eastern side measuring 2m wide by 0.7m deep and the western side measuring 4.8m wide by 1.8m deep, and partially cut the second ditch (F3145) in the north.

The burials were contained within the fourth enclosure and some of the burials were found in the upper fills of the innermost two ditches. Most of the burials were discovered in a 7m x 4.5m area, which the excavators suggest indicating that they may have at one time been enclosed, however there was no evidence of a structure or palisade. Two stone-lined and linteled burials were found to the west of the main concentration of burials. E-ware pottery was found in the fill of some of the burials as well as the enclosing ditch, providing a mid 6th-mid 7th century date for the cemetery (this dating was confirmed through radiocarbon dates of two burials). Other artifacts from the cemetery include a corroded piece of metal (possible blade) found in an older female burial and an annular bronze ring found with another adult female.

Early Medieval settlement activity, AD 700-900 / 8th-10thC (McConway phases 4-8)

Figure 20 Site plan of Phases 4-6, Ninch, Co. Meath. Adapted with permission from McConway (2010, Fig. 12.4)

After the initial enclosures were intentionally backfilled, and an unenclosed settlement was established in the north side of the site (McConway Phase 4) (Figure 20). The settlement consisted of circular house structures (6.5-7m diameter), slots, gullies, and a 48m long cobbled pathway. The cobbled pathway appeared to lead to the annex of House 3 and is suggested by the excavators to have been a formal trackway through the settlement. The preliminary reports also suggest that these structures may have been associated with Phase 2 in the south side of the site, due to unclear stratigraphic relationships.

During or after the construction of the unenclosed settlement, 5 oval enclosures were constructed, interpreted as animal enclosures (due to lack of internal structures and evidence of trampling at the entrance) (McConway Phase 5). These structures increased in size from the earliest (F4874/F4977), 16mx10.5m, to the latest (F3234/F6291), 30.4mx22.5m, and it does not appear that any of these structures were contemporaneous. All the structures had western facing entrances, suggesting additional settlement activity to the west.

McConway Phase 6 consists of additional slots, ditches, and gullies post-dating the establishment of the unenclosed settlement and pre-dating the fourth enclosure. These features include "House 4" (F4613), which at 8.5m in diameter, was larger than the other structures on the site. The ditch fill contained charcoal, crushed shell, and animal bone.

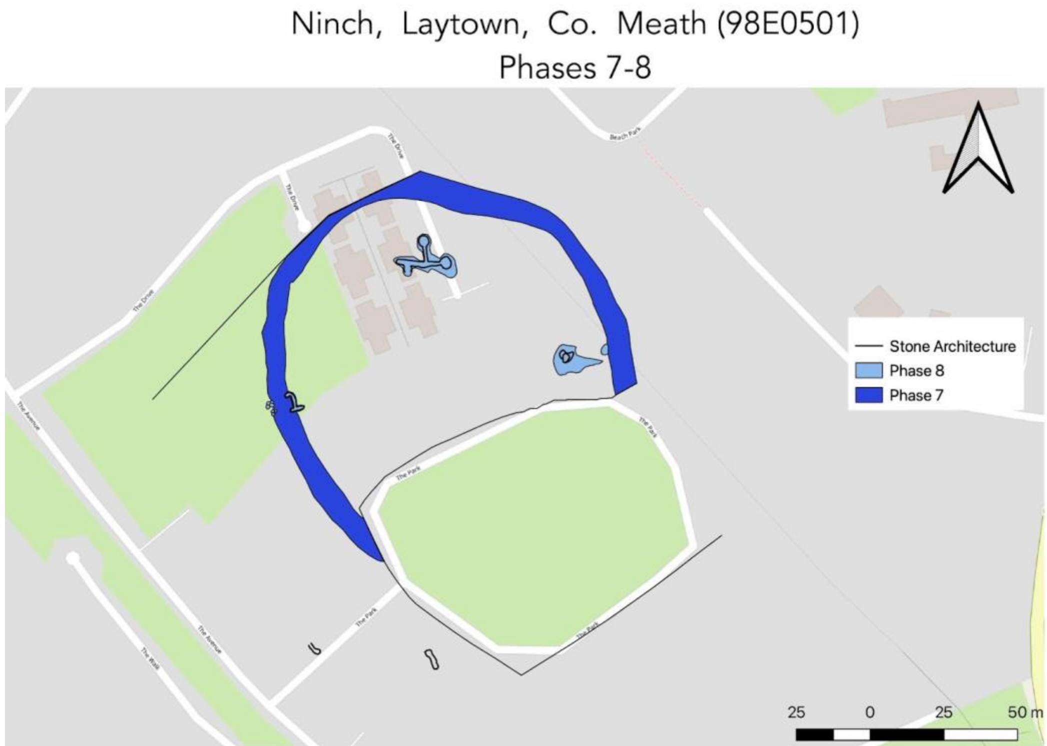

Figure 21 Site plan of Phased 7-8, Ninch, Co. Meath. Adapted with permission from McConway (2010, Fig. 12.4)

Phase 7 refers to the construction of a large, likely penannular enclosure (F4200), measuring 80m E/W by 80m N/S and 5m wide by 2m deep (Figure 21). The ditch cut earlier features (from McConway phases 4-6), which is cut by later pits and a souterrain (McConway Phase 8). The ditch was recut in the west (F1368, 4.4m wide by 1.2m deep) and the eastern side remained flooded during excavation, leading to some organic preservation, including a stave-built bucket.

Two souterrains and a pit interpreted as a fishpond were also constructed during this phase (McConway phase 8). The larger souterrain (F3006) was double chambered and possibly corbelled and cut through the junction of ditches associated with McConway phases 1-4 and 6. The smaller souterrain (F4158) was also possibly corbelled and cut through the upper fills of F4200, the large enclosing ditch. The pit associated with this phase measured 7.5m in diameter and 0.6m deep and contained grey, gritty clays and heavy boulders. During excavation, this pit filled with saltwater and so it is interpreted as a fishpond rather than as a well but could have also represented a cess pit.

Southern Area (Phases A-G)

Prehistoric (Late Neolithic-Bronze Age and late Iron Age-Early Medieval)

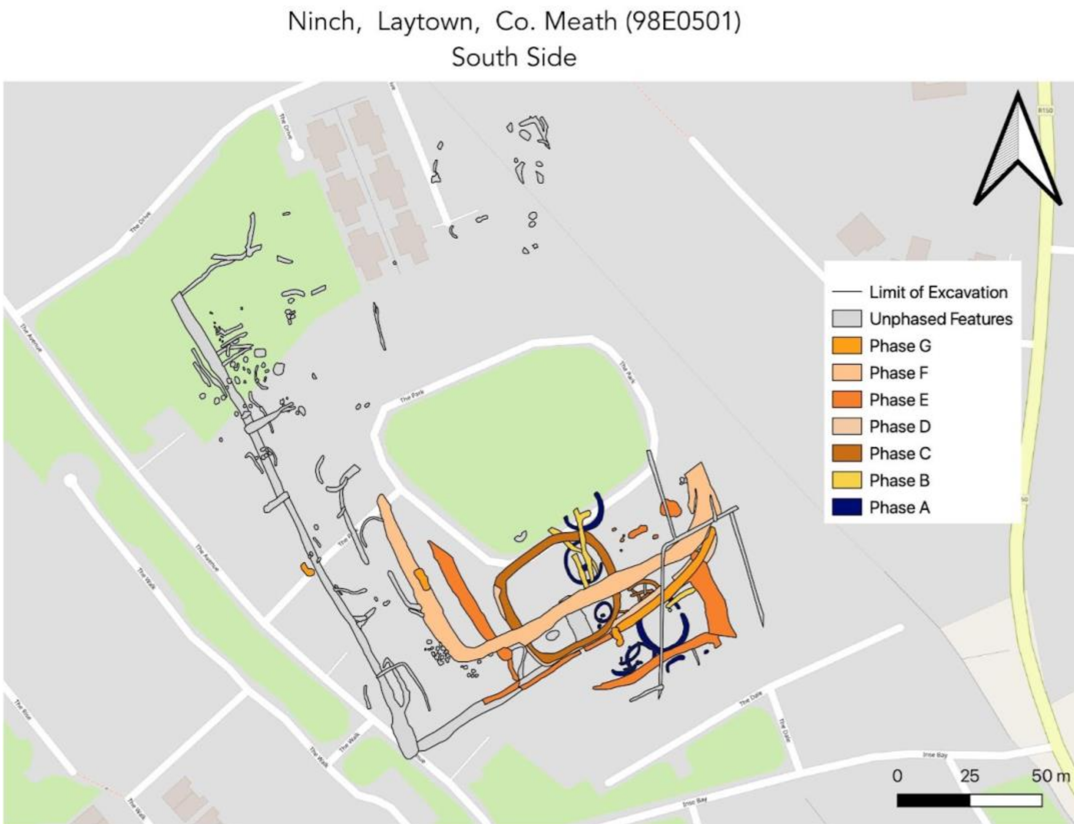

Figure 22 Site plan of Phases A-G, Ninch, Co. Meath. Adapted with permission from McConway (2010, Fig. 12.4)

Phase A in the Southern Area consists of five ring ditches or house slots and associated gully features (Figure 22). These features have, preliminarily, been dated to prehistoric Artifacts from this phase include flint debitage and fragments of late Neolithic pottery. The investigators suggest that this is evidence for a temporary late Neolithic or Early Bronze Age camp in the vicinity

Later Early Medieval

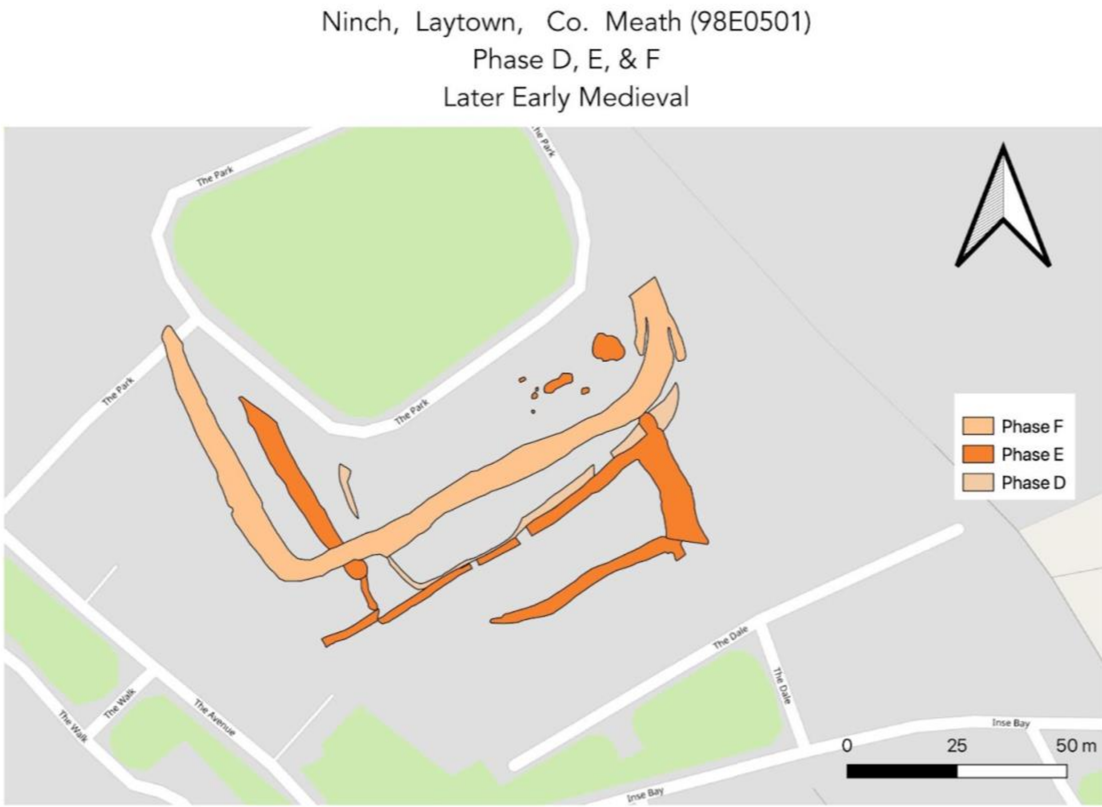

Figure 23 Site plan of Phases D-F, Ninch, Co. Meath. Adapted with permission from McConway (2010, Fig. 12.4)

Overtop of the prehistoric features in this part of the site lay a later Early Medieval (10th-12th century) occupation. Construction of three sub rectangular enclosures (Phases D, E, and F), a north-south oriented linear ditch, and two kilns and associated pits (Figure 23). Enclosure 1, Phase D, (24.6m in diameter) had a U-shaped ditch measuring 2.3m wide and 0.9m deep and a southwestern facing entrance 2m wide. The second enclosure, Phase E, measured 50m x 30m with a V-shaped ditch 1.46m wide x 0.87m deep. The third enclosure, Phase F, measured 80m x 60m with a 3.5m wide and 2m deep ditch. The third enclosure had a significant recut and reconstruction event. Artifacts found in the third enclosure ditch include animal bone and crushed shell, nondiagnostic pottery, a bone pin, a fragment of a jet bracelet, glass beads, and two ring pins dated to the 10th-12th century. The north-south linear ditch also contained a ring pin dated to the late 10th-early 11th century with comparable examples from Dublin. The shape of the enclosures (sub-rectangular rather than circular or sub-circular) and the presence of a Dublin-style ring pin led the excavators to suggest that this phase of occupation at the site may have been settled by a Norse, Hiberno-Norse, or Anglo-Norman community from Dublin. It is, however, also likely that the Dublin-style ring pins had been brought to the site through trade relationships based on exporting food (dairy products and fish) and wool and that the local community adopted a rectilinear style of ditch or fortification through contact with communities to the south.

Two drystone kilns were also constructed during this phase. One of the kilns contained charred wheat and the other, more elaborate kiln, contained glass slag. Large pits associated with this phase of activity at the site contained a lime/ash basal fill and have been interpreted as tanning pits. These features indicate that there was industrial activity at this site, producing valued goods such as glass and leather.

The excavation team concluded that the series of phases of occupation and burial with the inclusions of some fine metalwork and stone, horn, and antler craft production indicates that Ninch had been a locally important place or seat of power. Specifically, the excavation team hypothesized that the settlement at Ninch might have been the *tuath* of the Ciannachta, the name of a community from the region known from historical documents.

Results

I analyzed 25,959 bone fragments, of which 36.7% of the sample could be identified to family group, if not to species (Table 67). Most of the specimens (63.3%) were unidentifiable to a taxonomic level, which reflects carful hand collection as the primary collection strategy but does not reflect soil sample processing (flotation). Of those specimens that could not be identified to taxonomic level, 66% could be identified to size class. Specimens derive from 16 phases of occupation, as determined by the stratigraphic relationships described above. There is also material from unphased features (features without clear stratigraphic relationships to other features) which is discussed separately. There were 10 fragments of human remains, these were likely accidental inclusions resulting from disturbance of the cemetery during later phases of occupation.

NISP
Total

Taxon	*NSP*	*%NSP*	*%NISP*
Bos	5378	20.72	56.39
Caprovine	2167	8.35	22.72
Suid	1114	4.29	11.68
Equid	193	0.74	2.02
Canid	109	0.42	1.14
Felid	321	1.24	3.37
Cervid	19	0.07	0.20
Birds	97	0.37	1.02
Fish	66	0.25	0.69
Rodentia	31	0.12	0.33
Leporid	13	0.05	0.14
Mollusca	19	0.07	0.20
Human	10	0.04	0.10

Large mammal	6084	23.44
Medium mammal	4685	18.05
Small mammal	63	0.24
Unidentifiable	5590	21.53
NISP	9537	
NSP	25959	

Table 67 Fragment counts (NISP) and distribution (%NISP) per taxon for Ninch, Co. Meath

North Side NISP per Period

Taxon	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*2b-6*
Bos	214	329	707	422	115	446	1021	76	195	122
Caprovine	60	156	268	123	42	157	354	25	104	62
Suid	25	71	213	108	25	84	214	11	42	16
Equid	2	3	13	5	1	10	16	12	14	2
Canid	2	11	4	6	15	0	12	4	0	14
Felid	0	0	3	3	0	1	253	0	5	0
Cervid	0	0	0	4	0	2	5	0	0	0
Birds	8	7	7	6	0	4	4	1	18	1
Fish	14	0	3	3	2	2	5	2	18	0
Rodentia	0	0	0	0	0	0	0	0	30	0
Leporid	0	0	4	5	0	1	0	0	0	0
Mollusca	2	1	2	0	0	1	1	0	0	0
Human	0	0	3	4	0	0	3	0	0	0
LG	419	399	981	510	112	366	1054	118	235	118
MD	287	453	715	220	72	207	650	70	357	120
SM	1	0	3	2	19	6	3	2	19	1
UNF	457	482	907	276	70	296	608	16	402	176
NISP	327	578	1227	689	200	708	1888	131	426	217
NSP	1491	1912	3833	1697	473	1583	4203	337	1439	632

Table 68 NISP per Taxon, Pre-Phase 1-Phase 8

South Side NISP per Period

Taxon	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*Unph.*
Bos	52	36	33	46	362	479	140	583
Caprovine	38	155	20	1	83	184	16	319
Suid	12	21	2	20	7	110	8	125
Equid	0	0	1	1	66	38	2	7

Canid	0	0	0	0	37	1	2	1
Felid	0	36	0	0	0	14	0	6
Cervid	0	0	0	0	0	5	0	3
Birds	2	0	0	0	0	11	3	25
Fish	0	0	0	0	1	1	0	15
Rodentia	0	0	0	0	0	0	0	1
Leporid	0	0	0	0	0	1	0	2
Mollusca	0	0	0	0	8	0	0	4
Human	0	0	0	0	0	0	0	0
LG	42	53	23	43	319	448	47	797
MD	33	85	23	79	162	417	31	704
SM	0	1	0	0	0	1	0	5
UNF	47	1	14	0	454	632	102	650
NISP	104	248	56	68	564	844	171	1091
NSP	226	388	116	190	1499	2342	351	3247

Table 69 NISP per Taxon, Phase A-G

MNI

Total

Taxon	*MNI*	*%MNI*
Bos	123	27.64
Caprovine	105	23.6
Suid	76	17.08
Equid	21	4.72
Canid	18	4.04
Felid	12	2.7
Cervid	5	1.12
Birds	31	6.97
Fish	15	3.37
Rodentia	2	0.45
Leporid	5	1.12
Mollusca	18	4.04
Human	3	0.67
Other	11	2.47
Total	445	99.99

Table 70 Minimum Number of Individuals (MNI) per Taxon for Ninch, Co. Meath

North Side MNI per Period

Taxon	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*2b-6*
Bos	3	5	16	9	4	16	18	3	4	4
Caprovine	3	10	9	6	3	15	14	2	7	3
Suid	2	3	11	5	2	8	16	2	5	3
Equid	1	1	2	1	1	1	2	2	1	1
Canid	1	2	1	2	3	0	2	1	0	1
Felid	0	0	1	1	0	1	3	0	1	0
Cervid	0	0	0	1	0	1	1	0	0	0
Birds	2	2	2	2	0	1	1	1	7	3
Fish	2	0	1	1	1	1	1	1	1	0
Rodentia	0	0	0	0	0	0	0	0	1	0
Leporid	0	0	1	1	0	1	0	0	0	0
Mollusca	1	1	2	0	0	1	1	0	0	0
Human	0	0	1	1	0	0	1	0	0	0
Other	0	0	1	2	0	0	3	0	3	1
Total	15	24	48	32	14	46	63	12	30	16

Table 71 MNI per Taxon from the north side of Ninch, Co. Meath

South Side MNI per Period

Taxon	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*Unph.*
Bos	2	2	2	3	4	8	2	18
Caprovine	1	4	2	1	0	8	1	16
Suid	1	3	1	2	1	4	1	6
Equid	0	0	1	1	2	2	1	1
Canid	0	0	0	0	2	1	1	1
Felid	0	3	0	0	0	1	0	1
Cervid	0	0	0	0	0	1	0	1
Birds	1	0	0	0	0	3	2	4
Fish	0	0	0	0	1	1	0	3
Rodentia	0	0	0	0	0	0	0	1
Leporid	0	0	0	0	0	1	0	1
Mollusca	0	0	0	0	8	0	0	4
Human	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	1
Total	5	12	6	7	18	30	8	58

Table 72 MNI per Taxon from the south side of Ninch, Co. Meath

Taxonomic Diversity and Evenness

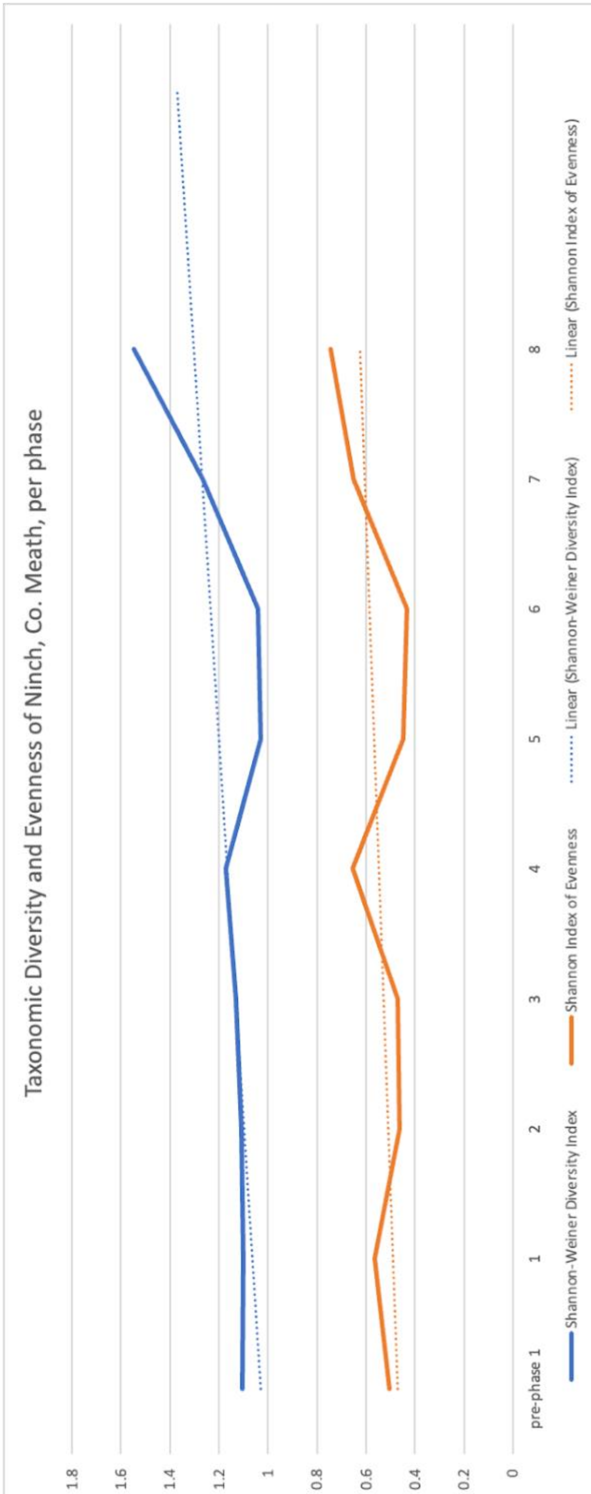

Figure 24 Diversity and evenness measures per phase of occupation at Ninch, Co. Meath

These data indicate that there were simultaneous increases in taxonomic diversity and taxonomic evenness from pre-Phase 1 through Phase 8 in the north side of the excavation at Ninch (these trends, however, were not significantly significant, the Shannon-Weiner Diversity Index $p = 0.1$ and the Shannon Index of Evenness $p = 0.203$). Between each period, however, there is some variability (Figure 24).

Between pre-Phase 1 and Phase 1, there is a slight decrease in the amount of diversity and increase in the amount of evenness, indicating that the number of species represented in the assemblage remained approximately the same while their frequencies became somewhat more evenly distributed. This suggests that animal husbandry practices became slightly less specialized during the initial period of enclosure at the site. Between Phase 1 and 2, taxonomic diversity continued to decrease slightly, and the distribution of frequencies became less even, suggesting that animal husbandry practices became slightly more specialized between the first and second phases of enclosure and this pattern remained somewhat consistent through the third phase of enclosure. After the third interior enclosure ditch was closed and settlement shifted to the east, both taxonomic diversity and taxonomic evenness increased, suggesting that animal husbandry practices became much less specialized during this transitional period. After the initial shift to less specialized practices, there was a return to more specialized practices between Phase 4 and 5, with a decrease in both taxonomic diversity and evenness and this pattern remained consistent through Phase 6. Finally, when the large penannular enclosure ditch was constructed during Phase 7, both taxonomic diversity and evenness increased, suggesting a shift to less specialized practices, with continued increases in taxonomic diversity but slightly less dramatic increases in evenness with the construction of the souterrains in Period 8 (this difference may be due to the nature of/use of the features sampled). These periodic shifts in animal husbandry strategies suggest that the community at Ninch responded to local (and later broader regional) social changes with changes in economic strategies.

Livestock

Cattle (Bos taurus)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Bos taurus	5378	56.39%	2411	123

Table 73 NISP and MNI for Bos taurus

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*2-6*
NISP	214	329	707	422	115	446	1021	76	195	122
MNI	3	5	16	9	4	16	18	3	4	4

Table 74 NISP and MNI for Bos taurus (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	52	36	33	46	362	462	140
MNI	2	2	2	3	4	8	2

Table 75 NISP and MNI for Bos taurus (Phases A-G)

Cattle (*Bos taurus*) represent the largest taxonomic grouping. There was a total of 5,378 identified fragments of cattle from the sample at Ninch. They represents a minimum of 123 individuals and 56.39% of the total number of identified fragments (Table 73). In the north side of the site, there were a total of 82 individuals identified, comprising 3,647 identified fragments (Table 74). The greatest concentrations of cattle remains were in Phases 3, 5, and 6 corresponding to the fill of the outer enclosure and the fill of gully features in the east part of the excavation area. In the south side of the site, there were a total of 23 individuals, comprising 1,131 identified fragments (this figure does not include cattle fragments identified from unphased features or from features whose phasing could not be accurately determined) (Table 75). The greatest concentrations of cattle remains were in Phases E and F, corresponding to the fill of the two sub-rectangular ditch features.

Modification

North	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carnivore*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Décor.*	*Art.*	*Path.*
P1	18	4	7					2	1	1		1				1
1	18	7	5					5								1
2	59	19	15	2	1	3		12	1	1	1					5
3	29	7	11			1		7	1							2
4	11	2	5			2		2								
5	17	4	4		1			6								2
6	69	16	28			1		13	3	1	1	1				4
7	2		1								1					
8	14	5	4		1			2	1							1
Tot	23 6	64	80	1	3	7	0	50	7	3	3	2	0	0	0	16

Table 76 Bone modifications for Bos taurus (Pre-Phase 1-Phase 8)

South	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carnivore*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Decor.*	*Art.*	*Path.*
A	2	1				1										
B	0															
C	1															1
D	0															
E	1	1														
F	24	3	9	2				4	1			2				3
G	1															1
Tot	29	5	9	2	0	1	0	4	1	0	0	2				5

Table 77 Bone modifications for Bos taurus (Phase A-G)

While fewer than 5% of the cattle remains had evidence of modifications, these modifications do indicate several possible uses for cattle at Ninch. Most modifications identified on cattle remains includes chop marks (89), followed by cut marks (69). Evidence of fileting and butchery suggests that beef was consumed at the site, particularly during the second and third phase of enclosure and burial and the final phase of occupation prior to the construction of the large enclosing ditch. Generally, at Ninch, among the cattle remains, there is limited evidence of roasting meat on the bone (8 elements had evidence of roasting), suggesting that most of the beef consumed at Ninch was removed from the bone or that bones with meat still attached were boiled together.

The next most prevalent modification is evidence of carnivore gnawing, mostly by carnivores, likely dogs. This indicates that either that dogs were provisioned with meat and bones or that discard from food production was exposed and dogs were able to scavenge from the debris. There is a possibility that dogs were provisioned at Ninch, as indicated by the presence of carnivore gnawing on bones that did not have cut marks on them (indicating primary access) including femora and one scapula, gnawing on bones that had not been exploited for marrow, and for the relatively low incidence of cattle remains with evidence of rodent gnawing (8), which is an indicator of food discard being exposed prior to burial.

Evidence of pathologies to cattle remains indicates additional uses for cattle beyond their value for meat and suggests that cattle were also used for traction (i.e., pulling plows). Among the cattle remains, there were 21 examples of pathologies across both the north and the south sides of the site. In the north side of the site, there is evidence of osteoarthritis on cattle remains in Phases 2, 3, 5, and 8 on elements including a scapula (OID 4842), radius, distal metapodia, ulna, ilium, and a carpal. In the south side of the site there is evidence of osteoarthritis in Phase C on an acetabulum. Evidence of osteoarthritis indicates that these individuals were of an advanced age and experienced mechanical stress on to their upper and lower limbs, consistent with evidence of trauma due to traction. Further, the evidence of extreme trauma on OID 4842, prior to butchery (evidence of cut marks) on a scapula, suggests that the animal was cared for a significant period post-trauma before consumption (Fig. 25).

Figure 25 Cattle scapula (OID 4842) with evidence of trauma and cut marks

Age-at-Slaughter
North Side per Period (Higham Mandibular Wear Stages)

Age in Months	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*2-6*
<6	0	2	0	1	0	1	0	0	0	0
6-18	1	3	13	2	1	3	4	2	1	0
18-24	1	1	3	5	0	2	4	1	1	0
24-36	0	1	6	0	0	3	8	0	0	2
>36	1	1	5	2	3	2	1	0	1	1
Total	3	8	27	10	4	11	17	3	3	3

Table 78 Number of individuals per age class per Phase, Pre-Phase 1-Phase 8 (Bos taurus)

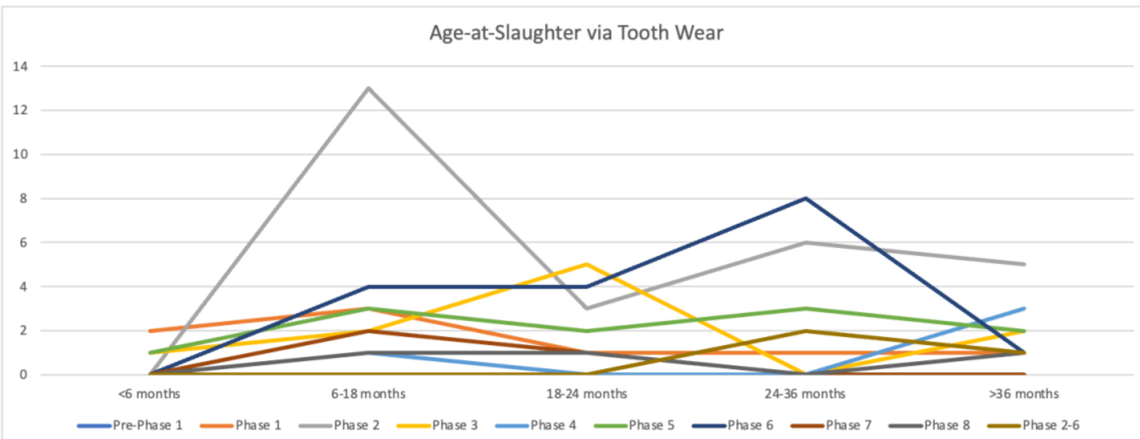

Figure 26 Mortality profiles, Pre-Phase 1-Phase 8 (Bos taurus)

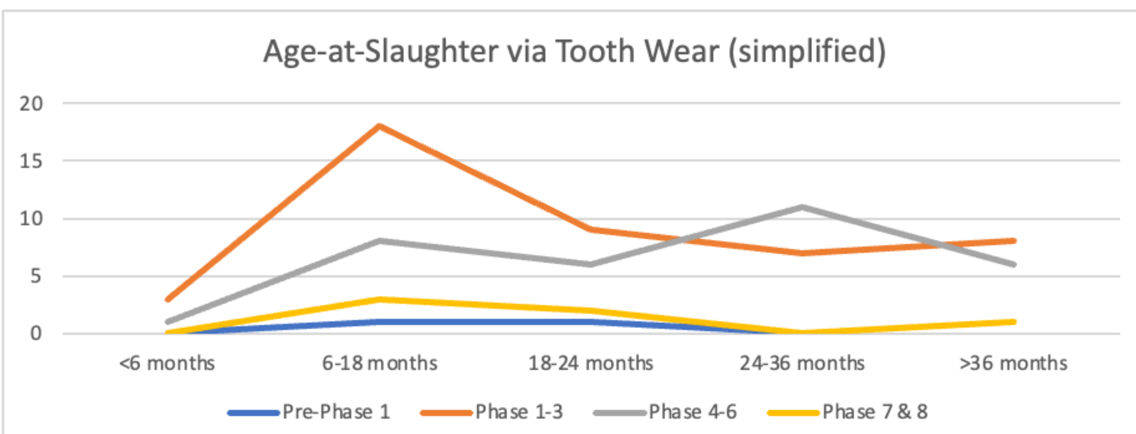

Figure 27 Mortality profiles per simplified Phases (Bos taurus)

South Side per Period (Higham Mandibular Wear Stages)

Age in Months	*A*	*B*	*C*	*D*	*E*	*F*	*G*
<6	0	0	0	0	0	1	0
6-18	0	1	0	1	1	1	0
18-24	1	0	0	0	1	1	0
24-36	0	0	0	2	1	2	0
>36	0	0	0	1	3	1	1

Table 79 Number of individuals per age class per Phase, Phase A-G (Bos taurus)

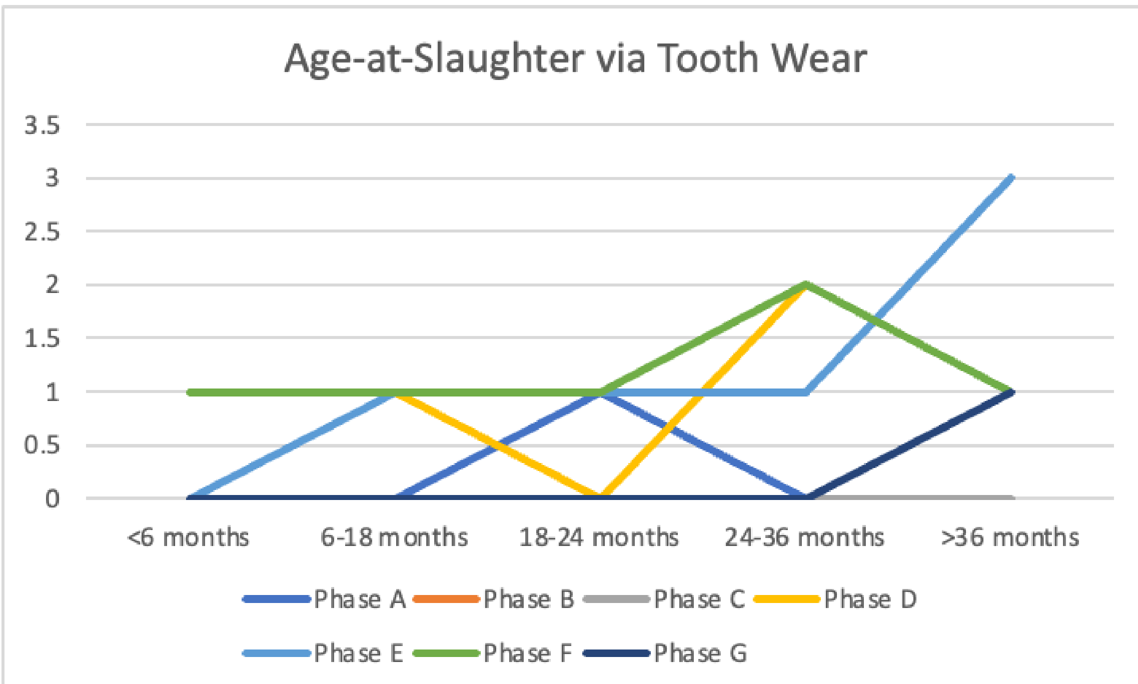

Figure 28 Mortality profiles Phase A-G (Bos taurus)

The age-at-slaughter data, presented in the form of mortality profiles, demonstrate shifts in cattle husbandry practices at Ninch. Broadly, cattle can be utilized for their meat, milk, and for tractions (e.g., pulling plows). Each of these products require different husbandry practices, for example dairy herds are expected to have mortality profiles that reflect a high degree of slaughter for juveniles around the time of weaning (as the presence of juveniles are required for the let down response in cows to produce milk but the cows will then stop producing milk once the young have been weaned).

In the north side of the site, there is a distinction between earlier use of cattle and later use (Figure 26 & 27). In the earlier phases of occupation (Pre-phase 1 through Phase 3), the greatest number of individuals were slaughtered between 6-18 months old. According to Payne (1973), these profiles model expected slaughter patterns for dairy production. In Phases 4-6, there is a shift in husbandry practices and fewer juveniles were slaughtered and the greatest number of individuals were slaughtered between 24-36 months, or prime age adults. This pattern was particularly visible in Phase 6. This slaughter pattern models the expected pattern for meat acquisition (Payne 1973). Finally, during Phases 7 and 8, there appears to be a shift back towards dairying, unfortunately there were too few mandibles available to confirm this pattern. Additionally, evidence of very old individuals in the north side of the site may be recognized by the identification of osteoarthritis and ossified floating ribs. Evidence of osteoarthritis was identified on elements in Phase 1 (1 element), Phase 2 (5 elements), Phase 3 (2 elements), Phase 5 (2 elements), Phase 6 (4 elements), and Phase 8 (1 element) and ossified floating ribs were identified in Phases 1 and 2. Neonatal bovid remains were also identified in Phases 3 (1), 6 (20), and 8 (187), suggesting that young were being raised on site during these phases.

In the south side of the site (Figure 28), broadly, the patterns of slaughter in the south side of the site suggest that meat was being produced, however there were few mandibulae available to age cattle accurately. In Phase F, the identification of neonatal bovid remains indicates the young were raised on site during this phase.

Sex Distribution

North Side per Period

	Pre-1	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*2-6*
Male	0	0	1	0	0	0	3	0	1	1
Female	2	2	1	0	0	0	1	0	1	0
Indeter.	0	1	1	2	2	2	4	0	0	2

Table 80 Sex distribution per Phase, Pre-Phase 1-Phase 8 (Bos taurus)

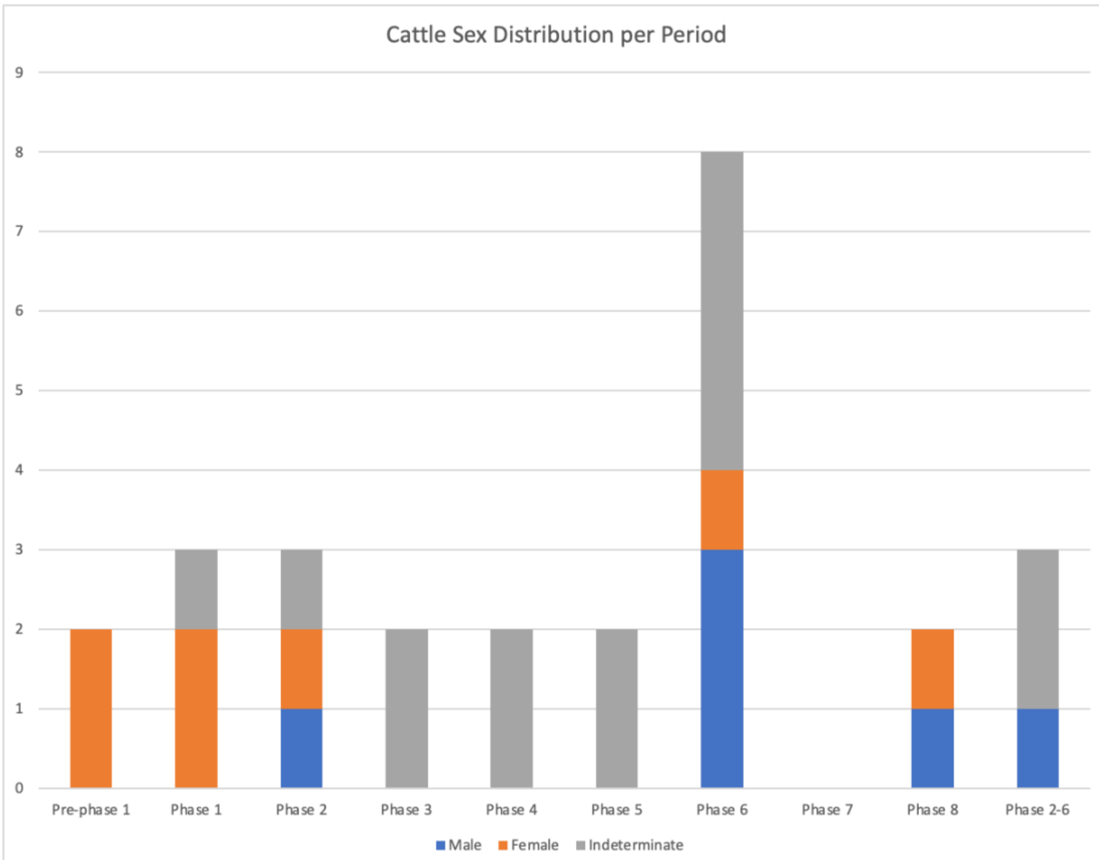

Figure 29 Sex distribution per Phase, Pre-Phase 1-Phase 8 (Bos taurus)

South Side per Period

	A	*B*	*C*	*D*	*E*	*F*	*G*
Male	0	0	0	0	0	1	0
Female	0	0	0	0	1	0	0
Indeterminate	0	1	1	0	1	2	2

Table 81 Sex distribution per Phase, Phase A-G (Bos taurus)

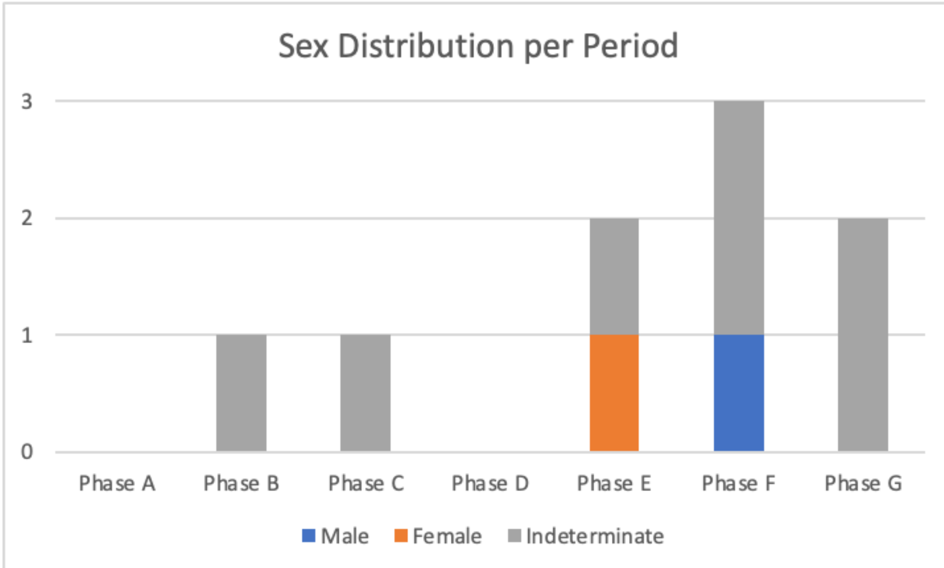

Figure 30 Sex distribution per Phase, Phase A-G (Bos taurus)

In cattle, there are few sexually dimorphic features, meaning that the sex of the individual can be estimated by the presence/absence or dimensions of certain features. One such feature includes metacarpal distal breadth (Bd). To limit the possibility of double counting individuals, in each phase, only one side was counted (either right side or left side metacarpals).

In the north side of the site (Table 80; Figure 29), there are distinct differences in sex ratio among the cattle at Ninch. In Pre-phase 1 and Phase 1, there are no positively identifiable males. In Phase 2, there were equal numbers of identified females and males. None of the individuals in Phases 3-5 could be identified as either male or female. In Phase 6, there was a shift and there were more males identified than females (3:1) and in Phase 8, an equal number of males and females were identified. These data indicate that there was a greater ratio of females to males in Pre-phase 1 and Phase 2, possibly through Phase 5 (though sex could not be accurately estimated) and then in Phase 6 there was a shift in ratio such that there was a greater number of males to females in the herd.

In the south side of the site (Table 81; Figure 30), there were fewer metacarpals available for sexing (due to both a smaller sample size and a greater number of broken elements). Most of the measurable metacarpals fell within the ‘indeterminate’ range and therefore cannot support or refute interpretations of cattle husbandry practices.

Cattle Overview

As indicated by the high percentage of identified fragments and the minimum number of individuals at Iron Age and early medieval sites, cattle are the most important livestock species among agricultural communities. Broadly speaking, cattle provide milk, meat, and traction (i.e., the ability to pull a plow).

Cattle (their rearing, trading, theft of, value of, and consumption of) are of major concern in the early Irish literature and law texts (See Chapter 2 for a more detailed discussion). These sources provide us with insights into early medieval cattle husbandry practices. For instance, according to the story *Longes mac nUislenn*, the sons of Uisliu could sing to cows to increase their milk yield. Aside from this example, the sources indicate that milking was performed twice a day, primarily by women (though male individuals were also mentioned as performing this task), collected in a wooden pail, and that the rights of the farmer to the milk produced from his cows were protected. In addition to milking practices, the texts indicate that cattle were moved between summer (upland) and winter (home) grazing pastures and, in the Life of Saint Cóemgen, the summer pastures for a wealthy farmer in *Míd* (Meath), could be as far south as the Wicklow Mountains (Kelly 1997). Although Costello (2015) notes that evidence for regular transhumance practices, ‘booleying,’ do not appear in historic texts or the archaeological record until much later, either in the high medieval period or early modern period. Interestingly, the law tracts reveal some cooperative strategies (as opposed to collective strategies) practiced by less-wealthy farmers, including joint herding, joint plowing, and bull-loaning, with the offspring of bull-loaning belonging explicitly with the owner of the cow and not the bull (Kelly 1988, 1997).

At Ninch, cattle represent 56.39% of the total identified faunal assemblage. At comparable Iron Age sites, cattle represent between 49-69% of faunal assemblages and between 26-77% of faunal assemblages dated to the early medieval period. There is some variation in the relative importance of cattle at Ninch (as suggested by %NISP), with Pre-Phase 1 representing the highest percentage of cattle (71%) and Phase 5 representing the lowest percentage of cattle 48%).

The age-at-slaughter, sex distribution, and modification data suggest that cattle were primarily raised for their meat and milk at varying points. The simplified mortality profiles (with Phases grouped by occupational patterns) indicates dairy production during the earlier phases of occupation, a shift towards beef production with the closing of the enclosure and cemetery and movement of the settlement to the east and north, and finally a mixed strategy with the construction of the large enclosure ditch and souterrains. Between each phase of occupation however, there is variability within these broad categories. Pre-Phase 1 through Phase 2, it appears that dairy was the primary focus of cattle husbandry practices (particularly in Phase 2), then from Phase 3-5 there is some variability in husbandry practices indicating mixed husbandry, the data from Phase 6 strongly suggests beef production, and finally Phases 7 and 8 represent mixed husbandry practices.

Examining husbandry practices during each of the occupational phases provides insights into the choices made by the community as social and political relationships similarly shifted. This also reflects broader island-wide patterns as noted by McCormick *et al* (2011), suggesting that there was a decline in the importance of cattle and increasing levels of cereal grain production. This study, however, provides greater insight into the individual choices of the community than suggested by McCormick *et al* (2011), which broadly recognizes a livestock economy focused on dairy production. These data demonstrate that the livestock economy at Ninch fluctuates between dairy, beef, and mixed agricultural practices associated with shifting social and political relationships.

Caprovines (Ovis aries and Capra hircus)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Caprovine	2167	22.72%	1175	89

Table 82 NISP and MNI for Caprovines

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	60	156	268	123	42	157	354	62	25	104
MNI	3	10	9	6	3	15	3	14	2	7

Table 83 NISP and MNI for Caprovines (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	38	155	20	1	83	184	16
MNI	1	4	2	1	0	8	1

Table 84 NISP and MNI for Caprovines (Phase A-G)

There was a total of 2,167 identified fragments of sheep and goat (broadly categorized as caprovines) from the sample at Ninch (Table 82). This represents a minimum of 89 individuals and 22.72% of the total number of identified fragments. In the North side of the site, there were a total of 1,351 identified fragments, comprising 72 individuals. The greatest concentration of caprovine remains was in Phases 2 and 6, corresponding to the fill of the inner enclosure and the fill of gully features in the east part of the excavation area. Among the caprovine assemblage from the north side of the site, very young juveniles (neonates) were identified from Pre-Phase 1 and Phases 3, 5, 6, and 8 (Table 83). The presence of neonatal individuals indicates that at least some caprovines were raised on site, rather than being brought to the site as adults. In the South side of the site, there were a total of 497 fragments, comprising 17 individuals. The greatest concentration of caprovines were found in Phase B features and Phase F features, corresponding to the later early medieval rectilinear ditches (Table 84).

Among this sample, a very small percentage of the caprovine remains could be positively identified as domestic goat (*Capra hircus*). 10 elements could be identified as goat, this includes horncores and cranial fragments (where the lambdoid suture was visible). The greatest concentration of goat remains derived from Phase 6 features (6 fragments) and, while there were some goat fragments found throughout Phases 1-6, there were no positively identified goat elements from Phases 7-8. The low incidence of goat is consistent with McCormick and Murray’s (2007) study of early medieval faunal assemblages and Kelly’s (1997) study of early medieval texts, which both assert that goat was an uncommon livestock species in early medieval Ireland. However, because sheep and goat axial elements are exceedingly difficult to differentiate, and with the positive identification of goat remains among the assemblage, for this study all sheep and goat remains are referred to as ‘caprovine.’

Modifications

North	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carn.*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Decor.*	*Art.*	*Path.*
P1	5	3	2													
1	12	5		1				3	1				1		1	
2	15	5	2			2		6								
3	8	4				1		2								1
4	1							1								
5	7	2	2					1								2
6	20	6	2	1		1	1	7		1						1
7	3	2						1								
8	7	2	1				1	2								1
Tot	78	29	9	2	0	4	2	23	1	1	0	0	1	0	1	5

Table 85 Bone modifications for Caprovines (Pre-Phase 1-Phase 8)

South	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carn.*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Decor.*	*Art.*	*Path.*
A	0															
B	2							2								
C	0															
D	0															
E	1							1								
F	13	3				2		5				1				2
G	0															
Tot.	16	3	0	0	0	2	0	8	0	0	0	1	0	0	0	2

Table 86 Bone modifications for Caprovines (Phase A-G)

In the north side of the site, most bone modifications to caprovine remains were identified in Phase 2 (15) and Phase 6 (20) (Table 85). This corresponds to the period of initial enclosure and burial and the final phase of occupation prior to construction of the large enclosure. Most of the modifications identified on caprovine remains relate to butchery (cut and chop, 29 and 9 examples, respectively) and carnivore action (23 examples). Importantly, both dog and cat gnaw marks were identified on caprovine remains. In the south side of the site, there were fewer modifications evident on caprovine remains (16). Of these modifications, the greatest number come from carnivore action (8), followed by cut marks (3). Modification evidence from both sides of the site demonstrate a preference for fileting meat from the bone in its preparation and the preparation of hides, as evidenced by where on the body modifications occur, particularly cut marks to the distal metapodia (see Butchery below).

Age-at-Slaughter

North Side per Period (Payne 1973)

Age	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
0-2m									1
2-6m	1		1	1			1		1
6-12m		2	3	1		2			
1-2y		1	1	1		1			1
2-3y			3			1	2		
3-4y									
4-6y							2		
6-8y									
8-10y							2		
Total	1	3	8	3	0	4	7	0	3

Table 87 Number of individuals per age class per Phase, Pre-Phase 1-Phase 8 (Caprovines)

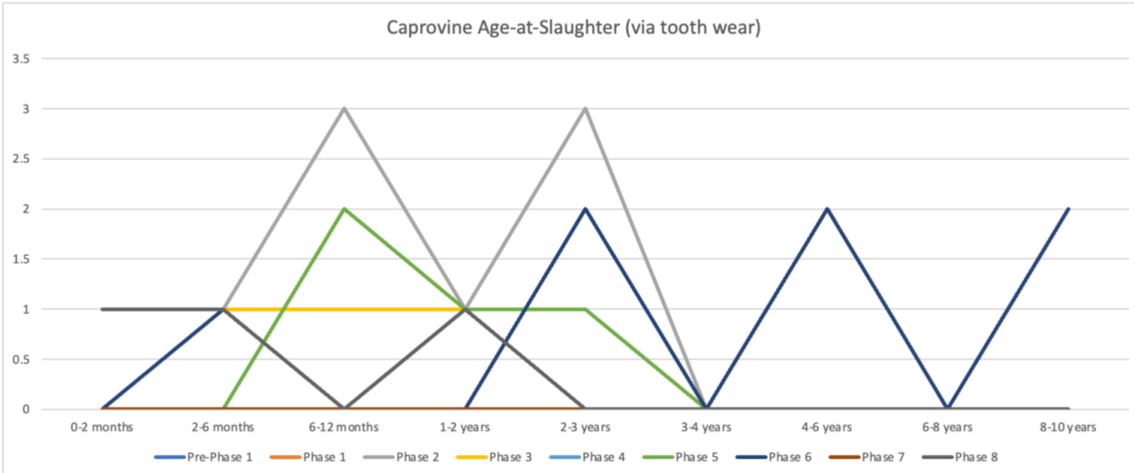

Figure 31 Mortality profiles, Pre-Phase 1-Phase 8 (Caprovines)

South Side per Period (Payne 1973)

Age	*A*	*B*	*C*	*D*	*E*	*F*	*G*
0-2m						1	
2-6m							
6-12m						2	
1-2y			1		2	3	
2-3y					1		
3-4y					1		1
4-6y		1					
6-8y		1				1	
8-10y					1		
Total	0	2	1	0	5	6	1

Table 88 Number of individuals per age class per Phase, Phase A-G (Caprovines)

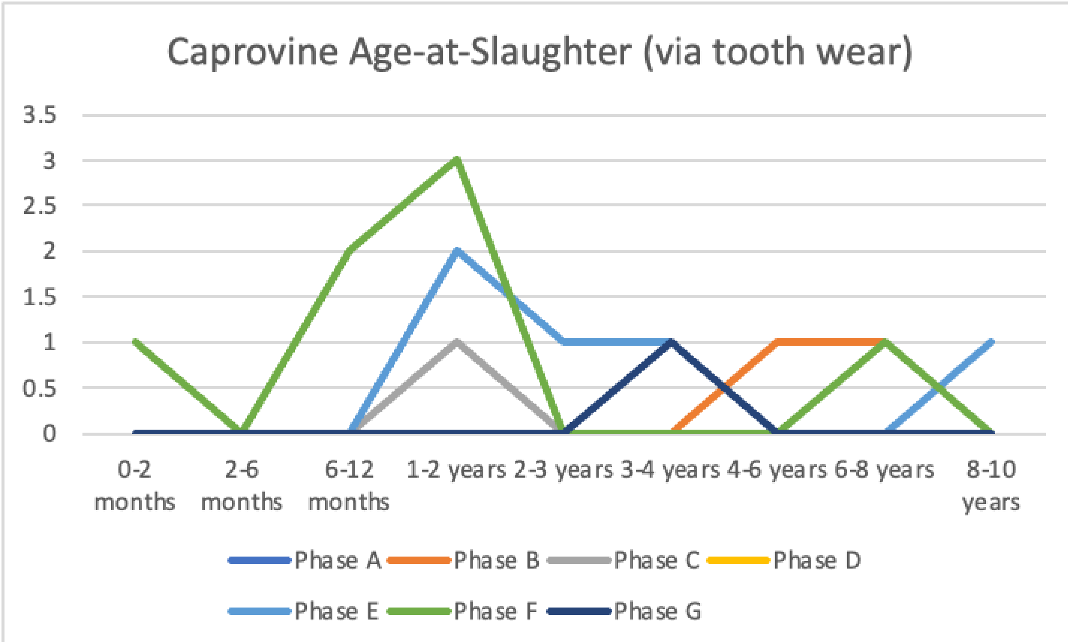

Figure 32 Mortality profiles, Phase A-G (Caprovines)

It is possible for caprovines to be raised for several different kinds of products, including meat (lamb/mutton and capretto/chevon), milk, and wool or fleece. In the north side of the site, there is a distinction between earlier use of caprovines and later use (Table 87; Figure 41). In the earlier phases of occupation (Pre-phase 1 through Phase 5), the majority of caprovines were slaughtered between six months old and three years old, with increases in slaughter for individuals aged between 6-12 months and 2-3 years. This is particularly evident in Phase 2, which also had the greatest number of ageable mandibulae. Phase 6, however, which had the second greatest number of ageable mandibulae demonstrates a shift to slaughtering older individuals, with increased rates of slaughter among individuals aged 2-3 years old, 4-6 years old, and even more than 8 years old. The earlier patterns of slaughter, with a focus on young individuals, might suggest caprovines were raised for their meat (Payne 1973), though McCormick and Murray, who found similar patterns of slaughter at Knowth, Co. Meath suggests that this might also represent slaughter for softer/finer fleece (2007). The identification of ossified caprovine floating ribs in Phase 2 indicates the presence of older individuals, which may have been maintained for their wool or to replenish the flock. The later pattern, represented in Phase 6, with the preferred slaughter of caprovines at approximately 3, 5, and 9 years of age, might represent husbandry practices that favored wool production (Payne 1973; McCormick *et al* 2011).

On the south side of the site (Table 88; Figure 42), there are similar patterns of slaughter that appear to favor meat production. Specifically, in Phases E and F, which produced the greatest number of ageable mandibulae, there were increased rates of slaughter for individuals aged between 1-2 years and 7-9 years. In Phase F, there was additionally a high number of slaughtered individuals between 6-12 months, which might represent slaughter at a slightly younger age for more tender meat.

Caprovine Overview

Sheep and goats (referred to jointly as ‘caprovines’) are important livestock species of agricultural communities as they provide milk, meat, and wool. At Ninch, caprovines represent 22.72% of the total faunal assemblage. At comparable Iron Age sites, caprovines represent between 7-23% of faunal assemblages and between 6-33% of faunal assemblages dated to the early medieval period. The age-at-slaughter data and the modification data suggest that caprovines were raised for their meat and possibly young fleece, until Phase 6 in the northern side of the site, where the age-at-slaughter data suggests that caprovines were raised for wool production. This is consistent with findings by McCormick and Murray at Knowth (2007) and McCormick *et al* (2011) at other late Iron Age and early medieval period sites.

In the Old Irish literature and law texts, sheep discussed are largely mentioned in terms of their fleece color and quality and as a form of small currency to pay for things such as remittance for illegal injury of a lower status individual. Goats are hardly mentioned, except that their milk was more desirable than sheep milk but are otherwise considered to be not common or important (Kelly 1997). Which is interesting, given that a genomic study of Irish bog butter revealed that a sample from the medieval period and a sample from the early Iron Age both contain a greater amount of sheep DNA than goat DNA (Mattiangelia *et al* 2020). Despite the concern for sheep wool, the law texts also suggest other uses for sheep, including for meat, for sheepskin (which was used to make clothing, leather, and parchment), and for their horns. With regards to horn, while there is no mention of polycerate sheep (or goats) in the literature, there is evidence of their breeding in early medieval Ireland, especially at Moynagh Lough, where Finbar McCormick found that 12% of the caprovines at the site were polycerate (1987). Horn would have been a valuable material to produce combs at the time.

There is, however, additional evidence from the literature and law tracts to indicate the value of mutton and chevon in late Iron Age and early medieval Ireland. For example, the market value (*lóg*) of a sheep increases periodically until both males and females reach a maximum value at 2 years of age and, unlike cattle, the distinctions between values appears to be based on quality of the animal rather than on fertility (Kelly 1997). According to Kelly (1997), the value of a sheep was calculated as ⅓ meat, ⅓ milk and wool, and ⅓ potential, highlighting the importance of mutton in relation to secondary products and the value of sheep as a form of wealth. At Ninch, this might account for the high levels of slaughter for individuals around two years old, when they had reached their maximum market value. Additionally, regarding food rents, clients were expected to pay their lord one weaned, castrated male (*molt*) with its fleece for the summer and autumn food rents. Payment of the autumn food rents would mean that the lambs would be about 6 months old, which is interesting to consider, given the high number of individuals slaughtered around 6 months old in Phases 2 and 5 in the north side of the site and Phase F in the south side of the site.

Pigs (Sus scrofa)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Sus domesticus	1114	11.68%	691	70

Table 89 NISP and MNI for Sus scrofa

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	25	71	213	108	25	84	214	16	11	42
MNI	2	3	11	5	2	8	16	3	2	5

Table 90 NISP and MNI for Sus scrofa (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	12	21	2	20	7	110	8
MNI	1	3	1	2	1	4	1

Table 91 NISP and MNI for Sus scrofa (Phase A-G)

There were 1114 identified fragments of domestic pig (*Sus domesticus*) from the assemblage at Ninch. This represents a minimum of 70 individuals and 11.68% of the total number of identified fragments (Table 89). In the north side of the site, there were 57 individuals identified, comprising 809 identified fragments (Table 90). The greatest concentrations of remains were in Phases 2 and 6, corresponding to the fill of the second inner enclosure and the fill of gully features in the east part of the excavation area. During these phases, pigs represented 17% and 11% of the identified fragments. On the south side of the site (Table 91), there were 13 individuals, comprising 180 fragments. The greatest concentration of fragments derived from Phases B, D, and F, corresponding to the fill of the large rectilinear ditches. Pig remains are generally considered to be evidence of primary product exploitation (pork production), as pigs do not generally provide secondary products such as wool, milk, or traction.

Modifications

North	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carn.*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Decor.*	*Art.*	*Path.*
P1	0															
1	0															
2	7	1	1					2				1	1		1	
3	7	3	1					1	1							1
4	1														1	
5	7	1	2		1			2								1
6	10	5	1			1		1								1
7	0															
8	0															
Tot	32	10	5	0	1	1	0	6	1	0	0	1	1	0	2	4

Table 92 Bone modifications for Sus scrofa (Pre-Phase 1-Phase 8)

South	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carn.*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Decor.*	*Art.*	*Path.*
A	0															
B	0															
C	0															
D	0															
E	0															
F	2	1	1													
G	0															
Tot.	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 93 Bone modifications for Sus scrofa (Phase A-G)

In the north side of the site (Table 92), most bone modifications to suid remains were identified in Phase 6 (10), followed by Phases 2, 3, and 5 (7 modifications, each). Many of the modifications identified on suid remains relate to butchery (cut and chop, 10 and 5 examples, respectively), cooking (roasting on the bone, 1), and the exploitation of pig bones for tool production (mostly in the form of pig fibula pins, 2). The relatively high level of butchery but low instance of burned bone suggests that meat was removed from the bones before cooking or could have been boiled on the bone (see discussion of butchery below). Additionally, three pathologies were identified on suid remains including slight evidence for osteomyelitis in Phase 3, dental disease in Phase 5, and a broken and misaligned podial in Phase 6. The low levels of pathologies evident suggest that the pig population was generally healthy and that there were few very old individuals.

In the south side of the site (Table 93), there were only two modifications identified on suid remains. These modifications include a cut mark and a chop mark to two different humeri in Phase F. These kinds of marks suggest that at least some butchery took place at Ninch during the period of enclosure in the south side of the site.

Age-at-Slaughter

North Side per Period (Grigson 1982a)

Age	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
<6m									1
9-12m							1		
13-18m							1		
18m									1
18-27m		1	1	2		1			
2.25-2.5y				2		1	2	1	1
2.5-3y	1	1	5			3	1		1
>3y	1	1	1	1			5		
Total	2	3	7	5	0	5	10	1	3

Table 94 Number of individuals per age class per Phase, Pre-Phase 1-Phase 8 (Sus scrofa)

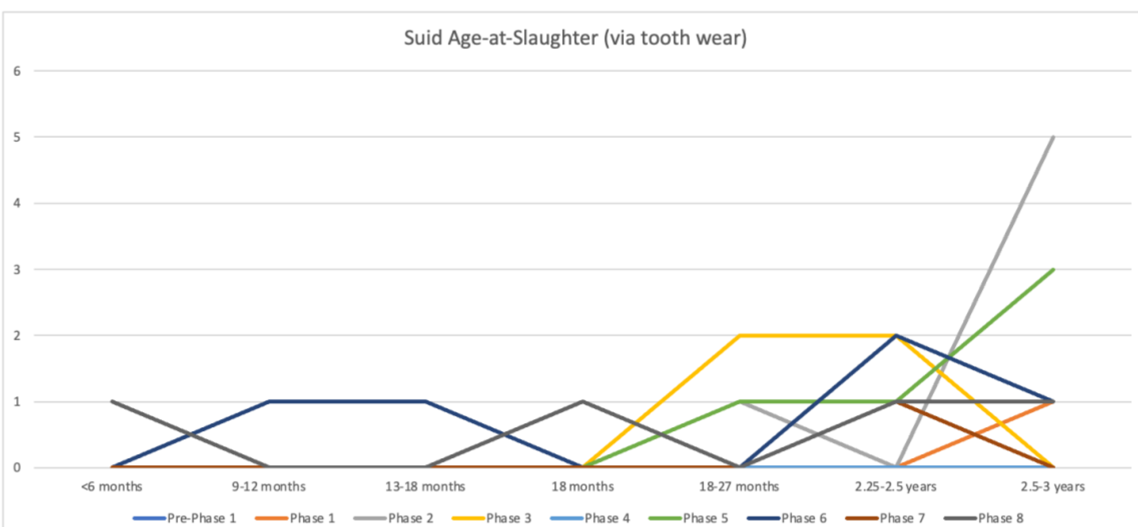

Figure 33 Mortality profiles, Pre-Phase 1-Phase 8 (Sus scrofa)

South Side per Period (Grigson 1982a)

Age	*A*	*B*	*C*	*D*	*E*	*F*	*G*
<6m							
9-12m						1	
13-18m			1				
18m	1			1		1	
18-27m							
2.25-2.5y						2	
2.5-3y							
>3y						1	
Total	1	0	1	1	0	5	0

Table 95 Number of individuals per age class per Phase, Pre-Phase 1-Phase 8 (Sus scrofa)

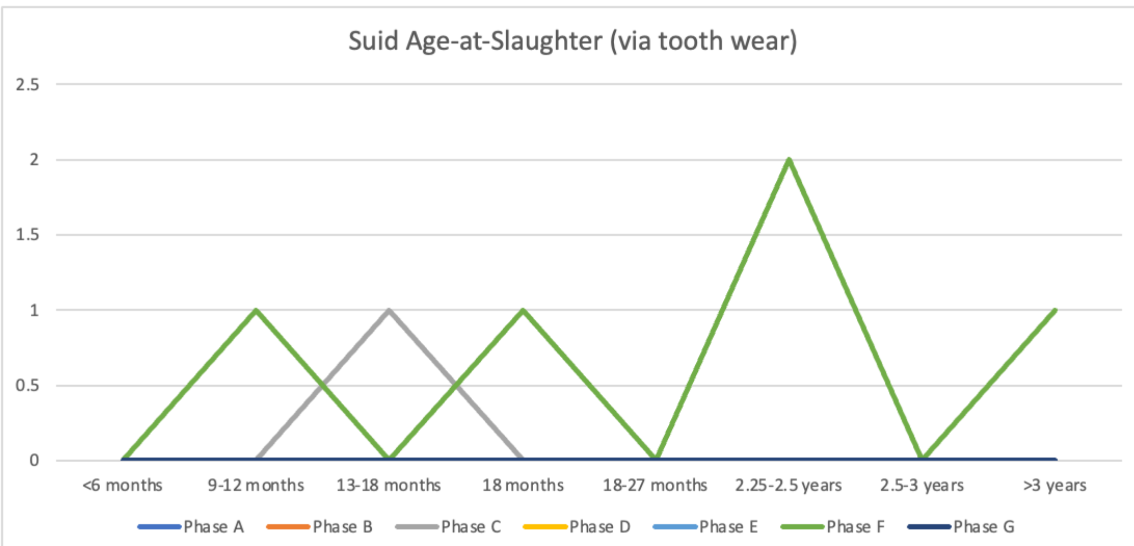

Figure 34 Mortality Profiles, Phase A-G (Sus scrofa)

In both the north side and south sides of the site, across all phases of occupation, most pigs were slaughtered between 1.5-2.5 years of age (Tables 95 & 96; Figures 33 & 34). Generally, at this age, pigs have grown to their full adult size. This makes economic sense as, at this age, the pigs will not be growing any larger and so will not convert more food into meat and so any resources that are provided to the pigs will not result in additional meat value.

Sex Distribution

North Side per Period

	Pre-1	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Male	0	2	4	3	1	2	10	1	4
Female	0	2	2	4	1	0	1	0	0

Table 96 Sex distribution per Phase, Pre-Phase 1-Phase 8 (Sus scrofa)

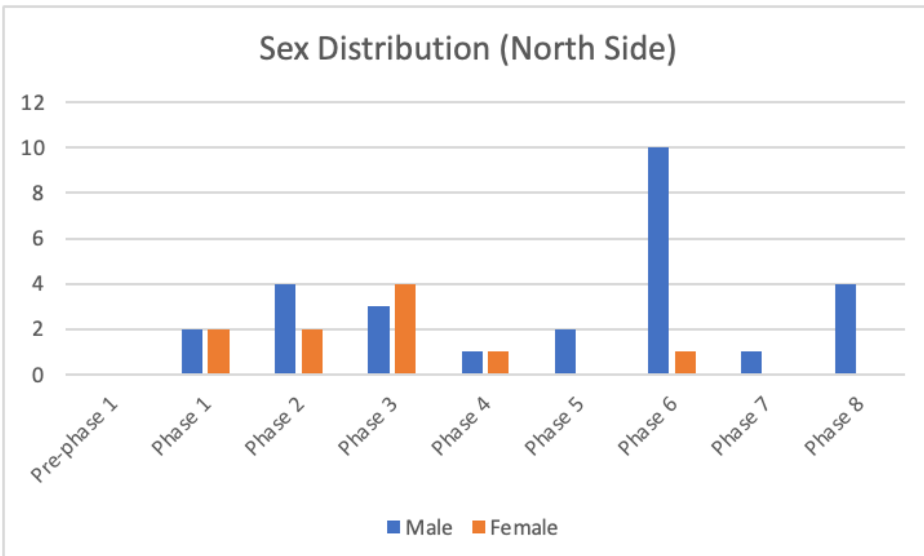

Figure 35 Sex distribution per Phase, Pre-Phase 1-Phase 8 (Sus scrofa)

South Side per Period

	A	*B*	*C*	*D*	*E*	*F*	*G*
Male	1	0	0	0	0	9	0
Female	0	2	0	1	0	8	0

Table 97 Sex distribution per Phase, Phase A-G (Sus scrofa)

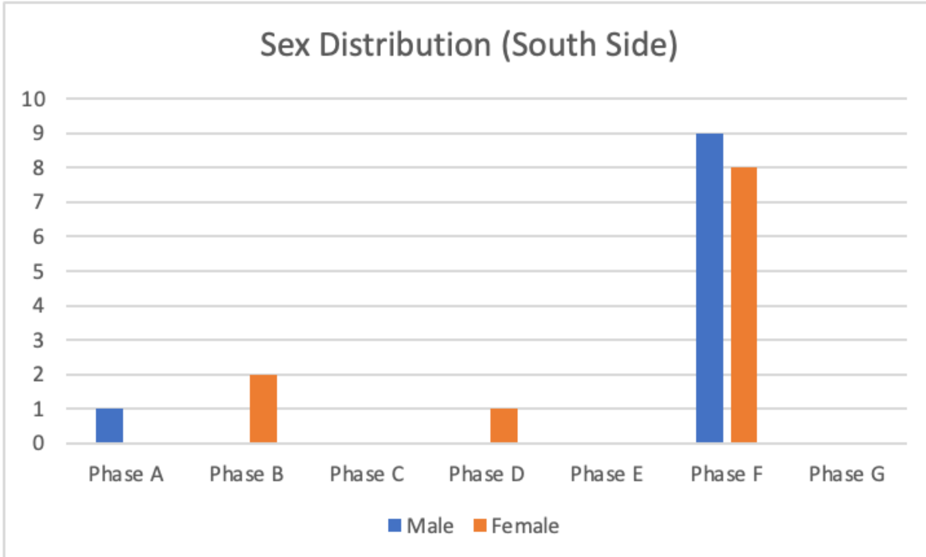

Figure 36 Sex distribution per Phase, Phase A-G (Sus scrofa)

Sex distribution data can provide additional information about animal husbandry practices. Sex is determined in pigs based on the morphology of their canines, with males developing larger tusks. For most of the phases of occupation at Ninch, there is generally an even distribution of male and female pigs (Tables 98 & 99; Figures 35 &36). This sex distribution is consistent with raising animals for their meat as the sex of the animal does not provide an advantage over the other, although older females may be valued somewhat more for their capacity to grow the size of the herd (Reitz and Wing 2008). It is worth noting, however, that this is not the case for phases 6, 7, and 8 on the north side of the site. In these later phases (particularly phases 6 and 8), there is a strong preference for males (Figure 35).

Suid Overview

Pigs in Iron Age and early medieval Ireland were an important livestock species, providing pork as well as bone as a raw material in craft production. Analysis of the faunal assemblage at important Iron Age sites, including Dun Ailinne, Navan Fort, and the Hill of Tara suggest that pigs were the second most important livestock species during this period, behind cattle. At Dun Ailinne, pigs represent 37% of the identified fragments (Crabtree 2007), and at the Hill of Tara (McCormick 2009), pigs represent 22% of the identified fragments. At 63%, pigs represented a more significant component of the faunal assemblage at Navan Fort (Madgwick *et al* 2019). Additionally, an isotope study conducted using pig mandibles from Navan Fort indicates that the assemblage represents animals that had been raised in various places across the northern part of Ireland, approximately corresponding to the later Province of Ulster (Madgwick *et al* 2019). These are, undoubtedly, unique sites and their faunal assemblages likely represent important forms of feasting that occurred on a somewhat regular basis. These data, however, compare to the range of identified species at other Iron Age dated sites, including Claristown 2, Co. Meath; Rathcash East, Co. Meath; Ballydavis, Co. Laois; and Moone, Co. Kildare. At these sites, pig remains represent between 12-45% of the identified specimens.

In the early medieval period, pigs continued to be one of the most prominent animal species represented in archaeological assemblages and in the literature and law-texts. According to Kelly (1997), pigs were considered quite significant in the law-texts, wisdom-texts, and literature. In the tale of Mac Dathó's Pig (*Scéla Mucce Meic Dathó*), conflict arises over who would get the honor of carving the pig at a feast and in *Aígidecht Aithrini*, pork is claimed to have been preferable to veal, mutton, or beef (from a bull, as opposed to a cow). A similar sentiment was shared in other texts that claim that lard from pigs was more palatable than that from cattle or sheep (Kelly 1997). Records from the 7th-9th centuries CE suggest that pigs were joint-herded, whereby a swineherd would manage pigs belonging to several different owners together, occasionally taking them overnight to forage, especially during September and October when acorns would be available. In addition to acorns, the law-texts claim that pigs were fattened on cereal grains and dairy products. The *Cannones Adomnani* claims that pigs would also eat carrion, but that it was inappropriate to consume a pig that had been fattened in such a way. Additionally, an Old Irish tale claims that it was most appropriate to give pigs the leftovers of a meal (Kelly 1997).

In the legal commentaries, value was not expressed in terms of pigs in the same way that it was in terms of cattle and sheep. Pig was, evidently, not used regular mediums of exchange in the same way (Kelly 1997). We are, however, able to determine the commercial and legal value of pigs from these documents. From these texts, pigs of both sexes accrued value over time from their juvenile stage through their third year, to a maximum value of between three and four *scruples* (between 1/8th and 1/6th of an ounce of silver). And the fine (*díre*) for killing a pig belonging to another individual was five *séts*, or approximately 15 times the commercial value (*lóg*) of the pig and could require additional restitution of a replacement pig and/or the commercial value of the pig that was killed (Kelly 1997). The *Críth Gablach* (law-text) additionally details the number of pigs expected to be included in the wealth of farmers of certain social statuses. According to this text, a prosperous farmer, or *mruigfer,* rank should have two breeding sows and a *bóaire*, a wealthy farmer, should have four boars, two sows, 20 additional pigs, and a cauldron large enough to cook a boar.

The archaeological record broadly reflects similar concern for the relative value of pigs in relation to other livestock species and similarly demonstrates periods of slaughter between 2-3 years of age. At Knowth, McCormick and Murray (2007) found that pigs represented between 20-30% of the faunal assemblage (by MNI). Examining the assemblage by period, McCormick and Murray found that the relative value of pigs increased at the site between the 7th-8th and 10th-11th centuries CE. McCormick and Murray found a similar pattern in the increased percentage of pigs around the 9th-10th centuries CE in the faunal assemblage from Rathmullen, Co. Down, though, this site is noted for the unusual dominance of pigs over other livestock species. McCormick (1997) postulates that high percentages of pig remains likely reflects the importance of arable farming and fattening pigs on cereals. The Early Medieval Archaeology Project (EMAP) did not find a comparable temporal pattern outside of Ulster (McCormick *et al* 2011). Among sites in Co. Meath dated to the early medieval period, McCormick *et al* (2011) found that pigs represented between 15-28% (MNI) or between 11-17% (NISP) of faunal assemblages. Among the sites included in the comparative analysis for this project, pig remains represent between 4-29% (NISP). McCormick also found that most pigs from Moynagh Crannóg were slaughtered between 1.5-2 years of age (1987).

At Ninch, pigs were one of the major livestock species raised at the site providing meat and bone as a raw material for craft production. The modification data indicate that pork was prepared in several ways, including fileted and prepared and roasted on the bone. The high percentage of bones without modifications might also suggest that pork was boiled on the bone at Ninch, a practice supported by literary evidence. On both the north and south sides of the site, pigs were primarily slaughtered between 1.5-2.5 years old. While the earlier phases of occupation in the north side of the site demonstrated a rather even ratio of males to females, Phases 5-8 showed a bias towards males. This discrepancy may be due to issues of preservation or sampling or may represent specific husbandry choices made by the community. While the frequency of pigs in the assemblage is comparatively low, the results based on age-at-slaughter and sex ratios are consistent with other important early medieval sites.

Horses (Equus caballus)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Equus caballus	193	2.02%	118	20

Table 98 NISP and MNI for Equus caballus

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	2	3	13	5	1	10	16	2	12	14
MNI	1	1	2	1	1	1	2	1	2	2

Table 99 NISP and MNI for Equus caballus (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	0	0	1	1	66	38	2
MNI	0	0	1	1	2	2	1

Table 100 NISP and MNI for Equus caballus (Phase A-G)

Modifications

North	*Total*	*Cut*	*Chop*	*Saw*	*Scrape*	*Roasted*	*Calcined*	*Carn.*	*Rodent*	*Split*	*Hole*	*Shape*	*Polish*	*Decor.*	*Art.*	*Path.*
P1	0															
1	6	1	1					1				1	1			1
2	3	1	1													1
3	0															
4	0															
5	0															
6	2		1					1								
7	1	1														
8	0															
Tot	12	3	3	0	0	0	0	2	0	0	0	1	1	0	0	2

Table 101 Bone modifications for Equus caballus (Pre-Phase 1-Phase 8)

South		Cut	Chop	Saw	Scrape	Roasted	Calcined	Carn.	Rodent	Split	Hole	Shape	Polish	Decor.	Art.	Path.
A	0															
B	0															
C	0															
D	3		1					1	1							
E	0															
F	0															
G	0															
Tot.	3	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0

Table 102 Bone modifications for Equus caballus (Phase A-G)

There was a total of 193 identified fragments of domestic horse (*Equus caballus*) from the assemblage at Ninch. This represents a minimum of 20 individuals and 2.02% of the total number of identified fragments (Table 100). In the north side of the site, there were a total of 14 individuals identified, comprising 78 identified fragments (Table 101). The greatest concentration of remains was in Phases 2, 6, and 8, corresponding to the fill of the second inner enclosure, the fill of gully features in the east part of the excavation area, and the fill of the souterrains. On the south side of the site, there were 7 individuals, comprising 110 fragments (Table 102). The greatest concentration of fragments derived from Phases E and F, corresponding to the fill of the large rectilinear ditches. The high number of fragments were identified as mandible fragments and loose teeth.

Evidence of bone modification and pathologies indicates several possible uses for horses at Ninch (Tables 103 & 104). The evidence of osteoarthritis on a proximal tibia (OID7814) and additional bone growth on an ischial spine (OID819) indicate that these individuals experienced increased stress to the lower back and lower limbs. Pathologies in these regions are suggestive of either use for transportation (riding) and/or for traction (pulling plows). Horse bones appear to have also been an important resource at the site with OID5519 showing evidence of polishing and shaping. OID5519 may be a possible bone artifact blank and bears some resemblance to bone skates from Dublin produced during the 9th and 10th centuries (National Museum of Ireland).

The cut and chop marks on OID5202, 5828, 6531, 8196, and 3448 may be the result of the disposal of a deceased individual or it may be evidence for the consumption of horsemeat. Chop marks on the radius, metacarpal, and ilium indicate disarticulation of the carcass and may have been necessary to remove a deceased horse from near living spaces for sanitary reasons. The much lighter cut marks on OID5202 and 3448 are indicative of filleting or deboning the forelimb. Evidence of carnivore gnawing, and rodent gnawing suggest that the remains were left exposed on the ground surface for some time before burial or deposition.

The possible evidence for the consumption of horsemeat at Ninch provides an interesting possibility. With the conversion to Christianity in Europe, many communities, Ireland included, banned the consumption of horsemeat. While this practice was not terribly common in Ireland prior to the conversion to Christianity, it certainly declined in popularity afterward. Literature recorded during the early medieval period further suggest that the consumption of horsemeat was an elite and possibly ritualized practice with horsemeat consumption associated with the inauguration of kings (McCormick 2007). Writers from Britain also remarked on the practice, including commentary from Giraldus Cambrensis, though his descriptions of the Irish are often fantastical and therefore should be approached with some caution (O'Meara 1948). Archaeologically, there is evidence of the consumption of horsemeat from the medieval occupations at Knowth and Tara as well as at other, smaller, elite sites.

Horses feature in other texts from the early medieval period, highlighting the important social role of horse racing and charioteering in warfare and the possession and use of horses was a symbol of social status. The *Críth Gablach* details the role of horse riding among elites, particularly how many horses each level of lord should possess, and the bridles associated with elite status. For example, a *bóaire*, a free farmer, should possess a work pony and a horse for riding and higher ranked elites should possess riding horses with increasingly elaborate equipment.

Commensal Animals

In addition to the livestock at Ninch, there were also domestic commensal animals present in the assemblage. This includes dogs (*Canis familiaris*) and cats (*Felis catus*). Dogs and cats were common at early Medieval Irish sites and occupied a particularly important role in Irish society. Domestic dogs and cats were brought to Ireland with the first farming societies and have been identified at archaeological sites in Ireland beginning in the Neolithic period.

Dogs (Canis familiaris)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Canidae	102	1.14%	82	15

Table 103 NISP and MNI for Canis familiaris

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	2	11	4	5	8	0	12	14	7	0
MNI	1	2	1	1	1	0	2	1	1	0

Table 104 NISP and MNI for Canis familiaris (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	0	0	0	0	37	1	2
MNI	0	0	0	0	2	1	2

Table 105 NISP and MNI for Canis familiaris (Phase A-G)

Metrical Analysis

Object ID	*Phase*	*Element*	*Measurements (mm)*			*Height Estimate (cm)*
OID1106	Phase 3	L. Mandible w/ teeth	Length 198			
OID4009	Phase 2-6	R. Humerus	Proximal breadth 44.34	Distal breadth 37.27	Greatest length 204.29	67.42
OID4015	Phase 2-6	Metacarpal	Length 73.16			
OID4016	Phase 2-6	Metacarpal	Length 72.84			
OID4178	Phase 6	R. Radius	Proximal breadth 23.42	Greatest length 139.46		46.29

Table 106 Metrical analyses for Canis familiaris

Modifications

Object ID	*Phase*	*Element*	*Modification*
OID2365	Phase 2	Radius	Cut marks on metaphysis
OID2444	Phase 6	Metapodia	Pathology - misaligned healed fracture

Table 107 Bone modifications for Canis familiaris

There was a total of 108 identified fragments of domestic dog (*Canis familiaris*) from the sample at Ninch. This represents a minimum of 15 individuals and 1.14% of the total number of identified fragments (Table 105). In the north side of the site, there were a total of 9 individuals identified, comprising 57 identified fragments (Table 106). The greatest concentration of dog remains was in Phases 1 and 6, corresponding to the fill of the inner enclosure and the fill of gully features in the east part of the excavation area.

Among these individuals, there were several examples of exceptionally large individuals (Table 108). The right humerus (OID4009) measured 204.29 mm at its greatest length, which according to Harcourt (1973) should yield a shoulder height estimate of 67.42 cm. This would have been one of the largest sizes of dog from the period or possibly a wolf (Harcourt 1973). Wolves were endemic to Ireland, prior to their extermination in 1786 (Hickey 2011). Another complete element, a right radius (OID4178), measured 139.49 mm and would have therefore measured 46.29cm at the shoulder (Harcourt 1973). Similarly large and medium-sized canines were noted in the Early Medieval Archaeology Project (EMAP) at early medieval sites. This suggests that there was selective breeding of dogs for purposes, such as for guarding and herding (McCormick 1991; and McCormick *et al* 2014)

Two specimens had evidence of bone modifications (Table 109). OID2365, a right radius from the second inner enclosure, had cut marks on the middle of the shaft and OID2444, a metapodia, had a healed misaligned fracture. Based on the location of the cut marks, this may indicate skinning or filleting, which would not have been a common practice at the time. A fractured paw could have been the result of an accident in which the individual was stepped on and the healing indicates that the individual lived for some time after the incident.

Dogs are mentioned extensively in the literature and laws of Early Ireland. Famously, delegates from Connacht and Ulster fought over a hound in the tale of Mac Da Tho's Pig and young Setanta earned the honorific "Cu Chulainn," or the Hound of Culainn, after he slayed a watchdog and took its place until a new dog could be trained. In the early medieval legal tradition, the rights and responsibilities of dogs are discussed at length. In fact, the penalty-fee for killing a guard dog (*archu*) included 10 cows as well as a substitute dog, and the penalty-fee for a herd dog (*conbuachaill cacha cethrae*) included 5 cows, a substitute dog, and any livestock killed by predators. The legal texts also identified two other types of dogs, hunting dogs (*milchu*) and pet dogs (*orcae*). The price for killing a dog in early medieval Ireland was determined in part by the role of that dog in the community and by the status of the dog's human counterpart (Kelly 1997).

The roles of each type of dog are clearly defined and most associated with the aristocracy. For instance, a household could not be considered truly high status unless they had an *archu*, described as the most valuable dog that protects the four doors -- the doors to the house, the sheepfold, the calf byres, and the oxen byres (Kelly 1997). Dogs associated with the peasantry, however, were referred to in less-honorific terms, such as 'dunghill dog' (*cu otraig*) and 'dog of the maggot-heap' (*cu chrumdumai*). It was also permissible to kill dogs outside of human association, or stray dogs, but only if they were a nuisance (Kelly 1997).

Cats (Felis catus)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Felidae	321	5.5%	185	11

Table 108 NISP and MNI for Felis catus

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	0	0	3	3	0	1	253	0	0	5
MNI	0	0	1	1	0	1	3	0	0	1

Table 109 NISP and MNI for Felis catus (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	0	36	0	0	0	14	0
MNI	0	3	0	0	0	1	0

Table 110 NISP and MNI for Felis catus (Phase A-G)

Modifications

Object ID	*Phase*	*Element*	*Modification*	*Object ID*	*Phase*
2435	6	Humerus	Cut marks	2435	6
5797	6	Caudal vertebrae	Pathology - fused	5797	6
5798	6	Lumbar vertebrae	Pathology - fused	5798	6

Table 111 Bone modifications for Felis catus

There were 321 positively identified domestic cat bones (*Felis catus*) from a minimum of 11 individuals in the sample from Ninch. This represents 5.5% of the identified remains from the entire sample (Table 110). Most of the cat remains were found in Phase 6 in the North side of the site (Table 111). This figure may be artificially inflated as it includes 107 cranial fragments, 56 rib fragments, and 40 vertebral fragments, however the minimum number of individuals for this phase (3) is the highest of any phase except for Phase B in the South side of the site, which also had a minimum of three individuals.

Among this sample, five elements had evidence of bone modifications, four of which were pathologies and the final one included cut marks (Table 113). The pathologies identified include four fused vertebrae (OID 5797 and 5798), two lumbar vertebrae and two caudal vertebrae. Since these remains were collected on the same day, in the same area (resulting in these elements being collected in the same sample bag), it is possible that these fragments come from the same individual. OID 7495, a complete left femur, had evidence of eburnation (polishing) on the distal condyles, another age-related pathology. Eburnation results from the rubbing of bone on bone after the cartilage has degraded, this is a common symptom of osteoarthritis. A final pathology was noted on OID 9196, a distal fragment of a humerus, consisting of a significant misalignment of a healed fracture. The bone was badly disfigured, and identification was only possible due to the presence of the supracondylar foramen. Remodeling around the fracture indicates that the individual lived for a period after the fracture. Such a significant fracture may have been the result of a fall or accident.

Other than pathologies, there was only one cat element that had evidence of human modification. There were cuts to the OID 2435, a left humerus, posterior distal shaft. Cut marks in such a location may be evidence for skinning. McCormick (1988), argued that, in the Medieval Period in Ireland, young cats were skinned to exploit the best quality fur, as fur quality decreases with age. McCormick (2013) also claims that cat exploitation as a commodity was a feature of urban settlement in Ireland. Evidence for skinning occurred in the same phase as the evidence for elderly cats, suggesting that grain production was important at Ninch during this phase and therefore cats remained important in their role as pest control.

The European wild cat (*Felis sylvestris sylvestris*) was once native to the British Isles and can still be found in the Scottish Highlands. There is evidence for wild cats from early prehistoric Irish sites, however, by the first millennium AD, they had been replaced by domestic cats (Van Wijngaarden-Bakker 1974**)**. Cats loom large in early Medieval Irish iconography and literature. Images of cats were common in illuminated manuscripts and marginalia, in fact, one of the oldest Old Irish poems was written by an anonymous Irish monk in what is now Germany named for and about his cat, *Pangur ban*. Cats would have been important non-livestock domestic animals in an agricultural context. In the law texts, cats are considered important household animals, useful for protecting food from mice and rats. Cats were also elevated to a companion status, mostly associated with women, children, and the kitchen (Kelly 1997). In these texts, there is evidence for cats given personal names and specific penalties for injuring or killing a cat. In the fragmentary *Catslechtae*, or ‘cat-sections,’ a cat that can purr and guard the barn, mill, and cereal-drying kilns was worth the value of three cows (Kelly 1997). As respected as cats appear to have been at a personal or household level, it was still permitted to kill a neighbor’s cat if it was caught in the food stores (Kelly 1997). Because of their association with the cow barn, the cowherd is the only adult male human associated with cats.

The evidence from Ninch, particularly the pathological evidence, suggests that the cats associated with the settlement may have been valued contributors to the community. The vertebral fusion and the presence of eburnation at the joints suggests that these individuals lived to an advanced age. Movement would have been somewhat inhibited by these pathologies and their continued presence at the settlement could indicate continued efficacy in protecting the grain or care provided by their human companions.

Wild Species

Despite the importance of domesticated species in agricultural contexts, wild animals continued to provide important food and raw material resources. Evidence of hunting birds and deer, fishing, and collecting shellfish, even if only to a small degree, have been identified throughout prehistory (McCormick 2007b). Access to and the exploitation of wild species gained particular importance in the Medieval period as deer hunting became a pastime of the elites (Beglane 2010).

The role of fishing is less well-defined. Freshwater fishing was an important part of prehistoric food production, particularly during the Mesolithic period, but there is little evidence for significant marine fishing. And in the near-shore, shellfish collection has been viewed as a marginal food source, even though there are 28 recorded shell middens from Ireland's coasts spanning the Mesolithic through the Medieval period. These views are starting to change, with evidence of some far shore species at early Medieval sites and an acknowledgement of the sheer volume of shellfish remains, including remains of dogwhelk, which would not have been consumed but used in the production of valuable dye (Murray, Gibbons, and McCormick 2011).

Birds

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Aves	72	1.02%	47	27

Table 112 NISP and MNI for Aves

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	8	7	7	6		4	4	1	1	18
MNI	2	2	2	2		1	3	1	1	7

Table 113 NISP and MNI for Aves (Pre-Phase 1-Phase 8)

Taxa	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
Gallus	2		3	2			1			3
Anatidae		3 - goose	1 - goose					1 - duck		3 - duck
Lariidae				1			1			1
Grus grus										
Corvidae										3
Passerine		1				2	2			2

Table 114 NISP per Taxon, Pre-Phase 1-Phase 8 (Aves)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP	2					11	3
MNI	1					3	2

Table 115 NISP and MNI for Aves (Phase A-G)

Taxa	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
Gallus						2	1	4		
Anatidae						1 - goose	1 - duck	1 - duck		
Lariidae	1							1	1	
Grus grus								1		
Corvidae										
Passerine						1				

Table 116 NISP per Taxon, Phase A-G (Aves)

Modifications

Object ID	*Phase*	*Element*	*Modification*
885	Unphased	Tibiotarsus	Carnivore gnawing

Table 117 Bone modifications for Aves

There were 72 identified fragments of bird remains from a minimum of 27 individuals in the sample from Ninch. This represents 1.26 %NISP of the identified remains from the entire sample (Table 114). The bird remains were found in all phases in the North side of the site except for Phase 4 and only in Phases A, F, and G in the South side of the site. There were an additional 25 identified bird fragments from unphased features. Most of the remains could not be identified to species, however *Gallus gallus* (domestic fowl), *Anatidae* (both ducks and geese, either wild or domestic), *Lariidae* (gulls), *Grus grus* (crane), *Corvidea* (corvids), and other passerines were all identified (Tables 116 & 118). Some of the evidence for birds at Ninch is evidence for local environmental conditions, including the inclusion of small songbirds (passerines) and seagulls, though it is possible that both could be consumed. I have interpreted the evidence of Galliformes as evidence of domestic fowl, however I did not have access to comparative samples of capercaillie, black grouse, or pheasant, which have also been identified at early medieval sites. The evidence of crane is particularly interesting as they are now very rare in Ireland but have been identified at other early medieval settlement sites (Hamilton-Dyer 2007; Adamson 2004).

There was one modification identified on a bird bone - evidence of carnivore gnawing on a tibiotarsus (Table 119). The punctures were quite small and fit the pattern for a domestic cat. Birds can be used several ways, including for their flesh, but also for their feathers which could be used for bedding or insulation as well as for their eggs. The paucity of bone modifications does not mean that birds were not consumed at Ninch, but it might suggest that birds were roasted whole or boiled whole in such a way that the limbs and flesh could be removed by hand rather than cut away. Further, the evidence of domestic fowl and possibly domestic goose indicates the exchange of birds for consumption purposes with Britain and the Continent, as neither are endogenous to Ireland.

Domestic fowl (mostly chicken) were a relatively recent import to Ireland and do not appear in the Irish archaeological record until the early medieval period, likely through increased contact with Romanized Britain during this period. The Roman Empire spread domestic chicken throughout northern Europe and domestic fowl appeared in Britain beginning in the late Iron Age (Hamilton-Dyer 2007). During this period, while dogs and cats were used for herding, guarding, and pest control, chickens were exclusively used for food (meat and eggs) and possibly for cockfighting as well. None of the individuals at Ninch could be positively identified as males (which have spurs on their tarsometatarsus and are used in cockfighting) and so were more likely used as food resources.

The literature and law tracks provide some evidence for the exploitation of birds during this period, both as food and as pets. For instance, the value of domestic fowl in legal commentaries indicates that they were likely valued for their eggs more so than for their flesh, as laying hens were valued at two bushels of grain whereas juvenile females or a sexually active males were valued at one bushel, and when fowl were unable to produce eggs or young, their value was reduced to a half-bushel (Kelly 1997). Hen eggs were particularly valued in Irish literature but so were other bird eggs, including gull eggs and goose eggs, and were consumed on religious fasting days as they were not considered to be meat (Kelly 1997). Other farmyard birds are also mentioned, including geese and ducks as well as doves, although there isn't archaeological evidence for dovecotes prior to the end of the first millennium AD. In addition to farmyard birds, there is discussion of wild birds and, particularly, the hunting of birds with traps, snares, slings, and spears (hawking is considered a later technique). Finally, birds were also noted to have been kept as pets, including cranes and crows. It is impossible to tell if the evidence for crane and crow (corvid) in the assemblage from Ninch represents captive or tamed individuals, as cranes were also slaughtered as pests and crows may have been included accidentally.

Fish

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Ichthys	66	0.69%	32	12

Table 118 NISP and MNI for Ichthys

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	14		3	3	2	2	5		2	18
MNI	2		2	1	1	1	1		1	1

Table 119 NISP and MNI for Ichthys (Pre-Phase 1-Phase 8)

Taxa	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
G. morhua	1								2	1
M. merlucius	1		1							
S. salar			1							
Esox lucius							1			

Table 120 NISP per Taxon, Pre-Phase 1-Phase 8 (Ichthys)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP					1	1	
MNI					1	1	

Table 121 NISP and MNI for Ichthys (Phase A-G)

Taxa	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*Unph.*
G. morhua								3
M. merlucius								
S. salar								
Esox lucius					1			2

Table 122 NISP per Taxon, Phase A-G (Ichthys)

There were 66 identified fragments of fish from a minimum of 12 individuals in the sample from Ninch. This represents 0.69% of the identified remains from the entire sample (Table 120). The fish remains were found in all phases in the north side of the site except for Phase 1 (Table 121) and only in Phases E and F in the South side of the site (Table 123). It may be that this is a conservative estimate of the exploitation of marine resources as this only represents the hand collected samples and not floatation samples. Fish remains, in general, do not preserve well and the lack of flotation samples means that there is a bias towards large fish as smaller fish, such as eel and herring, are difficult to identify in the field and are often missed in hand collected sampling. The samples identified from Ninch include three quite large specimen from Phase 3, the final phase of enclosure and burial in the mid-7th century CE (OID1255). There was one modification identified on a fish element (OID4649), a cut mark on a gadiform supracleithrum, from an unphased feature. Because the feature could not be dated either relatively or absolutely, it was not included in the final count but represents fish consumption at the site.

Most of the fish remains could not be identified to genus or species, however there were some samples for which that level of identification was possible. Identified species include *Gadus morhua* (Atlantic cod), *Merlucius merlucius* (hake), *Salmo salar* (Atlantic salmon), and *Esox lucius* (northern pike). Marine species, like cod, hake, and salmon are known from other early medieval sites however evidence of freshwater species, while common in the written sources, have rarely been found archaeologically. Evidence of pike is particularly interesting, as it has been assumed to have been a later introduction (Kelly 1997), however recent evidence of pike at Trim Castle, Co. Meath from a late 13th century feature may indicate some earlier importation (Hamilton-Dyer 2007). In Phase 7, dated broadly to the 9th-11th centuries CE, representation of fish increased to over 1% of the assemblage and included large cod and hake elements (OID3440 and OID3441). Both OID3440 and OID3441 are both vertebrae and OID3440 had a diameter of 26.53mm. Gadiformes of that size typically live at depths of over 100 meters. According to bathymetric maps of the Irish Sea, the closest area with sufficient depths for cod and hake of this size is over 26 miles offshore (Figure 37).

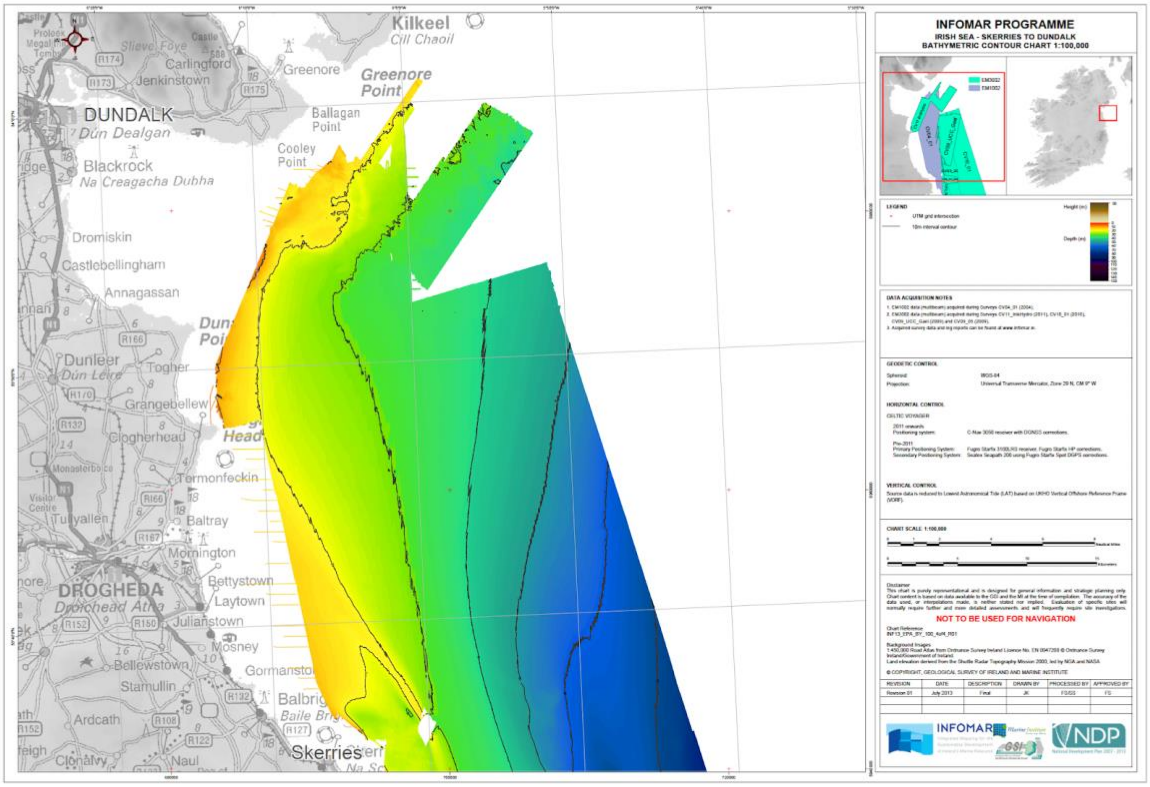

Figure 37 INFOMAR Programme (2013) Irish Sea - Skerries to Dundalk, Bathymetric Contour Chart. 1:100,000. Depth indicated by color. The dark blue represents depths up to 100m.

The early Irish literature and law tracts do not mention sea fishing extensively. It is possible that there were greater restrictions on sea fishing mentioned in the now lost *Muirbretha* ('sea-judgements') but the remaining passages from this text do not mention fishing rights (Kelly 1997). There is, generally, greater concern for freshwater or estuary fishing (using weirs), particularly for salmon. In the law tracts, salmon are a high-status food for the elite individuals and, in the early sagas, are associated with wisdom and power.

The early and extended practice of offshore fishing at Ninch reveals connections to changing practices across Europe. According to James Barrett and David Orton (2016), there is evidence from across Europe of increasing exploitation of offshore resources during the latter half of the first millennium AD. Around the turn of the first millennium, communities across northern Europe experienced a "fish event horizon." This phenomenon is most visible in England, particularly at York, but is also evident in other regions. Barrett and Orton conclude that the expansion of fishing efforts may have been a result of increased migration of Scandinavian communities and/or environmental changes.

The presence of fish cranial elements from all occupational phases at Ninch indicates that fishing was practiced at the site rather than importing dried or salted fish (Barrett 1997). Offshore fishing requires specialized knowledge, equipment, and the capability to process the catch quickly before it begins to decompose. The difficulty in acquiring large offshore fish could have increased its relative social and symbolic value. For example, there is evidence for cod consumption at Coldwinters, Co. Dublin. Coldwinters is a similar settlement-cemetery site, broadly dated to the 6th-7th centuries AD, about 31 km SW of Ninch and 13 km from the shore. A cod cranial bone (supracleithrum) found during excavation has clear, rather deep, butchery marks on the exterior side (Figure 38). The association of large, butchered, cod at a locally important funerary site may indicate its importance for the local community.

Figure 38 Cod supracleithrum with butchery marks from Coldwinters, Co. Dublin

In the shared special consumption of cod, we can see that the practice of offshore fishing at this early date, possibly supported through trade and exchange relationships with communities in central/eastern Europe/Scandinavia, was incorporated and adapted into local practices. These practices were further impacted by the increased importance of offshore fishing at the end of the early medieval period across Europe. At Ninch, the presence of offshore species dramatically increased around the 9th-10th centuries AD, essentially, its own 'fish event horizon.'

Cervids (Cervus elaphus)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Cervus elaphus	16	0.2%	11	4

Table 123 NISP and MNI for Cervus elaphus

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP				4		2	5			
MNI				1		1	1			

Table 124 NISP and MNI for Cervus elaphus (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP						5	
MNI						1	

Table 125 NISP and MNI for Cervus elaphus (Phase A-G)

Modifications

Object ID	*Phase*	*Element*	*Modification*
OID1118	3	Antler	Sawn and shaped
OID683	5	Atlas	Cut
OID9085	F	Radius	Chop
OID9015	F	Antler	Cut
OID9016	F	Antler	Cut

Table 126 Bone modifications for Cervus elaphus

There were 16 positively identified fragments from deer (*Cervus elaphus*) from a minimum of 4 individuals in the sample from Ninch. This represents 0.2% of the identified remains from the entire sample (Table 125). The deer remains were found in Phases 3, 5, and 6 in the north side of the site, corresponding to the fill of the third inner enclosure as well as the ditches and gullies to the east of the enclosures (Table 126). In the south side of the site, there was a concentration of deer remains found in Phase F features, which correspond to the fill of the large rectilinear ditch (Table 127). Meat-bearing postcranial elements were identified in all phases, including a radius fragment from Phase F with chop marks, indicating that deer hunting, and venison consumption occurred at low levels during this time. Most modified elements were fragments of antler cut-offs with cuts, saw marks, and shaping (Table 128). This indicates that there were low levels of antler craft production in Phases 3 and 5 and higher amounts of antler craft production in Phase F. Antler would have been a valuable material for craft production.

Red deer are the only deer species native to Ireland (though today there are several other deer species present that have been introduced from the Medieval to Modern periods). During the Late Iron Age, there is evidence for deer hunting and antler exploitation at various sites. The faunal assemblage from Moone, Co. Kildare contained 0.4% deer; Ballydavis, Co. Laois contained 3% deer; and Rathcash East 1 contained 13.1% deer. While most of the remains from these sites consisted of antler fragments, all these sites also contained postcranial fragments. Sites dating to the early medieval period tend to have lower levels of deer remains present (among my comparative sample, assemblages contained between 0.04-7.3% deer remains) with evidence of both hunting and antler exploitation.

There is textual evidence that indicates a low level of concern for deer hunting, represented as an activity for the elite but non-elites were not restricted from also hunting, as was the case in Britain (Kelly 1997). The sagas and law texts indicate that there were several ways to hunt deer, including using hounds, ambush, driving to barriers, and the use of traps like deer pits and hidden spikes. After the hunt, the carcass would be divided among the hunters, the landowners, and the hounds. Kelly (1997) suggests that, while the elite may have participated in hunting more regularly and employed deer hunters, deer were largely considered to be nuisances among the largely agricultural society and venison was not considered a particularly desirable commodity. John Soderberg (2004) found that monastic sites and urban sites from the later early medieval and medieval periods contained higher proportions of antler to postcranial elements, highlighting the importance of antler craft production over hunting in these contexts.

The assemblage at Ninch represents a mixture of low levels of hunting and antler craft production in the North side of the site and higher levels of antler craft production in the stratigraphically later South side Phase F. The increased antler craft production may be related to the economic relationship the community at Ninch had with the urban settlement at Dublin during this time (as evidenced by two Dublin-style bronze pins also found in this feature).

Fox (Vulpes vulpes)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Vulpes vulpes	8	.08%	8	2

Table 127 NISP and MNI for Vulpes vulpes

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP				1	7					
MNI				1	1					

Table 128 NISP and MNI for Vulpes vulpes (Pre-Phase 1-Phase 8)

There was a total of 8 identified fragments from *Vulpes vulpes* (red fox) from the assemblage at Ninch (Table 129). This represents a minimum of 2 individuals and 0.08% of the total number of identified fragments. Both individuals were identified in contexts in the north side of the site, from Phases 3 and 4, corresponding to the fill of the third inner enclosure, and the fill of gully features in the east part of the excavation area. The remains from Phase 3 consist of one mandible fragment and the remains from Phase 4 consist of both cranial and postcranial elements. As there were no identified modifications to any of the elements, it cannot be confirmed that the individuals represented hunted or trapped foxes and may represent natural inclusion.

Leporids (hare and rabbits)

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Leporidae	11	0.14%	15	4

Table 129 NISP and MNI for Leporids

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP			4	5		1				
MNI			1	1		1				

Table 130 NISP and MNI for Leporids (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP						1	
MNI						1	

Table 131 NISP and MNI for Leporids (Phase A-G)

There was a total of 11 identified fragments from *Leporidae* (either hare or rabbit) from the assemblage at Ninch. This represents a minimum of 4 individuals and 0.14% of the total number of identified fragments (Table 131). In the north side of the site, there were a total of 3 individuals identified, comprising 10 identified fragments (Table 132). These fragments derived from Phases 2, 3, and 5, corresponding to the fill of the second inner enclosure, the fill of the third inner enclosure, and the fill of gully features in the east part of the excavation area. On the south side of the site, there was 1 individual, comprising 1 fragment (Table 133). This fragment derived from Phase F, corresponding to the fill of the large rectilinear ditch. These individuals are more likely to represent hares rather than rabbits as rabbits were introduced to Ireland during the Anglo-Norman period, after occupation at Ninch had ceased.

There were no cut marks or modifications to any of the bone fragments, therefore it cannot be confirmed that hare was consumed at the site, however hare would have provided diversity in the diet at the site as well as pelts, which could be worn.

Rodents

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Rodentia	30	0.33%	5	1

Table 132 NISP and MNI for Rodents

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP										30
MNI										1

Table 133 NISP and MNI for Rodents (Pre-Phase 1-Phase 8)

There was a total of 30 identified fragments of rodent remains from the faunal assemblage at Ninch. This represents a minimum of 1 individual and 0.33% of the total number of identified fragments (Table 134). The remains derive from small rodent species such as woodmouse. All the remains were associated with Phase 8 in the north half of the site, which relates to the construction and use of the stone architecture/*souterrains* (Table 135). The presence of rodent remains supports the hypothesis that these features were used as underground food storage facilities.

Reptiles

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Testudines	1	0.01%	1	1

Table 134 NISP and MNI for Reptiles

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP				1						
MNI				1						

Table 135 NISP and MNI for Reptiles (Pre-Phase 1-Phase 8)

There was 1 positively identified reptile bone from a minimum of 1 individual in the sample from Ninch. This represents 0.01% of the identified remains from the entire sample (Table 136). The sample is represented by a single scapula from a turtle. There were no observed cut marks or other kinds of modifications to the bone, therefore it is unclear whether the turtle was trapped and brought to the site or if its presence in the faunal assemblage represents a natural deposition.

The turtle scapula likely derives from a marine species of turtle, such as the Leatherback (*Dermochelys coriacea*), a Green (*Chelonia mydas*), or Loggerhead (*Caretta caretta*), based on its size and generalized morphology and as all these species have been recorded around Ireland. Also possibly, but less likely, the scapula could represent a Hawksbill (*Eretmochelys imbricata*) or Kemp's Ridley Sea turtle (*Lepidochelys kempii*), which have rarely been recorded in Ireland. There are two freshwater turtle species in Ireland, however both are invasive species, which have only recently been introduced. The only native terrestrial reptile species in Ireland is the Viviparous lizard (National Biodiversity Data Centre).

Mollusks

Total	*NISP*	*%NISP*	*MNE*	*MNI*
Mollusca	19	0.2%	19	19

Table 136 NISP and MNI for Mollusks

North	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8*
NISP	2	1	2	0	0	1	1	0	0	0
MNI	2	1	1			1	1			

Table 137 NISP and MNI for Mollusks (Pre-Phase 1-Phase 8)

South	*A*	*B*	*C*	*D*	*E*	*F*	*G*
NISP					8		
MNI					8		

Table 138 NISP and MNI for Mollusks (Phase A-G)

There were 19 positively identified mollusk shells from a minimum of 19 individuals in the sample from Ninch. This represents 0.2% of the identified remains from the entire sample (Table 138). All the mollusk shells identified belonged to marine species, including oyster, clam, and limpets. This small sample represents only those shells that were included in bags with animal bone remains and does not accurately represent the exploitation of marine mollusks at Ninch, as there are several bags' worth of shells that have not been analyzed.

There are 29 documented shell midden sites along the Irish coast, ranging from the Mesolithic to the Post-Medieval Period. While most of these sites are undated, four have been identified as being formed during the Iron Age (Ballymulholland, Co. Londonderry; Culfin, Co. Galway; Omey Island, Co. Galway; and Poul Gorm, Co. Cork) and four have associated medieval occupations (Dooey, Co. Donegal; Robswalls 1, Co. Galway; Grange, Co. Sligo; and Rough Island, Co. Antrim). In the archaeological literature, shell midden sites are evidence for marginal subsistence practices. Aiden O'Sullivan and Colin Breen (2007) interpreted evidence for occupation at the Iron Age Ballymulholland shell midden as, "an occupation site of people who were eking out their scarce food resources after a long winter…" (94). This interpretation stands despite evidence for iron craft production at the site (which the authors acknowledge has important social and cultural implications). During the early medieval period, several shell midden sites contain evidence for high status craft production. For example, the midden at Dooey, Co. Donegal, contained evidence of iron production and bronze casting of brooches and pins in addition to evidence of bone and antler working. The remains of dogwhelks have been uncovered at Dooey and other shell midden sites, indicating high status resource exploitation. Dogwhelk flesh, while poisonous to humans, produces a substance that can be used in purple dye production, though it is difficult to produce and labor intensive. Rather than being marginal, these sites represent regular occupation and even high-status craft production.

The mollusk shell assemblage at Ninch represents potentially consistent exploitation of near-shore marine resources and needs to be examined further in future research.

Butchery

To understand butchery practices at Ninch, we can examine both the distribution of butchery marks across species and difference size classes as well as the distribution of butchery marks across different skeletal elements of the major livestock taxa. Butchery marks include cut marks, chop marks, and evidence of roasting, which include marks that would be consistent with disarticulation, filleting, and culinary practices. This excludes other kinds of modifications which might also occur on the same elements such as carnivore or rodent gnawing, shaping, polishing, pathologies, or the utilization of bones as raw material for tools or other objects.

Types of Butchery Marks per Period

North Side

Taxon	*Pre- 1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Cut	9	54	105	19	3	16	61	3	16
Chop	12	15	50	23	8	10	52	2	11
Saw	0	1	1	1	0	0	1	0	0
Scrape	0	0	1	0	0	2	0	0	1
Burnt/roasted	0	0	13	2	2	0	11	0	2
Burnt/calcined	4	2	1	0	0	0	4	0	3
Carnivore	5	24	25	12	3	13	26	2	4
Rodent	1	2	3	2	0	0	8	0	1
Split	1	0	1	0	0	0	2	0	0
Hole	0	0	1	0	0	0	1	2	1
Total	32	98	201	59	16	41	166	9	39

Table 139 Counts of types of butchery marks per Phase (Pre-Phase 1-Phase 8)

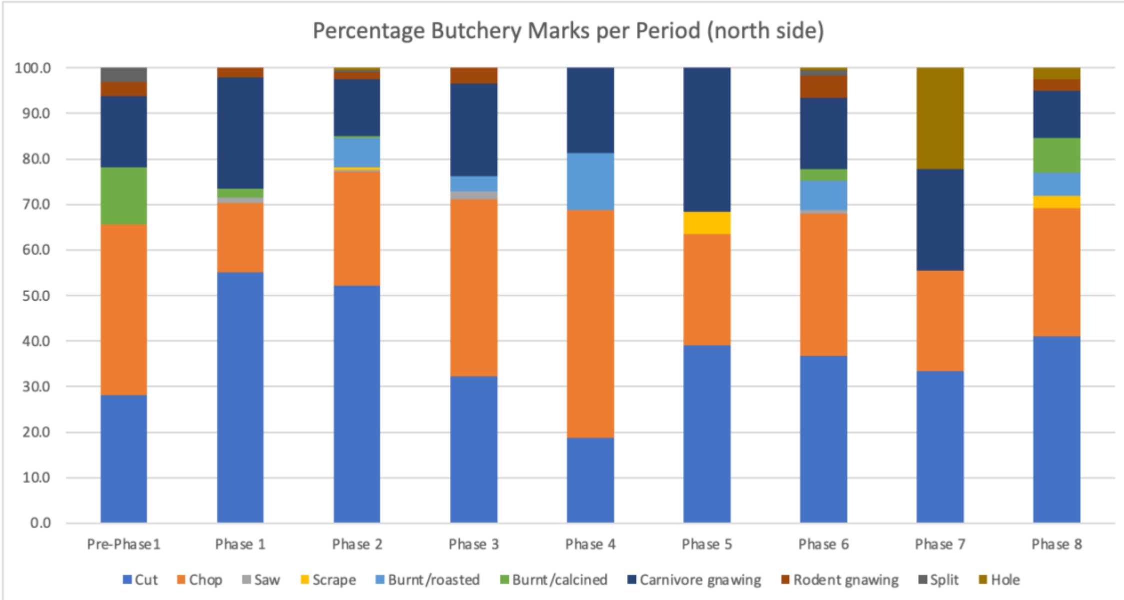

Figure 39 Proportion of types of butchery marks per Phase (Pre-Phase 1-Phase 8)

These data indicate the kinds of butchery practices that took place at Ninch. In Pre-Phase 1, Phase 3, and Phase 4, most butchery marks consisted of chop marks (Table 141 & Figure 39). Heavy chop marks are used in disarticulation and primary processing. Therefore, it is likely that, during these phases, cattle were slaughtered on site and the first phases of butchery took place. A high percentage of chop marks may not only indicate that livestock were raised and butchered on site but also a higher degree of livestock processing. Holes in bones may also indicate a higher degree of processing (even proto-industrial), such as OID2072, a cow scapula from Phase 6 with a hole through the blade (Figure 40).

Figure 40 Cattle scapula (OID 2027) with a puncture through the blade

Similar marks were discussed by Rizzetto, Crabtree, and Albarella (2017) as evidence of increased cattle processing during the Roman Period in Britain. Likewise, in Phase 1 and 2, the most common form of butchery marks was cut marks, which indicates fileting, or the removal of meat from the carcass. The evidence of roasting in Phases 2, 3, 4 and 6 suggest that there was some degree of consumption of meat roasted on the bone (which would differ from meat that was prepared in other ways, such as boiling). Additionally, the evidence of rodent gnawing suggests the presence of grain storage, which would have attracted rodents.

South Side

Taxon	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Cut	1	2	1	0	2	15	0
Chop	0	1	0	1	0	15	0
Saw	0	0	0	0	0	3	0
Scrape	0	0	0	0	0	0	0
Burnt/roasted	1	0	0	0	1	3	0
Burnt/calcined	0	0	1	0	1	1	0
Carnivore	0	2	0	1	1	9	0
Rodent	0	0	0	1	0	2	0
Split	0	0	0	0	0	0	0
Hole	0	0	0	0	0	0	0
Total	2	5	2	3	5	48	0

Table 140 Counts of types of butchery marks per Phase (Phase A-G)

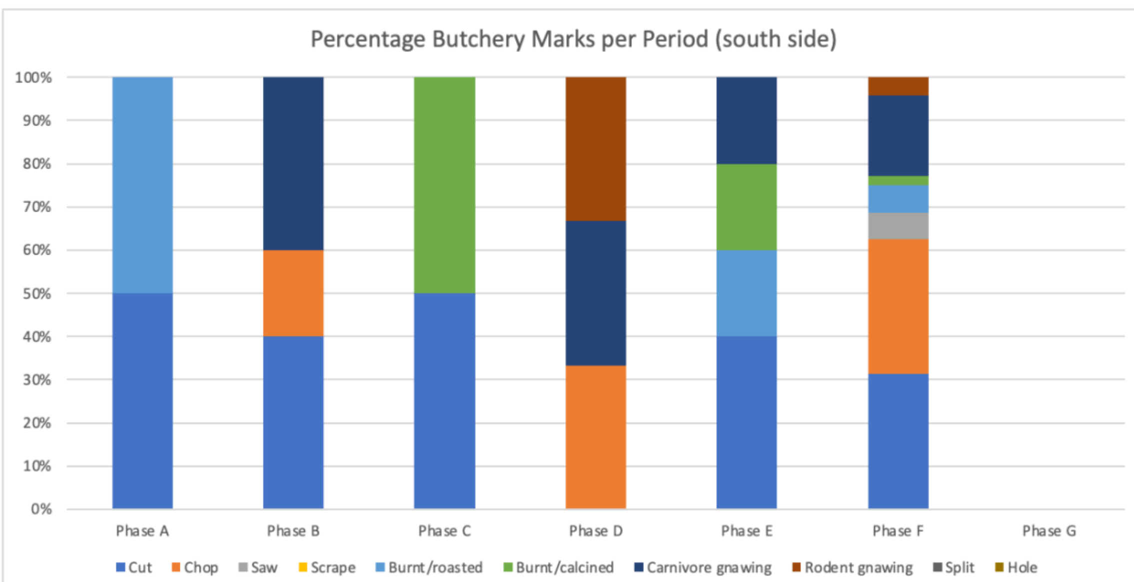

Figure 41 Proportion of types of butchery marks per Phase (Phase A-G)

On the south side of the site, there are considerably fewer butchery marks in total (Table 142 & Figure 41). Interesting, though perhaps unsurprisingly, Phase F has the greatest number of butchery marks and the greatest diversity of butchery marks. This indicates a variety of butchery and culinary practices and likely represents generalized habitation debris.

Size Class/Species Distribution per Period

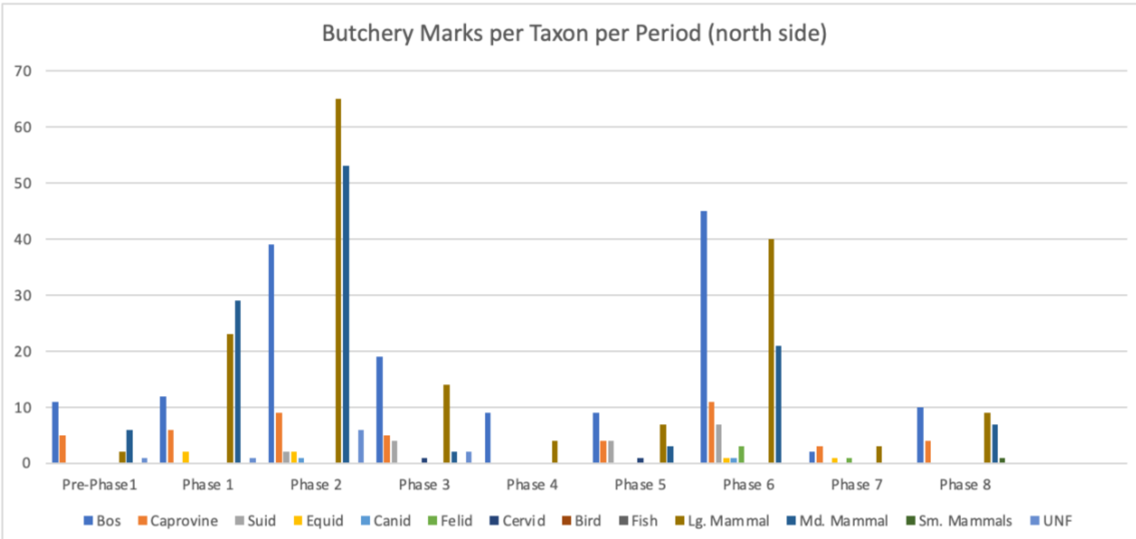

Figure 42 Butchery marks (counts) per Taxon per Phase (Pre-Phase 1-Phase 8)

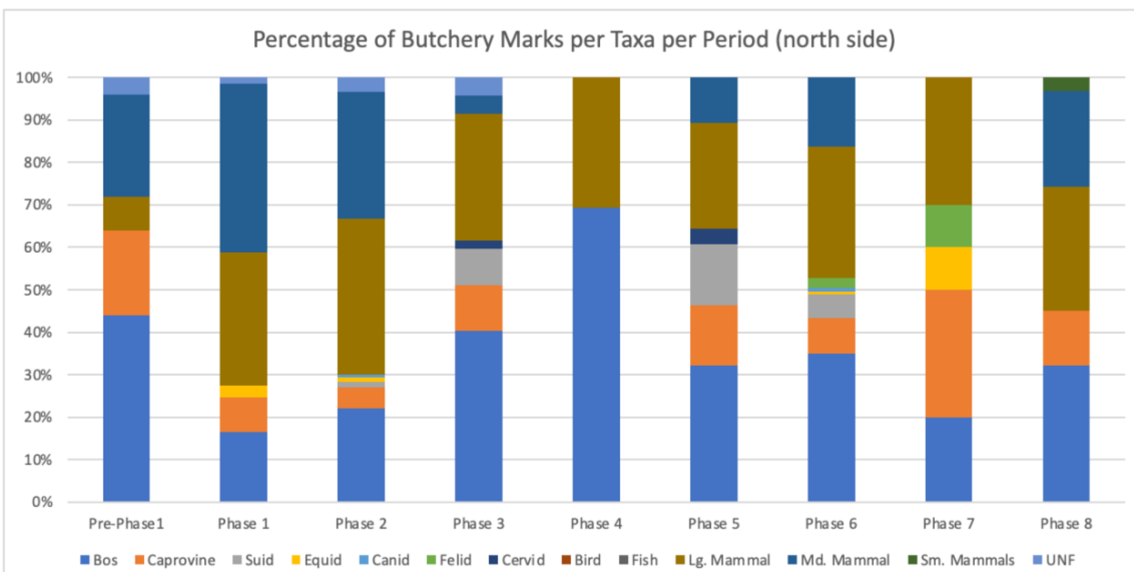

Figure 43 Proportion of butchery marks per Taxon per Phase (Pre-Phase 1-Phase 8)

In the north side of the site, there are shifts in both the number and frequency of butchery marks across species (Figure 43). Notably, Phases 2 and 6 demonstrate the greatest number of butchery marks (177 and 129, respectively) and Phase 7 the least (10). There are, additionally, changes in the distribution of butchery marks on taxa, including cattle and caprovines (sheep and/or goats). For example, in pre-Phase 1, 44% of butchery marks occurred on cattle and 20% occurred on caprovine remains, however, in Phase 1, only 16% of butchery marks occurred on cattle remains and 8% on caprovines (this change in frequency is evidence even when including butchery marks on unidentified large mammal remains [from 8 to 32%] and medium mammal remains [from 24 to 40%], which likely represent cattle and caprovines). In the final two phases (Phases 7 and 8), there are few butchery marks and a more even distribution of those marks across species. This, along with the measures of diversity and evenness from these periods, suggests unspecialized consumption practices.

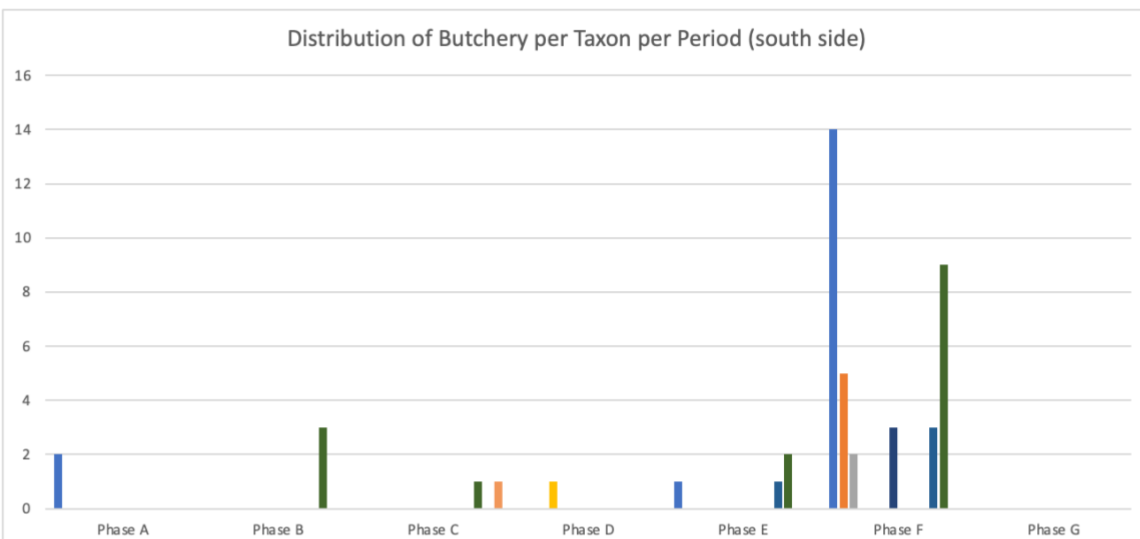

Figure 44 Butchery marks (counts) per Taxon per Phase (Phase A-G)

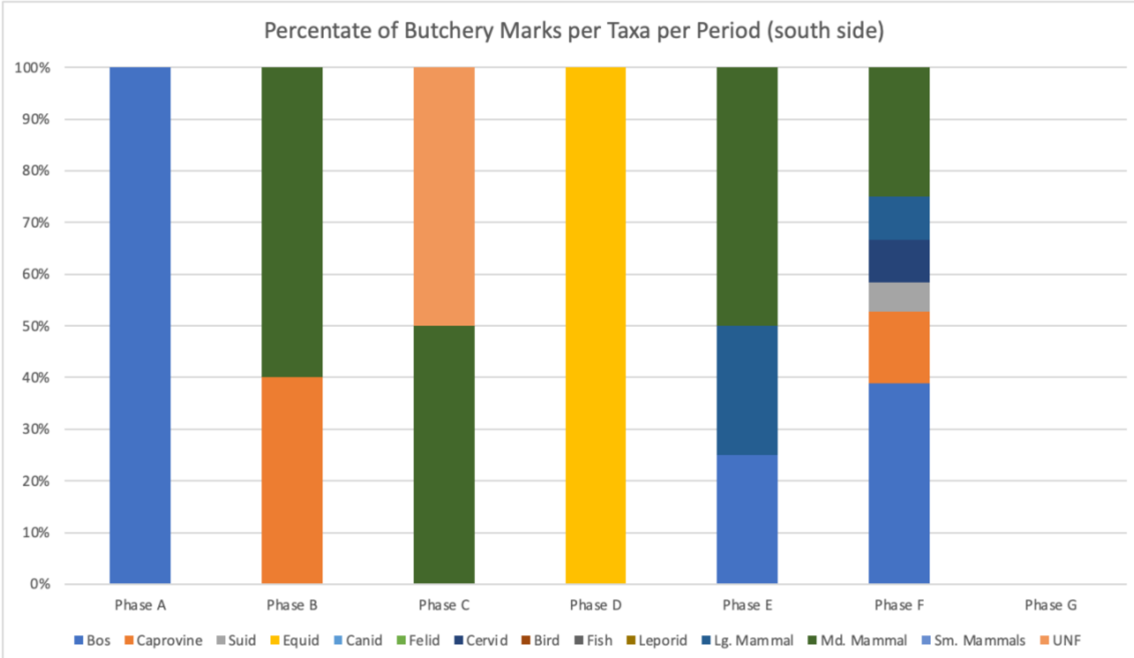

Figure 45 Proportion of butchery marks per Taxon per Phase (Phase A-G)

In the south side of the site, there were fewer instances of butchery, generally, with Phase F representing the greatest amount of butchery marks (36) and Phase 6 representing the least (0) (Figure 44). The high number of butchery marks in Phase F corresponds to the phase of occupation or features that also contain the greatest number of fragments and the greatest diversity of species butchered. There are, however, too few butchery marks from the south side of the site to generalize about butchery patterns during these phases of occupation, except for that it appears that Phase F represents generalized habitation debris.

Body Part Distribution per Period

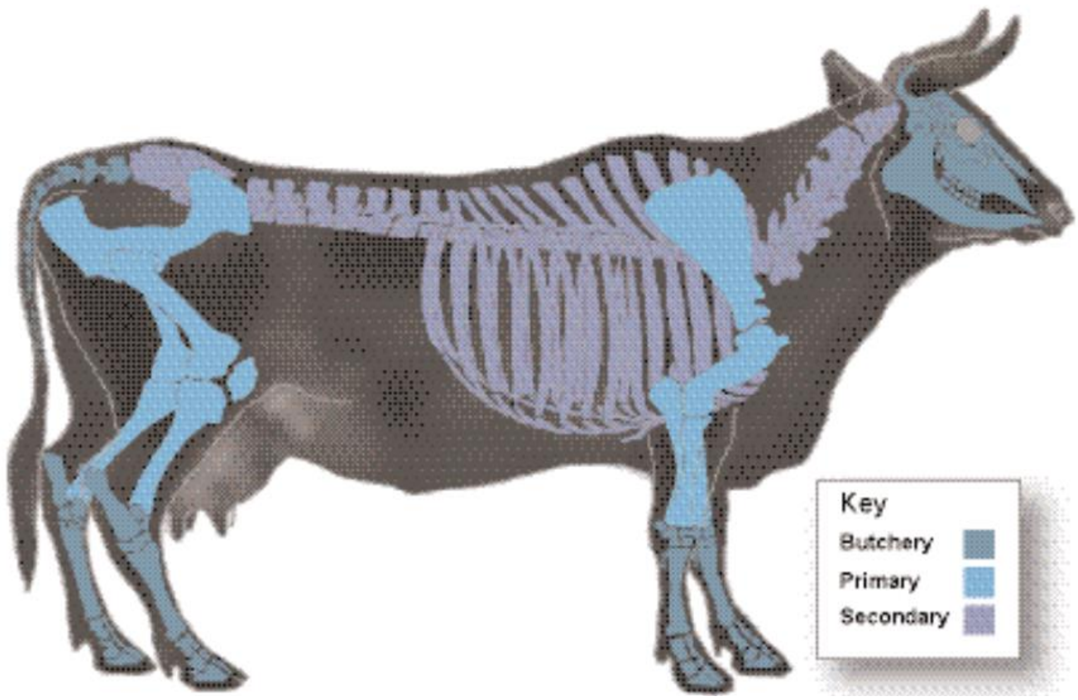

Figure 46 Cattle butchery figure by Sara Nylund and Eavan O'Dochartaigh from Tourunnen (2008)

It is important to examine both body part distributions and compare those data to elements where butchery marks occur. A predominance of certain body parts relates to different phases of butchery. Each of the phases of butchery suggests important information about agricultural production methods, perceptions of butchery, and transportation of meat and the distribution of meat through society (Binford 1978; Reitz and Wing 1999; and Lyman 1994a).

Figure 46 from Tourunen (2008) demonstrates the three primary phases of butchery: butchery, primary, and secondary butchery. Butchery, by Tourunen's example, is also referred to as slaughter. Cut marks in these regions (including the cranium, mandible, metapodia, and phalanges) represent cut marks made when the animals were initially dispatched as well as with skinning and horn removal. Primary butchery is also referred to as disarticulation. Cuts and chops made to the meat bearing upper and lower limbs, as well as the scapulae and innominate, represent removal of the major meat bearing elements and distribution of meat. Finally, secondary butchery reflects preparation for cooking. These definitions of primary and secondary butchery differ slightly from Gifford-Gonzalez's (2018) definitions but are analogous to what Gifford-Gonzalez refers to as primary butchery and culinary processing. The organization of the phases of butchery into these three phases relates to butchery and culinary practices and, importantly, differentiate between butchery that occurs *in situ* and body parts that have been transported either to or away from the site of consumption.

North Side (Pre-Phase 1-Phase 8 and unstratified material from Phases 2-6)

Taxa		*Pre- 1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Bos	Slaughter	3	5	14	5	2	3	16	2	1
	Primary	12	15	40	25	6	9	39	2	12
	Secondary	2	24	59	12	2	5	26	2	6
Caprovine	Slaughter	1	4	0	3	0	5	6	1	1
	Primary	2	11	11	4	0	2	11	1	4
	Secondary	3	24	1	1	0	0	0	0	0
Suids	Slaughter	0	0	2	1	0	1	3	0	0
	Primary	0	0	3	5	0	6	7	0	0
	Secondary	0	0	0	0	0	0	0	0	0
Md.	Slaughter	0	0	0	2	0	0	7	0	0
Mammal	Primary	0	0	7	0	0	0	1	0	3
	Secondary	0	0	43	1	0	3	19	0	4

Table 141 Butchery marks per Taxon per Level of buchery per Phase (Pre-Phase 1-Phase 8)

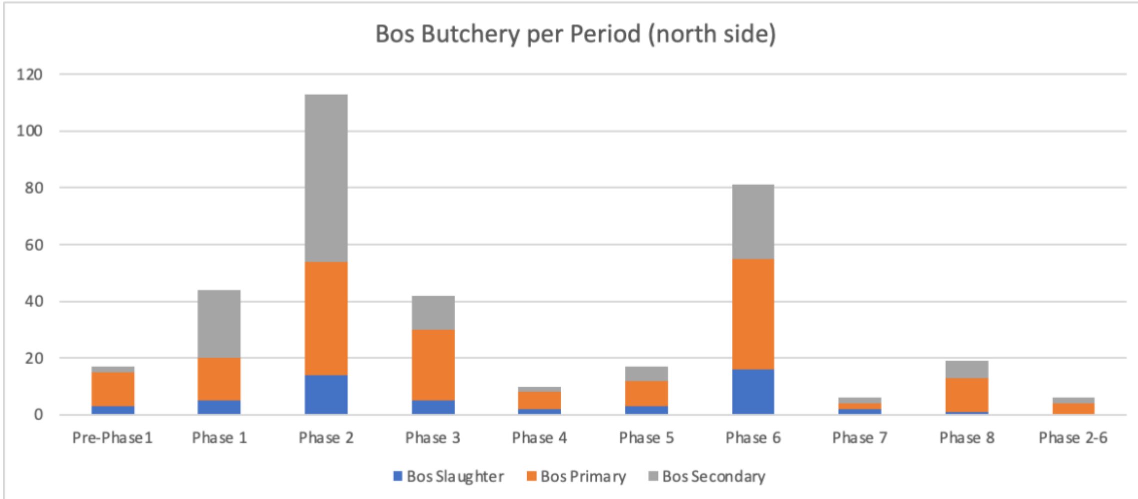

Figure 47 Butchery marks per Level of butchery per Phase, Pre-Phase 1-Phase 8 (Bos taurus)

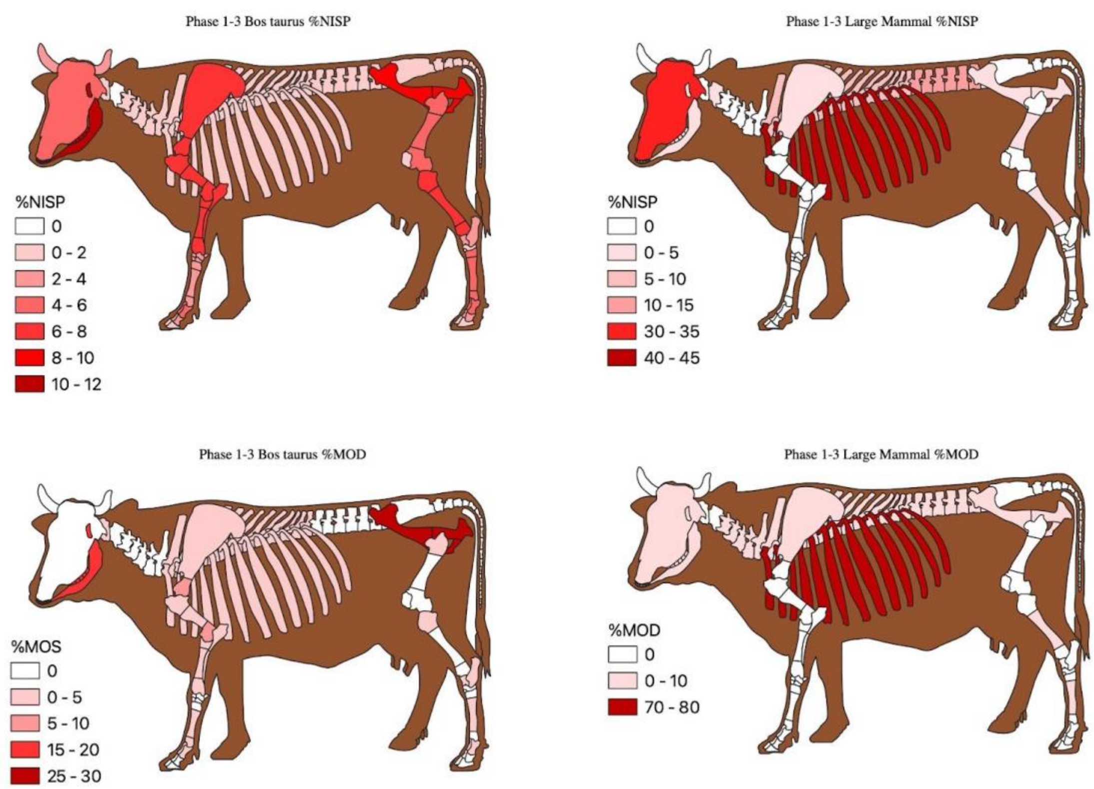

Figure 48 Bos taurus (left) and Large mammal (right) proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 1-3

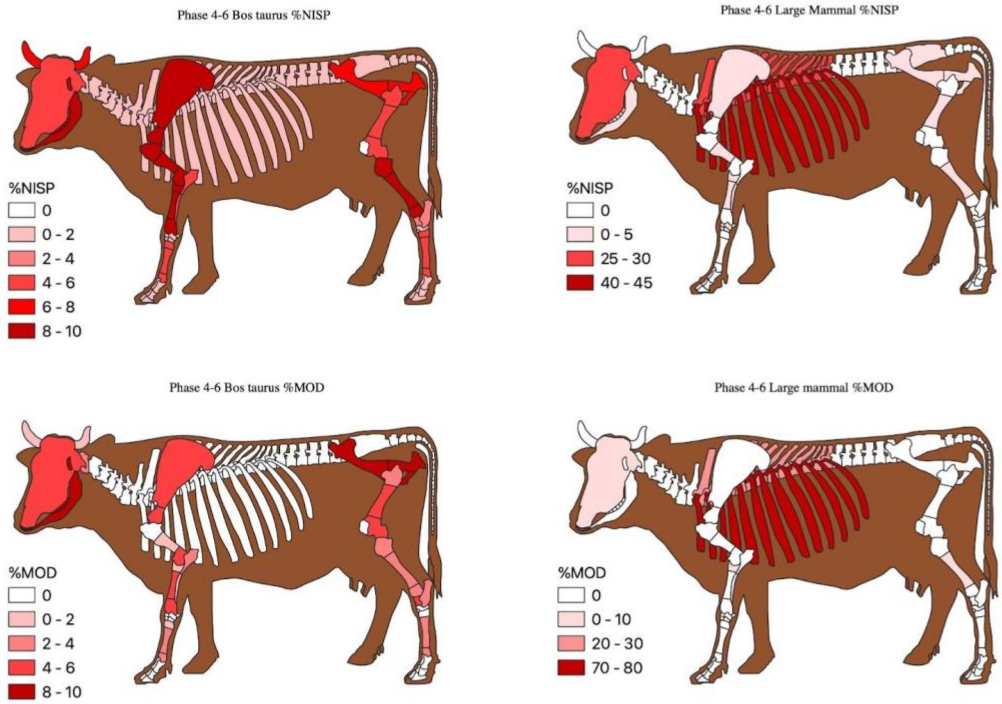

Figure 49 Bos taurus (left) and Large mammal (right) proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 4-6

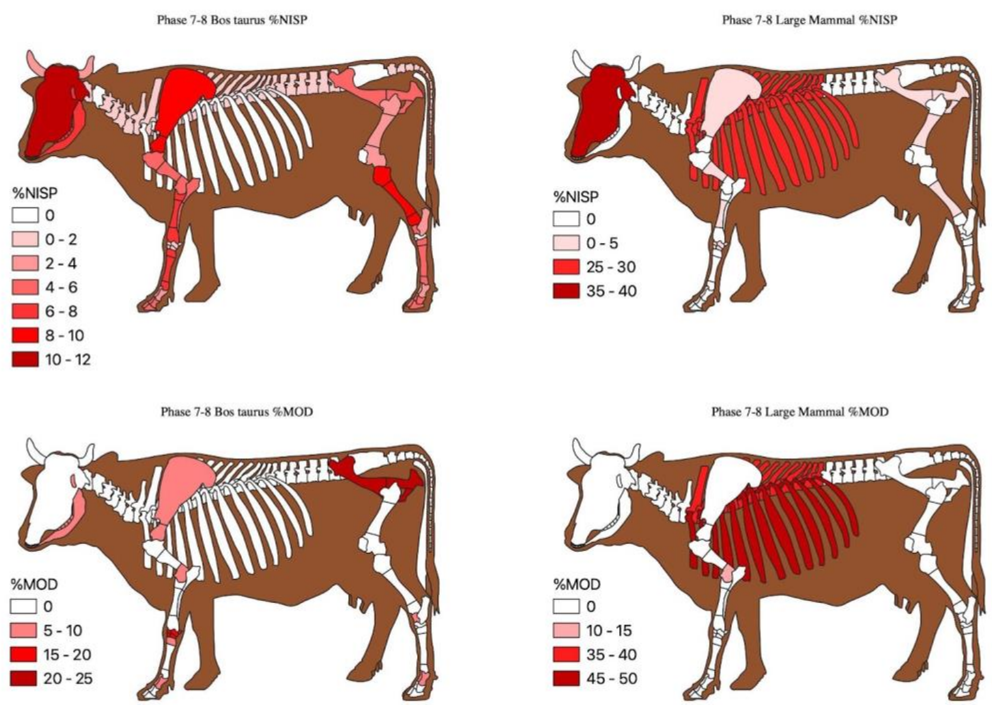

Figure 50 Bos taurus (left) and Large mammal (right) proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 7-8

The data Figures 48, 49, & 50 have been condensed to represent the three major phases of activity: Phases 1-3 (Figure 48) representing the period of initial enclosure and burial, Phases 4-6 (Figure 49) representing the shift to the east, and Phases 7-8 (Figure 50) representing the large enclosure ditch and souterrains (occupation moving back to the west). The body part distribution from Phases 1-3 shows a greater proportion of primary and secondary butchery with all four limbs represented (rather than, for example, a greater number of forelimbs to hindlimbs). This indicates that, while slaughter occurred on site, there was some meat that was brought to the site already butchered. In Phases 4-6, all three phases of butchery are well represented and there is a greater proportion of forelimbs to hindlimbs. This suggests that cattle were raised, butchered, and consumed on site. Finally, in Phases 7-8, there is evidence for slaughter and some primary butchery but less evidence for secondary butchery. This indicates that cattle were slaughtered on site and the major body parts were distributed, but consumption took place elsewhere or was likewise dispersed.

Evidence of cut marks on cattle from the north side of Ninch suggest shifting patterns in local and non-local consumption patterns. For instance, the relatively high proportions of secondary butchery in Phases 1, 2, 3, 5, 6, 7, and 8 suggest that cattle were slaughtered, butchered, and consumed on site. The relatively low proportions of secondary butchery in Pre-Phase 1 and Phases 4 might suggest that cattle were slaughtered and butchered locally but that meat was likely transported elsewhere for consumption. The evidence of local consumption during Phases 1-3 suggests that there was local habitation and consumption concurrent with the period of burial at the site. Similarly, the pattern of butchery from Phase 6 represents a particular focus on cattle butchery and local consumption. The paucity of butchery evidence from Phases 7 and 8 might support interpretations of off-site butchery and the increased importance of grain production for consumption at the site.

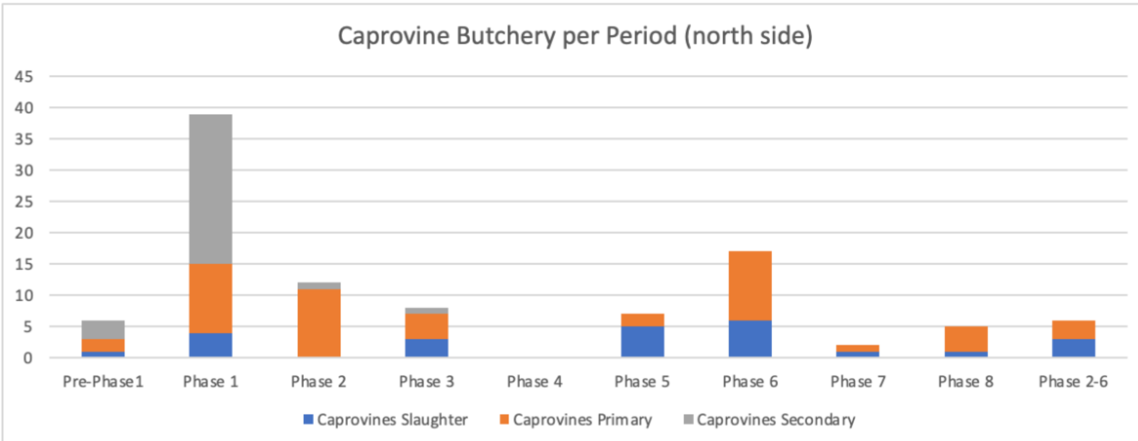

Figure 51 Butchery marks per Level of butchery per Phase, Pre-Phase 1-Phase 8 (Caprovine)

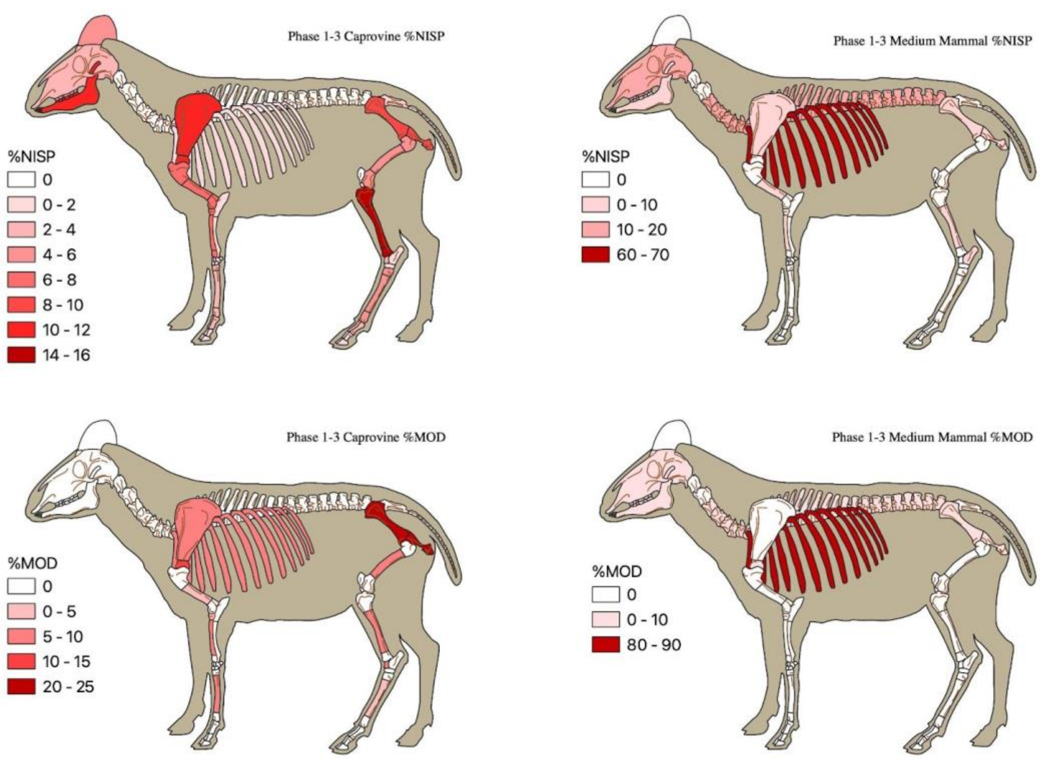

Figure 52 Caprovine (left) and Medium mammal (right) proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 1-3

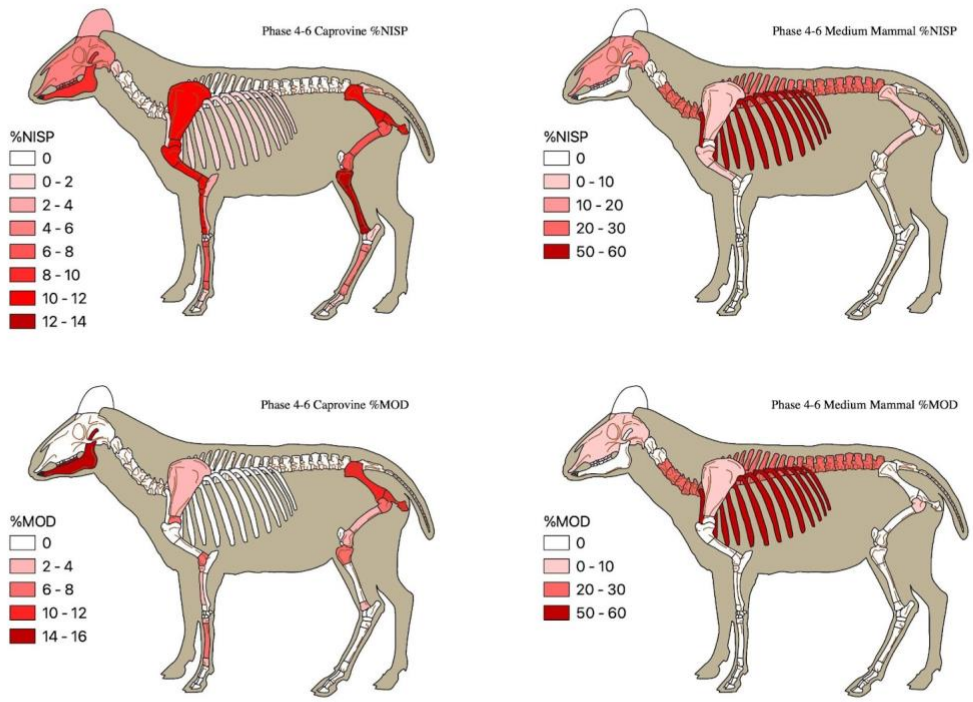

Figure 53 Caprovine (left) and Medium mammal (right) proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 4-6

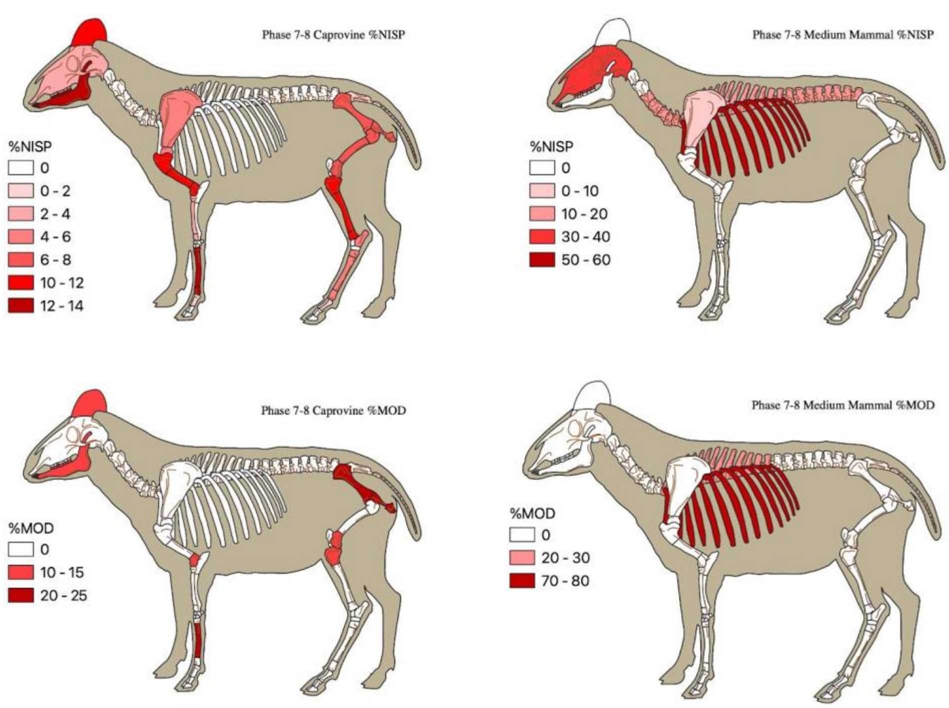

Figure 54 Caprovine (left) and Medium mammal (right) proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 7-8

The body part distribution for caprovines (which represents both sheep and goats due to their skeletal similarities), suggests that there was a shift from generalized butchery and consumption to primary butchery and distribution. In Phases 1-3 (Figure 52) there is a more even distribution between body part zones associated with all three phases of butchery. In Phases 4-6 (Figure 53), however, there is a preponderance of meat-bearing limb bones, associated with primary butchery, and fewer elements suggesting slaughter and consumption. Similarly, in Phases 7-8 (Figure 54), there are more elements present in the assemblage associated with slaughter and primary butchery, as well as a high proportion of butchery marks to the horns or horn cores and lower limbs. During all phases of occupation (but particularly during Phases 7-8 and, to a lesser degree Phases 1-3), there are a higher proportion of butchery marks to the metapodials. Cuts to this region are often associated with skinning (Binford 1981). There is historical and ethnographic evidence to support this interpretation, suggesting that, as an animal is skinned, the hides are left attached to the metapodia during preparation and transportation and, only with the hide in the final stages of preparation is the hide cut away from the metapodia. These data supports the interpretation that caprovines at Ninch were, in part, raised for their hides (in addition to their wool, which can be shorn without skinning, and their milk). The additional cuts made to the horns or horn cores in Phases 7-8 may also indicate a focus on the exploitation of horn material for crafts.

The evidence of butchery marks on caprovines suggests that, while caprovines were likely slaughtered on site during most phases of occupation (Pre-Phase 1 and Phases 1, 3, 5, 6, 7 and 8), consumption most likely took place primarily during Pre-Phase 1 and Phases 1, 2, and 6. The counts of butchery marks in the chart above exclude marks on ribs and vertebrae (evidence for secondary butchery), for the most part. This was largely due to a lack of comparative data to differentiate ribs and vertebrae between medium sized mammals. That data has been aggregated below. Comparing the data for butchery marks on positively identified caprovines to the aggregated medium mammal secondary butchery evidence, supports consumption of caprovines in Phases 2 and 6 (as well as even stronger data for caprovine slaughter in Phase 6). The aggregated data also suggest that there was less focus on caprovine slaughter in Phases 7 and 8, with some evidence of slaughter and primary butchery but no evidence of secondary butchery.

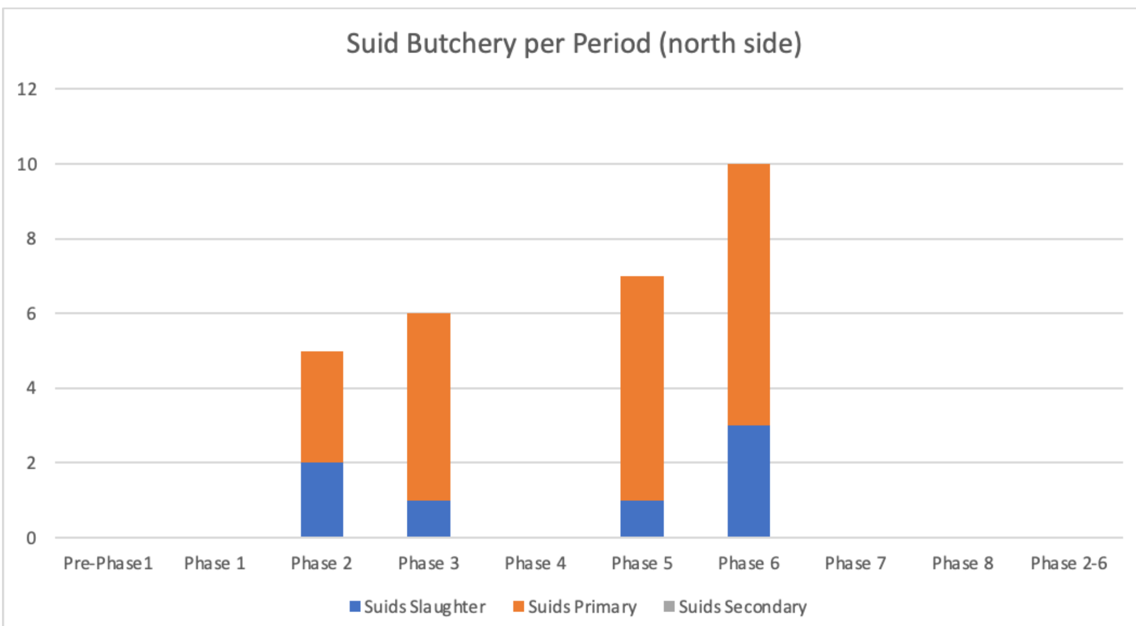

Figure 55 Butchery marks per Level of butchery per Phase, Pre-Phase 1-Phase 8 (Sus scrofa)

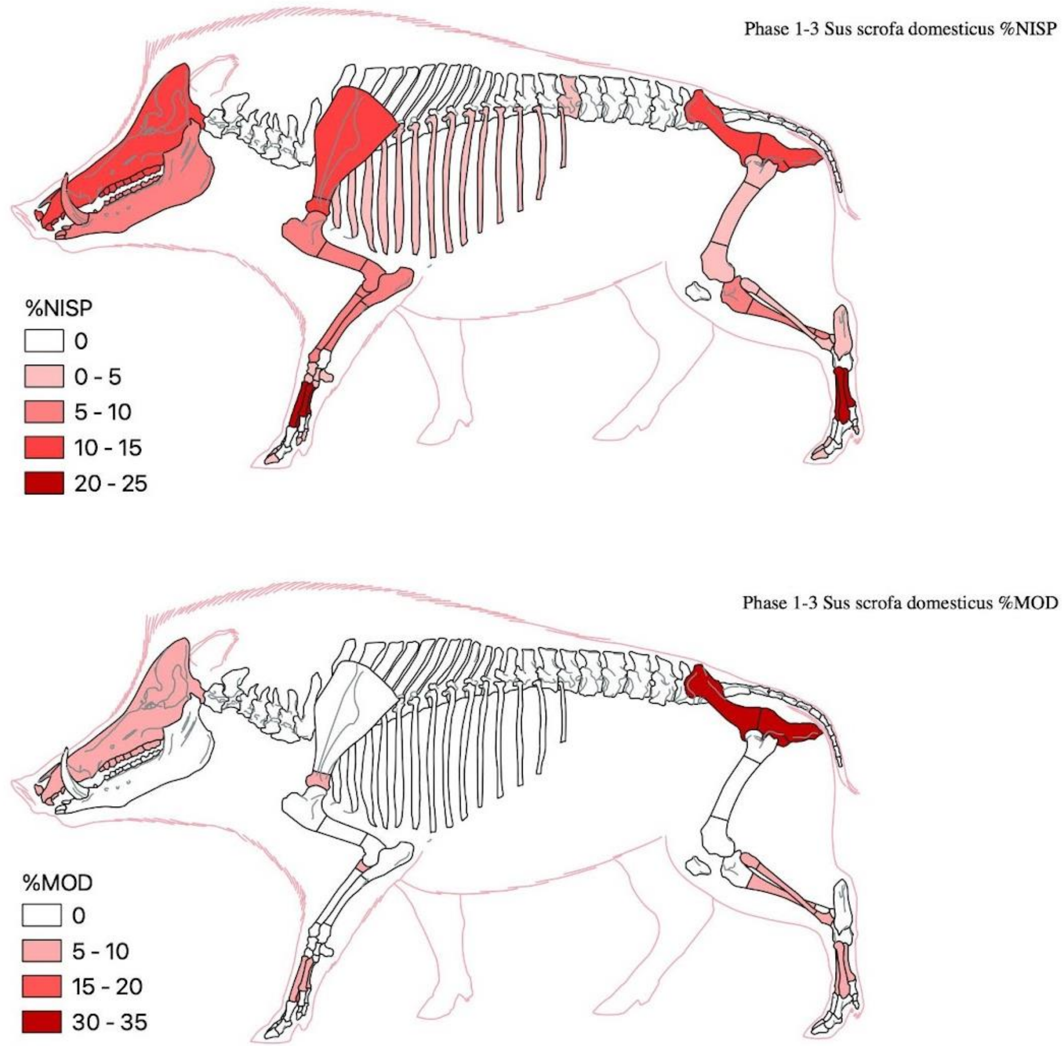

Figure 56 Sus scrofa proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 1-3

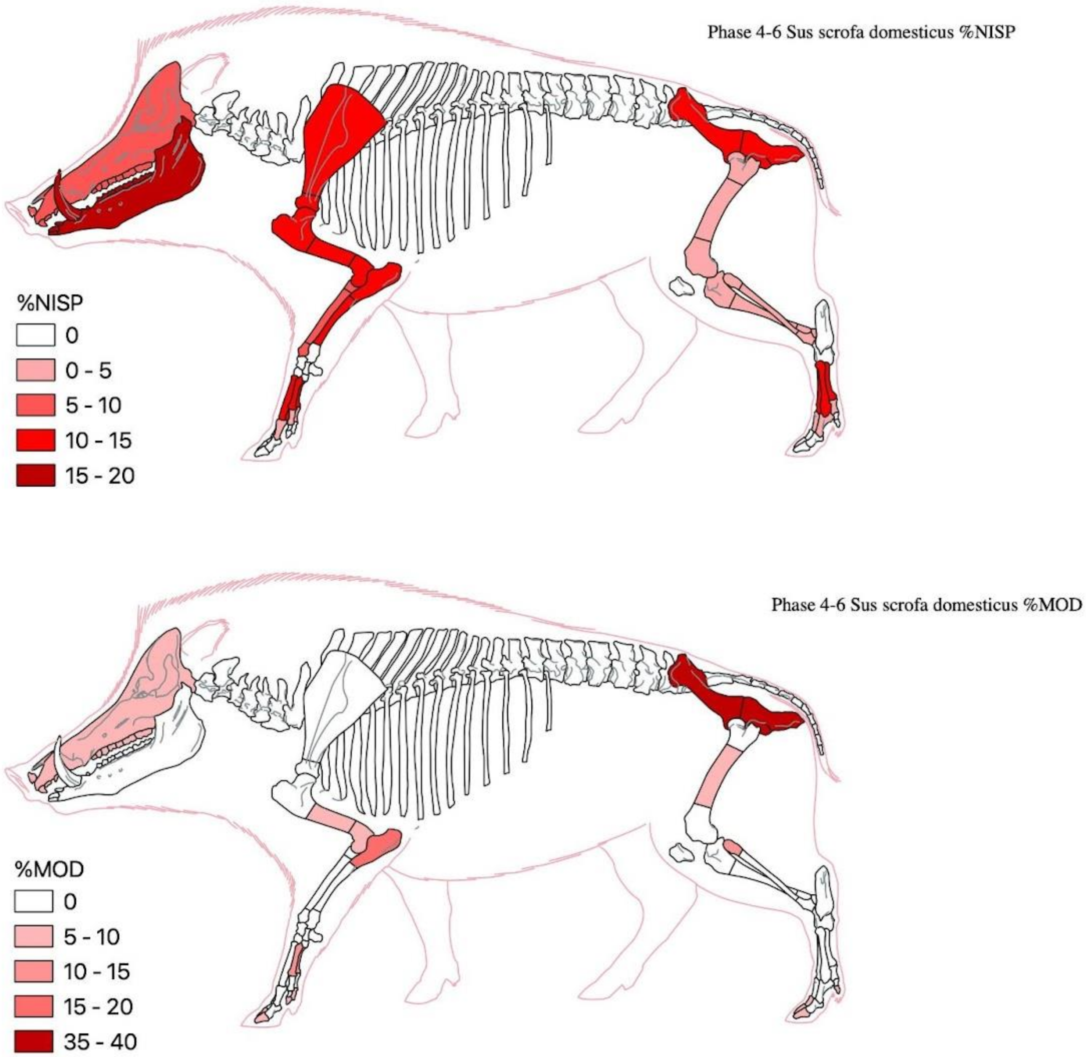

Figure 57 Sus scrofa proportions of skeletal elements (%NISP) and proportion of locations of butchery (%MOD), Phases 4-6

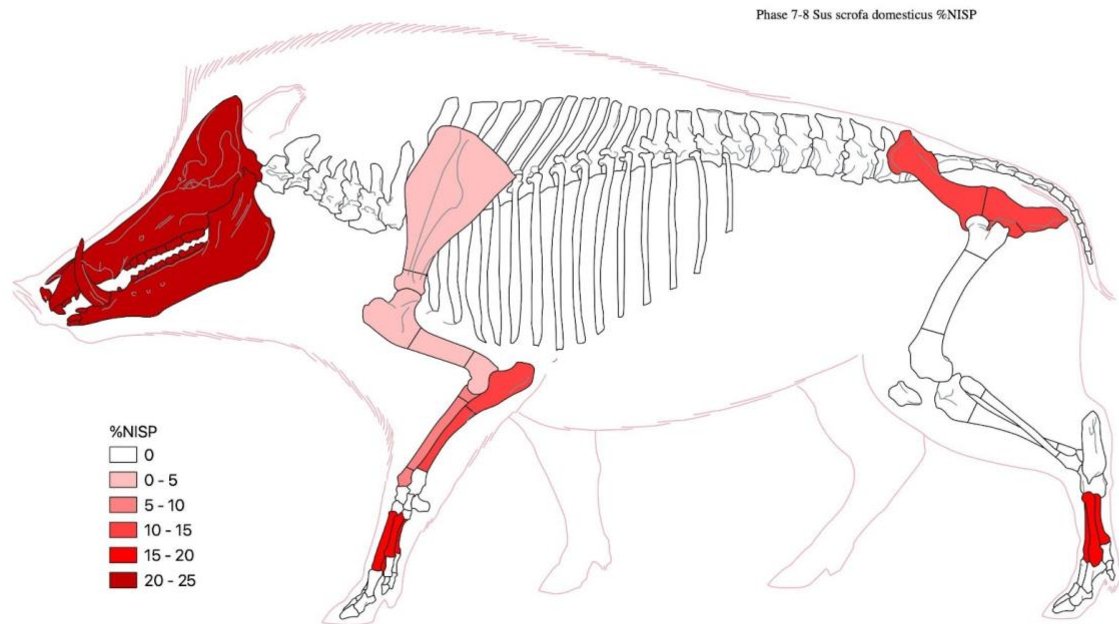

Figure 58 Sus scrofa proportions of skeletal elements (%NISP), Phases 7-8

Unlike the measures of butchery among cattle and caprovines, evidence of butchery in suids (pigs) may largely be attributed to consumption. This is because, unlike cattle and caprovines, suids are primarily raised for consumption rather than for secondary products (like dairy, wool, or traction). Therefore, these data indicate that there was a particular interest in pigs (or pork) in Phases 2, 3, 5, and 6 but not in Pre-Phase 1 and Phases 1, 4, 7, and 8. The presence of pig butchery Phases 2, 3, 5, and 6 correspond to generalized habitation waste.

The body part distribution of pig remains (measured by %NISP) might additionally suggest culinary practices (Figures 56, 57, & 58). For example, in all phases, there are a high proportion of cranial remains as well as long bones and other meat bearing elements (e.g., scapula and innominate). While the high number of cranial bones might be a result of post-depositional fragmentation, the additional evidence of cut marks to cranial bones suggests that slaughter did occur on site, and likely consumption as well. The high proportion of long limb bones and the relatively low proportion of evidence of secondary butchery may relate to culinary practices. For example, once broken down into smaller portions, pork may have been boiled on the bone rather than being butchered further. Boiling meat on the bone would additionally fortify the broth and might extract additional nutrients and make them available to the consumers. Therefore, while these data might suggest meat distribution and transport away from the site, it might similarly represent the consumption of boiled meat (not unlike a stew).

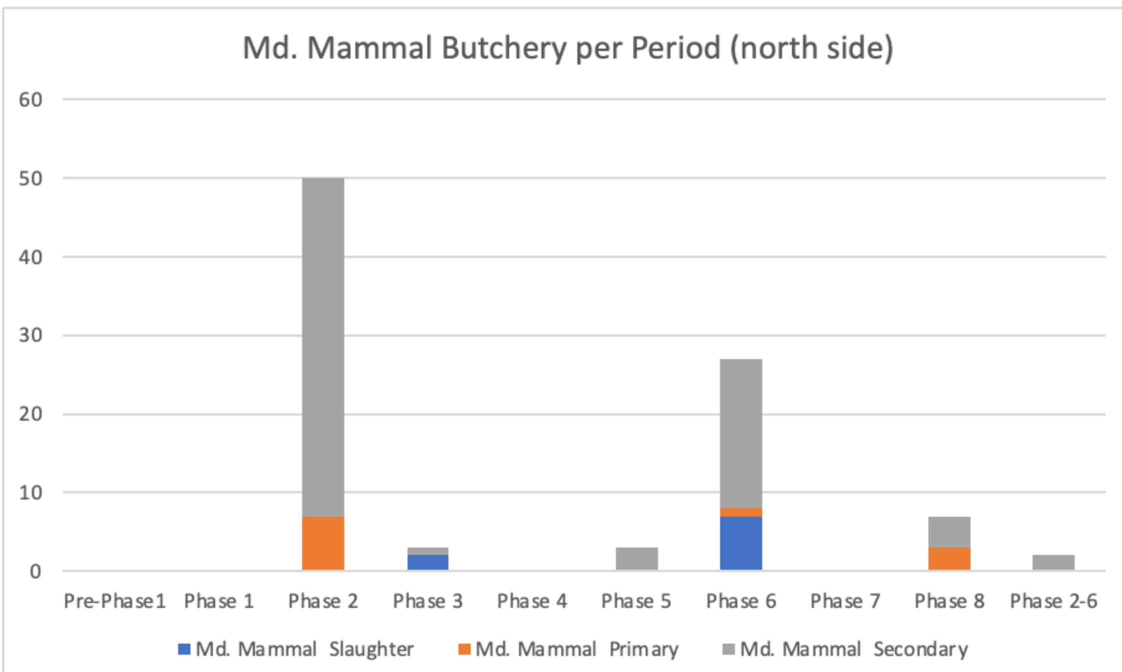

Figure 59 Butchery marks per Level of butchery per Phase, Pre-Phase 1-Phase 8 (Medium mammal)

South Side

Taxa		*A*	*B*	*C*	*D*	*E*	*F*	*G*
Bos	Slaughter	2	0	0	0	1	6	0
	Primary	0	0	1	1	0	10	0
	Secondary	0	0	0	0	0	1	0
Caprovines	Slaughter	0	0	0	0	0	4	0
	Primary	0	0	0	0	0	7	0
	Secondary	0	0	0	0	0	1	0
Suids	Slaughter	0	0	0	0	0	0	0
	Primary	0	0	0	0	0	2	0
	Secondary	0	0	0	0	0	0	0
Md. Mammal	Slaughter	0	0	0	0	0	0	0
	Primary	0	0	0	0	0	3	0
	Secondary	0	3	1	0	1	6	0

Table 142 Butchery marks per Taxon per Level of butchery per Phase (Phase A-G)

In general, there are far fewer instances of butchery marks in the features from the south side of the site (Table 142). Phase F does have the greatest number of elements with butchery marks, indicating a particular focus on cattle butchery, however this is likely a measure of Phase F having a greater number of fragments in total. Phase E has the second greatest number of fragments, though about half as many as Phase F, but has less evidence for butchery. This may be a matter of the nature of the features themselves or it might suggest that less butchery took place on site during that phase of occupation.

Pathology

North	*Tot.*	*Pre-1*	*1*	*2*	*3*	*4*	*5*	*6*	*2-6*	*7*	*8.*
Bos	17	1	1	5	2		2	4	1		1
Caprovine	8				1		2	3			1
Suid	4				1		1	2			
Equid	2		1	1							
Canid	1							1			
Felid	2							2			
Cervid	0										
Aves	0										
Fish	0										
Lg. Mam.	9			1	2		4	2			
Md. Mam.	2				1			1			
Sm. Mam.	0										
UNF	0										
Totals	44	1	2	7	7	0	9	15	1	0	2

Table 143 Pathology (count) per Taxon per Phase (Pre-Phase 1-Phase 8)

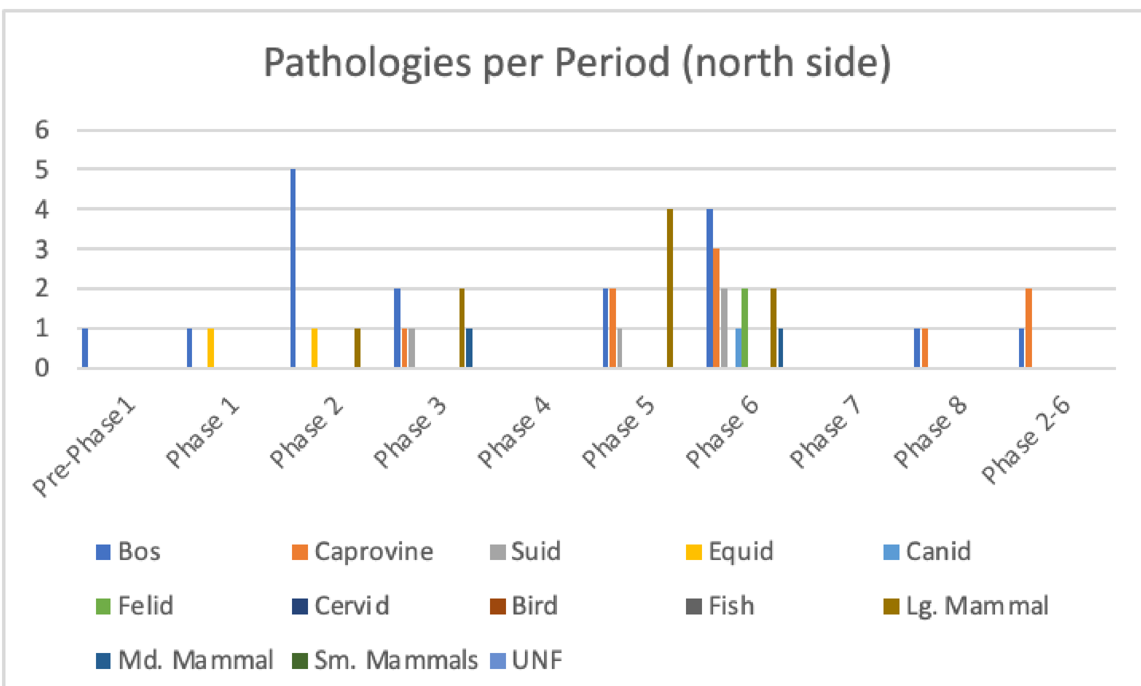

Figure 60 Pathology (count) per Taxon per Phase (Pre-Phase 1-Phase 8)

Data on animal pathologies from the north side at Ninch suggest that, at various points, livestock animals were kept in close confines and were used for traction (Table 143 & Figure 61). A total of 44 examples of pathological lesions and evidence of injuries were identified. The greatest number of pathologies were noted in Periods 2, 3, 5, and 6, which correspond to the second and third inner enclosures and the phase of occupation to the east of the enclosure ditches. The most common pathologies include evidence of osteoarthritis (additional bone growth and eburnation at the epiphyses) and broken and misaligned bones. Most pathologies occur on cattle elements, though there are also pathologies noted on sheep/goats, pigs, horses, as well as cats and dogs.

Evidence of osteoarthritis was the most common pathology identified at Ninch. Osteoarthritis can be identified by the presence of additional bone growth (osteosis) and scraping (eburnation) at the articulations. In cattle, evidence of osteoarthritis was identified on metatarsals (Phase 1 and 5), ilium (Phase 2), ulnae (Phase 3, 5 and 6), a femur (Phase 6), and carpals (Phase 8). Osteoarthritis to the lower limb bones and the upper forelimb in cattle is consistent with use in plowing (Bartosiewicz and Gál 2013). Similarly, evidence of osteoarthritis in horses in the lower limb bones and spine are also noted as evidence for use in traction or transportation (Bartosiewicz and Gál 2013). At Ninch (north), additional bone growth was noted in horse vertebra (Phase 1) and a tibia (Phase 2). Like in humans, in addition to evidence for occupation or mechanical stress, osteoarthritis is considered evidence of chronic or age-related illness, often taking years to manifest. This is true in cats, dogs, and livestock species not often used for traction and transportation, such as caprovines and pigs. At Ninch (north), two felid vertebrae were fused (Phase 6); two fused medium mammal vertebrae were identified in Phase 6; one pig podial had evidence of osteoarthritis (Phase 6); and one sheep/goat metatarsal (Phase 3), humerus (Phase 5), and humerus (Phase 6), also contained evidence for osteoarthritis.

There are, of course, other pathologies related to age, including the presence of ossified cartilage in the ribs. This ossified cartilage material presents as unusual bone material in the shape of a rib but appears to lack cortical bone. Ossified cattle ribs were identified in pre-Phase 1, Phase 1, four in Phase 2, and two in Phase 2-6. Ossified ribs belonging to caprovines were also identified in Phase 2, along with ossified ribs fragments belonging to a medium-sized mammal.

In the north side of the site, there was additional evidence for broken and misalignment or dislocation. Broken bones are identified by size, shape, or angle of bones and, occasionally, increased bone growth around the site of the breakage. Such evidence is exacerbated in the case of misaligned bones, which occurs when fragments of broken bones slide past one another and then are stabilized by muscle contraction. The bones then remodel in this new alignment. Broken and misaligned bones can also lead to infection, or osteomyelitis. Osteomyelitis can be identified by the growth of additional "woven" bone and foramina for pus drainage. In cattle, there were several identified broken and misaligned or infected bones including a first phalanx (Phase 1), scapula (Phase 2), and metacarpal (Phase 6). There were also several instances of large mammal ribs with the appearance of having been broken and misaligned as they healed in Phases 2, 5, and 6). In pigs, one metacarpal showed evidence of having been broken and misaligned (Phase 6). There is also one dog podial from Phase 6 that shows evidence of having been broken and misaligned as it healed. It is not uncommon for farmyard animals to suffer from injuries when they are kept in close confines (Bartosiewicz and Gál 2013). This suggests that livestock were being kept on site in Phases 1-3 and 4-6.

Interestingly, there are several instances of caprovines with unique genetic traits. Neither of these traits would have harmed the animal or caused them discomfort in life but present as unusual additions to the zooarchaeological assemblage. These traits include a metacarpal from Phase 5 with vestigial bone growth (metacarpals III and V) as well as two examples of split horns (*polyceraty*) from Phase 6 (Figures 62 & 63). In both cases of polyceraty, the individual appears to be a goat, identified by the morphology of the coronal and lambdoid sutures but this feature have been altered by the horn growth. Polyceraty is a rather rare genetic anomaly that has only been identified in two other assemblages in Ireland (both from eastern Ireland) dating to the 6th-10th centuries CE (Bartosiewicz 2013) (Figure 64). Research exploring the rare occurrence of four multi-horned sheep from Buda Castle, Hungary, suggests that these individuals may have been highly prized, and their crania kept as trophies (Daróczi-Szabó and Daróczi-Szabó 2018).

Figure 61 Polycerate sheep cranium (OID 3644)

Figure 62 Polycerate sheep cranium fragment (OID 3645)

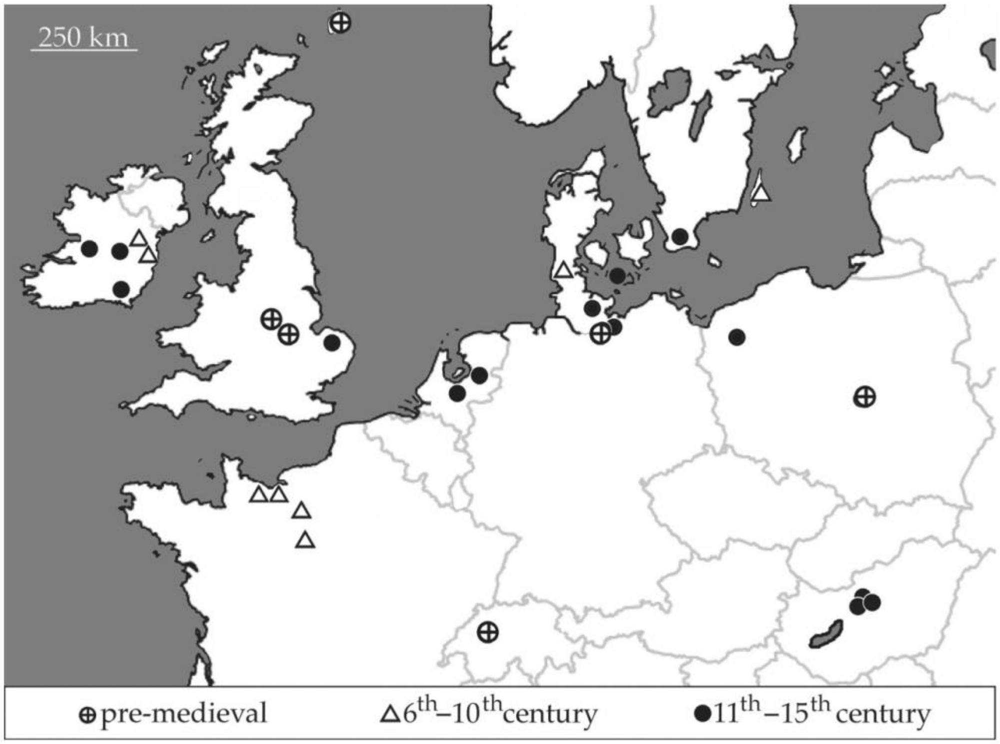

Figure 63 Figure reproduced from Bartosiewicz (2013)

South	*Tot.*	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*Unphased*
Bos	8			1			3	1	3
Caprovine	2						2		
Suid	0								
Equid	0								
Canid	0								
Felid	2		1				1		
Cervid	0								
Aves	0								
Fish	0								
Lg. Mam.	2								2
Md. Mam.	0								
Sm. Mam.	0								
UNF	0								
Totals	14	0	1	1	0	0	6	1	5

Table 144 Pathology (count) per Taxon per Phase (Phase A-G)

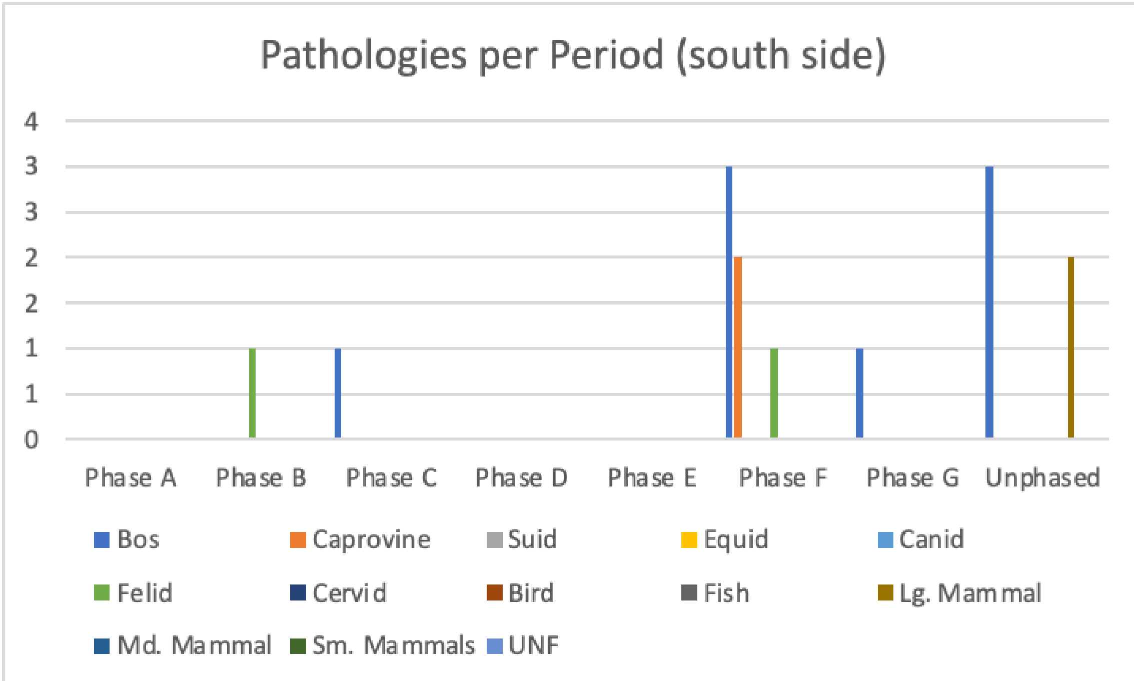

Figure 64 Pathology (count) per Taxon per Phase (Phase A-G)

In the south side of the site, there were fewer examples of pathological lesions and injuries among the faunal assemblage (14 total; Table 144 & Figure 65). The greatest number of pathologies were identified in Phase F (6) and unphased features (5). Most pathologies noted in the south side of the site suggest the use of animals in traction and the maintenance of older individuals. This means that there are several examples of osteoarthritis among individuals, particularly among cattle, with lower limb bones and acetabula displaying evidence for bone growth and eburnation. For example, an acetabulum in Phase C and in an unphased feature both show evidence of extreme wear, as does a femur in Phase F and a metapodia from an unphased feature. These data suggest that cattle were used for traction, including plowing.

Other evidence for keeping livestock species in close quarters (such as penning) includes broken and healed ribs. Examples of broken and healed ribs were evident in caprovines (Phase F) and in an unidentified large mammal (Unphased). An extreme example of a severely broken and healed humerus was identified as a cat (Phase F) (Figure 66). The amount of remodeling around the injury indicates that the cat lived for a long period of time after the injury. In the south side of the site, there are also several examples of dental disease among livestock species; this includes pathologies in mandibulae from cattle and caprovines. Finally, there is one example of a cattle lower third molar missing a third lobe (Phase G), such a pathology is considered a genetic mutation and would not have impacted the animal's ability to eat.

Figure 65 Misaligned and healed cat humerus (OID 9196)

Bone Tools

OID	Phase	Side	Material
6461	Pre-Phase 1	North	Bos metatarsal, worked - whittled in appearance
4889	1	North	Caprovine tibia - socketed longbone point
5519	1	North	Equid, worked - podial shaped and polished
816	1	North	Bone fragment, worked
2381	2	North	Suid fibula - bone pin
8663	2	North	Bone fragment, worked
1118	3	North	Antler fragment, worked
1242	3	North	Bone fragment, worked
1172	3	North	Bone fragment, worked
7968	4	North	Suid fibula - bone pin
5245	4	North	Bone fragment, worked
2064	6	North	Bos metapodia, worked
2756	6	North	Large mammal rib, shaped
4409	6	North	Medium mammal fragment, shaped and polished
615	6	North	Bone fragment - pin fragment
1431	8	North	Large mammal, worked - possible bone playing piece
9083	E	South	Bos metatarsal, worked
9082	E	South	Bos metapodia, worked - split and shaped
9081	E	South	Caprovine tibia - socketed longbone point
7712	Unphased	South	Bos radius, worked
1256	Unphased	South	Caprovine horncore, worked
7845	Unphased	South	Caprovine longbone, worked
70	Unphased	South	Large mammal, worked
83	Unphased	South	Decorated bone handle

Table 145 Bone tools identified during faunal analysis

Context	Find	Phase	Side	Material	Other Details	Condi.
1117		Ei	South	Bone, Worked	Bag 2	ok
1168	1	3	North	Bone Point	Bag 1	n
1213	1			Bone Point	Bag 2	n
1349	2	7a	North	Bone Point, Perforated	Bag 6	n
1463	1	Fii	South	Bone point, Fragment	Bag 5	n
1550	1	B	South	Bone Point, Perforated	Bag 3	n

1576	2	Fii	South	Bone Point, Perforated	Bag 6	n
1675				Bone, Worked	Bag 1	ok
1772	1	Fii	South	Bone Peg	Bag 1	c
3147	1			Bone Pestle	Bag 1	n
3147	2			Bone Point	Bag 7	n
3153	1			Bone comb fragments	Bag 1	c
3198	1	7	North	Antler Buckle	Bag 1	n
3455	1			Bone Point Fragment	Bag 14	n
3657	1			Perforated Bone Point in 3 fragments	Bag 1	n
3686	2			Antler Buckle	Bag 2	n
3686	1			Bone Comb Plate	Bag 1	n
3712	1			Piece of Bone Point	Bag 2	n
3760	1			Bone Comb Plate	Bag 1	n
3837	1			Bone Handle	Bag 1	n
3858	1			Perforated Bone Point	Bag 1	n
3989	1			Piece of Bone Point	Bag 1	n
4160	1	8	North	Decorated Bone Point	Bag 1	n
4204	1			Bone Point	Bag 1	n
4367	1			Bone Point	Bag 1	n
4544	1	8	North	Piece of Bone Comb Plate	Bag 1	n
5399	1	6	North	Bone Point	Bag 3	n
6016	1			Bone Point Rough-out	Bag 3	n

Table 146 Bone tools identified during excavation (from McConway report draft)

Several worked bones and bone artifacts were included in the faunal assemblage from Ninch. Between both the north and the south sides of the excavation, a total of 53 bone tools or possible bone tools were identified (Table 145). The charts above detail the 25 worked bone samples identified during primary faunal analysis (Table 145) and the 28 that were identified during excavation and recorded by ADS and McConway (Table 146). There were a greater number of examples of worked bone from the north side of the site (23), with the greatest number associated with Phases 1 (3), 3 (4), and 6 (5). This corresponds to the period of initial enclosure and burial at the site and the final phase of occupation to the east of the enclosures. Among these, 12 displayed evidence of having been generally worked, shaped, or polished, including two cattle metapodia, a horse metapodial, several large mammal fragments, and a worked piece of antler.

Among the other identified worked bones, three fragments represent broken pins (including two pig fibula pins) (Figure 67), one caprovine tibia that had been cut longitudinally, shaped, and polished (Figure 68), a possible playing piece (Figure 69), and a shaped and decorated bone handle (Figure 70). The caprovine tibia is an example of a tool known as a socketed longbone point (Mullins 2007). In earlier literature, these objects were referred to as 'gouges,' 'scoops,' or 'apple corers' though their original use is unclear. McCormick *et al* (2011) identified 106 examples of such items in the corpus of Irish early medieval archaeological site reports in the EMAP project. Finally, McCormick *et al* (2012) also identified several bone and antler gaming pieces from numerous early medieval sites in various forms. During excavation, ADS identified 6 bone objects, including bone points (Phase 3 and 6), a perforated bone point (Phase 7), an antler buckle (Phase 7), a decorated bone point (Phase 8), and a piece of a bone comb plate.

Figure 66 Pig fibula pin (OID 2381)

Figure 67 Socketed longbone point or "apple corer" (OID 4889)

Figure 68 Possible antler playing piece (OID 1431)

In the south side of the site, there were fewer examples of worked bone objects (13 in total). Most of the bone tools identified in the southern side of the site are attributed to unphased features (5) and the other bone objects all derive from Phases B

(1), E (1), and F (6). This included seven examples of bone that were generally worked, shaped, and polished, a bone point fragment, two perforated bone points, a bone peg, a socketed longbone point, and a decorated handle. Among the shaped and polished bone fragments there were two shaped cattle metapodia and one cattle radius, a caprovine horncore and longbone fragment, and a large mammal longbone fragment. The socketed longbone point (OID9081) was produced from a caprovine tibia with a longitudinal cut and shaping and, while the exterior was weathered, evidence of some polish on the surface of the bone. The decorated bone handle (OID83) measured 8 cm in length and 1 cm in width, the object was shaped and polished on all sides. One side of the handle was decorated with 10 circles. Each circle was approximately 3mm in diameter and most contained a small dot in the center (possibly from the use of a compass to space out and design the design). Similar objects have been identified as handles for small, tanged knives (McCormick *et al* 2011).

Figure 69 Decorated bone handle (OID 83)

At other early medieval sites, bone, antler, and horn working has been identified among habitation waste. Comber (2008) suggests that small-scale craft activities would have taken place in the settlement rather than in specific workshops. The objects identified in the faunal assemblage at Ninch indicate a wide range of craft activities, occupations, and personal ornamentation, for which bone, antler, and horn would have been used to produce necessary tools.

Animal Use Reconstructions at Ninch: Food, Animal Economies, and Society at Ninch

The faunal assemblage from Ninch, Co. Meath provides insight into the array of species that were present and shifting agricultural economies through the first millennium AD in Ireland. The primary species represented in the assemblage consisted of cattle, caprovine (sheep and goat), and pig. There was also evidence of horse, dog, cat, domestic fowl, wild birds, marine fish, red deer, fox, rodents, sea turtle, and mollusks in the assemblage.

South Side

The south side of the site produced faunal remains from all phases of occupation but, primarily from Phases E and F. The tooth wear aging data from cattle implies that the majority died, likely slaughtered, over 24 months of age, suggesting beef production. The caprovine aging data indicates that most sheep/goats were slaughtered between 12-24 months of age, also indicating meat production. Aging data for pig shows that the general age range of death was 2.5-5 years. In comparison to the north side of the site, there is a higher proportion of caprovines to cattle in the south side of the site as well as horse. In

Phase F, there is also evidence for antler craft production as well as hunting and the consumption of venison.

The evidence of meat production and craft production would have marked the site as a locally important site. The excavators hypothesized that the south side of the site might represent a Norse or Hiberno-Norse settlement based on the morphology of the enclosure ditch (rectilinear as opposed to circular/sub-circular) as well as 11-12th century Dublin-style ring pins. The faunal assemblage, however, does not closely resemble faunal assemblages from Hiberno-Norse settlements, but a close relationship between Ninch and Dublin is possible, with Ninch providing access to agricultural products that would have been traded and consumed in Dublin.

North Side

Faunal remains were found in all periods of occupation in the north side of the site, including the period of burial. The tooth wear aging data from cattle implies that the majority died, likely slaughtered, between 6-18 months of age, with many surviving to older adulthood. The caprovine aging data indicates that many sheep/goats were slaughtered between 12-24 months of age. Aging data for pig shows that the general age range of death was 2-3 years. Together, increasing diversity and increasing evenness across all phases suggests that the community at Ninch shifted towards a mixed livestock economic strategy over the course of the various phases of occupation (which reflects trends identified in the comparative analysis). However, this gross data obscures some of the shifting agricultural strategies evident from the assemblage. By examining each phase individually, it is possible to observe how the community negotiated economic change.

Using the demographic and butchery data for the three major livestock species (cattle, caprovines, and pigs), it is evident that the community at Ninch participated in several different agricultural practices (Table 147). In Pre-Phase 1, there is evidence for dairying, however the sample size is small. In phases 1-3, there is much stronger evidence for dairying as well as the consumption of caprovines for meat and increased consumption of pigs in Phase 2. In Phases 4-6, the demographic and butchery data for cattle suggest that they were raised for their meat, while caprovines were raised for their meat and wool, and there was increased pig consumption in Phase 5. Finally, in Phases 7-8, there is a shift back to dairy production and caprovines (likely sheep) were raised for their fleece.

Occupational Phase	*Cattle*	*Caprovine*	*Suid*
Pre-phase 1	Dairy (slight or mixed)		
Phases 1-3	Dairy (strong)	Meat	Increasing importance (Phase 2)
Phases 4-6	Beef	Meat/wool	Increasing importance (Phase 5)
Phases 7-8	Dairy (slight or mixed)	Wool	

Table 147 Livestock use reconstruction per simplified phase

The major livestock species are not the only animals at Ninch, and examination of the taxonomic diversity and evenness, as well as inclusion of other species, reveals more insights. For example, there is increasing taxonomic diversity and decreasing evenness during Phases 1-3, or the period of initial enclosure and burial. This means that during Phases 1-3, there was increased focus on breeding one species (cattle), but that diet was supplemented with other species. This includes the introduction of domestic fowl as well as hunted and foraged foods, including the consumption and geese and marine fish. In

Phases 2 and 3 there is evidence for exploiting freshwater and marine fish, including very large cod and hake, which live at a depth of 100-300 meters. According to bathymetric maps of the Irish Sea, the closest area with sufficient depths for cod and hake is 26 miles offshore. During Phase 3, there was also evidence for specialized craft activity, including use of deer antlers, and long-distance trade, including E-ware pottery, which would have been produced on the Continent. It is clear from these data, that the community was experimenting with different economic resources, while also specializing in cattle husbandry. The evidence from the first four phases of occupation suggests increasing amounts of cattle wealth and power. At Ninch, cattle were raised with a slight focus on dairy while other small stock, such as caprovines and pigs, were raised for slaughter as well as other hunted and fished resources.

Afterwards, there is rapid increase in evenness and a slight increase in diversity during Phase 4, the infilling of the enclosures and settlement to the north, followed by decreasing diversity and decreasing evenness through Phases 5-6, the construction of oval enclosures and animal pens to the east. During Phases 4-6, there was an initial shift towards a mixed economic strategy when settlement activity shifted to the north before shifting to a more specialized economic strategy, again, focused on cattle. In Phase 5 there is evidence of venison consumption and some fish. The shift towards greater economic diversity coincides with the backfilling of the enclosure ditches and the closing of the community cemetery. This shift in economies reflects resilient strategies by the community following a major social shift.

Finally, there was a rapid increase in taxonomic diversity and evenness in Phases 7-8, or the construction of the large enclosure ditch and souterrains. During Phases 7-8, there was a rapid shift to a mixed livestock economic strategy likely supplemented by increases in grain production. It is during this period that the souterrains are constructed, suggesting an increased need for food storage facilities. This is also supported by the increased evidence for rodents, which would have been attracted to the grain.

Evidence of bone modifications provides information about culinary practices at Ninch. In all phases of occupation, there is evidence for the consumption of livestock species, but that diet was supplemented by marine and freshwater fish, birds, and wild game (venison). Beef and pork were consumed in the highest quantities in Phases 2 & 6 (and Phase 3 for pork), while mutton/chevon was preferred in Phase 1. Rarely consumed animals, like horse and some domestic birds, and imported ceramic goods likely related to wine or olive oil importation (E ware) would have demonstrated the wealth of the community at Ninch and their access to particular foodstuffs and cultural practices. The high proportion of cut marks and low levels of evidence of roasting on the bone indicate that most of the meat was separated from the bone and cooked separately (though not exclusively). Evidence of boiling meat would also suggest communal consumption practices, as described in the law texts and literature of the period (Kelly 1997).

The use of animals at Ninch supports the conclusion from the excavators that this was a locally significant site. Early evidence of cattle wealth is supported by the high proportion of cattle with some evidence of dairy production supplemented by the consumption of small stock. During these phases of occupation, there is also evidence of antler craft production, the exploitation of offshore marine resources, the possible consumption of horse, and very large dogs, all of which would have marked Ninch as a high-status settlement. In Phases 4-6, there is a shift away from dairy production to beef production with the greatest number of individual cattle from Phases 5 and 6. During this time, there was also some evidence for hunting, to supplement the diet. There is also evidence for smaller, collie sized dogs, possibly used for sheep or cattle herding. Finally, during the final Phases of occupation, there is a shift back towards dairying but with greater emphasis on arable agriculture and food storage, suggesting changing attitudes towards the accumulation of animal wealth and a focus on grain production. The construction of a very large ditch and the increased importance of surplus production suggests accumulation of power by elites at this site. The presence of a former cemetery at Ninch may also have contributed to its selection as a seat of local power, as new elites at this site could claim legitimacy for land claims based on links to the communal past.

Chapter 7

Discussion and Conclusion

Animal Economies and Society in the 1st Millennium AD

The perennial issue with the Irish Iron Age has been a perceived lack of evidence. Until recent infrastructural advancements encouraging archaeological investigation, there have been few recorded Iron Age settlement sites. Even with increased archaeological excavation, evidence from the Iron Age remains scarce - far less than the preceding Bronze Age or later early medieval period. From the 6th century BC to the 5th century AD, settlements appear to be dispersed and temporary, there is a cessation in ceramic production, and a lack of high-status burials, which archaeologists typically use to understand community structure and social development. Despite the *invisibility* of Irish Iron Age archaeology, the development of idiomatic art styles, deposition of high-status metalwork, and construction of monumental structures suggest complex social and political institutions existed during this time.

At the end of the developed Iron Age (around the turn of the first millennium AD), there was a breakdown of regional social and political organization in Ireland (Dolan 2014), and the rise of strong kin group relationships and the development of local identities. During this period, the hilltop civic-ceremonial centers went out of use, large feasting events ceased, and pollen evidence demonstrates a level of forest regrowth indicating shifts in agricultural practices.

After the period of change during the late Iron Age, in the 6th-7th centuries AD, there was a construction boom of small, fortified farmsteads - establishing a site type known as the ‘ringfort’. Status, during this period was determined by the amount of cattle a farmer could raise, and, prior to a coin economy, taxes were paid in cattle and butter (Kelly 2004; Peters 2015).

It was during this period that the smallest political unit was the farmstead, and each farm was connected to other farmsteads through systems of social obligation. These farmsteads were, in turn, organized into small kingdoms, called a *tuath*, which were similarly connected to other *tuatha* in increasingly larger spheres of authority. At its most complex, there were around 150 *tuatha* across the island. To reify identity and social order at the local level, fairs and feasting events, called *oenach*, were held. These events provided an opportunity to trade with outside merchants, reinforce local law and order, and gather the community through feasting events (Gleeson 2018). Funerary feasts and *oenach*, therefore, acted to develop and reinforce local identities and establish social boundaries between different communities. This was particularly important as communities established permanent, fortified, settlements and increased production of arable crops -- inexorably linking their sense of self and community to place and food production.

The large corpus of vernacular texts from the early medieval period both provides fertile grounds for social analysis and raises more questions about the preceding period. The importance of cattle and dairy products during this later period is clear, but the mechanisms by which this system developed is not well understood. This study demonstrates that the dairying economy described in early medieval texts, supported by archaeological faunal assemblages, was not a stable institution and derived from a system of cattle wealth that developed in the earlier Iron Age.

Comparative Analysis Results

The results of the comparative analysis of faunal reports suggest that there might have been a system of cattle wealth that developed in the later Iron Age, that changed in character during the early medieval period because of changing social and political organization. The study of faunal assemblage diversity and evenness (or the distribution of bone fragments across the represented species) suggests that there was increased experimentation in agricultural strategies over time, leading to less specialization in husbandry practices (i.e., exploiting a greater number of species and less focus on one species).

The comparison of herd demographics suggests that there was increased diversity in cattle husbandry strategies (between beef, dairy, mixed, and 'provisioned' herds – 'provisioned' herds referring to ones that seem to resemble urbanized settlements in their composition) during the 6th and 7th centuries AD but less diversity in the latter part of the first millennium (just dairy and beef herds). This means that as cattle became less important in the later centuries of the first millennium, there was less concern for a diversity in cattle accumulation strategies.

McCormick and Murray (2007) came to similar conclusions using MNI data, though they suggest that the shift away from cattle began in the 9th century AD, whereas data in this study suggest that that transition started earlier, and the process continued for longer. This study shows that there was a system of cattle wealth that developed in the later Iron Age and the nature of that system changed in character during the early medieval period. This change may also be evident in the increased number of mixed and especially 'provisioned' sites during the 6th and 7th centuries AD.

In archaeological site reports of early medieval sites, zooarchaeological analyses of cattle husbandry practices discuss sites in terms of 'dairy' herds, 'beef' herds, or 'provisioned' sites, focusing on the division between producer and consumer sites. 'Provisioned' site faunal assemblages present herd demographics in which most cattle were slaughtered at 36+ months. The herd demographics that are considered evidence for provisioning are also the herd demographics that Russell (2012) identifies as evidence for cattle wealth. The presence of 'provisioned' sites might therefore represent local seats of power for which cattle would have been brought as tribute and taxes, as indicated by the early Irish law tracts.

Agricultural Change at Ninch, Co. Meath

The use of animals at Ninch supports the conclusion by the excavators that this was a locally significant site. Early evidence of cattle wealth is supported by the high proportion of cattle with some evidence of dairy production supplemented by the consumption of small stock. During the earlier phases of occupation (pre-Phase 1 through Phase 3), there is also evidence of antler craft production, the exploitation of offshore marine resources, very large dogs, and the possible consumption of horse, all of which would have marked Ninch as a high-status site. In Phases 4-6, there is a shift away from dairy production to beef production. Then, during Phases 7 and 8, there is a shift back towards dairying but with greater emphasis on arable agriculture and food storage, suggesting changing attitudes towards the accumulation of animal wealth and a focus on grain production.

Analysis of the faunal assemblage revealed animal remains in features from all periods of occupation in the north side of the site. Radiocarbon dating indicates that the earliest phases of construction activity in the north side commenced prior to the 6th century AD and that the earliest phases of enclosure were contemporary with the earliest burials. Increasing diversity and increasing evenness across all phases suggests that the community at Ninch shifted towards a mixed livestock economic strategy over time. Increasing taxonomic diversity and evenness at Ninch reflects trends observed in the comparative analysis for sites across Ireland. Faunal evidence from Ninch suggests increasing amounts of cattle wealth and the presence of a former cemetery at Ninch may have contributed to its selection as a seat of local power.

Using demographic and butchery data for the three major livestock species (cattle, caprovines, and pigs), it is evident that the community at Ninch participated in several different agricultural strategies. In the early phases of occupation, there is evidence for the increasing importance of dairy before a shift to beef production and then a final shift back to dairy (though dairying was evidently less important during the Phases 7-8 than it had been during Phases 1-3).

In addition to shifting livestock strategies, wild and other domestic species were exploited at Ninch, including fowl, fish, and deer. Exploitation of these additional species suggests craft and long-distance trade activities. For example, domestic fowl would have been imported from Britain and the Continent, as they are not endemic to Ireland. Long-distance trade is also indicated by the presence of E-ware pottery, which would have been produced on the Continent. Further, the size of the marine fish consumed at Ninch live offshore, indicating offshore fishing practices. Finally, there was also evidence for specialized craft activity, including use of deer antlers and horn, in the production of objects such as combs.

Animal Economies, Animal Wealth, and Society in the 1st Millennium AD

One way to understand the shifting social landscape during the first millennium AD is to consider the role of animal wealth in society. One of the defining features of the early medieval period is the dairying economy, in which the production of cattle and dairy products had social and political importance. In early medieval society status was reflected in quantities of dairy cattle and social obligations negotiated through butter and cheese (Kelly 2004; Peters 2015). Prior scholarship has suggested that the dairying economy was the result of contact with Roman Britain at the end of the Iron Age (McCormick 1995, 2013; Wailes 2004). But, by the 5th century AD, there was an established system of cattle wealth in Irish society and the development of a dairying economy may have been a means by which elites were able to control the accumulation of cattle and increase their social power.

Cattle Wealth

To be considered valuable as a medium for wealth accumulation, animals need to be exchanged for subsistence items and provide access to human labor and reproduction. It is possible to identify animal wealth through zooarchaeological analysis. For instance, while there will be a dominance of one species in the faunal assemblage, in this case, cattle, there may be smaller livestock species also raised on site. Small stock, such as caprovines and pigs, can operate as “change” in exchange in the absence of large livestock (or to exchange up to large stock) and small stock may also be slaughtered to meet the dietary needs of the community. In systems of animal wealth, cattle will be kept longer than may be optimal for meat or dairy production because slaughter is tantamount to wealth destruction. Cattle will also be bred smaller and will overstock pasture to prioritize the number of cattle over the quality of beef. As a result, cattle in the assemblage will tend towards older individuals and may be smaller in stature. Before animal wealth may be identified in faunal assemblages, however, animals must first accrue value in society.

Food, Feasting, and Ritual Economies

For materials to enter systems of exchange and gain value, objects must first have a performative function in ritual (Skre *et al* 2008). Often this includes exchanging objects through gift exchange networks. Such interactions are influenced by both parties’ attempts to achieve social power through the exchange as giver and receiver (Burns et al 2003). As the receiver, that individual obtains an object that has gained value through its rarity and through the action of transfer and therefore gains social power within their cultural milieu (Graeber 2001). The giver, on the other hand, gains social power in the interaction through making the receiver indebted to them (Kopytoff 1986). The act of transfer both gives the object social value, and it also transforms the object into a commodity (Skre *et al* 2008).

The act of gift exchange creates social inequality between the participants but, in doing so, also establishes a system of reciprocity by which the receiver then gives something to the giver to gain social power over them. This reciprocal system can then become a cyclical series of interactions, forming a social bond between the individuals participating in the exchange relationship. Similar exchange relationships have been studied in modern communities, such as the Ju/'hosani h'xaro system (Cronk 2000), the kula exchange system in the Trobriand Islands (Malinowski 1922; Appadurai 1994), and the exchange of wampum among the Iroquois (Graeber 2001).

Feasting and sacrifice function in similar ways to gift exchange, operating as other forms of ritualized exchange that valorize commodities and redistribute wealth and resources. Feasting, as a ritual act, further creates community through the commensal actions. In addition to creating community through commensality, feasting is an important means of social exchange that can be used to flatten social differences through the redistribution of goods or to increase social differences between hosts and guests (or patrons and clients). Feasts, in general, construct communities through mutual sacrifice and risk assumption. In forms of feasts that Michael Dietler (2001) termed "empowerment" feasts, hosts perform acts of conspicuous generosity that economically impoverish them, but in doing so, increase their prestige by indebting their guests to them. Alternatively, "patron-role" feasts increase economic difference between patrons and clients by provisioning the patron with materials for the feast (thus sacrificing their economic power).

Similarly, the importance of a sacrifice is to demonstrate economic loss. The value of a sacrifice is based on the equivalent value of the thing which you give up. In terms of livestock, individuals lose both the actual value of the animal in terms of meat but also the imagined value of the animal in terms of secondary products (such as wool, dairy, or traction) and their reproductive value. Therefore, the loss of livestock is felt both immediately but is also conceived of as a loss in future investment. As discussed in Chapter 3, ritual and economics were not separate entities in the past and the animal value expended in a sacrifice would not have been considered a loss but an investment. Animal sacrifices, primarily intended for ritual purposes, have an economic function by redistributing animal wealth among the community -- whether the sacrifice is in the form of burial, feasting, or structured deposits. Ritual economies refer to practices that include the production of materials for ritual consumption and sacrifice, and indeed can support and be embedded in domestic economies. This may function as redistribution of goods among the community and as a negotiation with the supernatural.

In the Irish Iron Age, there is significant evidence for large-scale feasting events at the civic-ceremonial regional centers, formerly known as the 'royal' sites. According to Crabtree and McCormick, feasting at these sites included the consumption of large quantities of young cattle at Dún Ailinne (Co. Kildare) and pigs at Navan Fort (Co. Armagh). A 2019 isotope study of the pig remains at Navan Fort demonstrated that, rather than coming from one source, pigs were transported from across Ulster to the feasts at Navan Fort. While resembling the expected distribution of economic resources for a "patron-role" feast, the absence of evidence for very powerful individuals in society might suggest that something else is occurring entirely. Rather than provisioning an individual, communities gathered to offer mutual sacrifices -- limiting the social difference between individuals through the mutual loss of wealth and the productive power of the livestock that they brought to the feast. Considering the relationship between labor, wealth, and sacrifice, this articulates with Johnston, Crabtree, and

Campana's (2014) conclusion that feasting at Dún Ailinne represented a 'work party feast'. In addition to reproducing community, the act of sacrificing wealth at communal feasting events acts reciprocally to valorize those commodities that were sacrificed and incentivize the community to raise more cattle, increasing their social and economic value. It is therefore through feasting and sacrifice that livestock were valorized and became symbols of wealth.

In addition to the evidence for periodic feasting at civic-ceremonial centers, there is also evidence of butter storage in the late Iron Age. Recent analysis of bog butter samples indicates a higher frequency of butter deposition during the late Iron Age than preceding periods (Downey *et al* 2006; Smyth *et al* 2019). There are competing theories about the intention and meaning behind bog butter deposits, whether for the natural preservative qualities of the bog (cool and anaerobic), for flavoring, or as a votive offering (Synott 2010). However, metal hoards and human remains from bogs have been interpreted as votive deposits, so it is not unreasonable to also suggest a similar motivation for butter deposition. The suggested ritual importance for dairy products therefore suggests a high degree of socio-political importance of cattle. Butter deposition continued through the medieval period and, with the value of dairy products was elaborated and codified in this period. What is clear, is that there was a concern for butter during this period that may have been social, political, and/or economic, and likely a combination of the three.

In the Developed Iron Age, there is some evidence for ritualized deposition of cattle remains. This includes the deposition of cattle mandibulae in a pit dated to 388-208 cal. BC at Coonagh West, Co. Laois (Ruttle and Taylor 2013). In the late Iron Age, there is evidence of continued ritualized behavior involving cattle in the form of special deposits of cattle remains, burials of whole cattle, and joint human-animal burials. At Rath Site 27, Co. Meath, dating to the 1stC BC-1stC AD, three complete cattle skulls were deposited in a well or watering hole associated with a structure interpreted as a sweat lodge and an inhumation burial (Schweitzer 2009). At Ballymount, Co. Kildare, a complete elderly ox, dated to about AD 15, was buried in association with a fragment of a human occipital bone with a hole drilled into it (Twomey 2009). At Woodlands West, Co. Kildare, mandibles of elderly cattle were deposited into the penannular ditch enclosing cremation burials and a second deposit at that site contained at least three complete cattle skulls, dated to about AD 64 (Clark and Long 2010). And at Cherrywood, Co. Dublin, a sub-rectangular pit inserted into a Bronze Age barrow contained a circle of stones and cattle teeth at the base. This deposit was also associated with an Iron Age human cremation, dated to about AD 85 (Ó Neill 2000). These special deposits highlight the ritualized treatment of cattle remains and underscore their important value in society at the time. Rofes (2002) and Sykes (2014) demonstrated that animal sacrifices and animal burials highlight the importance of these species in the cultural and economic life of the community.

Cattle Wealth and Social Organization

Prior scholarship examining the British and Irish Iron Age has suggested that society was largely hierarchical (Newman 1995), however more recent studies have suggested that society was heterarchical in structure (Armit 2007; Hill 2011). Conclusions about heterarchy in Irish Iron Age society have largely derived from lack of settlement evidence and belief in Iron Age pastoralism (Dolan 2014). The suggestion that Iron Age society was dispersed, pastoral, and heterarchical has led to interesting discussion of society in various forms, including as a house society (as discussed in Chapter 2). These new debates have provided fruitful insights into Iron Age society but have relied upon either small datasets or "often circumstantial evidence" according to Dolan (2014). Examining Iron Age society through the lens of cattle wealth (based on faunal evidence), however, provides additional insights.

During the final century BC and the first centuries AD, the development of cattle wealth would have lent itself to the development of social hierarchies, however, these hierarchies would have been limited by the alienability of the commodity. Animal wealth, particularly cattle wealth, without very careful management, is a risky form of wealth accumulation. Livestock are a particularly vulnerable commodity, especially larger stock such as cattle. Larger stock requires more space and fodder and produces fewer young each year than smaller stock such as pigs. The loss of a single animal due to drought, epidemic, or raiding is therefore a greater setback and a wealthy household can quickly become a poor one. On the other hand, with good planning and good fortune, a poor household may build its herds and become wealthy. According to Russell (2012), these qualities make it difficult to maintain a high degree of animal wealth over time, and therefore it is difficult to create and maintain extreme social distance between classes.

For these reasons, cattle wealth during the Iron Age could limit the development of extreme social distance through mutual losses associated with feasting. Systems of animal wealth, however, are not inherently egalitarian and can reproduce strict social hierarchies if the risks associated with the accumulation of livestock can be mitigated.

Explicitly, these risks can be mitigated and controlled by elites by diversifying agricultural economies (by both producing enough small stock to act as “change” and to control the production of fodder), the institution of “patron-role” feasts, and developing a system of bridewealth to control inheritance. It is possible to observe these mitigation strategies in the increasing taxonomic diversity through the first millennium.

During the Late Iron Age, there is increasing evidence for systems of mitigation to protect against the risks associated with cattle wealth. For instance, grain production technologies vastly improved, with an increase in more effective cereal drying kilns, the addition of the coulter to plows, and the development of water mills at the end of this period. Increased grain production increased the amount of fodder available for cattle. Controlling the production and accumulation of grain allowed elites to provision for their herds, increasing their wealth, and control the distribution of grain and fodder to their clients. In early medieval literature and law tracts, there were clear tributes and taxes that clients had to pay to their lord and the obligation for patrons to provide feasts for their lord every year was tightly regulated. At these events, meat and foodstuffs were distributed through the community, with a portion retained for the lord. Finally, law tracts from the early medieval period outline the role of bridewealth, or ‘bride-price,’ and the socially accepted forms of sexual union (Kelly 1998). The first three of which define the union by the individual (either the bride or groom) who brings most of the property to the union. This is potentially reflected in the increase in diversity of central burials in community/kin-group cemeteries, including female central burials, male central burials, and joint male-female central burials, as observed from the Mapping Death Database (discussed in Chapter 6).

Considering social organization in the Iron Age, the lens of economic practices related to cattle wealth provides some key insights. Systems of cattle wealth are not inherently egalitarian, and the evidence provided suggests that risk mitigation strategies became formalized in law and evident in the archaeological record in the mid to late first millennium AD. This lends support to prior scholarship that has suggested that society was largely heterarchical (Armit 2007; Hill 2011; Dolan 2014). Both Dolan (2014) and Becker (2019) suggest that society would have operated on several social levels, linking kin groups to local and regional political units and social identities. Economic practices focused on the accumulation of cattle would have supported such social relationships with greater mobility because of less dependence on arable agriculture and periodic aggregation for craft activity, trade, and feasting at regional civic-ceremonial centers.

From Iron Age Cattle Wealth to Early Medieval Dairy Wealth

In addition to diversifying agricultural economies, provisioning patrons, and controlling inheritance, by increasing the value of secondary products, elites are better able to accumulate wealth and control the distribution of goods. According to Russell "...secondary products enable people to live off their herds while slaughtering fewer of them, so … the ability to live off secondary products allowed their preexisting wealth value to be realized with fewer constraints (354)." Those who were able to produce more dairy products were able to provision their households so that there was less pressure to slaughter their cattle and reduce their wealth. In the next year, that household would be able to then produce more milk and provide more milk to the calves, improving their (the calves) health outcomes, ensuring that more of the young would survive, which would continue to grow their wealth. In this way, by producing dairy products, wealthier households would be able to increase their wealth.

Managing grain production and fodder is another strategy by which elites were able to control wealth accumulation by non-elites. The rapid increase in fortified settlement, development of the horizontal water mill, and increasing taxonomic evenness may represent agricultural strategies focused on wealth management. Additionally, the requirement to provide dairy products and (milk) cows as tax would require the specific slaughter of cattle to maintain a dairy herd and further increase the wealth and status of elites. The requirements to exchange dairy products in social and political negotiations during this time demonstrate the importance of accumulating dairy. In this way, during the early medieval period, the requirements of the established dairying economy resulted in the rise of ‘dairy wealth’ as opposed to ‘cattle wealth.’

Thus, a dairying economy developed because of a system of animal wealth, developed through the valorization of cattle in ritual and feasting practices during the Iron Age. During the early medieval period, cattle accumulation was mitigated by the requirements of using dairy products in social negotiations. Dairy, as a commodity, required specific cattle management strategies (rather than just accumulation) to gain and maintain status and reduce the risks associated with cattle wealth. The shift from ‘cattle wealth’ to ‘dairy wealth’ allowed for greater social differentiation and the rise of local forms of power and kingship (*tuatha*).

Conclusion

What were the agricultural strategies employed during the first millennium AD and what was their impact on Irish society? Returning to the hypothesis presented in Chapter 1, this study has not provided sufficient evidence to support Hypothesis 1, that husbandry practices in the Iron Age focused primarily on cattle and/or dairying. However, the diversity of agricultural practices supports Hypothesis 2, that animal economies were focused on cattle, representing a system of cattle wealth, and Hypothesis 3 predicted that the shift in agricultural practices occurred slowly over the course of the first millennium (as opposed to rapidly in the 9th century AD).

During the Iron Age, there is evidence for the valorization of cattle through feasting practices, structured deposits, and human-animal burials. At ring ditch and settlement sites in the late Iron Age, cattle dominate the faunal assemblages, though there are not clear indicators of primary or secondary product husbandry practices. In the early medieval period, faunal evidence suggests that cattle continued to dominate archaeological assemblages with demographic evidence to suggest that a variety of animal husbandry strategies were employed for the accumulation of cattle.

What this study has demonstrated is that a system of cattle wealth likely developed in the Iron Age and that system shifted from valorizing the accumulation of cattle to the accumulation and distribution of dairy products in the early medieval period. During the first millennium AD, animal economies became more diverse and more even, indicating that animal husbandry strategies became less specialized, particularly in the latter half of the millennium, away from a system that focused on the production of cattle. The shift to valorizing dairy products in trade and tribute and as a symbol of wealth was a strategy of wealth management by elites to increase social distance between social classes. This study demonstrates that animal economies, food, feasting, and power were intertwined in the first millennium AD and were integral to the social and political changes in Irish society.

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