The making of West Penwith's semi-natural environment

Exploring the development of a valued environment and landscape

View south over Carn Galva and West Penwith to Mount's Bay (© Cornwall and Isles of Scilly Historic Environment Record, Cornwall Council)

Peter Herring, Heritage and Historic Landscape

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The project was undertaken by a landscape archaeologist and historian with forty years' experience working on understanding the development and significance of Cornwall's historic landscape and historic environment while working with the National Trust, the Cornwall Archaeological Unit (Cornwall County Council), English Heritage, Historic England, and the Strategic Historic Environment Service of Cornwall Council.

A considerable part of that time was spent working in and on West Penwith. Many will recognise their influence on aspects of this report, though for some the influence is oblique rather than direct. It's been so long that some, sadly, are no longer with us, marked†. Many thanks to all.

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Opinions expressed, and any errors, are entirely those of the author, Peter Herring.

Porthmeor, Zennor, 1985

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Pendeen Manor, St Just.

Aims of the project

This report presents the results of a project commissioned by the Penwith Landscape Partnership to 'provide an overview of 11,700 years of landscape history in West Penwith', that of the Holocene period that commenced with the end of the last Ice Age.

To achieve that very broad aim, the work has explored aspects of the peninsula's topography, biogeography, and history and through them its semi-natural and semi-cultural environment and its landscape. It presents the results in two main parts: first a scene-setting provides a framework for then presenting a narrative that melds the genesis of both the natural and the human or historic environments and attempts to show how and why they are so interestingly intertwined.

The study has reviewed geology, topography, land use history, historic landscape survey and characterisation, palaeo-ecology, archaeology, history, place-names, farmers' and visitors' diaries and accounts, artistic representations and responses, and other sources. It has been undertaken by a landscape historian and archaeologist with over forty years' experience studying the development of the Cornish landscape, including several years living in and working on West Penwith.

Much of the landscape archaeology of this ancient landscape was surveyed in detail between 1980 and 2010 as part of the 'West Penwith Survey' (WPS), whose results include plans, descriptions and discussions (Johnson 2016). Individual WPS reports can be reached through the online Cornwall and Isles of Scilly Historic Environment Record (CSHER). Main conclusions were gathered and expanded upon in a major publication (Herring *et al* 2016).

This PLP project complements the West Penwith Survey and the CSHER by exploring the effects of people's activities on the peninsula's habitats, flora and fauna. It also complements and extends the intensive study of the peninsula's rough ground that was undertaken in the late 2000s for the HEATH project.

HEATH closely considered the various uses made of the plant communities of the rough ground (rough grasses, furze, heather, bracken, willow, rushes, etc), including a case study of the parish of Zennor. It also included an invaluable review of previous palaeo-environmental work (Straker 2011a; 2011b), a study of the Cornish and English names used by local communities for various aspects of rough ground (Padel 2011), and a review of folklore associated with rough ground (Dudley 2011; Kirkham 2011).

This report was completed just as a related report on the changing landscape of Mount's Bay was published: too late to incorporate its detailed findings into this one.

'The Penwith Landscape Partnership (PLP) was formed in 2014 by a group of community organisations and individuals who came together and shared the aim to support the understanding, conservation and enhancement of the Penwith Landscape as a sustainable living, working landscape' (PLP website)

Summary of key observations

The peninsula's intricate topography and complex history are reflected in a shimmering mosaic of semi-natural habitats and flora.

- Humans and other fauna have played a creative and disruptive role in the development of diverse semi-natural environment since Britain was recolonised 10,000 years ago.
    - The most radical changes may have been in the last 150 years, when specialisation in order to supply the needs of urban market economies resulted in partial or total suspension of traditional land use in some parts of West Penwith, including many downlands and cliff pastures.
- Until then, there was continuity in some fundamental elements of land use even when the detail of each varied considerably between places and changed greatly through time.
    - The long summertime (May to November) grazing of downlands and cliff tops, probably from Early Neolithic times, c4000 BC.
    - Containment and management of woodlands in the steep-sided valleys, again from the Early Neolithic period.
    - Mixed farming on the coastal plateaux and gentler valley-sides, probably from the Middle Bronze Age, c1500 BC.
- Herb-rich grasslands dominated West Penwith's downlands from at least as early as the first centuries of the Neolithic period (4th millennium BC) right through to the Romano-British and post-Roman periods.
- Surviving grasslands may be seen as Ancient Semi-Natural Grassland.
    - Their origination in the early Holocene (Mesolithic period) may have been partly natural, as elements of wood pastures, but Mesolithic hunter-gatherers probably enhanced the 'niches' they depended upon by deliberate manipulation, including by extending and managing grasslands to favour prey species, and to encourage plant life within the grassland that provided other forms of food and materials.
    - From the Neolithic period maintenance of the grasslands was part of a pastoralist strategy using domesticated livestock (probably cattle, horses, sheep, goats and pigs, all introduced to Britain, and ultimately derived from western Asia or south-eastern Europe).
    - Dairying has been an important element of West Penwith's mixed economy, possibly since the early Neolithic period.
- The open downland grazings were probably operated from early prehistory as a Common Property Regime (the universal means of administering commons identified by Elinor Ostrom). It ensured that levels of use were sustainable while also ensuring that commoners had reasonable rights when operating responsibly.
    - Much land in those commons could have been arable, but the need to maintain a balance between the enclosed and pastoral elements of a mixed farming system was maintained from the Middle Bronze Age (c1500 BC) to the post-medieval period.

- Administration of a Common Property Regime involves custom and rules, as well as decision making concerning current and future management.
    - Gatherings of the community to review and plan the use of the commons probably took place at West Penwith's prehistoric gathering places, most of which were located on the commons.
    - These would have included Early Neolithic tor enclosures and cromlechs, Later Neolithic and Bronze Age stone circles, hilltop enclosures, standing stones and Iron Age hillforts, many of which either reused or referred to earlier gathering places. Some hillforts (like Chun Castle) were reused in the Early Medieval period.
- Summer grazing was probably undertaken as a form of transhumance from the mid 2nd millennium BC to the end of the 1st millennium AD.
    - Transhumance with dairying in the summer pastures ensured marginal land was as productive as it could be. Cheese and butter making are among the most energy-efficient forms of food production.
    - The dairy food produced supported human sustenance in leaner times of the year, making society more resilient.
    - Removing livestock from enclosed land in summer enabled crop and hay production.
    - It was a rewarding and enriching experience for its principal practitioners, the community's young women.
- A surge in the extent of upland heathland in the 1st millennium AD was probably due to relaxation in grazing pressures associated with development of convertible husbandry, which enabled dairying in home-farm fields, reducing the intensity of upland grazing and allowing invasion of scrub such as the heathers.
    - Until then, heathland was just one of the several lesser elements of the mosaics of habitats within the herb-rich grasslands.
- The upland commons and those on the cliffs were closely subdivided to create 'hamlet commons' in the early medieval period, apparently using mini territories established around Iron Age and Romano-British hamlets set within intensively worked and closely organised field patterns.
- The needs of dairying appear to have underpinned the strategies and practices of mixed farming in West Penwith for up to 5,500 years.
    - Its importance has been obscured by the emphasis placed on other more spectacular but also usually more short-lived or sporadic aspects of the peninsula's heritage, archaeology and historical economy.
    - The modest and subtle remains of commons and transhumance that enabled dairying have been trumped by the more spectacular Neolithic and Bronze Age megalithic monuments, the later prehistoric forts, cliff castles, round houses, courtyard houses and fogous.
    - Historically, mining, pilchard fishing, market gardening (early fruit, veg and flowers) and tourism have each been showier than dairying, which has traditionally been the realm of women.

- Extents of heathland have reduced since the later medieval period, due to intakes and changing land use regimes, but remain much higher than in prehistory.
- Woodland levels have been low compared with most other parts of Cornwall and Britain from at least as early as the Neolithic period, with trees in the uplands and on coastal plateaux probably elements of wood pastures and any denser woodland largely confined to sheltered valleys and coastal wetlands.
- The Franz Vera hypothesis – that open wood pastures, rather than closed canopy continuous woodlands, would have prevailed in early prehistory – seems to apply well to West Penwith, certainly from the very early Neolithic period, and perhaps also through at least some of the preceding Mesolithic period of hunter-gatherers.
- Land uses of recent centuries – mixed and specialised agriculture, horticulture, recreation, ornamentation, industry, urbanisation, etc. – have contributed greatly to modern West Penwith's complex ecosystems and high environmental interest.
- The semi-natural communities may be regarded as having been enriched (or impoverished, depending on point of view), by aliens: the archaeophytes and neophytes introduced by people either deliberately or incidentally respectively before and after 1500 AD.

Ancient semi-natural grassland, with heathland patches, on Porthmeor Common, Zennor.

Place, landscape, land or environment, or all of these?

Some of the concepts used in this study to explore aspects of West Penwith are briefly introduced here.

Place

'Any part of the historic environment, of any scale, that has a distinctive identity perceived by people' (English Heritage 2008a, 72). The peninsula of West Penwith satisfies that definition as well as any place can.

Landscape

Landscape is most succinctly defined as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe 2000, European Landscape Convention). Landscape is therefore a personal response to place, not necessarily a universal or communally shared one though people influence each other's responses. Recognition of that plurality of perception and valuing encourages the championing of places that others may disregard, and the development of imaginative and artistic responses to them that excite, challenge and discomfort (all fully explored in Howard *et al* 2018).

Because people need to make decisions that affect landscape, a relatively objective approach to describing and presenting the variability we and others observe in the wider world has been developed. Landscape Character Assessment (LCA) characterises the main attributes of place in order to identify landscape character types and landscape character areas (Tudor 2014).

Land

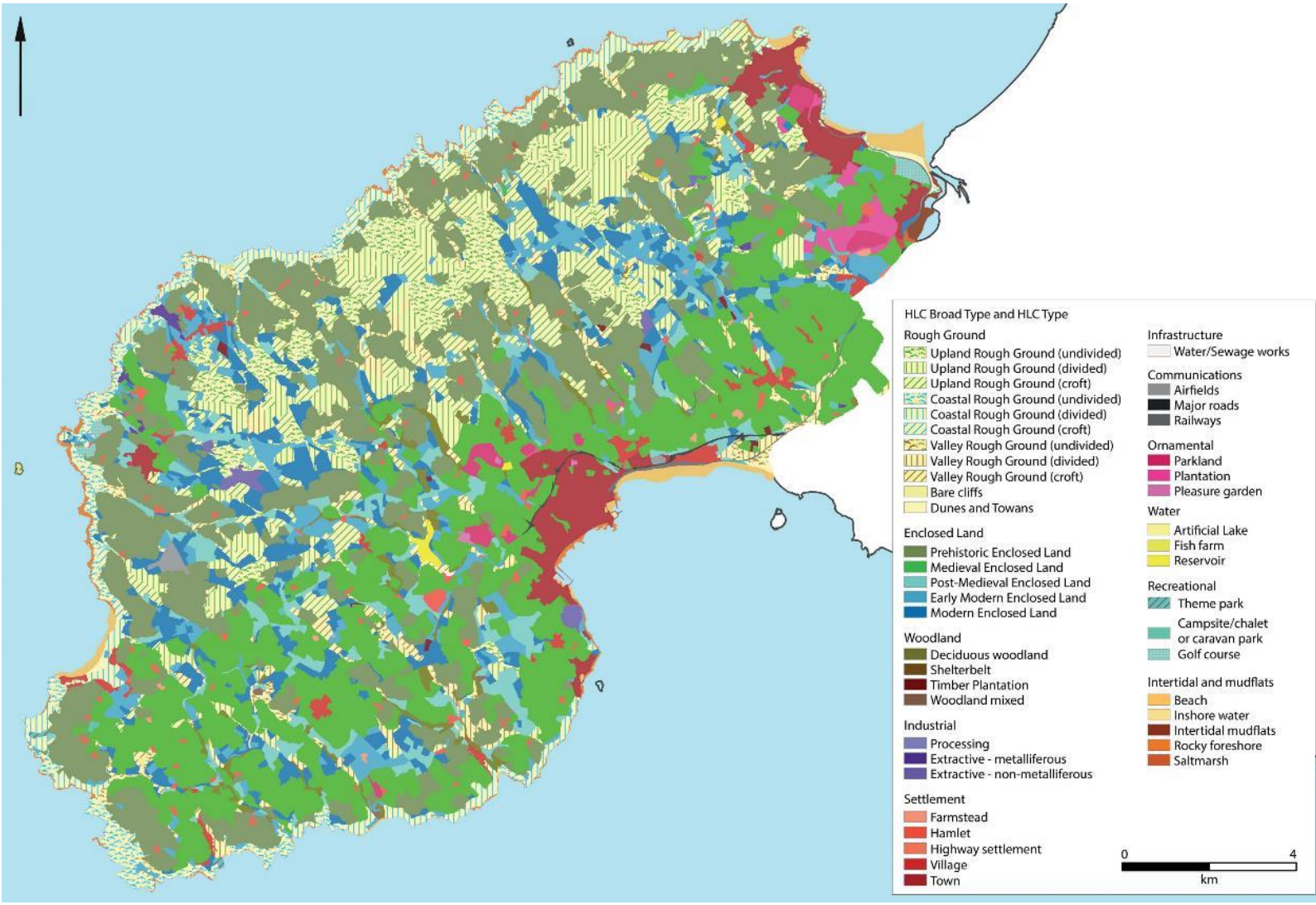
Land is where place becomes transactional: 'land is property; in many cases even private property. The owner decides more or less freely its use and shaping' (Antrop 2000, para 34; Earle 2000). Change in the landscape or environment cannot be planned or allowed without understanding constraints, as well as opportunities, and a major constraint on action is that land is also property or covered by some form of ownership or tenure (however that is or was asserted or tolerated). Territories and commons appear to have been defined in Britain as early as the Neolithic period (Oswald 2018) and are detectable through all subsequent periods.

Land also has qualities through which it is described and assessed. Landform is 'the shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes' (GLVIA3 2013, 157); land use describes 'what land is used for, based on broad categories of functional land cover such as urban and industrial use and the different types of agriculture and forestry' (GLVIA3 2013, 157); while land cover is 'the surface cover of the land, usually expressed in terms of vegetation cover or lack of it' (GLVIA3 2013, 157).

Environment

Environment was often treated as a synonym for landscape, and vice versa, until human perception was recognised as central to landscape. At its most basic, environment has been defined as 'the totality of all the external conditions affecting the life, development and survival of an organism' (United Nations 1997). In practice

in Britain, when dealing with extensive areas of land, environment is usually divided into two, natural environment and historic environment, and in good practice, in terms of both assessment and management, the two are then reintegrated.



Historic Landscape Characterisation indicating predominant character of all parts of West Penwith (see Dudley 2012). (From Herring et al 2016, fig 3.26. © Cornwall Archaeological Unit, Cornwall Council).

Natural environment

A good comprehensive definition of the natural environment includes its relationship with people: it 'encompasses all living and non-living things occurring naturally, meaning in this case not artificial. The term is most often applied to the Earth or some parts of Earth. This environment encompasses the interaction of all living species, climate, weather and natural resources that affect human survival and economic activity' (Johnson *et al* 1997).

Historic environment

Just as people figure in the natural environment, so does nature have a place in an equally widely accepted definition of the historic environment, that within the National Planning Policy Framework for England. 'All aspects of the environment resulting

from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora' (MHCLG 2021, Glossary).

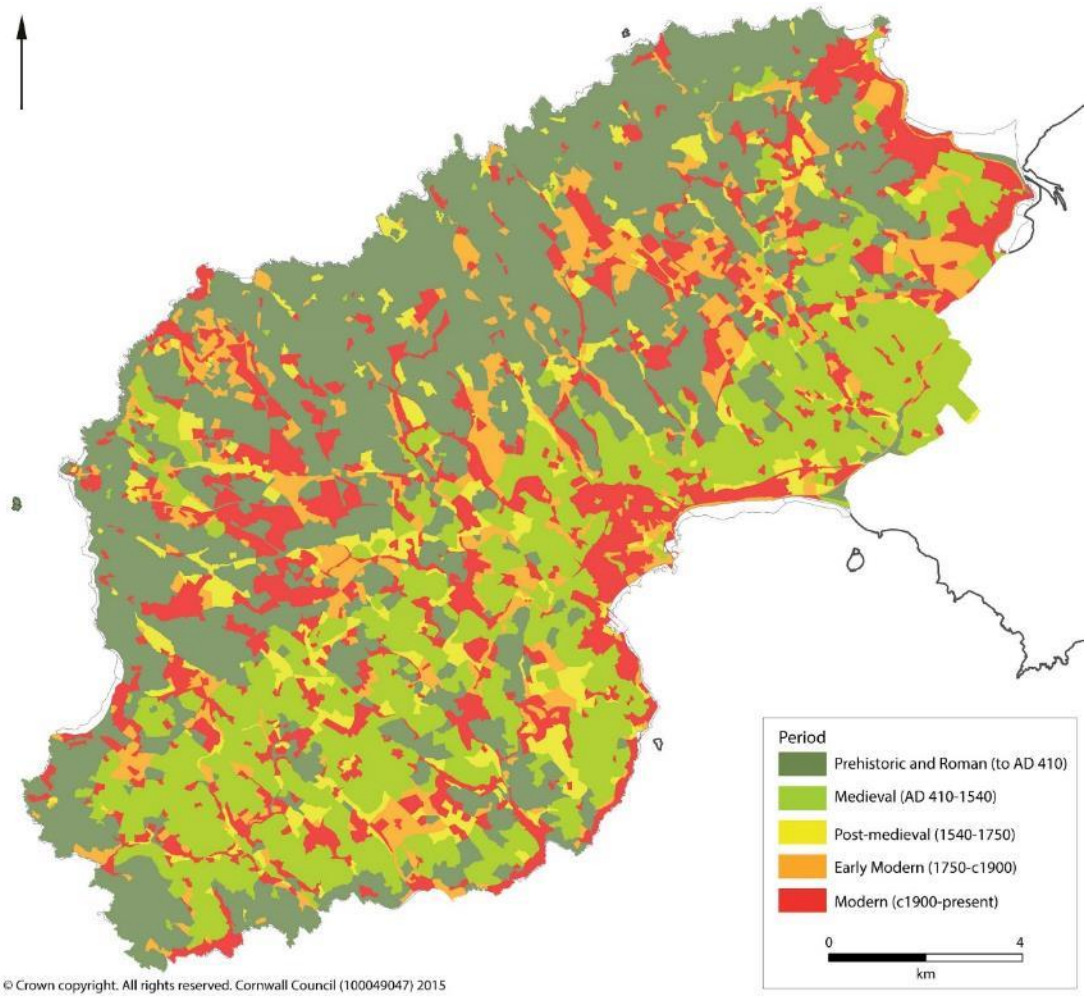
Semi-natural environment: the integration of natural and historic

Semi-natural

As noted, because the environment is neither wholly natural nor wholly historic, those who care for it consider the needs of both when making decisions.

> The term 'semi-natural' is normally used to identify ecosystems 'with most of their processes and biodiversity intact, though altered by human activity in strength or abundance relative to the natural state' (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services – IPBES).

The IPBES supports 'the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development', an aim shared by most in the Penwith Landscape Partnership.



Broad chronology of the historic character of West Penwith's landscape, based on the 2012 Historic Landscape Characterisation (Dudley 2012) (from Herring et al 2016, fig 1.16. © Cornwall Archaeological Unit, Cornwall Council).

The aim of identifying and then sustaining all substantially intact natural ecosystems is shared by those in modern society who are concerned about the climate and biodiversity crises.

It will be seen in this report that all ecosystems since the Ice Age have been affected to some extent by human activity. The degree to which their processes and biodiversity are 'intact' is often difficult to measure against yardsticks of unaltered pristine forms that are now largely theoretically derived or predicted.

In addition to protecting the better-preserved parts of the environment, substantial benefits can also be gained by recognising the potential for either repair of damaged ecosystems that no longer have 'most of their processes and biodiversity intact', but where those are still legible and recoverable. While our society is determined to protect well-preserved biodiversity it is also increasingly determined to 'grow the environment', as in Cornwall's own pioneering Environmental Growth Strategy (https://www.cornwall.gov.uk/environment/conservation-and-environment-protection/environmental-growth-strategy/).

Going beyond that, it is also possible to use recognition that all land still supports ecosystems (even if they are currently highly attenuated and thus of limited complexity and interest) to inspire radical regrowth, including through mechanisms like environmental growth and re-wilding.

This study therefore extends the term 'semi-natural' by suggesting that all of West Penwith is semi-natural in that all is somewhere on a continuum of naturalness, or semi-naturalness. All can then be regarded as capable of enrichment and re-growth or new growth and not just those areas that appear to be more 'natural' than others.

To illustrate the continuum, consider how apparently pristine ecosystems have been affected, usually negatively, but sometimes interestingly by human actions, either deliberately or incidentally. Conversely, consider how apparently irredeemably damaged places have either fragmentary survivals of 'original' features, or have become habitats for wholly new ecosystems and communities.

- An apparently undisturbed rock pool alive with intertidal plants and animals may still be affected by pollutants and materials people have introduced to seawater and the coastal environment.
- Soil profiles and land cover of an upland mire where cotton-grass waves and bog asphodel pokes through may still have been affected by prehistoric to modern summer grazing and historical turf-cutting. Now the 20th century cessation of thousands of years of grazing by ungulates ('wild' and 'domesticated') is diminishing the mire's biodiversity.
- At the other end of the continuum are intensively managed fields where drains, supplements and land use regimes all affect soils, crops and 'pests', but which are still visited by or are home to insects, birds, and 'weeds', some of them neophytes (or 'aliens'), emerging after crops are taken or hanging on in heavily trimmed hedges and disturbed margins.
- A disused mine site with stone, concrete and metal structures, and heaps of waste material excavated from the depths or dumped as the detritus from dressing floors, may be recolonised by unusual plants and animals that thrive

or survive in these new niches in ways that allow us to recognise that it is ‘returning to nature’ or, more accurately, becoming a different nature.

Semi-nature may be a modern concept, very useful when grappling with and explaining new ecological strategies, but what it describes is an ancient thing.

West Penwith has been semi-natural since at least the Mesolithic period, from the first millennia after the last Ice Age, when gatherers and hunters manipulated natural woodlands and rough ground, first incidentally by harvesting and killing and then deliberately by intelligently adjusting or creating their own niches to encourage favoured plants or to attract prey.

Grazing with domesticated animals, enclosing and cultivating land for crops, stream-working, mining and quarrying, and building and dwelling in settlements linked by tracks and then roads, have all turned nature into semi-nature, but that semi-nature, and the variety of it within the small area of West Penwith, is itself extremely rich.

It may be that West Penwith’s biodiversity now, with its multifarious modern ‘niches’ is more diverse and in some ways richer than if people had never stepped onto the peninsula. That is not to say that the loss of truly pristine ecosystems, those not affected at all by people’s activities, is anything other than a tragedy.

However, in our post-modern world, where people know what their predecessors have done, and understand what they and their successors are able to do, it seems not only reasonable but also urgently necessary to prioritise the enrichment of biodiversity through new relationships between nature and culture.

Carn Galva, the setting of an Early Neolithic tor enclosure. Away to the left, beyond and to the right of the mine engine houses, is a coastal tor that was drawn into the cultural world as an Iron Age cliff castle, Bosigran Castle.

Botallack, St Just. A semi-natural and semi-cultural environment, and an agricultural, post-industrial, recreational landscape.

Semi-cultural

The ‘yang’ of the semi-natural has its ‘ying’ in the semi-cultural, a concept that recognises that people have developed complex relationships with all aspects of nature. These include the ways they have drawn from its plants, animals, minerals, water and weather for food, drink, materials and energy. It also includes the ways that people respect and respond to it, including by incorporating it into their design of places.

People use natural features as landmarks and markers of boundaries. They have also used them as places of gathering for significant personal and community events and perhaps also for deciding how to administer and use shared natural resources and infrastructure, such as commons and routeways.

Designed landscapes, prehistoric and modern, include beautiful or meaningful natural features, like individual trees, woods, tors and valleys.

Such relationships between people and semi-nature lead to the construction of cultural meanings, both personal and communal, and thus the development of attachments and values, some of them formalised in festivals, rituals and ceremonies. Personal meanings may be reinforced by the personal pleasures enjoyed when places and nature trigger memories and help people see associations.

With all this in mind it is possible to appreciate the many ways that people assess the qualities and potential of places and semi-nature. It is likely that they have done so both consciously and intuitively, and in changing ways, for thousands of years and if it were possible to abstract the principles it may be that we could recognise something like those that underpin the identification of goods and services, as reflected in the recently developed ecosystem services approach to ecology and natural capital.

Ecosystem Services

Four principal types of ecosystem service, the processes or flows through which benefits are 'provided to society by the environment' were recognised by the UK National Ecosystem Assessment (NEA) (Fluck and Holyoak 2017, i).

- 'Provisioning services' refer to products obtained from ecosystems, like food, fibre, and fresh water.
- 'Regulating services' are the benefits we derive from the ways that ecosystems themselves regulate climate, air, water and soil quality, hazards, disease and pests, and enable pollination of plants.
- 'Supporting services' are those that are necessary for the production and maintenance of all other ecosystem services, things like soil formation, water and nutrient cycling, and primary production.
- 'Cultural services' are defined in the NEA as 'the non-material benefits people obtain from ecosystems', and examples given are 'spiritual or religious enrichment, cultural heritage, recreation and tourism and aesthetic experience' (all summarised in Fluck and Holyoak 2017, 18).

The ecosystem services approach is currently influential in ecological practice. The work of archaeologists, historians and palaeo-environmentalists can contribute to understanding the genesis of the provisioning, regulating and supporting services and so inform the planning and management that sustains them, in addition to contributing to the benefits society receives from 'cultural services'.

By understanding how people have been involved for millennia in shaping the semi-natural environment, Cultural Services may be seen to be more than simply 'non-material', as represented in the NEA definition. People do not only engage with nature in a relatively abstracted or remote way as consumers appreciating the aesthetics of beautiful or interesting places, being intrigued by cultural sites, by being tourists, and through sensing, respecting and celebrating the spiritual in nature and place.

They are also active agents in the other ecosystem processes, especially Provisioning and Supporting. The ways that goods and provisions are obtained from places and ecosystems, through agriculture, silviculture, fishing, mining, quarrying, water management, etc, are fundamentally historical and cultural, dependent on knowledge, awareness and intelligence, wrapped up in custom, tradition and skill, much of it a form of Traditional Ecological Knowledge (TEK) (for which see Whyte 2013) or traditional ecological expertise (Bele *et al*, forthcoming).

The ways that human actions affect Regulating and Supporting services, however unintentionally, also affects people's sense of inclusion with the interconnected relationships of nature, or semi-nature.

Remains of historic and prehistoric arrangements for delivering such services, the field patterns, mines, harbours, communication and transportation infrastructures, form much of the historic environment. Understanding how they developed helps people appreciate how provisioning and other ecosystem services are dependent on people developing ways of relating to semi-nature through ecosystem services that are as sustainable as possible.

Natural Capital

Natural Capital is usually considered alongside ecosystem services as 'the configuration of environmental resources and ecological processes that contribute to human welfare', effectively the 'stock', or the natural assets that provide value (Fluck and Holyoak 2017, i and 18). As such, it is a vital form of capital for society, including for a nation like the UK or for a part of it like West Penwith. Alongside financial, human, social and physical (i.e. manufactured) capital it is 'integral to our nation's economy and contributes to society's well-being' (UKNEA 2011, cited in Fluck and Holyoak 2017, 18).

This approach to assessing the health of our environment includes the historic as well as the natural aspects of it, in that much of human and social well-being is drawn from landscape (perception of place) and the visible, perceptible and understandable remains of earlier generations (ancestors or predecessors) as much as through the more basic provisioning services.

It can be helpful to draw on ecosystem services terminology and thinking when considering how people assessed and utilised types of place in the past, from the earliest Holocene inhabitants, the Mesolithic hunter-gatherers, to the most modern farmers.

- Provisioning
    - Food, fresh water, raw materials for clothing, equipment, etc
    - Shelter
    - Power
    - Navigating the land and sea when developing routeways
- Supporting
    - Managing, manuring and other ways of sustaining or improving land, including its soils
    - Establishing and maintaining rules for sustaining common resources, like pastures, access to water, public routeways
    - Ensuring water and other necessities are not fouled or diminished
- Intangible engagements, leading to tangible creations and adjustments, such as
    - Gaining and restricting access to areas
        - Forms of ownership
        - Bounding and boundaries
        - Common property regimes

        - Tensions and violence and preparation for and responses to that
    - Developing and responding to meaning in the landscape
        - Understanding and respecting origins, history and ancestors
        - Personal and communal events
        - Characterising and valuing

Through taking account of all the above, the study has attempted to gain a sense of the biogeography of West Penwith, i.e. an understanding of the geographical distribution of plants and animals and the natural and cultural factors that affected and controlled the composition of communities and floras. It involves subsidiary forms of study, some of which can be informed by a landscape historian's method and point of view. Aerography considers where a species, or a flora, or a fauna, can occur while chorology brings in time and studies the development of both a species and an area.

Structure of this report

As noted, this report interweaves nature and culture in a narrative whose drive is provided by arranging the material chronologically, as far as it is possible to do so, and then undertaking further interweaving to bring in particular themes and types of place.

The long established 'Ages' and named periods are retained for the chronological structure, aware that they have quite fuzzy boundaries. They help a wider audience follow the story more easily than simply using dates.

The dates themselves have been represented using the basic abbreviations BC and AD, rather than the forms used in academic literature (cal BC and cal AD) when radiocarbon dates have been subjected to calibration. This is because some dates have been derived from other means, like Optically Stimulated Luminescence (OSL) or from astronomical or literary sources, where dates are not calibrated.

While the main subject of the work is the Holocene period and thus Mesolithic and later communities, it is contextualised by touching briefly on human society in Cornwall and Britain in the Palaeolithic (or Old Stone Age) period.

So, the time strand runs through Palaeolithic, Mesolithic, Early Neolithic, Later Neolithic and Bronze Age, Middle Bronze Age, Later Bronze Age and Early Iron Age, Later Iron Age and Romano-British, Medieval, and Post-Medieval and Modern.

Finally, or firstly, the narrative section of the report is preceded by another substantial section that sets the scene by describing the peninsula – its geography, geology, land forms, including the coast and the land's relationship with the sea, soils and weather. It also introduces some of the key long-running themes that are threaded through multiple phases of West Penwith's history: commons, fields, boundaries, fauna and alien plants.

There are two appendices. One presents summaries of the palaeo-environmental studies that have been undertaken in West Penwith; the other contains brief introductions to the soil series identified in West Penwith.

Section 1 Setting the scene: West Penwith's landscape and physical environment, and long-term human practices

West Penwith's physical framework includes its land, coast, sea and weather – a particularly wet and windy sea-girt hard-rocked part of Britain. Storminess contributes to West Penwith's marginality as do acid soils derived from a largely granitic geology, land cover that includes extensive areas of clitter and spreads of granite moorstones, relief that has large areas of the land sloping, much of it steeply, and a coastline that has havens and coves interspersed with dangerous, rocky stretches that include great wall-like cliffs of granite and hard, angular metamorphosed rock.

That marginality is ameliorated by the benignity of fertile stretches, like the Golden Mile of Gulval and Ludgvan, the amenable deep soils of the plateaux of Paul, St Buryan and St Levan and the sheltered valleys of Sancreed, Madron and Gulval.

Geography

West Penwith is largely rural with considerable variety of land use and thus land cover. Its significance is manifold, but many would say that it resides in the following.

- Intricately interesting landscape.
- Beauty, in many people's eyes.
- Geology and extractive industry (especially tin and copper mining).
- Archaeology (famously the early prehistoric ritual and ceremonial monuments, but also cliff castles, courtyard houses, fogous, crosses, etc, and an increasingly widely recognised 'ancient landscape' of prehistoric fields and pastures).
- Art (especially the Newlyn and St Ives schools).
- Agriculture (a prime dairying area also renowned for early-season vegetables, fruits, and flowers).
- Wildness and remoteness; a sense of being far from the madding crowds.

A consequence of the diversity of interest, and the beauty, has been the development of an important visitor, leisure and recreational economy.

Most of West Penwith lies in National Character Area (NCA) 156, West Penwith (Natural England 2012). (NCA 152 'Cornish Killas' also reaches into the peninsula to include Penzance, the Golden Mile, and eastern parts of Lelant and Ludgvan parishes.)

A recent 'profile' of NCA 156 identifies the peninsula's key characteristics.

- 'An exposed, open and wind-swept granite plateau forms the core of the area with boulder-strewn slopes leading to an intricate matrix of spectacular sea cliffs, coves and coastal valleys.

- Lowland heath, rough species-rich grassland linked by lichen-encrusted granite walls and sycamore-dominated copses provide niches for a wide range of species.
- Intensive horticulture for early vegetables and flowers in the south and east of the area.
- Woodlands are generally limited to the more sheltered valleys with areas of scrub woodland developing on the higher moor areas.
- Impeded drainage and hard rock have given rise to shallow streams and wet heathland. Streams wind through the higher ground and cut down sharply in their lower reaches.
- A rich, internationally important cultural heritage tracing human occupation and activity from prehistory. One of the best surviving functional patterns of field enclosure originating in the Romano-British era or earlier; an ancient pattern of often tiny, irregular fields enclosed by Cornish hedges.
- Dispersed settlement of hamlets and farmsteads with occasional fishing and mining villages and small towns. The mining of tin has taken place in the area over a long period but became industrialised during the 18th century. This is now recognised as internationally important, reflected in the Cornwall and West Devon Mining Landscape World Heritage Site.

The front cover of the 50-page National Character Area Profile for West Penwith (NCA 156) (Natural England 2012).

- Buildings constructed from local granite with Cornish slate roofs and located in sheltered dips and pockets, and terraces of miners' cottages often overlaying earlier settlement present a simple and austere vernacular.

- The outdoor opportunities presented by beaches, the South West Coast Path and the area's wild character, combined with its artistic influence, make it a significant tourist destination' (English Nature 2012, 6).

Expanding on the peninsula's archaeological importance, the profile notes that it 'contains one of the best preserved and legible records of continuous human occupation of the landscape in Western Europe. The surviving and still functional pattern of Bronze Age fields, associated with well-preserved settlement and ritual sites, is of international importance' (Natural England 2012, 3).

Geology

The rock forming West Penwith's rounded but angular peninsula is a source of past, present and future opportunity and challenge. It is the basis of the peninsula's light and friable soils, the accommodator of the mineral lodes that led to the industrialisation of several of its parts, and the rock (or stone) from which its enduring patterns of fields, boundaries, buildings and settlements were made.

Solid geology is predominantly early Permian mica-rich magmatic granite, intruded into pre-existing Devonian sedimentary rocks. The Land's End granite is the largest and youngest of the main western Cornish intrusions, having formed between 268 and 275 million years ago during the Lower Permian geological period (Hall 1994, 2).

There is variability in age and structure of the West Penwith granite. The so-called 'Zennor lobe' is around 2 million years older than the 'St Buryan lobe'. Both contain coarse and fine-grained granite though the latter is more extensive in the Zennor lobe (Powell *et al* 1999).

Fractures within the granite and in the surrounding metamorphic aureole, which runs along much of the northern coast of the peninsula and in the hinterlands of Penzance and Mount's Bay, 'allowed mineralising fluids containing lead, silver, tin and uranium to ascend' (Howle c2018, 26). For detail on West Penwith's mining heritage see Sharpe 2016 and the Cornwall and West Devon Mining Landscape World Heritage Site (https://www.cornishmining.org.uk/.

That metamorphic aureole around the Land's End granite, created by the baking and distortion of adjacent rocks as the granite intruded, affected Devonian slates and metabasites (greenstones). There are also pillow lavas and metabasalts, some containing fragments of granite gneiss (Shail 1999, 7).

The geology of West Penwith is most excitingly visible on the coast. 'The metamorphic aureole is superbly displayed on the northern side of the Penwith peninsula' (Bristow 1996, 104).

Metamorphic rock at Carnelloe, Zennor (foreground) and at the peak of the long promontory of Gurnard's Head beyond.

Stones

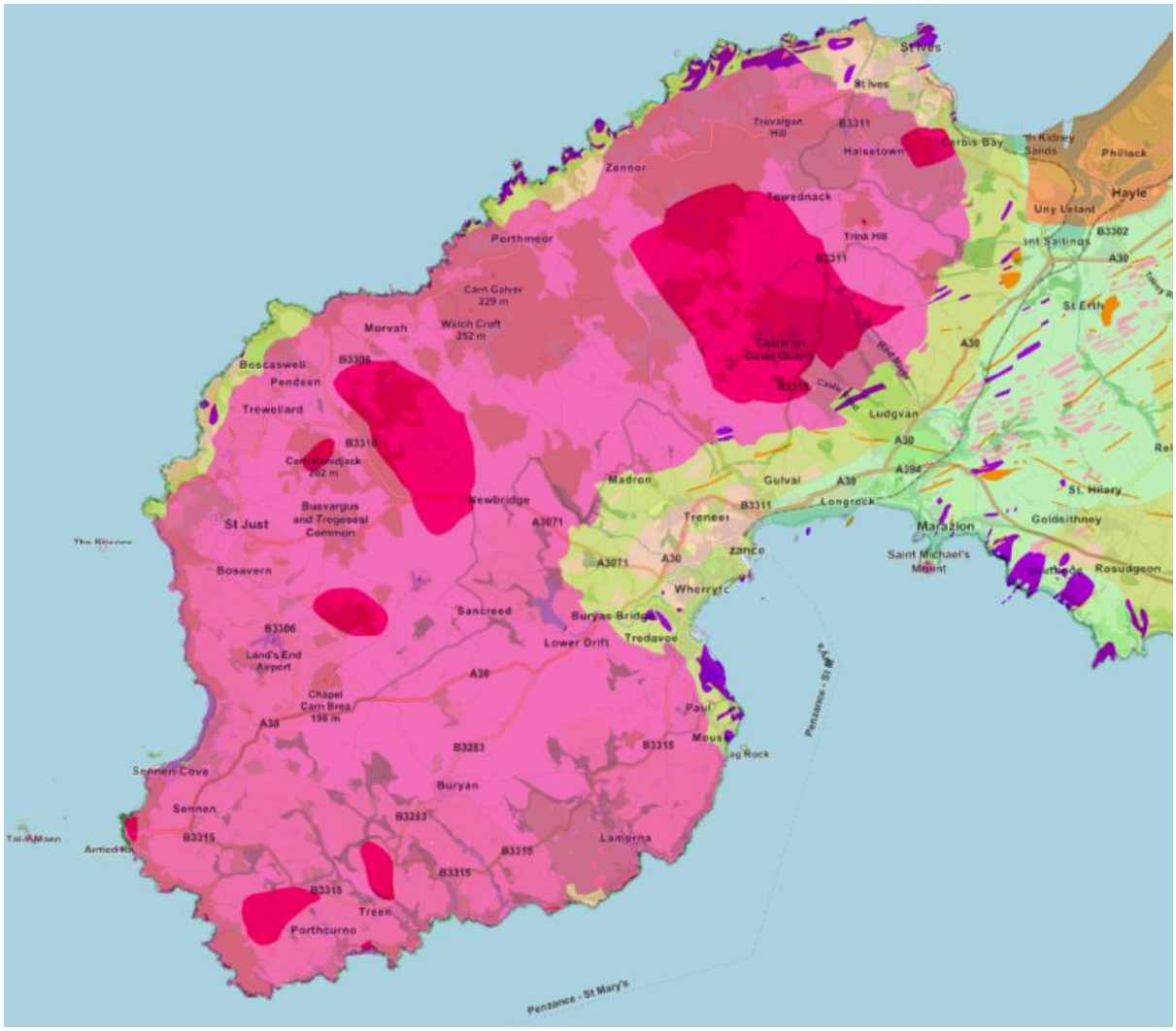
William Borlase (1758) brought a proto-scientific approach to his account of the 'Stones' of Cornwall, placing particular emphasis on their functional and economic value.

White spar. Borlase noted that this was called quartz in Germany, now also its familiar British name. Its stones are 'extremely hard, and repair roads, and face our hedges'; 'being full of angles they make the best pitch-work for paving courts, stables and the like; the pavement not easily growing slippery, or breaking, where these stones are laid' (Borlase 1758, 91).

Elvan. A quartz-porphyry, usually grey-blue colour that Borlase described as 'of very close grit', too hard to cleave, or break to face (Borlase 1758, 91-92).

Killas is the local name for the sedimentary rocks (metamorphosed or not). It is variably friable or laminated. Stones 'have a smooth face for building, and make a strong wall, but are apt to be feather-edged, which makes them lodge water, and throw damps into the walls' (Borlase 1758, 92).

Moorstone, or granite. Borlase noticed variety in granite's colours: white, dusky (dove), yellow, red and black. Ludgvan granite is dove-coloured while that at Treasso in Ludgvan, 'a bow-shot' from the house there, the granite has a red ground, and that from Bosworlas in St Just a black ground (Borlase 1758, 99-101).



The geology of West Penwith. Pink = Land's End granite intrusion. Darker, redder pink = finer grained granite. Pale green = Mylor Slate Formation. Purple = Devonian igneous intrusions (From Geology Viewer, British Geological Survey, Contains British Geological Survey materials © UKRI 2023). Much of the north coast is fringed by metamorphosed rocks.

Flints. Borlase described the 'beach of pebbles two miles and three quarters long, among which many hundred flints may be picked up every day' running from Penzance to Marazion. He knew that at Vorlas, in lower Ludgvan, lay a clay in which 'flints are discovered in great numbers, their size from the bigness of a man's fist to that of a bean.' The brown flints were mixed with shingle and quartz pebbles, the 'vestiges of the universal deluge' (Borlase 1758, 106), or more likely a gathering by the tides of pebbles that included flints displaced from sources that could have included the Haig Frais Cretaceous chalk deposits beneath the eastern Atlantic, near the Isles of Scilly (see Berridge and Roberts 1986, 13).

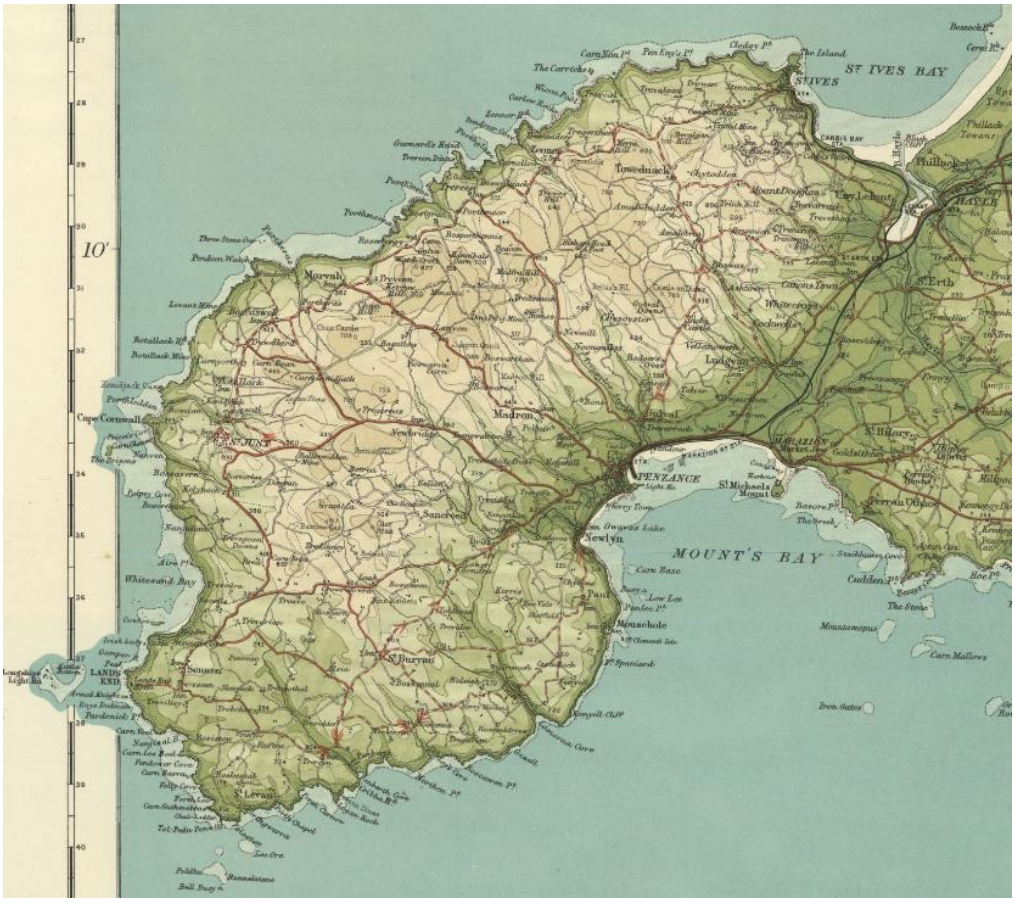
Stones were sometimes either named or incorporated into the names of places. Cornish *Karrek*, 'rock' and *legh,* 'flat stone, slab' were often applied to particular natural rocks used as boundary marks for parishes or estates. *Men*, 'stone' also

often referred to particular stones, but usually those placed upright by people: including prehistoric standing stones or *menhirs* (long stones).

Landform

The shape and form of the Land's End peninsula has been determined by its geology: granite and hardened metamorphic rocks hold back the Atlantic on its northern, western and southern sides. It is joined to the rest of Cornwall by an isthmus of low-lying land that enables West Penwith to be regarded as an almost island. St Michael's Mount, an island becoming a peninsula when the tide is low, is a second more miniature *presqu'île* projecting from the isthmus's southern side. Only low rounded hills (just 49 metres, 160 feet high) divide the waters of the Hayle River (issuing into St Ives Bay) from those of the Red River (Mount's Bay).

West Penwith*'s* variety of landform, land cover, land use and landscape is remarkable, even if the scale of each element is small. Its longest length, from Gwennap Head to St Ives Island is just 25 kilometres, or 16 miles. Perpendicular to that line, the width of the peninsula, from Penzance to Trevean Cliff in Morvah is just 8.3 kilometres or 5.2 miles, a two-hour walk. Its area is around 22,500 hectares (225.5 square kilometres), or 55,500 acres (87 square miles), depending on where its south-east boundary is drawn, similar to Bodmin Moor *(*210 square kilometres, 81 square miles*)*.



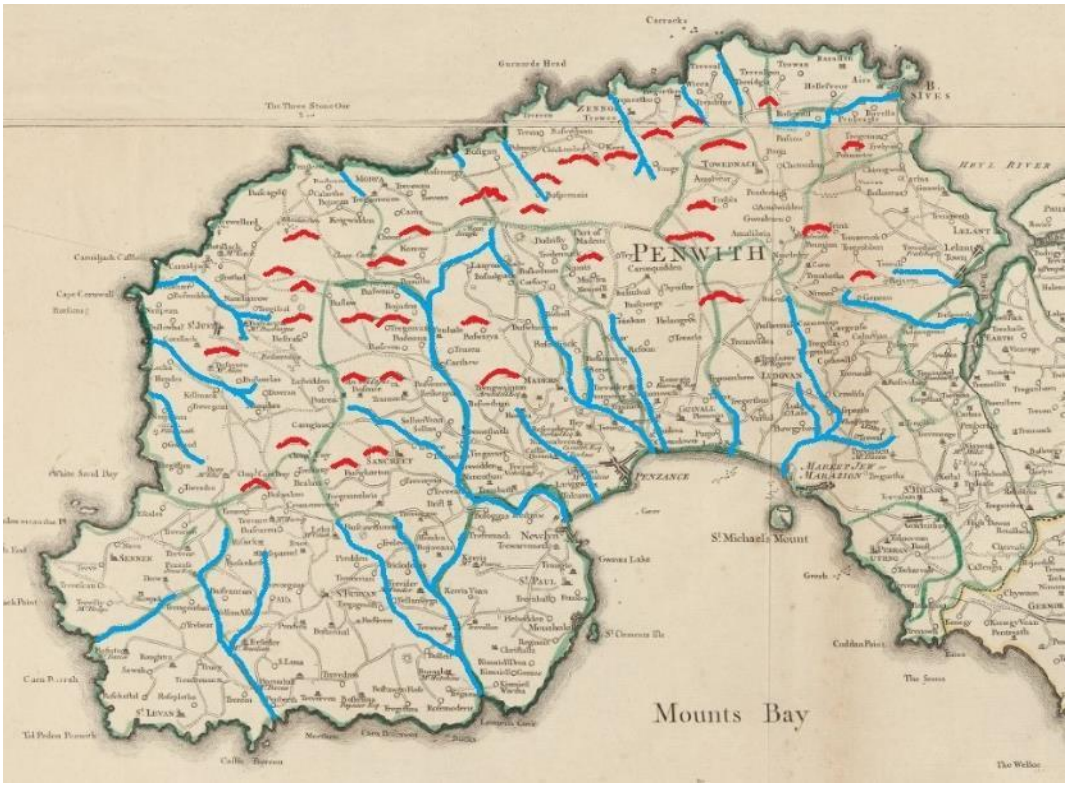
Extract from Bartholomew Half-Inch map, Sheet 37 Cornwall, 1903. This shows the basic relief of West Penwith clearly through the use of coloured contours. The isthmus and low-lying land around the two main bays stand out clearly.

Everything is relative, and the dense packing of topographical features creates a particular West Penwithian perspective. Valleys seem deeper and longer than they turn out to be and the highest ground appears almost mountainous from certain angles, with lofty, weather-beaten tors rising above steep clitter-strewn slopes. In fact, the longest river, the Newlyn Stream, is just 7 miles long (11.5 kilometres) and the highest ground, on Watch Croft, is only 252 metres (827 feet) above sea level. The rockier 'mountains' are all lower than that: Carn Galva at 249 metres (817 feet), Zennor Hill at 237 metres (778 feet), and Trencrom at barely 200 metres (656 feet). The Mount itself is a mere 125 metres (411 feet).

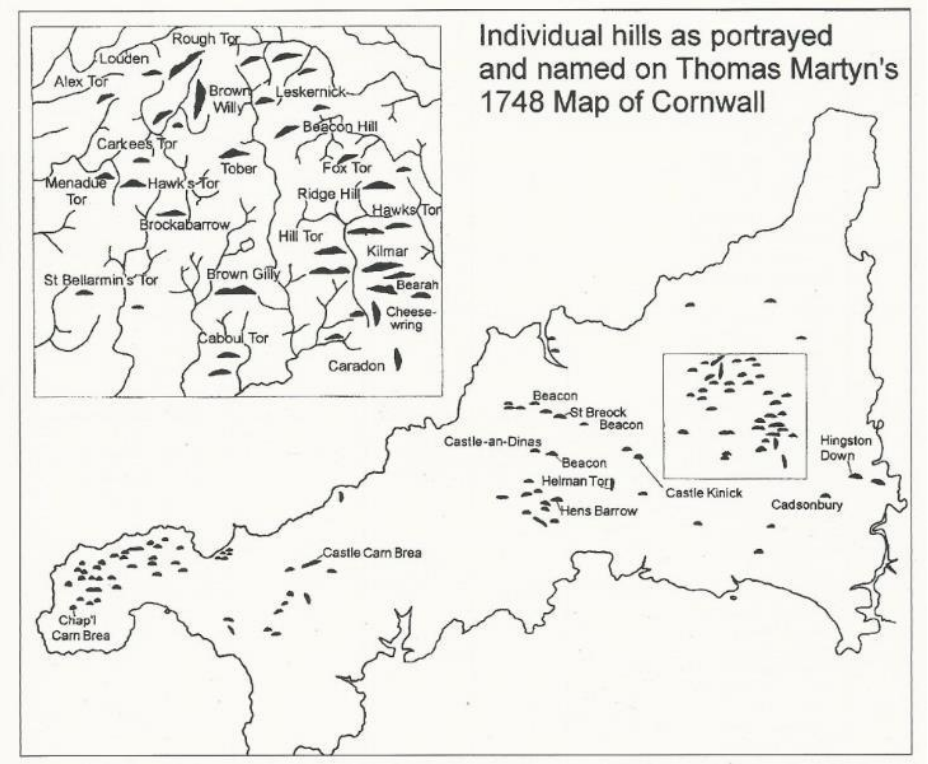
The eastern 'mountains' of West Penwith, Zennor Hill to the right and Eagle's Nest, and the downs of Sperris and Wicca to the left. They rise from the coastal plateau that is itself high above precipitous cliffs.

Uplands

Despite their low altitudes, the arc of hills curving from Carn Brea to Rosewall forms one of Cornwall's most distinctive upland areas. Known locally as the 'high countries' (e.g. Dudley 1957, 69), the hills form a strong visual barrier. They hide the exposed and remote-feeling northern and western coastal plateaux and separate that from the more sheltered southern plateau, and from the peninsula's central bowl, through which streams flow down to Mount's Bay and St Ives Bay.

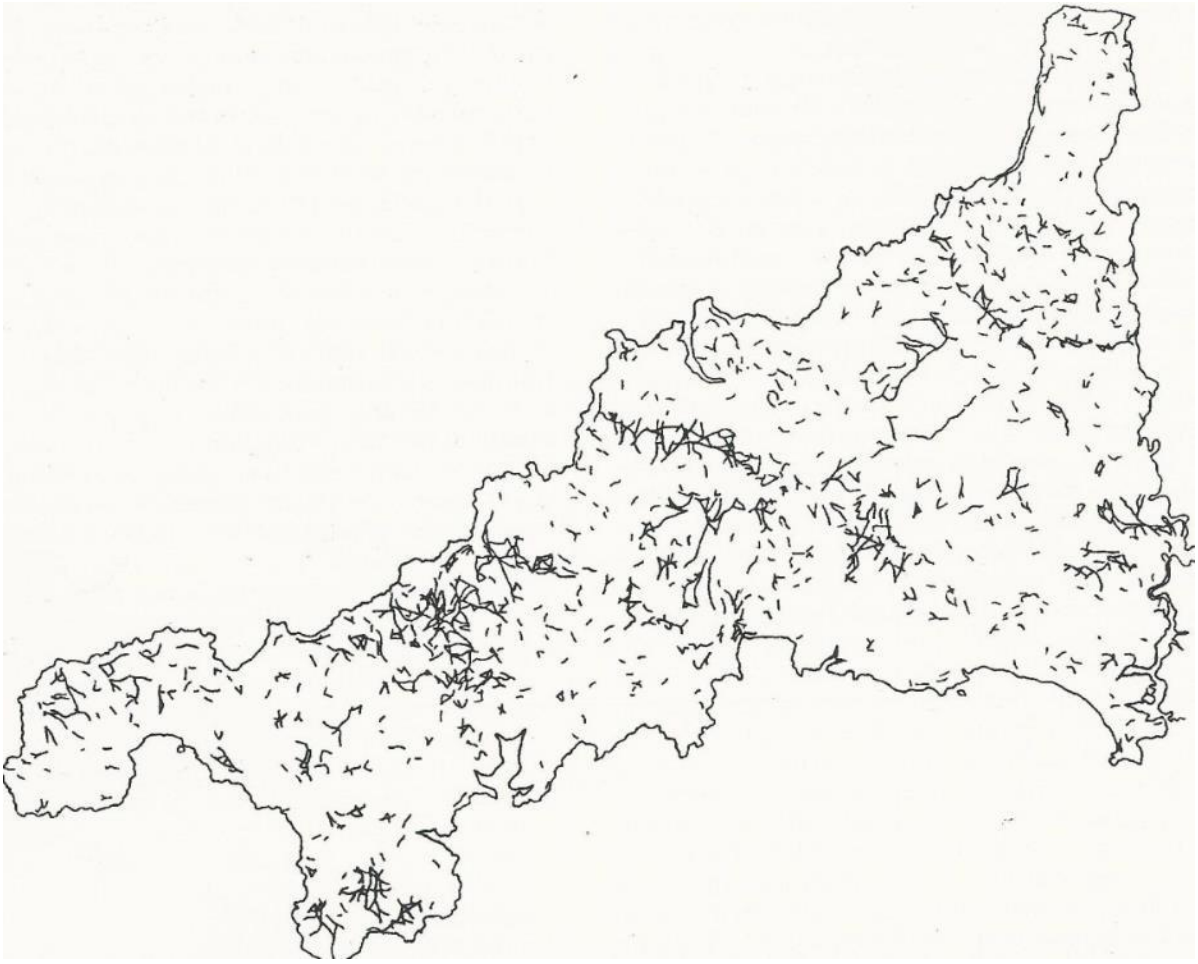


Detail of Thomas Martyn's Survey of Cornwall, 1748. Hills (red) were shown in profile. Rivers and streams in blue. Together they are a good early representation of the area's topography. (Map courtesy of the Harvard University Map Collection)



The cluster of West Penwith hills shown by Thomas Martyn on his 1748 map of Cornwall and all the other hills in Cornwall that he showed in the same way. Also shown are the hills that he named, including those on Fawymore (now Bodmin

Moor), shown in the inset map. Note how the West Penwith upland landscape stands out as strikingly densely packed with hills (from Herring 2004, fig 4.3).



This map of Cornwall is also derived from Thomas Martyn's 1748 map. It shows areas of open or unenclosed land by tracing lengths of roads and lanes displayed by Martyn with broken lines, indicating lack of hedges or fences. Again, for West Penwith, it emphasises the upland area of the peninsula's northern half, but also picks out the several smaller patches of open land in the southern half (from Herring 2004, fig 4.2).

Thomas Martyn represented the extent of West Penwith's rough and open uplands by drawing 33 discrete hills in profile on this part of his 1748 map of Cornwall. He was Cornwall's first systematic and comprehensive map-maker and each hill can be recognised. Carn Galva was distinguished by two peaks and hillforts and enclosures were drawn on Trencrom, Castle-an-Dinas, Chun, Caer Bran and Bartinney, the Neolithic quoit on Mulfra Down and the medieval chapel on Carn Brea.

Martyn worked before early modern enclosure and improvement turned rough ground into grassy pasture and diminished the upland character of West Penwith's hills. Earlier maps represent West Penwith's hilly roughness more schematically. The Great Map of the West of c1539 is rather fantastical but does catch the rounded nature of the peninsula's hills, or downs and shows them bare of trees. John Norden's late 16th century map of Penwith (Ravenhill 1972, 18-19) included names of several hills, including 'Tregomme' [Trencrom], 'Kern-nujack' [Carn Kenidjack],

‘Kern-inis’ [Carn Eanes], ‘Castle Andinas’ [Castle-an-Dinas], and ‘Castle anowthan’ [probably Carn Galva (Weatherhill 2014)]. He washed his hills with brown and green watercolour, suggestive of rough ground, and showed many with irregular tops, indicating tors.

Early perceptions of West Penwith uplands are also caught through place-names.

Names of types of hills

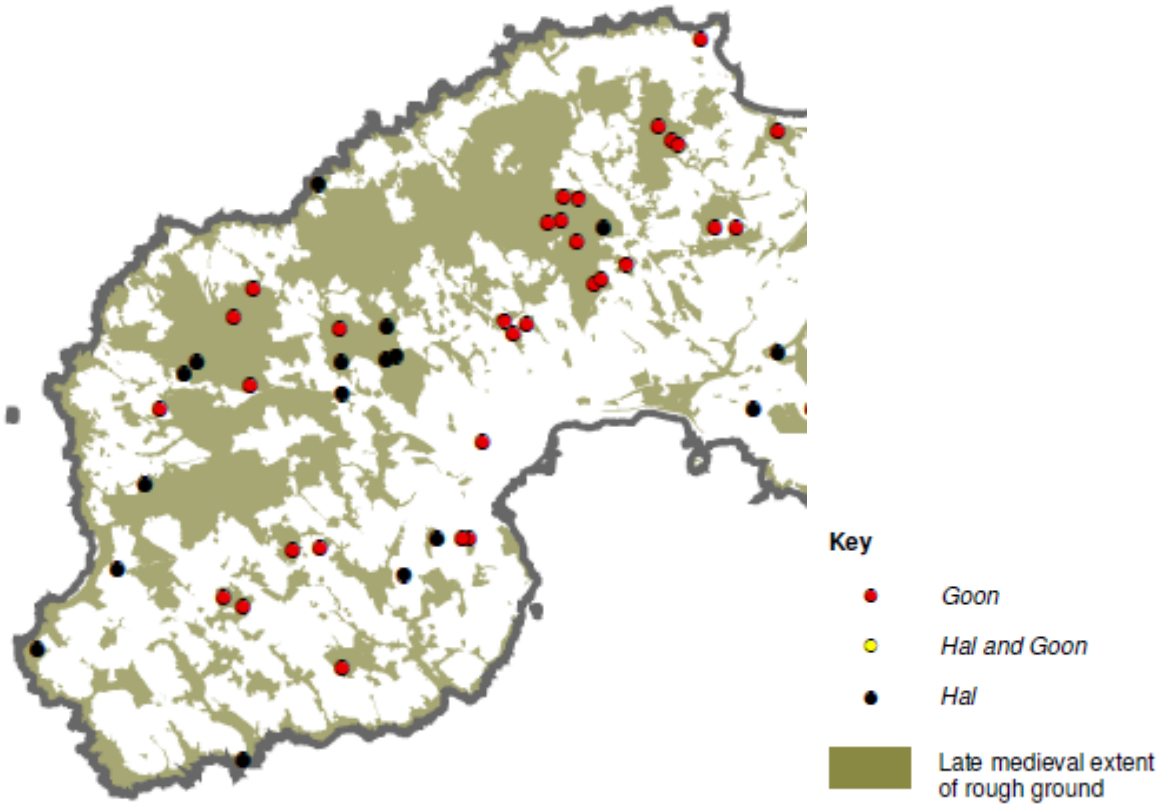
Bre – ‘hill’. An early Cornish name for a hill (Padel 1985, 30); appears to have been applied to discrete large, rounded hills, like Mulfra, Bartinney and Carn Brea.

Bartinney, a bre *hill: discrete, large and rounded.*

Meneth – ‘hill’. An Old Cornish word, usually applied to broad rounded hills, but rarely the tallest in their vicinity.

Ros – ‘promontory, hill-spur, rough grazing’. An early Cornish word for rough upland grazing, apparently preceding *goon* (Padel 1985, 199-201; 2011, 82-83). Often relatively low-lying downlands, like Rosevidney (Ludgvan), Rosecadgehill (Madron) and Boscawen Ros (St Buryan).

Goons and downs, the gently rolling uplands of West Penwith. Bosporthennis, Treen and Kerrow Downs with Noon Veor on the distant skyline.



Distributions of Cornish words use for areas of rough ground (from Dudley 2011, fig 71. © Cornwall Archaeological Unit, Cornwall Council).

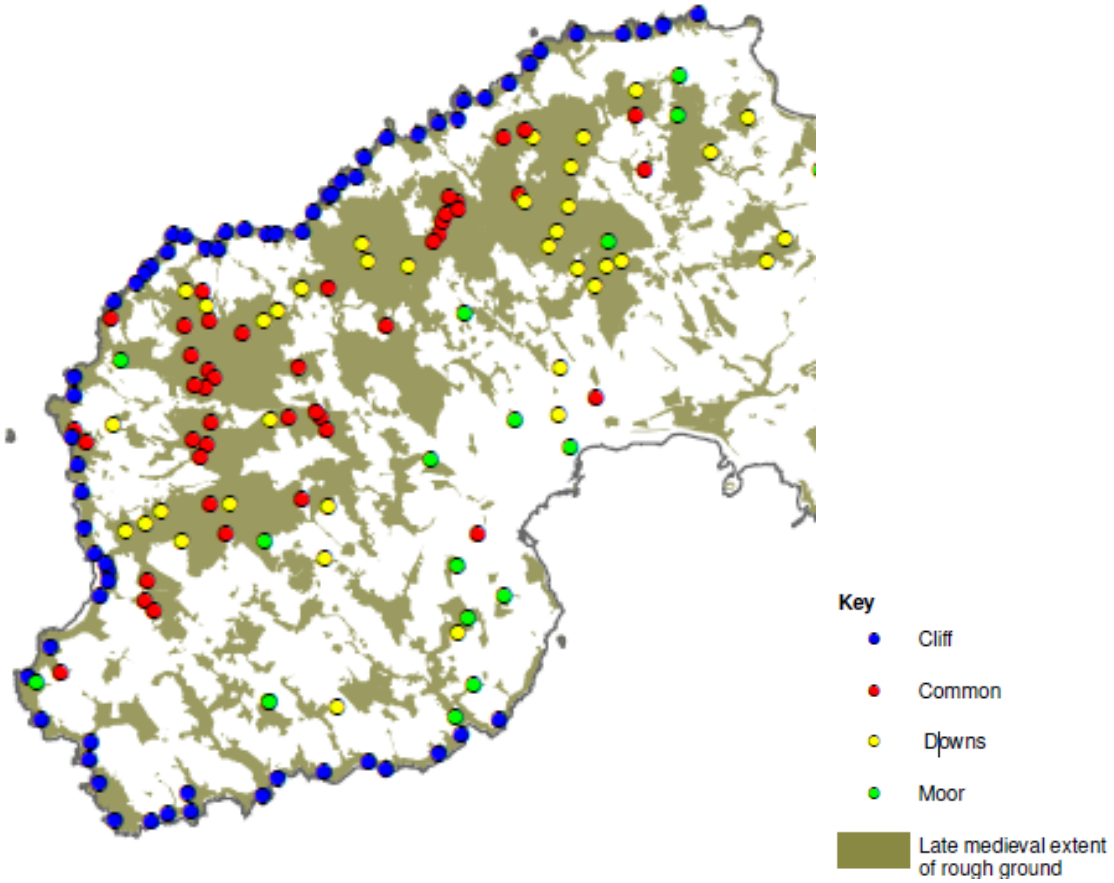
Goon – 'downland, unenclosed upland grassland pasture'. Many West Penwith downlands were given the Cornish name *goon*; 35 instances have been recorded (Pool 1985; Padel 1985; Weatherhill 2017). Earliest references are from the 12th and 13th centuries and its etymology suggests that places in *goon* were primarily open upland grasslands (Padel 2011, 82). The distribution of names with goon is largely that of the upland rough ground (e.g. as shown on Dudley 2011, fig 24).

'Down' and 'Downs' in both singular and plural forms. The English form of Cornish *goon*, rounded uplands with open rough grassland pasture, often a common (Padel 2011, 79). Many were named 'Common', usually the hamlet-commons established in the later medieval period (see Time and Change, Medieval, below).

'Hill'. Most frequent in the north-eastern quarter. Sometimes refers to long steep climbs rather than discrete hills.

'Mount'. Abrupt steep hills, often the tallest in their neighbourhood. Aside from St Michael's Mount, all are recent names.

Note that the term 'Moor' was applied almost exclusively to lowland wet ground (see below) in West Penwith, not to upland rough ground.



Distributions of English words use for areas of rough ground (from Dudley 2011, fig 70. © Cornwall Archaeological Unit, Cornwall Council).

Names can also describe elements of hills and sometimes their uses. For example *Guillua* – 'look-out place' refers to places from which movements, especially on the sea, can be observed. Includes hill tops like Carn Galva in Zennor (presumably its northern peak), though most examples are on cliff tops. Beacons, as in Sancreed Beacon and on Treen Common (Zennor) are hilltops where fires were lit to warn and inform.

Names descriptive of hills' shapes emphasise their rounded forms; West Penwith is a land of rolling downs. *Compes* 'level place', as in Woon Gumpus, St Just, feels faintly ironic, its gently undulating downs perceived as relatively level by people who elsewhere were descending into coombes or climbing steeply towards *carns*.

> GB Worgan in 1811 regarded Cornwall as 'remarkable for inequality of surface; ascents and descents follow in rapid succession. Some of the hills are very steep, and tediously prolong a journey' (Worgan 1811, 5).

Carn – 'tor, rock-pile' is by far the most prolific topographical place-name element in West Penwith. No less than 99 were recorded by Pool, Padel and Weatherhill. Many were first recorded on the first edition OS mapping in 1876 but the names can be expected to have been given long before that. In West Penwith the name was applied 41 times to *carns* on hills, usually but not always at or near their summits. The other 58 *carns* are coastal, the great rockpiles on the tops and slopes of cliffs.

Tors and rockpiles

While *carn* may be the most common topographical name, most of West Penwith's hills do not have substantial outcrops; most are indeed smoothly rounded downlands. Some do have tors and those are, to most people, the most distinctive hills: Carn Bosavern, **Carn Kenidjack**, Carn Eanes, **Carn Galva**, **Hannibal's Carn**, **Zennor Hill**, **Sperris Downs**, **Eagle's Nest**, Carn Boscubben, Trendrine Hill, Trevalgan Hil, **Rosewall Hill**, **Trencrom Hill**, **Sancreed Beacon**, **Trengwainton Carn** and **St Michael's Mount**. Those in bold are the most eye-catching rocky hills.

Hills with smaller tors, often on the midslopes rather than the top, include Carn Brea (a name that combines rockpile *carn* and rounded hill *bre*), Carne Downs (combining *carn* with rounded hill), Watch Croft, Mulfra Hill, Chykembro Hill, Kerrow Downs, Trewey Hill and Trink Hill.

The archaeologist Dorothy Dudley, when working on Sperris Hill in Zennor, from Cornish *sperys*, 'spirit, ghost' (Weatherhill 2017, 195) was affected by the tors there that 'assume weird and even terrifying shapes' (Dudley 1957, 69).

Dr William Borlase proposed that tors and their rock basins had been of great ritual significance for prehistoric people (Borlase 1769). More recently it has been noticed that many early prehistoric ritual and ceremonial monuments were set up on or against tors, or in positions where there was direct visual reference to them. This has suggested a degree of reverence for the tors (e.g. Tilley 1995; 1996; Bradley 2000; Tilley and Bennett 2002; Straffon 2004; Bender et al 2007; all volumes of *Meyn Mamvro*, passim).

Narratives have been developed that have tors as places ascribed significance and imbued with complex meanings by early prehistoric people. They were part of the inhabited and experienced world, and it is expected that early people would have tried to understand and explain their forms. If the piling up of slabs was seen as deliberate then the people may have responded to tors as products of powerful, giant predecessors, even ancestors.

Lowlands

In West Penwith lowlands are either the coastal plateaux running anticlockwise from Paul to St Ives or the valleys and low rounded ridges in the central bowl from Sancreed to Lelant through which the peninsula's longest rivers and streams flow down to Mount's Bay and St Ives Bay. But nither category is as neatly definable as that; short streams rush across the plateaux in short narrow valleys and neat discrete hills punctuate the central bowl.

Plateau land

The plateaux, shore platforms formed when the sea was substantially higher than at present, vary in width from as little as 450 metres at Bosigran in the north to 5500 metres in the south where whole large parishes like St Buryan and Paul, with all their fields, farmsteads, morasses and moors, are accommodated on it.

Few place-name elements relate directly to the topography of the plateaux. Most names here refer instead to the farming settlements whose fields cover most of the available land and use the *tre*, *bos*, *ker*, and *chy* settlement prefixes (for which see

Padel 1985). Some other names do refer to positions of settlements in relation to features like watercourses, covered in the next subsection, while a few relate to minor topographical qualities, like being hidden or on the margins. Two that refer to ground, *dor,* were on the edges of cultivable land, where it was first encountered when coming in from the rougher land.

The northern coastal plateau in Zennor looking NE from Carn Galva.

Valleys, streams, and wet places

While interest in west Cornwall's landscape may be concentrated now on the wilder uplands and the coast, the peninsula's valleys and wet places were also of importance to the people of the past.

West Penwith is a discrete hydrological unit: like on St Michael's Mount, all water finds its way to the sea within the peninsula (English Nature 2012, 5). Thomas Martyn in 1748 plotted most streams, including tributaries. While there are no substantial rivers in West Penwith, apart from the River Hayle that forms part of its eastern boundary, streams and especially their valleys, but also their springs and the marshes and moors along parts of their courses, are significant elements of the peninsula's topography. Most rise on the northern hills and run to the sea along sinuous but broadly parallel valleys.

Artificial water bodies in West Penwith's rough ground. Leswidden clayworks (top), Tredinney Lidden and Redinney clayworks (bottom).

> 'These valleys early in May, when the gorse and blackthorn are in full flower, are as brilliant as a poet's dream. To look down any one of them, on a fine day, is to realise a feast of colour, and a vision of the joy of life such as one is rarely permitted to behold' (Folliott-Stokes, 1912, 125-126).

Watery place-names include the few referring to the watercourses themselves, and the many more that describe their valleys, the ways people crossed them, or the more localised watery places associated with them.

There are few surviving names for particular rivers probably because they were minor features, at worst awkward to cross rather than significant barriers. Many no longer have a Cornish name, instead being called from adjacent settlements, like Chyandour Brook, Newlyn River and Rosemorran, Tolver and Trevaylor Streams.

Most valley names use the Cornish word *nans*: the 28 examples make it one of West Penwith's most common topographical place-name elements. It is also often early, with 20 examples being from medieval documents, one of which was pre-Norman. Valleys have long structured people's mental maps of Penwith and many of the early medieval 'estates' represented by the *tre* names have streams along at least one of their boundaries (Herring 2016, 196).

People most often have contact with rivers where their paths, tracks and roads met them. Most earlier crossing names are for fords, *rid* 'ford' and *kew-rys*, 'hollow-ford' and 14 out of the 16 examples have medieval names. The only *carbons*, 'causeway' that gave its name to a place, Carbis, is also early (earliest surviving record is 1391). Bridges on the other hand are generally later, with just 2 of the 14 using the Cornish name *pons* being medieval, Ponjou in Gulval and Penpons in Madron. Several places use English 'bridge'. As expected, given the scale of the streams and the proximity to towns and markets, to and from which goods were carted, most bridges are in the southern and eastern parts of the peninsula.

While the streams themselves are minor, the wetness at their heads, around their springs, and along some of their courses could be extensive and notable.

Cornish for spring is *fenten*, and there are at least seven examples of that name in West Penwith. 'Springs in Cornwall are either superficial, affected by rain, etc, or subterraneous' (Borlase 1758, 25). Some were more noted than others. Madern Well [Madron Well] is 'black, boggy, and light, rising through a grey moorstone gravel, called by the Cornish, grouan'. Its water helps those 'who labour under pains, aches, and stiffness of limbs'. Borlase had little sympathy for those others who come to springs and the wells formed at them on 'less justifiable errands'. These included the 'uneasy, impatient and superstitious, and by dropping pins or pebbles into the Water, and by shaking the ground round the Spring, so as to raise bubbles from the bottom, at a certain time of the year, Moon, and day, [they] endeavour to settle such doubts and enquiries as will not let the idle and anxious rest', but simply 'feed their uneasiness…, increase the gloom of the melancholy, suspicions of the jealous, and the passion of the enamoured' (Borlase 1758, 31).

Morasses, moors and marshes have their own particular archaeological and semi-natural heritage (Herring 2006a) derived from their specific uses in agriculture, basketry and wildfowling. Moors were highly prized in late medieval and early post-medieval Cornwall; with meadows they were often valued as highly as arable land (in terms of rent or return per acre) and were used for hay making, summer grazing and for their rushes, withies and wildfowl (ibid). In Cornish they were usually *hal*, 'moor or marsh' and in English 'moor'. Historically, 'moor' is rarely applied in West Cornwall to upland damp ground as it is on Fawymore (Bodmin Moor), Dartmoor and Exmoor. It is unfortunate then that the term 'Penwith Moors' has found favour in recent years.

Pools and ponds in West Penwith are usually artificial. Among the most interesting in terms of sustainable use of the uplands are the 'liddens' (from Cornish *lyn*, pool') created to store water for livestock high on downs where there are no springs or streams. These still need closer study, but Robin Menneer observed relationships that indicate that some are ancient (Menneer 2007, 15-17) and three namings are medieval. Other pools were created as reservoirs to serve various forms of extractive industry (particularly streamworks and, clayworks).

Commons, summer grazing, and transhumance

Extensive open common grazing from the 4th millennium BC

Cornwall's agriculture since the Middle Bronze Age appears to have been dominated by mixed farming regimes with 'home' farmland for crops and hay on the land best suited for that purpose, usually worked by households grouped into hamlets. These hamlets also needed areas of separate rough grazing, usually found on uplands but also on clifftop rough ground and in marshes, for turning out their livestock in the summer. Those rough pastures were little used in the half-year from November to April when coarse grasses died back and grazing animals found little nourishment. In the other half of the year livestock were brought to them from the home ground while it produced crops and hay, removing the risk of animals disturbing productive fields but also maximising the use of the upland grasses, herbs, and shrubs (Herring 2021).

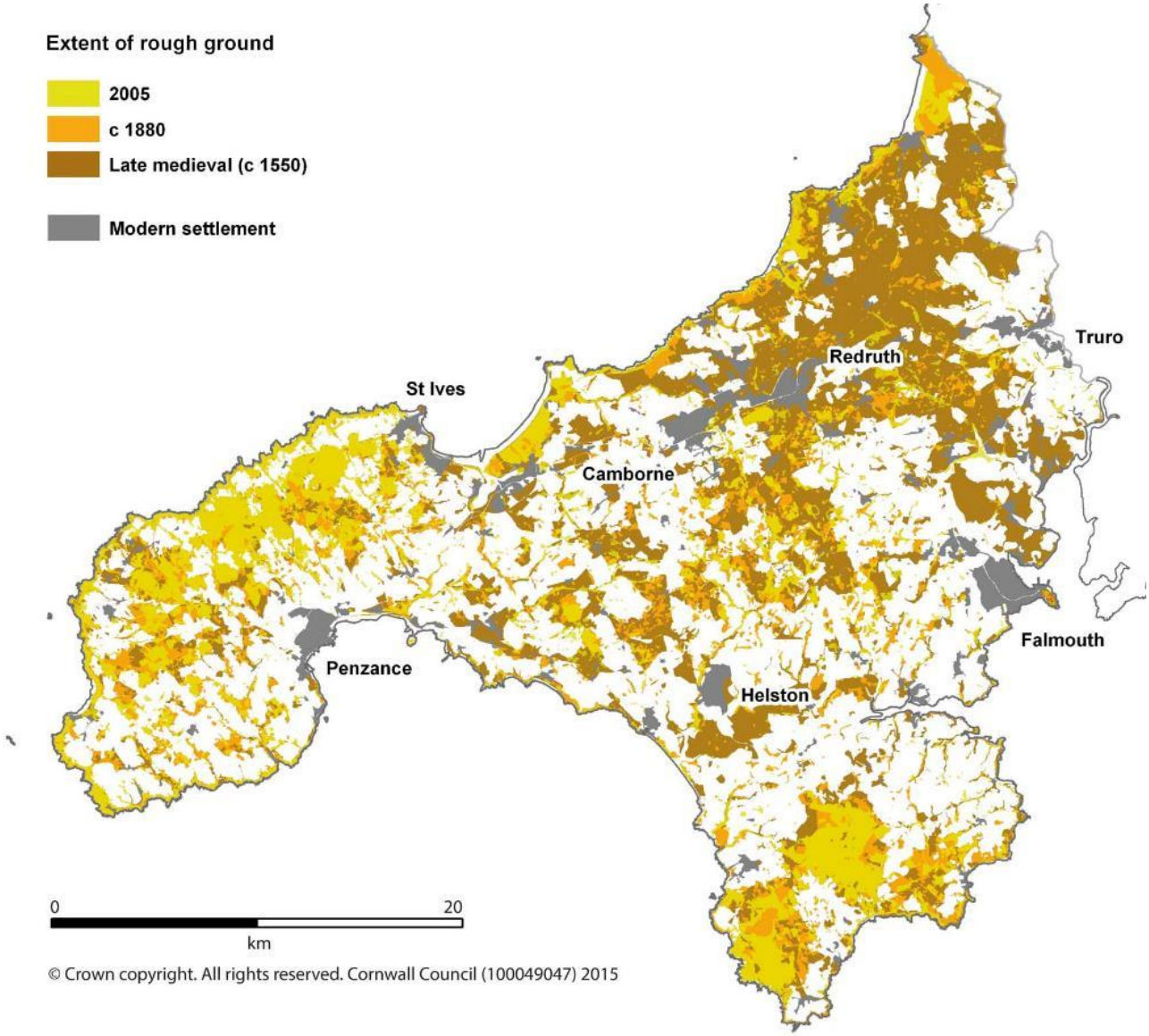
It will be seen (below, Time and Change) that the uplands and cliff-lands of West Penwith had also been managed as herb-rich rough grassland pastures from at least as early as the Early Neolithic (4th millennium BC), and through to the modern period, creating what is in effect an ancient semi-natural grassland.

Thousands of animals

It has been estimated that around 5000 cattle or 50,000 sheep would have been required to keep Bodmin Moor's 20,000 hectares of open rough ground from scrubbing over, and it has been suggested that the management of such grazing levels and the policing of access to commons was a significant element of early prehistoric local administration (Herring 2008, 81).

The West Penwith uplands are not as extensive as those of Bodmin Moor or Dartmoor, but probably took in much of the arc of northern hills, from Chapel Carn Brea to Rosewall Hill. These are the lands known in medieval times by names such as *ros*, *goon* and 'down', and have long been the core of West Penwith's open rough grazing, or the ancient 'extent of rough ground' mapped as part of the HEATH project (Dudley 2011, fig 24).

It is an area of around 5000 hectares, about a quarter of the size of Bodmin Moor. To keep the land as open as the palaeo-environmental evidence suggests it indeed was, there would have been a consistent need to turn out herds and flocks totalling around 1250 cattle or 12,500 sheep. If livestock were attached to prehistoric and medieval households, and if later medieval stock numbers can be taken as a guide, then an average of 5 cattle per household may be reasonable (Herring 1986), leading to a rough calculation of around 250 households using the West Penwith rough ground.



Rough ground of west Cornwall in the modern, Victorian and medieval periods. The last also represents later prehistoric extents as the white follows the extent of the Anciently Enclosed Land largely in place by the end of the 1st millennium BC. The West Penwith upland rough ground runs from Chapel Carn Brea and Caer Bran to Rosewall Hill and south to Castle-an-Dinas. (From Dudley 2011, fig 24. © Cornwall Archaeological Unit, Cornwall Council.)

The hills of West Penwith are also not as high as those of Bodmin Moor, but for the purposes of mixed farming households that would not have mattered; their annual urgent need was for summer grazing, first to remove the livestock from the home fields and make cultivation and haymaking viable and thus possible, and second to make their whole economy and society sufficiently resilient by turning milk into cheese and thus turning the sun's summer energy into their own winter energy (see Tunon and Bele 2019, 34 for a presentation of this, summarised below). West Penwith's lower-lying uplands would have satisfied that need, just as the low-lying downs of the Lizard, St Breock or Week St Mary did the same for other communities in Cornwall.

These extensive commons would then have been a valuable resource that local communities would have needed to maintain in good order. The summer pastures on West Penwith's uplands would have been subject to the same pressures as those on the South-West's higher and larger downlands and the oversight and administration of the sustainable use of the commons would have been as central to the prehistoric and medieval life of West Penwith as it was on Dartmoor, Bodmin Moor and elsewhere in Britain and Europe.

Energy balance involved in managing six cows over a period of 100 days at a Swedish summer farm

As modelled by Lars Kardell and presented in Tunon and Bele 2019, 34. Energy is measured in kilocalories.

Each of the 6 cows would produce on average 4 litres of milk a day, making 2400 litres over the 100 days. Of this, 100 litres were retained for consumption fresh. The remaining 2300 litres would typically be turned by the transhumant into 102 kg of butter, 245 kg of cheese, and 77 kg of whey butter. Five dry cattle would be kept at the summer pastures to be slaughtered at the end of the year; the creation of their meat was also estimated, as 0.15 kg per animal per day, making 75 kg over the 100 days. Swedish summer farms also curated dung for taking as manure for the home farm and this was estimated as sufficient to produce 1000 kg of hay

That product was then translated into Kilocalories (Kcal) as a measure of the energy it produced.

Fresh milk, 100 litres @ 70 Kcal per litre = 70,000 Kcal

Butter, 102 kg @ 701 Kcal per 100g = 724,200 Kcal

Cheese, 245 kg @ 400 Kcal per 100g = 980,000 Kcal

Whey butter, 77 kg @ 275 kcal per 100g = 211,750 Kcal

Meat, 75 kg @150 Kcal per 100g = 112,500 Kcal. **Total = 2,098,450 Kcal**

Then Lars Kardell estimated the energy consumed by the woman transhumant over 100 days (300,000 Kcal) and an allocation of 50 days of a man's time (for putting some of his work into transhumance-related activities: like mowing, wood-cutting, transport and site maintenance) (200,000 Kcal). **Total = 500,000 Kcal**

The balance is then a 1,598, 450 'profit' in terms of energy; or 4.2 to 1 ratio of energy gained over energy spent.

Tunon and Bele conclude that 'This archaic food production therefore produces more than four times as much energy than people consume for the work. The difference is created by the sun and photosynthesis. Today's food production generally consumes several times more energy than it creates' (Tunon and Bele 2019, 34). Photosynthesis, of course, involves the magic of plants using sunlight, water and carbon dioxide to produce oxygen and energy (in the form of sugar). Prehistoric and medieval people may not have known the science, but they would have observed the benefits and acted accordingly.

Prehistoric and Early Medieval West Penwith as a gradually evolving, but essentially stable Common Property Regime

It is not clear where the people of West Penwith lay their heads at night in the 2500 years before the Middle Bronze Age, during the Neolithic and earlier Bronze Age (broadly 4000 to 1500 BC). It seems likely that they were essentially nomadic, moving to and around the open pastures on the hills with their livestock in the summer months, roughly May to October, now May Day to Hallowe'en, when the upland herbage is most palatable, and then retiring with them to the sheltered lowlands in the long winter.

There is nothing in West Penwith's archaeology to suggest that access to the upland herb-rich grasslands, their summer pastures, was not shared and these pastures were undivided. They would then have been used as a form of 'common pool resource' (Earle 2000, 51; Oosthuizen 2013, 1).

It would then have been following the norm rather than the exception for the communities and individuals involved in using this common pool resource to have restricted such a benefit to a closed or exclusive group of individuals, a form of community, usually associated with a defined territory. At the same time, they would have established various rights and responsibilities that applied to the use of the resource. These became the basis of shared custom, maintained through adherence to and the policing of communally agreed rules (Ostrom 1990).

'Societies [operating commons] established rules governing the extraction of goods, defining what was legitimate, and generating the notion of defendable "rights". Custom and practice was not so much the basis of law, but was the law' (Bathe 2013, 178; emphasis original).

Susan Oosthuizen has studied the ways that communities used such custom and rules to sustain commons in Britain from prehistory through to the medieval period (e.g. 2013). Both Elinor Ostrom and Oosthuizen identified universal requirements for stable, certain and sustainable use of common pool resources. Early farming communities, such as those of prehistoric and early medieval West Penwith, would have organised themselves and their shared extensive resources, like common pastures, along the lines of a 'Common Property Regime'.

A common property regime used those customary and universally accepted set of rights, responsibilities and rules when allowing access to and managing use of shared summer grazing, or lanes, or wells, woods, the coast, the sea and the like. Such custom probably developed from the bottom-up, established to meet the reasonable needs of all commoners and, equally importantly, the needs of the common itself.

To ensure that the shared resources remained in good heart, they had to be used in indefinitely sustainable ways by limiting rights and policing them. Collective and consensual institutions, culminating in a 'king' (or equivalent) as ultimate authority for making decisions that all would accept as final, were also crucial for maintaining the custom and would also probably have been established from the bottom up; the kings thus designed and expected to serve the people (Oosthuizen 2013, 1-5; and see Herring 2016a, 193-195).

It has been suggested that the creation in early prehistory of places for gatherings, such as the Early Neolithic tor enclosures, and the more local cromlechs and then the later communal monuments like stone circles and the hilltop enclosures at places like Caer Bran and Castle-an-Dinas (later incorporated into Iron Age hillforts) was connected, in part, to the need to bring people together to administer the rights of individuals and communities to run their livestock on that rough ground. Such gatherings would deal with breaches of the customs, trespasses, depletions of commonly held resources and the like (Herring 2011a), the mundane but vital operation of the CPrR would then have been intermingled with those other uses of such gathering places – ceremonies and rituals, astronomical observations, feasting, partner-finding and trading.

From the Middle Bronze Age (around 1500 BC) there is field archaeology evidence for management and use of the commons: terminal boundaries of coaxial field systems (see below) delineated them, shared lanes led to them, and groups of small transhumance huts were established within them.

Transhumance

There is much archaeological and then place-name evidence in Cornwall (and Devon) for transhumance for the next 2500 years (until around AD 1000) (Fox 2012; Herring 2012; Fleming 2022).

Transhumance – the seasonal movement of a part of the household to the summer pastures with their livestock (cattle, sheep and goats) for the purpose of milking them and producing cheeses, butter, etc – was not a fleeting and marginal practice; rather the whole structure of society and seasonal life in much of upland Britain (which would include Cornwall) appears to have been built around it for several thousand years.

The semi-natural environment of West Penwith is at its early prehistoric, later prehistoric, and medieval core a transhumance environment.

West Penwith's landscape diversity and its biodiversity were developed and then maintained from Neolithic to Norman times through the use of commons and for at least half of that time (from the Middle Bronze Age onwards), and perhaps the whole of it, through the practice of transhumance. Transhumants would have developed and passed on a wealth of what may now be termed 'traditional ecological knowledge' and expertise whose application has created and maintained the beautiful, meaningful and now vulnerable semi-natural environment.

Transhumance was woven into the seasonal round, with May Day and Hallowe'en, Beltane and Samhain, pivotal moments in the rural and pagan year (Herring 2012; Fleming 2022). It was also fixed into the spatial structure of the prehistoric world, with the common and the home farming ground, on the uplands and in the lowlands respectively, being the two great arenas of post-Mesolithic and pre-Norman life. These two arenas are still the principal zones of West Penwith, as represented by the 2012 Historic Landscape Characterisation (Dudley 2012): the Rough Ground complementing the Anciently Enclosed Land (Herring 2011a).

As such ‘transhumance had an inherent stability; it should be seen as a complex, multi-facetted cultural institution, a persistent, relatively stable cultural practice’ (Fleming 2022, 54).

Unlike in West Penwith, transhumance has continued into the present day or into thoroughly documented times in some other parts of Britain and north-west Europe and other aspects of its typical practice can be identified from records and from continuing practice (see, for examples, Collis et al 2016; Costello and Svensson 2018; Costello 2020; Bowden and Herring 2021). One of the most significant is that the transhumants were typically women, usually a mix of girls, young adults and elderly women, with the adult women, men and boys largely remaining on the home farms and undertaking the work required there (Costello 2020; Herring 2021).

Reconstruction of the Bronze and Iron Age transhumance settlement in Sperris Croft, Zennor. Its line of seven roundhouses was broadly parallel with the long stock-proof boundary running along the crest of the East Zennor ridge. The community’s fields ran down the slope from that boundary to the coastal plateau. Land on the nearer upland side was open and probably used as a common. Six of the houses were so small it is unlikely that they accommodated whole households, but instead just one or two people, probably young women. The seventh house was probably a cow-house: especially large and with a small annexe (dairy?), a doorway wide enough for a cow, and a floor paved with large slabs, to reduce animal impact. The women stayed with their cattle all summer in order to milk them daily and make cheese and butter. (Reconstruction by Phoebe Herring for the Penwith Landscape Partnership; see Middle Bronze Age under Time and Change for more detail on the site.)

The transhumance environment was traditionally well-managed in order to keep it indefinitely sustainable. People learnt what plants were useful for treating conditions in both livestock and people and encouraged them and the regularly grazing kept ground open, allowing light to reach smaller more diverse flora which in turn supported a more diverse fauna, a particularly varied biodiversity and a rich semi-natural environment (Tunon and Bele 2019, 151-153; Bele *et al* forthcoming).

Transhumance appears to have ended in Cornwall around the close of the first millennium AD, probably because of the effects of convertible husbandry on the organisation of home fields and the consequent ability to produce and process milk closer to home. After that and into the 20th century the downs were still used in the summer but in this last millennium they were normally grazed by non-dairy livestock. They were turned out into areas delineated by long pasture boundaries, usually within 'hamlet commons', that is areas of rough ground operated communally by the several households in the early medieval hamlets. People would have checked the grazing animals daily but would not have spent their whole summer with them as in transhumance (Herring 2012; 2016a).

Soils

Early characterisations of Cornwall's soils

One of the earliest descriptions of the soils of Cornwall was by the Elizabethan topographer John Norden, and in it he recognises how people were affecting the character and quality of soil, making it clear that the substance upon which most West Penwith life depends has long been anthropogenic,

> 'Yet is the soyle of the Countrye for the moste parte but meane… by burning their grounde and by soyling it with sea sande it becometh verie profitable' (Norden c1600, 17). 'Burning' here is the 'beat-burning' that was an integral part of the convertible husbandry regime practiced throughout Cornwall from the Early Medieval period onwards (see Medieval in Section 2).

Dr William Borlase recorded three broad types of soil in Cornwall in the mid-18th century: 'the black and gritty, the shelfy slatty Soil, and the stiff reddish Soil, approaching more to the nature of Clay' (Borlase 1758, 59).

Borlase's typology stuck, so that Worgan in 1811 also noted just three soils in Cornwall: the 'black growan, or gravelly'; the 'shelfy or slaty'; and 'loams, differing in texture, colours, and degrees of fertility' (Worgan 1811, 8). Worgan also admitted that soil classification was problematic in Cornwall. 'To attempt to specify these soils severally, with their endless combinations and adventitious differences, would be a hopeless task, as in the same field they are frequently found to vary exceedingly, in the proportions of their several constituent parts' (ibid, 8).

Borlase's introduction to the black soil, the one that is found in most of West Penwith, emphasised how the land uses that people applied to it were affected by the qualities of the soil, and also how those land uses in turn affected the soil itself.

Some of the black soil is found in the 'highest grounds', on the tops and sides of hills.

> It ‘is so lax and cold, and its salts so dispersed by the rain and snow, that where it is dry at bottom it bears nothing but sour grass, moss and heath, which is cut up in thin turfs for firing, or at best, short, dwarf, commonly called Cornish Furze; where the rains have not liberty to run off, bogs and marshes are formed: here the Soil is less gravelly and deeper, but to be rang’d among the black Soils, and of little use than it yields a thick black brick turf, full of the matted roots of sedge-grass, the juncus, and the other marsh plants, which, when thoroughly dryed, make a strong fuel’ (Borlase 1758, 59).

Worgan noted that some of these soils ‘are a true peat’, lying on a ‘substratum of yellowish clay’ (Worgan 1811, 8). Worgan noted that the growan soils, those that were ‘black, moory, moist’ (i.e. on the granite) were ‘better for barley, oats, pilez and grass than for wheat’ (Worgan 1811, 7). This form of black soil is the **Hexworthy Series** of the Soil Survey; see below.

Borlase then moved to those black soils on the lower slopes, less severely leached by rains.

> ‘In crofts, farther down from the hills, this black soil serves as wintering for horned cattle, bears good potatoes, rye and pillas, the *avena nuda*; in fields, barley and oats, and serves as pasture for dairy and sheep, especially rearing young bullocks; but seldom turns to any account when sown with wheat. It is more or less charged with gravel, and therefore called by the Cornish grouan (or gravelly), the earthy parts exceeding light, so that, in a dry summer, the sun quickly exhales its moisture; and in a wet summer or winter, the tilled grounds of this sort have much of the vegetable Soil washed away from the grain’ (Borlase 1758, 59).

Worgan praised this soil. ‘It is rather adapted to the growth of barley, oats, pilez [i.e. pillas, the avena nuda] and grass, than wheat, and is particularly suited to potatoes, of which it bears abundant crops of excellent quality’; he noted that over in ‘Burian, Sennan and St Levan’ this soil ‘has a mixture of a strong loam with the growan, and is of a hazel colour’ and ‘is of a very fertile nature, producing large crops of corn of every kind’, including red wheat, prime barley and black oats (Worgan 1811, 9).In Paul the same soil type is ‘famous for producing two crops of potatoes in one year; its sheltered situation, and warm aspect, vicinity to sea weed and sand, concurring with the favourable soil, in giving this peculiar advantage’ (ibid). This soil is covered by the **Moretonhampstead** and **Moor Gate** Soil Series; see below. = Humic Brown Podzolic Soils, 611b Moretonhampstead, 612c Manod and 313 Powys

Borlase summarised the then current approach to soil amelioration: ‘To the black and slatty soils, stiff, earthy and calcareous manure, such as may warm, strengthen and consolidate; but to the red and loamy, every kind of manure that may loosen, quicken and open it’ are recommended (Borlase 1758, 60).

Borlase noted that little use was made in Cornwall of marl to improve soils, despite it existing in places. That was because most, ‘having sea-sand and ore-weed in plenty, do not heed what their own grounds might afford them to their great emolument’ (Borlase 1758, 85). The manures that were spread in the mid-18th century included sand, ore-weed [i.e. seaweeds], straw and animal faeces.

The ore-weed was collected from the shores after storms. It was best for the soil when still moist when it was spread on the soil and then covered with sand; 'it soon dissolves in to a salty oily slime, which contributes much to fatten and meliorate the other manures, and this is the most approved way of applying it. Some lay it naked fresh from the sea, upon their barley lands, in the end of March and beginning of April, and have a good crop of corn; but the weeds grow so plentifully and rank afterwards, that no wholesome grass for pasture is to be expected for that year' (Borlase 1758, 86-87).

Ore-weed manure also 'yield bad oats, and in a small quantity, the husks thicker than ordinary, and more darnel among the corn' (Borlase 1758, 87).

Another unusual manure was pilchards, either the decayed fish or the 'bay-salt' or 'cast-salt' that had already been used for salting pilchards; it was the cheapest and the richest manure and was best placed in heaps of earth and sand before spreading on arable land (Borlase 1758, 87).

Anthropogenic: little soil in West Penwith is wholly natural

The soils of West Penwith can all be considered anthropogenic, from cliff-edge to mountain-top and on all the types of land in between. All soils have been determined in part by underlying rock, head (poorly sorted sediments), alluvium or sand, some by peat and other humic growth, but all have also been influenced by the effects of human activity.

The most widespread anthropogenic modification of soils has been through the various forms and intensities of mixed farming, which has seen large parts of the peninsula cultivated at some time, including the steepest cliffs and highest, most exposed downlands (by Victorian and Edwardian cliff market gardens and later medieval outfield strips).

Anthropogenic soils (sometimes called anthrosoils) are soils that have been influenced, modified or created by human activity, in contrast to soils formed by natural processes. Forms of modification are usually one or more of the following:

- Addition of manure to improve the fertility and productivity of cultivated land (including market-gardening land) and improved pasture (including hay grounds and meadows). Includes the following.
    - Farmyard, cowhouse, chicken shed or stable dung.
    - Folding dung, where livestock are turned into an enclosure after spending the day on downland in order to dung improved or cultivable land at night.
    - Night soil or town dung (i.e. human excrement and other urban waste, collected from earth closets, privies, middens, etc and the like) (Fraser 1794, 33).
    - Cleanings from ditches and yards, loamy soil from archaeological earthworks like barrows, ramparts (Worgan 1811; Kirkham 2020).
    - Sea weed.
    - Rejected fish and fish guttings, etc (Borlase 1758, 87).
    - Guano (excrement of seabirds) either locally acquired, or imported from as far away as South America.
    - Artificial fertilisers, etc.

- Addition of sea sand and / or burnt lime to reduce acidity.
- Drainage (alongside hedges or in pipes or bolts (stone sided and capped) set deep within the soil), irrigation, and catch-work water meadows (Smith 2017).
- Cultivation, by ploughing or spade-digging, including creation of lazy beds.
- Removal of stones, from boulders (which in modern times might even be blasted) to fist to head-sized stones, as 'leazing stones' (Pool 1977, 267)
- The moving of soil from one part of a field to another, to maintain an even depth (Herring *et al* 1993).
- Removal of nutrients (e.g. in cutting hay, silage, etc).
- Removal of natural vegetation (woodland, scrub, etc) for a range of uses including timber and wood.
- Removal of furze (gorse) for domestic fuel and ferns (bracken) for use as bedding and floor covering).
- Removal of peaty layers in turf cutting for domestic fuel.
- Intensive pasturing: as well as 'folding dunging' (above), reducing biomass, trampling and poaching, etc.
- More extensive and often seasonal grazing of more marginal areas affects the ways that plants draw nutrients from and return them to the downland soils.
- In parts of Cornwall, including in West Penwith, there is also an additional form of anthropogenic soil, that which has been affected in various ways by industry, including mining, streamworking, quarrying and clay-working.

As yet, relatively little geo-archaeological work has been undertaken in west Cornwall, away from the soils along the north coast of Mount's Bay (for which see a recent summary in Jones and Allen 2023). Within farmland, valuable work has been undertaken recently by Dr Ben Pears in the Gulval area of the Golden Mile and for rougher ground, that by Richard Macphail at Chysauster in the 1990s.

The Soil Survey of England and Wales, published in 1983 a small-scale (1:250,000) mapping of the known or predicted soils of the whole country. Abstracted here is summary information on the soils mapped in West Penwith. The classification and descriptions are organised in a hierarchical way: broad groups, then soil types and then particular soil sub-types. More detailed summaries that include notes on how the soil types correlate with Historic Landscape Character Types are given in the Appendix to this report.

To support the Soil Survey a small selection of sample squares was identified across the country for closer examination and analysis. West Penwith is fortunate that one of those covered the area around Hayle and so included the eastern parts of the granite country and the Golden Mile, as well as the slate country to the east as far as Connor Downs and Townshend (Staines 1979).

In summary, the soils of West Penwith are broadly divided into **Humic brown podzolic soils** on the granite, with the Hexworthy series on the highest rockiest and most exposed parts, Manod on the intermediate land including most of the cliff tops, and Moretonhampstead on the more sheltered, deeper and most intensively cultivated land. On the killas are the **Typical Brown Earths**, the Denbigh 1 and 2 soil series.

More recently, the dense language of soil series named from often obscure locations (like Hexworthy, Manod, etc) has been simplified into lengthier but more descriptive types in the 'Soilscapes' mapping prepared by the National Soil Resources Institute (NSRI, based at Cranfield University). The Soilscapes mapping is derived directly from the 1983 Soil Survey, so it is helpful to set out the following concordance.

Soilscapes	1983 Soil Survey	Typical locations
16 'Very acid loamy upland soils with a wet peaty surface'	Humic Brown Podzolic Soils, 651b Hexworthy	Higher downlands on the granite
19 'Slowly permeable wet very acid upland soils with a peaty surface'	871a Laployd	The most poorly drained soils and marshes on the granite
13 'Freely draining acid loamy soils over rock'	Humic Brown Podzolic Soils, including 611b Moretonhampstead, 612c Manod and 313 Powys	The most common soils on the granite: lower slopes, valleys, coastal plateaux and cliffs
6 'Freely draining slightly acid loamy soils'	Typical Brown Earths, 541j Denbigh 1, 541k Denbigh 2 and 541n Trusham	Most of the slatey soils including south-eastern valleys
20 'Loamy and clayey floodplain soils with naturally high groundwater'	811b Conway	Lowlying soils along the northern fringe of Mount's Bay, from Penzance to Marazion
4 'Sand dune soils'	361 Sandwich	Towans in Lelant and Sennen

The soils described, interpreted and classified as part of the Soil Survey contain evidence of former land use. It would be possible to align different levels of anthropogenic alteration of soils (intensively cultivated, lightly cultivated, altered by different intensities of grazing, affected by the processes of mining and ore-dressing, etc.) with the Soil Survey types. See Appendix 2 for more detail for each soil type.

Descriptions and discussions of ancient soils in archaeological investigations

Chysauster, Gulval

The famous Iron-Age and Romano-British settlement of Chysauster stands on the west facing slopes of one of the more substantial valleys in West Penwith, the Rosemorran Stream. Richard Macphail studied 18 soil samples from across the site examined at Chysauster, including from beneath an early Bronze age cairn (radio-carbon dates from the early 2nd millennium BC). Present-day soils in the relict prehistoric field system uphill of the Chysauster Iron Age and Romano-British field system are ironpan stagnopodzols (Hexworthy Series, below).

The following is a summary of Macphail's conclusions regarding the development of the soils in the Rosemorran valley, based on his analyses and comparisons with other soils in in western Cornwall and Scilly.

Late glacial period

Macphail noticed that the weathered granitic head parent material is generally poor in clay (typically 10%) but that buried beneath the Early Bronze Age cairn had higher levels (20%) in clay loam horizons. He suggested that the clay may derive from late glacial loess, i.e. fine windborn sands and silts, which has been identified in several places across Cornwall and Scilly, including in the Neolithic soils at Carn Brea (Illogan) (Macphail 1997, 200).

Early and mid Holocene (Mesolithic, Neolithic and Bronze Age)

Soil development, probably in the Neolithic period produced acid brown soils worked by earthworms, as had previously been demonstrated at Carn Brea (Illogan) and on Colliford Down on Bodmin Moor (McPhail 1997, 200).

Macphail identified evidence for some cultivation and possibly stubble burning or clearance by fire of herbaceous cover as well as trampling preceding the construction of the Early Bronze Age cairn at Chysauster. The evidence was in the form of fine charcoal and phytoliths, the latter the distinctive microscopic structures of silica found in some plant tissues and surviving after its decay, within what appears to have been a plough soil, with some cereal pollen within it. It was acknowledged, however, that the charcoal and phytoliths could have been the result of the clearance of herbaceous vegetation by fire and the subsequent trampling by livestock of the cleared area (Macphail 1997, 200).

During the Bronze Age period that followed construction of the cairn the soils became strongly acidified.

Later prehistory and Romano-British period

The process of podzolisation in later prehistory leached organic and mineral nutrients from topsoils and concentrated it in the subsoils, as shown in soils buried by the banks and lynchets of the field system on the slopes above Chysauster prehistoric and Romano-British settlement. Soils may also have been subject to erosion on the fairly steep slopes of the valley sides and Macphail suggested that field boundaries may have been constructed in order to control soil loss. The leached soils are typically grey-white and have an iron-rich horizon beneath them.

Examinations of anthropogenic soils in Gulval and Ludgvan

Dr Ben R Pears, a soils archaeologist, sampled anthropogenic soils in several parts of west Cornwall in order to better understand how soil properties and chemistry can help improve understanding of the human interventions that have affected cultivated soils (Pears 2015).

Pears concentrated attention on the 'Freely draining slightly acid loamy soils', and specifically the Denbigh 2 Brown Earths and the 'Loamy and clayey floodplain soils with naturally high groundwater' represented by the Conway series on the edge of Mount's Bay, mainly within the Golden Mile (see Post-Medieval in Time and Change).

Whitecross, Ludgvan

Ben Pears selected a moderately exposed field (at SW 52610 34617; 55 metres AOD) on a moderate south-easterly slope just north-east of Whitecross. The land is currently used for cabbage and kale crops.

In 1838 it was in that part of Collurian whose land was jointly owned by The Reverend John Rogers (having ¾ of the ownership) and Mrs Hannah Millett (1/4). It was leased by William Millett and was occupied and farmed by Richard Ruberry as part of a large holding of 94 acres. The field itself was called Lower Wyth, was 2 ½ acres and was under Arable use, but the Cornish field name itself suggest it may once have been wooded, or had trees along its hedges. Wyth derives *gwyth*, plural of *gwedhen*, 'tree' (Pool 1990, 97-8).

Pears prepared a section that had a 0.425m deep plough soil (Ap) above a subsoil (Bs) rich in sesquioxides, Fe (iron) non-silicate clay minerals formed by oxidation (chemical weathering). Below that was a subsoil (BC) with little sign of pedogenesis (i.e. soil formation).

Pears interpreted the soil as the product of deliberate increase in the soil depth and the presence of calcium carbonate (established from chemical analysis) indicate the application of fine sand as well as 'organic manures and household waste'. There had also been intensive leaching of nutrients (Pears 2015).

Tolver, Gulval

A second Denbigh 2 soil was sampled by Pears at Tolver at SW 49021 32488. It is on the northern edge of the Golden Mile and is currently under horticultural crops on a gentle to moderate southerly slope with moderate exposure (being at 35m AOD). In 1844 the Gulval Tithe Map had the field as Park Shoater, when it was then described as under Arable (TA 2281). The Shoater part of the field name may derive from shute, a shared spout used for collecting domestic water. The field was then leased from the Pendarves estate by Jacob Corin.

In 1876 the OS map shows the field subdivided into 16 smaller rectangular fields, all shown under the orchards symbol. It seems to have been worked unusually intensively, perhaps for a specialist crop. Among the eight households at Tolver recorded in the 1871 Census Returns was Jacob Corin's; he was described as a farmer and Gardner. By 1906 (OS second edition) the subdivisions had been removed and the field appears to have been returned to normal arable use.

The plough soil (Ap) is much shallower (0.26m) than was the case in the soil at Colurrian and it lay above two B horizons with weak colour and structure (Bw).

Pears noted that there had been no deliberate increase in soil depth and that there had again been inputs of calcium carbonate sea sand and organic manures and household waste.

Churchtown Farm, Gulval

A third Denbigh 2 soil was sampled by Ben Pears in the fields of Churchtown Farm, Gulval, again within the Golden Mile (Section 15). It is in land currently farmed for brassicas on a gentle slope. In 1844 the field was called Higher Park East and was recorded as Arable.

It has a deep plough soil (Ap) horizon, 0.41m deep above a mixed layer of further plough soil and weakly coloured and structured B horizons above a third B horizon that appears to have been subject to little or no pedogenic alteration. Chemical tests showed the soil was distinctly alkaline and had a high organic carbon content. It was felt that there had been deliberate soil deepening and inputs of calcium carbonate sea sand and organic manures and household waste.

Pleming, Gulval

Dr Ben Pears sampled a 811 Conway series soil from near Longrock at Pleming, beside the Pleming Stream at SW 49478 31711. This is on the gentle slope behind the beach on the north shore of Mount's Bay and is currently down as permanent grassland but in 1840 it was under orchard trees (Gulval Tithe Apportionment, TA 2323), as it was again in 1880 and 1906, though the orchard was removed by c1930 (all OS mapping). It now lies within the Golden Mile.

The acidic soil with organic content has substantial plough soil 0.36m deep, but little sign of deliberate increase in its depth. Inputs appear to derive from calcium carbonate sea sand and organic manure sand household waste. There has been intensive leaching of nutrients, creating the gleyed Bg1 and Bg2 horizons. These lie above a BCg where there has been little or no predogenic alteration.

Field and pasture boundaries

West Penwith is famous for its granite boundaries, both Cornish hedges and various forms of banks and walls. Their interest and value are considerable and manifold.

First, many of those on the coastal plateau and in some of the sheltered valleys can be demonstrated through scientific dating tied to schemes of relative dating to be, famously, among the oldest structures in the world still employed for their original functions. At the other extreme, West Penwith also contains some of the most recent built boundaries in Cornwall around the edges of the smallholding landscapes associated with tin and copper mining and in the market gardens established on sunny slopes of the southern coast.

Second, they form complex patterns that contribute detail, texture and interest to the West Penwith landscape. They 'impose a natural pattern and give a sense of scale… without being assertive or detracting from the beauty of the landscape' (Garner 1984, 4). Analysis of those patterns helps us understand how the peninsula's agriculture developed.

Third, the hedges have become important habitats for trees, shrubs, herbs, ferns, lichens, bryophytes, mammals, birds, reptiles, and insects. The ecological value of Cornwall's hedges and other field boundaries have been closely studied and celebrated by, among others, Sarah Carter and Robin Menneer and are nicely summarised in Menneer 1994.

Functions

Boundaries are usually multipurpose structures. They could serve either all or some of the following functions.

Line demarcation

People have scribed lines onto and across West Penwith's landscape in the form of boundaries since the early prehistoric period. The earliest were relatively confined in

their extent, elements of gathering places, like the bouldery banks delineating early Neolithic tor enclosures (Carn Galva, Trencrom and possibly Carn Kenidjack) and the stonier banks forming early Bronze Age hilltop enclosures like Bartinney Castle, and the earliest, innermost lines of Caer Bran and Castle-an-Dinas hillforts.

In the Middle Bronze Age lines, again mainly surviving as stony banks, with occasional uprights, were built to separate farmed (cultivated) land from common pastures (as in east Zennor, alongside the Sperris Croft transhumance huts). They were also used in that farmland to define individual fields, presumably to enable a form of rotation of both arable farming and grazing to be managed, but possibly also as a form of allocation of land to individual households. The boundaries of those fields could be either curvilinear or coaxial in their pattern (see below for 'field systems').

In later prehistory and through the medieval and post-medieval periods lines in the form of boundaries continued to include those that enabled pastures to be separated off and managed, often through subdivisions that allowed grazing, turbaries and furze grounds to be efficiently managed. And field systems of first hamlets (groups of cooperating farmsteads) and then individual farmers, from yeomen with large holdings to miner-farmers with smallholdings, to delimit property and again to manage rotations and separate land uses (meadows, arable, pastures, crofts, etc).

Exclusion and inclusion

Almost all of those delineating functions required boundaries to be barriers that could keep livestock (and sometimes people) either out or in, and most often both. The few that did not need to be stockproof included those low banks that demarcated strips within open fields, either in the infields or the outfields. Few boundaries were able to exclude all wild animals.

Designs might be adjusted to accommodate particular species of animal; e.g. precarious looking walls 'give, to the appraising eye of a calculating ewe, an air of precariousness' and jutting copes keep back sheep (and at least check rabbits) (Nicholls 1967, 541-542). Containing cattle required heavier walls with good faces, lacking projections to which the beasts might be attracted for scratching (Garner 1984, 18). It was considered that 'to retain the most intrepid breeds of sheep a boundary needs to be over five feet (1.5m) high' (ibid, 4).

Animals were sometimes carefully prevented from testing a barrier's effectiveness. Richard Carew in the late 16th century recorded Cornish ewes being 'tied by the one leg at pasture' (1603, 66).

Joining two sheep with chains to prevent (or to at least make more difficult) their escape from fields continued into the 20th century, though not always successfully. 'Every now and then companions of the chain have to be changed, else they would grow cunning enough to lay their heads together for a joint leap; but it takes some months for a sheep to evolve so much resolve' (Hope-Moncrieff 1915, 19). And 'hobbling' sheep by tying one front and one back leg on the same side with a length of rope was still happening in Zennor before the Second World War, though not always successfully. 'Despite these precautions, hobbled sheep from Tregerthen, our neighbouring farm, were often to be found grazing the Tremedda fields; no doubt the

grass was sweeter' (Symons 1992, 41). At least one Zennor farmer was still hobbling sheep in the 1960s (Nicholls 1967, 540).

Sheep were regarded as the main stock problem on Bodmin Moor in the early 20th century and sheep-couples – iron collars joined by swivels and chains – were still in use at Newton in Blisland on Bodmin Moor in 1937 (Leigh 1937, 254-5). Some breeds of cattle, however, were comparatively restrained, so the Guernseys of Zennor were securely retained by walls just 3 or 4 feet high (Nicholls 1967, 540).

Enclosure

Hedges were a principal tool in the enclosure of unimproved land. This process can be traced back as far as the Middle Bronze Age, the middle of the 2nd millennium BC, in West Penwith and continued, in spurts, right through to the early 20th century AD, usually in episodes where economic opportunities were being taken such as at times of war, or when industrial activity brought large numbers of workers to an area and so provided a market for agricultural produce.

Shelter

In exposed country, such as much of the northern and western parts of West Penwith, providing shelter, and thus warmth, to livestock and to crops was a significant function of field boundaries. Doing this would 'improve the climature; and encouraging, in a particular manner, the growth of herbage; beside being, at the same time, singularly friendly to pasturing stock' (Marshall 1796, 31). Livestock still sensibly find the lee of a boundary when the winds howl. Those that had an earthen component were often planted up with shrubs to increase their shelter. A balance had to be struck to ensure that sheltering did not extend too far into shading, and thus diminishing sunshine and growth.

Supporting trees used for timber and wood

As noted, boundaries with earth cores were planted with 'thorns, hazel, and other brush-wood, or trees… [and so] these hedges find the farm-house in fuel: no unimportant consideration where coals [and wood] are scarce' (Worgan 1811, 47-8). Furze (or gorse) was also planted (Stockdale 1824, 11) and William Marshall writing in the late 18th century recommended that 'birch, mountain sorb, elder, holly, furze, broom, etc' be planted on hedges in exposed land for 'shelter' (Marshall 1796, 31).

As well as increasing the boundary's sheltering quality, this provided wood (the small-wood for the kitchen fire or stove) and timber (for construction), desperately sparse in the northern and western parts of the peninsula. In post-medieval centuries the leases of farms often included restrictive covenants that protected shrubs and especially trees, usually limiting the cutting of wood from hedges to a certain number of times for each term of renting (Fox 1971, 115; Stanes 1981, 54-5).

In the more sheltered parts, such as in lowland Paul, Sancreed, Madron, Gulval, Ludgvan and Lelant, substantial trees grew, mainly broadleaf but also some non-native conifers. The effect of so many trees on hedges in parts of these parishes created an effect akin to the bocage of parts of northern France, a sort of semi-wooded landscape.

Trees planted on hedges in the northern part of Paul lend the wooded feel of bocage to the landscape

Consuming stones cleared from fields

Boundaries were normally built with stones turned up in adjacent cultivated land. Some boundaries, like the sometimes enormously wide and high stone-faced stone walls in St Just, Morvah, Zennor and Towednack, were designed, in part, to consume the various sizes of stones – larger stones in the carefully built faces, smaller stones in a dense core – and the boundaries thus served as linear clearance heaps.

In the famous story of the young giant Tom, who appears to have lived around Lelant, he would occasionally help his human neighbours. When he saw them hedging 'he would turn to and roll in all the largest rocks from over the fields, for "grounders"' (Hunt 1881, 56) a footnote by the story's collector, Robert Hunt, notes that 'In making the really Cyclopean hedges which prevail in some parts of Cornwall, the large boulders of granite, or other stones, which lie scattered on the moors are used for the foundation. Indeed, one purpose, and a very important one, served by those hedges, has been the removal of the stones from the ground which has been enclosed, and the disposal of the stones so removed' (ibid).

A stone-faced stone wall at Bosigran made exceptionally wide in order to consume stones cleared from the adjacent fields.

Drainage

Ditches running alongside Cornish hedges and earthen banks were the sources of the cores of these boundary types, but they also served as drains and were no doubt originally intended to do so; the drains made up their cost in terms of area of land lost; they 'amply compensate for any supposed waste of soil, by keeping the land dry' (Worgan 1811, 48).

Retaining soil

West Penwith's soils are friable and light and so tend to move downhill quite freely when cultivated. One function of contour-following boundaries was to retain this earth, to save it from either flowing further downhill or washing away from the farm entirely. James Stevens of Foage described in detail the laborious task of dragging the soil from the lynchets that formed at the bases of fields back up to the higher parts of fields to maintain viable depths of soils in these parts of the fields (summarised in Herring *et al* 1993).

Protecting livestock

A number of boundaries in West Penwith were built along the edges of precipitous ground, like cliff edges and mine shafts, and were intended to prevent grazing livestock from toppling either over or in.

Typology

Determiners of boundary form

There were several determiners of a boundary's form, additional to the **functions** its builders expected it to perform (as introduced above).

Another significant influence was the **materials that builders had to hand**. On Bodmin Moor, experienced farmers did not expect to travel more than about 20 metres from the hedge they were working on to bring materials by hand (Mr Reddicliffe, Little Worth, St Neot, pers. comm.). In the post-medieval field system of Butterstor in St Breward this resulted in some long boundaries being stone-built along stretches where cultivation had brought sufficient stones to the surface and turf-built where there were no stones available.

Local **styles and tradition** played a part in determining boundary form as well. For example, drystone walls are a later post-medieval form. And styles of facing also changed and in some cases were distinctive of individual hedgers (Charke 1931, 35). Hedgers might also be **influenced by the published recommendations** of agricultural writers, and farmers may have been aware of and responded to the good and bad comments of neighbours. 'Walls which would be easily seen were often given better finishes than those farther from **public admiration, or condemnation** (see Brooks 1977, 16)' (Herring 1986, Volume 2, 45).

'It was a proud piece of work for the builder to turn a quoin, or make a good job of a gate-head, and the only tools used were a hedging-hammer, showl (shovel) and biddax [a simple mattock-like digging tool]' (Charke 1931, 35).

The **cost of building** (and maintaining) different types of boundary would also have influenced decisions regarding types of boundary. In 1811 a Cornish Hedge (which may then have been described as a stone-faced earth bank) cost from 3s to 4s 6d per 'yard' (that is a stretch 18 feet long and 6 feet high), compared with 10s to 15s a 'yard' for stone-faced stone walling, where the stone was raised in the adjacent field (Worgan 1811, 47-8).

'The cost of materials for these types obviously differed, but so did the price of labour. In 1845 the labour cost for building 16½ feet of turf hedge was 2s compared with 3s 6d to 5s for a Cornish hedge (Karkeek 1845, 459). (NB it would be assumed that the foundation trench was already dug and the stones ready.) If labour was limited or budgets tight, it would be no surprise if a farmer instructed a Cornish hedge to be built instead of a stone wall. Maintenance costs would, however, have also been taken into account and as Cornish hedges are more prone to slump and collapse than stone walls (Leigh 1937, 257) their maintenance would make them less cheap in the long run. Land values may have influenced wall widths – narrow walls, using less space, may have been preferred on arable land. Note the long 19th century debate about wide hedges wasting farming land in Devon and Cornwall (Fox 1971, 112-115; Herring 1986, volume 2, 44-45). Worgan also noted that hedges also 'carry a great deal of grass on their sides' (Worgan 1811, 48) redressing some of the loss of land.

Some tenants were **constrained by covenants** in their leases and sometimes were obliged to build boundaries of certain types (Stanes 1981, 54-55).

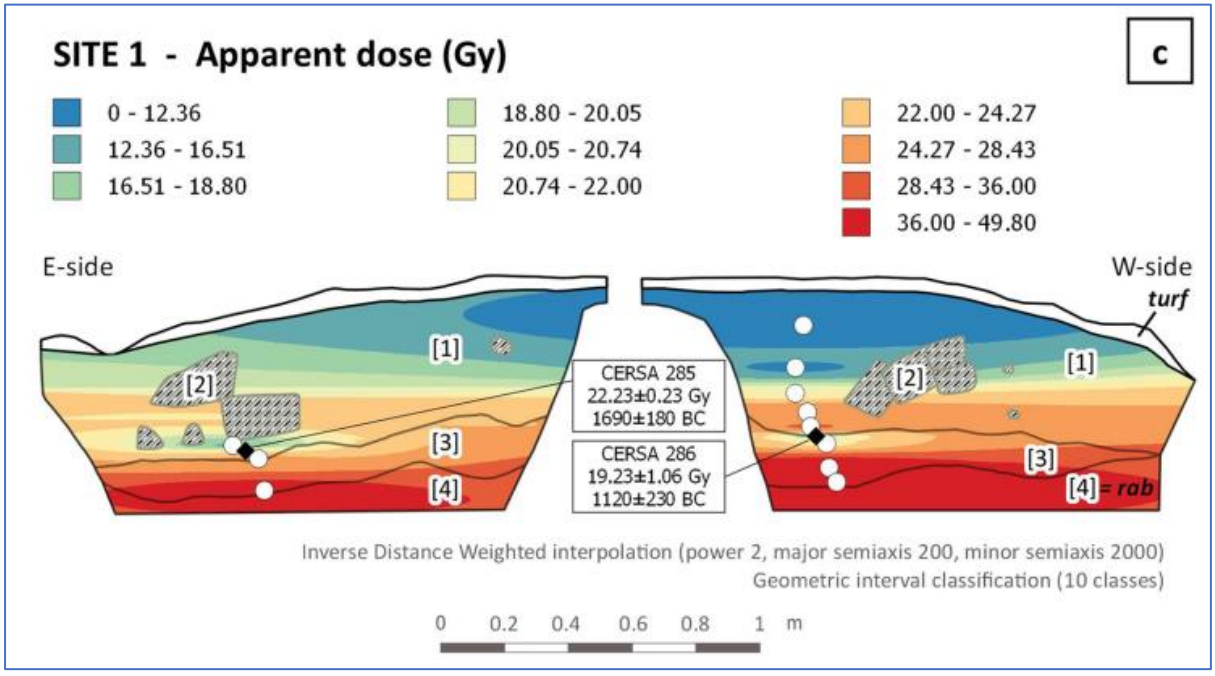
The following arrangement of boundaries into a relatively small number of types adheres to the framework established by the West Penwith Survey (see Herring and Young 2016, 61-64).

Relict boundary types

Stony bank

The earliest boundary type in the West Penwith sequence of forms is the low ***stony bank***, which physical and functional relationships indicate is usually either prehistoric or medieval. Prehistoric banks tend to be larger (wider and higher) and have occasional upright stones, suggesting former stone facing and that the bank results from collapse of a more organised structure, similar to the walls that became the stony banks of the well-built Bronze Age 'reaves' on Dartmoor (Fleming 2007). Medieval stony banks are slighter and appear to have never had structure, but instead simply marked lines (e.g. delineating strips within the medieval outfields, such as those on Chun Downs, St Just, or at Higher Kerrow and on Carn Galva in Zennor).

A stony bank forming part of a prehistoric coaxial field system at Halldrine Croft on the coastal plateau at Bosigran, Zennor, was sectioned by a trench and the soil buried beneath it was dated using the Optically Stimulated Luminescence method. This confirmed the date that had been proposed by analysis of relative chronology and through comparison with other coaxial systems in SW Britain: a start date after 1690±180 BC and before 1120±230 BC, so securely Middle Bronze Age, like the parallel reaves, the famous coaxial fields on Dartmoor (Vervust *et al* 2020, 432).



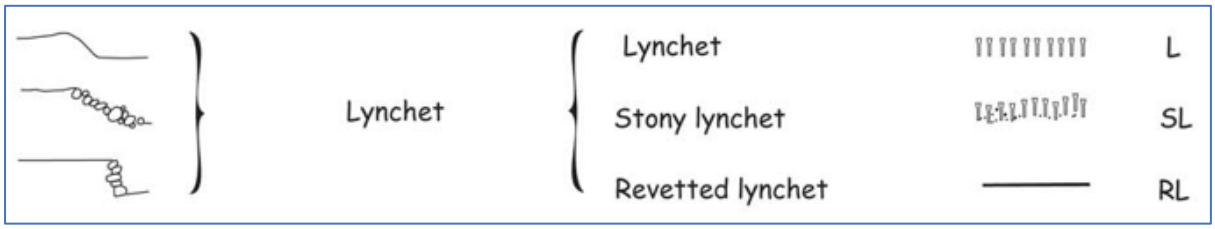
Section through the stony bank at Halldrine Croft, Bosigran with locations of the two dated OSL samples (black diamonds) (from Vervust et al 2020, fig 4).

A place-name in the probably early 10th century boundary-clause of the grant of land from King Athelstan to St Buryan church included a place called Mankependoim, which appears to contain the Cornish word *kee* ‘hedge, or bank’ plus *men*, stone, suggesting a boundary formed in part at least of stone and possibly referring to either a Cornish hedge or a stony bank (see Hooke 1994m 25; Padel 1985 45). This may have been an early medieval parish boundary, or one from later prehistory that was still in use in the 10th century.

As farming arrangements changed through time so many boundaries became redundant, were no longer maintained and gradually collapsed into stony banks. Farmers and map-makers often referred to these as gurgoes, a name derived from the Cornish **gor-ge* ‘low or broken-down hedge’ (Padel 1985, 110).

Detail of 1839 Towednack Tithe Map showing two boundaries on Trevega Cliff. They were shown by archaeological survey (Williams 1985) to have been created in the post-medieval period (overlying a group of medieval outfield strips) but had become redundant by 1839. The ‘old broken hedge’ is shown with a more continuous line on the Tithe Map than the later field boundary attached to its south, though by 1839 that boundary was in a poorer state, being shown as a more discontinuous line and labelled ‘Gurgo’.

Lynchet



There are in West Penwith several forms of ***lynchet***, the scarp created by soil building up at a cultivated field's lower edge (positive lynchet) or at the top of a cultivated field when the soil has been drawn away (negative lynchet). They include smoothened scarps in fields subjected to agriculture after the lynchetted boundary went out of use.

At Bosigran lynchet form and size was influenced by steepness of slope (reaching 3.2m high on cliff tops), intensity or longevity of cultivation (strongest lynchets along the primary lines of the Iron Age radial field system), dryness of soil (cloying clayey soils shifting less easily than light dry granitic soils), direction of ploughing (either across or with the slope) and even deliberate adjustments, as when James Stevens of Foage (Zennor) carried soil back upslope to redistribute his most valued asset, the soil (Herring *et al* 1993; Kirkham 2012).

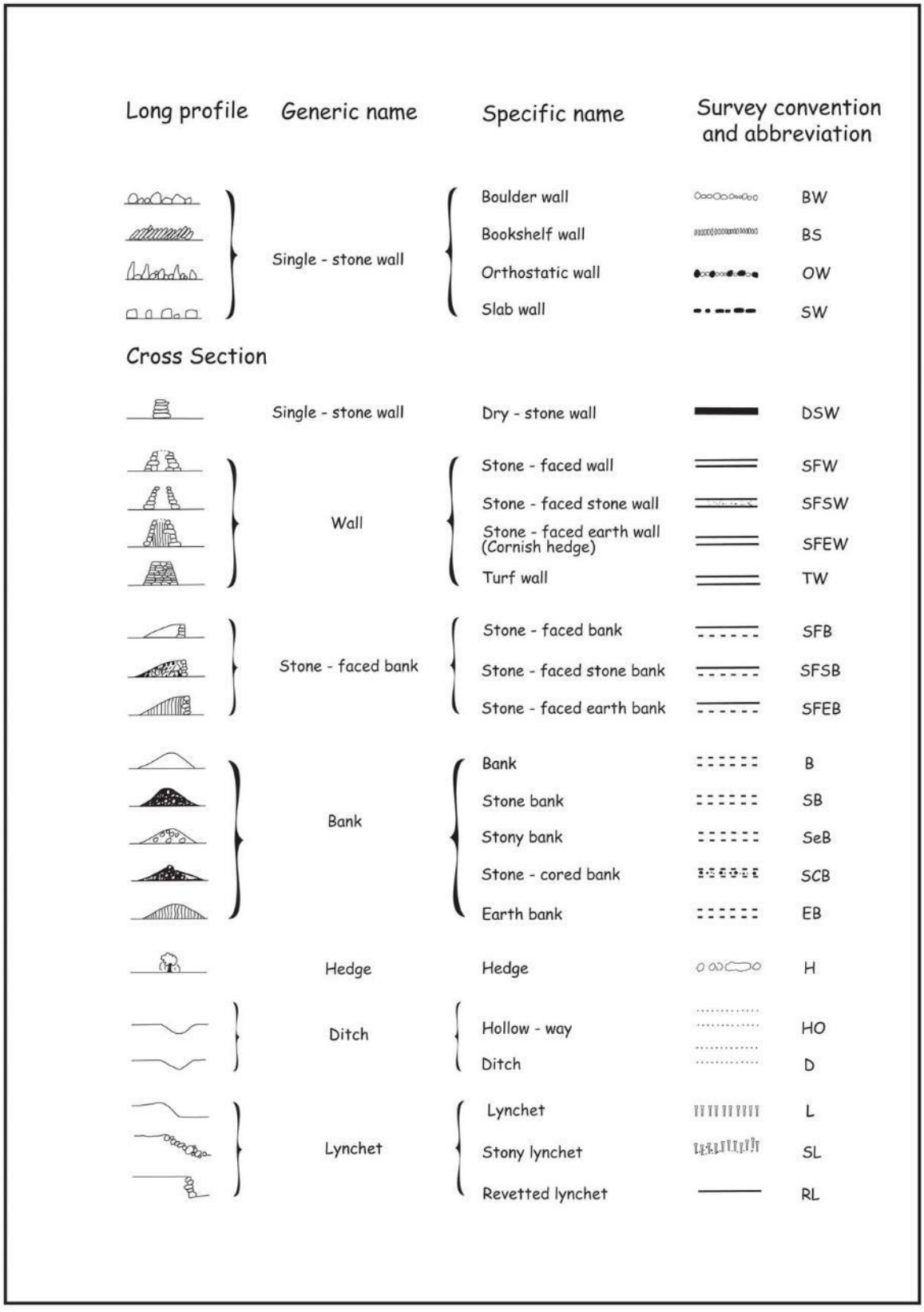
Most early West Penwith lynchets were enlarged, or became increasingly high, or deep, or wasteful of precious soil, as fields were reused; three distinct horizons of plough soil were identified within an excavated lynchet at Rosemergy (Morvah) (Nowakowski and Herring 1990, fig 18).

Stony lynchets, largely on the cliff-tops at places like Bosigran, are elements of Bronze Age, Iron Age and Romano-British field systems, and are probably collapsed remains of structures like walls or Cornish hedges (see below), or ***revetted lynchets***, those that were retained by strong stone-built faces, usually built with a batter to buttress the great pressure from the build up of tons of cultivation soil.

Some revetted lynchets can be seen to have originated as freestanding boundaries, with stock-proof height on each side originally (e.g. the one sectioned at Foage; Herring *et al* 1993), but which were eventually overwhelmed by the soil; many continued to be increased in height through incremental additions to the revetment.

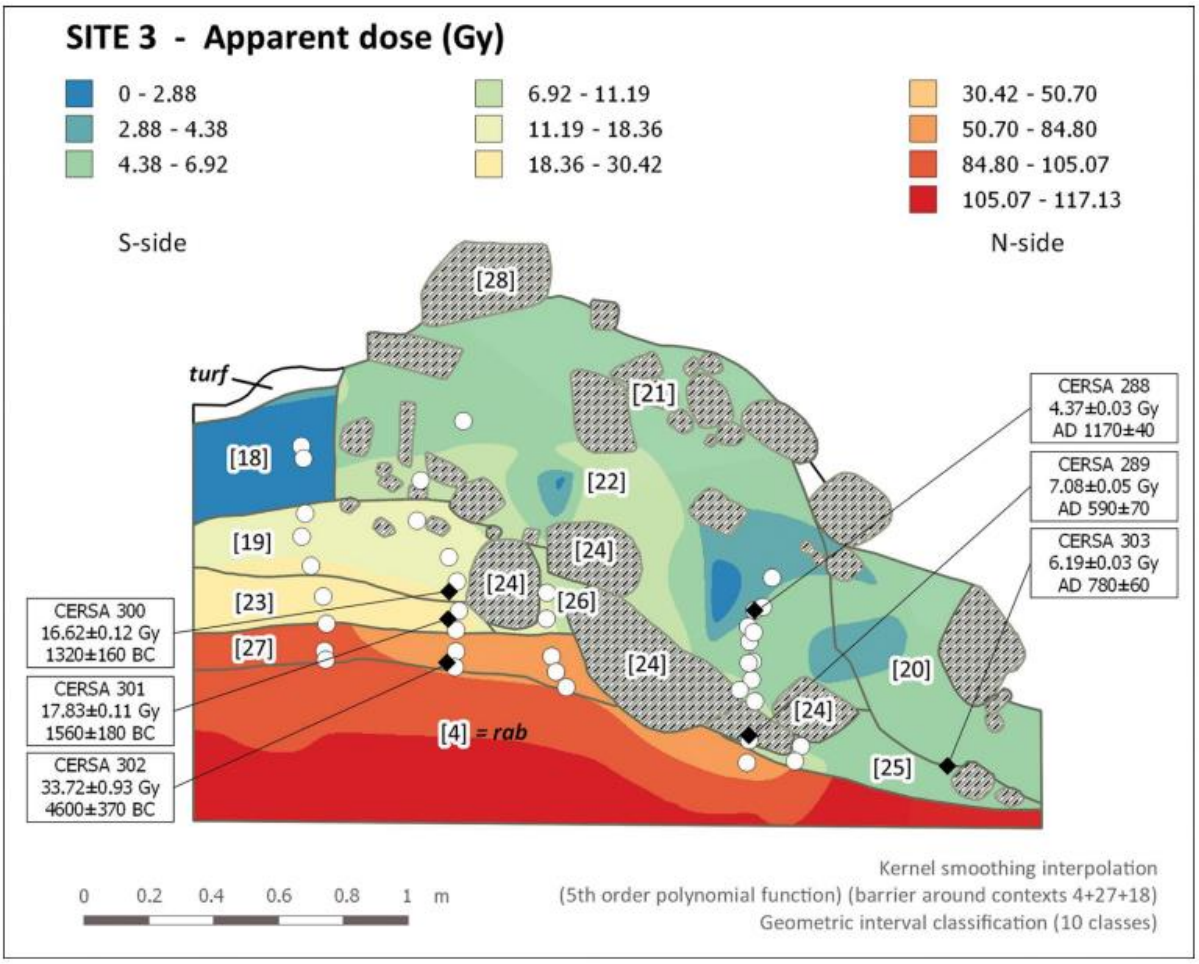
The scientific OSL dating of the field boundaries at Bosigran indicated that the regular field system there, the type in which most of the lynchets are found, was established in the Later Bronze Age or Iron Age (after 1320 ± 160 BC), but that the main volume of the lynchetting in the boundary examined was from the Early Medieval period, a surprise to those of us who had presumed that the Bosigran lynchets had been developing steadily throughout the later prehistoric and Romano-British periods (Vervust *et al* 2020, 432-434).

West Penwith Survey boundary typology



West Penwith boundary types, showing long profiles or cross sections, broad class (generic name), narrow class (specific name), and drafting conventions employed in the West Penwith Survey, with abbreviations used when annotating plans (from Herring and Young 2016, fig 3.4 © Cornwall Archaeological Unit, Cornwall Council).

Later prehistoric lynchet at Bosigran, Zennor



Section through the lynchetted boundary *examined for OSL dates. Again the black diamonds represent the dated samples. Note that the latest thickest layers shown as pale greens were formed in the Early Medieval period (from* Vervust et al 2020, fig 6*).*

Active boundary types

Cornish hedge

The earliest surviving type of constructed boundary in West Penwith is the ***Cornish hedge*****,** a bank of earth and stones with a battered or tapering stone face, built by careful placement of stone upon stone, on each side. An apparently Romano-British example was incorporated into the revetted lynchet sectioned at Foage, Zennor (Herring *et al* 1993). Long axes of stones run into the hedge for stability, but no projections are left that might provide footholds for livestock – these walls were designed to contain cattle, ponies and sheep. At Bosigran they range from 0.9 to 1.5m high and 1.0 to 1.5m wide at their base. Most faces are random rubble, though some are roughly coursed, and lowest layers are often large boulders, barred into place, and known as grounders.

Where stone is of a fairly uniform size, and especially in the slatier country of the south-east West Penwith, beyond the granite, the facing can be made more regular with rough coursing including stones set vertically, horizontally or at angles or herringbone, the stones in rows that lean alternately one way or the other, a style known as ‘Jack upon Jill’, or variants (Charke 1931, 35).

Most stretches of Cornish hedge in West Penwith contain numerous repairs, with extensive rebuilding of faces, though most grounders may be expected to have either medieval or even prehistoric origins. Cornish hedges away from the northern parishes often have shrubs or trees along their tops, providing domestic fuel and additional shelter.

Erosion of a Cornish hedge with furze hedgerow at Raginnis, Paul illustrates its construction with battered, roughly courses stone faces and tamped rab core.

Turf or earth bank

On the downlands, where peat growth covered stony layers, some boundaries, reaching up to 1.2m high and 1.4m wide, were built wholly of turf, the faces built of cut turves and loose earth used as a core. At Killiowe in Kea, near Truro, the farmer RL Gwatkin commented in 1811 that, 'for a turf-hedge to be six feet high when completed, we allow six feet base; but as it settles a good deal, half its height only is built before Christmas; with the filling ridged up in the middle to turn the wet. This remains to settle till March, when the remainder of the hedge is laid, and the proper plants or cuttings are set' (in Worgan 1811, 50).

Surmounted by a quick set hedge or a fence, such a boundary would be stock-proof (as shown by the Bosigran drove-road being defined by ***turf banks***). Where relative chronology is observable, as at Bosigran in Zennor, these banks appear to be seventeenth, eighteenth or nineteenth-century in date.

Stone-faced earth bank

Another predominantly post-medieval boundary type is the ***stone-faced earth bank***, often the perimeter of a pasture enclosure, which has only one side faced with stone, usually in the style of Cornish hedges, and is up to 1.3m high.

Stone-faced stone wall (or drystone wall)

So termed in the West Penwith Survey, but known as drystone walls elsewhere. Similar to Cornish hedges, but their cores are wholly of small stones, carefully packed in. They require skilled builders as each facing stone has to be carefully placed so as to be locked securely into place, lacking the earthen fabric of the Cornish hedge to bind the structure together. Through-stones and copestones were also used to bind the wall together.

Widths can reach 4.0m, reflecting a specialist function introduced above, the consumption of stones cleared from fields during cultivation. Where chronological relationships are detectable, stone-faced stone walls normally post-date Cornish hedges and many incorporate stones split by the post-1800 plug (or tare) and feather technique; they can generally be considered post-medieval in date.

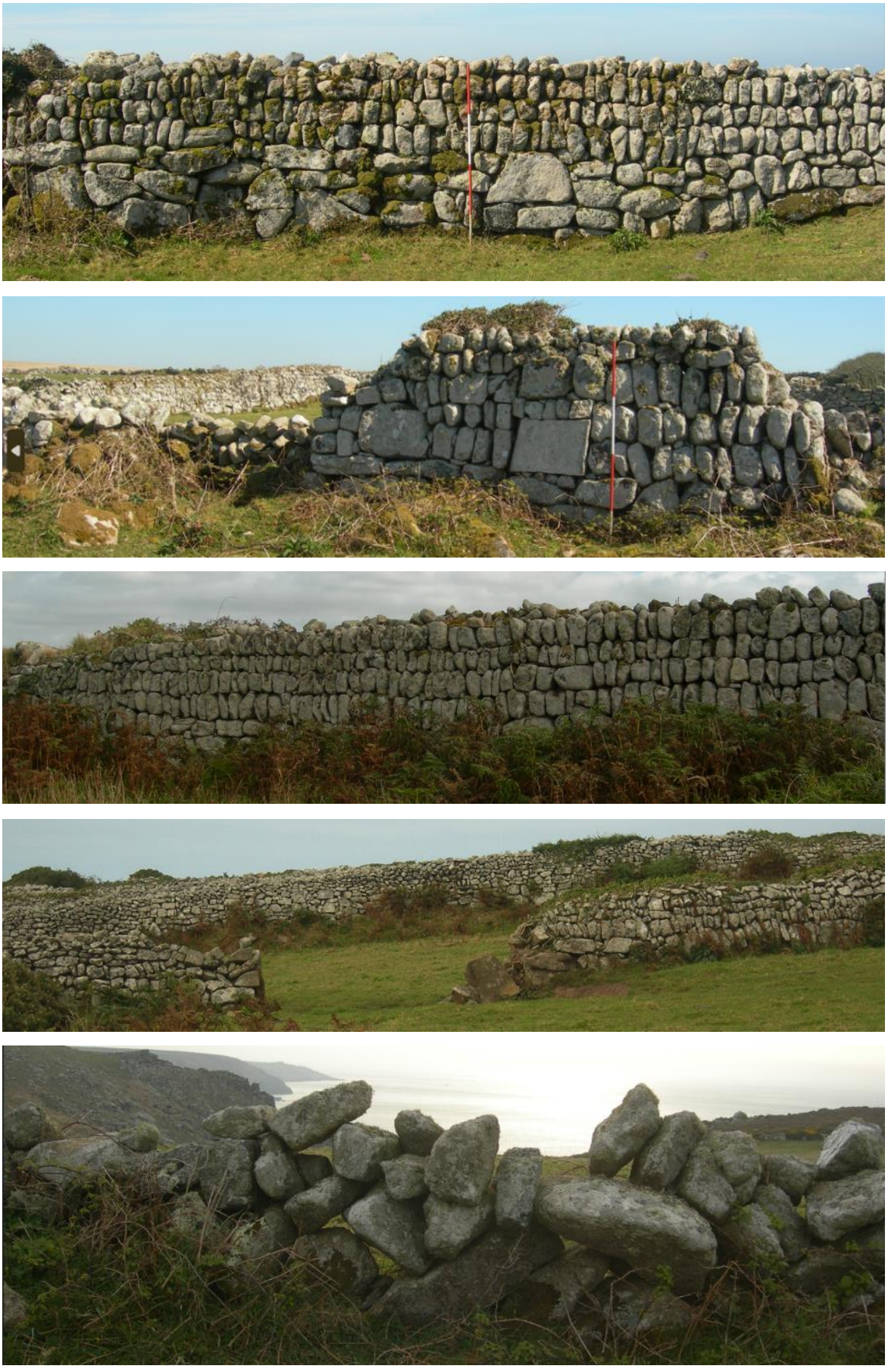
Stone-faced stone walls at Bosporthennis, Zennor.

Clearly, these boundaries cannot support shrubs and trees like Cornish hedges can, so the farmer loses on wood and timber and on shelter, but gains a little by the growth of such and other plants not encroaching onto the neighbouring ground, and not shading crops and growing or drying hay in fields.

Drystone or Single wall

The term ***dry stone wall*** has been applied in the West Penwith Survey to boundaries that might normally be called single walls, reaching 1.1m high, comprising delicately constructed boundaries a single stone in width, the medium-sized stones (head to torso in size) being carefully placed one on top of each other. Daylight shows through the gaps, making them appear insecure, and sheep apparently do not trust their weight on them (Nicholls 1967, 540). Where relationships can be observed these dry stone walls tend to be secondary to Cornish hedges and the use of plug and feather splitting of stones incorporated in some of them indicates a nineteenth or twentieth century date, confirmed by their first appearance on later editions of maps. This walling type was often used in blockings of gateways and breaches.

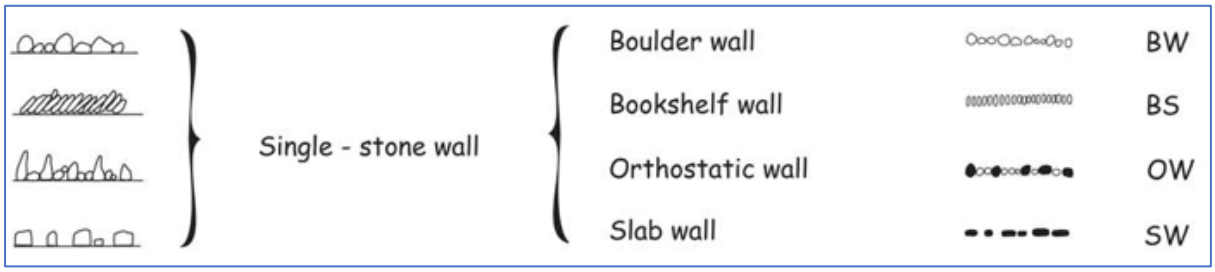
In upland England a good drystone waller might be expected to build 5 or 6 yards (or c 5 metres) of single wall in a day (Garner 1984, 4).



Bosporthennis and Bosigran stone walls, Zennor.

Single wall at Bosigran, Zennor

Single stone wall



Single stone walls are composed of large stones (1.2m maximum dimension), sometimes laid as blocks, more often set on edge, rather like orthostats (but not usually so deeply sunken into the ground). Some lean against each other like books on a shelf, others are neatly in line, like soldiers on parade. Relationships and splitting techniques suggest that these boundaries that look exceptionally old are actually one of the most recent types of boundary in West Penwith, of the eighteenth, nineteenth and twentieth centuries. They are also not very effective livestock boundaries as cattle can step over them and sheep can leap them. So they tend to be used as fairly casual demarcations of property intended to deter or steer humans rather than animals.

Maintaining boundaries

While hedges and walls were sturdy structures, they were also subject to the effects of weathering, pressures from livestock, and the entropic effects of decay and gravity. They will not stand for ever, even if their lines may survive for hundreds or even thousands of years. Farmers developed routines of maintenance that have helped secure West Penwith's historic and prehistoric boundaries.

A lease of 1798 for Tregue in St Clether may be used to illustrate a typical requirement of a tenant to maintain the Cornish hedges on the land they were renting: ‘from time to time to… new make cast dike and plash all and every the Hedges… from which they shall cut down the Wood growing thereon’ (Kresen Kernow, DD CF 91a). Four operations were required: ‘new make’ is to make as new, i.e. to repair the hedge; ‘cast dike’, is to clean out the ditch and cast up the cleanings on to the top of the hedge; ‘plash’ is to lay or pleach the shrubby growth on the top of the hedge; and to facilitate that the excess ‘Wood growing thereon’ was to be cut down.

Modern pressures on farmers’ time, which increased as it became less affordable to retain labourers who specialised in traditional maintenance crafts such as hedging, have seen most of these maintenance works suspended, leaving the boundaries vulnerable to gradual decay, and many have been supplemented by post and wire fences. Mechanised trimmers have enabled farmers to control the vegetative growth on their hedges, sometimes at times of the year and using trim settings that threaten hedge ecosystems. Robin Menneer and Sarah Carter provided reasonable advice on when and how to sustainably manage historic hedges in modern ways (Menneer 1994) and their work contributed to general advice that hedges are not trimmed between March and September, to enable birds to nest and fledge, and ideally not until January or February so that the berries and other fruits are available for birds, mammals and insects to eat.

Boundary furniture: gates, creeps, stiles, etc.

The term ‘boundary furniture’ is used here in a similar way to ‘street furniture’, that is in reference to the features often found directly associated with hedges, usually designed to be built into them.

Most boundaries are pierced by gateways, now and from at least as early as the 18th century normally closed by metal-hinged gates. Before that some may have been closed by hurdles made from hazel or other flexible wood, some with leather straps to hinge one end (Menneer 2017). Many would be closed off for whole seasons when gates were not operational by the insertion of stones laid aside for the purpose, often placed on the top of the hedges to each side.

It is easier to drive livestock through a gateway in a corner of a field so in a pastoral land, such as West Penwith, where most fields were expected to either retain or exclude livestock, this is where most are positioned.

Until the arrival of modern tractor-drawn farm machinery all field gates in West Penwith were between seven and eight feet wide (2.2 and 2.5 metres), a width determined by the need to accommodate wagons and wains to bring manures in and take hay and other crops out. In the age of the hinged gate, they usually had a 1.3m or higher granite post on the hanging side and either another shorter post or a built gatehead on the other slamming or closing side. Gates that were required only for pedestrians or for horses (such as hunters’ gates) were around half as wide.

In West Penwith, where timber is quite scarce, a tradition developed, probably in the 18th or 19th centuries, for local smiths to create wrought-iron gates. Five or six round bars were threaded through holes made in three vertical and two diagonally set

bracing straps 1.5 inches wide, all bolted together, and with tops of the end verticals and the diagonals finished with scrolls to make an attractive and distinctive gate. The practical and aesthetic value of these gates, and their role in making West Penwith's farming landscape distinctive, has been recognised in recent decades and many have been carefully repaired while others have been made anew, using surviving gates as templates.

Wrought iron gate across the Church Path from Bosigran to Zennor church, with a cattle-grid style stile to its side.

Sheep creeps are openings built into the foot of hedges. usually topped with substantial granite slabs used as lintels, that allow sheep to pass between fields but prevent cattle and horses from doing so. They therefore enable sheep to graze more widely while controlling the movement of the larger animals, whose grazing can then be managed by rotation through fields (Menneer 2017; Cornwall Council and Historic England c2015).

People moving through or around a field system would have passed through hedges by gateways when they could, but some passages were distant from gates and in these places stiles were created to save people clambering uncomfortably over boundaries and dislodging stones. Styles of stiles varied. In some parts of West Penwith there are the cattle-grid forms where a stone lined pit was fitted with four or five long crossing stones. The so-called 'Church Path' in Zennor formed a sort of pedestrian thoroughfare linking the several medieval hamlets to the west and east of the churchtown (Treveglos) to the parish church there.

Other church paths did the same job in most of the other parishes in the peninsula. These stiles may well have been created at the parish's expense in recognition of the need to have a comfortable and manageable way for parishioners to attend church services and ceremonies, including funerals. In Zennor some of these stiles were fitted with plinths on which a coffin could be placed to allow its bearers a rest as they made their way to the churchyard. The use of the cattle-grid form prevented the incidental upgrade of human footpaths to livestock tracks and eventually lanes.

Other stiles were made by inserting long stones deeply and securely into the two faces of a hedge so that they projected and served as steps, usually three or four on each side.

Field systems

Fields, or enclosures bounded by stock-proof fences and used for various forms of agriculture, were rarely single isolated features. Instead, they were normally joined with others in patterns that are often called field systems. The joining may have been sequential, with fields accreted on to pre-existing others, or they may have been laid out in a planned way with larger areas enclosed and then subdivided into fields in more or less regular ways.

Variety in field shapes is usually quite limited. They can be curvilinear, rectilinear or more irregular versions of both, but they can be very variable in size. For example, in Zennor in the early 20th century, fields ranged from one fifth of an acre to 6.25 acres (0.1 to 2.5 hectares), around thirty times as large (OS 1:2500, 2nd series mapping).

The study of field systems enables us to understand fundamental aspects of their creators' economy and their society. Their direct link to land use also helps us identify probable dispositions of more or less intensively worked ground, and thus differences in the development and treatment of anthropogenic soils, and thus different forms of land cover and, from that, variability in habitats, in floral and faunal communities, and in the nature of biodiversity.

In West Penwith we have surviving above ground, as patterns of banks and hedges, field systems that can now be demonstrated to cover a period of 3500 years. Within that long period there were several significant changes in basic pattern that appear to have been applied to much or all of the peninsula and so can be regarded as indicators of substantial economic or cultural change.

These are described and discussed in the relevant parts of the narrative in the next section but can be summarised as follows. Physical relationships confirm the sequence. Later field systems cut across or respect earlier ones in various ways (see Herring and Young 2016 for principles of such relative chronologies).

- **Settlements with no enclosures.** Groups of round or oval houses either in apparently irregular arrangements or in lines. On downland rough grazing. Probably transhumance settlements. Earliest are probably Middle Bronze Age; the type continued through prehistory in West Penwith and on Bodmin Moor.
- **Irregular, curvilinear and accretive fields**, one attached to the others, some subdivided. Small communities with round houses scattered through fields.

Direct access via lanes to extensive common land (largely grasslands in West Penwith) beyond the fields. Earliest part of the Middle Bronze Age, around 1600 BC.

- Regular coaxial fields with several parallel lines, often subdivided and where sufficiently well-preserved depending from long terminal boundaries that separate farmed land from common pastures. Akin to the Dartmoor reaves. Occupied and worked by larger communities. Later part of the Middle Bronze Age, from around 1500 or 1400 BC:
- Regular intensively farmed brick work or radial field patterns. Associated with hamlets of up to around 6 houses; the land probably shared equitably by intermixing and probably used in a rotation with some fields arable, others under grass in any given year. Early Iron Age through to the very early part of the Early Medieval period, i.e. very long-lived, over 1500 years, from c1000 BC to c AD 500 to 700. Many in northern West Penwith still in use, but from later medieval adapted using contemporary forms (strips, then crofts and intakes). Developed substantial lynchets (much of them in the Early Medieval period). Set within larger areas of land that also included extensive areas of rough grazing, probably used as commons.
- Strip fields in which the land held by households in medieval hamlets was shared equitably, from the middle centuries of the 1st millennium AD. In three distinct forms.
    - Wholly new field patterns (often laid out over prehistoric fields that have been levelled). Usually within ring-fenced hamlet-lands that also contain extensive areas of rough ground used in common by the households of the hamlets.
    - Bundles of strips fitted into inherited prehistoric field systems, usually involving some removal of the earlier boundaries, or attached to their perimeters as new intakes of permanent fields. Retain the later prehistoric areas of rough grazing.
    - Groups of outfield strips established within open commons. Appear to be short-lived and may have been opportunistic, Reverted to rough ground on abandonment.
        - Crofts, were usually attached to existing prehistoric or medieval field systems and were created as the communal system decayed in the later medieval and post-medieval periods, broadly from around 1300 to 1800. They were large irregularly shaped enclosed areas of rough ground with strong stock-proof boundaries that contained privately-held rough grazing and as fuel ground but were occasionally cultivated.
- Intakes were created from rough ground in the post-medieval, early modern and modern periods, from the 18th century to the early 20th. Like the strips they were in several distinct subtypes.
    - Extensions of existing field systems.
    - Wholly new farms
    - Smallholdings
    - Cliff gardens

Palaeo-environmental research

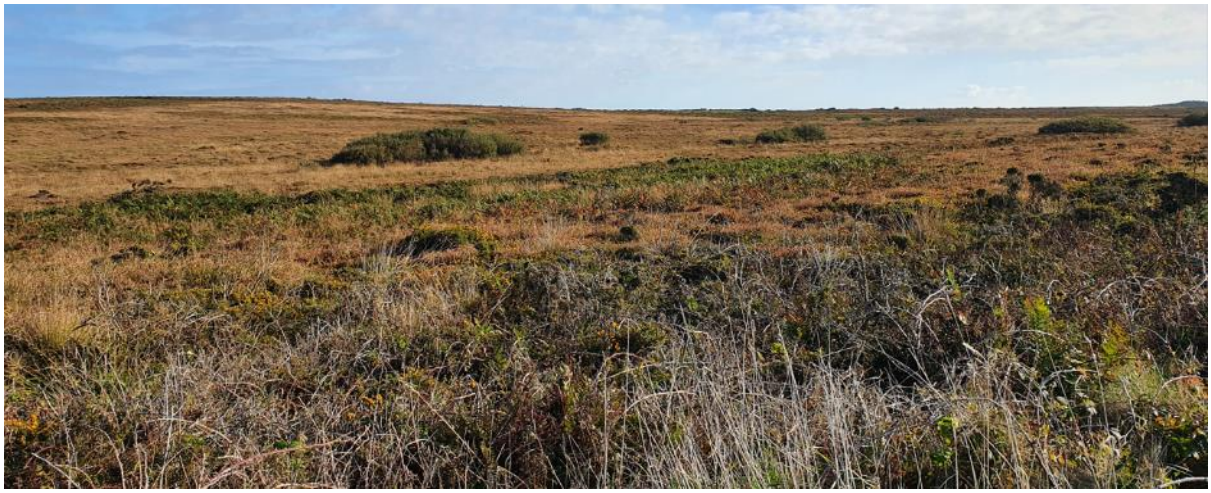
Palaeo-environmental evidence in West Penwith is predominantly from pollen records and macrofossils, mainly charred seeds and wood. It is relatively sparse compared with some other parts of the country.

> It is hoped that this study and some of its conclusions will provoke further examination of aspects of the semi-natural environment of West Penwith and so serve as a form of research framework that will stimulate and inform further palaeo-environmental work in the peninsula.

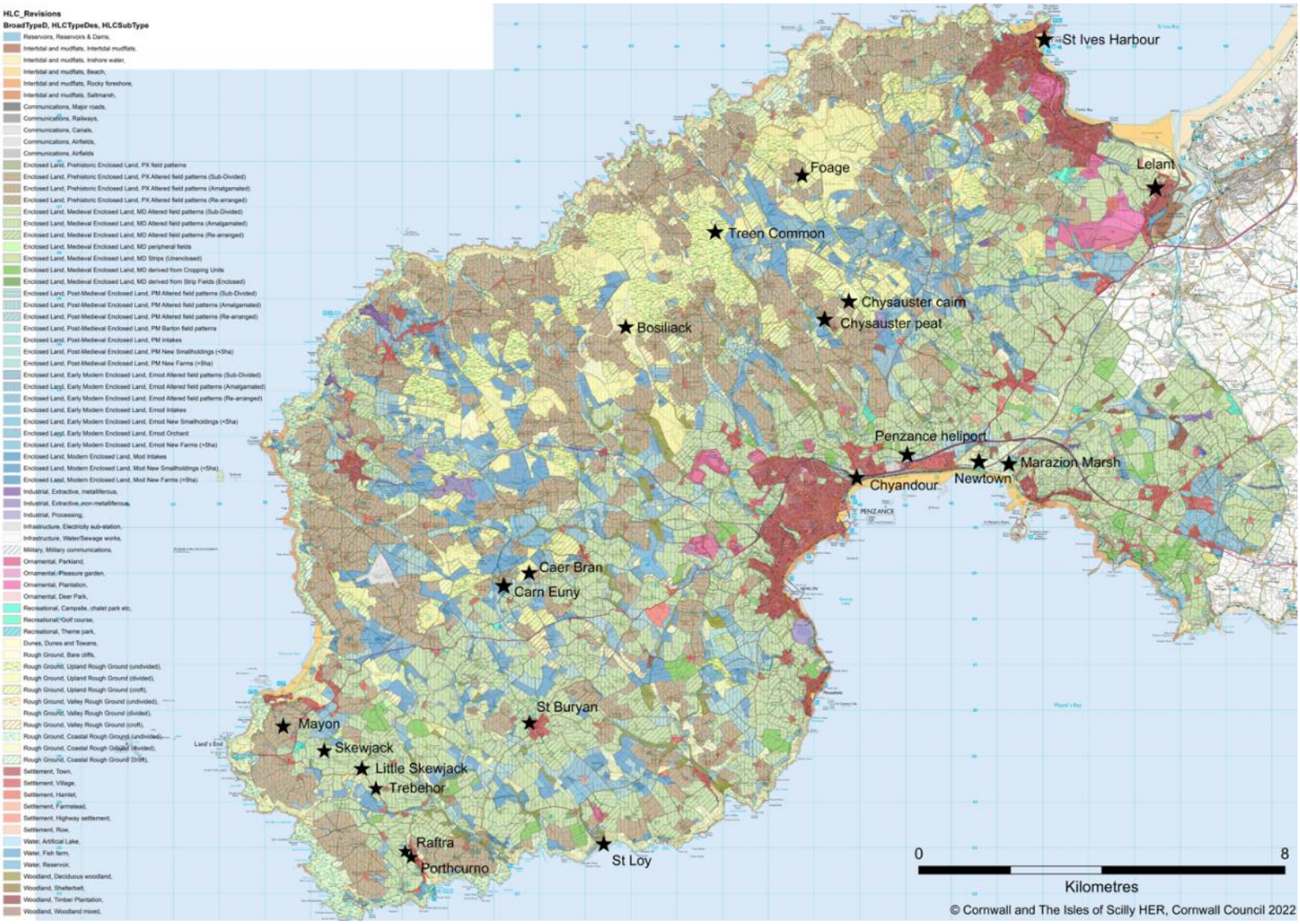
Preservation of pollen is generally good in the acid soils and peats of the granite area, while preservation of bones and shell is poor (as calcareous material dissolves). In direct contrast soils in dunes or affected by sand-blow have substantially higher pH levels and here shell and bone survive well, but pollen does not. Killas-based soils, beyond the granite, are less acid and pollen preservation is poorer (Straker 2011a, 66-7).

As part of the HEATH project (whose area of study included the Lizard and Carnmenellis uplands as well as those of West Penwith), English Heritage (now Historic England) provided support through their Archaeological Science team and their Regional Science Adviser Vanessa Straker. Vanessa provided invaluable summaries of previous palaeo-environmental studies (Dudley 2011; Kirkham 2011).

In addition, Emily Forster and David Earle Robinson of English Heritage's Archaeological Science team undertook new exploratory work in west Cornwall, largely to address gaps in knowledge of west Cornwall's vegetational prehistory and history. A key aim was to establish the histories in West Cornwall of the cross-leaved heath (*Erica tetralix*) and the Cornish heath (*Erica vagans*), a form of *Erica ciliaris*. Their pollen is similar but distinguishable. The EH project sampled peats and sediments at sites selected in consultation with Cornwall Archaeological Unit. That at Treen Common, Zennor, has deep peat whose analysis is summarised in the Mesolithic to early medieval sections, below.



Treen Common, Zennor, pollen analysis here informs current understanding of early West Penwith's semi-natural environment.



Locations of sites subjected to palaeo-environmental sampling and analysis, plotted against the 2012 revision of the Historic Landscape Characterisation (Base map © Cornwall Council)

Summary from all palaeo-environmental studies

Before c8000 BC

Tundra grassland, recorded at St Loy, in silts dated to around 30,000 BP.

c8000 – c3900 BC Mesolithic

Marazion Marsh. Late Mesolithic alder-dominated fen carr and reed marsh before marine incursion; then grass/sedge dominated vegetation, colonised by some trees and shrubs including *Salix* (Willow) and aquatics.

Newtown Marsh. Late Mesolithic hazel (or *Corylus avellana*-type), birch and alder dominated woodland until rising water table led to willow and 'strong pastoral element'.

Treen Common, Zennor, LPAZ 1 (c3900 – c2400 BC Neolithic)

An open landscape with grasses and a variety of herbs.

- Overwhelmingly dominated by grasses (Poaceae undifferentiated)
- All other plants as members of a grassland community
- Scattered trees, shrubs and herbs
- Minimal heath
- A rich mosaic kept open by grazing animals, presumably a mix of wild ungulates and domesticated livestock.

Chysauster peat sample. Valley-bottom site. Probably Neolithic. Alder and willow on wetland with oak and hazel woodland around.

Tyringham Road, Lelant. Later Neolithic (Beaker period). Charred wood included yew, hazel and *maloideae* type (includes hawthorn, apple etc).

Treen Common, Zennor, LPAZ 2 (c2400 – c 1000 BC Bronze Age)

Increased tree pollen, but still significant grasslands.

- Rise in trees largely accounted for by *Corylus avellana*
    - uncertain whether this is hazel or bog myrtle (*Myrica gale*)
- Grasses decline a little but are still an important element
- Many herbs decline
- Heath and woodland still minimal

Maen, Sennen. Later Neolithic and Early Bronze Age. Charred wood was overwhelmingly oak, but *maloideae* type (includes hawthorn, apple etc) also present. Other charred plant remains indicate a more open and varied land cover and land use than suggested by the wood. Grasses, chickweed, dock, ribwort plantain, vetch, bugle, and furze. Arable farming was indicated by several *Triticum* (wheat) grains.

Skewjack, Sennen. Later Neolithic and Early Bronze Age. Charred wood was overwhelmingly oak, but hazel, birch, alder, cherry, *maloideae* type (includes hawthorn, apple etc) also present. Other charred plant remains indicate a more open and varied land cover and land use than suggested by the wood. Grasses in particular. Arable farming indicated by *Triticum* (wheat) and *Avena* (oats) grains.

Trebehor, St Levan. Later Neolithic and Early Bronze Age. Charred wood was dominated by oak, but hazel, birch, alder, cherry, *maloideae* type (includes hawthorn, apple etc) also present. Other charred plant remains indicate a more open and varied land cover and land use than suggested by the wood. They included Fat Hen, Orache and Redshank.

Chyandour, Gulval. Early Bronze Age. Mire near edge of Mount's Bay woodland. Alder carr on mire and oak and birch woodland beyond that; replaced by hazel, with bracken and grasses.

Chysauster cairn, Gulval. Oak-hazel woodland with little evidence for heathland, but some evidence of farming, including pastoralism in the form of grassland, cereals and plantain.

Porthcurno, St Levan. Early or Middle Bronze Age. Charred wood, overwhelmingly oak, but also hazel, *maloideae* type (includes hawthorn, apple etc), broom/furze. Open grassland nearby is indicated by charred grasses, bramble and dock.

Tower Meadows, St Buryan. Middle Bronze Age. Charred plant fragments included cereal grains – hulled barley and wheat, plus a Celtic or field bean. Also weeds often associated with crops, like fat hen, pale persicaria, black bindweed, ribwort plantain and heath grass. Rough grassland nearby is suggested by bracken and lesser celandine.

Bosiliack, Madron. Middle Bronze Age. Charcoal from floors of houses oak, hazel, cherry, and furze / broom.

Treen Common, Zennor, LPAZ 3 (c1000 – 0 BC Late Bronze Age and Iron Age)

Tree pollen declined dramatically while grasses and herbs increased.

- Herbs are those associated with grazing, not arable; many returned having been lost during LPAZ 2
- Heath and woodland still minimal

Caer Bran, Sancreed. Probably either Later Bronze Age or Iron Age. Pollens in palaeosol beneath rampart of hillfort. Grassland with bracken, cinquefoil, ribwort plantain and many others. Minimal heath. Hazel predominates in tree pollen, with oak, alder, birch also recorded. May be interpreted as rough pasture on the downs with woodland on the hill's slopes.

Carn Euny, Sancreed. Iron Age and Romano-British. Pollen from soils beneath settlement features. Woodland (oak and hazel mainly) replaced by grasses, with weeds normally associated with both pasture and arable. So, some farming nearby.

Foage, Zennor. Probably Iron Age, buried soil beneath lynchetted boundary. Open vegetation dominated by grassland and herbs of pasture (no cereal pollen). Bracken. Minimal woodland (but that is oak, elm, holly and birch) and minimal heath.

Treen Common, Zennor, LPAZ 4 (c0 BC – c1600 AD Romano-British, Medieval and early post-medieval)

Dramatic increase in heathland, with *Erica ciliaris* type dominant over *E tetralix*. Heathland dropped away in the later medieval as arable increased.

- Heathland peaked early, in the Romano-British and early medieval periods
- Intensity of use of upland pastures decreased, perhaps as attention was concentrated on dense field patterns, whose lynchets increased (Vervust *et al* 2020)
- Arable as well as pasture herbs increased in the later medieval peroid (a period when outfields were laid out on Treen Common)
- Woodland still minimal

Aliens: archaeophytes in West Penwith.

The character and history of West Penwith's flora will largely be covered by the main section on Time and Change. The introduction of alien species of plants is a slightly separate subject as it cross-cuts the history of development in often quite random ways. Early aliens, the archaeophytes, are introduced here, and individual archaeophytes are touched on in those period sections that appear most appropriate.

This section considers the effects on West Penwith's semi-natural environment of early introductions or early arrivals of 'alien' plant taxa.

The importance to botanists and ecologists of studying aliens has been summarised:

> 'In floristic and phytogeographical studies it is important to make as accurate a distinction as possible between native and alien species. This distinction is needed if we are to understand the different components which make up the biodiversity of an area, and to interpret changes in the range and abundance of different taxa. The recognition of native and alien species also has implications for species conservation and vegetation management. Native taxa are often the only ones considered as qualifying for conservation designation and protection, and the inclusion of a species in a Red Data Book, for example, may depend on whether it is regarded as a native or an alien. The spread of recently introduced species has been identified as one of the main threats to native taxa in a wide range of ecosystems' (Preston *et al* 2004, 257).

'The need to differentiate carefully between alien and native genetic stock is not born of chauvinistic elitism, but of scientific necessity'. This is because to understand an area's vegetational history it is 'absolutely essential that we consider only our native flora', the one that has developed complex inter-relationships with other plants and fungi, micro-organisms and animals (Stace and Crawley 2015, 2).

Stace and Crawley (2015) have reviewed recent literature to arrive at definitions of the two key terms, native and alien.

'A **native** taxon is one that has originated in the area without human involvement, or has migrated to the area without human intervention from an area in which the taxon is/was native… [while] An **alien** taxon is one that has migrated to the area with human involvement (whether intentional or unintentional), or has migrated there without human involvement but from an area in which the taxon is/was also alien' (ibid 3). An alien may have arrived as long ago as the Neolithic, 'when man's activities first made such migrations possible' (ibid, 4).

Aliens are divided into two classes, principally on the basis of chronology: archaeophytes and neophytes. Botanists separate the two by regarding as archaeophytes those plant species introduced either deliberately or accidentally in 'ancient times', normally regarded in Britain as before 1492, when Christopher Columbus landed in America, and usually rounded up to pre-1500. Neophytes are those that arrived after 1500.

Archaeophytes are then divided into three subgroups largely on the basis of their relationship to the activities of people. Cultivated Plants were introduced 'by people as crops or developed here as such from species that arrived here by chance with them or their crops, and then escaping or persisting' (Stace and Crawley 2105, 4). A Colonist was defined as long ago as 1847 as 'a weed of cultivated land, by road sides or about houses, and seldom found except in places where the ground has been adapted for its production and continuance by the operations of man' (Watson 1847, cited in Stace and Crawley 2105, 4). Finally, a Denizen was defined as a plant that is 'at present maintaining its habitats as if a native species, without the direct aid of man, but liable to some suspicion of having been originally introduced by human

agency, whether by design or by accident' (Watson 1847, cited in Stace and Crawley 2105, 4)

Archaeologists, historians and those who have an interest in the development of the semi-natural environment as part of their understanding of landscape and place have a related but different interest in archaeophytes (and neophytes). Their introduction to an area like West Penwith, whether deliberate or incidental, throws light on more general processes of change. These include the development of particular land uses, including pastoral, arable and mixed agriculture, silviculture and horticulture, and thus includes the botanist's Cultivated Plants and Colonists. These are substantial contributors to the domestication of nature that has created the semi-natural world we currently live in and enjoy. The botanist's Denizens may be subsumed in an archaeological approach within those other two. An archaeologist might, however, include another sub-group, those species that arrived not as part of the package of domestication and cultivation but instead as incidental effects of contact between areas including when introduced accidentally alongside primary trade goods. Most of those would be neophytes, but a few may have come before 1500 and thus be archaeophytes.

Some of the identification of archaeophytes by botanists has been based on presumption and intuition, rather than on the application of reasonable and agreed criteria (Preston *et al* 2004, 257). Those who have tried to take a more systematic and reliable approach can separate out those species for which there is 'incontrovertible evidence that they are alien' – examples given include *Pseudotsuga menziesii* (Douglas Fir), brought in from north America – and those where there is a 'continuous fossil record since at least the Late-glacial which demonstrates that they are certainly native' – examples include *Corylus avellana* (Common Hazel) (ibid, 258), though even here there may a little doubt given the importance of palynological studies for tracking species' history and the similarity of the pollen of hazel and bog myrtle (*Myrica gale*).

Many other species may be regarded as native on the basis of ecology, history and phytogeography (that is the branch of biogeography concerned with the distribution of plant species), although each of these three approaches would necessarily involve making and accepting various assumptions. Anyway, there is 'a sizeable minority of species where the native status is doubtful' (Preston *et al* 2004, 258), essentially the Denizens, and authors have taken different views. Of course, people have been present in Britain and probably also in west Cornwall since the lower palaeolithic period (see Section 2) and therefore actively affecting the environment, so the late-glacial cut-off for native species may not be regarded by some as absolute.

As noted, archaeophytes can include cultivated species, deliberately introduced by people as food stuffs, fodder for livestock, for timber and any number of other practical uses. But they can also include 'weeds' of cultivation or those associated with other land use. And as noted there are again those more incidental aliens – like those brought in accidentally with ballast or waste on vessels calling at west Cornish harbours. One of the earliest records of such an alien was that of the common nettle (*Urtica dioica*), which was carried to the New World by the English settlers. John Josselyn noted as early as 1672 that, 'such Plants… have sprung up since the

English planted [i.e. settled] and kept cattle in New England' (cited in Grigson 1958, 238).

Another source of uncertainty in the work of distinguishing the native and the alien lies in the definition of the 'given area'. Regions assessed tend to be coterminous with the areas of interest adopted by institutions (academia, agencies, societies): native to France, or alien to 'the British Isles (Britain, Ireland, the Isle of Man and the Channel Islands)' as in Stacey and Crawley 2015. As they clearly state, there will be variability between the islands, at least, and also between different parts of Britain, and they illustaret this with the example of the Sea-buckthorn which is native on England's eastern coast but an alien on other coasts and inland (Stacey and Crawley 2015, 7, fig 4).

There are famously no snakes in Ireland, while there are many in England, and the native and alien plants of St Levan can be expected to be substantially different from those found in Caithness or Kent. Even within West Penwith the differences in geologies, soils and climates lead to dependent differences in plant and animal communities and species, both native and alien.

The study of aliens, neophytes and archaeophytes has burgeoned in the last 60 years, since the ground-breaking work of Sir Edward Salisbury in *Weeds and Aliens* (1961). In 1958 just 626 species of vascular plants in Britain (or 28% of the total) had been regarded as 'alien' (Dandy 1958), but by 2015 that number had risen to 2,068 (or 59%) (Stace and Crawley 2015).

Preston *et al* (2004) discussed terms and presented what may be regarded as a long list of archaeophytes in Britain (ibid, table 2). It is possible to cross-check that list with French 2020 (*A Flora of Cornwall*) to pursue the existence of these in W Penwith today and in recent times.

More interestingly, at least for this study of the development of West Penwith's natural environment, the archaeophytes listed in Preston *et al* can also be searched for in the several pollen analyses undertaken in West Penwith. It will be seen that disappointingly few have been identified, but it should be noted again that paleoenvironmental work in the peninsula is still in its infancy and we should expect that more will be identified as more samples are taken and analysed.

The following arranges those archaeophytes recorded in publications of analyses in West Penwith by broad period, starting in the Mesolithic period. This is of course unusually early, being immediately after the Ice Age that we have seen is also the cut-off for regarding plants as essentially 'native' rather than alien. It should be noted that Preston *et al* (2004, table 2) record no taxa as archaeophytes in the Mesolithic period and just 5 species from Neolithic deposits or peats. So, the West Penwith records may be important in an unexpected way, for casting some doubt on the identification of species as archaeophytes at all; they may instead be considered as candidates for native status. However, the three species concerned are of interest in terms of what they may indicate about the processes of conversion of woodland to grassland and farmland in early post-glacial prehistory and so for present purposes they have been assumed to be real archaeophytes.

Fauna

The fauna that have had the greatest impact on West Penwith's semi-natural environment are humans. Others, though, would also have been significant, most notably the grazing ungulates, first the wild ones and then the domesticated, which, with the exception of the dog, were introduced from the continent in Neolithic times.

Evidence for animals is extremely patchy in west Cornwall, largely because so few of their bones survive, and the records kept in historic times typically deal with livestock only obliquely.

Frank Turk prepared 'Notes on Cornish Mammals' in the *Annual Reports of the Royal Cornwall Polytechnic Society* for eight years until doing the same in the *Cornish Archaeology* journal from 1968. Many of the bones he examined were excavated by Charles Thomas in the Gwithian area where sand-blow and towans created unusually alkaline conditions in which bone was preserved. Elsewhere in Cornwall the acid soils destroy bones. Turk described the problem in 1970.

> 'Complete bones (except astragali), even much worn complete ones, are a great rarity in Cornwall; large portions of crania are almost never found, no individual animal is represented by more than a half-dozen bones, and (for some species) even this may be rare. Often the osteologist has to do the best that he can with fragments which would, at many sites elsewhere and following normal routine, be discarded' (Turk 1970, 121).

It was then generally assumed that Cornwall's relative isolation would have affected its 'feral, semi-feral and domesticated faunas in very special ways' (Turk 1968, 74). Some of the wild fauna were presumed, or confirmed to have lingered longer here than in most other parts of Britain. For example the 'dark race of the **water vole** *(Anicola amphibius* subsp. *reta* Miller) and a race of the vole, *Microtus arvalis* Pallas, which today is found live in Britain only in Guernsey and the Orkneys but which was still part of the Scilly fauna in the Early Christian period' (ibid).

Regarding the **Elk**, **Beaver**, **Wolf** and **Bear**, Turk noted that each had long been extinct, but for how long was uncertain. Bears may have survived in Scotland into the 9th or 10th centuries A.D. Elks probably disappeared in the Neolithic period, but beavers and wolves were here in the Iron Age although for how long afterwards could not be said (ibid).

Remains of a **seal** were found among the 1st to 3rd century AD material at Crane Godrevy. It was noted that smaller quantities of seals were being taken compared with before the 2nd century (Turk 1970, 125).

Venomous 'wormes' or **snakes** were common in Carew's time, the late 16th century.

Richard Carew separated those wild animals whose value to people was for venery, that is hunting, in order to reduce damage to their property – listed as **martenes**, **squirrels**, **foxes**, **badgers** and **otters** – from those whose value was as a source of meat – listed as **hares**, **conies** [i.e. **rabbits**] and **deere** – though these too could provide sport for those who hunted.

Carew writes poetically of the **fox**, who 'planteth his dwelling in the steep cliffs by the seaside', 'impossible to disseysze him of this his ancient inheritance', but if the Captain of the hunters discovers his foraying and sets the 'souldier-like Hounds… in ambush between him and home… then master Reignard ransacketh every corner of his wily sconce, and bestirrreth the utmost of his nimble stumps to quit his coate from their jawes. He crosseth brookes, to make them lose the sent, he slippeth into coverts, to steale out of sight' (Carew 1603, 22).

Carew noticed that the **Otters**, 'though one in kind, have yet two several places of haunt: some keepe the Cliffes, and there breed, and feede on Sea-fishe; others live in the fresh ryvers…, who being lesse stored with provision, make bold now and then to visite the land, and to breake their fast, upon the goodmans Lambs, or the goodwives pultrie' (Carew 1603, 22).

The left and right mandibles of an otter were found in the 1st to 3rd century AD levels at Crane Godrevy round. It was supposed that the animal was caught for its skin, though it may also have been eaten, and may even have been tamed and used for fishing, as was done on the Yangtse River in China from as early as the 8th century AD (Turk 1970, 124-125).

'Of **conies**, there are here and there some few little Warrens, scantly worth the remembering' (Carew 1603, 22); the rabbit was clearly then not yet as ubiquitous as it now is.

Regarding domesticated animals, Cornwall was known to have developed its own breeds of **cattle**, and perhaps also of **horses** (Turk 1968, 74). (See more in Medieval and Post-medieval.)

Early later medieval bones of an **ox** found at Sandy Lane, Gwithian in an excavation by Charles Thomas were exceptionally large, comparable to modern breeds, and larger than another found in nearby Hockins Pit, of roughly similar date. Frank Turk had noticed that the size of oxen in Cornwall had until this period 'changed very little in Cornwall and Scilly since Bronze Age times' (Turk 1969, 101). It had been suggested that the red Devon breed of cattle may have been disseminated form its north Devon home area in the 11th century (Trow-Smith 1957). In Elizabethan times John Norden noted that 'The cattell in this Countrye are not greate, their feeding being but meane' (Norden 1600, 18).

Richard Carew considered 'Rother cattle' [i.e. cattle with long horns] as 'serving for meate onely' (1603, 23). 'Some Gentlemen suffer their beastees [i.e. cattle] to runne wilde, in their Woods and waste grounds, where they are hunted and killed with Crossbowes and Peeces [i.e. early guns], in the manner of Deere, and by their fiercenesse, and warinesse, seeme to have put on a part of the others nature' (Carew 1603, 23-24). Oxen were used for 'meate, draught, and plowing', and 'Each Oxe hath his several name, upon which the drivers call aloud, both to direct and give them courage as they are at worke' (ibid).

A **sheep** found in Romano-British layers at Crane Godrevy, an enclosed settlement or 'round' was described as being of 'the very small breed, usual at this period' (Turk 1970, 123). Richard Carew remembered that prior to

improvements of the land in his own time Cornwall's 'Sheepe had generally little bodies, and course fleeces, so as their Wooll bare no better name, then of Cornish hayre' (1603, 23).

Bones of a **horse** found in 1st to 3rd century AD layers at Crane Godrevy round, near Gwithian, was 'of a small breed, little more than a pony' (Turk 1970, 123). Frank Turk wondered whether the horse was relatively undeveloped; he felt that its teeth were closer in form to those of a tarpan, and 'on such evidence as we have, it is reasonable to suppose that it was, all in all, a very serviceable hardy little animal well suited to general purposes' (Turk 1970, 124). Another horse found in Early later medieval layers at Hockins Pit, Gwithian suggested a 'small slender-footed animal little larger than a pony' (Turk 1969, 101).

'From the teeth and bones of Cornish horses that I have seen to date, ranging perhaps through the first millennium and a quarter A.D., I would reconstruct an animal 12½ to 14 hands high – sometimes possibly a little more – with a rather coarse heavy head (scarcely that of a pony), short legs and small feet. The shoulder was probably strong, but the breed may have been incapable of any but weak knee action, and this suggests an animal more able to walk and to trot than to gallop. Perhaps, of all modern breeds, it most nearly approached the Fell pony of Cumberland and Westmorland, although, no doubt, larger specimens were to be found' (Turk 1970, 126).

'Their **horses** are of small growth, being fedd and browghte up upon the high, colde, and harde mountaynes.' 'There is a kinde of Naggs bredd upon a mountainous and spatious peece of grounde called Goon-hillye… which are the hardeste naggs and beste of travaile for their bones within this kingdome, resembling in body for quantitie, and in goodness of mettle the Galloway naggs' (Norden c1600, 18).

Both Goonhilly and Galloway nags are now extinct.

The Sea

William Borlase noted how Cornwall's 'marine situation has its advantages; it fills our bays and harbours, makes a number of fishing creeks, brings its native products, sand, ore-weed, and fish (as well as foreign merchandize) home to our doors in a multitude of places, exports our tin and fish with great conveniency. …in short, the Sea, being on every side of us, procures plenty, and promotes trade and employment in many shapes utterly unknown to the more inland counties' (Borlase 1758, 51).

West Penwith juts into the Atlantic Ocean, the Celtic Sea, the Bristol Channel and the English Channel, or *La Manche*, 'the Sleeve'. The promontories encountered by sailors aiming for the last two are Pendeen Watch and Gwennap Head respectively though Cape Cornwall and Land's End are more famous projections into the sea, when viewed from a terrestrial perspective. The sea is divided into stretches by islands, islets and numerous rocks and reefs.

The sea fills land's indents in the form of bays (in which the land curves inwards) and dozens of coves (smaller inlets, often with narrow entrances). The largest bays, Mount's Bay and St Ives Bay, eat into the neck or isthmus holding West Penwith on to Cornwall. Both have gathered sand to form long beaches along their innermost

edges. The same has happened in the lesser bays, Carbis Bay (a portion or fractal of St Ives Bay), Gwavas Lake (a portion of Mount's Bay) and Whitesand Bay, but not in Mill Bay (Sennen) where the sea has instead deposited boulders. Smaller beaches, some filling coves, sometimes lose much or all of their sand after violent storms.

To encircle West Penwith with as much salt sea as possible, the Hayle River can be followed to its highest tidal point, which Charles Henderson suggested had once been as far upstream as Relubbus before tin-working detritus clogged the river and raised its floor. Major early thoroughfares like that fording the Hayle at Relubbus (containing Cornish *rid*, 'ford') were often at the lowest crossing places of tidal rivers. Relubbus's great road, probably extant before the Romans arrived in west Cornwall, originated deep in southern Britain and ran the length of Cornwall and headed directly for St Michael's Mount (Henderson and Coates 1928, 101).

The normal tidal limit on the River Hayle is now at St Erth bridge but in 1748 Thomas Martyn showed the estuary extending half a mile further south (0.85 km) to the crossing of the lane from Trewinnard to Tremellin. This extended tidal limit contributes to the sense of separation of West Penwith from the rest of Cornwall. Ferries, bridges and causeways were required to gain entry from Phillack and St Erth.

The Coast

The interface between land and sea is also that between the activities of people on both – the porths and ports where boats and ships made connections and the beaches, towans and cliffs where the fruits of the sea were landed or could be reached and where, especially in more recent times, the sea could be enjoyed by local people and increasingly by visitors.

With its cliffs, promontories, coves, zawns (deep, narrow inlets with steep or vertical side walls), beaches and towans (dunes), the coast of West Penwith is richly variable, not least in its geology. Most of the northern and north-western coast is not granite but various hard metamorphic rocks and the gnawing away at each has produced a variety of finishes to cliffs, and coves. Cliffs can be vertical, as at Porthmoina, Bosigran, Zennor, or can grade down gradually, allowing people, and grazing livestock, to make their way from top to bottom in relative safety.

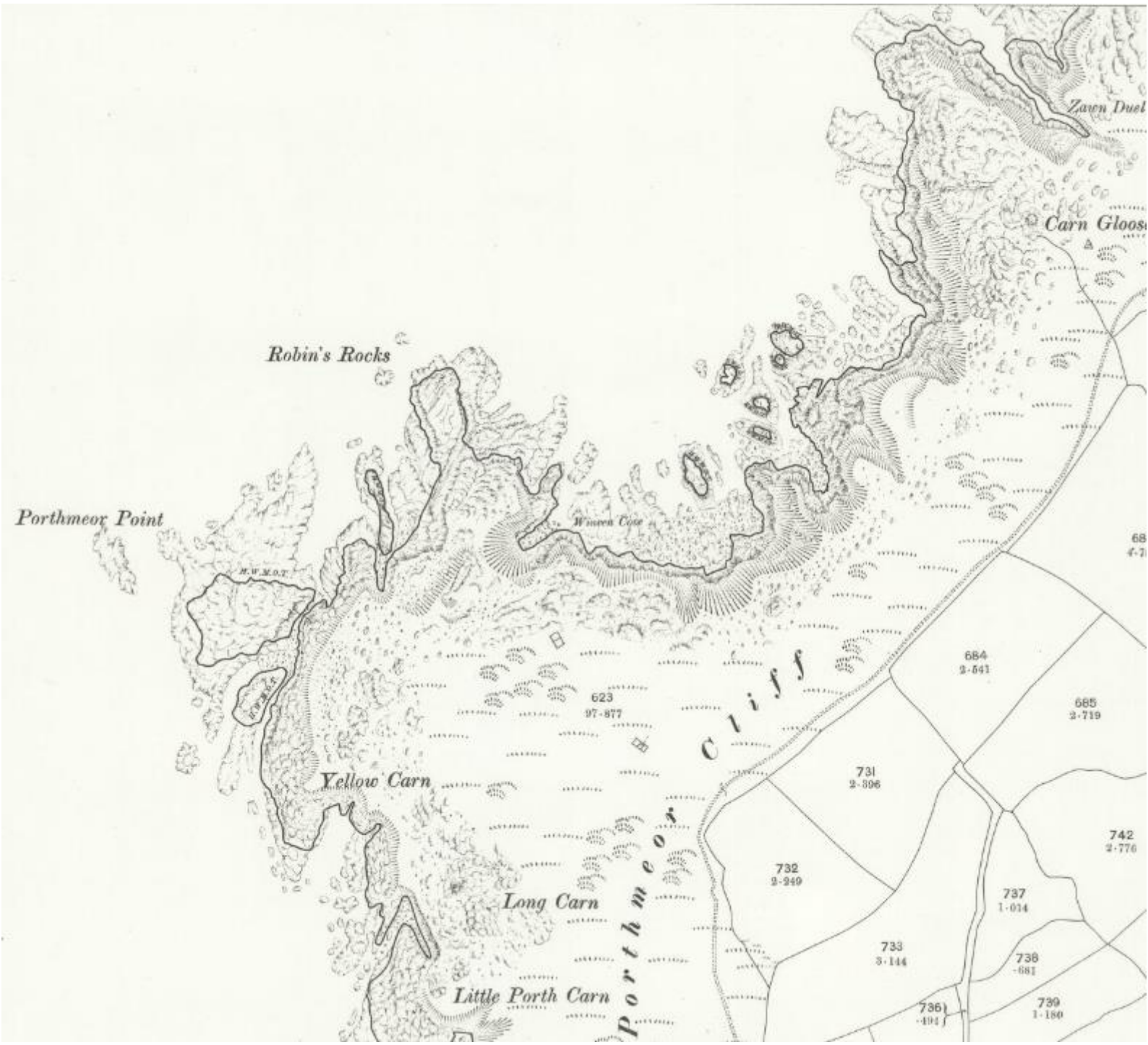
The Elizabethan topographer John Norden was aware that the coastline is not as solid as it sometimes appears, 'the Sea, ayded by tyme and tempests, is every where a powrefull adversarie to the Land, and in moste places the Lande weake to resiste' (Norden 1600, 10).

Cape Cornwall from Kenidjack Cliff, both promontories formed of metamorphic rocks, Cape Cornwall of Hornfelsed slate and siltsone and Kendijack Cliff (and the two rocky islets, the Brisons) of Metabalsatic rock.

Cliff falls and erosion of sandy shores show current and recent change, and the work of Healey (1999) and Camm (1999) illustrate the gradual loss of the lowlands in what is now Mount's Bay during the post-Ice Age Holocene period, but there were significantly more dramatic changes to Britain's coastline in the half-million years of the pre-Holocene period when people were sporadic inhabitants or visitors. The glacial and inter-glacial periods saw great fluctuations in sea levels as water was or was not tied up in ice sheets. This was the time of either land bridges when the levels were low and inundations when they were high (see below in Time and Change: Before the Holocene and in later relevant chronological periods).

Because of the myriad indentations within indentations, West Penwith also has a very long coast. Its length varies continuously of course as tides rise and fall (with mean spring tide ranges of 5.6m at Newlyn and 5.4m at Land's End; Kidson and Heyworth 1982, table 1). Coastal convolutions are represented differently at different scales of mapping so the coast at low water, from the east of Marazion parish to the east of Lelant (the Penwith Landscape Partnership area), is 71 kilometres long on 1:250,000 mapping, but 82 kilometres at 1:32,000 and 121 kilometres at 1:4000, weaving in and out of each zawn and around each tiny promontory. But it can be as little as 62 kilometres if regarded as the line that people actually walk along it (when using the coast path). Whatever, the coastal edge of West Penwith is substantially

longer than its inland boundary, which is as little as 8.5 kilometres as the crow flies, but 15 if the boundaries of Lelant, Ludgvan and Marazion parishes are followed.



Typically intricate West Penwith coastline at Porthmeor in Zennor. Promontories, zawns, coves, rocks and islets as well as cliff top and cliff-side carns, rocky scree and clitter, and different forms of land cover (rough grassland and furze) contribute to a complex natural and semi-natural environment and a stunningly beautiful landscape. (Ordnance Survey 1:2500, surveyed 1876. Reproduced with the permission of the National Library of Scotland).

Previous page: tides and waves, shifting sands, collapsing cliffs: the coast is constantly changing. Pednvounder Beach with Treryn Dinas beyond (above). The west coast with Whitesand Bay in the foreground and Cape Cornwall in the distance and the chisel-edged cliffs that rim the coastal plateau in between (below).

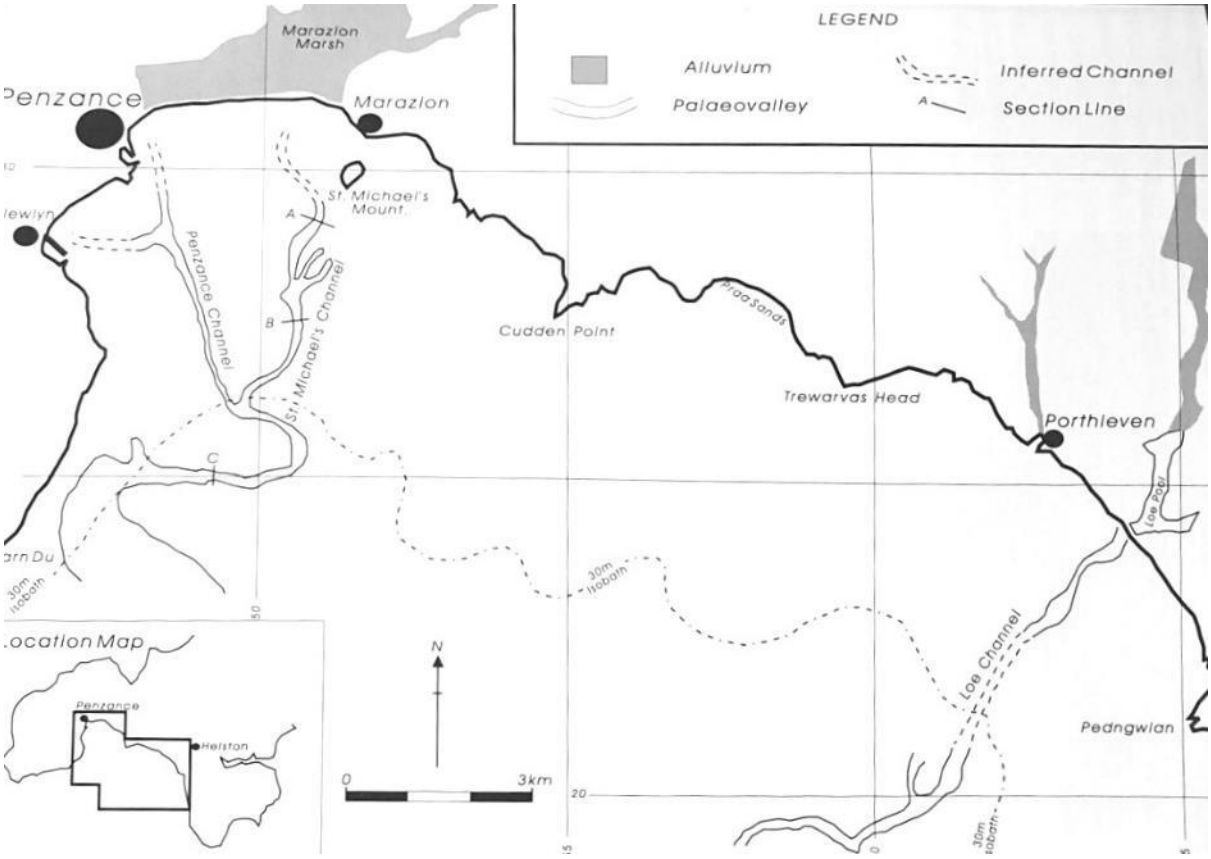
In the earliest part of the Mesolithic period the coast lay miles out to sea in some parts of Cornwall (Berridge and Roberts 1986, fig 3, based on sea level curves calculated by Kidson and Heyworth 1982). In West Penwith it was tighter to the present line, in part because of the hardness of the geology. Coastline shift was largely due to changes in sea level, which in the first centuries after the Ice Age was rapid, rising by around 1 centimetre each year until between 7000 and 6500 BP, when it started to slow (Hosfield *et al* 2008). Sea level changes were also affected by the land itself also rising due to the loss of the weight of the ice. All this means that Mesolithic sites that appear coastal now may have been some way inland, and the Mesolithic's own coastal sites are now under water.

The last land bridge connecting Britain to mainland Europe was severed by c7500 BP, the date normally taken as the cut-off for 'native' species; any that arrived later are regarded as 'alien' (Hosfield *et al* 2008).

Submerged forest remains along the northern coast of Mount's Bay indicate that *terra firma* was inundated in prehistoric times. Work at Marazion Marsh has suggested that this indundation was gradual, and that the episode that left the remains of a 'submerged forest' which can still be seen at certain low tides between Chyandour and Long Rock, took place between 4450 and 4230 before the present BP, in the later Neolithic and early Bronze Age period. It is suggested that natural coastal barriers 'damped' the influence of rising sea-level within embayed sites, with freshwater marshes developing below sea-level behind them. When breached further barriers may have developed further inland that would later be breached in turn (Healy 1999b, 59).

Other investigations in Mount's Bay have recorded palaeovalleys of rivers that continued the courses of those that still exist on land. The Newlyn River and Chyandour Stream converged around 1 mile off Penzance to form what has been named the Penzance Channel. This was in turn joined about 2 miles further south by the so-called St Michael's Channel, a continuation of the Red River that passes through Marazion Marsh (Camm 1999).

> The work of Camm and colleagues has recently been re-presented and discussed in Jones and Allen 2023, who also drew on an unpublished dissertation by AH Channon (2018). Together they created a useful series of coloured maps (Jones and Allen 2023, figs 11.3 to 11.9, and fig 14.1) showing the gradual 'drowning' of the Mount's Bay lowlands in the first two-thirds of the Holocene period. They then related these to selected archaeological sites (including selected artefacts considered to have been carefully deposited) in order to speculate on how communities (and individuals within them) may have felt at seeing their familiar world altered by the forces of nature (Jones and Allen 2023, chapter 14).



Map of palaeochannels in Mount's Bay; detail from Camm 1999, fig 13.

Towans (or sand dunes)

West Cornwall has several extensive systems of towans or dunes (unstable hillocks and ridges of wind-driven sand), notably around St Ives Bay (Lelant Towans and Phillack Towans), but also at Whitesand Bay, where climbing dunes extend 1.5km inland between Escalls Green and Mayon Green, and along stretches of Mount's Bay, especially near the mouth of the Red River that passes through Marazion Marsh (Pye *et al* 2007). A sandy layer at the base of cores obtained at Ponjou, Gulval, was also interpreted as possibly derived from sand blow and dunes (Allen 2019, 58).

The towans of Godrevy and Gwithian have received the most intensive archaeological and palaeo-environmental study, the latter largely through examination of molluscs (Nowakowski *et al* 2007; Walker 2014). Britain's dune systems appear to have begun forming around 5000 years ago in the early Neolithic period, after sea levels had become relatively stable after their post-Ice Age fluctuations (Walker 2014, 1).

Towans are important archaeologically in Cornwall, especially for the remains of settlements, fields and various activity areas within them, often with better preserved artefactual and ecofactual material in their sandy alkaline soils than elsewhere where acid soils destroy much organic material. This is exemplified by the many seasons of work at Gwithian, just east of West Penwith, where Bronze Age, Romano-British and post-Roman remains dominate the sites examined by Charles Thomas and his teams from the 1940s to the early 2000s (summarised in Nowakowski *et al* 2007). It

may be expected that prehistoric and early medieval remains, and those from other periods, also survive within the towans of West Penwith.

Palaeoenvironmental studies in the towans complement those undertaken in more acid soils where pollen and other material may survive better (Walker 2014). Thomas Walker's work at Gwithian enabled him to model the process of its towan's formation. In the Early Bronze Age areas of blown sand were confined to the edges of a marsh at the mouth of the Red River. Later Bronze Age sand blows extended the towans upstream and along the coastline, overwhelming much of the earlier marshland and narrowing the Red River channel. The towans appear to have reached their maximum extent by the Romano-British period, climbing onto the higher ground of Godrevy and in the Later Medieval period the activities of farmers, improving the sandy soils, helped push back their margins. (See Walker 2014, fig 167 for mapping of the land cover during these four phases.)

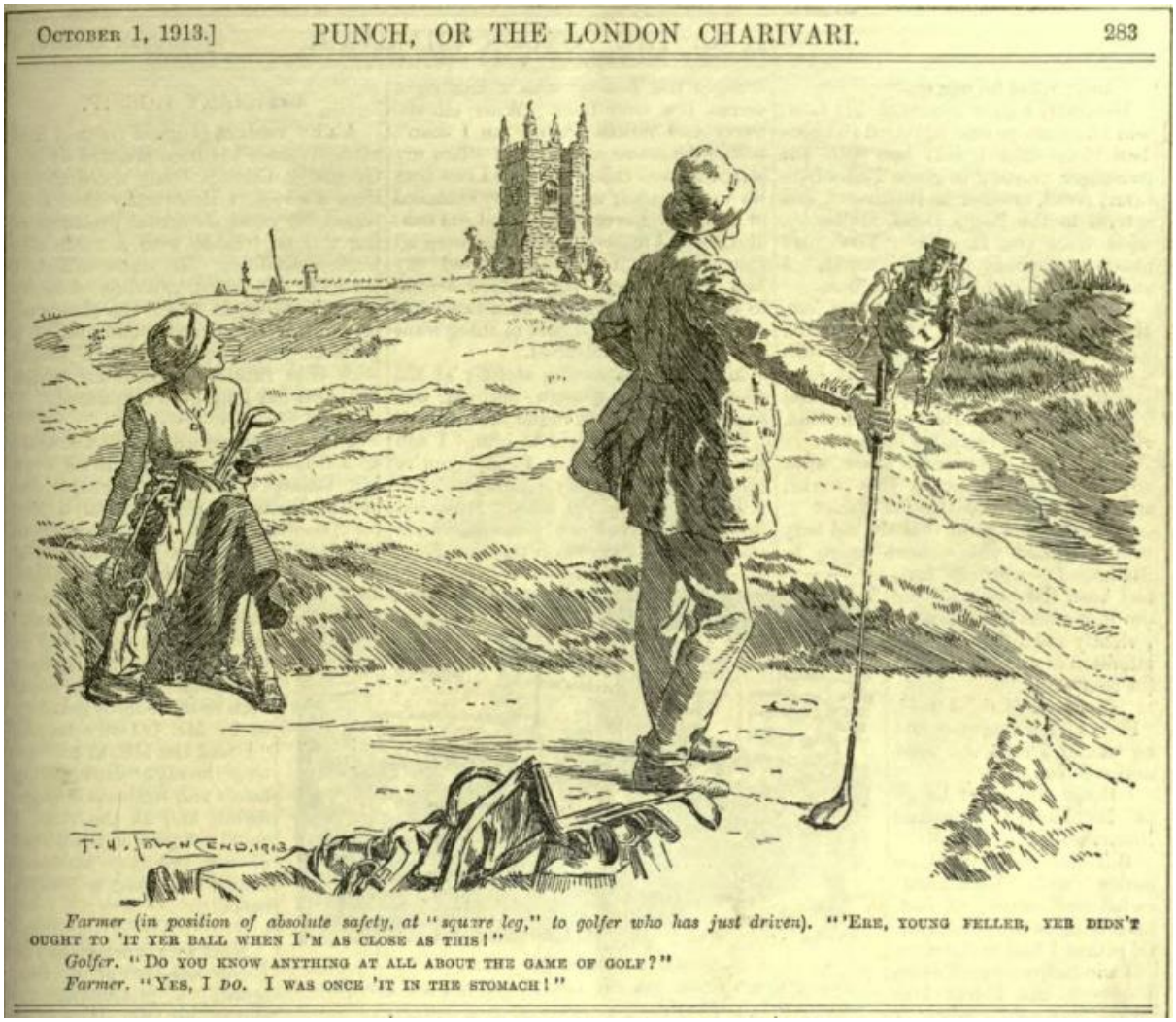
Walker was also able to identify individual sand blows, some of which led to encroachments on fields and abandonment of settlements, such as those of the late Bronze Age settlement at Gwithian in around 900BC, the Romano-British farmstead at Porth Godrevy in around the 4th century AD, and the medieval hamlet of Crane Godrevy at the end of the 16th century AD (Walker 2014, 166). Similar events may be expected to have occurred in the West Penwith towans.

Sand blows on the Lelant Towans led to 'Old Lelant' town being rapidly overwhelmed by vast sand drifts (Mathews 1892, 92) and St Ives town was also threatened by sea sand in the early 16th century when John Leland recorded in c1535 that 'Most part of the houses in the peninsula be sore oppressed or over covered with sandes that the stormy windes and rages castith up there. This calamitie hath continuid ther litle above 20 yeares… The best part of the town now standith in the south part of the Peninsula, toward another hille for defence from the sandes' (cited in Mathews 1892, 48).

John Norden in c 1600 recorded that 'Uny-juxta Lalant [i.e. Lelant] was sometyme a haven towne, but then of late decayed, owing to the drifting in of the sands, which had buried much of the lands and houses, and many devices were used to preserve the church' (Norden c1600, 31). Then in 1662 John Ray recorded that Lelant church was 'almost quite covered with sand blown up by the wind' (Ray 1662) and churchwardens accounts from the 18th century record payments for removing sand from the church (Noall 1964, 35-36).

Containment of sand blows and thus the towans was effected by the planting the common sea-rush, *Arundo arenaria*, or *Calamagrostis arenaria* (Halliwell 1861, 18; Mathews 1892, 4). (Now known as Marram Grass, its scientific name is now *Ammophila arenaria*.)

Most Cornish towans, including those in west Penwith, are now no longer grazed, as they had been until relatively recent times. Most are now used primarily for recreation, as adjuncts to sandy beaches or as places where holiday chalets have been built (as on Phillack Townas on the east side of the mouth of the River Hayle) and golf courses have been laid out. The West Cornwall Golf Club based on Lelant Towans is the oldest in Cornwall, having been founded in 1889 (Britton 2012).



Cartoon by FH Townsend published in October 1st 1913 edition of Punch, showing an interaction between a golfer and a farmer at West Cornwall Golf Club, with the tower of Lelant church visible beyond the towans.

Weather

'Nature hath so confined it [Cornwall], as that the Seas saltnes sendeth warme euaporations which cherisheth the earth as with a contynuall sweete deaw, which yeldeth vnto the earthes increase quick maturitye, and preuenteth the bitternes of the nipping froste, which can not long conynue violent, nor the most contrynuying fall of the thickninge snowe make a daungerous deepnes to remayne longe, in regarde of the seas heate meltinge it in the fall: But the fierce and furious wyndes sharply assayle the naked hills and Dales, hauing no defensive woodes for shelter' (Norden c1600, 17).

Modern meteorological recording has been in place for sufficiently long for coherent representation of typical weather patterns in all parts of Britain to be established and compared. Analyses of the records made across south-west Britain between the years 1971 and 2000 (Met Office nd) are drawn from in the following summary of the typical modern weather of West Penwith, which also contains less scientific observations made in the earlier 18th century by William Borlase, the antiquarian and scientist, born in Pendeen and then rector of Ludgvan.

West Cornwall's weather has changed through time, of course, and its fauna and flora have reflected that: they have included communities that can survive tundra, at one end of temperature scale, to those that can endure semi-tropical conditions. In the current Holocene epoch there have been periods when the climate was either warmer or cooler than now, wetter or dryer, and more or less windy. There have also been shifts in prevailing wind direction (though they have always been broadly westerly) (see Time and Change).

Cornwall's annual mean temperature, 11º to 12º (all temperatures are given in centigrade), is relatively high for British coastal areas. Winters are 'far milder than in any part of England' and snow seldom lies for more than 3 or 4 days (Met Office nd), though in 1739 it lay for 2 months (Borlase 1758, 11). Springs are slower than other parts and summers not so hot; the air is 'more temperate and less sultry' (Borlase 1758, 11-12).

Average maximum temperatures for July (16º to 18.9º for all of West Penwith except the northern shore of Mount's Bay which is 19º to 19.6º) are between 4 and 5 degrees cooler than most of east Devon and Somerset (Met Office nd, figure 3).

Conversely the average minimum temperatures in July are the highest in the region (3.6º to 6.7º) while some parts (Dartmoor, Exmoor and other uplands) fall as low as 0º to 1.5º (Met Office nd, fig 4). This produces narrow temperature ranges that demonstrate how equable the summer weather of West Penwith is. The range between average minimum and maximum is 12.8º to 18.9º (just 6.1º range) in most of West Penwith, whereas the more wildly divergent summers of SE Somerset produce a range from 9º to 22.4º (a much more noticeable 13.4º range).

West Penwith shares with most of the rest of Cornwall's coast the highest average numbers of hours of sunshine in south-west Britain, between 1611 and 1806 per year, compared with an average range of 1348 to 1470 on Dartmoor and Exmoor (Met Office nd, figure 11).

'The Dews in Cornwall are not remarkably noxious to either herbs or animals, which I attribute to our having no long calms, nor lasting fogs' (Borlase 1758, 25). This may seem odd to those who experienced long days hearing every 30 seconds the shuddering five-second blast of the Pendeen foghorn. This was installed in 1900, less than half a mile from Borlase's birthplace; he must surely have experienced many dense fogs in his own time. The foghorn was finally switched off in 2014.

There have always been fluctuations in the climate and instances of extreme weather. Ice was regularly harvested from pools and lakes of Cornish country houses in the later 19th century (Trengwainton has an icehouse) indicating a prolonged period of colder winters. In the later 20th century, the West Penwith peninsula had on average fewer than 20 days a year with air frost, and sometimes as few as 2 days (Met Office nd, figure 7).

February is on average the coldest month in Cornwall while July and August are the warmest. Extreme heat is rare as it is most often brought in from mainland Europe by south-easterly winds (Met Office nd, 6).

In 1891 a 36-hour long easterly blizzard raged from 9th to the 10th of March, causing drifts of powdery, pellety snow to build up to heights of 20 feet, the wind so fierce that the snow was not able to form crystals (Carter 1971). Such an event may seem unimaginable now when snow does not fall or lie at all in many years in west

Cornwall; the number of days on which snow lies is less than 11 on average on the hills and just 3 in the Mount's Bay area (Met Office nd, fig 19).

As a result of modern technologies, the foghorns of Pendeen Light have been silent since 2014.

'In Cornwall, where a dry summer is a rare thing; and when other parts of England suffer by drought, Cornwall has seldom reason to complain' (Borlase 1758, 5). It rarely rains all day, 'rather frequent than heavy and excessive' (Borlase 1758, 6). Rainfall is highest in December and January as the sea is still relatively warm and Atlantic depressions are at their most vigorous, and it is at its lowest from April to July as the sea is quite cool and high pressure from the Azores affects our weather the most (Met Office nd, 11).

There is noticeable and perhaps surprising variation across the tiny land of West Penwith in terms of aspects of its climate, and in particular its rainfall. For example, the average spring rainfall in the south-western parishes of Sennen and St Levan is 136 to 180 mm (5.4 to 7 inches) while the hills of Zennor have between 241 and 270 (9.5 to 10.6 inches) (Met Office nd, fig 12). In summer the same two areas range from 128 to 170 mm (5 to 6.7 inches) in the SW to 231 to 260 mm (9.1 to 10.2 inches) on the hills. and in the winter the ranges vary even more, from 170 to 250 mm (6.7 to 9.8 inches) in St Levan to 401 to 460 (15.8 to 18.1 inches) on the hills.

Wind is a particular feature of west Cornwall's weather. Average wind speeds are only greater than those of south-west Britain in western Scotland and being the most westerly peninsula, West Penwith bears the brunt of the Atlantic storms. They are at their fiercest from November to March and most often absent from June to August. Winter gusts reach 80 knots (92 mph) most years and on 15th December 1979

reached 103 knots (118 mph) at Gwennap Head (St Levan). A gale is recorded if winds exceed 34 knots for 10 consecutive minutes or more and coastal west Cornwall averages 24 days with gales each year (compared with just four in Avon). Most gales are from the western half of the compass, and in Cornwall this is the principal direction of all winds with south-westerlies the most common and south-easterlies the least (Met Office nd fig 21).

Section 2 Time and Change

‘Setting the scene’ introduced some of the ways that West Penwith has changed and continues to change.

Time and change as related to human activities and the physical outcomes of those will be described and discussed within the framework of the principal periods that archaeologists and historians routinely employ in Britain. It concentrates on the tangible outcomes of peoples’ actions – artefacts, sites, monuments and historic landscape, as well as the semi-natural communities resulting from human interventions and made visible by palaeoenvironmental study.

- Palaeolithic: early hunting and gathering
- Mesolithic: late hunting and gathering
- Neolithic: dairying, hunting and gathering
- Later Neolithic and Early Bronze Age: intensified pastoralism and first settlements; substantial ceremonial and ritual monuments
- Middle and Later Bronze Age: permanent and seasonal settlement, land division and mixed farming
- Iron Age and Romano-British: intensive communal agriculture in organised fields and on commons
- Medieval: Continued intensive agriculture and establishment of the basis of current settlement pattern. Introduction of convertible husbandry; diversification of economy
- Post-medieval and Modern: gradual replacement of communal arrangements by individualistic ones; effects of industrialisation, commercialisation and imperialism; homogenisation, suspension and dilution of traditional and local ways of using the land

Many practices, and especially the maintenance of areas of summer grazing, continued through chronological divides, when other aspects of society and culture, such as beliefs and ideologies, or political and administrative arrangements, changed substantially.

Enduring seasonal uses of shared resources contribute to the sense of a *longue durée* in the ways that people lived in and exploited West Penwith’s prehistoric and historic landscape. Most or all of those resources, the upland pastures, the roads, the coastal grazings, and the seashore, were effectively ‘commons’ whose use was controlled by customs and rules based on fairness, natural justice and the need to conserve the resource in a long-term sustainable way, thereby creating the conditions that encouraged long-term continuity (as exemplified in Oosthuizen 2013 and discussed in relation to West Penwith in Herring 2016).

Before the Holocene, the Palaeolithic: hunting and gathering (to around 10,000 BC)

Occasional visitors

Most human activity in West Penwith has been of the Holocene epoch that commenced at the end of the Pleistocene epoch, the 2.5 million years of glaciations. However, people probably did come here in the pre-Holocene interglacial periods when the climate and conditions could be as benign as now, or even more so.

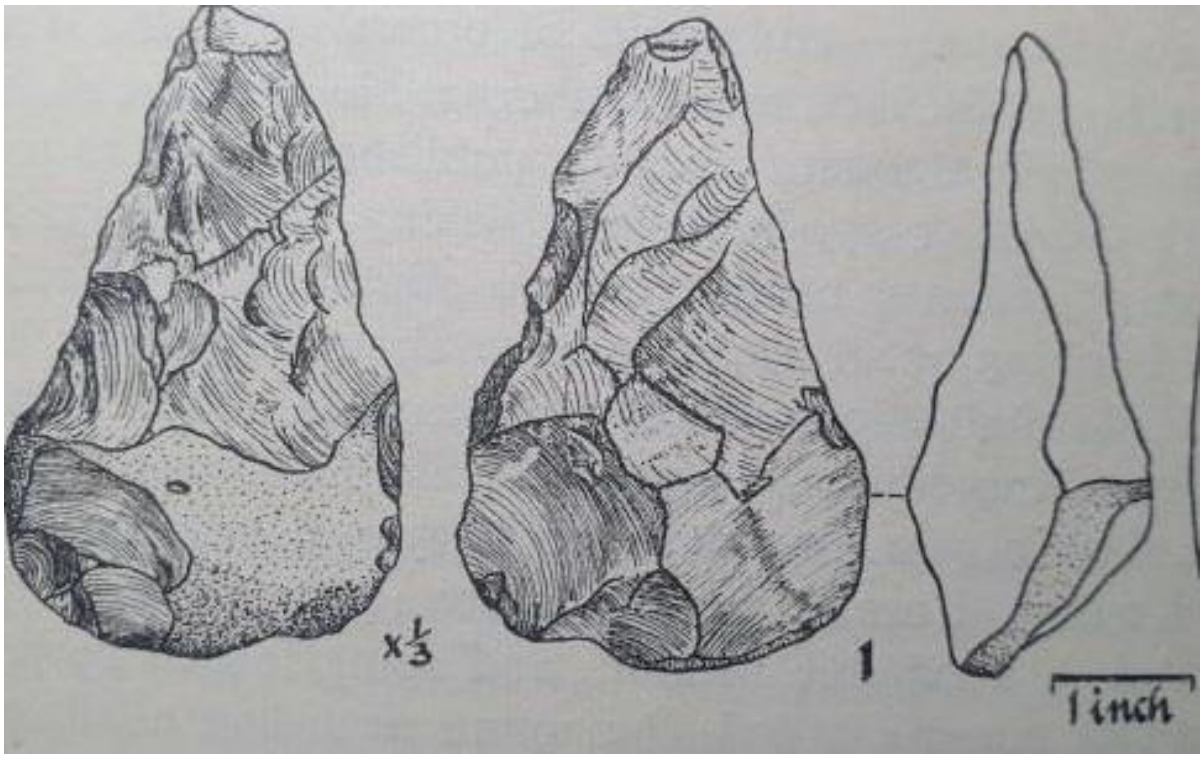
Between 1846 and 1879 William Pengelly of Looe, a Cornish geologist and archaeologist, worked on the sealed deposits in Torbay's caves, including Kents Cavern. He was the first to demonstrate that human-made tools were found in 500,000 years old layers, contemporary with the bones of large extinct mammals like cave bear, cave lion, and woolly rhinoceros, and that human occupation of Britain was therefore considerably older than had been hitherto supposed. Britain then was still attached to mainland Europe by the great land bridge.

William Pengelly, 1812-1894, a Cornishman, from East Looe, was one of the great pioneer archaeologists, not just making the momentous discovery of human artefacts intermingled with extinct prehistoric fauna at Kents Cavern, Torbay, but also developing techniques of excavation and recording that form the basis of modern archaeological method. (Picture courtesy and copyright of Torquay Museum.)

The makers and users of those tools at Kents Cavern were probably *Homo heidelbergensis*, who had branched from *Homo erectus* (below) between 1,000,000 and 750,000 years ago (Rightmire 2020, fig 2). As they were hunter-gatherers, they may well have made their way to what is now West Penwith, just 150 kilometres, or 90 miles, west of Torbay.

A palaeolithic artefact at Lower Leha

An Acheulian flint hand-axe was found at Lower Leha in St Buryan (SW 50578 27579) in the 1950s (Guthrie 1960). Such artefacts are presumed to be of the Hoxnian inter-glacial period, c225,000 BC, when typical temperatures were similar to or a little warmer than today. Acheulian hand-axes had been first made by that ancestor of *Homo heidelbergensis*, *Homo erectus*, or 'upright man'. There is as yet no direct evidence (in the form of fossil bones) that *Homo erectus* ever reached Europe, let alone Britain, but their descendants, like *Homo heidelbergensis* did.



Acheulian hand-axe of around 200,000 to 225,000 BC from Lower Leha in St Buryan (from Guthrie 1960).

It is not possible to reconstruct Lower Palaeolithic life in west Cornwall from a single hand axe. There is even a possibility that it had been brought to Cornwall by a collector and discarded (Dr John Coles in Guthrie 1960, 177). But other hand axes have been found in more secure contexts elsewhere in Cornwall (Berridge and Roberts 1986, fig 1) making it more likely that the St Buryan find is genuine and that at least one group of early people, possibly *Homo heidelbergensis*, as at Kents Cavern, made their way to what is now Lower Leha.

Homo erectus and their followers walked erect and could run long distances; their hairlessness allowed them to stay cool by sweating, giving them a distinct advantage over both prey and predators. Their robust digestion and varied diet enabled them to adapt to habitats and so disperse from their African homeland. Careful examination of evidence from elsewhere by archaeologists and anthropologists shows that they

appear to have lived in large groups (to around 100), divided labour between men (hunting and fishing) and women (gathering) and worked cooperatively. A growth plateau from around ages 5 to 12 (when children ceased to grow significantly before growing rapidly in their adolescent spurt) suggests parental and societal investment in developing individuals through prolonged education and socialisation. From this it is presumed that *Homo erectus* was capable of complex communication, including language (Veldhuis *et al* 2020; Middleton and Anton 2014).

Changing coastlines exemplify massive differences from our world

In the long period during which people may have been around in what is now west Cornwall, from around 500,000 years ago, some of the changes in sea-level and environment were huge. They are vividly presented in a sequence of maps prepared by the Natural History Museum of London based on collations of numerous studies of indicators of sea-level, climate and fauna and flora (*https://www.nhm.ac.uk/discover/the-making-of-an-island.html*).

At the start of their sequence Britain was still attached to mainland Europe by a land bridge in south-east Britain. That bridge had expanded greatly by 450,000 BP as a great ice sheet caused sea levels to drop substantially; Britain became too cold for humans to survive. Thawing of the ice caused flows that scoured out the English Channel at around 400,000 BP. By 125,000 BP sea levels were higher than now and lions and hippopotamuses were stranded on Britain, but by 60,000 years ago the ice caps had returned and had drawn up sea water again so that the British Isles were all one with each other and with Europe.

After 60,000 years ago and before the end of the Ice Age people were able to return to Britain only sporadically, as brief improvements in temperature allowed. These included periods when some reused Kents Cavern. Their economy included tracking and killing the large mammals that form the most visible remains of their food, their bones. Those included mammoth, red deer and horses as well as hyena, hare and rhinoceros. The people themselves were carefully disposed of when they died, the bodies of some being skinned and dismembered before being placed within caves. This was the period when these hunter-gatherers deployed representational art, including by carving on bones or painting in caves. As Cornwall has no suitable caves and its acid soil destroys bone, we have no evidence of any of this, but that is not to say Cornwall was not included in the territories of these widely ranging groups (Pettitt and White 2012).

Later palaeolithic West Penwith

At St Loy in St Buryan pollen has been recorded and identified from deeply buried soils on the edge of the boulder beach that have been radiocarbon dated to c 29,000BP, in the final Pleistocene cold stage. The pollen indicates Arctic tundra grassland, with grasses and small herbs like *Solidago* (goldenrods), buttercups and yarrow. Bur reed and pond weed show that there were pools of standing water (Straker 2011a, 68; from Scourse 1999).

Any Upper Palaeolithic people who made their way into such tundra, in the flickerings of warmer weather that punctuated the late Ice Age would have been, like us, *Homo sapiens*. Upper Palaeolithic flint tools have been found elsewhere in Cornwall and on Scilly (Berridge and Roberts 1986, 8-9) and a find has reportedly also been made in St Buryan, though no details were given (Hosfield *et al* 2008, 39).

The Upper Palaeolithic period is broadly from 40,000 to 10,000 BP (i.e. Before Present, or Before Physics, generally accepted as being before 1950).

By 20,000 BP the last Ice Age was at its most severe and an ice sheet reached almost to the northern edge of what is now West Penwith. People were driven by the cold from Britain, and only returned when the Holocene began.

Upper Palaeolithic people are presumed to have been 'hunter-gatherers', moving through the country in a nomadic way informed by close knowledge of resources and their seasonal variability. Their journeys would have responded to the annual and seasonal rhythms that would have made these people familiar with landmarks, productive, sheltered and comfortable places, activity areas, and personally and communally significant places.

The animals that were hunted are presumed to have included reindeer, aurochs (or wild ox; *Bos primigenius*), red deer and wild horse, and not, as was once thought, the ibex and woolly rhinoceros (Yalden 1999, 41). There were other animals beside the ungulates, notably their other hunters, the carnivores, with whom people were competing, and some of which they themselves had to take great care of. These included the lynx, brown bear, wolf, red fox, arctic fox and wolverine (ibid, 41-43).

Their most reliable and consistent source of food was probably from plants, fish, birds and smaller mammals, not from the larger mammals that we know they also hunted or exploited (perhaps sometimes when already dead). Recognising the significance of the 'gathering' element of their economy encourages us to think harder about the range of resources that people (and other animals) drew from, and it also places greater emphasis on the activities of women, and children, who are expected, on the basis of ethnographical parallels, to have been extensively involved in the gathering side of the palaeolithic economy.

While numbers may have been low, even these people would have affected change in the 'natural' world, creating trackways, predating animal populations and harvesting and affecting the growth of plants. Of course, all such changes were swept away as the last and coldest stage of the Ice Age forced palaeolithic people out of Britain. Other sociable, cooperative groups of hunter-gatherers, their Mesolithic successors, dominate the next period of West Penwith's development. It should be noted that the forms of the flint tools of the first Mesolithic people appear to have developed from those made and used by Upper Palaeolithic people (Berridge and Roberts 1986).

Mesolithic: Hunting, gathering, and changing the environment (c10,000 to 4000BC)

The start of our own geological epoch, the Holocene, occurred around 11,650 years BP (Before Present, i.e. before 1950), or around 9700 BCE (Before the Christian Era). People moved back into Britain after the last glaciation around 10,300 BP (8,300 BC), at first occupying, in a mobile, nomadic way, the south-east of Britain, and reaching Cornwall and the South West shortly after (Hosfield *et al* 2008).

The Mesolithic semi-natural environment: forest or wood pasture?

Those first or Early Mesolithic peoples were in Britain during the earliest post-glacial Pollen Zone, the Pre-Boreal, when plant communities rapidly succeeded each other as the land cover changed from the late glacial tundra to grasslands, scrublands, and then birch woods. This rapid environmental change ran for a few hundred years from the later 9th into the earlier 8th millennia BC.

The Later Mesolithic period (in Cornwall running to between 6000 and 5500 BP, or 3500BC) is usually characterised as one with fairly stable woodland-dominated land cover, where the birch woodland was replaced by pine and then in the Atlantic Pollen Zone, around the transition to the earlier Neolithic period, a more mixed and ultimately a largely deciduous, oak and hazel-based woodland.

The Franz Vera wood pasture hypothesis

Until recently, when Franz Vera proposed an alternative hypothesis (Vera 2000), it was widely presumed that such woodland was quite continuous, with a form of closed canopy, except in the most exposed upland places or where temporary glades were created by tree fall, lightning-strike induced fires, etc.

Vera suggested that grazing animals, especially herds of wild ungulates, would have contributed to the establishment and maintenance of a much more open woodland, resembling wood pasture, but with areas of denser woodland confined to places where grazing was less easy, such as on steeper slopes.

The established closed-canopy view was based on the principles of vegetational succession whereby waves of colonist plant communities are successively replaced by others until the climax vegetation type for any given area is reached, essentially the one whose height allows tall plants to outcompete all others by monopolising access to light. Such a climax vegetation is often presumed to be that closed-canopy woodland.

> ‘It is a generally accepted theory that in the natural state, i.e. if there had been no human intervention, the lowlands of Central and Western Europe, with their temperate climate, would have been covered, in places where trees can grow, with deciduous forest’ (Vera 2000, 1).

Vera emphasised that this is actually an interpretation, or a theory, and he proposed his hypothesis as an alternative theory. He noted that large herbivore animals including the grass-eating aurochs (*Bos primigenius*), tarpan or wild horse (*equus przewalski gmelina*), and European bison (*Bison bonasus*), and the browsers of woody vegetation the red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), elk (*Alces alces*), wild boar (*Sus scrofa*; an omnivorous creature) and beaver (*Castor fiber*) had been in the areas supposedly covered by climax deciduous woodland for

several thousand years beforehand and that most of these animals remained in Europe right through to the Middle Ages.

He also noted that pedunculate oak (*Quercus robur*), sessile oak (*Quercus petraea*) and hazel (*Corylus avellana*), European woodlands' principal trees, struggle to establish themselves in glades and yet they dominated the pollen record of large areas. He further noted that these three dominant tree species also thrive in more open wood pasture and that hazel only flowers, and so only produces pollen, when it receives sufficient sunlight: in other words, when growing outside of a closed canopy space.

Vera's alternative theory or hypothesis therefore proposed that there was before people commenced agriculture no extensively continuous closed-canopy woodland but instead a much more varied land cover that may have been dominated by natural wood pasture in which the grazing that maintained its character, and its greater biodiversity (relative to that of closed-canopy woodland) was done by the original or native, undomesticated herbivorous fauna (Vera 2000, 1-8).

Longhorn cattle in parkland at Trewithen, Probus. Aside from the fences, this scene may resemble the early post-glacial wood pasture, with a mosaic of grassland, scrubland, woodland and scattered spreading trees hypothesised by Franz Vera.

Vera suggested that grass pollen is under-represented in wood pastures because intensive grazing reduces its flowering and thus its pollen generation. He may have downplayed the role of another large mammal in determining the form of post-glacial vegetation, *Homo sapiens*, who may have contributed to extinctions of mega-fauna like the woolly mammoth, woolly rhinoceros and Irish Elk (Yalden 1999, 57) and may have also increasingly controlled or domesticated grazing animals as part of their own strategy. Humans may also have deliberately deployed fire to clear areas for grazing, having observed the effects of natural fire.

The debate on Franz Vera's hypothesis continues; pollen evidence (high oak and hazel with low grassland figures) has been deployed to counter it, especially when using samples from Ireland where it is believed that no large herbivore mammals existed in the early Holocene and yet oak and hazel dominated pollen records in ways very similar to mainland Britain (Mitchell 2005).

Nevertheless, it is increasingly believed that the old model of continuous closed-canopy high forest is no longer sustainable. More nuanced reconstructions of early Holocene woodlands are needed that recognise greater variety across Europe. Central Europe may have had more continuous dense and high forest while Atlantic regions, including West Penwith, had lower and more open or fragmentary woodland cover, forming an element of a mosaic of land cover that included extensive grasslands (Sandom *et al* 2014).

The arrival and spread of tree species

Harry Birks in 1989 analysed the results of 135 radiocarbon dated pollen studies across the British Isles to produce simple maps showing the gradual migration of selected significant tree taxa. Two of those sites were Hawk's Tor and Dozmary Pool on Bodmin Moor – there was none from further west in Cornwall. Birks' aim was to produce relatively simple images of the spread of trees in the earlier Holocene, i.e. before the Climatic Optimum.

Perhaps surprisingly, there was no standard mode of colonisation; instead, each species of tree had its own pattern of colonisation (Birks 1989, 521). This extends to substantial differences in the points of entry into the British Isles: Birch (Betula) from the east; pine, elm, alder, lime, ash and beech from the south-east, and oak and hazel from the south-west, including Cornwall (*ibid*). Timings also vary considerably, from 10,000 BP for the arrival of birch to 3000 BP for beech.

Hazel (Corylus avellana).

Hazel is a frost-sensitive tree. Initial dispersal was probably by animals (birds, rodents, etc), water and possibly by humans (as hazelnuts were an important element of the Mesolithic diet). It 'first became established in the British Isles around the Irish Sea basin and along the western seaboard of Scotland and subsequently spread inland eastwards and westwards' (Birks 1989, 508, and fig 3).

Elm (*Ulmus*)

Present in southern England by 9500 BP, spreading rapidly. Dramatic decrease in numbers (but not extent) between 5500 and 5000 BP (Birks 1989, 511 and fig 4)

Oak (Quercus)

Oak was present in south-west England by 9500 BP, the earliest record for the British Isles and spread quickly northwards. Which species the earliest oaks were is unknown (Birks 1989, 511 and fig 5).

Pine (Pinus sylvestris)

In southern England by 9000BP. Possibly a separate Scottish pine population that may even have survived the glaciation in sheltered parts (Birks 1989, 513-5, and fig 6).

Alder (*Alnus glutinosa*)

In Cornwall after 7000BC, spreading from the east (Birks 1989, 515-517 and fig 7).

Lime (*Tilia*)

In south-eastern England by 7500 BP, but not in Cornwall till after 6000 BP (Birks 1989, 517 and fig 8)).

Ash (Fraxinus excelsior)

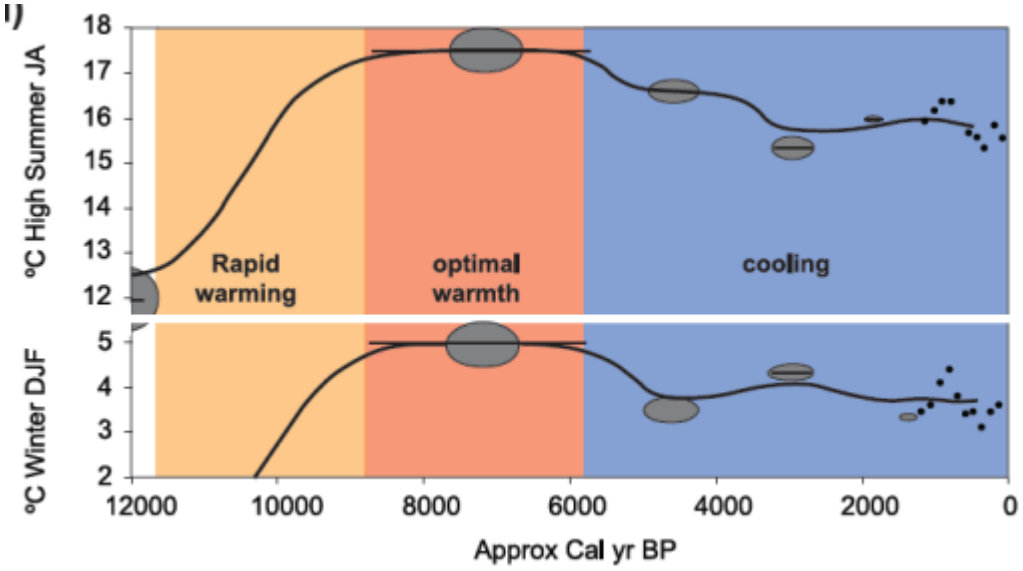
In eastern and central England by 6000 BP but not in Cornwall until after around 5000 BP (Birks 1989, 517, and fig 9).

The Holocene: established views of climate and vegetation change in Britain and Cornwall

Subdivision of the Holocene period, based originally on Scandinavian research, was initially tied to broad Pollen Zones (see table below) that reflected significant changes in climate, especially by Harry Godwin (1975 and 1977). Hubert Lamb was at the same time preparing improved reconstructions of prehistoric and historic climate change (1977).

The Holocene was divided by them into three main periods:

- Post-glacial rapid warming in the 12th to 10th millennia BP, broadly the Early Mesolithic period.
- 'A period of greatest warmth' between around 8500 to around 5500 cal BP, the Holocene Climate Optimum, broadly contemporary with the later Mesolithic period.
- A more gradual decline in temperature to the present day, from the Neolithic period onwards.



'Temperature curves estimated by Lamb (1977) from palaeobotanical and documentary evidence, ovals represent estimates of uncertainty based on both palaeobotanical indicators and chronologies. Timescales adjusted to cal yr BP from original published data.' (from Charman 2010, Fig 1d).

The model was inferred largely on the basis of pollen records and plant macrofossils. There has been little attempt to critique this model since Lamb, though more recent work has shown that while summer temperature started to decline c6000BP, the winter temperatures either continued to increase or showed little change (Charman 2010).

It seems that at around 6000 BP, culturally when the Mesolithic period of the hunter-gatherers was being replaced by the earliest agriculturalists and settlers of the early Neolithic period in Britain, maximum summer warmth was up to 1.8ºC above present-day temperatures, but winter temperatures may have been up to 1ºC cooler than today 'even during the so-called climatic optimum of the mid-Holocene'. Therefore 'the notion of a Holocene climatic optimum thus seems to apply only to northern summer temperatures. Europe as a whole did not experience a mid-Holocene climatic optimum, as warmth in the north was balanced by cooler conditions in the south' (Charman 2010, summarising Davis *et al* 2003).

See also the invaluable summary by Keith Wilkinson and Vanessa Straker of the environment, climate and sea-level changes in SW Britain in the earlier Holocene period (Wilkinson and Straker 2007).

Post-Optimum Climate Change: Neolithic to the present-day

Dan Charman (2010) has reviewed climatic changes in the British Isles over the last 4500 years using 'multi-proxy indicators' that include 'bog oak populations, peatland surface wetness, flooding episodes from fluvial deposits, speleothem band width and oxygen isotopes, chironomids from lake sediments and sand and dune deposition.' 'Most proxies reflect water balance rather than temperature alone, and records predominantly reflect warm season climate' (Charman 2010).

This is the first review of the evidence for the British Isles since 1977 (Shotton).

Patterns of temperature change drawn from this work can be summarised as follows.

- 'Relatively cool' before c. 3100 yr BP, i.e. 4500-3100, or 2500 BC to 1100BC, broadly the Bronze Age.
- 'Warmer' 3100 – 2000 BP, i.e. 1100BC to 0BC, broadly the Iron Age.
- 'Cool' 2000 – 1250 BP, i.e. AD 0 to AD 750, Romano-British and post-Roman/Late Antique.
- 'Warm' 1250 – 650 BP, i.e. AD 750 to 1350, Early Medieval and early party of Later Medieval.
- 'Cool' 650 BP to the present, i.e. AD 1350 to present, Latest Medieval, Post-Medieval and Modern.

Tying changes in vegetation and climate together through Pollen Zones

Pollen Zones have been used for over a century by palaeo-environmentalists to subdivide the Last Glacial Period and our own Holocene epoch. They broadly align with major changes in climate and summarise the plant communities known and exploited by people. The Zones were rationalised by Harrry Godwin in 1940 and J Iverson in 1954, working in Britain and Denmark respectively, to produce the following sequence of west European Pollen Zones. (Detail is necessarily smoothened and some of the dates may be subject to revision.)

Zone	Biostratigraphic division	Dates	Dominant plant type	Archaeological periods	Geological stage
IX	Sub-Atlantic	500 BC to present	Spread of grasses and pine and beech woodland	Iron Age onwards	Flandrian
VIII	Sub-Boreal	3000–500 BC	Mixed oak forest	Bronze Age and Iron Age	Flandrian
VII	Atlantic	5500 - 3000 BC	Mixed oak forest	Neolithic and Bronze Age	Flandrian
V and VI	Boreal	c.7700–5500 BC	Pine/birch forest and increasing mixed forest	Mesolithic	Flandrian
IV	Pre-Boreal	c.8300–7700 BC	Birch forest	Late Upper Palaeolithic and early–mid Mesolithic	Devensian glaciation and Flandrian
III	Younger Dryas	c. 8800 - 8300 BC	Tundra	Late Upper Palaeolithic	Devensian
II	Allerød oscillation	c. 9800 - 8800 BC	Tundra, Park Tundra and birch forest	Late Upper Palaeolithic	Devensian
Ic	Older Dryas	c. 10,000 - 9800 BC	Tundra	Late Upper Palaeolithic	Devensian

Zone	Biostratigraphic division	Dates	Dominant plant type	Archaeological periods	Geological stage
Ib	Bølling oscillation	c.10,500–10,000 BC	Park Tundra	Late Upper Palaeolithic	Devensian
Ia	Oldest Dryas	c.13,000–10,500 BC	Tundra	Late Upper Palaeolithic	Devensian

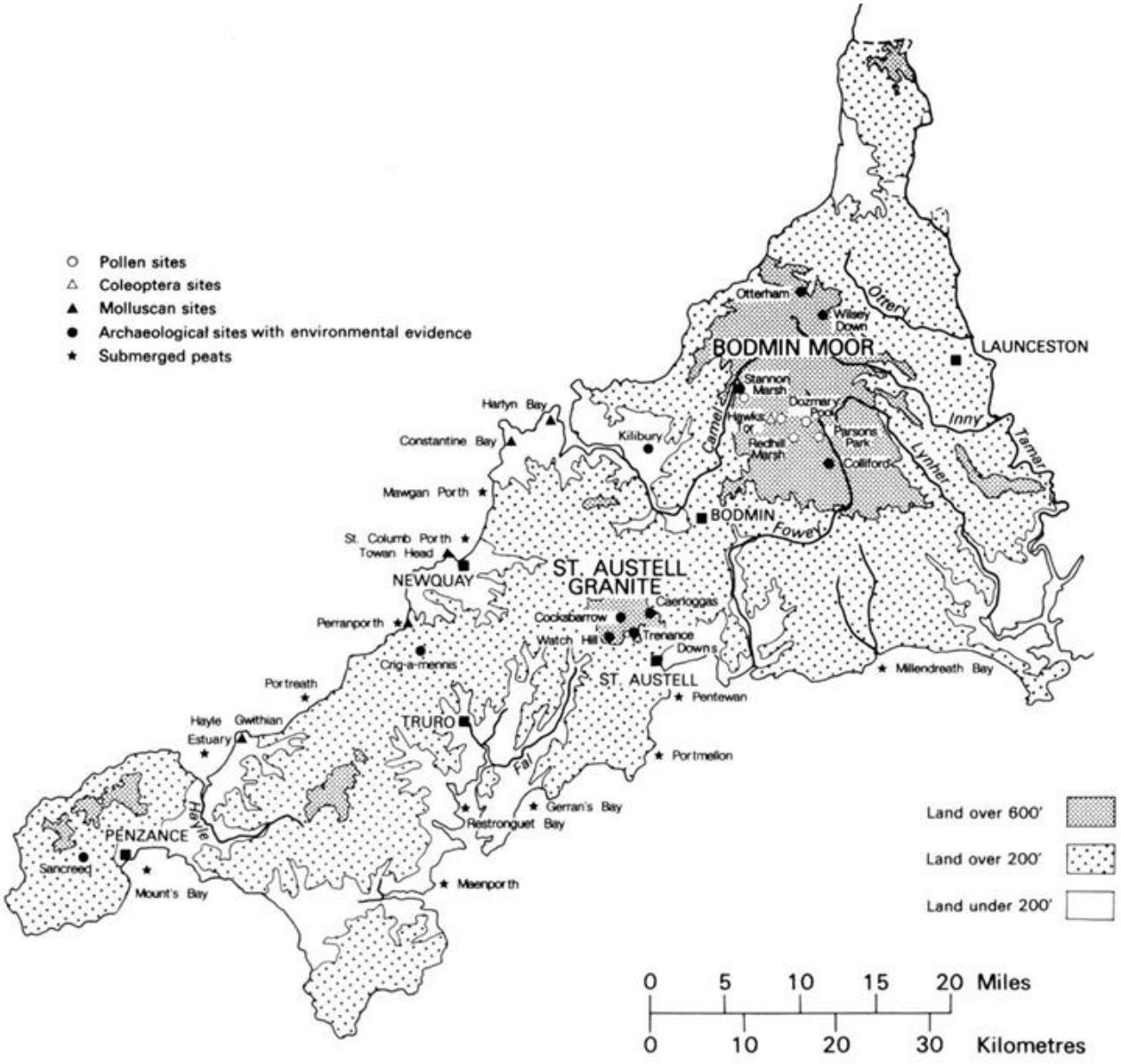
Chris Caseldine's 1980 baseline view of Cornwall's environmental history

For a conventional or foundational narrative of the environmental history of Cornwall in the Holocene period, we can draw on Christopher Caseldine's 1980 review of the then previous work, mainly based on pollen analyses, but also the then less substantial work done with plant macrofossils, beetles and land snails (Caseldine 1980).

Much of Caseldine's account was grounded on pollen analyses of peat deposits on Bodmin Moor (Hawk's Tor, Dosmary Pool, Redhill Marsh and Parson's Park) plus the environmental evidence gathered on archaeological excavations elsewhere in Cornwall, including Colliford and Stannon Down on Bodmin Moor and Cocksbarrow, Caerloggas, Watch Hill and Trenance on the Hensbarrow granite.

Evidence from submerged peats in Mount's Bay was supplemented with information from other Cornish maritime sites. Molluscs had already been studied in some towans, including at Gwithian, and remains of beetles had been examined at Hawk's Tor. So, the basis for Caseldine's work was more limited than it would be now, as illustrated by Vanessa Straker's summary of the environmental history of west Cornwall prepared for the HEATH project (Straker 2011a). Nevertheless, it is a good place to start a review of what has been learnt in the last four decades and provides a useful framework within which to place the west Cornwall material summarised in this project.

Caseldine noted that there had been surprisingly limited palaeoenvironmental work in Cornwall and the south-west of Britain. He suggested that this was because those interested in developing long narratives of climate and vegetation change had concentrated their work in areas more directly affected by the Ice Age where deep peats developed in deep basins and beside lakes. Peats in the south-west are relatively shallow and commenced quite late (Caseldine 1980, 4-5). Exceptions examined on Bodmin Moor were recorded at Hawk's Tor in Blisland and Parson's Park in St Neot (Brown 1977).



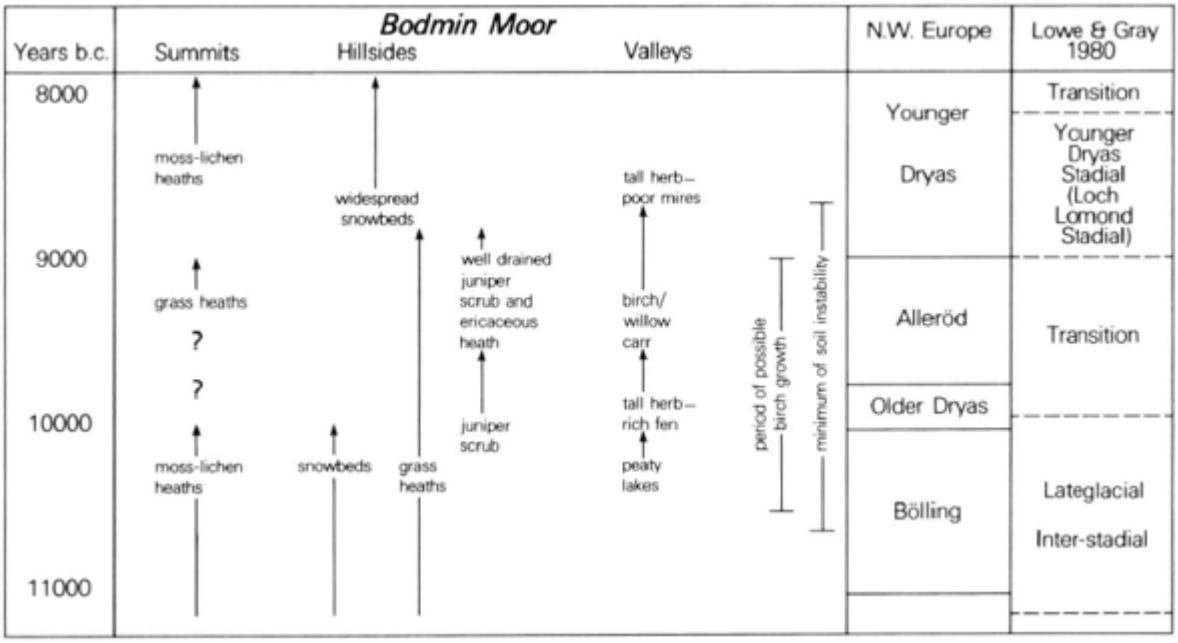
Sites in Cornwall where palaeoenvironmental work had been undertaken prior to 1980 (from Caseldine 1980, fig 1). The site at 'Sancreed' is Carn Euny and Caer Bran.

Early Holocene (c11,000 to 8000bc)

During the last glaciation, the Devensian (c70,000 to 10,000 BP) the ice sheet lay to the north of Cornwall which would have experienced 'an extremely severe Arctic climate with a landscape which could be described as that of a Polar desert' (Caseldine 1980, 7).

Brown's examination of the peat at Hawk's Tor (radiocarbon dated to 11,138 cal BC) suggested 'a rich herb flora in the form of open grassland' that was followed by juniper scrub by c10,000 BC and then scattered birch woodland, probably in valley carrs (waterlogged woods) on Bodmin Moor, by between 9500 and 9000 BC. It was felt that birch woodland may then have been more extensive in lowland Cornwall but the evidence was in 1980 unclear. There was another very cold spell, the Younger

Dryas stadial, at the end of the glaciation, radio-carbon dated at around 8934BC at Hawk's Tor (Caseldine 1980, 7-9).



A diagrammatic summary of late glacial environmental change on Bodmin Moor (Caseldine 1980, fig 2, based on the work of Brown 1977).

Early Flandrian (c8000 to c3000bc)

Again, the narrative prepared in 1980 for Cornwall's environment in the Mesolithic and early Neolithic periods, essentially the period of the Holocene Climate Optimum, was largely based on evidence from Bodmin Moor.

Temperatures rose rapidly after the glaciation to reach levels higher than the present day (the Holocene Climate Optimum), and tree species migrated into Britain 'taking advantage of lowered sea levels', levels that did not approximate those of the present day until around 5000BC. Sedge peat at Hawk's Tor radio-carbon dated to c7700 BC, when Mesolithic hunter-gatherer communities appear (from artefactual evidence) to have already been exploiting the Moor, contained pollen indicating juniper scrub and crowberry (*Empetrum)* heath, but no woodland. As birch woodland is known of at this time elsewhere in Britain it was thought that it may have been suppressed by exposure on Bodmin Moor's uplands.

Caseldine suggested that by the later 8th millennium, around 7000BC, oak and hazel would have been well established at lower altitudes and in sheltered sites, having no competition from conifers like pine that had not been able to establish themselves (Caseldine 1980, 10). On the uplands, woodland may never have been fully established, leaving these areas as grasslands and heathlands. 'One distinctive characteristic of the woodland communities, especially at higher altitudes, would have been their openness, and, possibly, their low species diversity' (Caseldine 1980, 10). It had been suggested by Ussher in 1879 that the tree line, presumably a broken line, may have been as high as 800 feet (244m).

Water levels fell at Dosmary Pool between 7000 and 4500 BC, in the Mesolithic period, suggesting a drier period, possibly the result of continental air masses dominating over ones from the Atlantic. Charcoal observed in the peat deposits was presumed to have originated from natural fires (Caseldine 1980, 10), but it is now increasingly recognised that hunters and gatherers used fires to manage vegetation and to drive prey animals (see below).

It is interesting that Caseldine envisaged a relatively open woodland on Bodmin Moor, not a closed-canopy woodland and instead something closer to the wood pastures that were to be later hypothesised by Franz Vera (see above).

[Note that deep ditches cut for the Stannon china-clay works on the northern slopes of Stannon Down at the 250m contour (i.e. 820 feet) cut through the trunks and limbs of one or two substantial trees, considered to be oaks by Dr Vanessa Starker, but not the masses of them to be expected from dense woodland (Herring 1998, 13; Nowakowski 2000, 38). It seems instead to have been a relatively open woodland, the sort of wood pasture envisaged by Caseldine.]

In their comprehensive and authoritative summary of palaeo-environmental work in south-west Britain, Wilkinson and Straker note that work in the great uplands of Dartmoor, Exmoor and Bodmin Moor indicate that woodlands had been disturbed and diminished before the end of the Mesolithic period (Wilkinson and Straker 2007, 69-70). It would be a surprise if the upland parts of West Penwith differed significantly from this pattern.

Evidence for the active clearance of so-called ‘wildwood’ is widespread in pollen and mollusc analyses of Mesolithic semi-natural environments. ‘Indeed almost every new pollen diagram – and mollusc analysis – of Mesolithic strata from the region contains peaks in microscopic charcoal or other floral/faunal indicators of clearance (Wilkinson and Straker 2007, 72). The discovery of charcoal fragments and dung beetles in a thick peat considered to be mid Holocene (i.e. late Mesolithic or early Neolithic) in what is now St Ives harbour ‘may indicate burning of vegetation to encourage grazing’ (Straker 2011a, 69; Gilbert 1995).

Palaeo-environmental evidence for Mesolithic West Penwith

There is limited palaeoenvironmental evidence for the Mesolithic period in West Penwith. The earliest is from towards the end of the period, from peats, sands, gravels and clays at Marazion Marsh and nearby Newtown. On the downlands of West Penwith, the only possible Mesolithic evidence comes from the very earliest levels of the peat core taken at Treen Common in Zennor.

Coastal woodland

A wooded landscape appears to have existed in the later Mesolithic on the edge of what is now Mount’s Bay.

Palaeo-environmental work was undertaken on cores taken during the archaeological and geo-archaeological investigations in the vicinity of a Bronze Age barrow on the low-lying ground between Ponjou and Gulval churchtown, site of the **Penzance Heliport**. They indicate that in levels which have been radiocarbon dated to the late 5th millennium cal BC (i.e. the later Mesolithic period) an alder and willow

woodland dominated in the wet ground and oak and Corylus-avellana type woodland (probably dominated by the hazel) occupied the drier ground nearby.

At **Newtown in Ludgvan**, west of Marazion Marsh on the wet lowlands inland from the shore of Mount's Bay, coring of peats and silts produced a vegetation history through pollen analysis that commenced in the Mesolithic period (radio-carbon dates of 5060-4850 cal BC) and presumably ran into the earlier Neolithic. There was minimal pollen from either grassland and heathland, but the alder and willow may have colonised a wetland that was initially a 'grass-sedge fen' (Scaife and Langdon 2023, 64-66). There was also pollen (in smaller amounts) from pine (*Pinus*) birch (*Betula*), ash (*Fraxinus*), lime (*Tilia*), holly (*Ilex aquifolium*) and ivy (*Hedera helix*) (ibid, fig 6.2).

The dominant dry-land tree was *Corylus avellana*-type, usually regarded as Hazel, though the pollen is difficult to distinguish from *Myrica gale*, the Bog Myrtle (see Later Neolithic for discussion). It should also be noted that the original assessment of the cores from this site included pollen from spruce (*Picea*) (Allen et al 2020).

	Raw Data	% Data
Betula (Birch)	6	3.8
Pinus (Pine)	15	9.6
Picea (Spruce)	1	0.6
Quercus (Oak)	5	3.2
Ilex aquifolium (Holly)	2	1.3
Alnus glutinosa (Alder)	20	12.7
Corylus avellana type (Hazel or Bog Myrtle)	95	60.5

The records of *Pinus* and *Picea* (pine and spruce) are of some interest.

All the members of the Pine family currently found in Cornwall are clearly introductions, neophytes, including the examples of Scots Pine (*Pinus sylvestris*), a species that Colin French recognised did exist in Cornwall 'early in the Holocene, but completely disappeared within a few thousand years' (French 2020, 91).

Pollen and diatoms (microalgae, unicellular organisms found in the soil, waterways and oceans) were sampled and analysed; they were taken from organic sediments behind a marine barrier at **Marazion Marsh**. Radiocarbon dates placed this towards the end of the Mesolithic hunting and gathering period, at the very end of the Holocene Climate Optimum (Healy 1999a; Straker 2011b, 164).

The pollen analysis shows a sedge-based vegetation being replaced by wet woodland, with alder (*Alnus*) the dominant tree (c60%) with oak (*Quercus*; 11%) also significant. Pine (*Pinus* 1%), elm (*Ulmus*) and ash (*Fraxinus*) were also present. Many of the tree pollen, aside from the wet-tolerant alder, probably came from the near vicinity rather than from the marshland itself. Shrub pollen included holly (*Ilex aquifolium*) and Common Juniper (*Juniperus communis*).

Common Juniper is no longer found in Cornwall and historical records are very limited: two plants at Par Sands in 1917 and 1930, and near Portreath in 1950. A subspecies, the prostrate Cornish Juniper (*Juniperus communis* subsp. *hemisphaerica*) developed on the Lizard peninsula and is clinging on (French 2020, 94).

On Treen Common in Zennor, however, pollen from the very end of the Mesolithic period indicates a 'largely open landscape, dominated by grasses and a variety of herbs' (Forster and Robinson 2011, 14). Such grasslands would have been kept open through grazing, presumably by ungulates.

Without earlier palaeo-environmental samples form West Penwith, it is not possible to say how far back those grasslands may be projected into the Mesolithic period, and thus whether wood pastures were typical throughout, and whether the ratio of grasslands to other habitats increased as people manipulated the semi-natural environment.

See Appendix 1 for more details.

Archaeological evidence for the Mesolithic in West Penwith

Flints and other artefact scatters comprise the principal archaeological evidence for the Mesolithic period in west Cornwall.

Early Mesolithic flint forms were developed from the preceding Upper Palaeolithic 'industries' found across northern Europe. They are based on relatively broad blades and feature microliths of the obliquely blunted point and isosceles triangle forms, often significantly larger than the narrower-bladed microliths of the later Mesolithic, below. Obliquely blunted points are presumed to have been hafted in combination to create a multi-barbed hunting tool (arrows, spears, harpoons), or mounted in other ways to form knives or sickles (Hosfield *et al* 2008).

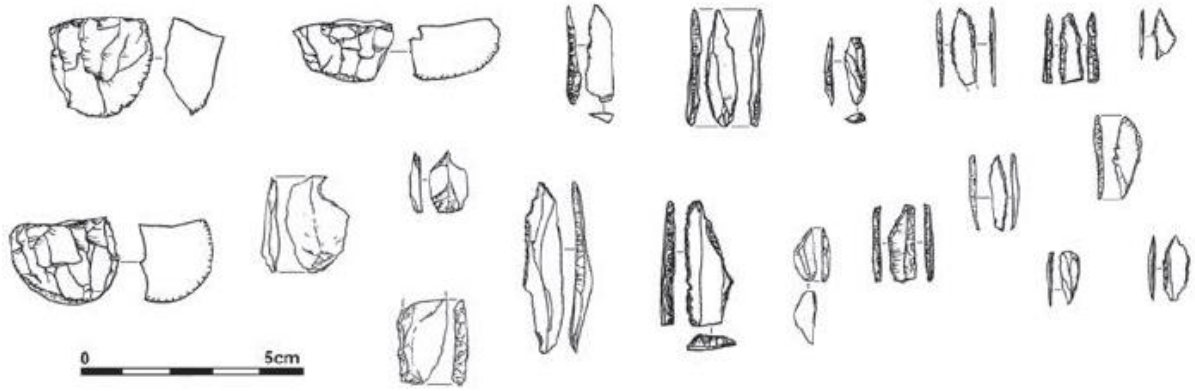
The flint employed in Mesolithic Cornwall appears to have been almost wholly derived from the beach pebbles found on its shores. As noted, these (and numerous other types of pebble) were especially common on the shore of Mount's Bay between Penzance and Marazion (Borlase 1758, 106).

Field walking by Graham Hill and Dave Edmunds around Clodgy Moor and Trungle Moor in Paul parish resulted in the collection of over 700 Mesolithic flint artefacts. They were predominantly but not exclusively Later Mesolithic and were mainly microliths, micro-burins, awls and scrapers. Micro-burins were normally part of the waste material created when fashioning microliths, and the other tools, especially awls and scrapers, were used to process food and other materials (Jones *et al* 2013).

Most of the Clodgy Moor concentrations of Mesolithic artefacts were near springs and streams, often in sheltered spots. One site, with the highest number of flint tools, included some that may have been affected by heat, suggesting the presence of fire, possibly contained in hearths and thus the possibility that there may even have been structures; possibly a place that was regularly returned to (ibid).

The pattern and density of Mesolithic sites in this part of West Penwith is similar to that at Butterstor on Bodmin Moor (Herring and Lewis 1992, fig 1). Unlike in Clodgy Moor, where there has been much post-Mesolithic disturbance, primarily by agriculture, the Butterstor scatters appear to have lain undisturbed in downland that had only ever been used subsequent to the Mesolithic period for extensive grazing.

They were therefore remarkably discrete scatters often covering areas less than 1 metre across, and often only 10 or 20 metres apart. This density of scatters was used to develop an estimated total of around 140,000 similar scatters across all of Bodmin Moor, an area a little smaller than West Penwith.

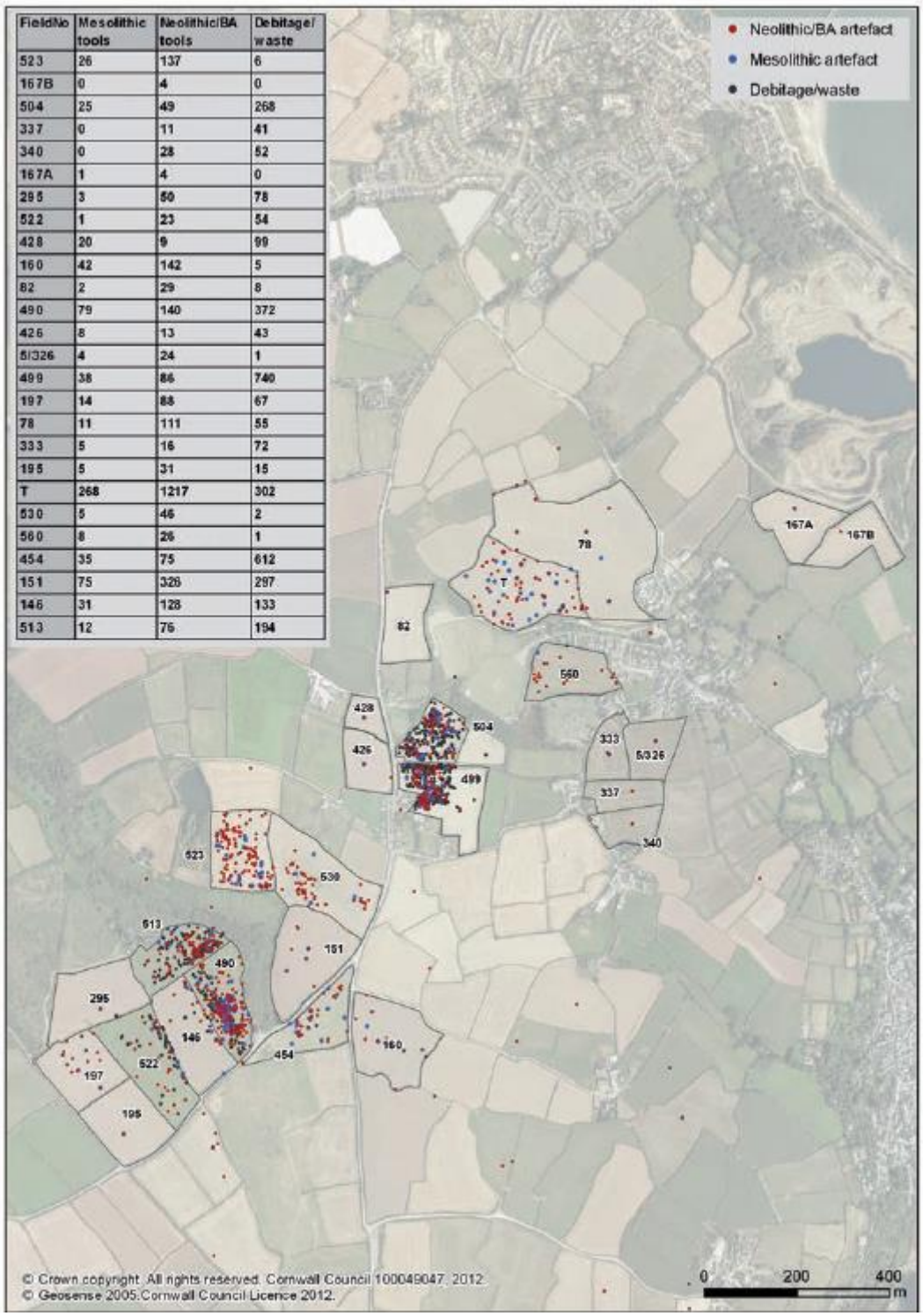


Sample of flint artefacts – cores, micro-burins and microliths – from field walking at Clodgy Moor (from Jones et al 2013, illustration 6. © Cornwall Archaeological Unit, Cornwall Council).

Tens or even hundreds of thousands of Mesolithic artefact scatters and the activity areas they represent may then be expected in the West Penwith peninsula. Such numbers seem large initially, but the period lasted around 4000 years and if the projected 140,000 scatters on Bodmin Moor were formed at an even rate then just 35 scatters needed to be created each year (Herring and Lewis 1992). The projected high numbers of Mesolithic scatters appear to be borne out by those flints routinely encountered on excavations as 'residual' items in the background soil of a later site, or picked up where people pass over disturbed ground on paths and in gateways.

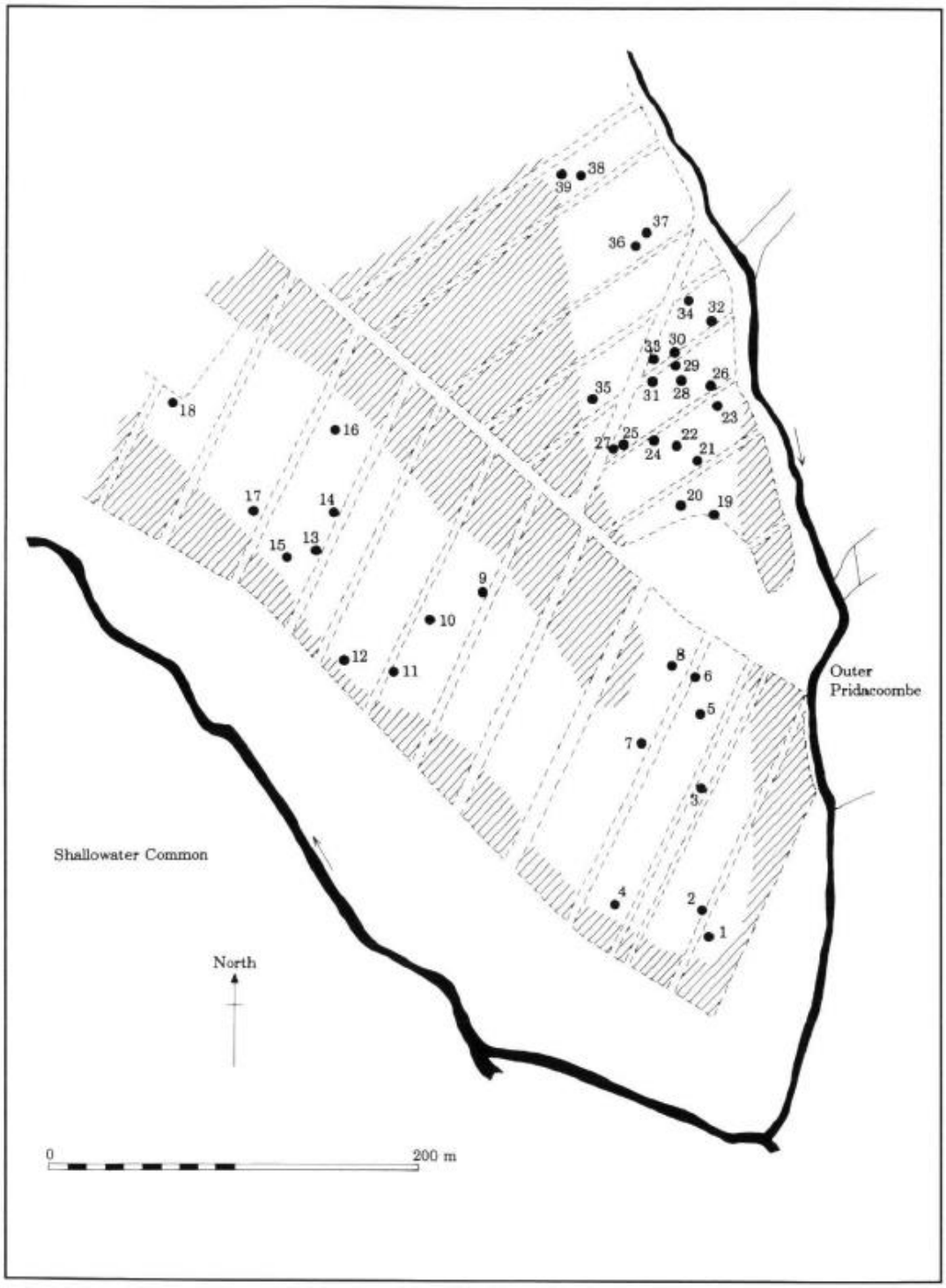
'People in the Mesolithic period… seem to have followed the seasons as they moved around what were probably quite large territories running from the high ground down to the seashore, exploiting plants and animals as they became available. Close familiarity with and understanding of the natural world would have been essential, and it would not be surprising if Mesolithic people began to query and develop stories to interpret some of the features they encountered as they moved around their world: the tors in particular, with their stacks of large granite slabs, apparently carefully piled on top of each other, might have intrigued them, as they later intrigued those who invented and passed on folk tales' (Herring 2011a, 26).

The CSHER includes records of scores of Mesolithic flint sites in West Penwith additional to those around Clodgy Moor. The earliest systematic field work was done by JG Marsden (1920) who found 'several thousand' flints, including numerous Mesolithic microliths (termed by him 'pygmy flints') in the parishes of St Levan (where he lived), St Buryan and Sennen.



FieldNo	Mesolithic tools	Neolithic/BA tools	Debitage/ waste
523	26	137	6
167B	0	4	0
504	25	49	268
337	0	11	41
340	0	28	52
167A	1	4	0
295	3	50	78
522	1	23	54
428	20	9	99
160	42	142	5
82	2	29	8
490	79	140	372
426	8	13	43
5/326	4	24	1
499	38	86	740
197	14	88	67
78	11	111	55
333	5	16	72
195	5	31	15
T	268	1217	302
530	5	46	2
560	8	26	1
454	35	75	612
151	75	326	297
146	31	128	133
513	12	76	194

Distributions of flint artefacts collected in the Clodgy Moor project. Mesolithic artefacts are coloured blue; Neolithic and Bronze Age are red (from Jones et al 2013, illustration 2. © Cornwall Archaeological Unit, Cornwall Council)



Pattern of predominantly Mesolithic flint scatters on the southern part of the rounded downland of Butterstor, St Breward, Bodmin Moor. The black lines are streams, the rectangles picked out with broken lines are areas deep ploughed for forestry and the cross-hatched areas are deep peat where no flint finds could be expected. Note how numerous are the scatters, and how a cluster of scatters was found beside the eastern stream, sheltered from the prevailing wind. This may have been a place that groups of Mesolithic nomadic people resorted to regularly (from Herring and Lewis 1992, fig 1).

Hunting and gathering: Mesolithic people's relationship with their semi-natural environment

'Hunter-gatherer' is one of the most evocative and enduring terms in archaeology and ethnography. It succinctly captures the economy and behaviour of all the people who preceded and in most parts of the world have been displaced by the more sedentary agriculturalist. Their way of life had prevailed for a period of around 2 million years and many adaptations of body and brain were determined by the needs of hunting and gathering.

The term hunter-gatherer recognises a means of obtaining sustenance by foraging for food-stuffs and normally living a mobile life with no permanent settlements and few structures and quite minimal and portable material culture. Some archaeologists reverse the words – 'gather-hunters' – to emphasise that it may have been gathering that dominated over hunting in terms of acquiring foodstuffs, and to suggest that the semi-natural environment may have been perceived by gatherer-hunters as a fundamentally 'giving' environment, acting rather like a caring parent, and one of their most important voluntary behaviours was itself giving or distributing – to other groups and individuals (e.g. Bird-David 1990).

A valuable recent paper discusses how hunter-gatherers, gatherer-hunters, or 'foragers', are often much less passive consumers of nature's gifts and instead turn it into semi-nature by constructing 'niches' and so change or even transform places and the wider environment (Nikulina *et al* 2022). Niche construction has been defined as 'the process whereby organisms, through their metabolism, their activities and their choices, modify their own and/or other species' niches' (Odling-Smee *et al* 2013).

The human hunter-gatherer was one among many other omnivorous animals, but their effects on the world have been disproportionate in relation to their strength and speed. Their ability to respond to their needs more imaginatively and more strategically appears to stem from two abilities that distinguishes the human from other animals: complex scenario building and exchanging complex thoughts with others. Associated with these are other distinctively human things like complex language, foresight, culture and morality. While many animals 'are smarter than widely thought' and can be shown to remember, communicate, have empathy, develop and follow tradition, and deploy both social and physical reasoning in certain situations, it does seem that only humans can 'form nested scenarios, an inner theatre of the mind that allows us to envision and mentally manipulate many possible situations and anticipate different outcomes' (Suddendorf 2018).

What did hunting and gathering involve?

The term hunter-gatherer simplifies a complex way of living, filled with excitement and fraught with risks and dangers, with fewer certainties than in the simpler lives of most modern people. Even if attention is confined to the functional, or economic aspects of hunting and gathering, the life was astonishingly varied, and rich in situations that required the ability to rapidly assess scenarios for their risks and opportunities, and which required good communication between individuals and among groups.

For example, the 'hunting' element includes tracking, pursuing, trapping, netting, shooting, and other ways of capturing, controlling or killing creatures, and the different means of preparing for and doing each of those for each of the prey animals

sought, from small birds to large and dangerous ones, freshwater fish to sea fish and shellfish, sea mammals like seals to land mammals ranging from large ungulates to small rodents. Then there were the many ways that the prey, if killed, was processed and used, including skinning, gutting, butchering, preserving or caching, rendering fat to make oil, cooking and sharing / exchanging. In addition, some meat and animal materials, like skins, were obtained not through the killing of living animals, but through scavenging for creatures already dead, including those killed by other predators (e.g. Binford 1986).

While the variety of potential foodstuffs was at many times enormous, it does seem that human groups considered the range of risks and benefits and narrowed these down by acting strategically and developing specialisms: concentrating much attention on a few prey and plant types and developing tools and tactics that enabled them to be as successful and thus as resilient as possible (Mithen 1990).

The erect gait and relatively hairless bodies of early (and later) hominids made them well-adapted for the long endurance running required to wear out hairier prey animals that were less able to cool themselves by sweating and so suffered exhaustion sooner (Liebenberg 2006).

Hunter-gatherers may have developed other exploitative or symbiotic relationships with animals and plants as elements of ‘nested scenarios’. Those could have included those that flowed from creation of improved and more palatable grazing (by clearance, or by burning) in order to create closer relationships with the large animals that may have been among the humans’ principal prey. Or it could have included the taming, controlling and training of animals like wolves and dogs to provide security and to herd and pursue other animals. Or the taming of some birds to lay eggs; the capturing and tending of bee swarms to facilitate harvesting of honey; even the milking of ungulates and using the milk gained to prepare dairy foods that could be stored for use in the leaner periods of the year.

Both gathering and hunting involved moving through the land, probably led by the animals, who would have established trackways that people adopted and eventually turned into their own thoroughfares, some of which may still survive today as paths, lanes and even roads (Bell 2020; Lykke Syse 2022).

Because of the acid soils there are no bones of Mesolithic animals in West Penwith. Elsewhere in Britain the fauna was ‘that of a temperate forest’: red and roe deer, elk (perhaps principally in northern parts of Britain), aurochs, and wild boar were the ungulates, and other mammals included beaver, hare, pine marten, badger, wolf, red fox, brown bear and hedgehog (Yalden 1999) and it is reasonable to expect the same to have inhabited West Penwith.

The ‘gathering’ word also subsumes much within it: a mass of ways of drawing food from plant life, from fungi to roots, stems, leaves, fruits (including nuts and seeds) of a great range of plants that people learned were edible. The activity also involved learning those sources of food that were not edible or even poisonous (like they had also learned about those hunted or encountered animals that posed their own particular dangers for people). Again, the knowledge that people would have developed for themselves or learned as part of their society’s culture would have included ways of encouraging plants that were especially good for them.

Some may regard hunting and gathering as a primitive form of life, though in doing so they disregard the complexity of knowledge, tactics and strategies required to

sustain a life through the seasons and through lifetimes that included nurturing initially utterly dependent children to adulthood. Hunter-gatherer society appears from ethnographic study to have normally been quite egalitarian, especially in comparison to the societies of many agricultural peoples. Leaders appear to have been recognised in a fluid way – someone might lead in certain activities or at certain times and not at others.

It is salutary to note that the hunter-gatherer life, as broadly defined above, was an exceptionally long-lived one, occupying the vast majority of human history, with other strategies occupying considerably less than 1% of the time people have been on Earth.

Hunting and gathering also seems to have been an essentially sustainable life, it not being in the group's interest to jeopardise future years' harvests or prey by over-exploitation. However, there are some significant extinction events that may be attributed, in part at least, to the activities of hunter-gatherers, most noticeably, at the end of the last Ice Age. These included the extinction of the 'mega-fauna' that included the mammoth, giant deer, woolly rhinoceros, cave bears, cave lions and cave leopards. There is archaeological evidence that human groups did predate at least some of these. Those mega-fauna that were predators may, however, have become extinct as their principal prey disappeared, and the effects of a suddenly significantly warmer climate on animals whose thick woolly fur was an adaptation to prolonged cold conditions may have been another significant contributory factor (summarised from Mithen 1990; 2003; see also Yalden 1999).

Three ways that hunter-gatherers modified or constructed niches

Nikulina *et al* 2022 identified the following three principal forms of niche construction through ethnographic study of current or recent hunter-gatherer community behaviours.

Modification of vegetation communities via burning.

This has been documented in all vegetation types except tundra and was most common in areas of forest and shrub. The aim of burning was to improve both quantity and quality of forage. Ecological consequences were affected by the intensity, seasonality and frequency of burns and the resilience of plants to them.

While burns were usually undertaken for immediate or short-term purposes, such as for easing hunting, their repetition had longer-term consequences on vegetation, most of which may now be regarded as beneficial. It contributed to the creation of mosaic vegetation patterns, increased biodiversity, and reduced the risk of catastrophic habitat loss.

Establishing whether such activities occurred in a place at a particular time in early prehistory is not straightforward and requires examination of proxy data. These include palynological (pollen) studies, analysis of non-pollen palynomorphs (NPP), plant macrofossils, DNA from sediments and phytoliths (Nikulina *et al* 2022).

Ethnographic studies show that fire was also used by hunter-gatherers for other purposes besides improving grazing for ungulates.

- To signal to dispersed members of the group or to signal to other groups.
- To keep predators at bay.

- And, related to that, as a weapon in warfare (Scherjon *et al* 2015).

Small-scale plant manipulation

This is not a form of plant domestication, defined as 'human intervention becoming essential for replanting and the plant food making a large contribution to human diet'. Instead, it included smaller-scale activities, such as broadcasting of wild annuals' seeds, and transplanting, and in-place encouragement of fruit and nut species. It could extend to encouragement of other plants that provide root crops and various raw materials. Activities included pruning, coppicing, thinning, clearing, weeding and fertilising.

All of these activities are difficult to trace and distinguish as undertaken by humans in the distant past. There is a possibility that an effect of some of them may be visible in genetic transformations, but again it is difficult to confirm human agency in any such changes. Also, some foraging communities have been recorded creating earthworks that support their plant-manipulation activities: soil retention walls and small-scale water diversions, including dams. In certain circumstances some of these may survive, but they are very unlikely to do so in parts of the world that have seen much post-hunter-gatherer activity.

Landscape modification to impact animal presence and their abundance at specific locations.

The aim of such activities is to ease and improve hunting and fishing. They include erection of fences to guide the movement of prey animals or the use of fire to drive them to a specific location. Burning also leaves areas whose new vegetation has higher nutrient levels, making them attractive to herbivores. The open character created by burning also makes it easier for herbivores to see and avoid predators, who will include people. Birds and insects, also part of the human diet, may be drawn to these newly open areas.

Another benefit of fires, including from the smoke of campfires is the relief that prey mammals, like deer, can get from biting insects, drawing them closer to humans.

Rivers and streams were also adjusted by creation of weirs and traps to control and take fish (Nikulina *et al* 2022).

Hunter-gatherers and the Anthropocene

The effects of the hunters and gatherers on ecosystems and occasionally on landforms has led some to push the start of the so-called Anthropocene geological epoch back to the end of the last Ice Age rather than confining it to the modern industrial period. Others have suggested it should be regarded as starting around 4000 years ago (when agriculture and pastoralism had become widespread and urbanism was developing), in the industrial period (1800 when the industrial revolution became widespread), or 1945 (when the nuclear bomb demonstrated the ability of people to radically transform places and introduced radioactive particles to all parts of the world), or more recently still, to when globalisation took destructive development to many more parts of the world.

Lewis and Maslin (2015) provide a good introduction to the concept and definition of the Anthropocene and discuss the merits of regarding it as starting with the large-

scale effects on vegetation and thus on soils of hunter-gatherers, especially when they deployed fire.

An underlying presumption is that ecosystems would have developed in a more predictable other way, a natural or human-free way, and may have been more stable and self-sustaining, if they had not been affected by the actions of humans, in this case hunters and gatherers.

Hunting and gathering is, of course, a form of life shared, in its barest essentials, with other omnivorous creatures, but human population levels and hunter-gatherer strategies, tactics and behaviours seem to have changed rapidly and substantially in the Mesolithic period. These caused significant changes in themselves, but when they morphed into or, more often, were replaced by domestication and agriculture, they can be seen to have spawned countless others, those of human civilisation, that have had fundamental impacts on most other life on Earth, and which will impoverish biodiversity and leave traces in the geological and soil record that will endure for millions of years (Lewis and Maslin 2015).

Early Neolithic: hunting, gathering, and possibly also dairying (c4000 to 2500 BC)

The persistence of hunting and gathering

It is generally presumed in archaeological accounts of south-west Britain, including West Penwith, that people in the area in the fourth and early third millennia BC continued to be mobile, not living in permanent settlements, but instead still following the seasons and the movements of wild animals and working with the fluctuating availability of food from plants and animals (including sea and freshwater fish, and birds) (e.g. Thomas 1991; Pollard and Healy 2007, 80; Jones *et al* 2013; Jones 2016a).

The full-scale agricultural revolution with permanent settlements and sophisticated mixed farming involving cultivated grain and other crops that was once imagined of the Neolithic period may not have occurred in this period; creation of agricultural enclosures and fields largely commenced in the 2nd millennium BC.

Patterns of the scatters of Neolithic flint artefacts (scrapers, knives, arrow-heads, etc) collected in the Clodgy Moor project generally echo those of the Mesolithic period (spring and stream-heads and valley sides, but also cliff tops and hill sides) (Jones *et al* 2013). Such patterns reinforce the impression that the early Neolithic population effectively continued a nomadic or semi-nomadic lifestyle involving hunting and gathering and with short-term stopping points or activity areas.

Early Neolithic artefacts also appear to be those of hunters and gatherers, and pastoralists. Arrowheads may have been used in human skirmishes at Carn Brea (Mercer 1981) but are more likely to have been used routinely in hunting; scrapers and piercers can be expected to have been used in the working of wood and leather.

The possibility of early dairying and farming

Grazing grounds are likely to have been extended through the clearance of woodland and the introduction of domesticated cattle, sheep, goats and pigs (Pollard and Healy 2007, 88). The first three may have provided milk as well as meat and other materials.

The animals of the wood pastures of Britain did not include any native wild forms of sheep and goat, so the domesticated animals of the early Neolithic period were certainly introduced, not domesticated in Britain. The principal ungulates of the Mesolithic period, those who whose grazing would have contributed to establishing and maintaining grasslands, would have included the aurochs, a form of cattle.

Domesticated sheep were derived from the ‘Urial’ (*Ovis orientalis*) which was a native of the mountains of Turkey and Iran, and the goat from the Bezoar (*Capra aegagrus*), also of the Middle East (Yalden 1999, 93-95) The only animal that was domesticated by Mesolithic times appears to have been the dog (Yalden 1999, 98-100).

Intriguingly for the early centuries of the story of West Penwith’s farming landscape, some of the broad, round-bottomed pots, such as those recovered from tor enclosures like Carn Brea and Helman Tor (e.g. Mercer 1981, figs 66-71; 1997, fig 8), may have had uses in **dairying**. Analyses of lipids (fatty and oily compounds) found on excavated pottery sherds throughout Britain indicate that dairying was

widespread by the early Neolithic period. It continued to be a significant activity throughout subsequent prehistoric periods (Copley *et al* 2003).

The earliest evidence for dairying in Europe comes from Linearbandkeramik sites dated around 5400 BC in France and NW Germany (Casanova *et al* 2022).

Future researchers will remain alert to the development of any techniques that might test for dairying activity. Several approaches are already being used and refined by those investigating prehistoric dairying.

- Age-at-death slaughter patterns of domesticated livestock, with the presence of more older-aged female cattle, sheep and goats being suggestive of a use other than for meat, which would favour slaughter of younger animals (Legge 1981).
- Calving seasonality (as identified through intra-tooth isotope ration analysis of molar enamel), where an assumption would be that to maintain a reasonable supply of fresh milk, calving, lambing and kidding would be multi-seasonal, whereas it would be more likely to be single-season if animals were bred for supplying meat (Towers *et al* 2016).
- Analysis of lipids preserved in vessels that humans have used to identify dairy fats (Copley et al 2005).
- It is also possible to identify whey protein ßlactoglobulin in human dental calculus, and to establish whether the milk was from cattle, sheep or goats (Warinner et al 2014).
- The length of time required for the evolution of lactase persistence (LP) in humans as a means of countering lactose intolerance, offers another possible route. LP is ‘a genetic condition defined as the continuous production of the enzyme lactase-phlorizin hydrolase after the end of weaning in infancy. The enzyme allows for the digestion of the milk sugar lactose by splitting its beta-glycosidic bond’ (Mays 2022, 55). It developed unusually early in Europe and may have done so in response to the establishment of a dairying culture (Warinner et al 2014; Hirst 2021; Mays 2022).

Modelling of Neolithic land use and land cover needs therefore to accommodate the possibility (or probability) of dairying and the conditions for and effects of it. People can be expected to have observed the types of grasslands and herbage that dairy animals thrived upon, and then how to manage land to encourage such communities.

While there may not have been much Neolithic arable in West Penwith, production of cheeses and other dairy products would have helped human communities gain confidence in their ability to produce reliable year-long sources of food from a defined territory. Some natural environments and topographies, such as the rounded downlands of West Penwith, may already have become in the early Neolithic period the prime dairying lands that they continued to be for the following five or six thousand years.

Treen Common, Zennor, vegetation on a typical West Penwith downland

Treen Common, Zennor. One of several rounded downs at the heart of West Penwith's northern uplands. Deep peat in the slight valley was cored and its pollen analysed, providing a detailed record of upland vegetation change and continuity.

The pollen from the lowest, earliest levels at Treen Common, broadly from the very end of the Mesolithic period and through the whole of the Neolithic, the period when gathering and hunting was replaced by managed grazing using domesticated livestock and by sporadic arable farming, indicate a 'largely open landscape, dominated by grasses and a variety of herbs' (Forster and Robinson 2011, 14).

The pollen of Herbs was overwhelmingly dominated by the grasses (*Poaceae* undifferentiated) with all other plants being regarded as members of a grassland community – with scattered trees, shrubs and herbs, each presumably concentrated in niches where they thrived or survived. The vegetation is rich, and formed a shimmering mosaic kept open by the effects of grazing animals, presumably a mix of wild ungulates and those domesticated livestock of Neolithic communities. See Appendix 1 for details.

There was minimal tree pollen, just small percentages of pine, elm, birch, oak, hazel or bog myrtle (or both), willow, holly and buckthorn.

Similarly, there was little pollen from heath vegetation, though it was present in small amounts.

Sedges (*Cyperaceae*), reeds and aquatic plants are common in this zone, indicating wet conditions at or near the site; the Treen/Gear stream is just 60m to the north.

Some cereal-type pollen grains were found at the base of the monolith. Mainly of *Hordeum* type that includes 'wild grasses' as well as barley and a few were *Avena* / *Triticum* type (wheat and oat species), 'indicative of agriculture in the catchment area', an interpretation supported by the presence of other species often found in disturbed or cultivated ground, like Goosefoot/fat hen, nettles and mugworts / wormwood. This is very early in the Neolithic period; there was to be little evidence of arable in later levels, until the later medieval period.

On Bodmin Moor there are traces of simple curvilinear fields on the slopes of the two hills with the most substantial tor enclosures, Rough Tor and Stowe's Hill (Herring 2008, 79-81 and fig 11) and traces of cultivation near a third tor enclosure at Carn Brea in Illogan was recorded by Mercer (1980). This very early experimentation in

arable farming appears to have been dispensed with and the Neolithic economy of Cornwall was essentially pastoralist.

Archaeophytes (alien plants introduced in antiquity)

Cichorium intybus, common chicory

Pollen of *Cichorium intybus* was recorded in the early Neolithic zone of the peat sample from Treen Common, Zennor (Foster and Robinson 2011).

Common chicory thrives in open grassland and fields and alongside tracks. It may have been an accidental introduction, but it has qualities that may suggest that it was deliberately brought in, alongside the domesticated livestock, who would have benefitted from consuming it. Chicory is 'also sown with grass because of its ability to accumulate the element selenium, which is valuable to stock' (Stace and Crawley 2015, 57).

In particular, cattle gain benefit from selenium in that it helps prevent mastitis and scour. Such valuable effects may well have been observed by early pastoralists, especially if it was also used for animal fodder, as it still is in many parts of the world. Chicory provides 'a potpourri of nutrients ranging within carbohydrates, proteins, vitamins, minerals, soluble fibre, trace elements, and bioactive phenolic compounds, which are responsible for the various nutritive, prophylactic, and therapeutic qualities of chicory' (Nwafor *et al* 2017, 1).

Chicory is also widely used as human food. All parts of the plant are, can be and may have been utilised. 'The leaves and flowers are usually used as vegetables in salads and the roots are used as a coffee substitute, livestock feedstuff, or pet food. Chicory extracts are sometimes added to alcoholic and non-alcoholic beverages to improve taste, while the inulin rich tuberous roots can be converted to alcohol. In some countries, parts of the chicory plant are used as ethnoveterinary remedy for bodily ailments and disorders and for prophylactic purposes in both humans and livestock. Since fresh chicory roots have a rather bitter taste, the roots are normally debittered by boiling, drying, baking or roasting, and soaking in water or citric acid solution and then chopped or milled before being used as coffee blends, feed, or a functional food ingredient' (Nwafor *et al* 2017, 1).

The great Cornish writer Geoffrey Grigson was unsure of its status: 'Probably, but not certainly, a native'. He noted that it was in recent times in western Europe often grown with herbs as it was good for 'purging and for the bladder' (ibid) and its beautiful sky-blue flowers were turned into a brilliant red dye when mixed with formic acid, such as when flowers were placed in an anthill (Grigson 1958, 391).

Conium maculatum, poison hemlock

Poison hemlock pollen was recorded in the early Neolithic zone of the peat from Treen Common, Zennor (Foster and Robinson 2011). The plant is now found mainly on waste ground and alongside watercourses and tracks. Treen Common in the Neolithic period was a herb-rich grassland with the numerous trackways of grazing animals, people and other animals being possibly the places where poison hemlock would have been encountered.

While chicory may be regarded as a highly beneficial plant, poison hemlock has a deserved reputation as a dangerous and unwelcome one, its most famous practical application being its use in executions, most famously of Socrates in 399 BC. The death that he and others forced to drink hemlock infusion suffered was grotesque, involving, 'salivation, bloating, dilation of the pupils, rolling of the eyes; laboured respiration, diminished frequency of breathing, irregular heart action; loss of sensation, convulsions, uncertain gait, falling, and at the end complete paralysis' (Grigson 1958, 214).

This is indeed a highly poisonous plant, often found beside streams, beside fields and in waste areas and nowadays along roadsides and ditches (Stace and Crawley 2015, 63-65).

Urtica urens, small nettle

Recorded in the Neolithic zone at Treen Common, Zennor (Foster and Robinson 2011). The small nettle is a plant of fields, waste land and yards, areas of activity. It is an annual, unlike the native common nettle (*Urtica dioica*), and is smaller than that, hence the name. Its sting is also harsher (one nickname being 'burning nettle').

Most uses of nettles by people are likely to have involved the common nettle: nettle soup, which has medicinal value (treating muscles and joints, arthritis, gout and anaemia, as well as enlarged prostate), and the working of the fibrous stems into fine and strong cloth (Grigson 1958, 238-9).

Urtica urens is still found in West Penwith, and is especially common in the area of the Golden Mile, north-east of Gulval (French 2020, 184).

Localised woodland: mainly in the valleys and lowlands

Archaeological and palaeo-environmental research has developed a model of early Neolithic Cornwall having relatively open uplands and more wooded lowlands (Wilkinson and Straker 2007). The evidence from West Penwith is quite limited, but what there is seems to support that characterisation.

The lowest peat at a spring in the valley below **Chysauster in Gulval** was also possibly Neolithic in date. There was 'fluctuating alder and willow' in the immediately adjacent wetland, 'with oak and hazel woodland round about' (Straker 2011b, 165).

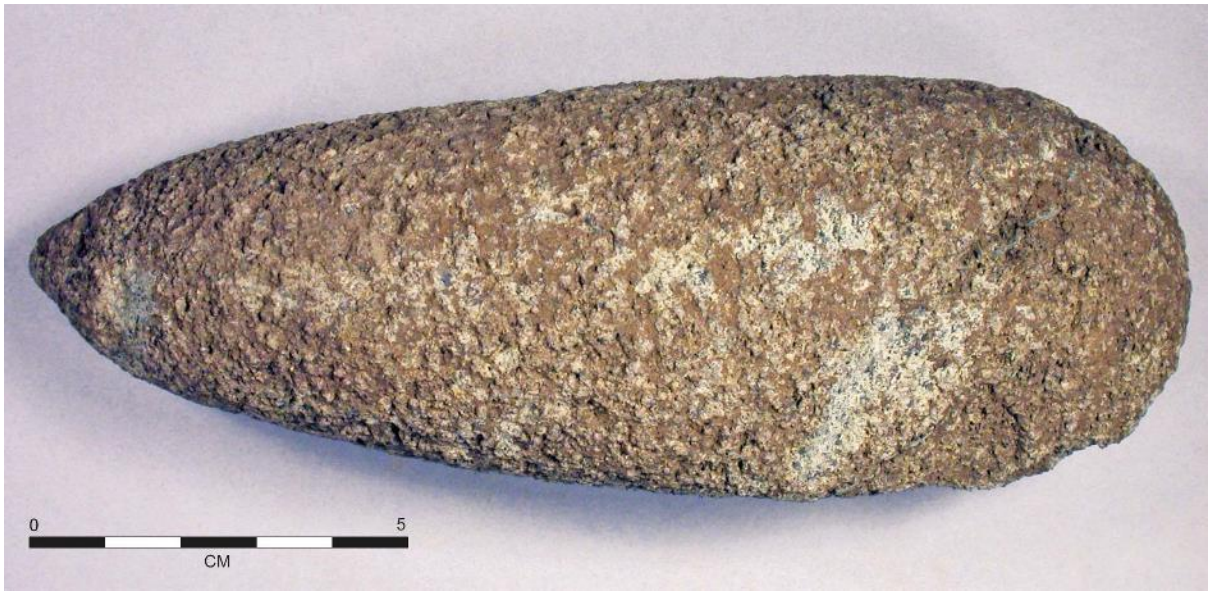
In **Lelant churchtown**, at Tyringham Road, just west of the Hayle River, charcoal was retrieved from early and later Neolithic layers. The largest and most numerous fragments of wood were from a pit with an Early Neolithic date (3794-3662 cal BC) and were of *Taxus baccata* (yew), but there were also pieces that could have been either *Alnus* or *Corylus* (alder or hazel, probably the latter) and *Maloideae* (the family that includes hawthorn, apple, whitebeams, etc) (Challinor 2020, 152-3). The wood may have been local, but it could also have been transported here, so a woodland cannot be confidently reconstructed with this mix.

See Appendix 1 for more details.

Artefacts

Axe and adze heads formed of greenstone or flint suggest woodland management and wood working. Greenstone came from either outcrops such as those now drowned in Mount's Bay or on the northern coast, like at Zennor Head or Gurnard's

Greenstone outcrops at Gurnard's head (top) and Zennor Head, possible sources of the raw material used for making axe heads and other Early Neolithic stone implements.



A Group I greenstone axehead found at Trevorian Common, Sennen (Photo by Anna Tyacke, from Jones 2016a, fig 5.5. © Cornwall Archaeological Unit, Cornwall Council).

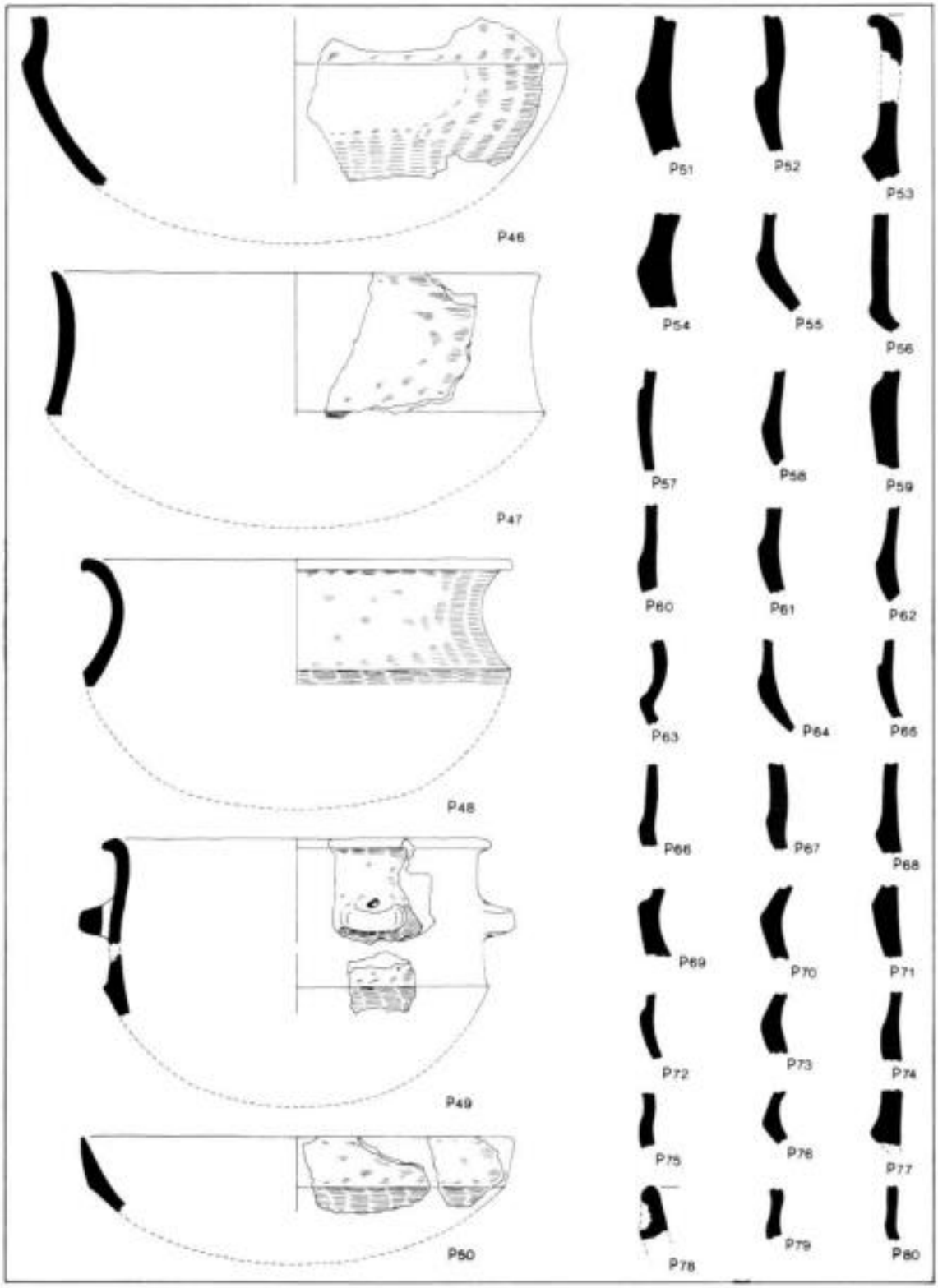


Fig. 68
Carn Brea. Neolithic Pottery, P46-P80. x ⅓.

Examples of early Neolithic gabbroic-clay pottery excavated at the Carn Brea tor enclosure, Illogan. Some of these could have been used in dairying (from Smith 1981b, fig 68).

Head, or from beach or river pebbles. Axeheads were exchanged over very long distances (reaching places as far away as northern England). Roughouts of axeheads were recorded amongst flint scatters in the Clodgy Moor field walking (Jones *et al* 2013).

Higher quality flint than that picked up as pebbles from local beaches was among the material brought into West Penwith in this period, but this still made up only a small proportion of the raw material used; 98% of the flint collected in a project in the St Just area was shown to be beach derived (Lawson-Jones 2013, 200).

Pottery was sophisticated and decorated and the clays used in it were brought from the south-eastern part of the Lizard peninsula as they contained fragments of gabbro.

Early Neolithic cromlechs at Zennor and Chun. Note that as the cromlech is reached at Chun the topmost tors of the tor enclosure of Carn Galva emerge above the southern right-hand slope of Watch Croft, the great hill in the distance.

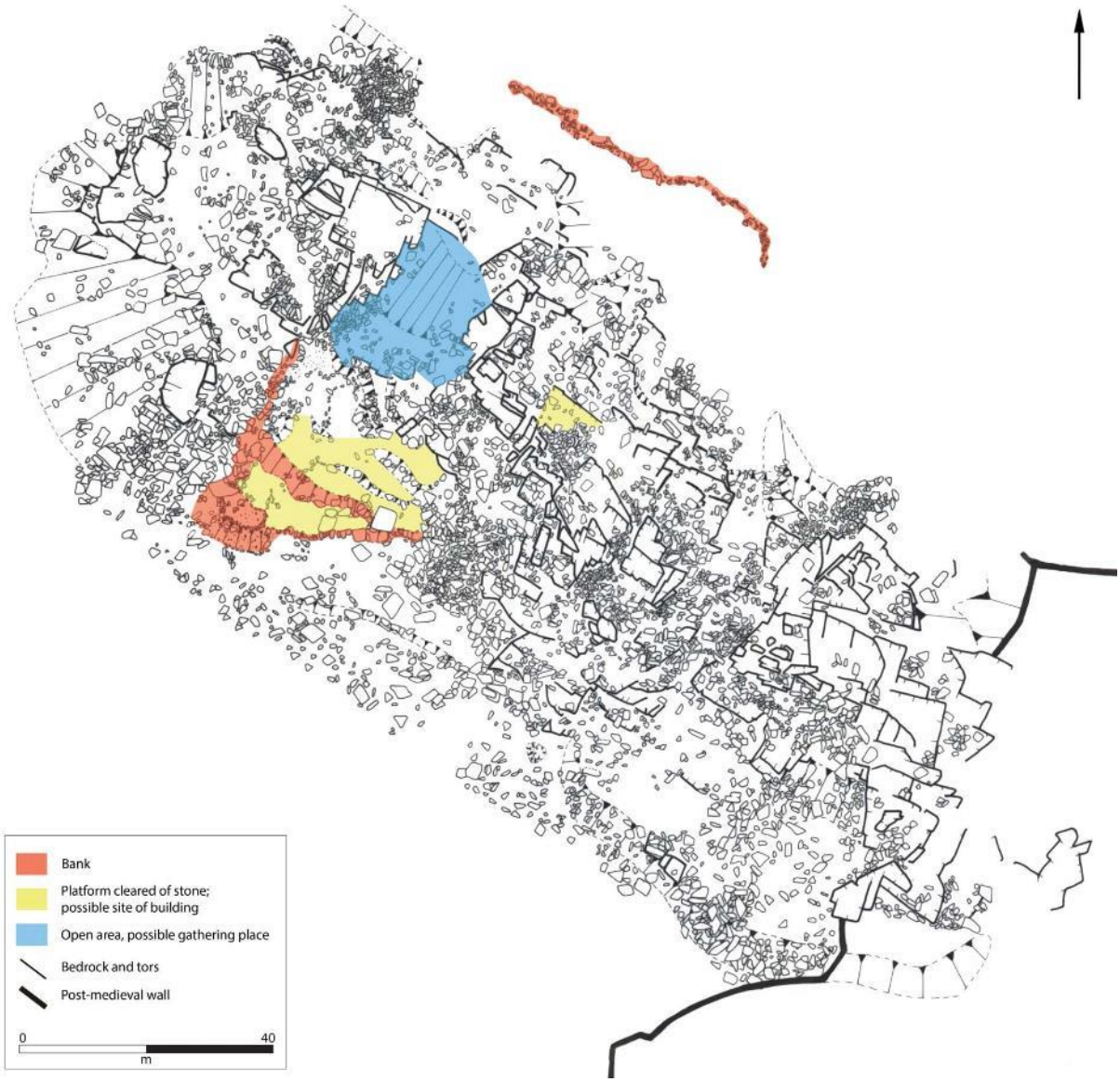
Archaeological remains

From early in the 4th millennium BC, the first centuries of the Neolithic period, many large monuments were erected by communities in West Penwith. These included the cromlechs, the old Cornish term for the archaeologist's 'portal dolmens' that more recent Cornish communities call quoits (discussed in Herring 2016b), and the long cairn at Chapel Carn Brea (Thomas 1990, 14-15). Propped stones have also been recorded on several tors and if the example on Leskernick Hill can be taken as a guide to their age then these may also be of the 4th millennium BC (Herring 1997; 2016).

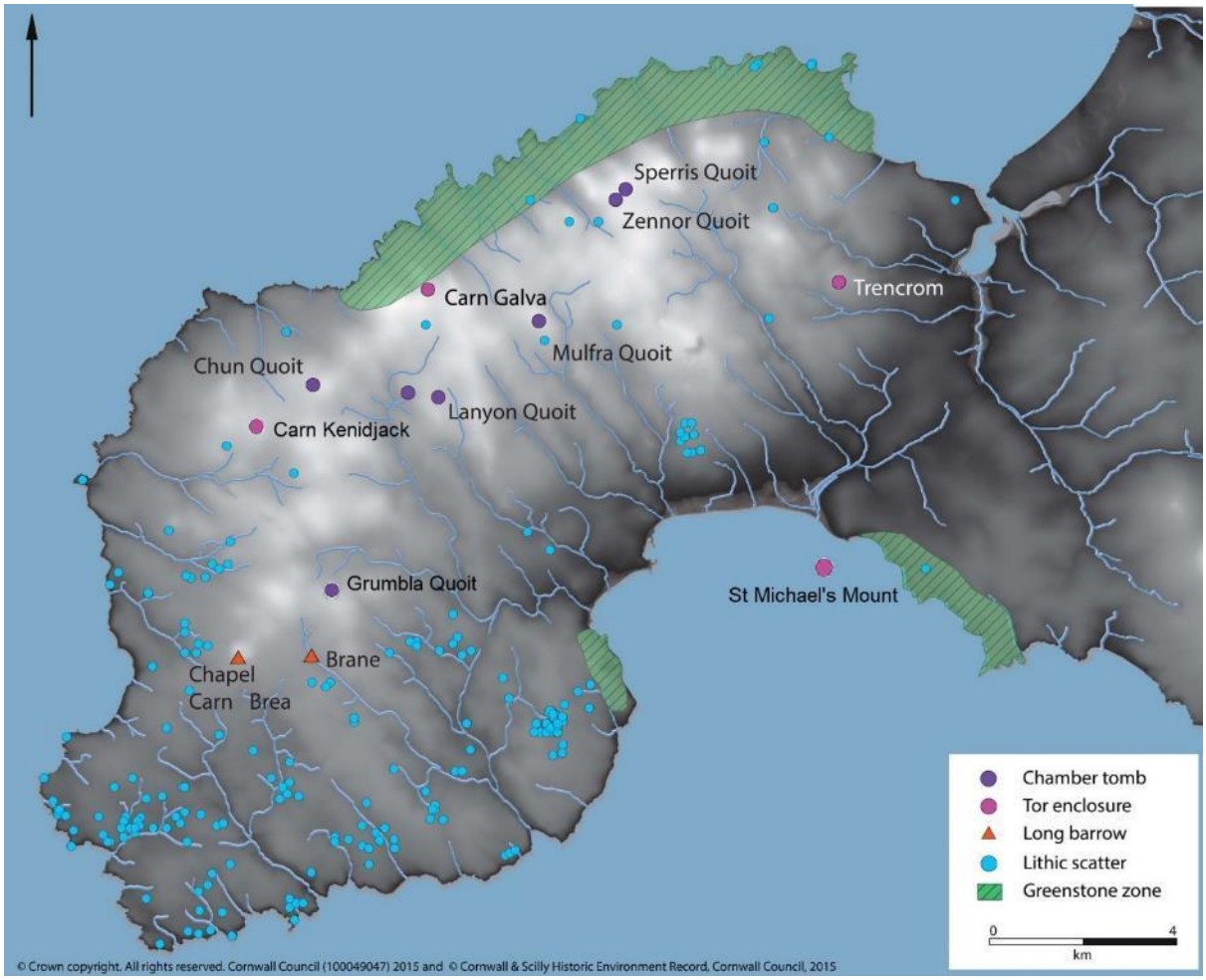
The scale of some of these monuments and their distribution suggest the existence in West Penwith, of several discrete territories capable of sustaining viable human

communities and of supporting the herds and flocks that such communities depended upon.

There were also several much more substantial apparently early Neolithic sites in West Penwith, the tor enclosures. These dramatically positioned sites, presumed to have been primarily used as gathering places, have been recorded at Carn Galva and Trencrom and suggested for St Michael's Mount (Herring 2011) and Carn Kenidjack (Weatherhill 2017).



Plan of the tor enclosure on Carn Galva, Bosigran, Zennor showing all natural tors and spreads of clitter and thus how cleverly the enclosure's builders worked their own banks of stones (coloured red) into the inherited natural structure, possibly regarded as the creations of giant predecessors. From excavated examples at Carn Brea and Helman Tor (Mercer 1981 and 1997), it is likely that the cleared gently sloping platforms coloured yellow supported wooden structures used as shelters. A larger cleared area (coloured blue) set between two dramatic tors appears the most likely gathering place. (From Herring 2016, fig 4.4; derived from Herring 1987. © Cornwall Archaeological Unit, Cornwall Council).



Distribution of Early Neolithic archaeological sites in West Penwith showing the widely spaced out tor enclosures and the much more tightly spaced cromlechs (here called chamber tombs). Note that St Michael's Mount would at that time have still been permanently joined to the mainland. (From Jones 2016a, fig 5,1, with adaptations. © Cornwall Archaeological Unit, Cornwall Council.)

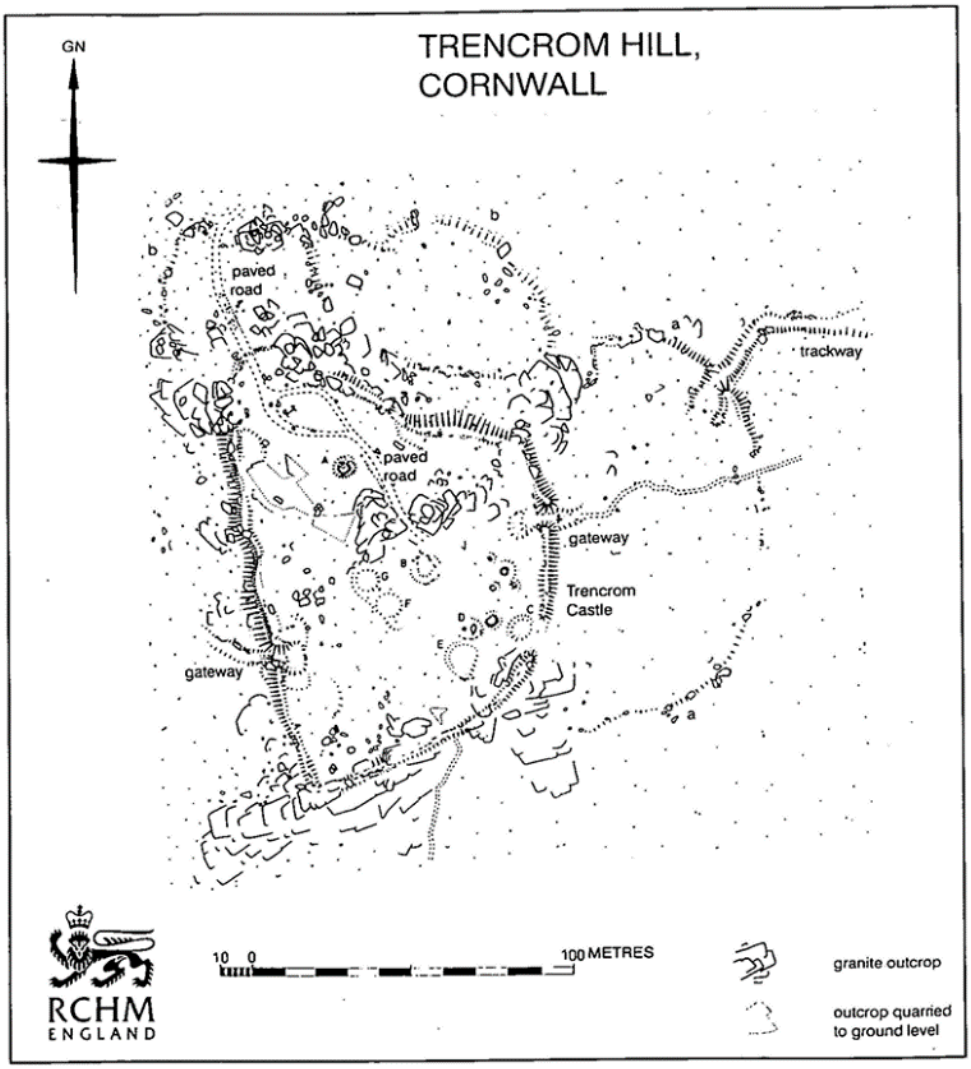
It is not certain what the gatherings at tor enclosures entailed, but it is likely that they were multi-functional. Ritual and ceremony, perhaps keyed into a calendar structured by astronomical events (solar or stellar), may have drawn people to these places at certain times of the year. Once there, they may have taken part in a form of fair, with exchange of material, food, livestock, clothing, etc going on in between times while people met up with family, friends and associates. Here life partners may have been found and friendships made, and the issues that develop when many people are drawing livelihoods from shared land, effectively commons, are resolved (Herring 2011a, 27).

> 'One of the functions of such gatherings, whether the larger or more local ones [at cromlechs], might well have been to establish, organise and control access to shared resources such as the open areas of pasture used by the herds and flocks of the increasingly domesticated animals. These meetings may have also functioned as a form of court used to resolve disputes over such resources' (Herring 2011a, 27).

That function of the gatherings is one that is threaded through all the subsequent landscape history of West Penwith: how to manage access to and rights within the commons.

The subtlety of this landscape design also suggests that the land cover on the downlands was already open in the very early Neolithic period, supporting the results of the pollen analysis at Treen Common. The hills, at least, were free of woodland, and indeed free of dense shrub; they were indeed already part of what may now be regarded as Ancient Semi-Natural Grassland.

Those wider territories associated with tor enclosures were probably early commons in which the domesticated livestock of individuals, households and communities ran together, subject to customs and rules that were enforced when the great gatherings occurred at the tor enclosures, and perhaps also at the more local gatherings at cromlechs (Herring 2013). The architecture of some of the cromlechs, and notably that at Zennor Quoit, with its dramatic south-eastern façade, appears designed to form an arena for gatherings.



The tor enclosure at Trencrom planned by Alastair Oswald and Iain Sainsbury of RCHME in 1996 (from Oswald 1996).

Later Neolithic and Early Bronze Age: intensified pastoral agriculture; earliest settlements; ceremonial and ritual complexes (c2500 to 1500 BC)

Palaeo-environmental evidence

The limited palaeo-environmental evidence suggests that this may have been the period in West Penwith's prehistory when woodland reached its greatest extent since the Mesolithic although there was also open ground in wetlands at Marazion Marsh and near St Ives and still a grassland community near Chysauster.

On **Treen Common, Zennor**, quantities of tree pollen in the peat core appear to have grown (in relation to other types of pollen) in the later 3rd millennium and through the 2nd millennium. The tree pollen was dominated by *Corylus avellana*-type, which could derive from either hazel *(Corylus avellana*) or bog myrtle (*Myrica gale*) (Forster and Robinson 2011). The local conditions might suggest that bog myrtle is the more likely as the pollen of sedges, reeds and aquatic plants are also common in this period.

Hazel is a fairly substantial tree, but bog myrtle is a low multi-branched deciduous shrub, less than two metres high (Chambers *et al* 2010-11, 7; Skene *et al* 2000). The pollen of the two are virtually identical in appearance (Rackham 1986, 7; Forster and Robinson 2011, 27). Given the damp exposed site it may be supposed that the pollen is more likely to be bog myrtle (which thrives in damp acidic soil – Skene *et al* 2000, 1081), even though there is a long tradition of envisaging extensive oak-hazel woodland in prehistoric Britain and Cornwall.

*Bog myrtle (*Myrica gale*) photographed in June in Anglesey, Wales (from https://www.first-nature.com/flowers/myrica-gale.php)*

Myrica gale, or bog myrtle, had value. At various times and places in Europe and beyond its leaves were used as a flavouring in alcoholic drinks, including being used in beers before hops became popular; it gave a headiness to beer or ale, speeding drunkenness. It was a savouring for roast meat, a tea-like infusion, and a perfume for

linen. Its catkins and cones when boiled in water produce a ‘scum beeswax’ used to make candles while its roots and bark were used to tan calfskins and to dye wool yellow, and its nuts were used as a spice (Grigson 1958, 243).

Bog myrtle was efficacious against insects, including midges, because of its sweet resinous scent.

Bog myrtle was called Gale in Cornwall (and in several other western parts of Britain). ‘It provided faggots for the cloam oven’ (Grigson 1958, 243). It is now mainly found in the centre of Cornwall, usually in valley bogs, with all historical records in West Penwith having been made before 1950 (French 2020, 187).

Birch (*Betula*), willow (*Salix*) and oak (*Quercus*) also increased, and alder (*Alnus*) appears for the first time, though in small quantities. There was still a little pine (*Pinus sylvestris*) and also small quantities of holly (*Ilex aquifolium*), buckthorn (*Frangula alnus*), ash (*Fraxinus excelsior*) and honeysuckle (*Lonicera periclymenum*).

The grasses (*Poaceae*) declined a little in this phase, but ‘grasses remain[ed] an important vegetation type in the landscape’ and heathland or ericaceous pollen was present, though in small amounts, throughout the zone, which is presumed to end in the early part of the 1st millennium BC, around the turn of the Later Bronze Age and Early Iron Age (Forster and Robinson 2011, 27). Sedges continued to be important elements of the vegetation, as did ferns and sphagnum mosses. Bracken (*Pteridium aquilinum*) was present, but not dominant.

A herb that emerges in this phase is the field forget-me-not (*Myosotis arvensis*), another archaeophyte.

- There was a marine incursion at **Marazion Marsh** after 4500 BP, in the later Neolithic period of the 3rd millennium BC. After it the vegetation was dominated by grass and sedge, and willow (*Salix*) and hazel (*Corylus*) had replaced alder and oak as the predominant trees, but these in turn were replaced by alder again and there was also birch (*Betula*), elm and oak. Shrubs included sea-buckthorn (*Hippophae*) and joint-pine (*Ephedra*) (Healy 1995; 1999a; Straker 2011a, 69).
- Macrofossils recovered from peat buried beneath sand in **St Ives harbour** indicated that an alder fen carr (waterlogged woodland) was accompanied by an oak woodland on drier land nearby, with hawthorn, hazel and holly also represented, probably as an understorey. As at Marazion Marsh, the carr was later replaced by a sedge fen (Gilbert 1995; Straker 2011a, 69).
- Soil beneath an excavated barrow at **Chysauster** (in Gulval) has been radiocarbon dated to 2280-1780 BC. Pollen analysis showed that the environment before cairn construction, which can be taken to be the later Neolithic period, of the later 3rd millennium, broadly contemporary with the Marazion Marsh sample, was dominated by oak (*Quercus*) and hazel (*Corylus*) woodland and shrub with grasses also important (see Section 8 for details). Smaller quantities of alder (*Alnus*) were also present and also fewer pollen of birch (*Betula*), pine (*Pinus*), elm (*Ulmus*), lime (*Tilia*), and yew (Taxus). Heathland shrubs (*Calluna* and *Erica*) had conspicuously low pollen counts (Scaife 1997, fig 22; Straker 2011a, 69-70).
    - The herbs whose pollen was recognised in the buried soil were various, as shown below. Those of weeds often found in cultivated land increased

towards the higher and thus later levels of the soil, suggesting that some cultivation was taking place in the vicinity, apparently confirmed by the presence of cereal type pollen in those higher levels. The herbaceous plants recorded were as follows:

- *Plantago lanceolata* (all levels), ribwort plantain
- *Ranunculus* type (all levels), buttercup types
- *Rumex* (most levels), docks and sorrels
- *Galium* (lower, earlier levels), bedstraws
- *Lonicera* (lower levels), honeysuckle
- *Dipsacacea* (lower levels), teasels
- *Cirsium* type (lower levels), thistles
- *Sinapis* (higher, later levels), mustards, charlocks
- *Dianthus* type (higher levels), carnations and pinks
- *Rosaceae*, undifferentiated (higher levels), roses
- *Hedera* (higher levels), ivy
- *Convolvulus* (higher levels), bindweed
- *Melampyrum* (higher levels), cow wheats. *[Common Cow-wheat has been recorded in Cornwall since 1848, but it appears that no records have been made in West Penwith – French 2020, 360.]*
- *Taraxacum* type (higher levels), dandelions

- At **Porthcurno** pits dug in the Early or Middle Bronze Age included charred remains of fragments of wood, dominated by oak, but with some hazel and furze or broom as well as grasses, bramble and dock (Jones *et al* 2012). They suggest a mixed land cover in this south-western valley.

So, the sketchy evidence that we have for West Penwith suggests an upland zone with some trees (hazel or bog myrtle) and grasslands and oak and hazel based wood in the valleys and alder based wet woodlands in low-lying wet ground. There was also some cultivation of grain crops in the downlands (around Chysauster).

Archaeophytes

Myosotis arvensis, field forget-me-not

Recorded in the broadly Bronze Age zone of the Treen Common peat sample (Foster and Robinson 2011). It may be presumed that grazing continued but perhaps at a lower intensity than in earlier prehistory. There would still have been trackways (animal and human) including to and beside watercourses and it is likely to have been there that the forget-me-not was found.

Formerly known in Britain as Scorpion Grass, the present rather more romantic name is supposed by some (e.g. Grigson 1958, 284) to have been inspired by the 1802 poem *The Keepsake* by the Romantic poet Samuel Taylor Coleridge.

See Appendix 1 for more detail.

Fossilised trees and the submerged forest in Mount's Bay.

John Leland noted in the early 16th century, probably in around 1542 when he visited south-west Britain, that 'In the Bay betwixt the Mont [St Michael's Mount] and Pensants [Penzance] be fownd neere the lowe Water Marke Rootes of Trees yn dyvers Places, as a Token of the Grownde wasted' (in Pearse Chope 1918, 29).

Richard Carew writing at the turn of the 17th century confirmed that ‘at some low ebbes, rootes of mightie trees are discryed in the sands about it’ (St Michael’s Mount) (Carew 1603, 3).

Dr William Borlase’s *The Natural History of Cornwall* (1758) included descriptions of ‘subterranean vegetables called Fossil-trees’. Borlase recorded such trees unearthed from four feet deep during drainage works in 1740 near Trewinard (on the west or West Penwith side of the River Hayle), and a tree ‘of the oak kind’ found by miner John Roberts in 1750 at a depth of 30 feet in tinworkings behind the beach of Whitesand Bay at Velindreath in Sennen parish. It was closely associated with the bones and antler of a large deer, considered by Borlase to be either an elk or a moose (Borlase 1758, 220-221). Note that antlers were sometimes repurposed as digging tools in prehistoric tinworks in Cornwall; one from the streamworks has been radiocarbon dated to 1620-1497 cal BC (Timberlake 2017; Timberlake and Hartgroves 2018).

Then Borlase described the ‘whole groves’ of trees ‘standing as perpendicular as they grew’, the result, he believed, of the subsidence of the ground. As an example he described the ‘remains of the wood which, according to tradition, covered anciently a large tract of ground on the edge of Mount’s Bay’. This had appeared on the 10th January 1757, revealed when a violent sea removed the sands. In places where all the sand had been removed he found that the soil from which the trees and roots grew also survived. This was around 300 yards from highest water mark and 12 feet below the water level at high tide. There were the roots and stools of several trees, as well ‘part of a large oak… the body of a tree three feet in diameter’, a willow with its bark still on that was one foot and a half in diameter, and ‘part of a hazel-branch with its fat glossy bark on’. He also saw the leaves of the *Juncus aquaticus maximus* [the Bull Rush, or Great Water Rush] (Borlase 1758, 221-4).

Carne in 1846 added birch to the oak, willow and hazel previously recorded in the Mount’s Bay submerged forest. Local fishermen are also known to have occasionally dredged up trees (James 1990, 299).

Valuable research on the Mount’s Bay forest was carried out in 1992 by HCL James and Erica Guttmann that included a summary of previous work on submerged forests in west Cornwall as context for their report on pollen analysis of a sample taken at Chyandour in advance of the Penzance Distributor Road (part of the A30). They reported ‘a detailed paper [by HS Boase] incorporating a cross section of the “Ligneous stratum” from Ponsandane to the west of the Chyandour site. Macrofossils of hazel, alder, elm and oak were extracted from this organic unit’ (James 1992, 60; Boase 1825). James himself had noted that a borehole drilled c4 km offshore from Penzance on a line between Penlee and Cudden Points, near the mouth of the bay had a peat bed at the depth of c32m below OD. This had had been sampled and dated to 12,070 BP, i.e. later palaeolithic period (Goode and Taylor 1988; James 1990).

Archaeological remains

West Penwith is famous for the monumental archaeological sites of this period. There are many good descriptions of the standing stones, stone circles, stone rows,

cairns and barrows, entrance graves, cists and hilltop enclosures (e.g. Weatherhill 1981; Barnatt 1982; Straffon 1986-2023; 1992; Dudley 2011; Jones 2016a) so those do not need repeating here.

Most discussions of these monuments concentrate on their use for ceremonies and rituals and focus on those aspects of their design and location that support current theories concerning those functions. It has been suggested that 'their roles as communal gathering and meeting places was equally significant; as such they maintained the functions of earlier hilltop [tor] enclosures and quoits [cromlechs]' (Herring 2011c, 89). Rituals and ceremonies, important in themselves, brought dispersed people together, providing opportunities to formally or informally discuss the management of the shared resources, such as commons, upon which they depended. The locations of many such sites near the edges of these commons appears significant in this respect (e.g. Herring 2008b; Dudley 2011, fig 80).

Of particular interest are those hilltop enclosures containing ring cairns at Caer Bran and Castle-an-Dinas. It will be suggested (below, Iron Age) that the much slighter outer 'rampart' of Chun Castle (see Leeds 1927 fig 4, and Weatherhill 1981, 44-5) represents a third such enclosure. All three were incorporated into later Iron Age hillforts, which are likely to have been late prehistoric gathering places that would also probably have included management of the commons amongst their various functions.

All three are also either on or very close to a primary line in the pattern of the early medieval parish boundaries. It will be suggested (Medieval, below) that this was a survival from prehistoric arrangements for sharing and managing the summer pastures. An implication of all this is that there seems to be continuity in using these three places in the management of commons that may have continued from c2000 BC through to c1000 AD, for around three thousand years.

The continuity may have been even longer, around 5,000 years, if the alignment of the original entrance of Chun's enclosure on nearby Chun Quoit an early 4th millennium BC cromlech (portal dolmen), 250m due west, is significant. It has been suggested (above, Early Neolithic) that cromlechs were themselves gathering places at which management of the commons was also one of the issues dealt with by communities. The Penwith Landscape Partnership project has noticed that when standing at Chun Quoit and looking east to Chun Castle the Nine Maidens stone circle on distant Boskednan Downs is skylined, making a visual link between four monument types that could all have been used as gathering places for administering the commons of West Penwith

The stone circles of west Penwith are also positioned adjacent to this line.

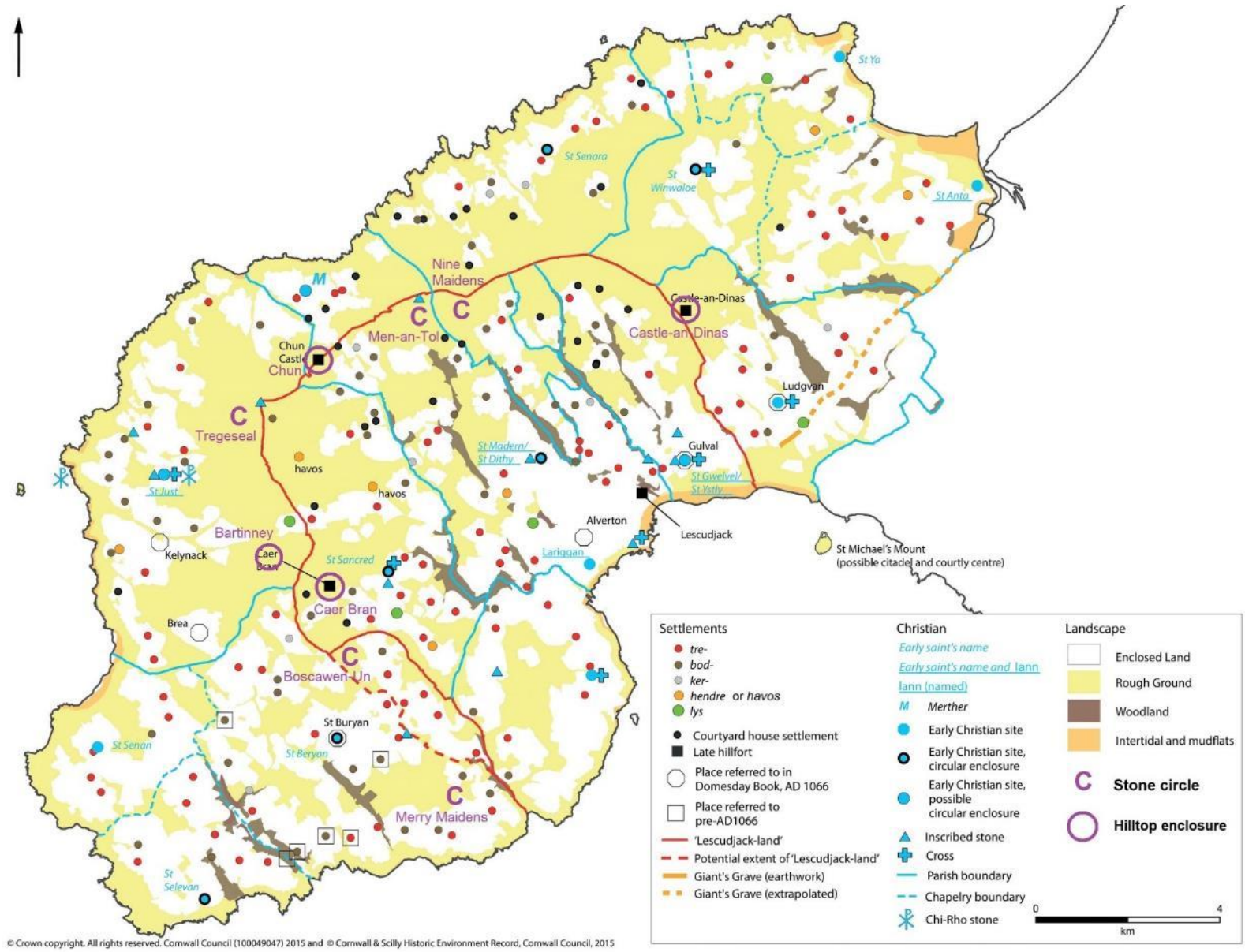
The form and scale of these sites also contributes to understanding the nature of the land cover and land use when they were created and used.

Few Late Neolithic or Early Bronze Age monuments are solitary; most are directly related to others so that new structures became elements in complexes that were presumably experienced in a narrative sort of way, the stories associated with each element being revealed by those who knew them to people who came together for either ceremony or ritual (Herring 2008b).

An example of a complex that would have been experienced by moving between several component monuments is the arrangement of cairns and other features on Boskednan Downs and Carn Galva. This contains over a dozen discrete monuments

and others may once have existed, now removed. Each is apparently nicely finished in itself: a stone circle (Nine Maidens), several platform cairns with kerbs and internal structures, smaller cairns that may have contained burials, and a standing stone. Each monument served well as the focus of either ritual or ceremony, or as the subject of communal memory, a memorial to dead people perhaps, or a signifier of meanings that the community drew from the landscape, such as from significant tors or from views to distant elements of the world they knew.

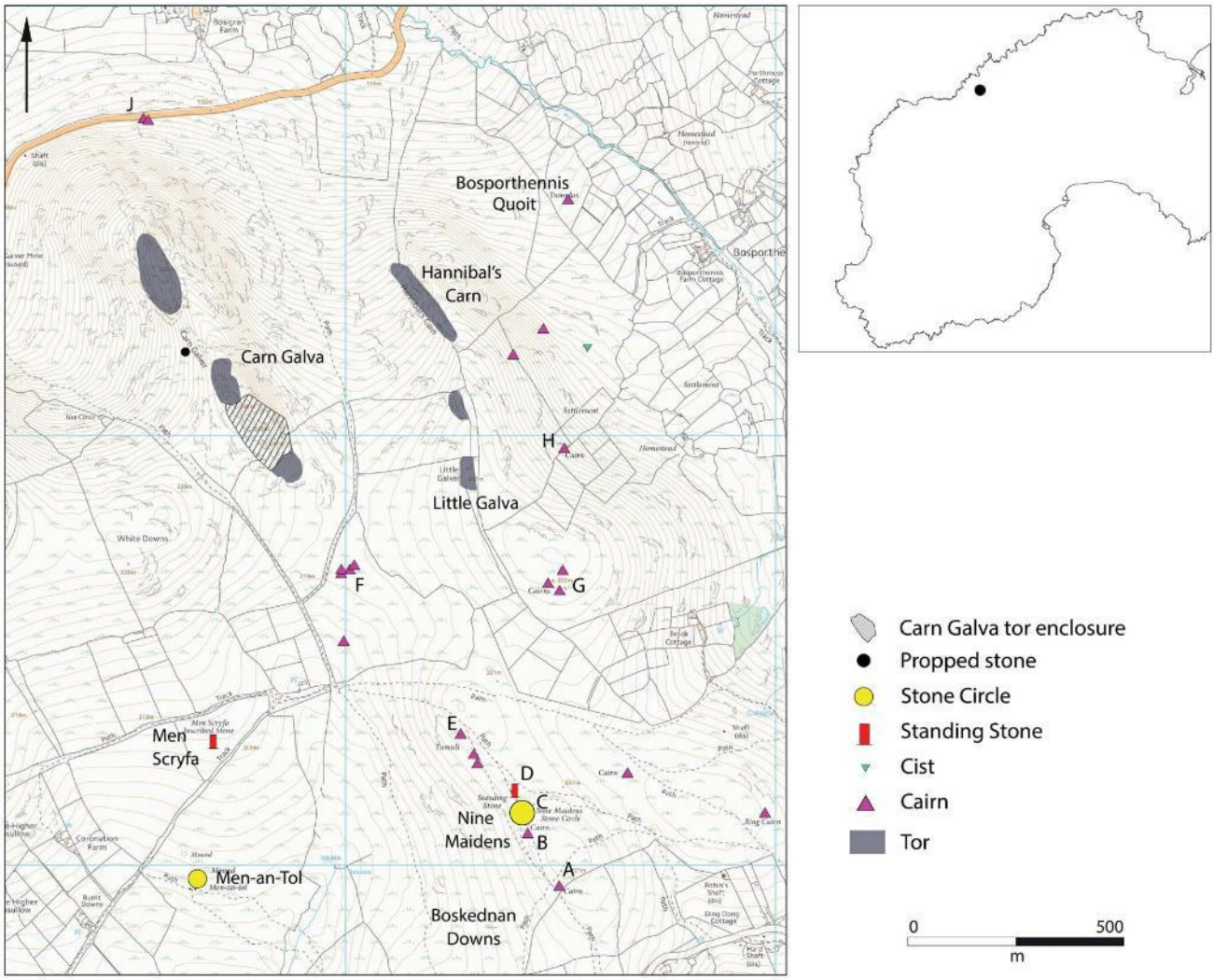
A feature of these sites is that they are elements of landscape as well as places where rituals and ceremonies were performed. Individuals and groups are presumed to have approached and moved around the sites and also to have observed distant phenomena, like other contemporary or earlier monuments or significant and meaningful natural features (Tilley 1995; Bradley 2000; Bender et al 2007; Herring 2008a; 2008b).



The positions of two of the principal types of later Neolithic or Early Bronze Age gathering places, the stone circles and hilltop enclosures, in relation to the rough

ground (yellow) and the apparently significant primary line termed 'Lescudjack-land'. See below (Medieval) and Herring 2016a, fig 8.1 for more detail on this map.

We can feel fairly confident of this through observing how the Boskednan and Carn Galva monuments are arranged in a linear way suggestive of movement along them, movement that appears to have been designed to start at a neatly kerbed platform cairn. Here people would have seen Carn Galva and all the other monuments in the complex ahead of them to the north, and St Michael's Mount sitting in its bay (still relatively newly arrived; Jones and Allen 2023) to the south. Several of the monuments were also skylined when approached or seen from the east or west (such as the Nine Maidens from Chun Quoit, above). For both sets of effects to have been appreciated the land would need to have been open, unencumbered by trees or large shrubs. Given what is understood of the land use and vegetation of the preceding periods, it appears likely that such conditions were created by extensive and regular grazing (Herring 2011a, 30; 2016).



Carn Galva, a dominant landscape feature was made culturally meaningful by having the early Neolithic tor enclosure built on it. Several later monuments, apparently dating from the end of the Neolithic period and the early Bronze Age and forming a complex that included the Nine Maidens stone circle, were aligned on the tor and may have been moved along by groups of people performing rituals or ceremonies focused on it. From A and E, fine platform cairns, both Carn Galva and St Michael's

Mount can be seen and at F, where Carn Galva is most impressive, four small cairns were placed in a line set transversely to the alignment, as if closing movement towards the tor.

Views to and visual relationships with Carn Galva may have influenced the positioning of other early monuments, such as the pair of kerbed cairns on the northern foot of the hill (J) and the erection of the menhir that was later inscribed as the Men Scryfa. The builders of cairns at G and H probably responded to the tor of Little Galva while those who built the large cist called Bosporthennis Quoit placed it precisely where the tors of the southern peak of Carn Galva poked over the shoulder of Hannibal's Carn. By contrast, Carn Galva is not visible from the small stone circle with a holed stone at Men-an-Tol, which has longer views to the western hills. (From Herring 2016, Fig 4.7, © Cornwall Archaeological Unit, Cornwall Council)

The southern tor of Carn Galva, Zennor, framed by the two tallest stones of the Boskednan, Nine Maidens stone circle as seen from a cairn built against the circle's SSE side.

The Nine Maidens stone circle, Madron, is skylined and visible because the land cover is open.

Reconstruction of Bartinney 'Castle' hilltop enclosure containing a group of ring cairns and round cairns. Generally presumed to have ritual and ceremonial functions, the gatherings at the four sites of this type known in West Penwith (Castle-an-Dinas, Caer Bran and Chun Castle are the others, all Iron Age hillforts that incorporated such enclosures into their designs) are likely to have also served as opportunities to discuss and make decisions about the extensive common pastures

in which they stand. (Reconstruction by Phoebe Herring for Penwith Landscape partnership, based on survey by The Royal Commission on the Historical Monuments of England; see Herring 1995.)

On Bodmin Moor some of the monuments were created with stones so small that they would not have been noticed in land covers other than grasslands. The grassland and the common grazing that produced it were therefore ‘an essential part of the monument’ (Herring 2008b, 87). The monuments were in turn means of gathering people in the open grassland commons to address any issues that may have arisen since their last meeting that affected how those commons would be used.

‘Keeping the Moor’s downs clear would have required large herds and flocks, with animal numbers in the tens of thousands, scales of activity, investment and problems, in terms of managing sustainable access to a limited resource, that are still surprising to those who expect early prehistoric farming to have been small-scale and localised (Herring 2008a; and see Pryor 2006). In addition to the implications for our understanding of contemporary demography, economy, administration and society, appreciation of this encourages us to imagine how prehistoric people would have felt about the transformations they themselves had wrought on a familiar world. Mile after mile of open land with wide and long views and in which they could strike out in any direction had replaced a largely closed and tree-dominated world, even if one accepts the model of earlier prehistoric tree cover being more like wood pasture rather than dense forest (see Vera 2000). We have become accustomed to the British uplands being clear, but for those who created a world in which hills ran uninterrupted into each other, with yet others visible beyond, this open-ness and freedom may be expected to have been something to come to terms with. The ways that many monuments were designed in response to these qualities, and the ways they were experienced, suggest that communities were indeed dealing with the implications of creating commons for their sense of being, their sense of place, and their identity’ (Herring 2013, 253).

Middle and Later Bronze Age: permanent and possibly seasonal settlements; mixed farming

Palaeoenvironmental evidence

A search for heathland

The palaeo-environmental strand of the HEATH project (Dudley 2011; Kirkham 2011b) examined the established narrative that heathland developed in west Cornwall from the Bronze Age onwards, in the 2nd and 1st millennia BC. The expectation was that as human activity removed woodland from brown soils it left them vulnerable to leaching and acidification. Climatic deterioration (becoming cooler and wetter) in the Later Bronze Age and Iron Age is then expected to have accelerated the development of the peaty soils that can support heathland vegetation.

The palaeo-environmental evidence gathered in the HEATH project and in other archaeological investigations of particular sites in the peninsula has tended not to support that hypothesis. It will be seen, below, that West Penwith heathland developed principally in the Early Medieval period, not in prehistoric times. Herb-rich rough grassland was instead the principal vegetation on the downlands of West Penwith.

At Treen Common the pollen evidence suggests broad continuity in vegetation communities and land use from the previous period, but that in the final centuries of the Bronze Age (the first half of the 1st millennium BC) there was a dramatic decrease in woodland pollen (which as noted may have been predominantly bog myrtle) and a complementary rise in grasslands and those herbs normally associated with grazing. The herbs included *Plantago* spp (plantains) and *Cichorium intybus*-type (dandelion/chicory) that normally suggest grazing rather than agriculture, and it is noticeable that no cereal pollen was found in this period (Forster and Robinson 2011).

Regarding the trees, the *Corylus*-type pollen (hazel or bog myrtle) remained the largest type, albeit in significantly smaller numbers. Pine, elm, oak, birch, willow, alder and buckthorn were also still present, but holly and ash disappeared from the pollen record (ibid).

Fern records remain low, as do heathland species although *Erica ciliaris*, *E tetralix*, *E* undifferentiated, *Calluna vulgaris* and *Ericacea* undifferentiated are all present throughout, in small quantities, perhaps indicating small stands at the edges of grasslands (ibid).

Several herbs that had disappeared in the previous phase returned, including sorrel, red or sheep's sorrel, yarrows, bird's foot trefoil and bellflowers. Some continued from the first and second periods, like the buttercups, meadowsweet, cinqufoils, roses, umbellifers, small scabious, goldenrods, chicories and clovers. Others disappeared during this phase, including the asters, bladder campion, rowan, forget-me-not and marsh valerian. And others emerged for the first time, including spurrey (*Spergula* type), purging flax (*Linum catharticum*) and hedge bindweed (*Calystegia*) (ibid).

This suggests extension and intensification of summer grazing, presumably associated with continuation of the milking and dairying (cheese and butter making)

seen from the early Neolithic period. There was still little sign of extensive heathland (ibid).

- At **Chyandour** peats accumulating between 1460-1110 BC and AD 1250-1410 produced pollen that showed an alder carr beside the water and grasses and sedges on the mire surface. Oak and birch woodland was gradually replaced by hazel and bracken and grasses also increased (James and Guttman 1992; Straker 2011a, 68-69).
- Charred plant remains found at **St Buryan churchtown** (Tower Meadows) included hulled wheat and barley and Celtic bean, as well as some weeds often associated with crop husbandry, like fat hen, pale persicaria, black bindweed, ribwort plantation and heath grass (Allen *et al* 2020). Fat hen and black bindweed may have supplemented the diet of the inhabitants of the Middle Bronze Age settlement being investigated and could have been deliberately encouraged (see below, under Archaeophytes).
- Pollen from a soil buried beneath one of the ramparts of **Caer Bran** hillfort was investigated. Interpretation is made imprecise as the two ramparts at Caer Bran may be of very different periods: the inner one as early as the later Neolithic or Early Bronze Age and the outer one Later Iron Age (see Lawson-Jones and Herring 1997). The buried soil may therefore be from either 3rd or 1st millennium BC. Grasses dominated in each sample taken though oak and hazel (or bog myrtle) were also fairly significant. The likelihood is that there was another mixed mosaic of land cover on the top and slopes of Caer Bran before the rampart was created.
- Pollen from soils at **Carn Euny** dated to the 5th century BC, before the settlement was established, indicate that an oak and hazel woodland had been replaced by grass-based pasture and some arable, with weeds of both grassland and arable present (Dimbleby 1978).

Archaeophytes

Cichorium intybus, common chicory

Recorded in the broadly Bronze Age zone of the Treen Common peat sample (Foster and Robinson 2011). See above (Mesolithic and Neolithic) for discussion.

Myosotis arvensis, field forget-me-not

Recorded in the broadly Bronze Age zone of the Treen Common peat sample (Foster and Robinson 2011). The down had been partially invaded by trees (hazel or bog myrtle), but grasses were still an important element, and it may be presumed that grazing continued but perhaps at a lower intensity than in earlier prehistory. There would still have been trackways (animal and human) including to and beside watercourses and it is likely to have been there that the forget-me-not was found.

Formerly known in Britain as Scorpion Grass, the present rather more romantic name is supposed by some (e.g. Grigson 1958, 284) to have been inspired by the footnote to the 1802 poem *The Keepsake* by the Romantic poet Samuel Taylor Coleridge.

Fallopia convolvulus, black bindweed, or climbing buckwheat

Found charred alongside other ‘weeds’ often found associated with crop husbandry, *Chenopodium album* (Fat Hen) and *Persicaria lapathifolia* (Pale Persicaria) in Middle

Bronze Age (later 2nd millennium BC) layers at Tower Meadows, St Buryan (Allen *et al* 2020).

These charred plant remains indicate arable farming while fragments of bracken and lesser celandine (*Ficaria verna*) suggest that this was intermixed with grassland. The black bindweed is likely to have thrived best in the arable ground and while its seeds could have supplemented the crops, and thus made it a useful plant (see below), it is also likely that it was a nuisance to the early farmers due to its habit of climbing stalks of other plants and bringing them down to earth.

Most archaeologists now regard black bindweed as an unwelcome 'arable weed', and modern gardeners receive advice on how to eliminate it. But Geoffrey Grigson in the 1950s followed contemporary archaeologists like Graham Clarke in regarding it as a 'utility plant', along with the Pale Persicaria also at St Buryan.

Grigson cites Clarke 1952 who said sensible things about weeds and utility plants: 'under primitive conditions the distinction between "wild" and "domesticated" plants is often slight', and 'a multitude of gradations in status may exist between wild, protected, and fully domesticated species', with no clear division recognised 'between weeds and the main crop' (Grigson 1958, 233). This is a clear setting out of the issues that still attend the identification of some archaeophytes (and native species like the Fat Hen and Pale Persicaria) as ancient weeds.

Hans Helbaek, a contemporary of Graham Clarke, and a student of ancient crops in Britain and Europe, noted that black bindweed seeds were found in such numbers on one Danish Early Iron Age site (not much later than this site at St Buryan) that 'it is evident that they were gathered as supplementary food' (Helbaek 1952, 206). He was also involved in the analysis of the contents of the stomach of 'Tollund Man', the most famous of the Danish bog bodies, executed by hanging in the early 4th century BC. His last meal was a broth made of numerous grains and seeds, including Fat Hen, Pale Persicaria and Black Bindweed, as well as Corn Spurrey, see below (Grigson 1958, 233).

See Appendix 1 for more detail.

Archaeological sites

The earliest fields: Mixed farming in the Middle Bronze Age

Curvilinear and accretive

The earliest surviving fields in West Penwith are those that archaeologists term 'curvilinear'. Their above-ground remains are low stony banks whose occasional orthostats (upright slabs) suggest they were once stock-proof hedges.

Their shapes were those designed to most efficiently create enclosed spaces – circles doing that more cost-effectively than rectangles – and they appear to have been laid out in open country, with no earlier fields to accommodate; field shapes appear unaffected by any pre-existing features, other than natural topography. They seem then to have been pioneering enclosures taken in from pasture.

Field patterns were combinations of accretions, with successive curving fences pushing into open ground and then subdivision within the spaces created to form

smaller, more polygonal fields. Some fields contain ‘clearance heaps’: small and medium sized stones placed on natural boulders. These suggest cultivation, as does the existence of low lynchets – accumulations of soil along the lower edges of some fields. Cultivation is likely to have involved cutting and turning the sod with simple hand tools as there was no attempt to lay out straight edges of fields and facilitate people or animals (like oxen) pulling ards or primitive ploughs.

Fields may also have been used for saving hay to be used as winter fodder, or for containing grazing livestock, concentrating dunging on land that would later be used for crops or hay. In such ways the soils within fields would be gradually altered.

Several curvilinear field systems are directly associated with roundhouse settlements that have been excavated and appear to have been established in the Middle Bronze Age, in the middle centuries of the 2nd millennium BC (Nowakowski 2016a). Some boundaries of these field systems continued in use into later periods, and a few underlie hedges that are still in use.

The most clearly defined curvilinear field system is on Trewey Downs, Zennor (Nowakowski 2016a, fig 11). Its three roundhouses were excavated by Dorothy Dudley in the 1930s; she called them ‘Huts’ 1-3 (Dudley 1941). Hut 3, in the east, was associated with the curvilinear enclosures immediately to its south that appear to be primary elements in the system in that other fields were attached to them; these included boundaries that subdivided the primary curvilinear fields. Pottery sherds from each of the three houses are of Middle Bronze Age form (Quinnell 2013, 152).

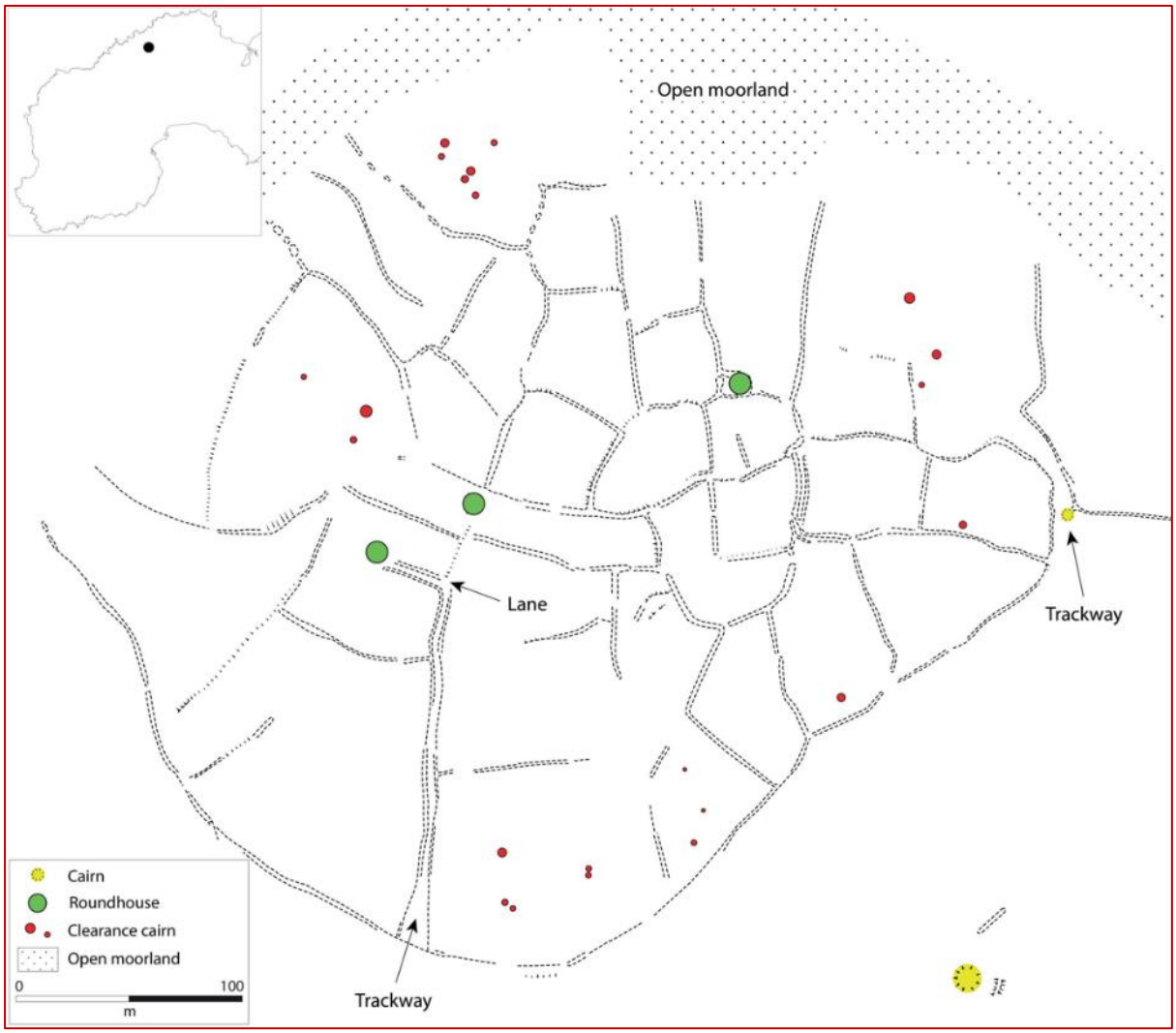
The roundhouses had direct functional relationships with the fields, exemplified by the doorway of Hut 3 being aligned with an opening in the field bank to its south-east. Dudley’s excavations elsewhere in the system demonstrated the contemporaneity of houses and fields (Dudley 1941, 119-120).

The Trewey Downs field system lay within a much larger ring fence, itself curvilinear, which appears to be a form of staking out of a claim to an area of land for the use of the group of households living in the roundhouses. A trackway 2.7 to 3.6 metres wide served the two western roundhouses (Huts 1 and 2), enabling people and livestock to make their way onto the open ground beyond the field system and beyond the privatising ring fence. That open ground appears to have been a form of common; a second trackway from Hut 3 also opened onto it. Each lane has a funnel-shaped opening, confirming their use for driving livestock back into the lane from the commons. The existence of a side lane to Hut 1 confirms that lane, trackway, fields and common are all Middle Bronze Age.

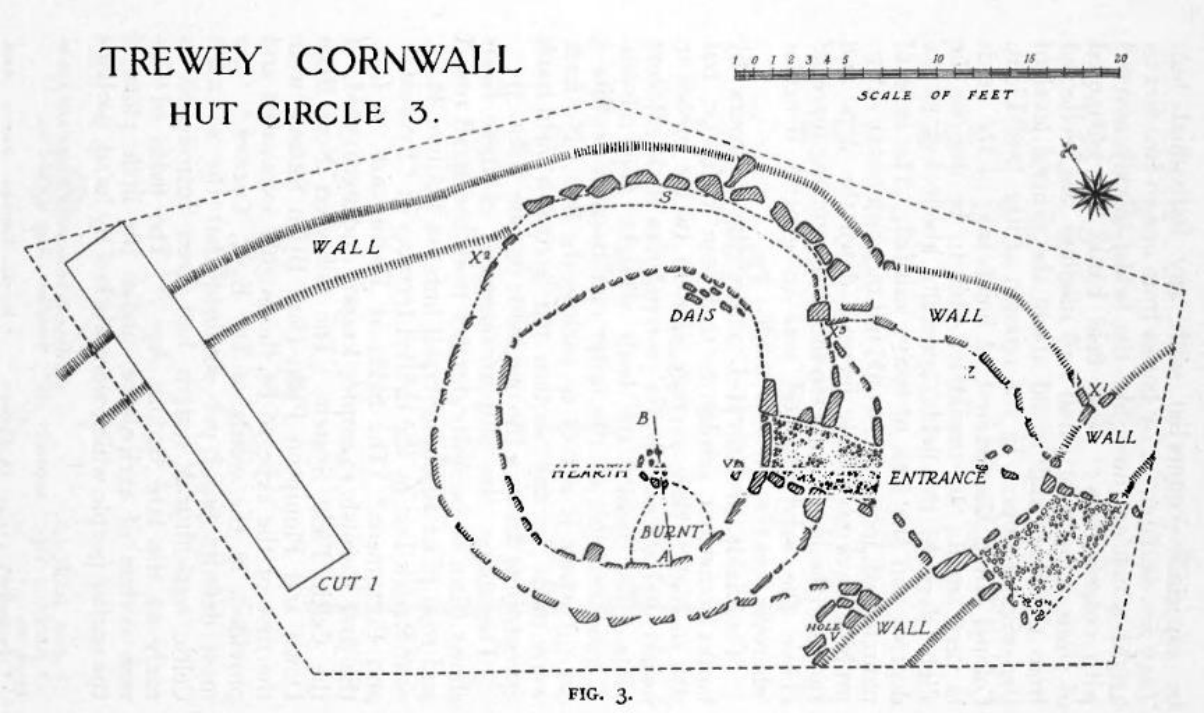
Trewey Downs was a mixed farming settlement. Those lynchets in the fields indicate cultivation, as does a granite muller, used for grinding grain on a saddle quern, found in Hut 2 (Dudley 1941, 118 and fig 7). Hedges protected fields from incursions by livestock, suggesting crops or hay, while the lanes and their funnel entrances indicate livestock. Forecourts to houses 1 and 3 may have provided places where cattle and sheep could be milked.

The pottery appears designed to contain and carry liquid, possibly milk, given how lipid analysis demonstrates that many early prehistoric vessels contained milk or dairy products (see above, early Neolithic).

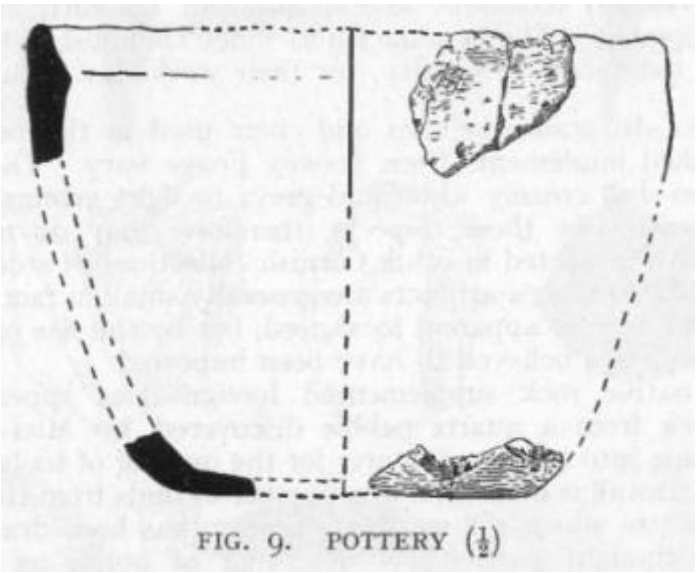
The spacing of the houses suggests they contained individual households who worked the fields closest to them, as if the land within them was held relatively privately. At the same time all households sent their livestock out onto a shared common, and it is possible that other elements of the field system were also shared, as the western trackway was shared by the inhabitants of Huts 1 and 2.



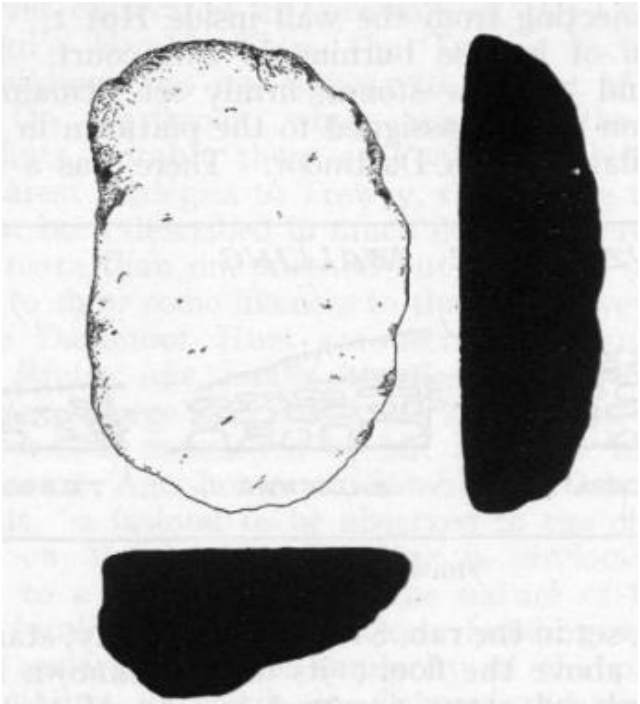
Curvilinear field system on Trewey Downs, Zennor, as surveyed by the Cornwall Archaeological Unit (Nowakowski 2016a, fig 6.11). (Note that the 'open moorland' is actually to the south of the field system, the unenclosed land to which the two trackways run. The stippled area to the north is the steep-sided Foage valley, where it may be expected woodland existed in the Middle Bronze Age.) (From Nowakowski 2016a, fig 6.11. © Cornwall Archaeological Unit, Cornwall Council.)



Plan of the excavation of Hut 3 at Trewey Downs showing the relationship of the roundhouse's south-eastern doorway with the gap in the field 'wall'. Note also the way the wall to the east of the house also curves in a way that creates a sort of forecourt in front of the door, an area where a farming household may have been able to work with livestock brought in through that gateway, for example for milking cows or ewes (Dudley 1941, fig 3).



The sherds from Hut 3 at Trewey Downs as drawn and reconstructed by CA Ralegh Radford (Dudley 1941, fig 9). The scale is not easy to understand from the drawing, but the pot seems to have been around 6 inches in diameter and 5 inches high (152 mm and 127 mm). Its proportions and flat base made for a very stable vessel and the internal rim shape reduced the likelihood that any liquid within it would spill when being moved. That internal rim would have also facilitated the placing of a lid in the opening.

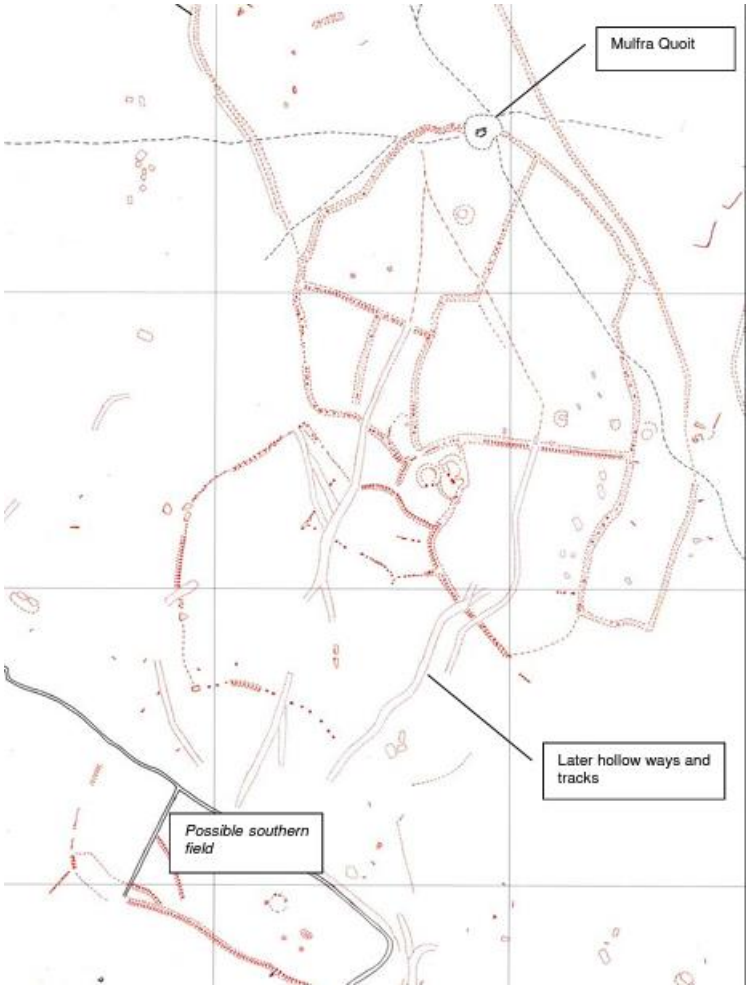


A heavy muller, of porphyritic granite, used for grinding grain on a saddle quern, found within 'Hut 2' at Trewey Downs in Zennor, the central roundhouse shown in the CAU survey (Dudley 1941, fig 7). Its dimensions are around 10 by 7 by 3 inches, or 250 by 180 by 75 mm.

The score or so of small, roughly equal-sized fields in the main part of the Trewey Downs field system suggest that each field had a similar capacity in terms of the number of animals that could sustainably graze them, or in terms of the quantities of the produce of any cultivation. It is reasonable to then think that the fields were subjected to rotations over time, with decisions being made annually regarding which ones were to be set aside for hay or crops, and which would then be available for grazing. It is also reasonable to model that most of the community's livestock would have been turned out onto the open commons for much of the year and that those grazing the fields were those animals that were young or sick.

Other curvilinear field systems in West Penwith

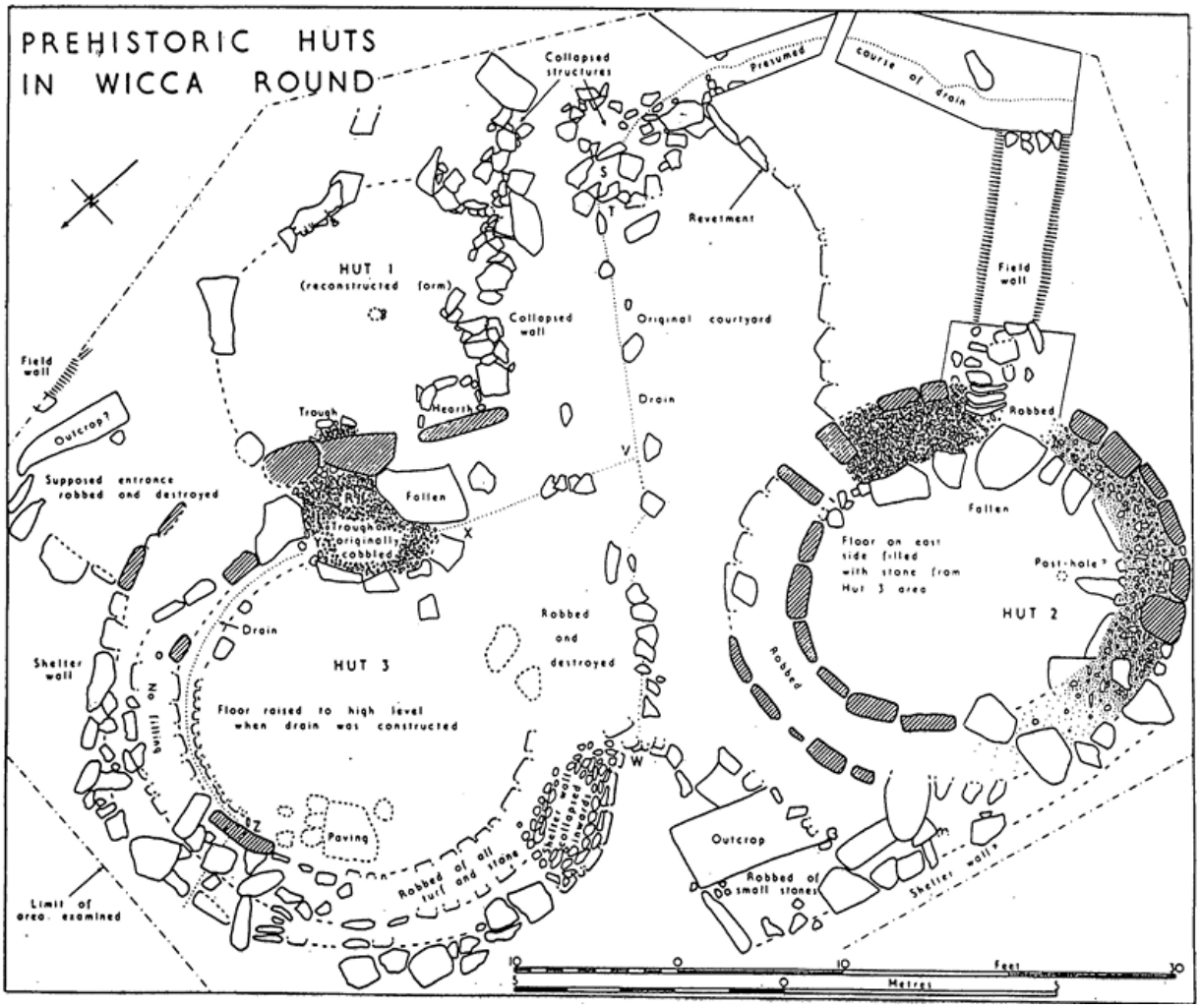
As on Bodmin Moor and Dartmoor, the better-preserved curvilinear field systems survive on downland beyond the margins of later prehistoric and later field systems. Another good example is high on the southern slopes of **Mulfra Hill** where those who laid out fields ran their northern perimeter up to the early Neolithic cromlech (Mulfra Quoit) at its windswept summit. At least seven irregularly shaped fields of more variable size than at Trewey Downs can be discerned and surveyed (Rose 2009, fig 9). A short lane led through the fields to open ground from the settlement that had three buildings, one a roundhouse, and two ancillary structures.



Curvilinear field system on the high southern slopes of Mulfra Hill, Madron, as surveyed by Peter Rose of CAU (Rose 2009, fig 9. © Cornwall Archaeological Unit, Cornwall Council.).

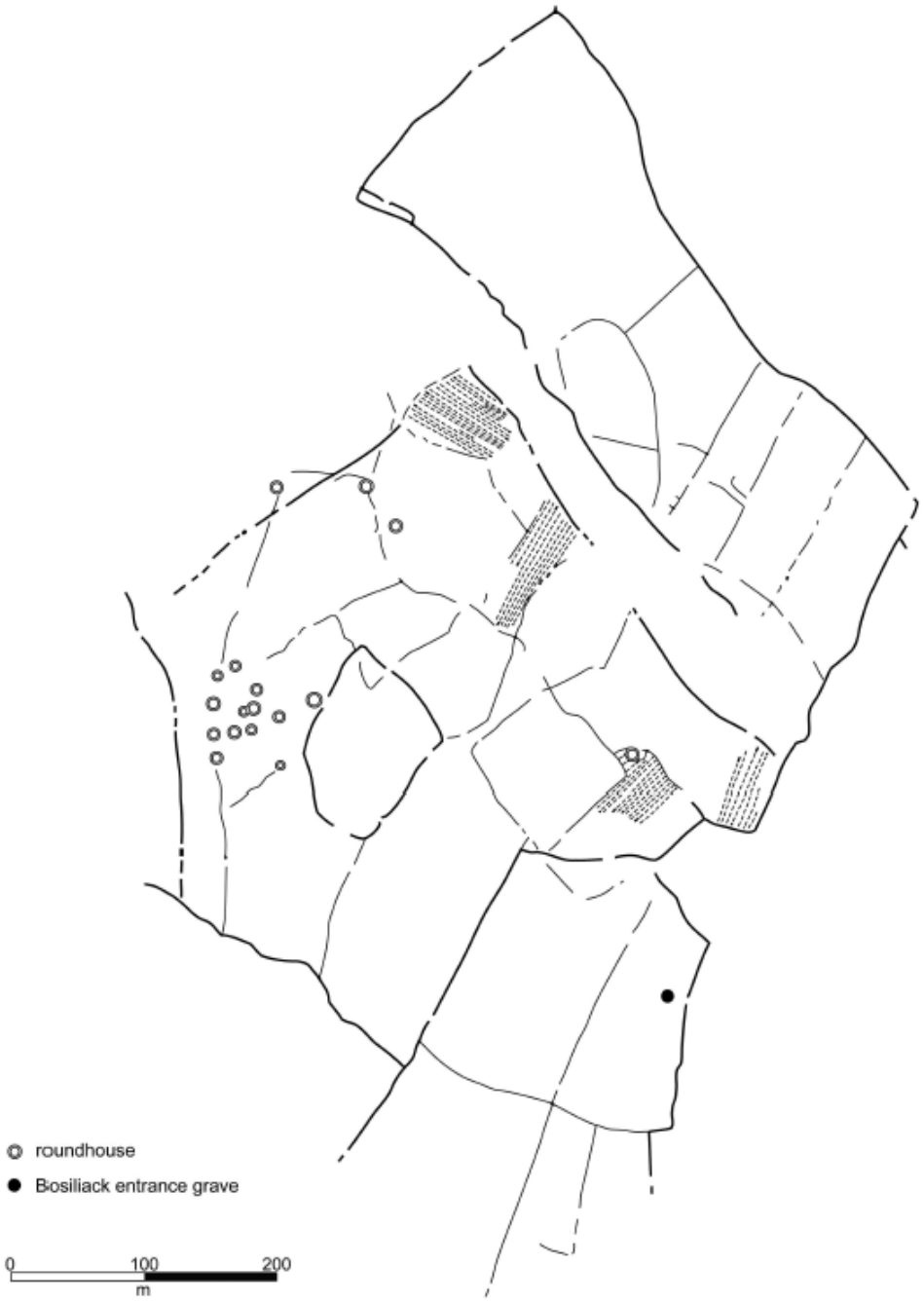
The Mulfra settlement is similar to the tight cluster of three roundhouses at the heart of another curvilinear field system further east on the downs above Wicca, named **Wicca Round** by Dorothy Dudley (its excavator). It lies above the coastal plateau in a slight hollow which provided some shelter from westerly winds. The fields were directly associated with the settlement – their 'banks ran up to the hut walls' (Dudley 1957, 75; Herring 1986b, 43).

Large quantities of pottery sherds recovered from the Wicca Round roundhouses have been re-examined by Henrietta Quinnell. The earliest are Middle Bronze Age, like at Trewey Downs, but some are Later Bronze Age and Early and Middle Iron Age (Quinnell 2013, 152), covering the best part of a millennium. Despite being high on a northern slope, the settlement was not, therefore, short-lived, though it seems likely that later occupants operated within a radically different field system, the coaxial fields of east Zennor, which were laid out over the remains of the curvilinear field system (see below).



Round houses at Wicca Round as excavated by Dorothy Dudley (1957)

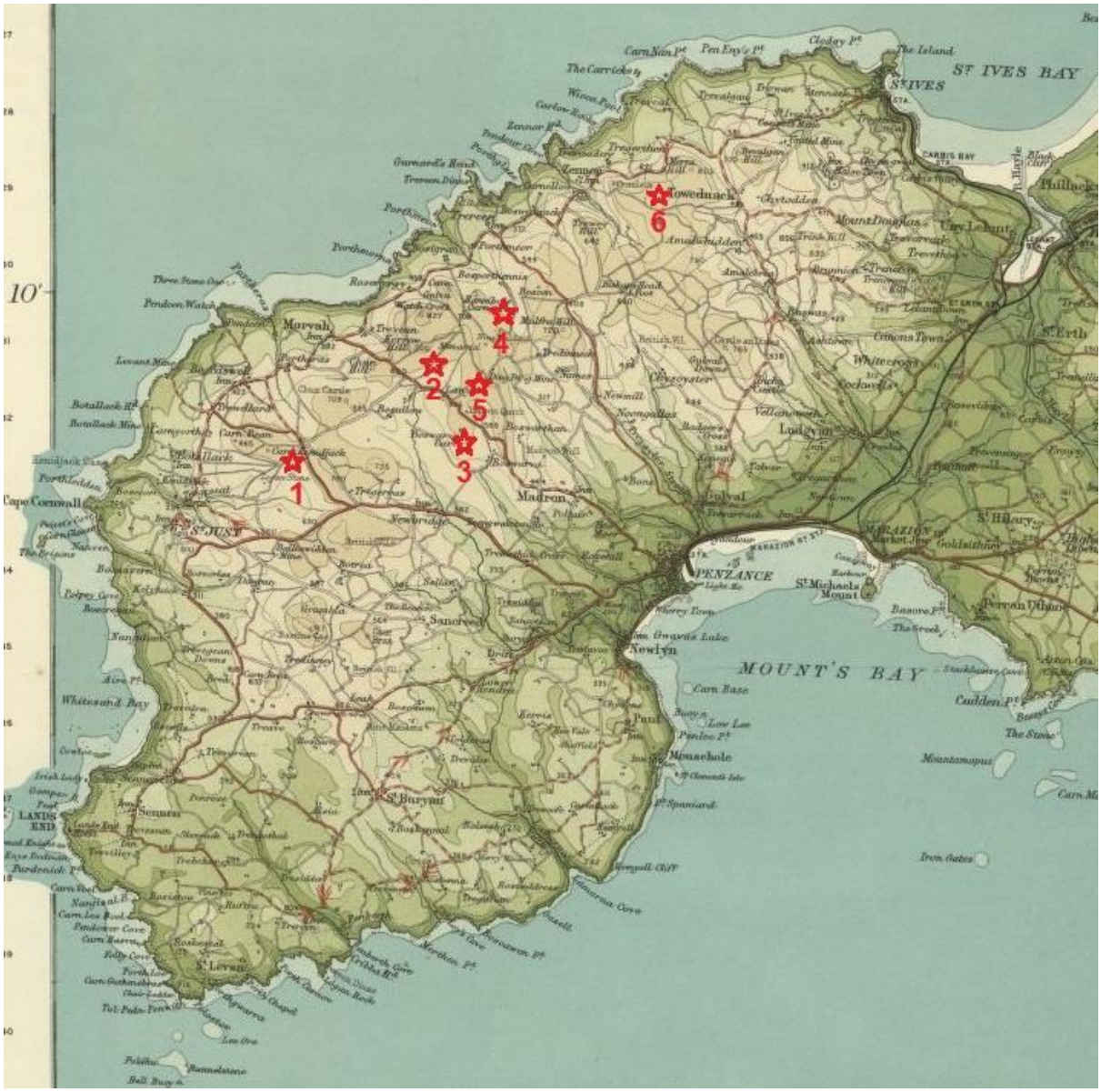
At **Bosiliack** in Madron on Greenburrow Downs is a roundhouse settlement surveyed and excavated by CAU in the 1980s and partially excavated by them in 1984 (Jones and Quinnell 2011) and in 2011 (Jones 2013). The settlement appears to be in two parts: a densely packed group of 13 round houses (see below, transhumance), some with either small annexes or remnants of earlier houses poking out from beneath them; and a much more widely scattered group of four more houses incorporated into the boundaries of a field system that is similar in many respects to the curvilinear fields described above. None of these four houses was selected for investigation by CAU, but the similarity of the field system's pattern to other curvilinear and accretive systems in West Penwith (and on Bodmin Moor) would suggest a mid-2nd Millennium or Middle Bronze Age date is likely.



Bosiliack, Madron with a cluster of 13 small roundhouses that selected excavations have indicated were established in the Middle Bronze Age, possibly pre-dating the creation of a curvilinear and accretive field system, presumed to be of Middle Bronze Age date, with another four roundhouses. (From Jones 2013. © Cornwall Archaeological Unit, Cornwall Council.)

Transhumance: Bronze Age settlements lacking enclosures on downlands

The location of the cluster of 13 roundhouse at Bosiliack is similar to that of several other settlements in West Penwith that have groups of round houses but few or no enclosures. They are on downland at between 180 and 190 metres AOD. Given how much the uplands of West Penwith have been disturbed, it is likely that many other similar sites formerly existed in the land of *goon* and down.



Locations of the six roundhouse settlements lacking substantial enclosures and considered possible transhumance settlements. (Base map, Bartholomew's Half-Inch series 1903)

The numbers refer to the sites shown on the map.

- 1 Carn Kenidjack, SW 388 329, at 194 to 200 metres AOD. At least 3 round houses, closely spaced immediately south of the distinctively shaped tor. Sketch surveyed by Adam Sharpe. (CSHER MCO 19244)
- 2 Little Higher Bosullow, SW 421 348, at 190 to 198 metres AOD. At least 5 round houses, closely spaced on southern slopes of Watch Croft. Identified by Vivien Russell (1971, 51). One possible small enclosure. (CSHER MCO 21171)
- 3 Higher Boswarva, SW 431 332, at 184 to 188 metres AOD. At least 5 round houses on SE slopes of Boswarva Carn. (Russell 1971, 51; CSHER MCO 19661)

- 4 Bosporthennis, SW 436 360 at 172 to 182 metres AOD. At least 6 round houses on E slopes of Little Galver. (Nowakowski 1987, 33 and fig 5; CSHER MCO 18872)
- 5 Bosiliack, SW 428 344, at 182 to 188 metres AOD. A group of 13 round houses on W slopes of Greenburrow Downs. All smaller than 6.0m internal diameter. Identified by Vivien Russell (1971, 51). Three houses excavated by originated in the Middle Bronze Age but use continued into later prehistory (Jones and Quinnell 2011; Jones 2013). (CSHER MCO 18838)
- 6 Sperris Croft, SW 473384 at 222 to 230 metres AOD. Group of 7 round houses in a line on the lower E slopes of Sperris Hill. Identified and excavated by West Cornwall Field Club in 1956 and 1957 (Dudley 1957). Sherds from houses appear to be Late Bronze Age or Early Iron Age (Quinnell 2013, 152). (CSHER MCO 20237)

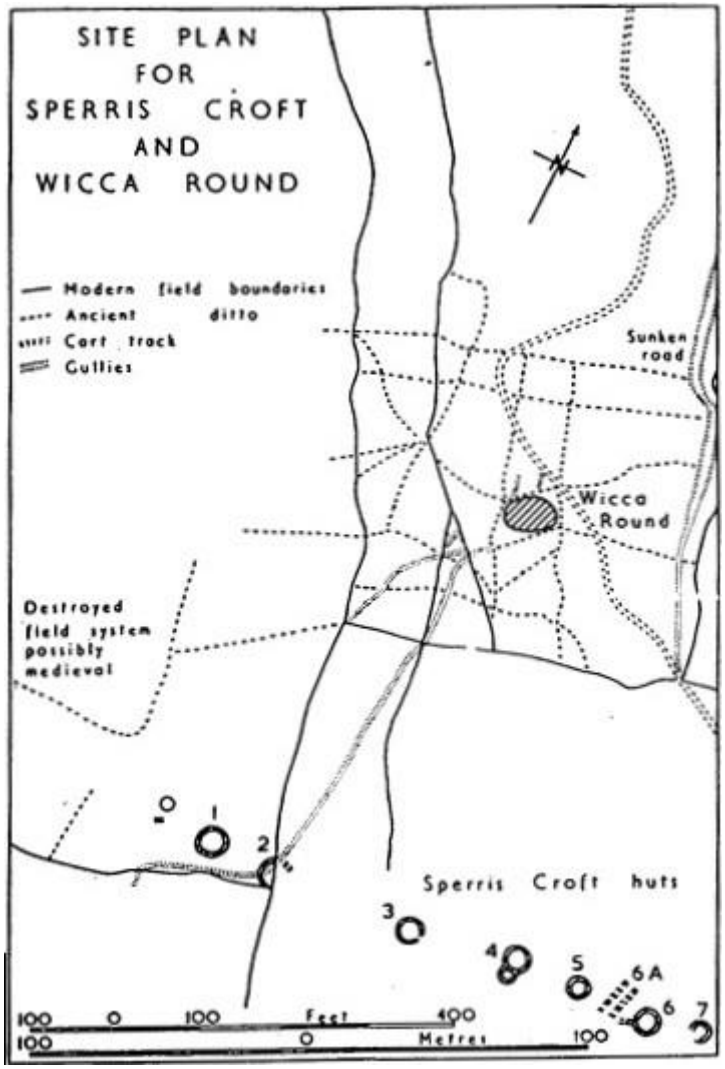
There is increasing evidence and recognition that transhumance was a widespread practice in prehistoric Britain (Collis et al 2016; Bowden 2021; Fleming 2022).

Sperris Croft

On the exposed downland above the more sheltered curvilinear fields at Wicca in eastern Zennor is a line of seven roundhouses called **Sperris Croft** (from the post-medieval enclosure in which they lie). They were first identified by the West Cornwall Field Club who excavated the four eastern houses, termed ‘huts’, in 1956 and 1957.

Hut 4 was a particularly large roundhouse, 8.2m in internal diameter (27 feet), and it had a smaller circular building (just 3.0m or 10 feet in internal diameter) built against a narrow secondary entrance with a paved floor and ‘neatly-coursed sides’. There was no hearth in either house. Most of the pottery sherds came from the small attached hut (Dudley 1957, 73).

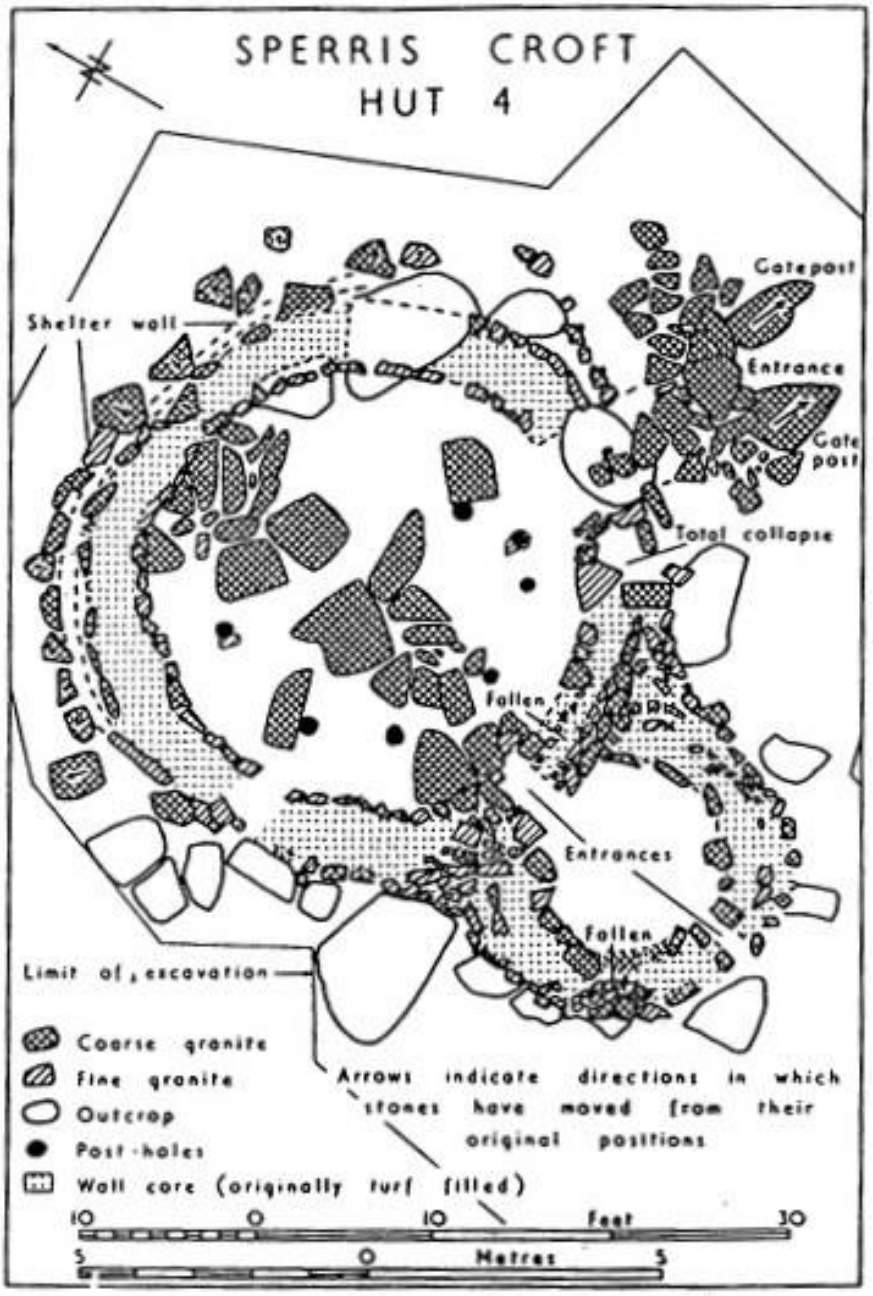
The entrance linking the two buildings is just 0.45m wide, with a paved floor and neatly built sides. It is just manageable for a slim person entering sideways but too wide to accommodate a cow. The principal entrance to the main house, on its SE side, away from the prevailing winds, was in contrast unusually wide, over 1.5m, sufficiently wide for a cow to be lead through it. It also had a large granite threshold stone and an area of ‘pavement’ outside it. Within the main house are numerous large paving slabs, addressing the probability of erosion of the floor. All these observations would support use of the main house as a cowhouse rather than a dwelling, with the very narrow passage allowing someone to enter it from the smaller house, which would then be for people, presumably those who worked with the cattle in the larger house, milking them.



Site plan for the Sperris Croft line of 7 roundhouses and the Wicca Round cluster (see above) (from Dudley 1957, fig 2).

Three of the other roundhouses were excavated here, all small and lacking hearths.

A ‘tiny fragment of a blue glass bead was found in posthole 4 in hut 4; it is possibly prehistoric but cannot be closely dated’ (ibid, 81). A necklace of beautifully worked beads (tin, amber, shale and fired clay) was placed in the burial of a young woman, regarded as probably a transhumant, in the Whitehorse Hill cist in the highest and most remote part of Dartmoor (Jones 2016b; Herring 2021, 93-97). Other probable transhumance sites on Bodmin Moor have also produced blue beads: an Iron Age bead from a round house on Garrow Tor (Herring 1986, fig 20) and an Early Medieval bead found in excavations of much earlier, Bronze Age structures on Stannon Down (Jones 2004-2005, 40). They suggest that the prehistoric and early medieval transhumants who accompanied livestock to summer dwellings in south-west Britain were women (Herring 2012, 97). This Sperris Croft blue bead may now be used in turn to support to interpretation of these houses as a transhumance settlement and then to the likelihood that the transhumants themselves were girls or women, as they have been in most documented transhumance systems in north-western Europe (Herring 2021; Costello 2020, 64-67).



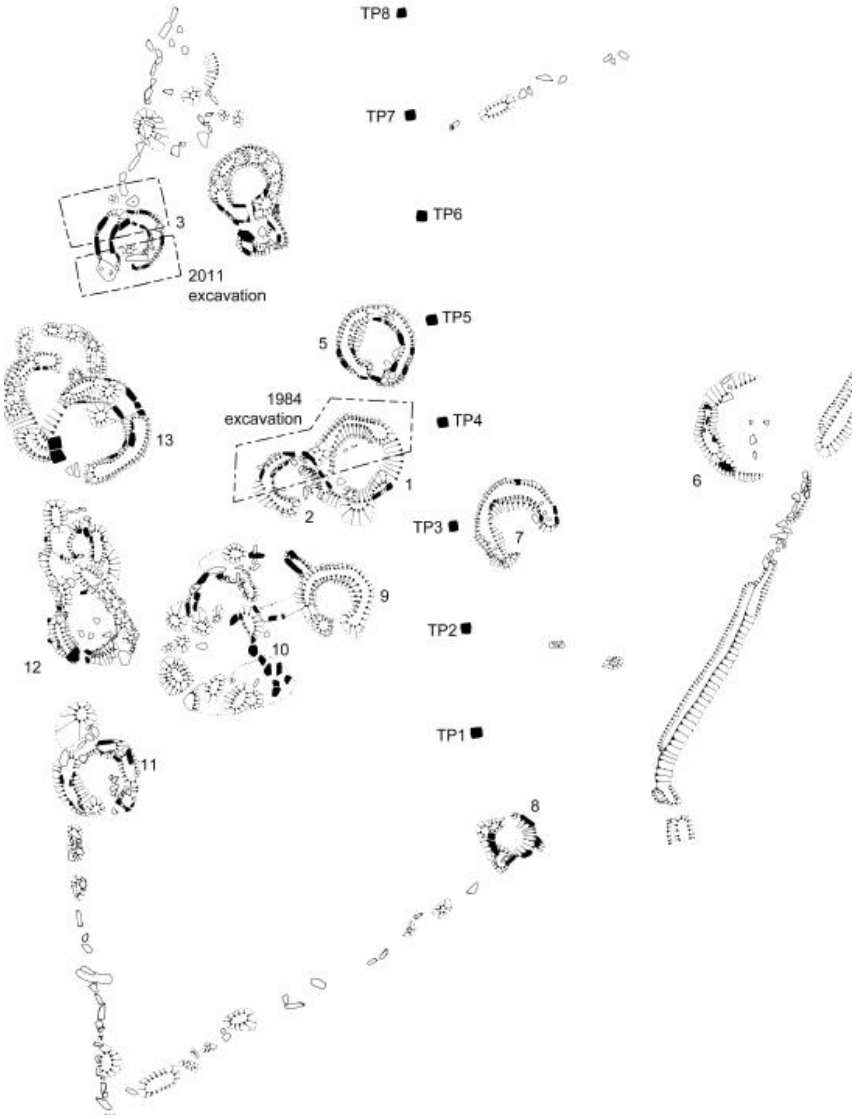
The excavation plan of Hut 4, the most substantially built of the seven structures in the Sperris Croft roundhouse settlement (from Dudley 1957, fig 3). Note the narrowness of the entrances to the small, attached house, including that linking it to the larger house. Also, the unusually great width of the main entrance to the larger house, and the large paving slabs laid to protect both its floor and the approach and entrance to it. These attributes, and the concentration of artefacts (pottery) in the smaller house, led to an interpretation of the larger house as a cowhouse, used for milking in inclement weather, and the smaller house as the accommodation of the milker, or as a form of dairy (Herring 1986, 26).

Also found in Sperris Croft Hut 4 was a ‘naturally-holed quartz pebble (possibly aided by art)’ (Dudley 1957, 82). Dudley noticed that ‘Such are said to be hung in cow-sheds to protect cattle from the evil eye’ (ibid, 82), possibly a subtle indication that she too had also wondered whether Hut 4 was a cow-shed.

Bosiliack

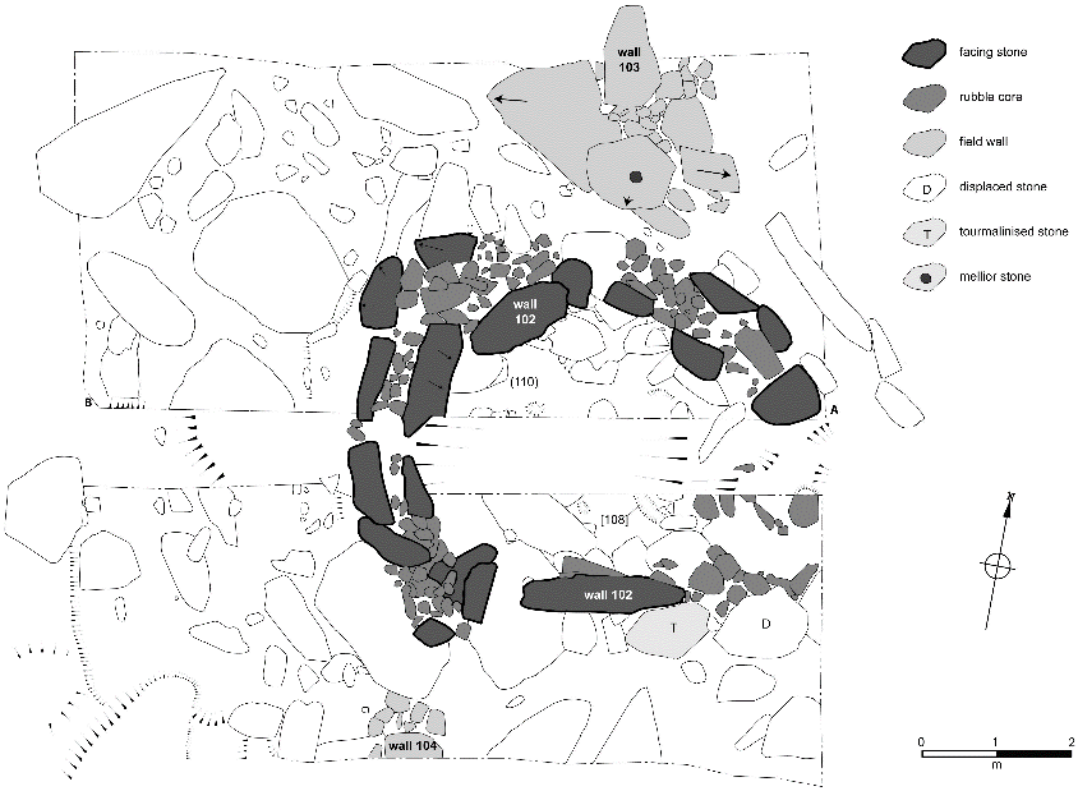
The three houses excavated by CAU at **Bosiliack** were within the group of thirteen. Dating by radiocarbon determinations and through assessing pottery forms indicates that these too are middle 2nd millennium BC (Jones 2013).

The 2011 excavation of one of the 13 houses that appears to lie along the western perimeter of the field system revealed that the stone wall as it survives did not have a direct physical relationship with the house (Jones 2013, figures 4 and 5). However, the offsetting of the line of the wall on either side of House 3 appears to indicate that the house was in place first and that the field boundary (and field system) post-dated it. resuing the line of four houses (numbers 11, 12, 13 and 3) at the west of the group as a means of saving the need to build around 35 metres of its western perimeter boundary. Those houses may have still been in use when this was done, or they could have been ruinous when their walls were incorporated into the boundary.



Detailed plan of the group of 13 roundhouses at Bosiliack, showing locations of the excavations (from Jones 2013, fig 4. © Cornwall Archaeological Unit, Cornwall

Council.). Houses 4 (immediately east of House 3), 9, 10, 12 and 13 each had an ancillary structure attached; house 4's annex may have been similar to that on Hut 4 at Sperris Croft (Dudley 1957, fig 3), but as it seems to be attached to the larger building's entrance it is more likely to have served as a sort of porch.



Plan of the excavation of Bosiliack House 3 (Jones 2013, fig 5. © Cornwall Archaeological Unit, Cornwall Council.). The two stretches of field wall appear off-set on the house, suggesting that they post-date it [103 and 104].

The round houses in the group of 13 were all relatively small, compared with typical houses on Bodmin Moor (around 7.5m internally) (Herring 1979). Only House 13 was greater than 6 metres and all the others were less than 5.0 metres in internal diameter, with one (House 8) just 3.0 metres. It is likely that these were homes for just a portion of the household.

The settlements of round houses without associated enclosures are in areas expected to have been used primarily as rough grazing in the Middle and Later Bronze Age. It is suggested that they housed only that portion of the household who worked seasonally in the pastures in the summer months when grasses and other vegetation were at their most productive, like those similar sites found on Bodmin Moor, with few small enclosures or none at all, such as at Blacktor Downs, Brown Gelly, Brown Willy, Stanninghill, Louden Hill, and Kilmar Tor (Johnson and Rose 1994, 56; Herring and Rose 2001, 33-35; Herring 2008, 82-84). Similar groups on Dartmoor have also been suggested as transhumance settlements (Fleming 2008; Newman 2011, 81) and at Kynance gate on the Lizard downs (Herring 2011a, 32).

Andy M Jones, excavator of the Bosiliack round houses, had also interpreted them as possibly occupied by transhumants. He noted that the charred plant remains from

the hearth were furze or broom, plants of rough ground, rather than the trees of woodland, and a lack of querns or rubbing stones, suggesting that meal was prepared elsewhere and brought up to the settlement (Jones 2013, 164).

An extensive common

The pattern of the possible transhumance settlements high on the northern downs of West Penwith add weight to the suggestion that this land was grazed as one in the second millennium BC as extensive open pastures, probably shared by the numerous settlements and thus working as a form of common. This is again similar to arrangements on Bodmin Moor and Dartmoor (Herring and Rose 2001; Fleming 2008).

The Middle Bronze Age curvilinear field systems, close to the margins of this large common, can then be regarded as evidence for a gradual and probably piecemeal colonisation and enclosure by small groups of farming households of fragments of the extensive area of rough ground that had previously been communally exploited and administered. It is likely that such a change reflected pressures on land available for enclosure and in turn exacerbated pressures on the management and use of those commons, which appear to have been a major feature of the West Penwith landscape until the very early medieval period, and probably had been since at least as early as the Early Neolithic, a period of around 4000 years.

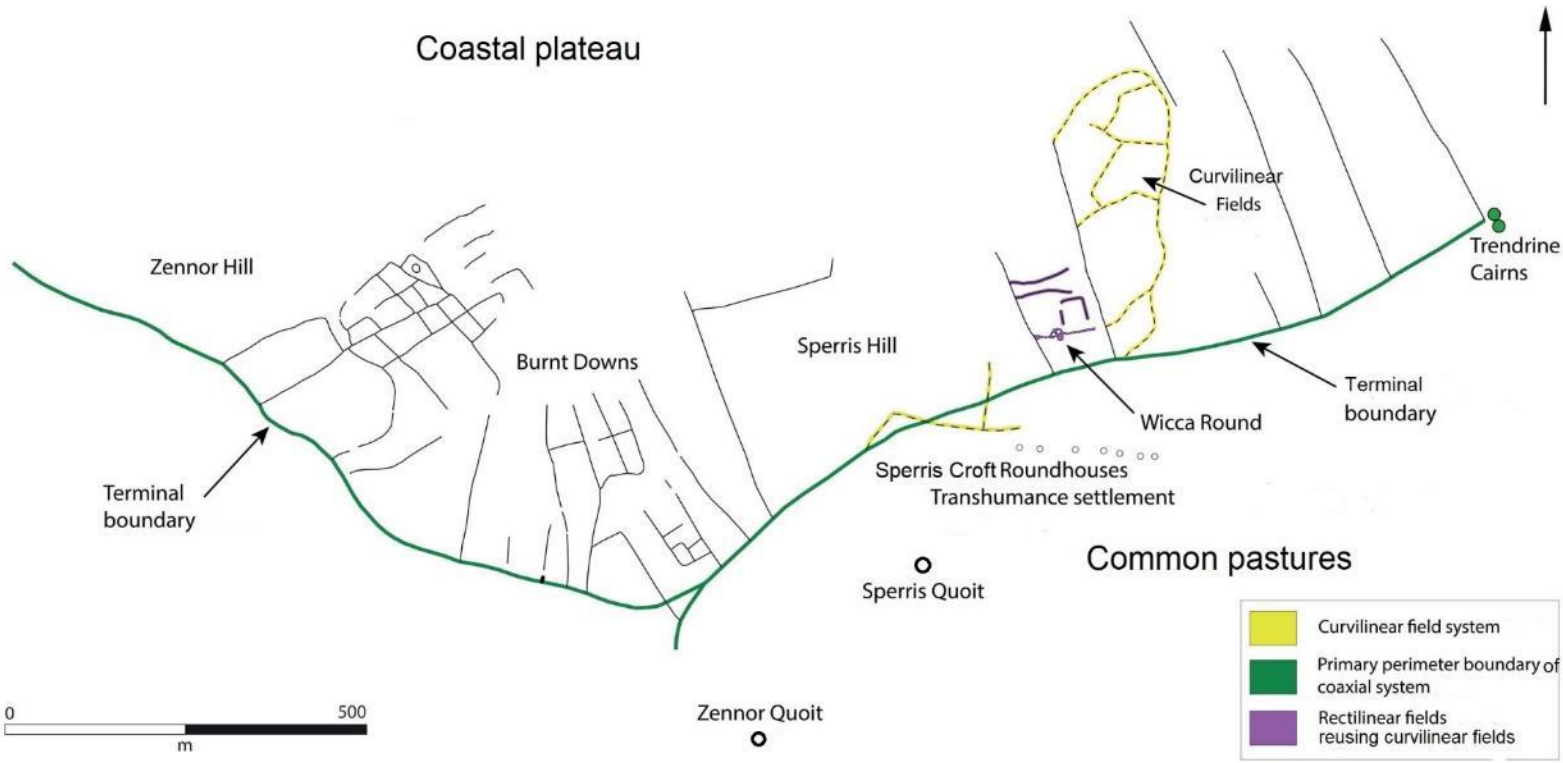
Coaxial field systems: communal responses to pressures on the commons

Just a short time after the curvilinear fields were created there seems to have been a reorganisation of the management of land in West Penwith as well as on the edges of the two larger uplands Dartmoor and Bodmin Moor. This involved delineating more firmly the edges of the upland commons, in places by building a West Penwith equivalent of the Dartmoor ‘terminal reaves’, surviving most clearly in eastern Zennor, where a strong bank, presumed to be Middle Bronze Age, still runs along the crest of the northern slopes from Zennor Hill to Trendrine Hill.

Attached to that ‘terminal’ and depending from it are a number of substantial banks, roughly parallel to each other. (Both the terminal and some of those dependent banks have had stretches reused and rebuilt as croft boundaries in more recent periods, but other stretches survive in typical prehistoric bank form, confirming their early date.) Other coaxial fields have been identified in West Penwith, most of them overlain by and poking out from the edges of later prehistoric and medieval field patterns, at places like Zennor Head, Treveal Cliff, Noon Digory and on Halldrine Croft at Bosigran. At the latter OSL dating was used to confirm a Middle Bronze Age date – a start date after 1690±180 BC and before 1120±230 BC (Vervust et al 2020).

It may be that the creation of the curvilinear field systems was a cause of concern regarding piecemeal nibbling away at the open pastures, or commons and it is quite startling how the ‘terminal’ slices through the Wicca Round curvilinear fields. The effect of this reorganisation was to not only rationalise the access of communities’ livestock to the commons, but also to create a new pattern of fields for the crop and hay side of the farming economy.

These systems appear to have been organised at a level of society that transcended the hamlet or neighbourhood group, and represented Middle Bronze Age equivalents of communities (analogous in some ways to parishes or manors) (Herring 2011a).



Plan of the East Zennor coaxial field system which depends from the green terminal boundary that follows the crest of the high ground above the coastal plateau. Common pastures lay to its south, where the Sperris Croft transhumance roundhouses were placed. The coaxial fields overlie and post-dated the yellow curvilinear fields associated with the Wicca Round settlement. (Adjusted from Nowakowski 2016a, fig 6.15, itself redrawn from Herring 1986b, fig 7. © Cornwall Archaeological Unit, Cornwall Council.)

Of particular interest is the position of the Sperris Croft round houses in relation to the 'terminal' boundary of the East Zennor coaxial field system. The line of houses is roughly parallel with the terminal boundary and are on the 'commons' side of it. They are within the summer grazing land and also appear associated with the communally organised coaxial fields of a community practicing a mixed farming economy.

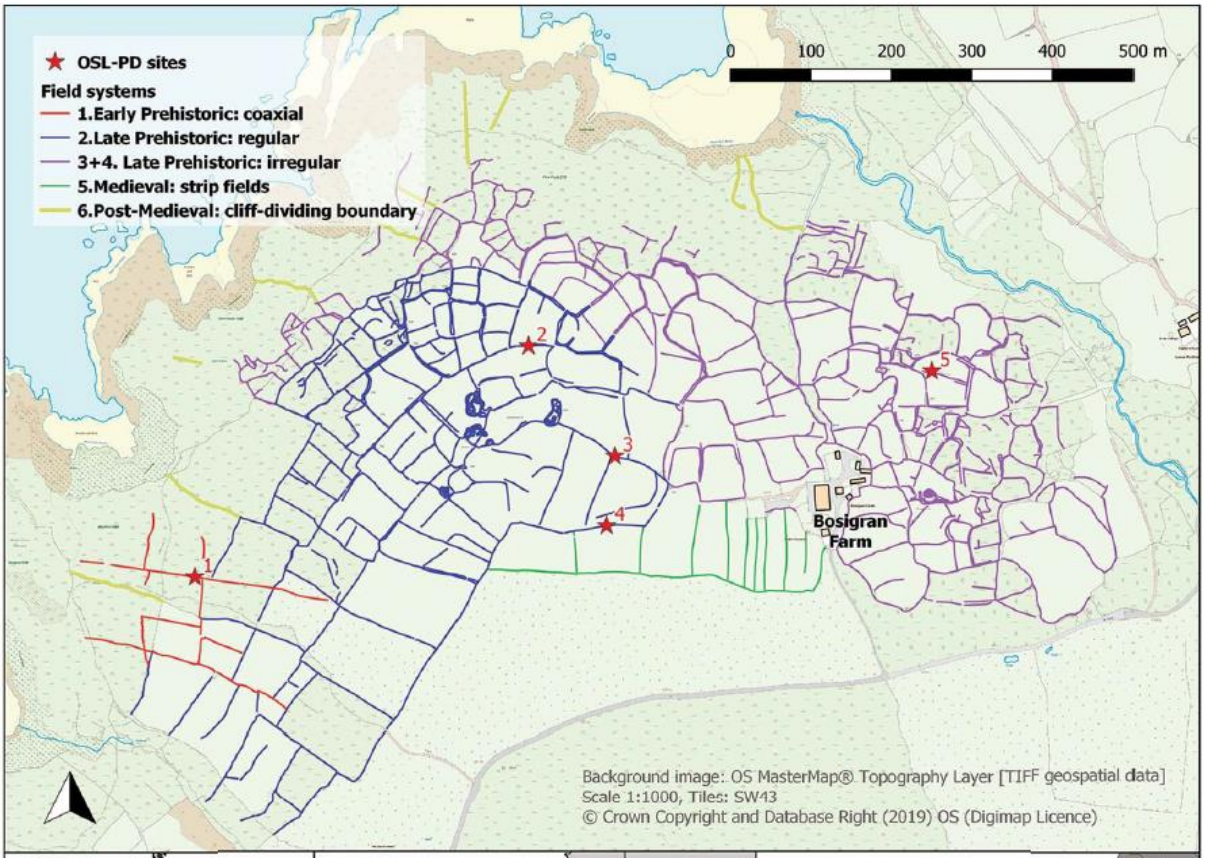
Given the apparent functions of the houses, one a cowhouse, another a possible dairy, and all the others probably occupied by just part of the household, it seems likely that these are indeed the summer homes of transhumants, possibly girls and young women, if the arrangements in more recent northern European transhumance systems can be a guide (Costello 2022; Herring 2021). Given the durability of transhumance as a land use practice (Fleming 2022), it is likely that the settlement at Sperris Croft was long-lived.

Reconstruction by Phoebe Herring for the PLP of the Sperris Croft transhumance settlement. See caption for the same image illustrating the Commons, Summer Grazing and Transhumance section, above.

Iron Age and Romano-British: intensive agriculture in extensive regularly organised field patterns with upland and cliff-top grazing.

Transformation of land use in the home farm land

The Iron Age in West Penwith covered most of the last millennium BC and the Romano-British period ran into the 5th century AD. They are grouped together here as the palaeo-environmental and archaeological evidence suggests an essential continuity between the two in terms of land use and land cover, regardless of the changes in some aspects of settlement form and the influence on society and the wider economy of the arrival of the Romans in the 1st century AD.



The field system at Bosigran, Zennor has five main phases. First (red) is the Middle Bronze Age coaxial field system; second are the brick-shaped fields of the Middle Iron Age (blue) which are framed by several strong contour-following primary lines and which runs across the coaxial fields; they were farmed from the hamlet of round houses that preceded the courtyard houses. The purple are irregular fields including those that extend the Middle Iron Age fields onto the cliff tops. Green indicates medieval strip fields that extend the system onto the lower slopes of Carn Galva and yellow are post-medieval pasture boundaries that divide the commons of the cliff grazings into privately worked crofts (from Vervust et al 2020, fig 2).

From the perspective of the development of the peninsula's semi-natural environment, this long period was characterised primarily by continuity, again, in the use of the downs which appear to have continued as commons, with the practice of transhumance also continuing. There was, however, substantial change, and

apparently quite early in the Iron Age, in the way that the home farms were organised. The Bronze Age coaxial fields were effectively replaced by tighter grids of smaller roughly rectangular fields, sometimes referred to as brick-shaped fields (examples are illustrated and described in Nowakowski 2016b). The commons may also have been subdivided in terms of allocation of blocks of them to particular hamlets, for their common fuels (peat/turf and furze) as much as for their grazing, fixing particular areas of the commons to particular hamlets, as precursors of the 'hamlet commons' that were more firmly established in the medieval period (below). Hefting of livestock to particular zones in the open commons would have reinforced such attachments of particular blocks of land with particular hamlets.

OSL dating of a primary boundary in such a brick-shaped field system at Bosigran in Zennor confirmed an early to middle Iron Age (mid 1st millennium BC) date for the creation of the boundary. It has been in use as part of the farm here ever since, with substantial lynchetting developing on its uphill side, largely from the Early Medieval period onwards (Vervust *et al* 2020).

The rationale for this substantial change.

As those working these fields lived in hamlets, rather than in houses scattered widely through the fields, there was probably an intermixing of the fields worked by individual households to ensure fair distribution of land of varying quality between them. Regularity of field shapes and sizes made such intermixing easier to achieve.

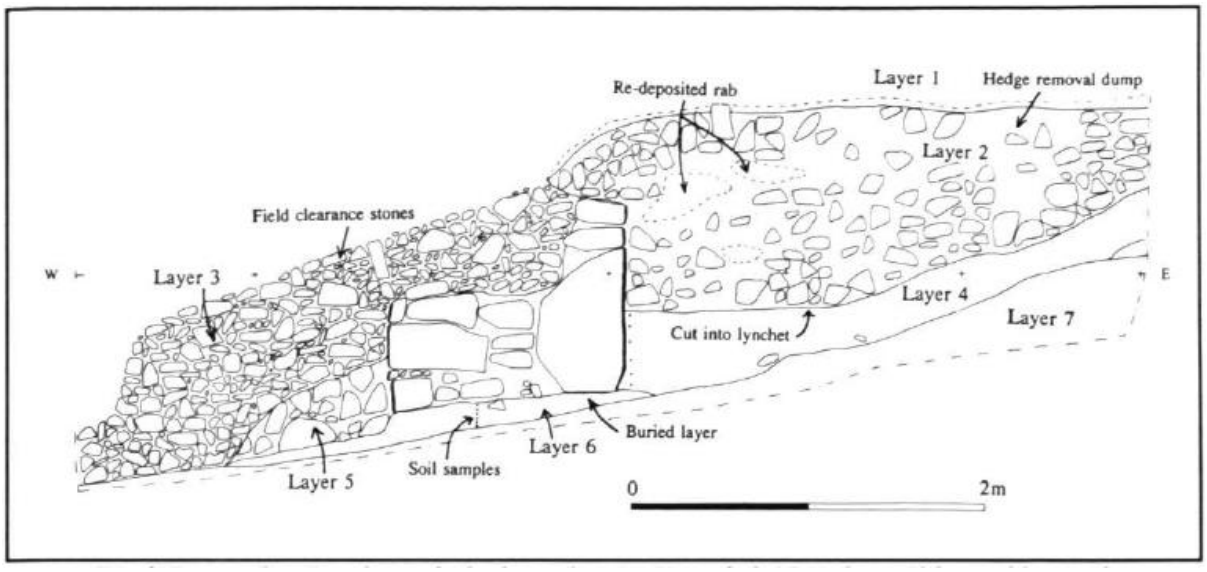
The new field systems appear to have been organised at the more local and flexible hamlet or cooperative group level of society, not at the more distant and thus less sensitive community level of the preceding coaxial fields. This allowed the design of the new field systems to be more equitable and more sensitive to the qualities of the land, drawing on peoples' knowledge of the place.

As before, the reason for undertaking such massive changes would have been to keep the whole farming system sustainable. Fields were now able to be more intensively used for arable (with substantial lynchets developing) and hay, to keep livestock through the winter; the area set aside for summer grazing continued largely as before.

Palaeoenvironmental evidence

At Treen Common in Zennor analysis of the pollen in the peat core indicates a continuation of the open grassland dominated vegetation, still with minimal woodland and heathland (Forster and Robinson 2011). It may be presumed that land use continued as summer grazing with dairying and commoning. See below, under archaeological evidence for discussion on the management of the commons.

- A buried soil beneath a field boundary on the higher eastern slopes of the Foage valley south of Zennor churchtown, just a mile to the east of Treen Common, was examined. From its archaeological context it was believed to be either iron Age or Romano-British in date, being a boundary within a field system associated with a courtyard house just a few metres to its south. It contained the pollen of an open landscape community dominated by herbaceous grassland and with low levels of heathland and woodland (Herring *et al* 1993).



Buried soil beneath a Cornish hedge at Foage, Zennor, showing lynchet on uphill right-hand side that had in 1892 been cut into by farmer James Stevens to shift the loamy soil to other parts of the Great Flat Field (see Post-medieval and Modern, below) (from Herring et al 1993, fig 3).

The small yellow 'L' marks the lynchet at Foage whose buried soil was sampled for pollen and showed herbaceous grassland on the crest of the valley in later prehistoric times.

- At Carn Euny, on steep slopes at the head of a valley, buried soils and land surfaces pre-dating creation of the fogou were investigated for their pollen. They were expected to indicate conditions prior to the settlement's

establishment and showed the presence of oak and hazel woodland in the vicinity.
    - Pollen in other soils believed to be of the period of the Carn Euny settlement itself (Later Iron Age and Romano-British; second half of the 1st millennium BC, running into the first centuries AD) showed the woodland was gradually replaced by grasses and herbs that suggest the existence nearby of arable land: sorrels (*Rumex*), great plantain (*Plantago major*) as well as unidentified members of the Cruciferae (mustards, cabbages, etc), Urticaceae (nettles) and Umbelliferae or Apiaceae families (the umbellifers, like carrots) (Dimbleby 1978; Straker 2011a, 70).
    - Charred material from the excavations was mainly of broom or gorse (*Sarothamnus* or *Ulex*) but also included ash, hawthorn and wild cherry (Christie 1978).
- One of the hearths at Goldherring enclosed settlement also produced charred fragments, mainly pieces of oak wood, but with some elm, alder, rose, apple/pear and gorse (*Ulex*) (Guthrie 1969, 38).

Archaeophytes

Pollen from the broadly Iron Age pollen zone 3 of the peat sample taken from Treen Common, Zennor (Foster and Robinson 2011) included further examples of both ***Cichorium intybus*, common chicory** and ***Myosotis arvensis*, field forget-me-not** (see above for details of each).

See Appendix 1 for more detail.

Archaeological sites

Round house settlements on the commons

The round houses in some of the settlements adjoining the downlands either continued in use or were sporadically reused. House 1 at Bosiliack had four hearths that provided radiocarbon dates from the Middle Bronze Age through to the later Iron Age. It seems possible that this house had been abandoned and then reused as one of its hearths was built against the inner wall, presumably when roofless (Jones 2013, 141). Middle Bronze Age houses had also been reused at Wicca Round and Bodrifty (Quinnell 2013, 152).

Similar reuse was recorded by Dorothy Dudley at Garrow (Herring 1986) and by Bender *et al* (2007, 88-87) at Leskernick, both in the heart of Bodmin Moor. Bodrifty, Wicca Round and Bosiliack can also be regarded as downland sites and their locations, combined with the longevity, persistence and stability and, to a considerable degree, the necessity of transhumance (see Setting the Scene) makes it likely that this reuse was transhumance use.

Round houses and courtyard houses among the fields, including some within ‘rounds’

Other round houses were downslope on the coastal plateau or on valley sides and can be more reasonably associated with the ‘home’ farming settlements whose occupants worked the brick-shaped field systems within which they lie, normally close to their centres. These include some surviving on the edges of hamlets that in

the Romano-British period were provided with courtyard houses (most famously at Chysauster and Carn Euny).

Courtyard houses are multi-celled structures arranged around a central courtyard. They are of interest as each room appears to have had a particular function and those that are sausage or banana shaped are often interpreted as cow-houses, perhaps used principally in the winter when cattle could be fed fodder and continue to provide the household with milk (plans of examples are included in Nowakowski 2016b).

Excavations have produced evidence of mixed farming, with saddle and rotary querns (for grinding grain) alongside spindle whorls (for spinning fibres into yarn; presumably mainly wool). Pottery also typically includes large vessels, one of whose functions may have been to contain milk. Good examples can be found in the reports of excavations at Carn Euny (Christie 1978), Goldherring, which included several jars and bowls and several shallow dishes of the kind used in dairying (Guthrie 1969, fig 11, item 19; fig 14, items 1-10).

Some hamlets were built within ‘rounds’ the local term for roughly circular enclosed settlements, their perimeter defined by a ditch outside a strong bank. These ‘defences’ may have been principally indicators of social status, distinguishing them from that of the unenclosed hamlets, but the material culture as expressed in surviving finds does not necessarily indicate substantial differences between the two types.

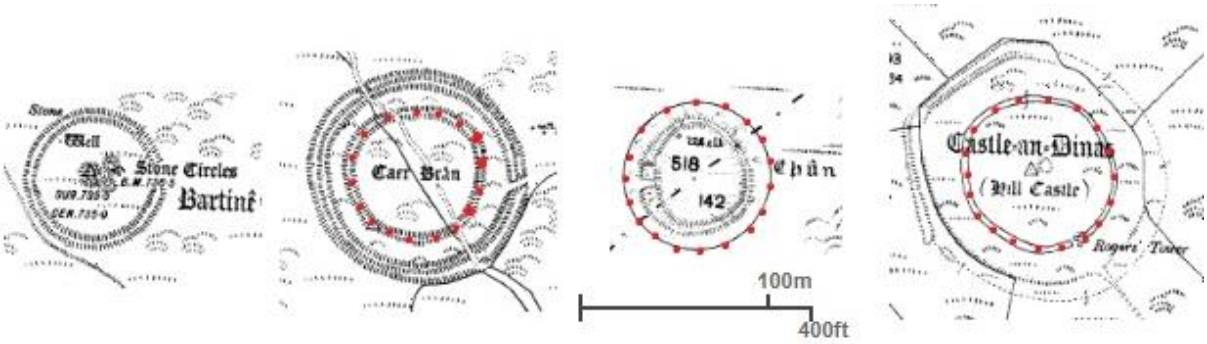
Hillforts as Iron Age gathering places for administering the commons

The hillfort is an Iron Age archaeological type with great variety of scale, form and type and intensity of use and occupation. There is considerable variability within the several hillforts in West Penwith (Herring 1994). Those with simpler irregular shapes, following the contours of the tops of the hills they were placed upon, and usually having just one rampart, are presumed to be earlier than the neatly circular hillforts that typically have two or three concentric lines of ramparts and ditches and are presumed to be of the second half of the first millennium BC (ibid; Bowden 2018, 4).

In West Penwith both types tend to be on hills where there were remains of earlier prehistoric monuments. Trencrom is an early type that has reused the lines of an Early Neolithic tor enclosure, while Caer Bran and Castle-an-Dinas have incorporated as their inner lines earlier hilltop enclosures associated with Early Bronze Age ring cairns, enclosures that were similar to that which survives well on Bartinney Downs. These inner ‘ramparts’ have been noticed as being much slighter than the external ramparts of these two hillforts.

The builders of Chun Castle appear to have also reused such an enclosure, but they did so in a different way. They retained the earlier enclosure as an outer ‘rampart’. Again it is unusually slight for a hillfort. The three reused circuits are very similar in diameter: Caer Bran 79 metres; Castle-an-Dinas 79.5 metres; Chun 80 metres. And Bartinney is 77.5 metres, so all four are within 2.5m of each other and may be regarded as a very tightly defined type.

The curving Iron Age outer bank of Caer Bran hillfort and the view north towards Carn Galva, showing a large part of the West Penwith prehistoric commons whose management the gatherings in such forts would have overseen.



The hilltop enclosure at Bartinney (left) and those other three of identical size and similar form reused in the later hillforts of Caer Bran, Chun, and Castle-an-Dinas. (Maplets from the OS 1:2500 second series)

Such reuse is often interestingly interpreted as ‘memorialising’ and paying respect to predecessors or ancestors: the monuments seem to ‘have “lives” beyond the intentions of their original creators’ (Jones 2016, 136).

There seems to be an additional connection between the Iron Age present and the Early Bronze Age past if the later structures, the hillforts, performed essentially the same function as the earlier ones, as gathering places for groups to continue to make decisions regarding the management and administration of the ancient commons. The builders and users of the hillforts would not only be memorialising earlier people and earlier ways of doing things, but instead continuing and sustaining them. Then the further back reference through the alignment of the entrance of the earlier enclosure at Chun with the Early Neolithic Chun Quoit ties the practice of commoning right back to the start of pastoralism in the 4th millennium BC. It ahs also been noticed that when looking the other way, from Chun Quoit back to Chun Castle, that on the distant skyline the Nine Stones stone circle, another early meeting place, is distinguishable

Turning the other way, the excavations of Chun Castle in the 1920s and 1930s produced artefactual evidence of its continued use into the Early Medieval period: imported Mediterranean amphora sherds and locally made ‘grass-marked’ pottery (Thomas 1956).

All the West Penwith hillforts apart from Lescudjack and Lesingey (close to what is now the town of Penzance) are on the edges of the downlands, at places within the commons. Their spacing suggests the community that gathered in each may have been responsible for a substantial portion of the rough ground. There may, then have been a division of the open common into a number of large parts.

The locations of those three circular hillforts that appear to reuse Early Bronze Age hilltop enclosures are especially interesting in this respect. As noted above (later Neolithic), and as will be seen in the next section they were included on a primary line in the pattern of parishes.

Contemplative cow in Trencrom hillfort

Medieval: another reorganisation, convertible husbandry, and the end of transhumance

Strip fields and convertible husbandry and their effect on transhumance

The second half of the first millennium AD and the first half of the second saw substantial changes to the ways that people managed both the home farm land and the summer grazing elements of the land use system of West Penwith.

There appears to have been a slight retraction in the extent of settlement and field patterns in the lowlands in the post-Roman centuries (Rose and Preston-Jones 1995). The introduction of Christianity broadly coincided with the more equitable allotment of the hamlet's land through the strip fields that were to also dominate the enclosed land of Cornwall from the 7th or 8th centuries until the end of the medieval period. Their legacy, in the form of long fields and distinguishable cropping units (Cornish versions of furlongs) are still visible throughout the peninsula. Most of the early and later medieval hamlets are likely to have replaced prehistoric ones as they adopted the same small territories, most of which had topographically determined boundaries (stream, ridges, etc).

Replacing the brick-shaped fields with strips was more problematic in West Penwith than in other parts of Cornwall due to the durability of the Iron Age and Romano-British fields. They were not so easy to remove as in other parts where the prehistoric boundaries did not use such massive stones and did not have such substantial lynchets. In West Penwith the solution was often to insert strips within prehistoric fields and to continue the medieval-style intermixing of holdings that had begun in the later prehistoric brick-shaped fields (see Herring 2016a).

The probable development of convertible husbandry in south-west Britain during this period allowed the management of the enclosed land (now with the fields being the cropping units) to be intensified further through improved manuring and dressing of land prior to ploughing. The long slow rotation of convertible husbandry also enabled more fields to be under good-quality grass that would not only supply sufficient hay for the winter, but would provide home-farm grazing for the dairy animals, ending the millennia-old use of the upland commons for dairying. Transhumance also ended with this as the women would remain in the hamlet with the rest of the household (Dudley 2011; Herring 2016a).

Place-names indicating the practice of transhumance appear then to have been given right at the end of the long tradition of it in west Cornwall: *Hendre* or *gwavos* for the home farm, and *havos* for the summer dwellings (Herring 2012). A possible early medieval transhumance hut, similar to those found on Bodmin Moor, has been recorded on the western slopes of Carn Galva in Zennor (Herring 2016a, fig 8.4).

Convertible husbandry dominated Cornish farming from the early medieval period through to the early twentieth century (Herring 2006, 68-69). It was normally practiced within field systems that had around 10 or 15 individual fields, to allow the long rotation to flow smoothly. In strip field systems the cropping unit was the field.

Land was put under grass (for hay and grazing) for up to around ten years before its turf was removed, dried and burnt. The ashes were mixed with other manures – dung, seaweed, sea sand, middens, etc – before being spread on the land. Once ploughed winter-sown wheat was usually the first in the short three- or four-year

cropping rotation. The land was then returned to grass (Herring 2011b, 289). It will be recognised that the pastoral element of this mixed farming was at least as important as the arable, reflecting how it was the direct successor of the transhumance-based farming that had dominated previously.

Convertible husbandry is suggested by the proportions of plough lands to plough teams recorded in Domesday Book; there were generally around a quarter or a third of the teams that would have been required if all the plough lands were always under the plough. Instead, it seems that around two thirds or three quarters of the land was not and was under grass most years (Herring 2016a).

The intensification of the use of arable in the inherited prehistoric fields during the Early Medieval period appears to have led to a more rapid development of the lynchets within them. The OSL dating of soils in such a lynchet at Bosigran, Zennor indicate that much of it developed in the Early Medieval period (Vervust et al 2020). Note also the increase in arable pollen at nearby Treen Common in this period (see below).

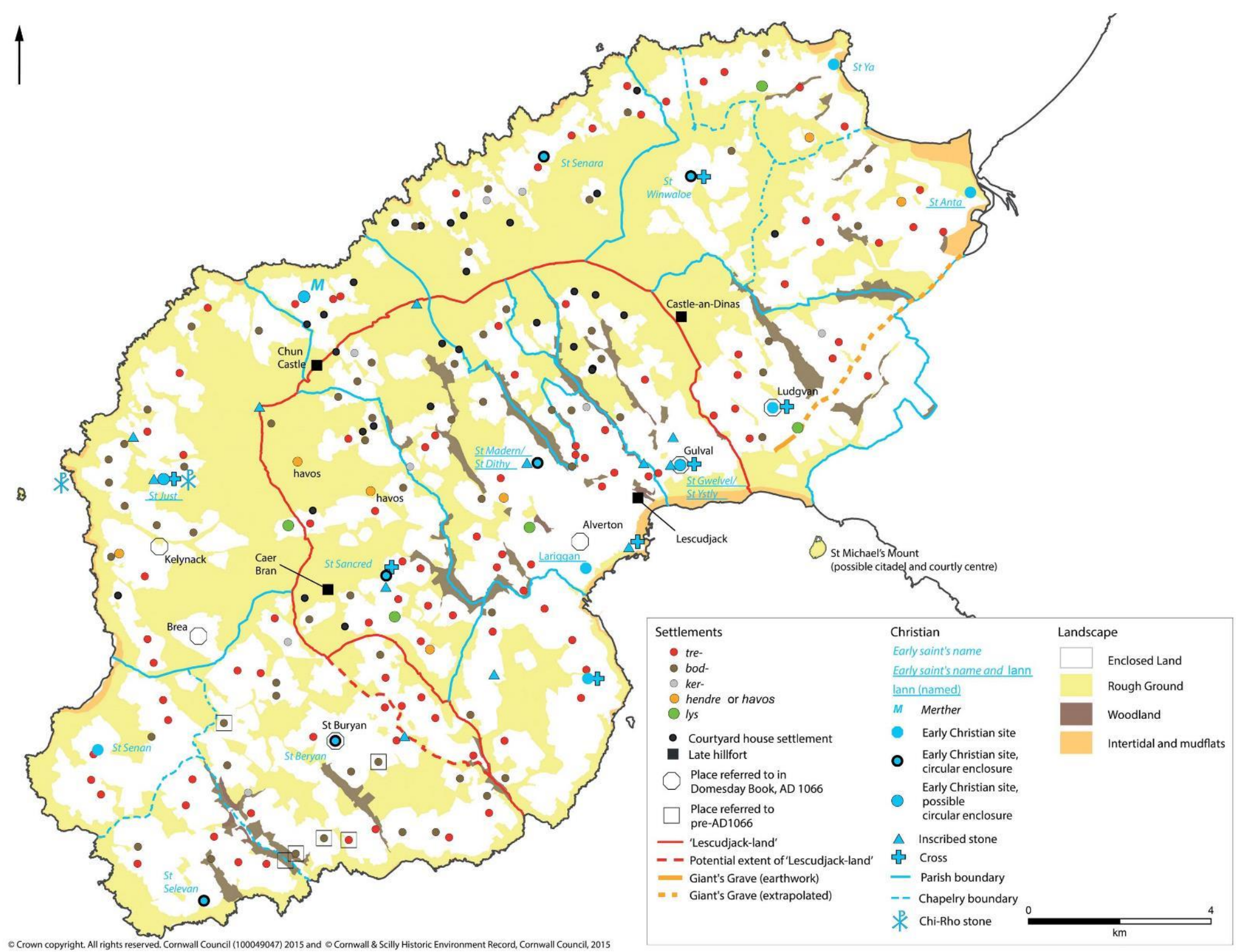
Early medieval place-names

Many of the most widely used Cornish place-names elements, especially those descriptive of settlement forms (*ker*, enclosed settlement, round'; *bod*, 'house'; *havos*, summer house' etc), estates (*tre* 'farming estate' and *hendre* 'old or home-farming esteate, in relation to *havos*) or land use / cover (*goon*, 'open rough ground, common'*, cos*, 'woodland' etc) were first used in the pre-Norman period (Padel 1985; Pool 1985). Together with historic landscape survey and characterisation they provide a rich representation of early medieval historical and natural environments in West Penwith.

The more ancient organisation of the land becomes visible

The peninsula's early medieval (and possibly also its later prehistoric) administrative framework is represented by lines dividing it into units of organisation of people and land, and by the places of gathering and decision-making, the successors of those identified in prehistory from the Early Neolithic period onwards. These can be most clearly seen in the boundaries of parishes, which appear to have been established in this period, though possibly reusing earlier entities termed by landscape historians 'multiple estates'. The individual estates here are the hamlets and their fields and also their customary rights to areas of rough grazing in the commons; many of them appear to be directly derived from the hamlets and fields of the Iron Age and Romano-British period. They typically held a mix of good farmland and an area or a right to a patch or rough ground, later fixed in coastal parishes like Zennor as ribbon-shaped tenements (Herring 2016a, fig 8.2).

Within the pattern of lines the parishes (or multiple estates) make there is a long curving boundary that appears to focus on the area now occupied by Penzance, perhaps originally on the hillfort of Lescudjack, later on Lesingey, and then Alverton, all local centres that preceded the town itself. The line curves apparently quite deliberately through the ancient area of common, based on the arc of higher hills and downlands. It is a particularly early line as all the other parish boundaries are attached to and secondary to it. A modern name for the area was invented to reflect this: Lescudjack-land (Herring 2016a, 200-202).



(Previous page) Early medieval West Penwith. The coloured backdrop is an interpreted historic landscape characterisation indicating likely dispositions of enclosed farmland, rough ground (yellow) and woodland. Against this are shown the distributions of the four main Cornish pre-Norman place-name elements used for farming hamlets: ker, tre, bod*, and* hendre*. Two examples of the* havos *element used for the summer transhumant huts are in that rough ground.*

Also shown are two apparently significant early territorial boundaries, the Giant's Grave earthwork that appears to cut West Penwith off from the rest of Cornwall, and the extent of 'Lescudjack-land'. Both appear to have later prehistoric origins, but are shown here as they influenced the pattern of early medieval units of land, notably the parishes that supported Christian communities and may have originated as 'multiple estates', each containing between a dozen and a score of the hamlet-level estates. Lescudjack-land has been named here from the large and probably early Iron Age hillfort at Penzance that may have been its central gathering place from which administration and policing of the great commons was overseen.

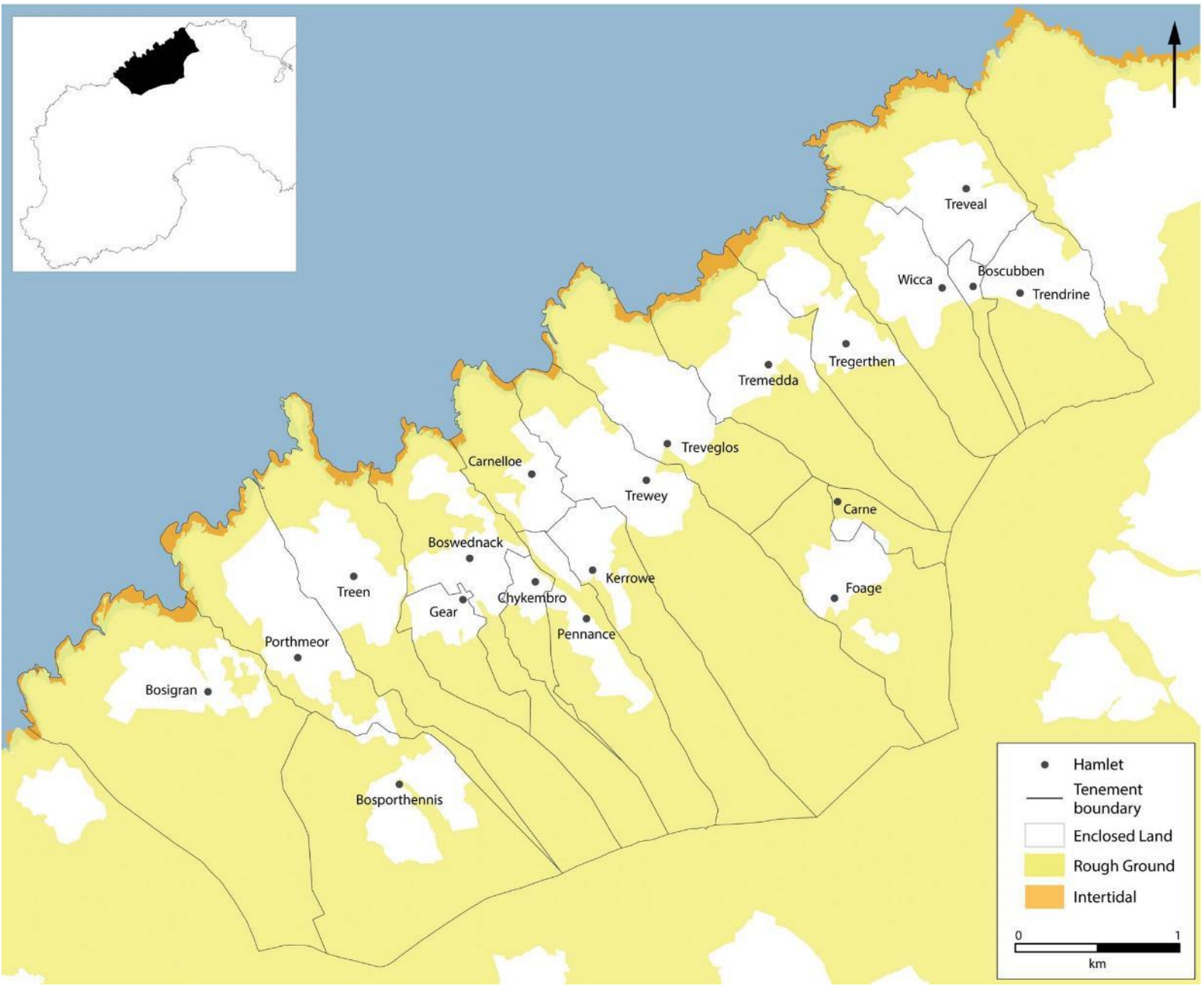
Three other hillforts that appear to be of later form, with multiple concentric circular ramparts and ditches, are either on the line of Lescudjack-land or are on the nearest hilltop to it. All three (Caer Bran, Chun Castle and Castle-an-Dinas) appear to have re-used Early Bronze Age enclosures, suggesting that the division of the peninsula along the line may have been in place that early.

Also shown are survivals and indicators of early medieval Christianity, including lann *sites (early Christian enclosures), early saints' names, circular churchyards, inscribed stones and pre-Norman crosses. The Norman Conquest closed the early medieval period, but the six 'manors' recorded in the Domesday Book of 1086 existed by 1066. The other places recorded before 1066 are those in the boundary clause of the 10th-century St Buryan charter. (From Herring 2016a, Fig 8.1. © Cornwall Archaeological Unit, Cornwall Council.)*

The positioning on it of three of the main hillforts of West Penwith may suggest that its origins can be sought in prehistory, perhaps even early prehistory, given that two of the hillforts certainly incorporate the sites of earlier gathering places, hilltop enclosures, within them (Caer Bran and Castle-an-Dinas) and the third, Chun, may also do so, being of identical scale.

At its northern point, as far from its Penzance focus as can be, as if to show the full extent of its area of interest and influence, stands the Men Scrya. This early inscribed stone (probably 6th century AD, but also probably reusing a Bronze Age menhir) has the deeply inscribed names of two royal figures, the heroic Rialobran (Kingly Bran, or raven) and his father Cunoval ('valiant as a hound') (Thomas 1994, 286), perhaps among the last of the long line of 'kings' who oversaw the policing of West Penwith's commons and come here to the menhir to make judgements about its use (see also Commons, etc in Setting the Scene).

Early Medieval arrangements therefore seem to involve continuity from the long prehistoric period of transhumance. Those arrangements still affect the modern world in the form of the parish boundaries, most of which have survived modern rejigging. 'The alignment of parish boundaries witnesses a scrupulous care in the division of waste land' (Pounds 1945, 127).



Zennor tenements in 1842 (lines from Tithe map). These early medieval tre *estates (not necessarily with* tre *names) were ribbon-shaped so that farmers in each hamlet on enclosed land's ancient fields had access to substantial areas of coastal and/or upland rough ground, crucial for summer grazing and supplying furze and turf for domestic fuel. The 13 tenements hang from a strong southern line running along the upland spine, indicating that they all belonged to a single larger unit, a 'multiple estate'. For the western six this also defines Lescudjack-land (from Herring 2016a, fig 8.2. © Cornwall Archaeological Unit, Cornwall Council).*

The Men Scryfa*, the stone with writing, is more often photographed from the south, with the peak of Carn Galva rising dramatically beyond. When seen from the north, as here, not only are the two names Rialobran and his father Cunoval visible, but those who read them now, or read them then, in the 6th century, can or could see beyond the stone (and the cattle who redden it through their rubbing) the gentler sheltered slopes of 'Lescudjack-land'. The stone stands on its northern boundary, presumably because this was a territory with which Cunoval and Rialobran had a particular connection, perhaps as two of the kings who oversaw the administration of the commons it helped to delineate (Photo: By kind permission and © Ann Preston-Jones).*

Domesday Book (1086)

The period ends politically with the Norman Conquest. King William's Domesday Book provides a generalised view of the land use and administration of the peninsula in 1086 and 1066, but it can be regarded as setting out the Early Medieval situation. This extends to a survey of the livestock held on the demesnes of the several manors or estates.

Estate / manor	Hides	Ploughlands /Ploughs	Pasture	Value (1086)	Population	Owner, holder	Livestock on demesne land (Exeter Domesday)
Alverton (5.1.11)	3	60/15	2 leagues by 1	£20	60 (35 v, 30 sm, 13 sl)	Count of Mortain, Alfward before 1066	1 cob, 17 unbroken mares, 9 cattle, 4 pigs, 100 sheep
Gulval (2.10)	1.5	12/4	2 leagues by 1	£3	20 (13 v, 6 sm, 3 sl)	Bishop of Exeter, Roland	1 cob, 3 cows 30 sheep
Ludgvan (5.3.27)	3	15 or 30/12	300 acres	60 shillings	63 (14 v, 40 sm, 9 sl)	Count of Mortain, Richard, Alwin before 1066	27 unbroken mares, 22 cattle, 17 pigs, 140 sheep
Kelynack (5.3.28)	1	8/5	100 acres	20 shillings	21 (6 v, 10 sm, 5 sl)	Count of Mortain, Richard, Godric before 1066	2 unbroken mares, 6 cattle, 1 pig, 25 sheep
St Buryan (4.27)	1	8/0.5	20 acres	40 shillings	12 (6 v, 6 sm)	Count of Mortain, Canons of S Buryan	12 cattle, 12 sheep
Brea (5.12.3)	0.5	3/1.5	40 acres	12s 6d	9 (1 v, 5 sm, 3 sl)	Count of Mortain, Erchenbald, Doda before 1066	4 cattle, 4 pigs, 25 sheep

Notes. Numbers in parentheses after manor names are references to Domesday Book (Thorn and Thorn 1979). Hides were taxable units of land, of now uncertain area, but they can be regarded as a general measure of scale; ploughlands the areas capable of being ploughed as represented by the numbers of plough teams required to plough all of them, pasture the open rough grazing represented as acres, a less precise but generally larger measure than modern statutory acres, or leagues, which are again imprecise, but may have been around 1.5 miles in length. Value is a expressed in £ s D but appears to have been a means by which the assessors represented agricultural potential. Population probably refers to numbers of households, not individuals. Here v = villeins/villagers, sm = smallholders, and sl = slaves. While all land was held ultimately by the King, in West Penwith, as in much of Cornwall, most was under the control of his half-brother, the Count of Mortain. The canons of St Buryan held their manor both before and after the Conquest, but the other four Mortain manors were passed to new holders, the largest, Alverton, being held by the Count himself.

Domesday Book provides a crude representation of West Penwith, but the two main zones, the Anciently Enclosed Land, or home farm land, and the summer pastures, the Rough Ground are clearly visible within it. The former is there in the ploughlands, primarily within the area picked out by the Lescudjack-land line, and also where the majority of people lived, and the latter are there as the extensive pastures. Conspicuously absent is woodland.

Later medieval diversification of the economy

Later medieval west Cornwall, after the Norman Conquest, is increasingly visible through archaeological, documentary and even cartographic sources. It also became increasingly complex as a place, an economy, and a society. Its economy was famously diverse as mining, fishing, victualing, boat-building and various forms of

commerce all extant in the early medieval period grew significantly. Fairs, markets and towns were either established or increased to meet their needs and as commercialisation affected household economies the communalism that had been a key aspect of agricultural practice and arrangements from the Middle Bronze Age came under stress.

Some of the communal strip field systems were reorganised in the later part of the medieval period as individual tenants enclosed their land against their former colleagues. Crofts (privately held enclosures of rough pasture) were also created on the rough ground, possibly from as early as the 13th century (Padel 2011, 79). Some wholly new farms were also created, though these were no longer in hamlets, but single holdings, their farmsteads isolated from their neighbours; many had the new Cornish name *chy*, 'dwelling', as in Chysauster (Herring 2016a).

There was, however, much continuity, with most farmers still living in hamlets, rough pastures still largely in the 'hamlet commons', and even some new open fields being created on the high downs as bundles of outfield strips, including on Treen Common itself. And in most of the northern half of the peninsula the field systems continued to be those inherited from the first millennium BC.

Livestock

Information about medieval livestock in West Penwith includes the demesne livestock (those belonging to the 'lord' of each estate) recorded in the Exeter version of the 1086 Domesday Book. Altogether they had large numbers of sheep (332 in all), cattle (56), unbroken mares (46), and pigs (26), but many more animals would have been owned by the tenants (Herring 2016a).

Records from West Penwith tithings (the groups of people responsible for maintaining local law and order) include notices of 'strays' that had to be impounded before being returned to or collected by their owners. Peter Pool studied the local tithing records for the period around 1580. The fourteen horses impounded then were eleven mares, two colts and a horse. Their colours were noted: six bay, four black, two red, one grey and one white (Pool 1959, 179-181). Twelve cattle included a cow with two calves, three bulls, and heifers and bullocks. Their colours were noted as well: black, red and fallow (pale brown) (Herring 2016a).

Cattle are presumed to have been housed in winter in longhouses like that excavated at Old Lanyon in Madron (Beresford 1994); some of the shallow pottery vessels have been identified as possibly used in dairying, for scalding as part of butter-making (O'Mahoney 1994). Some farms were even called Laity, from Cornish *lety* 'milk-house' (examples in Lelant and Towednack) (Herring 2016a).

An archaeological watching brief in Lelant, near Lelant Towans included collection of several animal bones from the unusually alkaline soil, radio-carbon dated to the later medieval period (cal AD 1433-1512). Five fragments of cattle bone were recovered; all were from mature animals and three of the bones had been sawn through, presumably during butchery. Four leg bones (tibia) of sheep or goat were recovered and one of those was also sawn (Randall 2020, 152).

The excavated later medieval farmstead of Old Lanyon in Madron. The southern building is a longhouse that had cattle tethered in its downhill western end (from Herring 2016a, fig 8.15. © Cornwall Archaeological Unit, Cornwall Council).

Palaeoenvironmental evidence

At Treen Common in Zennor, the Early Medieval is the period of rapid extensification of heathland cover 'with *Erica ciliaris* type dominant over *E tetralix* until at least the medieval period when both are present in similar percentages. So, it seems likely that the spread of cross-leaved heath at the expense of Cornish heath is a relatively recent phenomenon (post-medieval)'. Crowberry (*Empetretum nigrum*) and whortleberry (*Vaccinium*) returned in this phase (Forster and Robinson 2011, 14-18). It seems most likely, then, that the uplands, the commons, were still grazed, though less intensively than before.

Grasses (*Poaceae*) were at a slightly lower level than in the previous phase but remained steady throughout period. There is some rye pollen (*Secale cereale*) as well as barley and wheat type cereals (*Avena/Triticum*, *Hordeum?Avena/Triticum* type, *Hordeum* type) and a slight increase in plantains (*Plantago*-type), suggesting further arable farming in the vicinity, supporting the observations regarding lynchet development at Bosigran, Zennor (above). Treen Common was also subdivided into outfield strips in the medieval period; their low stony banks still survive (Herring 2006, fig 23).

Tree pollen from this period include recurrence of elm, oak, birch, willow, alder and buckthorn as well as the *Corylus avellana* type (hazel or bog myrtle). But there were also new trees in the vicinity, albeit in small numbers: beech (*Fagus sylvaticus*), hornbeam (*Carpinus betulus*) and lime (*Tilia undifferntiated*).

Sedges, rushes, cotton-grasses and *Sphagnum* mosses increased, all suggesting wetter conditions, reflected also in the presence of waterlily (*Nymphaea alba*). Ferns (*Pteropsida monolete* and *Polypodium*) also increased in this phase (Forster and Robinson 2011, 14-18).

The early medieval heathland cover at Treen appears to have retracted gradually in the later medieval period perhaps as outfields and pasture boundaries were established, indicating a more intensive use of these areas. Grasses continued to be significant throughout, confirming that some summer grazing continued (Forster and Robinson 2011).

The southern peak of Carn Galva, Zennor.

Heathland

‘Rough ground, and especially heathland, with its high biodiversity value, has become an ecological icon, a habitat of prime importance in north-west Europe. Many consider it wild, timeless and primeval, a world away from the more civilized and more damaged realm of people. In fact, heathland landscapes were created by human activity’ (Dudley 2011, 1). As noted, in West Penwith some large areas of heathland appear to have succeeded herb-rich grassland when levels of grazing were reduced in the early medieval period.

Heathland is now recognised by ecologists as an important semi-natural habitat in West Cornwall and is defined as ‘characterised by the presence of a range of dwarf-shrubs. These include various types of heather and gorse, as well as bilberry / blaeberry, cowberry and crowberry’ (DEFRA 2015). It has been divided into various sub-types, as follows.

South-western oceanic dry heath

‘The climate becomes increasingly mild and oceanic towards the south-west of England and in southern Wales. The soils here are therefore slightly damp and different types of dry heath are found.’

‘From the New Forest and west to Dorset, *Ulex minor-Agrostis curtisii* [dwarf gorse – bristle bent] heath occurs. Heather frequently dominates this vegetation, especially where there has been no recent burning. Dwarf gorse is a frequent associate, but very variable in abundance. Unlike on more easterly heaths, both bell heather and crossleaved heath occur and they can be prominent – bell heather especially after burning and cross-leaved heath on more strongly gleyed soils. Bristle bent and purple moor-grass are characteristic grasses – after burning they can also become prominent. Various other species can be found occasionally, for example bracken *Pteridium aquilinum*, tormentil *Potentilla erecta*, heath milkwort *Polygala serpyllifolia*, pill sedge *Carex pilulifera*, and the curious parasitic plant, dodder *Cuscuta epithymum*.’

‘Across south-west England and into southern Wales, *Ulex gallii-Agrostis curtisii* [western gorse – bristle bent] heath occurs. This is very similar to *Ulex minor-Agrostis curtisii* heath, the major difference being the replacement of one dwarf gorse species by another, i.e. dwarf gorse *Ulex minor* by the western gorse *Ulex gallii*, the eastern limits of which in east Dorset forms the boundary between these two heath types’ (DEFRA 2015).

Central warm oceanic heath

‘At low to moderate altitudes in warm oceanic parts of southern Britain (from south-west England, across Wales and the northern Midlands and round into Norfolk and Suffolk), the typical form of heathland is *Calluna vulgaris-Ulex gallii* [common heather or ling – western gorse] heath. This vegetation type is a characteristically diverse with abundant heather, western gorse and bell heather, and no cross-leaved heath, purple moor-grass or bristle bent. Common gorse may be abundant on disturbed ground, and both bracken and bramble may be present’ (DEFRA 2015).

Coastal dry heath

‘Dry heath also occurs on cliffs and slopes around the UK located near to the sea. This mainly forms *Calluna vulgaris-Scilla verna* [common heather or ling – spring squill] heath, which is characteristically low growing and usually contains the attractive spring squill *Scilla verna*. Although dwarf-shrubs are a consistent feature of this vegetation, they are not always obvious and rarely continuous; even where more extensive, they are commonly penetrated by herbs such as bird's-foot trefoil *Lotus corniculatus* and wild thyme *Thymus praecox*. Heather is the most frequent dwarf-shrub and is often dominant, though on dry soils it is normally accompanied by bell heather. On wetter soils, cross-leaved heath and/or crowberry are the usual associates. Western gorse is found occasionally. In the far north, on Orkney and Shetland, and in north-west Wales, there is an unusual lichen-rich, waved form of this heath type.’

‘In the warm, oceanic, coastal climate of The Lizard Peninsula in Cornwall, *Erica vagans-Ulex europaeus* [Cornish heath – European/common gorse] heath occurs. This is a nationally rare and distinctive type of dry heath, in which Cornish heath *Erica vagans* and common gorse are the main co-dominants. Both western gorse and bell heather occur commonly and in places are abundant. Heather is, however, notably infrequent. The height and cover of dwarf-shrubs is variable, reflecting differences in grazing, burning and soil conditions – in exposed situations the vegetation can be very short. Various grasses and herbs are widespread, including betony *Stachys officinalis*, brown bent *Agrostis vinealis*, common dog-violet *Viola riviniana*, common milkwort *Polygala vulgaris*, glaucous sedge *Carex flacca*, and meadowsweet *Filipendula ulmaria*. This reflects the peculiar association of this habitat with well-drained, moderately base-rich soils derived from serpentine rock.’

‘Coastal dry heath also occurs in certain situations on acidic sand dunes and sandy shingle – see UK Coastal Habitats Correspondence Table. This can take the form of Calluna vulgaris- Carex arenaria [common heather or ling – sand sedge] heath, in which sand sedge *Carex arenaria* is a constant and defining feature, and heather, bell heather, and (in north and east Scotland) crowberry are the main dwarf-shrubs. This is, by far, the key dune heath community in Scotland. In other places, the vegetation of coastal dunes takes on the characteristics of *Calluna vulgaris-Festuca ovina* [common heather or ling – sheep’s fescue] heath (albeit distinguished again by the presence of sand sedge) or of Calluna vulgaris-Erica cinerea [Common heather or ling – bell heather] heath’ (DEFRA 2015).

Palaeo-environmental studies undertaken in West Penwith indicate that heathland was not a significant element of its early, prehistoric vegetation. In the open environment on the higher slopes at Treen Common, Foage, Chysauster and Caer Bran, where heathland is now widespread, the pollen of species of heather and ling were low in prehistory while those of herb-rich grassland were relatively high.

See Appendix 1 for more detail.

Heathland and coarse grassland on Caer Bran, with Bartinney Downs in the background..

Post-medieval and modern: maintenance, suspension or transformation of traditional land uses

Post-medieval west Cornwall's economy and society diversified in numerous directions, additional to those introduced in this section. Each contributed to radically changing the land, towns, society and perceptions of West Penwith but they are not included as they have impacted the semi-natural environment less directly than those activities touched upon. For summaries of the post-medieval landscape history of West Penwith see Dudley 2011, Herring 2016e and Sharpe 2016.

- Extractive industry (stream working, mining, quarrying, clayworking, fishing, etc).
- Processing and manufacturing industry (mineral, stone and clay dressing, fish processing, boat and ship building, etc).
- Supporting tourism and providing local recreation.
- Arts and crafts (Newlyn and St Ives painting schools, copperworks, dress design and making, etc), and celebrating the peninsula's heritage.

Continued shift from cooperative to individual farming

The shift from communalism towards individualism begun in the later medieval period with the enclosure of strip fields and creation of crofts accelerated in the post-medieval period. By 1695, Lanhydrock Atlas's maps of the Robartes' tenements, showed virtually no surviving active strip fields in West Penwith. Most farming hamlets had their enclosed land extended considerably by the numerous crofts taken in from formerly shared hamlet commons (Dudley 2011, 45-47; Herring 2010; 2016e).

Intakes

Creation of new farms and smallholdings, mainly taken in from upland and coastal rough ground, largely took place in the 18th, 19th and early 20th centuries (Sharpe 2016). They further reduced the areas of rough land available for summer grazing, the former commons, and were in part stimulated by the demand for food from mining, clay-working and quarrying populations.

Intake fields were usually straight-sided, especially where new holdings were established on leased land: the estate's stewards carefully laid them out. Field boundaries and buildings were, however, built by the tenants themselves, in the time remaining from labouring in local industries and for local farmers (see Dudley 2011, 47-55; Sharpe 2016). Boundaries were a mix of drystone walls (which absorbed much of the loose stone thrown up on cultivation), Cornish hedges and turf hedges.

Most new farms echoed the old in their mix of land uses, with arable fields, meadows, and rougher pasture. All built beyond the margins of the long established prehistoric and medieval anciently enclosed land, in more exposed, steeper and thinner-soiled ground (Dudley 2011). Many struggled and were abandoned by the earlier 20th century, only for some to be re-occupied in more recent decades.

Coronation Farm, Madron, named from Edward VII (1902), with the barns, cowhouses, piggeries of a typical West Penwith farmstead.

Eighteenth and nineteenth century agricultural commentators, almost all of whom were of the ‘improving’ kind, were supported by the local and national press when encouraging the transformation of the rough grounds that had been the core of the agricultural economy for several thousands of years (Dudley 2011). The herb-rich grasslands of early prehistory were now scrubbing over and disparaged as ‘waste lands’ or ‘scanty pasturage’ (Worgan 1811, 106), all worthy of enclosure and ‘improvement’. Some commentators idealised the intakes as an encouragement to others. The following is an example.

‘It is in a little glen of this strip of heath land that we find a comfortable little cottage and outbuilding, which form the most westerly homestead of England. This is surrounded by a little farm of not more than six acres, which has been gradually enclosed from the waste, is supplied with water by a little streamlet, supports a horse and a cow or two, which are fed with the grass in summer and rough hay and unthrashed oats in winter. The land is divided into six or seven little fields, and is held on lease at only about 60s a year. It might interest, and deeply too, some of our great modern agriculturalists from fertile diluvial soils to behold this most primitive of little farms: its rude, healthy, yet modest appearance; all its inmates, like its huge granite cliffs, so simple, yet so bright’ (Johnson 1862, 7).

The small early nineteenth century farm of Greebe / Greeb as portrayed on the Sennen Tithe Map

This was Greeb, created between 1809 (not on the OS 2-inch drawing) and 1840 when its house, outhouse and western fields (almost exactly 6 acres) were shown on the Sennen Tithe Map. Its occupants' story can be drawn from the 1841 to 1891 census returns.

Greeb, named from its crest-like rocks (Cornish *krib*), was the home in 1841 of George (75 years) and Elizabeth Blackwell and their two adult sons, James and Thomas, 25 and 20, both agricultural labourers; they were creating a productive smallholding in their spare time. By 1851 George had passed on and the house was known not as Greeb, but as 'George Blackwell's House'. Its head was now the younger son, Thomas, still an agricultural labourer, living with his elderly mother Elizabeth and another brother. In 1861 Thomas, still an agricultural labourer, had married another Elizabeth and they had four young children, the eldest yet another Elizabeth: the 'bright' people Johnson admired. Thomas stayed at Greeb until at

least 1901 when at 84 years old, he was ‘Living on own means’, having lost his wife Elizabeth by 1891 (when still an agricultural labourer) (Sennen Census Returns).

Enclosure of common pastures and common fields (which is what strip fields were) transformed both the appearance and the operation of West Penwith’s agricultural landscape. It went from the world underpinned by communalism and cooperation that prevailed from early prehistory to the later centuries of the medieval period to one where farming households were economic units operating on their own: investing, risking, working and reaping rewards on their own account.

The transformation produced West Cornwall’s larger farms and its smaller holdings. It also enabled or encouraged greater diversity of individual strategies for making a living from West Penwith’s land (Dudley 2011). Some were specialisations in activities that had previously been individual elements of the traditional mixed meat, dairy and arable farming, focussing on particular market-led crop production (potatoes, broccoli, flowers, and fruits) or turning dairying from a core subsistence activity to a profitable market-led industry.

The following subsections sample the multifarious resources available for understanding and illustrating post-medieval and modern rural West Penwith.

Arable

Arable land in post-medieval records is that which was subject to convertible husbandry, which prevailed in all farmland in Cornwall for over a millennium, another long-term tradition, like that of transhumance, the practice that it largely displaced.

Convertible husbandry included as a central activity a practice ‘beat-burning’ that is now all but forgotten, but for that millennium devoured several weeks of a farming household’s time every year. It involved skimming off the matted grassy turf of the old pastures intended for cultivation. The turf was turned and pooked till dry enough for burning. The ashes were then mixed with other manures (dung, ditch cleanings, middens, seaweed, sea sand, pilchard guts, etc) in dressing the land before its autumn ploughing. This practice continued into the early 20th century, even if the hardest task the skimming with hand tools like biddaxes and breast spades had replaced by the 18th and 19th centuries by velling shares on horse-drawn ploughs.

Grass seed (usually clover and ‘ever’, the local name for ‘ray’ or perennial rye grass) would be mixed with the final spring-sown crop (usually either barley or oats) so that a good sward was available for hay-making the following year and for the next five to nine years. Lengths of leys varied across Cornwall, and reflected the qualities of the various fields on any farm. (See Jewell 1981; Herring 2016a for detail.)

Sowing of grass was usually done on a quiet, windless day, ‘lest the young growth should stripe the field. Anyone who produced this effect, either with corn, patent manure or grass seeds, would become the butt of all his neighbours, and many quaint questions would be asked as to how it was done’ (Charke 1931, 36).

Dr Borlase noted that in the mid-18th century, ‘The general custom, at the last tillage, is to sow twelve gallons of ever-grass (*gramen loliaceum*), with ten pounds of clover, or the melilot trefoil (*Trifolium agrarium dodonaei*) in each acre’. The trefoils ‘thicken the ever-grass and both together considerably add to the pasture, especially in poor

lands and narrow limits, in the former of which the husbandman cannot expect natural-grass under two or three years, and in the latter, he cannot stay a year for the natural-grass to come without distressing his cattle' (Borlase 1758, 88-89).

Any one field would be cultivated for just three or four years out of every ten or twelve, so the farming landscape would have been one with just a quarter of the fields under the plough at any one time, the remainder being used as pasture, including early summer hay-making.

Crops

Borlase noted that Cornish grain crops included wheat, barley, oats, rye and *avena nuda*, or pilez. Turnips and potatoes were also grown (1758, 87).

Wheat

Wheat on some lands was very fruitful. Thomas Roberts of Penzance in 1740 produced 20 bushels (each of 3 Winchesters or 24 gallons) on one acre, adjoining the town; he obtained a good price too, 1 guinea per bushel (Borlase 1758, 87). This is likely to have been grown on the excellent soils in which Penzance lay, not those on the granite.

In the 17th century farmers aimed to sow wheat by September 29th (Whetter 1974), that is Michaelmas.

Worgan noted that red wheat was grown on the moors and white wheat elsewhere (Worgan 1811, 60).

Barley

In later Elizabethan times, barley was grown much more in Cornwall than previously. Richard Carew believed its increase had saved the lives of many as the starving 'poore found happie benefit' from it. It grew so well 'in the Westerne-most parts of Cornwall', that it could be carried to the mill just 'eight or nine weekes from the time that they sowed it' (Carew 1603, 20). Dr Borlase also noted that farmers sometimes got a return within just 9 weeks. Barley was used for both bread and beer (Borlase 1748, 87). In the 17th century farmers aimed to sow barley by March 25th (Whetter 1974), that is the Feast of the Annunciation.

Oats

Oats usually followed wheat or barley in the convertible husbandry rotation. They were sown earlier than barley, in late February or early March, mainly on the coarser grounds (Worgan 1811, 65). As noted, they were also usually sown mixed with grass seeds, the latter to make the ley that succeeded the cropping round (Karkeek 1845). Before barley growing increased in Elizabethan times, oats had been malted for drinks, 'to the ill-relishing of strangers' (Carew 1603, 20). In the 17th century farmers aimed to sow wheat by February 2nd (Whetter 1974), that is the Feast of the Presentation of the Lord.

Pillas

Avena nuda, or pilez [most often spelt pillas] 'grows in the poorest croft-land that has been tilled two or three seasons before with potatoes, and for the uses of the poor answers all the purposes of oatmeal: it is a small yellow grain of the price of wheat (reckoned of the wheat kind) and for fattening calves accounted superior to any other

nourishment' (Borlase 1758, 87). Worgan noted that the growan soils, those that were 'black, moory, moist' (i.e. on granite) were 'better for barley, oats, pilez and grass than for wheat' (Worgan 1811, 7).

Farmers often sowed pillas as a 'farewell crop' on exhausted soils, but it 'bears the price of wheat'. It was used for fattening pigs and rearing calves and its straw was much finer than oats, 'almost as good as hay' (ibid, 57; 66). When consumed by humans it was boiled into 'a sort of porridge' called gurts (Jenkin 1945, 378-9).

Pillas appears to have died away after the repeal of the Corn Laws, when skimmed milk replaced it for rearing calves and potatoes for fattening pigs (Pounds 1944, 200). Hamilton Jenkin believed it was last grown in the 1870s in Sancreed (1845, 378-9). It is now the subject of an exciting project, driven by Harriet Gendall, to reinstate it in Cornwall's agriculture (Gendall 2022).

'Shocks' of oats at Kerrow, Zennor in 1985 (see Symons 1992, 91-3 for harvesting methods and terms in the earlier 20th century).

Rye

In Carew's time, the later Elizabethan, rye was 'employed onely on those worst grounds, which will beare no Wheate' (Carew 1603, 20), and by Borlase's time rye was tilled even less than before because barren lands had become so much more improved (by dressing or manuring) that they were able to bear barley (ibid, 87). In the 17th century farmers aimed to sow rye by November 1st (Whetter 1974), that is All Saints Day.

Turnip

Turnips were grown in the mid-18th century for feeding sheep and cattle and for 'mellowing ground for corn' (Borlase 1758, 89). Its use was extended in Cornwall

after the Napoleonic Wars so that by 1845 green crops were estimated to cover between 5 and 10% of the tilled ground, and that was divided roughly equally between potatoes and turnips (Karkeek 1845, 403-406).

Mangelwurzels at Trewey, Zennor, 1984.

Potato

'A still more useful root, now everywhere cultivated, and in shallow, poor lands, seasonably tilled thrives best; grateful to the rich, the support of the poor, and most salutary to both' (Borlase 1758, 89). Two sorts were grown in 1758: flat or kidney and round. The flat was planted in early winter, drawn around midsummer and lasted till Christmas. The round potato was planted in Spring (April or May), drawn at Christmas and lasted till autumn (ibid, 89). By the early Victorian period farmers were getting two crops of potatoes, including the lucrative 'earlies' for the London market (Anonymous 1836, 196). Potatoes brought in 'quite a part of the farm revenue' before imported potatoes undermined the market (Charke 1931, 31).

The work of traditional arable farming in Zennor.

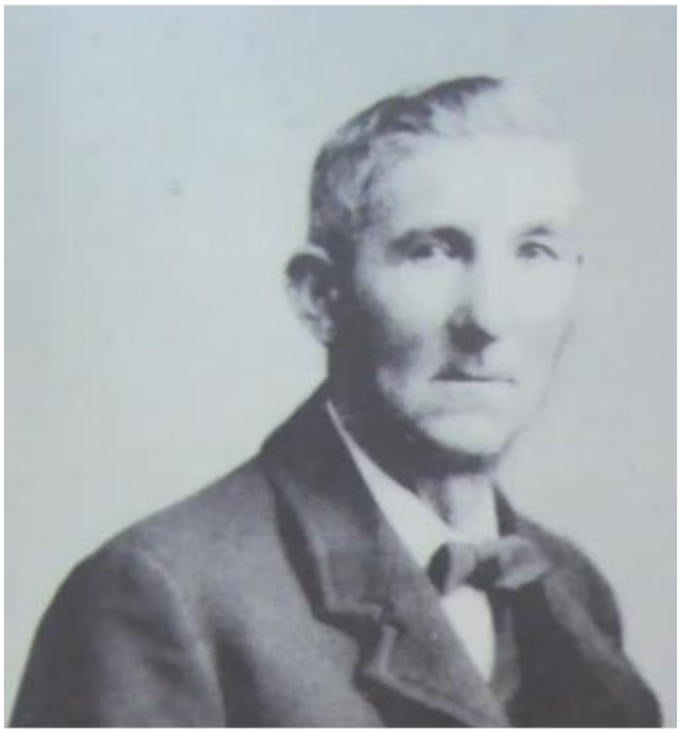
From the diary of a Cornish farmer (1877 to 1912): James Stevens of Zennor and Sancreed

There is no reason to believe that James Stevens was anything other than a typical West Penwith farmer when working the smallholding of Eglosmeor Mill, Zennor in 1877, Foage farm, Zennor from January 1892 to September 1897 and Glebe farm, Sancreed from then until December 1912. The difference is that for those years he kept a detailed daily record of his work in each field, providing a precious view into the ways land was managed under traditional agricultural regimes in west Cornwall. Peter Pool edited and published the diary in 1977 (Pool 1977). Some of its entries have been analysed to gain better understanding of the historic landscape at Eglosmeor Mill and Foage (Herring 1986; 1989).

James Stevens described how fields were prepared for cultivation, the crops grown, their harvesting, and the ways fields under grass were grazed and had hay taken. It is a key source for understanding the post-medieval stage of the development of the anthropogenic soils and semi-natural environment of West Penwith.

Eglosmeor Mill smallholding

Now called Carn Cobba, it comprised four fields plus a large Garden (Herring 1986, fig 3). In 1877 James Stevens used the Garden for vegetables, as well as 'currants, gooseberries, strawberries, tomatoes and tobacco and [he] also kept a few stocks of bees' (Pool 1977, 33). Surpluses were sold, especially potatoes.



James Stevens in later life, probably when farming at the Glebe, Sancreed (from Pool 1977, fig 7).

On the fields he kept hens (up to 5 dozen eggs per week for sale, additional to those for household use), two horses, and two cows, producing butter that was also sold (up to 6 pounds per week). He also sold pigs (17 in 1877, plus a quantity of pork) and sheep (selling three lambs and three fleeces, suggesting he had three ewes). He also sold one of his cows and a calf. The bees produced a 'cake of beeswax' that he sold, along with two ducks and a fowl. All of this supplemented his main income, from milling.

In 1877 two fields were under grass, one cut for hay in June. The previous year it had grown barley and to increase its hay yield James spread nitrate of soda on it during March. A third field produced potatoes and cabbages.

The fourth field was divided into three for the year and produced barley, oats and mangolds. The barley ground had been grass the previous year so was prepared in a traditional way derived from convertible husbandry (Herring 2010).

Its turf was skimmed off (probably using a breast-spade) over a period of six days in February and in the same month dung was pulled to the field and left in two piles. Cleanings from the field's ditch were mixed with the dung to form a dressing. The

'tobs' left in the field (dried out roots and lumps of vegetation) were raked up with a harrow and covered with earth to rot away. Stones turned up during skimming and harrowing were 'picked off'. A barrow was use for spreading the dressing – 144 loads in one day. And the ploughing was done the following day (May 1st) so that the dressing was turned into the soil while still moist. The plough soil was harrowed before seeds were tilled on May 5th (Herring 1986, 49-52).

The other fields had similar regimes, though the oats and mangolds were thwarted (i.e. ploughed two ways, one across the ridges) and were also rolled. Dissolved bone was added to the mangolds ground before planting the seedlings (which had been sown in a dung pile). Work continued after sowing – hoeing the mangolds, spreading salt around the cabbages 'to stop the ravages of the worm'. The barley was harvested just 3.5 months after being sown, and the oats 4 months after (Herring 1986, 53-55).

Foage, Zennor

James Stevens moved a mile up the Zennor valley to Foage in about 1884 (Pool 1977, 7). The story of just one of its fields, Great Flat Field, during 1892 was extracted in 1993 when its lower boundary was investigated. The entries below are verbatim transcripts extracted from James' diary (Herring *et al* 1993, 23-24). James' work in Great Flat Field formed just a small fraction of his work in 1892.

[Commentary in square brackets.]

January

1 Heaved the leat in great flat field [Cleared out the leat, presumably a ditch]
4 Heaved leat in flat field
5 Broke up ditch in flat field
25 Broke up ditch in flat field
26 Turned ditch [Possibly emptying a ditch of its sits, a rich source of nutrients usually spread over land due for cultivation as part of a dressing.]
27 Turned ditch
28 Turned ditch
29 Turned ditch
30 Broke up ditch

February

1 Pulled away the stones that I digged out of ditch to the hedges [Stones were cleared from cultivated land to ease the plough.]
8 Plowed part of the great flat field one way [James was intending to also plough the other way, a process known as thwarting, as at Eglosmeor Mill, above.]
9 Plowed part of the field
10 Plowed
11 Plowed
12 Plowed
15 Finished plowing lay field
22 Broke up ditch in flat field
23 Broke up ditch in flat field

March

5 Pulled out ditch of great flat field in slide over the shallow lower corner and pulled some loads of scrapings on green pile plot for pile. [James shifted material from the ditch to a ‘shallow’ corner to deepen the soil. Other ‘scrapings’ were added to a ‘pile’ of dressing destined to be spread on cultivated land.]

April

11 Pulled harrow over the great flat field and tilled part of it with oats. Sowed 2 bags of special manure over part of it. I measured this field and find it about 1 acre and 49 lace. [The special manure was some form of artificial fertiliser. ‘Bone and Special Manures’ were being sold by Proctor and Tylands in 1893.]

12 Till the other part of flat field, sowed in it all 3½ bus. of Prince Edward's oats and a peck of Cornish oats. [A bushel is equal to 8 gallons, or 36.4 litres. A peck is equal to 2 gallons.]

13 Finishing tilling the flat field

19 Rolled great flat field.

August

15 Cut oats and bound 2 mows. [A mow was a carefully constructed pile of sheaves. In Cornwall there were around 50 to 60 sheaves in a ‘hand mow’ and about 100 in a ‘knee mow’ (which was usually constructed later in the harvest by combining hand mows).]

16 Finished cutting the great flat field

19 Bound 4 mows oats in flat field

20 Raked the flat field and pulled in the rakings and put the geese 23 in the arish. [All parts of the crop were saved, as straw and grain. When satisfied, the farmer turned out 23 geese who were fattened on stray grains and whose droppings contributed to manuring the field.]

22 Trimmed the hedge of the great flat field. [Trimming would have been done with hand tools and left where they fell initially, to be gathered the following day.]

24 Pulled in the trimmings of the great flat field. Pulled out 9 load of ditch from the moor side on the shallow corner and scuffled it. [More shifting of earth or silts from ditches to be spread in shallow corners. Scuffling was another word for cultivating, using a horse-drawn multi-tined implement, employed in preparing ground for cultivation.]

25 Scuffled the field again.

September

9 Scuffled great flat field

16 Harrowed and rolled pilf on the great flat field. [Pilf is a dialect term for ‘dry waste vegetation’ (Pool 1977, 268). Here it was the vegetation mechanically weeded through scuffling.]

17 Harrowed flat field

26 Chained harrowed pilf on the great flat field and raked part of it. [The chain harrow acted as a sort of net, gathering pilf.]

October

10 Pulled out ditch in flat field and made two bottoms.

13 Plowing the flat field with the horse. [Distinguishing the use of a horse here suggests that James used another form of traction for his other plowing. Perhaps oxen?]

17 Finished plowing flat field [plowing in October suggests that he sowed winter corn?].
28 Broke up ditch in great flat field under the thorns.
29 Pulled 5 load of earth from the ditch under the thorns to a pile for grass in the ferny field. [The mention of the thorns suggests that the earth retrieved from Great Flat Field was taken to a pile of dressing material in another field, presumably nearby; no Ferny Field was recorded on the 1840 Tithe Map.]

The 1993 archaeological investigation of the lynchet at the foot of Great Flat Field recorded some of the effects of this intensive husbandry on the field's soil (Herring *et al* 1993). The lynchet that built up behind the hedge is one of thousands surviving in West Penwith. It comprises a 'substantial layer of medium brown loam (layer 4), 0.45m deep immediately behind the wall. There were very few stones in the light, well-sorted lynchet layer. The section shows that this lynchet layer had been cut into; it would once have been much deeper, at least 1.0m deep immediately behind the boundary, leaving little wall height on this side.'

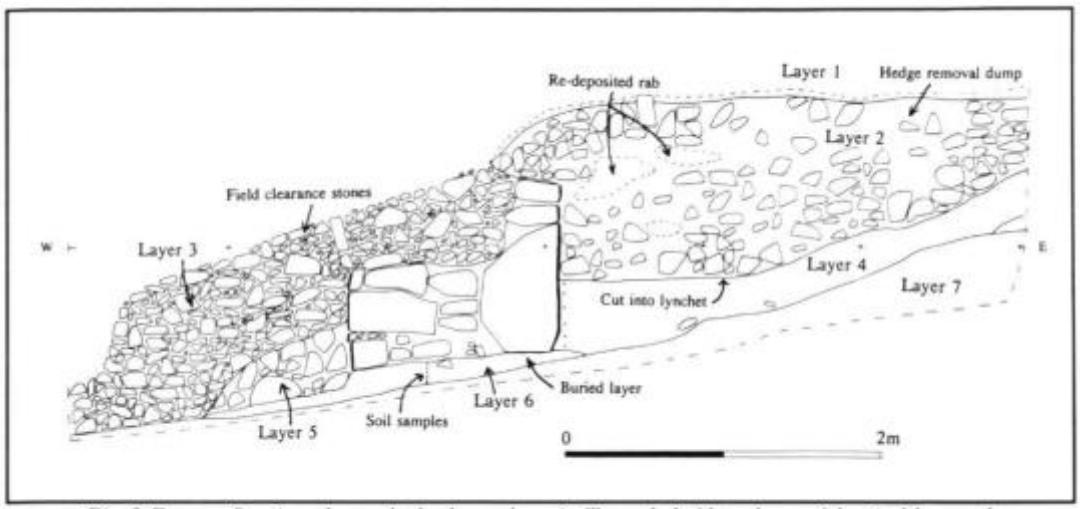


Fig 3 Foage. Section through the boundary in Trench 1. Note layer 6 buried beneath Romano-British wall

The depth of this plough soil at the foot of the field was mirrored by shallowness in other parts, those areas from which the soil that accumulated here had moved. Such soil loss was a perennial problem in West Penwith fields, so the evidence provided by the section drawing of the lynchet, coupled with James Stevens' diary is invaluable for demonstrating how it was tackled.

The well-sorted, nutrient-rich and fairly stone-free lynchet soil was taken away and re-used elsewhere, a husbandry practice recorded elsewhere in the South-West (eg Jewell 1981,104). His diary entry for March 5th reveals his method and intention: 'Pulled out ditch of great flat field in slide [ie farm sledge] over the shallow lower corner and pulled some loads of scrapings on green pile plot for pile' (Pool 1977).'

James Stevens would not have been the first Foage farmer to take soil from this lynchet, but he may have been the last. Many labour-intensive farming practices established in the medieval or earlier periods ended in Zennor in the decades around the turn of the 20th century. The cutting into the lynchet recorded in the section is quite likely to be that made in January 1892.

Many more lynchets in West Penwith and Cornwall can be expected to have been cut into, making it more difficult to now equate depth (or height) of lynchet with intensity or duration of cultivation. James Steven's diary also indicates the sheer hard work involved in the farming of Zennor's fields. In all, he spent 17 days in 1892 clearing material from the 'ditches' of this one field. Presumably in the following year he did the same in another field (Herring *et al* 1993, 20).

The section through the boundary also shows the clearance of smaller stones from the fields during ground preparation (plowing, harrowing, scuffling, etc).

Pastures

Rough pastures

Open, or unenclosed rough ground was often termed *terra vasta* in late medieval documents, or 'waste' more recently. This was not waste in the modern sense of surplus to requirements, or useless, but instead 'empty' of buildings and enclosed land. It was, of course, highly useful as rough summer grazing and for turf (for domestic and industrial fuel, including charked as charcoal), furze (gorse) for domestic fuel and when crushed as fodder, ferns (bracken) for bedding, rushes for flooring and thatching, and wild fruits (such as whortleberries), fungi, and mammals and birds, as wild food, gathered, hunted and trapped, in activities that echoed those of Mesolithic uses of such ground (Padel 2011, 77; Dudley 2011; Symons 1992).

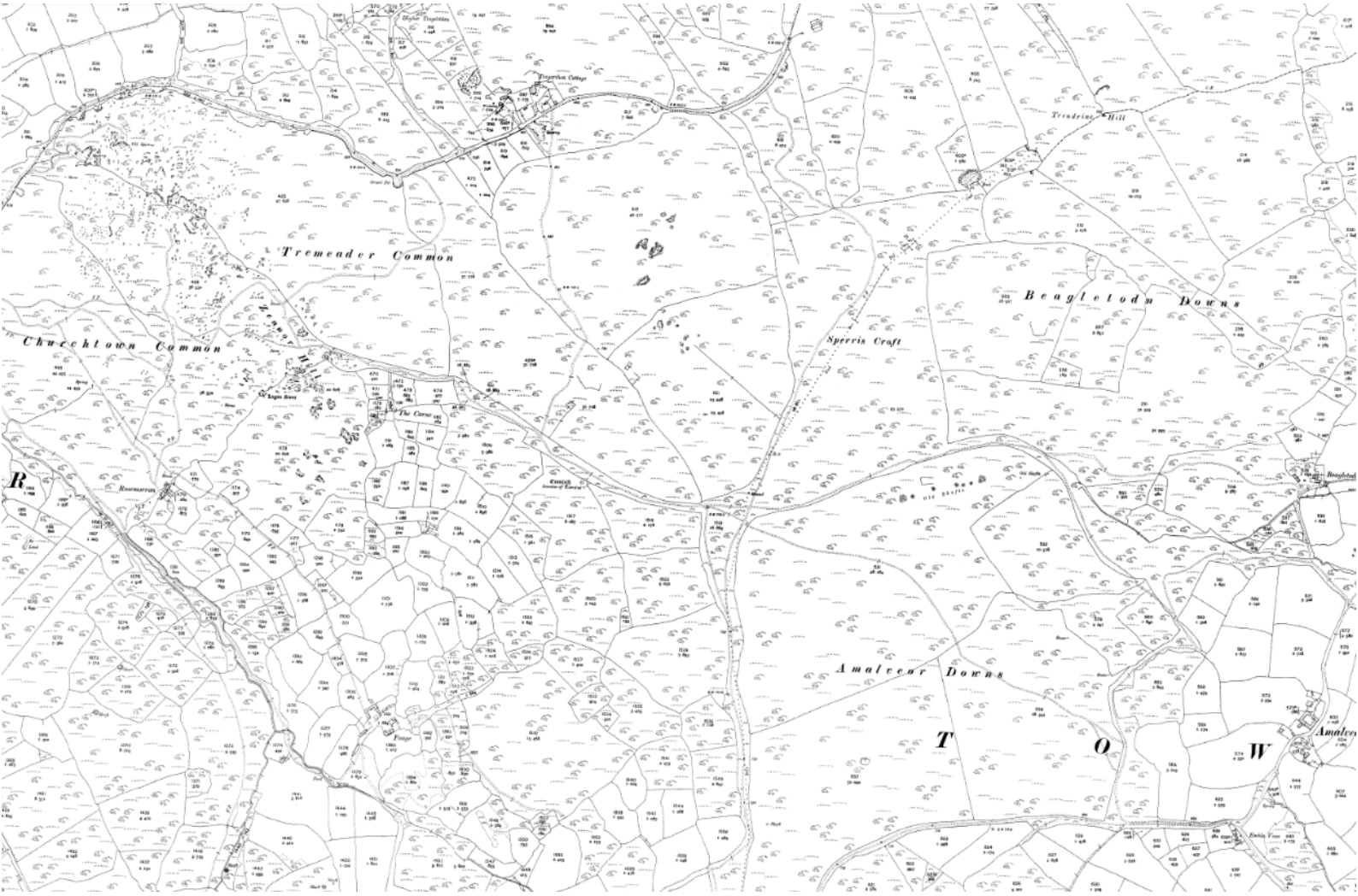
'Even the tops of the lower mountains are far from barren; supporting numerous herds of cattle, as well as many sheep' (Marshall 1796, 4). The animals sent there were generally the 'young store stock', not the dairy animals of transhumance times, but they spent roughly the same period of the year there, when the bite was nutritious, being 'sent thither about May, and remain until October' (Worgan 1811, 146).

As the local economy became increasingly market-led in the later medieval and post-medieval periods, rough ground was occasionally drawn into the arable land, to take advantage of higher prices in a fairly reactive way, a continuation of the 'outfields' of the later medieval period, when people were still working communally and so shared intakes as narrow strips. In the later period this was often done within crofts (below), whose stock-proof boundaries kept the tilled land more secure.

In the post-medieval period activities that had for so long been communal, with households working together, and on common lands shared by limited groups of households, became both individual, farmers working on their own, and also separate, the farmers working solely in their own enclosed areas of the rough ground. Long pasture boundaries divided off large blocks of rough ground in the uplands and on the cliffs. Cliff grazings were open and common until the post-medieval period when first sinuous and then from the 19th century straight stock-proof boundaries were run from the edges of the fields down to the cliff-edges to subdivide them by agreement.

Areas of open common land, where the commons used by adjacent hamlets were still run together, with no built boundaries separating them, had by the later 19th century become much reduced. One of the largest surviving open areas was that

downland between Kerrow and Bosporthennis in Zennor that was the common land used by the farmers of Bosporthenis, Porthmeor, Treen, Boswednack, Gear and Chykembro (see Padel 2011, fig 69). Others included the land around Carn Kenidjack in St Just that included the commons of Carnyorth, Truthwall and Botallack; and that west of Newbridge that included Deveral, Bosvenning, Roskennals and Hewas Commons. These echo old prehistoric arrangements of the West Penwith more open commons. Almost all other commons, however, had been enclosed at the hamlet level first, and then many of those had been further split into large blocks as individual farmers arranged to take control of their right in the common in the form of a single block of land.



Several hamlet commons in Zennor and Towednack separated from each other by pasture boundaries and then subdivided in themselves by further boundaries to form blocks of effectively privately managed rough ground (Ordnance Survey 2nd series, 1906. Reproduced with the permission of the National Library of Scotland).

Two parallel Cornish hedges created a block of private rough grazing on the cliffs of Boswednack.

Sheep grazing Treveal Cliff, Zennor, 1984.

Burning of rank scrub to improve pastures was an occasional practice in the 19th and 20th centuries (Dudley 2011, 144-145), a period when suspension of intensive grazing probably made the need for such work greater than in prehistoric and medieval times, when it may be presumed that it was also used only rarely.

In recent decades the extent of relatively unmanaged rough ground has left large areas of West Penwith's rough ground vulnerable to larger and more damaging fires, such as those on Bartinney Downs in 2021 and Zennor Head in 2022, the latter having previously been devastated un 1953 (*Coventry Evening Telegraph, 20.11.1953*).

Mulfra Hill burning in the 1990s.

For further detail on the various uses traditionally made of the plants of rough ground see Dudley 2011, 139-150.

Crofts

These enclosures of rough ground were being established by the later medieval period (see Medieval) but became widespread in the post-medieval period and continued to be created into the 18th and 19th centuries when their sides then were often perfectly straight (more sinuous in earlier crofts). By the later 17th century, when many crofts were portrayed in the Lanhydrock Atlas of 1695, most were shown with the convention for 'furze', suggesting that a major function was to secure a reliable of winter fuel (Herring 2010; Padel 2011).

Crofts were occasionally cultivated, indicated by those recorded in the 1695 Lanhydrock Atlas and early 19th century tithe apportionments with names indicating the crops grown (pillas, oats, potatoes, rye, etc). 'One third [of rough pasture] is in furse crofts, which are only broke up once in twenty or thirty years' (Fraser 1794, 56-57).

GB Worgan in 1811 described in detail the way that West Penwith farmers used their crofts on the black growan soil. They were 'kept up', that is kept back from being grazed, all the summer in readiness for the cows who, having been on the 'high land' through the long Cornish summer (May Day to Hallowe'en) were turned into them 'about the first week of November, and remain there until about three weeks before they calve, when they are brought to the fields, which having been kept up, are now full of grass; this feed, with an oaten sheaf now and then serve to raise their milk; but they have no other dry meat, nor turnips through the winter, while in the crofts; the grass there being plenty and of good quality' (Worgan 1811, 140-141).

Crofts, sometimes called ‘furze-ground’ often had an unusual legal status when land was leased; it was regarded as additional to the ‘tillable’ or arable land (Anonymous 1836, 197).

Meadows

‘Meadowe ther is verie small quantitie, the Countrye being so subjecte to mountaynes and rocks, affordeth little scoape for lowe groundes. Their haye growth commonly in the uplande and dry groundes, manured for the purpose; and that which is, is verye sweete’ (Norden c1600, 18).

Considering how vital they were for Cornish pastoral farming, as hay grounds (for the vital winter fodder) and as best grazing on which to turn young and nursing animals, meadows were always at a premium in Cornwall. Typically, there were two or three small meadows close to the farmstead on which farmstead dung was spread to boost growth, and several other meadows in the bottoms (veering towards being moors) where the best hay was cut. Usually, one or two fields in the main field system were also set aside each year for hay-making (Herring 2016a).

Invasions of bracken were traditionally dealt with by scything them four times in the year, to exhaust the plants: in April, June, July and August (Stanes 1964, 299).

Valley-bottom meadow near Madron Well.

Good management of pastures would leave adequate winter grazing as fodder for cattle in the 17th century, though hay had also been made (Whetter 1974, 28-29).

Hay making

Crops of hay were taken whenever possible, as the size of the hay ricks determined how many cattle could be over-wintered (Pounds 1973, 72).

In the later Victorian period, towards the end of traditional farming in Cornwall, fields destined for haymaking were ‘hained’ (i.e. livestock were removed from them). In the 17th century the saying was ‘the worse the meadow the sooner we haine’, typically on Lady Day (March 25th) (Stanes 1964, 300).

Late-cut hay (11th October) in cliff-top field in St Buryan.

Mowing with scythes then took place at the end of June or beginning of July: ‘swinging their scythes in rhythm for hours on end, from eight in the morning till seven or eight ta night’ (Charke 1931, 4). It was left to wilt for one or two days in ‘swars’ (swathes) and then turned with prongs. When dry, every three swars were turned into one, to ensure there was room for the waggons, and then it was pooked up into heaps or cocks. Eventually it was taken to the yard and ricked. Judging the size of the rick was another skill as it had, of course, to be the right size to take all the hay (Charke 1931, 6). Five days of fair weather ‘and good attendance’ was usually needed to make ‘sweete haye’ in the 17th century. In those days short hay was considered best for calves, sheep and goats, and long hay for horses and bullocks (Pounds 1964, 300).

Earlier, in the later 16th century, Cornish meadows were in short supply and were dressed with manure to obtain ‘very sweete’ haye (Norden c1600, 8).

Livestock

Cattle

'The Cattell in this Countrye are not greate, their feeding being but meane' (Norden c1600, 18). Carew (1603) described the Cornish breed as of 'little mould' (i.e. small), and kept for 'whitsull' (that is for dairying: milk, sour milk, cheese and butter) as well as for beef, leather and tallow. Rother cattle (i.e. long-horned) were mainly kept for meat. In the 17th century, cattle colours, as recorded in Cornish inventories were: red, red and white, brown, black, black and white, and white (Whetter 1974, 27).

In 1811 the Cornish 'native' breed was described as small, black and short-horned; some weighing only 3 or 4 hundredweight. Most cattle then were non-native: the North and South Devons or a cross of the two. Milk was made into either butter or clotted cream or fed to calves (Worgan 1811). Very few of the native black breed remained by 1845 (Karkeek 1845, 450), but they were reckoned to be the 'best adapted to the climate and pasture… [and] much kept for milch kine' (Anonymous 1836), 197).

Victorian Cornish farmers were described as 'generally keeping as many as can be maintained alive during the winter'. They were taken into the houses to feed 'about the months of October and November, when they are fed on white and yellow turnips, straw and hay until March' (Karkeek 1845, 406; 452).

Oxen had been the primary beast of traction on Cornwall's roads until the turn of the 19th century (Karkeek 1845, 456). They were shod and very docile and kept a good straight line when ploughing, even on steep ground' (Jenkin 1934, 28).

Sheep

The local Cornish 'native' sheep were not admired by commentators, they were recognised as hardy, but produced little meat or wool and in the early modern period were being rapidly replaced by up-country breeds (e.g. Worgan 1811).

Goats

William Marshall was told in the late 18th century that there were large herds of goats kept for milking and for kid's meat (Marshall 1796, 14).

Horses

The Cornish horses of the early post-medieval period were famously hardy and strong (e.g. Carew 1603).

Horses gradually took over from oxen as the beasts of the field. Karkeek in 1845 noted that two horses could harrow or roll 8 acres a day while 4 oxen could only do 6. When ploughing 2 horses could do an acre a day while 4 oxen could only manage ¾ acre, and also required a boy to help the ploughman (Karkeek 1845, 452).

Donkeys

Around the turn of the 20th century the donkey was still a general beast of burden for many smallholders; it carried stone, corn, faggots, cabbages and all, and the farmer also rode around on it (Charke 1931, 31).

Modern shifts to specialisation

Introduction

Much of what preceded the post-medieval and modern periods, from Mesolithic to Medieval, now seems very alien. The land as a common; the strategies of farmers and their households subservient to the needs of the Common Property regime's insistence on maintaining the sustainability of the common; the practice of farming being based on communalism and cooperation in order to minimise risks to the group rather than enabling opportunities for the individual.

When seen against the backdrop of the long history of West Penwith's land use and its semi-natural environment, it is the post-medieval and modern period that is unusual. It is not alien because strands of landholding (property and estates), practice and land use, as well as the resilience of many semi-natural communities, ran through from the older days and older ways. But the post-medieval and modern periods are alien in that the drivers of change and continuity are radically different and all farming veered away from simple sustainable subsistence.

For some holdings farming was just one part of a diverse household economy, supplementing wages from labouring on other people's larger farms or in local industries, mainly but not only the extractive ones. Such smallholdings tended to be conservative in their practice: miniature versions of the old mixed farms, with patches for potatoes, oats and pillas, and two or three milking cows enabling cheese and butter to be made and small surpluses to be sold. (James Stevens when at Eglosmeor Mill (above) is a good example: much of his household's income came from milling, but the four small fields attached to the mill and rights on the commons on Zennor Cliff provided a substantial supplement to that income, brought considerable personal satisfaction, and allowed traditional farming methods to be maintained).

Other farms moved from the traditional fairly wide-ranging mixed farming that utilised all parts of a holding, including its rough ground, to a more specialised one in which returns from a narrower range of agricultural practice could be expected to bring in greater income by raising the fertility and productivity of the more favourable parts, allowing the more marginal parts to be used less intensively, and in some places neglected entirely.

Transport throughout Britain brings the markets closer to the Land's End

The 1860s saw transport communications between west Cornwall and the rest of Britain greatly improved.

In 1860 the West Cornwall Railway (Penzance to Truro) was attached to the Cornwall Railway (Truro to Plymouth) at CR's Truro station. When the WCR sold its lines to the Great Western Railway they were re-laid as broad gauge, allowing goods trains to run through from Penzance to London in 1866, and passenger trains in 1867 (Bennett 1988). This, the longest main line in the United Kingdom (362.5 miles), now takes just under 6 hours to travel and in 1891 a respectable 8 hours and 40 minutes (Pattinson 1893).

Cornwall had of course long been an important centre of maritime routeways, including via coasters sailing and steaming to British ports, cities and regions, bringing in visitors, coals and materials, taking away minerals, of course, but also produce from the fishing towns, fields and market gardens of west Cornwall.

Market gardens

The Golden Mile

The mainline railway link accelerated the opening up of west Cornwall to the markets of London and other British urban centres and boosted the economy of west Cornwall. Market gardening benefitted greatly, and two areas in particular saw large-scale horticultural development: the high-grade farmlands whose sun-warmed fields sloped down to the northern shore of Mount's Bay; and the south-facing cliff-gardens from Mousehole to Penberth.

The so-called Golden Mile runs along the gently sloping ground rising from the northern shore of Mount's Bay in Gulval and Ludgvan. It is the only strip of land in Cornwall regarded as **'Excellent'** in the Agricultural Land Classification (Natural England 2010), that is:

> 'Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality' (MAFF 1988, 9).

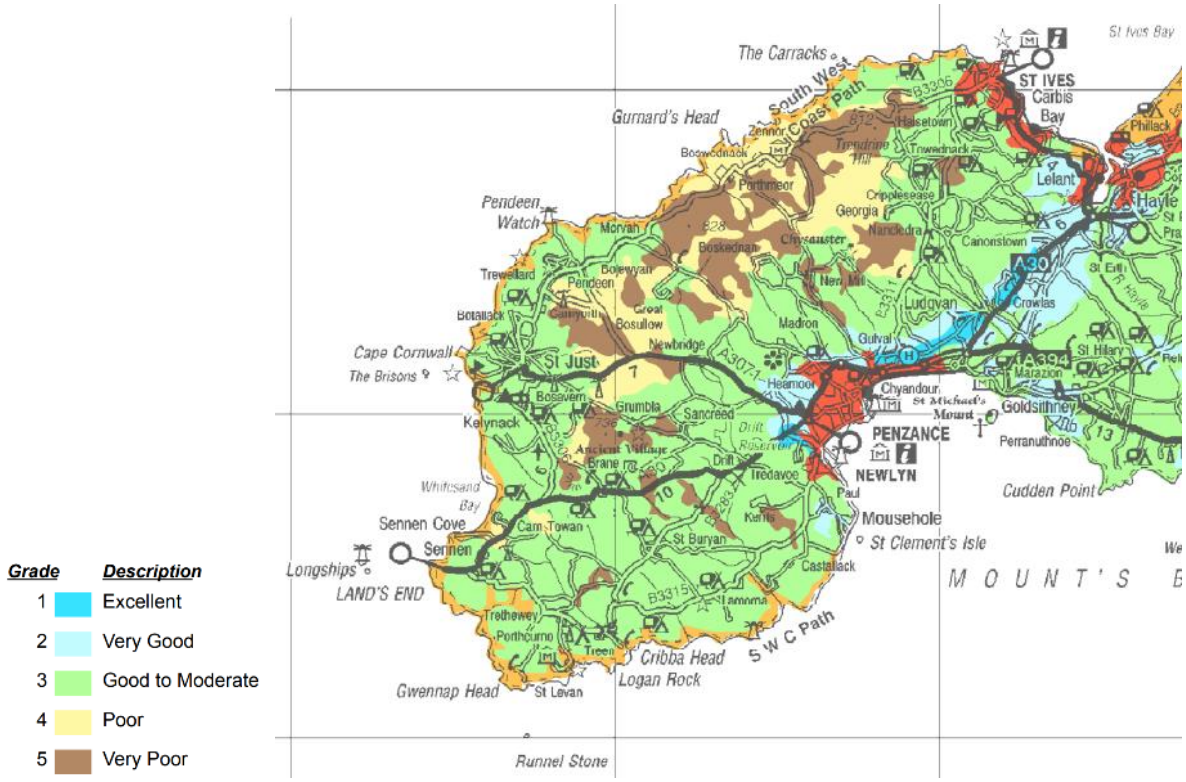
This Excellent strip runs from Gulval churchtown to Canonstown at the eastern end of Ludgvan, a distance of four miles. There is also a tiny patch of Excellent land west of Penzance and north of Newlyn, around Trembath, where Madron and Paul meet.

The strip lies within a broader and longer band of land assessed as **Very Good**, that is,

> 'Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.' (MAFF 1988, 9)

The classification of agricultural land assesses site conditions, soil, and interactions between climate, site and soil, essentially wetness and erosion (MAFF 1988). Much of the rest of lowland West Penwith is classified as **Good to Moderate**.

> 'Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2' (MAFF 1988, 9).

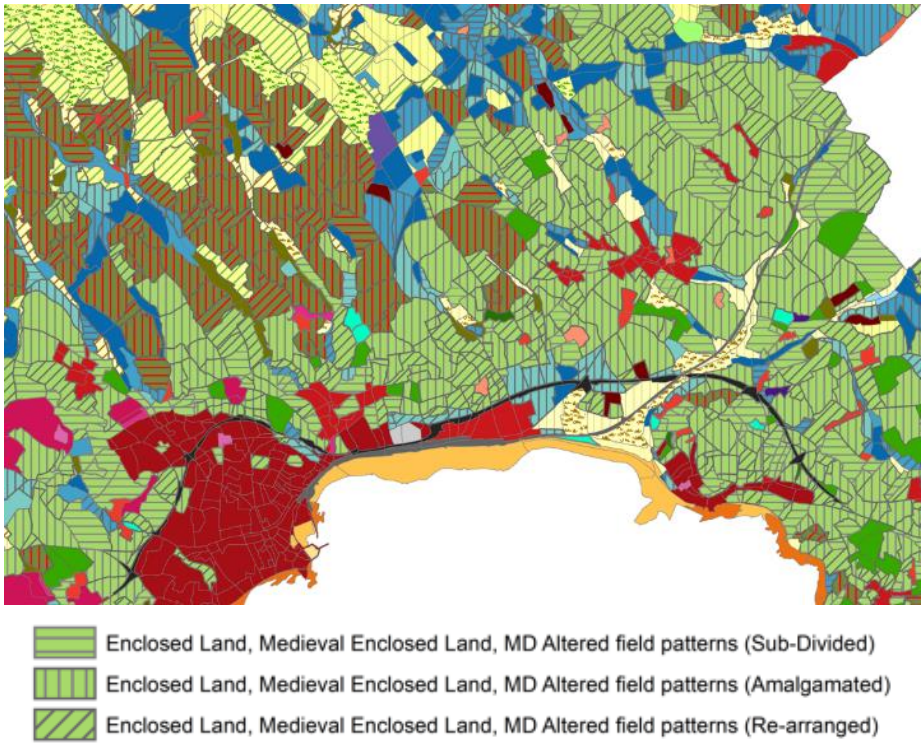


Extract from SW Region Agricultural Land Classification (Natural England 2010)

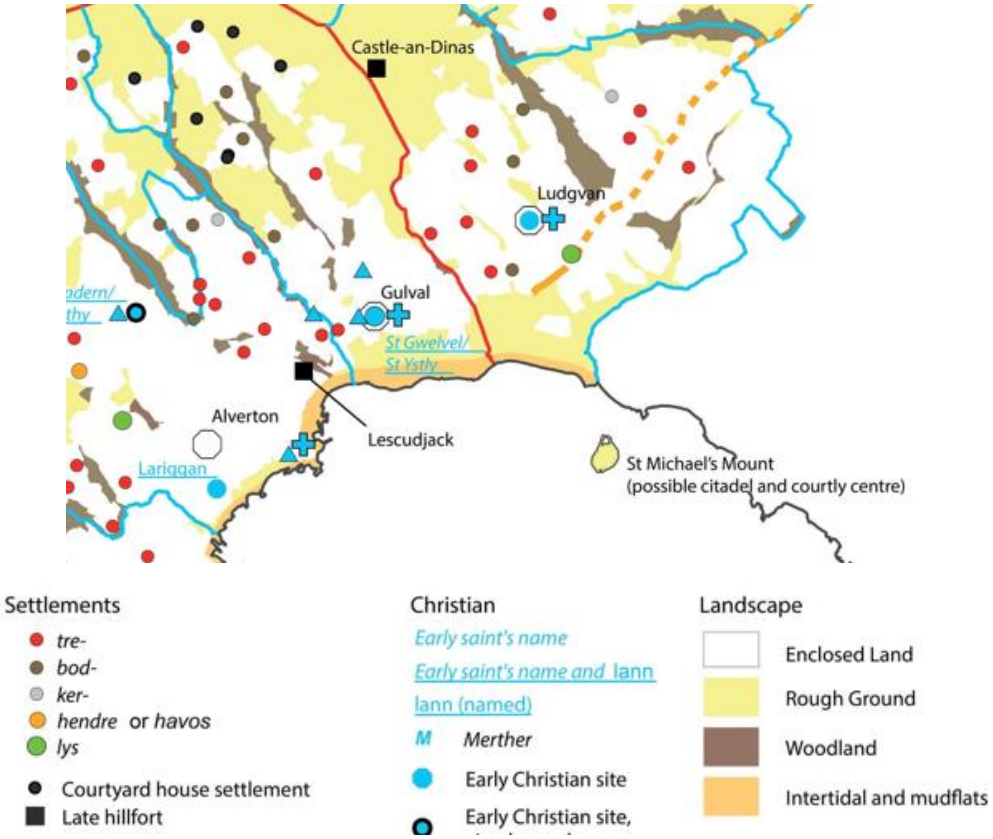
There is little archaeological evidence for especially intensive prehistoric settlement and arable cultivation in this area and it may be supposed that the Excellent soils are in large part products of relatively recent improvement. There is a loose scatter of possible rounds (later prehistoric or Romano-British enclosed hamlets), mostly inferred from field-names like Round Field along the Golden Mile. If these names really are references to prehistoric settlement earthworks it suggests that those were still upstanding at least as late as the later medieval period. The removal of any such earthworks may have occurred in the post-medieval period when people realised that old earth used in the ramparts was of value as rich soil (see Kirkham 2020).

The 2012 Historic Landscape Characterisation has most of the Golden Four Miles, from Gulval to Canonstown as Enclosed Land whose field patterns were derived from the enclosure of strip fields. These would have been worked by groups of farming households living in hamlets, such as those with old, pre-Norman, Cornish names, many with the *tre* prefix indicating 'farming estate' (Padel 1985, 223-232), including, west to east, Trembath (earliest surviving record 1327), these include Trereife (1201), Treneere (1280), Trannack (1317), Trevarrack (1243), Trenow (1798), Tremenheere (1287), Tregarthen(1262), Trevorrow (1299), Tregender (1250), Tregellast (1518) (first references from Weatherhill 2017, via Gover 1948).

While all their earliest references are 2nd millennium AD, it is probable that the establishment of these *tre* 'estates' and hamlets was in the middle to later centuries of the 1st millennium (Padel 1985, 223-232; Herring 2016, 193-197 and fig 8.1).



The area of the Golden Mile as largely Medieval Enclosed Land on the 2012 HLC © Cornwall and Isles of Scilly Historic Environment Record).



The area of the Golden Mile in the Early medieval period. The tre *settlements dominate, with manorial centres recorded in the 1086 Domesday Survey at Alverton, Gulval and Ludgvan. (Detail from Herring 2016, fig 8.1 © Cornwall Archaeological Unit, Cornwall Council.)*

The horticultural qualities of this area had been recognised some time before the arrival of the railways; coasters had taken much produce away to feed and delight the populations of Britain.

‘Gulval and Ludgvan parishes were the chief centres of market gardening in the far-off days… I have heard that in Gulval there is a part known as the Golden Mile. The soil is rich and the sun shines on it all day, and being near the shores of Mount’s Bay quantities of seaweed are taken from the sea-shore by carts and then put on the soil as a fertilizer’ (Richards 1944).

In 1875 JS Courtney of Penzance reminisced about the great changes that had occurred in Penzance life over the previous fifty years. In doing so he lay the groundwork for a history of the Golden Mile.

> ‘Large pieces of ground are laid out in market gardens, in which potatoes and broccoli are especially cultivated. Early potatoes were sent out from this neighbourhood in great quantities as far back as 1820. Soon after that time I recollect the carts from Penzance (twenty or thirty on a market day), coming to Falmouth. Besides the potatoes consumed in the town, large quantities were taken abroad by the Falmouth packets. In 1828 some brought to Falmouth found their way to London by the steamers from Dublin, which used to touch at that port.’
>
> ‘A new business was added about 1838, and it began in this way; Mr Dupen, the steward of the *Herald* and afterwards of the *Cornwall* steamer, which went from Hayle to Bristol, took up to the latter port some early broccoli, and they sold so well that he continued his adventure season after season. Of course this did not escape observation, and others tried the experiment, and so far succeeded that they carried their trade to London, and far into the midland districts of England. The trade in broccoli and potatoes gradually increased as facilities for sending them away became more fully developed, and now above 2,000 tons of broccoli are disposed of yearly.’
>
> ‘In 1838 new potatoes were I believe first sent direct from Penzance to London; at this time the best potatoes were to be had in July and August at four-pence to six-pence the gallon, and the later kinds mostly consumed at home ranged from four shillings and six-pence to eight shillings the Cornish bushel of twenty-four gallons; the latter was considered an enormous price. Now in the early potatoe season buyers are here from Leeds, Manchester, Hull, Wolverhampton, London, etc., and the quantity sold is very large. I have known one dealer to send away in a few weeks more than £3,000 worth. Besides potatoes and broccoli large quantities of fruit are sent at times from this district to the midland counties, and even as far as Glasgow.’
>
> ‘Forty years ago [i.e. 1838] fine strawberries were sold in Penzance at two-pence and three-pence a quart. The cultivation of this fruit largely fell off, but lately gardeners in the higher part of Gulval and Ludgvan have again been turning their attention to it, and from Tremenheere many baskets have been sent to London. Onions and asparagus are also often sent away from this neighbourhood. At Penzance an exhibition of flowers, fruits, and vegetables is

held every year in connection with the Western Cottagers' Garden Society; this society was instituted in 1836, and its first exhibition was held in the Assmeby Room, at the Union Hotel' (Courtney 1878, 47-49)

In 1862 the agriculturalist Cuthbert Johnson (author of *The American Farmer's Encyclopedia*) visited west Cornwall. 'The immediate neighbourhood of Penzance is remarkable for the excellence of certain vegetables, such as early potatoes and cauliflower; with which it largely supplies the metropolitan markets. I was struck when at the town in September last year, with the luxuriant growth of the brocoli.'

Golden Mile broccoli below Ludgvan, 2022.

'There is a good deal of land around Mount's Bay from which they procure two good crops of vegetables in the year, viz., early potatoes and broccoli. The potatoes, which they begin to plant in October and November, are raised in April, and the cauliflower or broccoli, are immediately planted. Of these, it was estimated that in the season of 1861-62 at least 600 acres were grown immediately around the town of Penzance' (Johnson 1862, 6).

Johnson proceeded to describe how the ground was prepared for potatoes, and how the soils of the Golden Mile, already fertile, were made even more so.

'The planting of the early kidney potatoes in Cornwall commences the latter end of October, and continues until Christmas. Lay is best adapted for the purpose, which is turned down in a peculiar manner by hand labour, and a good tilth obtained on the surface by the dexterous hand of the workman. The manure used is generally sea weed. The "sets" are placed in the drill, a little earth thrown on them, and sea weed placed over the whole. A better plan is to place a little rotten stable dung between the earth and the seaweed. The early potatoes are not banked up, but merely hoed, and

this not after the middle of March. They are grown on what the good Cornish men call the growan (gravelly) soils; but the most extensive breadth is on the greenstone rocks, where they intersect the clay slate in the fine sheltered districts near Penzance; 1,000 acres of which is said to yield a clear rental of £10,000. A few of the potatoes are taken up early in April, and these are worth on the spot 1s 3d per lb, and sometimes even 2s 6d. These are not obtained by digging up the entire plant, but by carefully examining the root with the hand, pulling off such tubers as may be sufficiently large. The root is then covered up again. The potatoes are full-grown by about the middle of May' (Johnson 1862, 6).

An idea of the scale of the later Victorian gardening industry in Gulval can be gained from the Ordnance Survey 1st edition 1:2500 map of 1877, which shows orchards clearly. Unfortunately, there was no convention for distinguishing market gardens (flowers, potatoes and soft fruit) from other forms of improved agricultural land so those remain largely invisible. The 1877 orchards were clustered around Rosemorran, Halnoweth, Trevarrack and Gulval Churchtown in the west of the lower part of the parish and around Poniou, Tolver and Pleming in the east.

Extract from the 1877 OS 1:2500 map showing the regular stippled patterns of the orchards in the south-western and south-eastern parts of Gulval parish. (Reproduced with the permission of the National Library of Scotland.)

The scale and the patterns shown on the map are supported by those drawn from the 1881 Census Returns, those that are nearest in time to the map (available online at https://sites.rootsweb.com/~kayhin/82347b.html). These record, among other things, the occupation of each person and do so in some detail, distinguishing Market Gardeners (18 recorded: 16 men, 2 women), Market Garden Workers (10: all women), Gardeners (7: 5 men, 2 women), Garden Labourers (21: 15 men, 6 women), Garden Girls (3), Garden Boys (1), Garden Women (8), Jobbing Gardeners (1, an elderly man), Gentleman's gardeners (3, all men), Under Gardeners (1 man), Gardeners' Children (specified as such and so presumed to work in their parents'

gardens) (5: 3 boys and 2 girls). Two others had joint employment, a Publican at Long Rock was also a Market Gardener, while a farmer at Hallnoweth was also a Gardener, and employed 8 men, 4 women and 2 boys, presumably partly in the gardens. A total of 83 people in Gulval in 1881 made their living from gardening in some way, and they supported many more within their families.

Two Gulval settlements were dominated by the gardening community in 1881. The Churchtown had 20 individuals who gained their living through gardening, while Trevarrack to its west had another 19. The other 44 gardeners were scattered among the farms and hamlets of the southern half of the parish, extending as far north as Badgers Cross.

A similar picture could be drawn from the maps and census returns for Ludgvan parish, where 71 people were employed in gardening and the maps show concentrations of orchards around Tregarthen, Crowlas, Cockwells, Whitecross and Canonstown.

The area of the Golden Mile as portrayed by Thomas Martyn in 1748. Most of the farming settlements were still hamlets (small circles). (Courtesy of Harvard University Map Collection.)

The orchards of Gulval and west Ludgvan as portrayed on the 1876 OS 1:2500 map. (Reproduced with the permission of the National Library of Scotland.)

Descriptions

‘Gulval is one of the flower-growing villages of Cornwall. In the early spring its fields are white with narcissi, or ruddy with the rich-hued bloom of the wallflower. From Gulval to Ludgvan, a distance of about two miles, there is a stretch of level land between the hills and the sea that is extremely fertile and highly cultivated. It is largely tilled by spade husbandry, and is really an immense fruit, vegetable, and flower garden. Here you will see field labour as in France; whole families work together. Idyllic scenes of wonderful picturesqueness greet the eye’ (Folliott-Stokes 1912, 238).

‘In February potato planting commences. The use of the long-handled spade necessitates attitudes of classic grace. The back is not bent, and the spade is not pressed into the ground with the foot as with the short-handled instrument. The body with straightened back is inclined forward, one leg being advanced. The necessary pressure is conveyed through the arms, one of which is bent and the other straight, as is the case with the legs. When the ground is hard the foot is used, but without much alteration in the general position of the body and limbs. Each spade-wielder is followed by a boy or girl, who, stooping drops a seed potato into the trough made by the spade. Another spade-wielder follows and with the same fine pose covers up the trough with earth. The whole thing forms a striking “motive” such as would delight the heart of Clausen, who has painted several fine pictures of field labour’ (Folliott-Stokes 1912, 238-9).

‘This is followed by the flower-picking which commences in March. Numbers of women and girls are in the fields all day long, picking and tying into bunches the narcissi, wallflowers and violets. This is, perhaps, the most wonderful time of the year; it would need the poetic pen of a Ruskin to do it justice. The air is heavy with the sweet scent of the flowers; the buds of the apple trees, beneath which they often grow, are visibly swelling, there is a peculiar brilliancy in the sunlit air; while the medieval outline of St Michael’s Mount, always visible through the trees, gives just that subtle touch of romance that makes the “English” visitor ask himself with pleased surprise, “Am I in England? Is this the month of March?” Yes, it is March, but not England; at least not to a Cornishman, who always talks of “going to England” whenever he leaves his “delectable Duchy”’ (Folliott-Stokes 1912, 239).

‘Early in June is the potato harvest. Again, whole families are to be seen in the fields, gathering the tubers as the spade-wielder reveals them, and packing them into hampers. Picturesque groups of men, women, and children, clad in many colours, and as joyous as the Tuscan peasants. Even in the dead of winter the kindly earth is bountiful, with the kindly assistance of the moderating sea and its gifts of fertilising seaweed. As early as January men are busy cutting the great flower-heads of the broccoli and packing them in crates for the London and other markets. Many different crops are harvested during the year, and much gold finds its way into the pockets of the landlords. The rental of some of this land is, I believe, as much as £10 per acre’ (Folliott-Stokes 1912, 240).

A modern observer, Virginia Spears, also cast her eye over the Golden Mile, looking north from the summit of St Michael’s Mount.

‘Beside the summit chapel, from the battlements edging the north terrace, the quayside cottages and their vegetable gardens, the harbour and curving wakes of boats appear like a pictorial map or primitive painting. On the mainland, little fields along the sheltered Golden Mile (south-facing and renowned for its mild climate) show bare earth already harvested of first early potatoes. To the east, daffodils are grown on a large scale. Rents of £300 per acre are paid and the cut flowers and top-class bulbs are exported to America’ (Virginia Spears, Country Diary, *The Guardian* 28 June 2011).

Gulval Horticultural Experimental Station.

This establishment, also known as the ‘Gulval Fruit Plot’, was operated by the Cornwall Education Committee, part of Cornwall County Council from 1898 until at least 1952 (ACSS AD233). Its location was recorded on the c1935 OS map (at SW 4858 3159, 200m south-east of Gulval parish church). This is in the southern half of the arable field part of Ponjou Farm known in 1843 as The Butts Park (Gulval Tithe Map, field 2345).

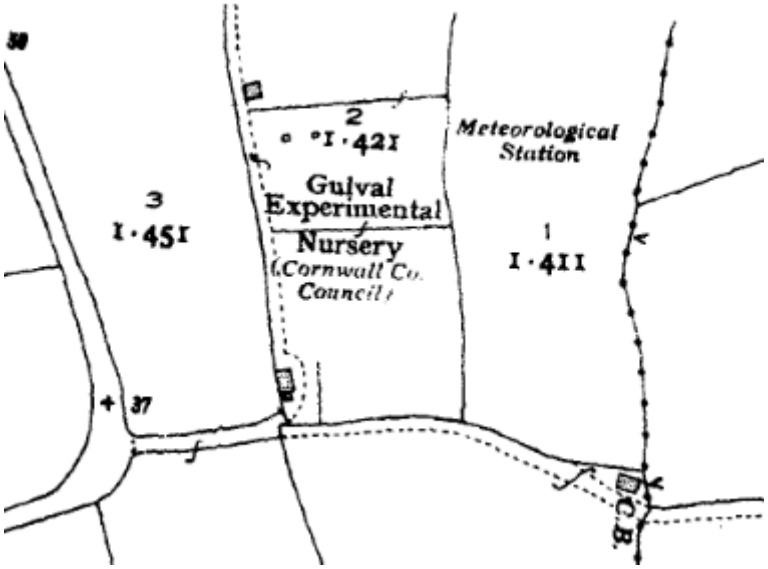
‘In the first instance, one half [of the station] was planted with fruit and served to demonstrate that apples and pears could be raised in the Penzance district of sufficiently good quality to realise top prices in the London markets; the other half was used for asparagus and vegetable production on French gardening lines’ (JMA 1922, 764).

‘Local growers were generally more interested in potatoes and broccoli, the earliest potatoes (varieties like Duke of York, May Queen, Sharpe’s Express and Advance) being grown to be harvested by the second week of May. Experiments at Gulval included testing the effect of sprouting the tubers in boxes; the aim was to ‘provide

valuable new information to those Cornish growers who have too long followed the same system' (JMA 1922, 765).

For example, the standard broccoli variety had long been the Penzance Early, but in 1922 the station experimented with a range of alternative varieties.

From 1923 to 1952 the Gulval station was led by Mr HW Abbiss (Whitehouse and Paton 1963) and managed in the 1920s by Alec Gray, a famous daffodil breeder (Tompsett 2006, 55). When Abbiss moved to the newly created Rosewarne horticultural station near Camborne in 1952 his daffodil collection went with him.



Gulval Experimental Nursey as shown on the c1935 OS 1:2500 map. The dividing hedge separated the fruit from the vegetables.

Arrival of the anemone

The Rev Canon Arthur Townshend Boscawen, rector of Ludgvan and a celebrated gardener, is supposed to have introduced the anemone to Cornwall as a commercially grown flower. In 1925 he collected seeds in the Mediterranean while on holiday and gave 2 ounces of them, in a tobacco tin, to the Gulval Experimental Station. The crop helped fill the gap in the farming year between narcissi and cauliflowers (Fordham 2003, 20-21). As early as the following year Harold Harvey created his famous painting 'Anemones' showing two young women sat on the ground picking from a sea of red, blue and white flowers.

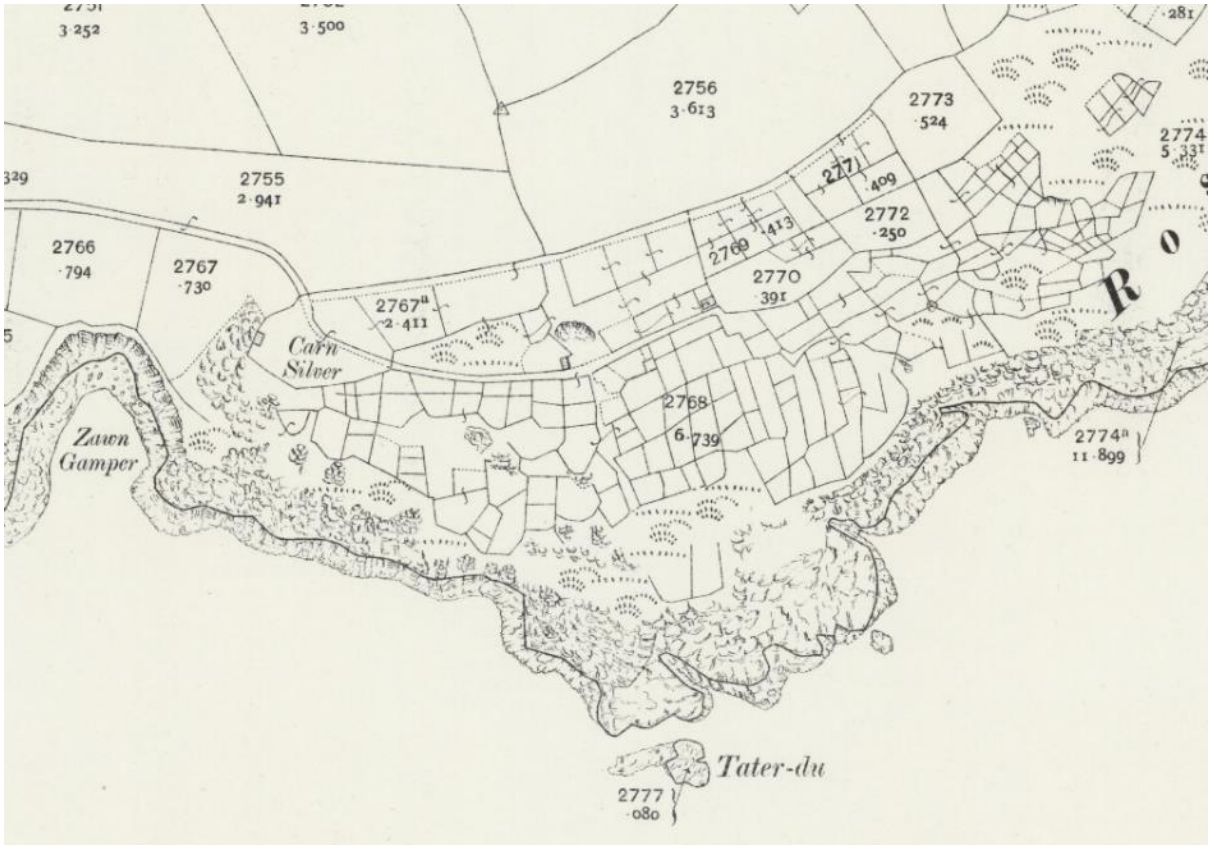
The cliff gardens

The cliffs fringing the southern sides of Paul and St Buryan parishes contain one of the many wonders of West Penwith. Dense patterns of tiny square, rectangular or more loosely quadrilateral fields subdivide the slopes, their tall boundaries of stone (cleared from the land) or living hedges, or both, provided additional shelter for the crops carefully tended by the gardeners of flowers (daffodils, narcissi, tulips, lilies, violets, anemones, chrysanthemums, irises and others), fruits (some tree fruits but mainly soft ones, including strawberries) and vegetables (notably potatoes but also brassicas and root crops).

Relatively little has been written about these cliff gardens though archaeological assessments were made of those at Kemyel Crease in Paul (Herring 2000, 130-131)

and Tregiffian in St Buryan (Dudley 2003, 16-21). Folliott-Stokes visited these gardens in the 1900s, when they were mature and well used.

‘Presently we reach a lane and a couple of cottages [i.e. Tregiffian Cottages]. Passing in front of these and following a field path, we come upon as curious a collection of little gardens as could be found anywhere. Scores of little plots, each one surrounded by an elder hedge ten to fifteen feet high. So thick are these hedges and so small the plots they enclose that the whole thing seems a cunningly constructed maze, through which you wander from one little garden to another, till all sense of direction vanishes. After the primeval tangle of the cliffs and the weedy spaciousness of the contiguous farm fields, the shaded tidiness of these well-tilled enclosures is strange indeed. One seems to have suddenly entered another country, where our slovenly agricultural methods have been superseded by a Dutch or French thoroughness. In these gardens, many of them not more than fifteen or twenty yards square, the earliest potatoes in England are grown’ (Folliott-Stokes 1912, 206-207).



The cliff gardens of Tregiffian mapped in 1906, a few years before Folliott-Stokes described them (OS 1:2500). many gardens were reached by passing through others. Small buildings in the corners of one or two were presumably tool and chitting sheds. ((Reproduced with the permission of the National Library of Scotland.)

Pete Dudley’s description of the remains of the ‘bewildering array’ of these now disused gardens was made 90 years later. He describes stone walls standing over 1.25 metres high and stone-revetted banks, almost terraces reaching up to 2.5m high. Natural outcrops are incorporated into the corners of these gardens. Map regression shows that the Tregiffian fields were laid out in blocks between 1838 and

1876, the fields being extended southwards down the cliffs, and these blocks were then further subdivided between 1876 and 1908 (1st and 2nd editions of the OS 1:2500 mapping) (Dudley 2003, 19-121).

The Tregiffian cliff gardens as recorded on the 1906 OS 1:2500 map. Note access tracks, three sheds and a small quarry that was probably used as the source of stone in the field boundaries. (Reproduced with the permission of the National Library of Scotland.)

At Kemyel Crease in Paul parish the first gardens were established after 1840 and before 1876 within a field that had been called ‘Garden of Eden’ in the 1840 Tithe Apportionment, presumably because of its benign conditions. The gradual extensions and subdivisions of the gardens here were similar to those at Tregiffian. Dr Frank Turk visited them in 1977 and established that the gardens were still being cultivated in the 1930s when between 6 and 12 donkeys were used to work the land and carry materials. The fields were then still being manured by sea weed (Herring 2000, 130-131).

It was probably these Kemyel Crease gardens that JRA Hockin entered and enjoyed in 1936. When close to Lamorna he found himself ‘among the cliffside potato fields and flower patches some of which are of violets sheltered by fuschia hedges – a dizzy combination when the sea below happens to be imperially blue!’ (Hockin 1936, 254).

Gardening continued for a few years after Hockin’s time as there are also records of flower bulbs being uprooted and replaced by potatoes during the Second World War, when the labour was provided by Land Girls (Herring 2000, 131).

The Kemyel Crease cliff gardens in April (when choughs make their nests). The colours indicate a mix of daffodils, tulips and other flowers as well as the duller greens of potatoes and vegetables. Donkeys trudge along the cliff-edge path, bringing seaweed to spread on the soil between crops. A steamer heads west from Penzance, perhaps laden with new potatoes. (Reconstructed from early 20th century OS mapping by Phoebe Herring in a painting commissioned by the Penwith Landscape Partnership.)

Some of the most evocative evidence for the gardens comes from artists, notably those of the Newlyn School who flourished at the same time that the flowers were in their prime. Harold Harvey, born locally in Penzance, was especially taken by the flowers and their pickers, preparing several beautiful paintings suggesting the Garden of Eden continued into the early 20th century on the slopes near Mousehole. He also illustrated orchards, especially when they were under blossom.

Modern shift to specialisation: Dairying

In the later 19th century, dairying went from being a universal element of all mixed farming economies to a specialism for those many farms capable of the capital investment in productive livestock and the increased mechanisation of milking.

Before specialisation

In the early 19th century, it was stated that ‘the dairy does not constitute a very important department in the husbandry of Cornwall’ and ‘very little cheese is made’. The native Cornish and the Devon breeds were those ‘most appropriated to this use’,

and there were also ‘many Jersey and Guernsey cows, their milk yielding a cream of a richer colour and quality’ (Worgan 1811, 140).

Worgan did, however, describe an important dairying side-industry in west Cornwall, the land ‘from the River Hayle to the Land’s End’. The cattle that the typical farmer brought to calf in the crofts (see above, under Rough Pastures) were, once the calf had been taken from them (and sold), let out ‘to labourers and poor people’ at £6 or £8 per cow, for 7 or 8 months; 4, 6, 8 or 10 cows per person. The hirer then paid the ‘cow-rent’ by milk and butter, ‘for which he finds a ready market and sale in this populous district.’ When a rented cow ‘approaches her time of calving, the farmer is obliged to take her, and provide the person with another, flush in milk. These cow-renters generally have a piece of ground allotted them by the farmer, on which they grow potatoes; with these, and with the scalded milk which has yielded cream for butter, they fatten a great many young porkers’ (Worgan 1811,141).

Worgan also described the making of butter, which included the use of large, shallow scalding pans for gently heating to separate off the cream (ibid, 142).

Specialisation

In the last quarter of the 19th century, after the railways of west Cornwall had been linked to mainlines to Britain’s cities (see Market Gardening, below), dairy rapidly developed as an agricultural specialisation. ‘Cornish butter was generally regarded as of poor quality, so in the 1890s “dairy factories” were established throughout the county to produce a more uniform and improved butter (Rowe 1996, 186). A significant later stimulus was the creation in 1933 of the Milk Marketing Board, intended to protect and guarantee milk prices and to collect milk from farms in churns’ (Dudley, 2011, 55-57).

Primrose Dairy at Sancreed was founded in 1910 by Martin Oates, and expanded in the 1930s under Leslie Oates. They boasted automated wrapping; the butter never touched by a human hand. From 12,000 to 15,000 gallons of milk were delivered to Sancreed every day in churns picked up from roadside stands (many still surviving as archaeological features), by lorries from as far away as Falmouth (*Cornishman* 11 July 1935). Milk was purchased from around 600 farms in the 1930s to produce the nationally well-known Ennis Vale Cornish Butter and Cornish Clotted Cream (Murley 2022, 47).

From an advertisement in The Cornishman, 11.7.1935.

At the ends of most farm lanes in mid-20th century West Penwith stood the stand for the dozen or so churns of milk. Many still survive to conjure memories of the morning milk lorries. Bosporthennis, Zennor.

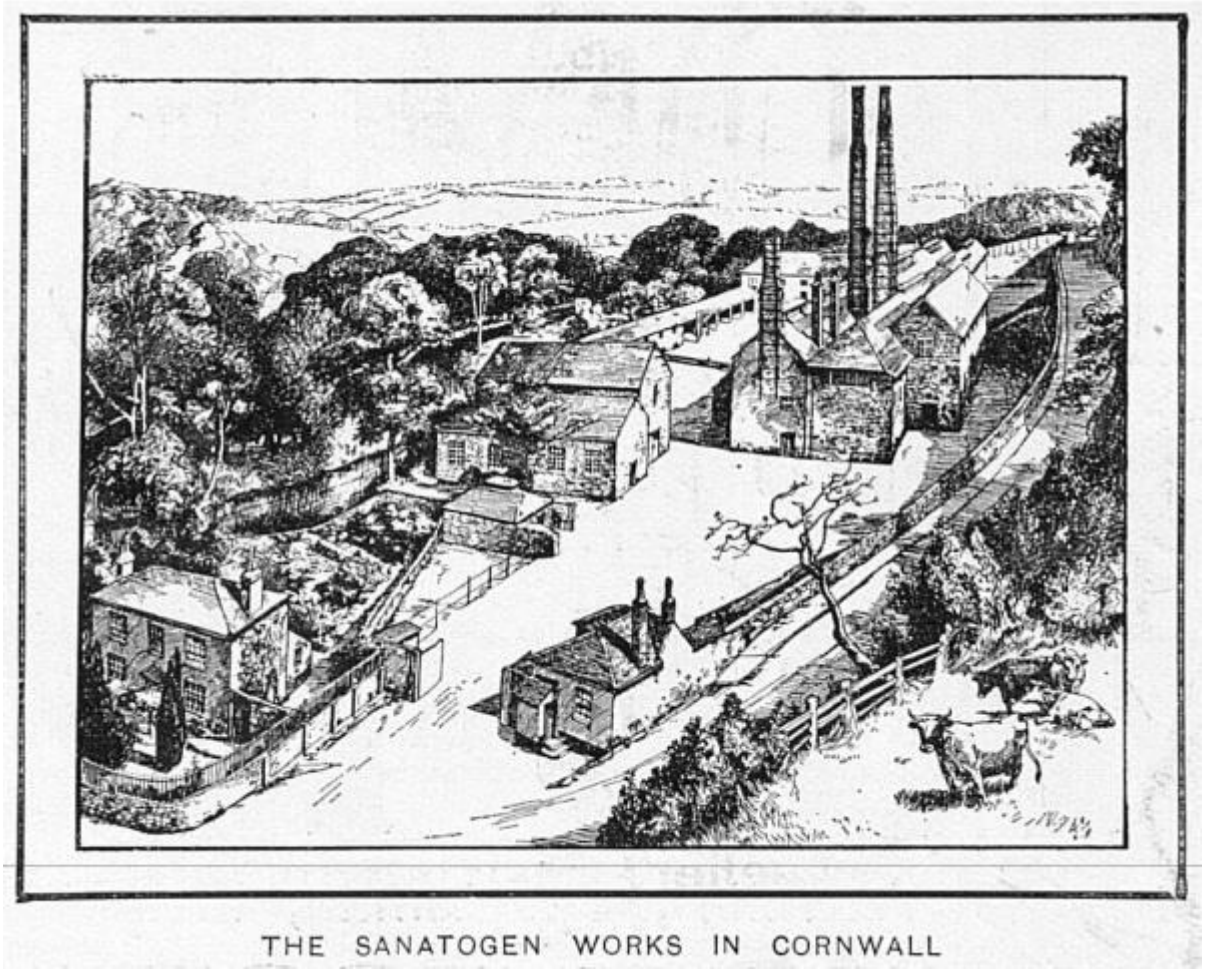
In 1936 Leslie Oates moved Primrose Dairy to St Erth, to the old Porthia China Clays Limited works, which had a ceramic pipe from clayworks in Towednack that was reused for supplying the large quantities of fresh water required by the dairy. It was also adjacent to the mainline railway that could take its products up-country. By April 1944 Primrose Dairy was supplied by up to 1600 farms (*Cornishman* 6 April 1944). As well as absorbing the old Sancreed dairy it took over another dairy near St Erth, at Treloweth beside the Lamb and Flag pub (on the site of the Lamb and Flag smelting works). That creamery and butter-factory had been managed by Edward Mitchell from 1888 (Murley 2022, 48).

There were other dairies in West Penwith, including the Catchall Dairy, Buryas Bridge, Sancreed (Kelly's 1935, 453; *Cornishman* 1st June 1944); Alexandra Dairy in Penzance (Kelly's 1935, 453), Land's End Co-operative Dairy Co, at The Bottoms, St Buryan (ibid), Ludgvan & District Dairy Co, Long Rock (ibid), John Mann (at both Redinnick Terace and Morrab Road in Penzance; ibid), West Cornwall Creameries, Lelant (Kellys 1935, 454) in addition to numerous smaller-scale 'dairymen' (Kelly's 1935, 453-4).

Another use of West Cornwall's milk was in the production of Sanatogen, the 'brain tonic' that was 95% milk protein and 5% sodium glycerophosphate. A factory was established on yet another old industrial works, the Trereife smelting works in the

valley of the Newlyn River at Stable Hobba. In publicity in early 1909, shortly after opening, the milk of West Cornwall was lauded as long famous ‘for its purity and quality… indisputably due to the climatic conditions [of] that happily-dowered country… [which] ensure the magnificent grazing grounds as well as the health of the cattle with which the Cornish land of sunshine has long been synonymous. From the neighbouring farmers enormous quantities of pure, rich new milk are taken daily to be converted into Sanatogen’ (*The Sphere, 20 February 1909*).

Dairy cattle in the west of Cornwall were still largely Channel Island breeds in the mid-20th century, as they had been at the start of the 19th (Worgan 1811, 140; Dudley 2011, 57).



Channel Island cattle decorate this image of the Stable Hobba Sanatogen factory near Newlyn (from The Sphere, 20 February 1909)

A simple effect of this shift to dairy was a concomitant shift away from all but the best grass land from the turn of the 20th century. From then on, the upland rough ground, the remnants of the great commons, were increasingly neglected agriculturally. Dairy cattle were kept on the best grass on the in-bye land and their focus on dairy (and other specialisations like market gardening) left farmers with little capacity to devote to other strands of their work.

Milking time at Treen, St Levan, 2022.

Trees and woodland

‘The greateste wante that the Countrye hath is woode and timber: The weste parte of the Countrye, as Pen-with, Kerrier, Pyder, and Powder hundreds, are in manner meerely berefte of theis benefitts’ (Norden c1600, 18).

‘This hundred [Penwith] is ill stored with woode, but less with timber: It is verie mountainous and rockye’ (Norden c1600, 26). Norden distinguished between wood and timber, the former produced poles and branches of small diameter, used for barking, charcoal and firewood, and the latter, the timber, capable of producing trunks and large branches suitable for building or carpentry (Rackham 1986).

‘We observed the same scarcity of trees on the whole coast of Cornwall, and as far inland as we could see. It is occasioned by the westerly wind, which passing over a vast extent of sea, comes unmixed and untempered to this coast, and blighting as it blows, extirpates, root and branch, every tree and shrub that oppose it. The westerly wind is more prevalent and more boisterous than any other. Dr. Johnson observed that he had travelled two hundred miles in Scotland and seen only one tree not younger than himself: we travelled at least half that distance in Cornwall, and saw only three not shorter than ourselves. The pernicious effect of the salt wind was strikingly evidenced in a few stumps which we saw coaxed up under the lee of a wall, and which could not raise their heads an inch above it, but were shaved as flat as with a scythe, and all of equal height, or just as high as the wall (Ayton and Daniell 1813, 15-16).

'…our plantations make the less figure because they are low, and our hills are naked' (Borlase 1758, 2). The air is salty (from the sea) and 'very prejudicial to shrubs and trees… very discouraging to all new plantations' (Borlase 1758, 10).

The coast and sea

Averting or minimising danger on the coast

This is a dangerous coast, with all too few havens, and has been the scene of countless wrecks and tragedies (see Carter and Larn 1969 and Carter 1970 for just some of the more recent ones). Numerous wrecks are identified in the Cornwall and Isles of Scilly Historic Environment Record.

Daymarks and lighthouses were erected to help pilot boats and ships into harbours or to warn sailors to keep their distance, if they could. Lookouts kept watch and coastguards and lifeboats have been engaged in saving those in danger, while havens have been made available to vessels vulnerable to storm.

Those coves named from the Cornish *porth* in West Penwith may have been places where a boat could be landed *in extremis*. Not all sandy coves may have been suitable as porths as the cliffs behind many were unscalable. The most unlikely such haven is Porthmoina in Zennor, but even here sand is sometimes in place, and the cliffs while terrifying can be climbed.

Harbours with built quays and piers were created in some sheltered places, as havens and to support fishing and commerce. Part of Mousehole's western quay is Cornwall's earliest surviving pier, built in the last decade of the 14th century 'as a defense against the sea' (Mattingly 2009, 26) and St Michael's Mount had been begun by the 15th century (Herring 1993, 130). Newlyn, St Ives and Penzance also had 15th century piers (Kittridge 1989, 41-42; Pool 1974, 21). Other quays are much later: Lamorna 1853, to serve the granite quarries, and Sennen 1908 (Kittridge 1989, 41; though see the 1839 Sennen Tithe Map which shows an earlier stubby quay).

Other coves had slipways equipped with windlasses to haul boats up, as at Penberth, Porthgwarra, Priests Cove and Sennen Cove.

Some medieval church towers served as daymarks, including that of St Buryan, 92 feet high, built in 4 stages, nearly 2 miles inland. Daymarks were used to guide boats and ships safely to shore, usually with the help of local pilots, but they also enabled fishermen to find their way to productive fishing areas, including over wrecks. Other daymarks were built to improve safety for shipping. In 1821 the Corporation of Trinity House built two concrete-rendered structures at Gwennap Head, west of Porthgwarra, in line with the dangerous Runnel Stone reef. When the southern red cone completely covered the northern black and white double-cone a person (on a ship) would be above the Runnel Stone (now also marked by a permanent marker buoy).

The coast was also dotted with look-outs, some to watch for fish, and especially the great shoals of pilchard, others for smugglers, enemy vessels or those that were in trouble on the sea. The Coastguard Service was established in 1822 initially to protect revenue (against smugglers) but when that need diminished its role became a form of naval reserve, with some life-saving responsibilities and from the 1920s,

the latter became their primary purpose (Smith 2012, 2). Coastguard Stations occupied by 'government' men were established at St Ives, Treen (Zennor, with a lookout on Gurnard's Head), St Just (lookout on Cape Cornwall), Sennen Cove (lookout on Pedn-men-du), Porthgwarra (lookout at Tol-Pedn-Penwith), Mousehole, Newlyn, Penzance and Marazion.

The Coastguard still operates, partly supported by volunteers, with bases at St Ives, Land's End and Penzance. A watch is also still kept on the seas around West Penwith, now from National Coastwatch Institution (NCI) lookouts at St Ives, Cape Cornwall, Gwennap Head and Penzance.

Lighthouses have guided seafarers away from dangerous coasts since at least the medieval period. A beacon light was maintained at Chapel Carn Brea from as early as 1396 (Hague and Christie 1975, 18) and an oil-fuelled cresset light kept lit on the tower of St Michael's Mount church was referred to as early as 1433 (ibid, 150-153).

A lighthouse placed on the Longships (off Land's End) in 1795 was replaced by the present stone tower in 1873. The great Wolf Rock lighthouse, six miles west of Gwennap Head, was commenced in 1861 (Todd and Laws 1972, 149-150). Pendeen Watch lighthouse (and famous foghorn) was built in 1900 (Jackson 1975) and Tater-Du in 1965 (Todd and Laws 1972, 149-150).

Even with all these arrangements in places vessels would still get into difficulties and lifeboat stations were established at St Ives (in 1840), Sennen Cove (1853), Penlee, Mousehole (1913), Newlyn (1983), and Penzance (1803, the earliest lifeboat in Cornwall, 21 years before the RNLI was established). Most were equipped with the rocket apparatus invented by Cornishman Henry Trengrouse, that fired a line either from the shore or from a lifeboat onto a stricken ship to help evacuate people.

Protecting the coast and expanding harbours

Sea defences and harbours

Besides the effects of natural processes, the sea and coasts have also been changed by people. As well as the quays and wharves of harbour villages and towns, both soft and hard sea defences line much of the northern coast of Mount's Bay. Penzance's great granite Promenade was built in 1844 primarily as a sea defence to protect the Western Green towans (Edmonds 1862, 154; Pool 1974, 191). Another sea defence was built along the southern edge of Whitesand Bay, to protect the road to Sennen Cove.

Penzance's northern or Albert Pier (1845) enclosed 17 hectares of open sea and at Newlyn 13 hectares was taken in by the South and North Piers (1885 and 1894). St Ives' harbour was relatively small (4.5 hectares) though it was earlier (begun in 1766). The medieval harbours at St Michael's Mount and Mousehole were much smaller again (each 1.25 hectares) and Sennen Cove is just 0.4 hectares.

The causeway linking the Mount to Marazion was created by nature, 'by the Eastern and Western currents which meeting here every tide by their mutual resistance equally contribute to raise this ridge of rocks and pebbles' (Borlase 1731) and was paved around the turn of the 20th century (Herring 1992, 170).

Massive breakwaters proposed for St Ives and Mount's Bays

All of these interventions, each significant in itself, would have been dwarfed by 19th century schemes for breakwaters in St Ives and Mount's Bays.

St Ives Bay

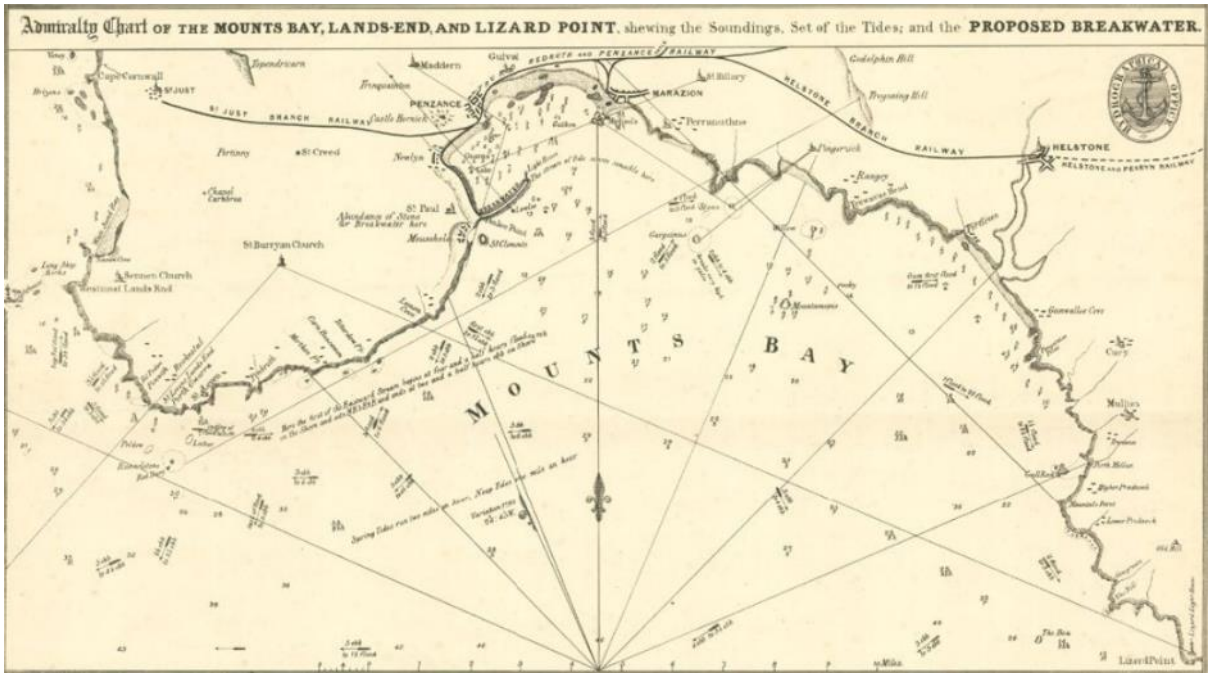
The St Ives scheme, involving Richard Trevithick, was set out in a Bill of 1811 for 'Making, Forming and Maintaining a Breakwater or Sea Wall and other improvements in the bay of St Ives'. It was designed to run for 'two thousand feet or upwards' (610 metres, or 0.4 miles) in an easterly direction from the Merryn. Work commenced in 1816 but was soon abandoned as the ebb tides continually shifted the newly dumped elvan rocks (Stevens 2023).

Mount's Bay

The Bill for an even more ambitious Penzance breakwater proposal was presented to Parliament in 1836. This breakwater would have been associated with connection of the Truro, Redruth and Penzance Railway Company to the London, Exeter and Falmouth Railway (*West Briton*, 28.10.1836). It would start at Penlee Point, near Mousehole, and reach halfway across Mount's Bay, a distance of around 1.9 kilometres, enclosing around 1200 acres, or 490 hectares and creating a very large area of sheltered water in Gwavas Lake (Dean 1836; see also *West Briton* 9.12.1836.)

The scheme seems overblown now, but the 1.6 kilometre Plymouth Breakwater which still softens Channel seas, was then under construction. Richard Edmonds was still excited by the Penzance breakwater in 1862; he pointed out a 'pole marking…. where the proposed Mount's-bay breakwater is to commence: and nowhere would a breakwater be of more importance to the nation than in this bay…. Mount's-bay is the natural port or gate of all Britain, and…. hundreds of vessels may be often seen here at anchor, unable either to weather the Lizard, or to pass around the Land's-end. It is nearer than any other British port to the Mediterranean, the East Indies, Australia, South America, the West Indies, the United States and Canada… Hence when the breakwater is made, the British merchants who make this bay the port for their homeward and outward bound ships will always be the earliest in the market, both at home and abroad' (Edmonds 1862, 170-171).

Of course, the breakwater was never built, but we may still imagine what its effects may have been on the economy, society, landscape and environment of west Cornwall.



The Mount's Bay breakwater as proposed. It is the curving structure attached to Penlee Point just north of Mousehole (from Dean 1836).

Water supply

Streams, rivers, springs and wells are no longer sufficient to supply the population's water, so reservoirs have been created. The earliest municipal reservoir was created at Causewayhead in Penzance in 1757, fed by a leat from a spring near Madron Well (Parkes 2022, 17). Another early town-top reservoir was created for St Ives, supplying water for the first time on 8th May 1843 (Penwith Local History Group, www.penwithlocalhistorygroup.co.uk/on-this-day/?id=138). The largest reservoir, at Drift on the Newlyn River, was opened in 1961. Slightly earlier and smaller is that on the Stennack River near Halsetown, serving St Ives, already well-stocked with fish when Lamorna Birch, who died in 1955, painted it.

Final thoughts

Since the late 19th and earlier 20th century concentration of much farming on the better land following specialisation, furze, ferns (bracken), thorns and brambles have taken a firm grip elsewhere in West Penwith. Many of those once ecologically diverse pastures, the downs, moors and commons, now lie rarely or never grazed, not even by wild animals, a situation that has never previously prevailed. This anomalous period is now so long that many regard the current state of the peninsula's rough ground as its natural state (Dudley 2011, 1).

Proposals and practices that might reinstate or maintain some of the traditional land uses that created and sustained a more dynamic and more biodiverse environment and a more accessible and beautiful landscape sometimes meet with contestation. This is because there are many more interests in the semi-natural environment now than there were when it was essentially the preserve of pre-Holocene ungulates and their predators or the post-Mesolithic owners and commoners.

In the last century or so, there has been a claiming of the open spaces by a much wider society. This has been partly through democratically supported designation (Area of Outstanding Natural Beauty, Sites of Special Scientific Interest, Scheduled Monuments etc), based on the widely accepted landscape, ecological and archaeological values of West Penwith. And partly through the more diverse ways that people access and enjoy places and thereby develop attachments to them.

Now that multiple sets of values are engaged, the traditional practices of farmers are increasingly entangled in other strands of interest and action, including those of ecologists, archaeologists, ramblers and other users. The way forward for these precious areas appears to depend again on the gathering and meeting of minds: when careful and considerate negotiations can take place between all those with rights and interests, as was the case in much of the Neolithic, Bronze Age, Iron Age and early medieval past.

As west Cornish biodiversity and semi-natural environment is culturally formed and culturally maintained, or changed, then strategies for its management will be most sustainable if they are built on thorough historical understanding on the one hand and if they successfully accommodate contemporary cultural and ecological interests on the other. Communities can find common cause and use common concepts and language to ensure that the opportunities are taken for agreeing common solutions. Extending or building on tradition and including all communities is then realistic rather than romantically nostalgic. (Summarised from Herring 2013, 258-260.)

References

Note that this report, while quite long, was once longer. Following its reduction, some of the references are now no longer mentioned in the remaining text. They have been retained as some readers may find them useful if they wish to pursue themes of interest.

Allen, MJ, 2019 *Penzance proposed Heliport site, Geoarchaeology 1: deposit and sample records*, Allen Environmental Archaeology, Warminster

Allen, MJ, Clapham, AJ, Dudley, P and Jones, AM, 2020 Archaeological investigations at Tower meadows, St Buryan, 2019-2020, *Cornish Archaeology* **59**, 177-184

Allen, MJ, Clapham, AJ, Cameron, N and Langdon, CT, 2020 *Marazion Marsh, Mount's Bay, Penzance, Cornwall: Palaeoenvironmental Assessment: geoarchaeology, pollen and diatoms*, Allen Environmental Archaeology, Warminster

Anonymous, 1836 The Cornish Farmer and the Labouring Classes, *Penny Magazine* **V** (May 21st, 1836), 196-199

Antrop, M, 2000 Geography and Landscape Science, *Belgeo*, 1-2-3-4, 9-36

Ayton, R and Daniell, W, 1814 *A Voyage round Great Britain undertaken in the summer of the year 1813*, reissued Tate Gallery 1978

Barnatt, J, 1982 *Prehistoric Cornwall, the ceremonial monuments*, Turnstone, Wellingborough

Bathe, G, 2013 Of Commoners and Kings, in ID Rotherham (ed) *Cultural Severance and the Environment, the ending of traditional and customary practice on Commons and landscapes managed in commo*n, Springer, Heidelberg, 177-190

Bele, B, Nielsen, VKS, Fairclough, G and Herring, P, forthcoming A heritage without boundaries: nature-culture synergies in and around Norwegian protected landscapes

Bell, M, 2020 *Making one's way in the world, the footprints and trackways of prehistoric people*, Oxbow Books, Oxford

Bender, B, Hamilton, S and Tilley, C, 2007 *Stone Worlds, Narrative and Reflexivity in Landscape Archaeology*, Left Coast Press, Walnut Creek

Bennett, A, 1988 *The Great Western Railway in West Cornwall*, Runpast Publishing, Cheltenham

Bennett, K, 1989 A provisional map of forest types for the British Isles 5000 years ago, *Journal of Quaternary Science*, **4**, 141-144

Beresford, G, 1994 Old Lanyon, Madron: a deserted medieval settlement. The late E Marie Minter's excavations of 1964, *Cornish Archaeology*, **33**, 130-169

Berridge, P and Roberts, A, 1986 The Mesolithic period in Cornwall, Cornish Archaeology 25, 7-34

Binford, L, 1986 Human ancestors: changing views of their behavior, *Journal of Anthropological Archaeology*, **3**, 235-257

Bird-David, N, 1990 The giving environment: another perspective on the economic system of Gatherer-Hunters, *Current Anthropology*, **31.2**, 189-196

Birks, HJB 1989 Holocene Isochrone Maps and Patterns of Tree-Spreading in the British Isles, *Journal of Biogeography*, **16.6**, 503-540

Blackman, T, 2011 Pseudo-Quoits to Propped Stones, in S. Pearce (ed.) *Recent archaeological work in south-western Britain; papers in honour of Henrietta Quinnell*. Oxford: BAR British Series, 548, 41-48

Boase, HS, 1825 On the sand-banks on the northern shores of Mount's Bay, *Trans Royal Geol Soc of Cornwall*, **3**, 166-191

Borlase, W, 1731 Letterbook 1, labelled 13, unpublished MS, held in Penzance Library, Morrab Gardens

Borlase, W, 1758 *The Natural History of Cornwall*, Oxford

Borlase, W, 1769 *Antiquities Historical and Monumental of the County of Cornwall*, Second edition. Baker and Leigh, London

Borlase, WC 1872 *Naenia Cornubiae, A descriptive essay illustrative of the sepulchres and funeral customs of the early inhabitants of the county of Cornwall*, Longmans, Green, Reader and Dyer, London

Bowden, M, 2021 Evidence for transhumance in British prehistory, in Bowden, M and Herring, P (eds) *Transhumance*, Archaeopress, Oxford, 11-22

Bradley, R, 2000 *An Archaeology of Natural Places*, Routledge, London

Britton, P, 2012 West Cornwall Golf Club – the jewel of the West Country, *Pitchcare Magazine* **43** https://www.pitchcare.com/news-media/west-cornwall-golf-club-the-jewel-of-the-west-country.html

Brookes J 1995 Grazing cliff-top grasslands and heaths of West Penwith, Cornwall. *Biol J Linn Soc* **56**, 47–48

Brown, AP, 1977 Late-Devensian and Flandrian vegetational history of Bodmin Moor, Cornwall, *Philosophical Transactions of the Royal Society*, **B276**, 251-320.

Camm, GS, 1999 Palaeovalley systems in Mount's Bat, west Cornwall, in Scourse and Furze 1999, 46-57

Carew, 1603 *The Survey of Cornwall*, first published 1603, reissued in 2004 by Devon and Cornwall Record Society New Series, Volume 47, Exeter

Carne, J 1846 Notice on the remains of a submarine forest in the north-eastern part of Mount's Bay, *Trans Royal Geol Soc of Cornwall*, **6**, 230-235

Carter, C 1970 *Cornish Shipwrecks, the North Coast*, David and Charles, Newton Abbot

Carter, C 1971 *The Blizzard of '91*, David and Charles, Newton Abbot

Casanova, E, Knowles, TDJ, Bayliss, A and Evershed, RP, 2022 Dating the emergence of dairying by the first farmers of Central Europe using ^{14}C analysis of fatty acids preserved in pottery vessels, *Proceedings of the National Academy of Sciences*, **119.43**, https://doi.org/10.1073/pnas.2109325118

Caseldine CJ 1980 Environmental change in Cornwall during the last 13,000 years. *Corn Archaeol* **19**, 3–16

Casimir, MJ, 1990 On Milk-drinking San and the 'Myth of the Primitive Isolate', *Current Archaeology*, **31.5**, 551-554

Challinor, D, 2011, The charcoal, in Jones and Quinnell 2011, 111-112

Challinor, D, 2012, Charcoal, in Jones *et al* 2012, 39-41

Challinor, D, 2013, Charcoal, in Jones 2013, 154-155

Challinor, D 2020 Charcoal, in Jones and Lawson-Jones 2020, 152-3

Chambers, FM, van Geel, B and van der Linden, M, 2011 Considerations for the preparation of peat samples for palynology, *Mires and Peat*, **7**, 1-14

Channon, AH, 2018 *A palaeoenvironmental reconstruction of the Mount's Bay coastline: implications and applicability towards understanding current trends and future projections of sea-level rise*, Unpublished BA dissertation, University of Plymouth

Charke, WJ, 1931 Remembrance of life on a farm, *Old Cornwall* **2.1**, 28-36

Charman, DJ 2010 Centennial climate variability in the British Isles during the mid-late Holocene, *Quaternary Science Reviews*, **29**, 1539-1554

Christie, PM, 1960, Crig-a-mennis: a Bronze Age barrow at Liskey, Perranzabuloe, Cornwall, *Proceedings Prehistoric Society*, **26**, 76-97

Christie, PM, 1978 The excavation of an Iron Age souterrain and settlement at carn Euny, Sancreed, Cornwall, *Proceedings Prehistoric Society*, **44**, 309-433

Clark, J, Darlington, J, and Fairclough, G, 2004. *Using Historic Landscape Characterisation*, London, English Heritage and Lancashire County Council

Collis, J, Nicolis, F and Pearce, M 2016 Summer Farms, *Seasonal Exploitation of the Uplands from Prehistory to the Present*, Sheffield Archaeological Monographs, Sheffield

Copley, MS, Bertsan, R, Dudd, SN, Docherty, G, Mukherjee, AJ, Straker, V, Payne, S, and Evershed, RP, 2003 Direct chemical evidence for widespread dairying in prehistoric Britain, *Proceedings of the National Academy of Sciences of the United States of America*, **120.7**, 1524-1529 https://doi.org/10.1073/pnas.0335955100

Copley, MS, Berstan, R, Dudd, SN, Aillaud, S, Mukherjee, AJ, Straker, V, Payne, S and Evershed, RP, 2005 Processing of milk products in pottery vessels through British prehistory, *Antiquity* **79.306**, 895-908 https://doi.org/10.1017/S0003598X00115029

Coque-Delhuille B 1991 The long-term geomorphologic evolution of the English South-West massif (UK). *Z Geomorph NF* 35:65–84

Cornwall Council and Historic England, c2015 Cornwall Farmsteads Character Statement, Cornwall Council and Historic England.

Cornwall County Council 1996 *Cornwall Landscape Assessment 1994*, Landscape Design Associates and Cornwall Archaeological Unit for CCC, Truro

Costello, E. and E. Svensson (eds) 2018. *Historical Archaeologies of Transhumance across Europe.* Abingdon: EAA/Routledge, Themes in Contemporary Archaeology 6.

Costello, E, 2020 *Transhumance and the Making of Ireland's Uplands, 1550-1900*, The Boydell Press, Woodbridge

Council of Europe 2000 *European Landscape Convention*, Florence

Countryside Commission 1994 *The Landscape of Bodmin Moor*, Land Use Consultants and Cornwall Archaeological Unit, Bristol

Courtney, L, 1878 *Half a Century of Penzance (1825-1875), from notes by JS Courtney*, Beare and Son, Penzance

Cranfield University 2018 *The National Soil Map and Soil Classification*,

Cranfield University 2022. *The Soils Guide.* Available: www.landis.org.uk. Cranfield University, UK. Last accessed 21/07/2022

Crawford, OGS 1936 The Work of Giants*, Antiquity* 10, 162-174

Davis, BAS, Brewer, S, Stevenson, AC, Guiot, J, 2003 The temperature of Europe during the Holocene reconstructed from pollen data, *Quaternary Science Reviews*, **22**, 1701-1716

Dean, C, 1836 *Truro, Redruth & Penzance Railway, with the Breakwater at Penlee Point Mount's Bay*, Captain Hackett, Exeter

DEFRA 2015 UK Terrestrial & Freshwater Habitat Types: Lowland Heathland Habitat Description, https://webarchive.nationalarchives.gov.uk/ukgwa/20190301143626/http://jncc.defra.gov.uk/page-4532

Diacano Associates and White Consultants 2007 Cornwall and the Isles of Scilly Landscape Character Assessment,

Dimbleby, GW 1963 Pollen analysis from three Cornish barrows, *Journal Royal Institution of Cornwall*, **ns4**, 364-375

Dimbleby, GW 1978 Pollen work, in Christie 1978, 424-429

Dixon, DD, 1890 Northumbrian plant names, *Nature Notes*, **1**, 110-111

Dudley, D, 1941 A Late Bronze Age settlement on Trewey Downs, Zennor, Cornwall, *Archaeological Journal*, **98**, 105-130

Dudley, D, 1956 An excavation at Bodrifty, Mulfra Hill, near Penzance, Cornwall, *Archaeological Journal*, **113**, 1-32

Dudley, D, 1957 Late Bronze Age and Early Iron Age Settlements in Sperris Croft and Wicca Round, Zennor, Cornwall, *Journal of the Royal Institution of Cornwall*, **III.1**, 66-82

Dudley, P, 2003 *Tregiffian, St Buryan, Archaeological Assessment*, Cornwall County Council, Truro

Dudley, P, 2011 *Goon hal, cliff and croft, the archaeology and landscape history of west Cornwall's rough ground*, Cornwall Council, Truro

Earle, T, 2000 Archaeology, property and prehistory, *Annual Review of Anthropology*, **29**, 39-60

Edmonds, R, 1862 *The Land's End District; its antiquities, natural history, natural phenomena and scenery*, J Russell Smith, London

English Heritage 2008a *Conservation Principles, Policies and Principles* English Heritage, Swindon

Evans, DJA, Kalyan, R and Orton, C 2017 Periglacial geomorphology of summit tors on Bodmin Moor, Cornwall, SW England, *J Maps* **13**, 342–349

Evans, J, 1800 *A Tour through part of North Wales in 1798, and at other times*, White, London

Eversheds, RP, Smith, GD, Roffet-Salque, M *et al* (105 other 'authors') 2022 Dairying, diseases and the evolution of lactase persistence in Europe, *Nature* **608**, 336-345

Farnworth, R., with Herring, P, Tapper, B, and Farnworth, C, forthcoming, a. The Rough Tor Effect: early prehistoric monuments focusing on significant tors in Cornwall.

Farnworth, R., with Herring, P, Tapper, B, and Farnworth, C, forthcoming, b. The Rough Tor Effect: investigating the locations of Cornish cairns

Farnworth, R., with Herring, P, Tapper, B, and Farnworth, C, forthcoming, c. The Rough Tor Effect: stone circles on Bodmin Moor and the Pole Star

Farnworth, R., with Herring, P, Tapper, B, and Farnworth, C, forthcoming, d. Neolithic excarnation on Bodmin Moor, Cornwall

Fewlass, H, Mitchell, PJ, Casanova, E and Cramp, LJE 2020 Chemical evidence of dairying by hunter-gatherers in highland Lesotho in the late first millennium AD, *Nature, Human Behaviour*, **4**, 791-799

Fleming, A, 2008 *The Dartmoor Reaves, second edition*, Oxbow Books, Oxford

Fleming, A 2022 Exploring the Origins and Character of Transhumance in England, in W Morrison (ed) *Challenging Preconceptions of the European Iron Age*, Archaeopress, Oxford

Fleming, F, 2016 *Penzance, Cornish Ports and Harbours*, Cornwall Council

Fluck, H and Holyoak, V 2017 *Ecosystem Services, Natural capital and the Historic Environment, Historic England Research Report 19/2107*, Historic England, Swindon

Folliott-Stokes, AG, 1912 *The Cornish Coast and Moors*, Greening & Co, London

Fordham, R, 2003 Canon Boscawen of Ludgvan and his contributions to horticulture, in *Ludgvan: a century of horticulture 1903-2003*, Ludgvan Horticultural Society, 17-21

Forster, E and Robinson, DE, 2011 *The West Cornish Heath, Landscape studies in Southwest England, Research Report 53-2011*, English Heritage, Portsmouth

Fox, HSA, 1971 *A Geographical Study of the Field Systems of Devon and Cornwall*, PhD thesis, University of Cambridge

Fraser, R, 1794, *General View of the Agriculture of the County of Cornwall*, London

French, CN, 1999 The 'submerged forest' palaeosols of Cornwall, *Geo-Science in South-West England*, **9**, 365-369

French, C, 2020 *A Flora of Cornwall*, Wheal Seton Press, Camborne

Garner, L, 1984 *Dry Stone Walls*, Shire, Aylesbury

Gearey, BR, Charman, DJ, and Kent, M 2000 Palaeoecological evidence for the prehistoric settlement of Bodmin Moor, Cornwall, southwest England. Part II: Land use changes from the Neolithic to the present. *J Archaeol Sci* **27,** 493–508

Gendall, H, 2022 Hope for a forgotten grain in Cornwall, Royal Botanic Gardens, Kew, https://www.kew.org/read-and-watch/cornish-oat-pillas

Gilbert, P, 1995 *Plant macrofossil analysis of an intertidal peat deposit from St Ives harbour, Cornwall*, unpublished BA dissertation, University of Bristol

GLVIA3 2013 *Guidelines for Landscape and Visual Impact Assessment 3rd edition*, Landscape Institute and Institute of Environmental Management and Assessment

Godwin, H. 1975. *History of the British Flora*, Cambridge University Press, Cambridge

Godwin, H. 1977. Quaternary history of the British flora. In: Shotton, FW (ed), *British Quaternary Studies*, Oxford University Press, Oxford, 107-118

Goldsmith, O, 1824 *A History of the Earth and Animated Nature,* Wright, London

Gover, JEB, 1948 *The Place-Names of Cornwall*, unpublished MS at the Royal Institution of Cornwall

Grigson, G, 1958, *The Englishman's Flora*, Phoenix House, London

Guthrie, A 1960 A Palaeolithic hand-axe from St Buryan parish, *Proceedings of the West Cornwall Field Club*, **2.4**, 175-177

Guthrie, A, 1969 Excavation of a settlement at Goldherring, Sancreed, 1958-1961, *Cornish Archaeology*, **8**, 5-39

Hall, A, 1994 *West Cornwall, Geologists' Association Guide No. 19*, The Geologists' Association: London

Hall, A, 2005 *West Cornwall. Geologists' Association Guide No. 31*, Geologists' Association, London

Halliwell, JO, 1861 *Rambles in western Cornwall by the footsteps of the Giants, with notes on the Celtic remains of the Land's End district and the Islands of Scilly*, John Russell Smith, Soho Square, London

Hamilton, S, Harrison, S, Bender, B, 2008 Conflicting imaginations: Archaeology, anthropology and geomorphology on Leskernick Hill, Bodmin Moor, southwest Britain. *Geoforum* **39**, 602–615

Harrod, TR, 2017 *Soils in Devon, IX, Sheet SX68/78 (Moretonhampstead and Chagford), Soil Survey Record No. 117*, Crediton

Hawkes, CFC 1932 The Towednack Gold Hoard, *Man*, **32**, 177-186

Healy, MG, 1993 *Holocene coastal evolution and relative sea-level change in west Cornwall, UK*, unpublished PhD thesis, National University of Ireland

Healy, MG, 1995 The lithostratigraphy and biostratigraphy of a Holocene coastal sequence in Marazion Marsh, west Cornwall, UK, with reference to sea-level movements, *Marine Geology*, **34**, 237-252

Healy, MG, ed 1996 *Late Quaternary coastal change in west Cornwall, UK. Field Guide*. International Geological Correlation Programme Project 367, University of Durham

Healy, MG, 1999a Marazion Marsh in Scourse and Furze 1999, 74-80

Healy, MG, 1999b Holocene relative sea-level change in west Cornwall, in Scourse and Furze 1999, 58-61

Helbaek, H, 1952, Early Crops in Southern England, *Proceedings of the Prehistoric Society*, **12**, 194-233.

Henderson, C, and Coates, H, 1928 *Old Cornish Bridges and Streams*, Simpkin Marshall for the University College of the South West, Exeter

Herring, P 1979 *Circularity on the Moor, an introduction to the hut-circles of Bodmin Moor, Cornwall*, unpublished BA dissertation, University of Sheffield, Dept of Prehistory and Archaeology

Herring, P, 1986a *Eglosmeor Mill and Carn Cobba*, Herring, Penzance

Herring, P, 1986b *Wicca, Zennor, National Trust Archaeological Survey*, Cornwall County Council, Truro

Herring, P, 1986c *An exercise in landscape history: pre-Norman and medieval Brown Willy and Bodmin Moor,* unpublished MPhil thesis, University of Sheffield

Herring, P 1987 *Bosigran, Zennor, National Trust West Penwith Survey*, Cornwall Archaeological Unit, Truro

Herring, P, 1989 *Foage Zennor, National Trust Archaeological Report*, Cornwall County Council, Truro

Herring, P, 1991 *The Giant's Grave, Varfell, Ludgvan*, Cornwall County Council, Truro

Herring, P, 1993 *St Michael's Mount, an archaeological evaluation*, Cornwall Archaeological Unit, Truro

Herring, P, 1994 The cliff castles and hillforts of West Penwith in the light of recent work at Maen Castle and Treryn Dinas, *Cornish Archaeology*, **33**, 40-56

Herring, P, 1995 *Bartinney Hill, Tredinney Common and Carn Grean, an archaeological assessment*, Cornwall County Council, Truro. https://map.cornwall.gov.uk/reports_event_record/1995/1995R002.pdf

Herring, P, 1997 Early prehistoric sites at Leskernick, Altarnun. *Cornish Archaeology*, **36**, 176-185

Herring, P, 1998 *Cornwall's Historic Landscape, A method of assessing historic landscape character*, Cornwall County Council, Truro

Herring, P, 1998 *Relubbus Bridge, St Hilary and St Erth, an archaeological and historical assessment*, Cornwall County Council, Truro

Herring, P, 2000 *Wild Cornwall; archaeological assessments of Cornwall Wildlife Trust nature reserves*, Cornwall County Council, Truro

Herring, P, 2004 Cornish uplands: medieval, post-medieval and modern extents, in Ian D Whyte and Angus JL Winchester (eds) *Society, Landscape and Environment in Upland Britain*, Society for Landscape Studies, supplementary series, 2, 37-52

Herring, P, 2006a *Morasses, Moors and Marshes, lost corners of Cornwall's historic environment*, Cornwall Archaeological Unit, Cornwall County Council, Truro

Herring, P, 2006b Cornish Strip Fields, in Turner 2006, 44-77

Herring, P, 2008a Commons, fields and communities in prehistoric Cornwall, in A Chadwick (ed) *Recent Approaches to the Archaeology of Land Allotment,* British Archaeological Reports (International Series), 1875, Oxford, 70-95

Herring, P, 2008b Stepping onto the Commons: South-Western stone rows, in P Rainbird (ed) *Monuments in the Landscape*, Tempus, Stroud, 79-88

Herring, P, 2009 *Cornwall Historic Landscape Character Types texts*, Cornwall Council, Truro

Herring, P, 2010 The Cornish landscape in the Lanhydrock Atlas, in P. Holden, P. Herring and O.J. Padel (eds.) *The Lanhydrock Atlas*, Cornish Editions, Fowey, 27-40

Herring, P, 2011a West Cornwall's rough ground: a history. Prehistory (to AD 400) in Dudley 2011, 26-38)

Herring, P, 2011b Hilltop enclosures, in Dudley 2011, 84-86

Herring, P, 2012a The past informs the future: landscape archaeology and historic landscape characterisation, in S. Kluiving and E. Guttmann (eds) *Landscape archaeology between art and science, from a multi- to an interdisciplinary*

approach; proceedings of 1st Landscape Archaeology Conference 2010, Amsterdam University Press, Amsterdam, 485–502

Herring, P, 2012b, Shadows of Ghosts: Early Medieval Transhumants in Cornwall, in S. Turner and B. Silvester (eds), *Life in Medieval Landscapes; people and places in the Middle Ages*, Windgather, Oxford, 89-105

Herring, P, 2013, Changing Cornish Commons, in ID Rotherham (ed) *Cultural Severance and the Environment, the ending of traditional and customary practice on Commons and landscapes managed in commo*n, Springer, Heidelberg, 249-262

Herring, P, 2016a Medieval West Penwith (c400-1540 AD), in Herring *et al* 2016, 192-215

Herring, P, 2016b A tomb for the living: Grumbla cromlech, the Giant's Chair, Sancreed, *Cornish Archaeology*, **55**, 119-133

Herring, P, 2016c Bosigran and Bosporthennis – a case study, in Herring *et al* 2016, 78-111

Herring, P, 2016d Introduction to West Penwith's historic landscape, in Herring *et al* 2016, 10-23

Herring, P, 2016e Early post-medieval West Penwith (1540-1750 D), in Herring *et al* 216, 216-237

Herring, P, 2021 Extremes of British transhumance: Bronze Age and Inter-War; Dartmoor and Lewis, in Bowden, M and Herring, P (eds) *Transhumance*, 93-110

Herring, P, Crabtree, K, Straker, V and West, S, 1993 Examining a Romano-British boundary at Foage, Zennor, *Cornish Archaeology*, **32**, 17-27

Herring, P, Dabaut, N and Last, J, 2021 Where next for Historic Landscape Characterisation (HLC), *Landscapes*, **21.2**, 98-112 https://doi.org/10.1080/14662035.2020.1938428

Herring, P, Johnson, N, Jones, AM, Nowakowski, JA, Sharpe, A and Young, A, 2016 *Archaeology and Landscape at the Land's End, Cornwall. The West Penwith Surveys, 1980-2010*, Cornwall Council, Truro

Herring, P, and Lewis, B, 1992 Ploughing up gatherer-hunters. Mesolithic and later flints from Butterstor and elsewhere on Bodmin Moor, *Cornish Archaeology*, **31**, 5-14

Herring, P, and Rose, P, 2001 *Bodmin Moor's archaeological heritage*, Cornwall County Council, Truro

Herring, P, and Young, A, 2016 Understanding the landscape, in Herring *et al* 2016, 52-77

Hirst, K, 2021 Dairy Farming - the Ancient History of Producing Milk *ThoughtCo*, Oct. 18, 2021, thoughtco.com/dairy-farming-ancient-history-171199

Hockin, JRA, 1936 *Walking in Cornwall*, Alexander Maclehose, London

Hooke, D, 1994 *Pre-Conquest charter-bounds of Devon and Cornwall*, Boydell, Woodbridge

Hope-Moncrieff, AR (1915), *Black's Guide to Cornwall* (22nd Edition), A & C Black: London

Hosfield, R, Straker, V, and Gardiner, P, 2008 Palaeolithic and Mesolithic, in CJ Webster (ed) *South West Archaeological Research Framework*, Somerset County Council, Taunton, 23-62

Howard, P, Thompson, I, Waterton, E and Atha, M, 2018 *The Routledge Companion to Landscape Studies*, second edition, Routledge, London

Hudson, WH 1908 *The Land's End, a naturalist's impressions in West Cornwall*, Hutchinson, London

Hunt, R, 1881. *Popular Romances of the West of England* (3rd edition), Chatto and Windus, London

ICOMOS 2002 *International Cultural Tourism Charter*

JMA 1922 Gulval Fruit Plot, *Journal of the Ministry of Agriculture*, November 1922, 764-765

Jackson, D, 1975, *Lighthouses of England and Wales*, David and Charles, Newton Abbot

James, HCL, 1990 Post-glacial site at Ponsondane, Penzance, *Proceedings of the Ussher Society*, **7**, 299-300

James, HCL, 1996 Evidence for late Quaternary sea level changes in west Cornwall, in Healy ed 1996, 60-68

James, HCL, and Guttman, EB, 1992 Late Holocene development at Chyandour near Penzance, west Cornwall, *Proc Ussher Soc*, **8**, 60-63

Jenkin, AKH, 1945 *Cornwall and its People*, Dent and Sons, London

Jewell, A, 1981 Some cultivation techniques in the south-west of England, in W. Minchinton (ed.) *Agricultural Improvement: Medieval and Modern*, Exeter University Press, Exeter

Johnson, CW 1862 The Land's End and the Lizard, *West Briton and Cornwall Advertiser, 21 November 1862*, 6-7

Johnson, DL, Ambrose, SH, Bassett, TJ, Bowen, ML, Crummey, DE, Isaacson, JS, Johnson, DN, Lamb, P, Saul, M, Winter-Nelson, AE, 1997 Meanings of Environmental Terms, *Journal of Environmental Quality* **26** (3), 581–589

Johnson, N, 2016 Surveys in West Penwith1980 to 2010, in Herring et al 2016, 24-51

Johnson, N and Rose, P, 1994 *Bodmin Moor, an archaeological survey, volume 1: The human landscape to c1800*, English Heritage, second edition in 2008, English Heritage, Swindon

Jones, AM 2004-5 Settlement and ceremony: archaeological investigations at Stannon Down, St Breward, Cornwall, *Cornish Archaeology*, **43-44**, 1-140

Jones, AM, 2013 Archaeological excavations at Bosiliack, Madron, Cornwall, *Cornish Archaeology*, **52**, 135-169

Jones, AM, 2016a Early landscape and ceremony, in Herring *et al* 2016, 112-137

Jones, AM 2016b *Preserved in the Peat; an extraordinary Bronze Age burial on Whitehorse Hill, Dartmoor, and its wider context*. Oxford: Oxbow

Jones, AM, 2020 *Longrock and Marazion marsh coastal protection works Archaeological Recording: Archive report*, Cornwall Council, Truro

Jones, AM and Allen, MJ, 2023 *The Drowning of a Cornish Prehistoric Landscape: Tradition, Deposition and Social Responses to Sea level Rise*, Oxbow Books, Oxford

Jones, AM and Lawson-Jones A, 2020 Beneath the sands: a placed Beaker pit deposit at Tyringham Road, Lelant, Cornwall, *Cornish Archaeology* **59**, 145-157

Jones, AM, Lawson-Jones, A, Quinnell, H, and Tyacke, A, 2013 Landscapes of Stone: Contextualizing Greenstone Working and Lithics from Clodgy Moor, West Penwith, Cornwall, *Archaeological Journal*, **170**, 2-29

Jones, AM, and Quinnell, H, 2011 Bosiliack, a later prehistoric settlement in Penwith, Cornwall, *Archaeological Journal*, **168**, 96-132

Jones, AM, Taylor, S, and Sturgess, J, 2012 Sennen to Porthcurno South West Water pipeline, *Cornish Archaeology*, **51**, 1-68

Jones, J, 2012 Charred plant macrofossils, in Jones *et al* 2012, 42-47

Karkeek, WF, 1845 On the Farming of Cornwall, *J Roy Agr Soc England* **6**, 400-462

Kidson, C and Heyworth, A, 1982 Sea-level changes in South West England and Wales, *Proceedings of the Geological Association*, **93(1)**, 91-111

Kirkham, G, 2011a Something different at the Land's End, in A M Jones and G Kirkham, eds, *Beyond the core; reflections on regionality in prehistory*, Oxford (Oxbow), 101–12

Kirkham, G, 2011b *Managing the historic environment on west Cornwall's rough ground*, Cornwall Council, Truro

Kirkham, G, 2020 Recycling the past: monuments, manuring, masons, improvers, antiquaries and landscape change in post-medieval Cornwall, *Cornish Archaeology*, **59**, 77-110

Kittridge, A, 1989 *Cornwall's Maritime Heritage*, Twelveheads Press, Truro

Knight, J, 2005 Regional climatic versus local controls on periglacial slope deposition: a case study from west Cornwall. *Geosci SW Engl* **11**, 151–157

Knight J, and Harrison S, 2013 'A land history of men': The intersection of geomorphology, culture and heritage in Cornwall, southwest England. *Appl Geogr* **42**, 186–194

Lamb, H.H. 1977. *Climate: past present and future. Volume 2,* Methuen, London

Larn, R and Carter, C, 1969. *Cornish Shipwrecks, the South Coast*, David and Charles, Newton Abbot

Lawson-Jones, A and Herring, P, 1997 *Caer Bran, an archaeological assessment*, Cornwall County Council, Truro

Lawson-Jones, A, 2020 *Penzance Heliport, archaeological barrow excavation*, Cornwall Council, Truro

Legge, AJ, 1981, The agricultural economy, in RJ Mercer (ed) *Grimes Graves, Norfolk: Excavations 1971-72: volume I*, Department of the Environment Archaeological Reports No 11, HMSO, London

Leigh, M, 1937 *Harvest of the Moor*, Westaway, London

Lewis, SL and Maslin, MA, 2015 Defining the Anthropocene, *Nature*, **519**, 171-180

Liebenberg, L, 2006, Persistence hunting by modern hunter-gatherers, *Current Anthropology*, **47.6**, 1017-1026

Lightfoot, J, 1777 *Flora Scotica*, London

Limbrey, S, 1978 Report on soil and other samples, in Christie 1978, 429-430

Lovschal, M 2022 Mutual entrapment; domestication goes both ways, *Aeon*, https://aeon.co/essays/how-one-modest-shrub-entrapped-humans-in-its-service?fbclid=IwAR0jCqzlj4KQSRNy2WQ2Boxl06WJnI7CjwgZbtwa0vZ9dbdfkmAFzA9UR88

Lykke Syse, K 2022 Hefting the Land: a locative heritage of hooves and feet, in Svensson, D, Saltzman, K and Sorlin, S, Exploring the Routes of a Movement Heritage, White Horse Press, Winwick, 97-113

MAFF (Ministry of Agriculture, Fisheries and Food) 1988 Agricultural land Classification of England And Wales; revised guidelines and criteria for grading the quality of agricultural land,

Maltby, E and Caseldine, CJ, 1982 Prehistoric soil and vegetation development on Bodmin Moor, southwestern England, *Nature*, **297**, 397-400

Manning, DAC, 1998 Granites and associated igneous activity. In: Selwood EB, Durrance EM, Bristow CM (eds) *The geology of Cornwall and the Isles of Scilly*. University of Exeter Press, Exeter, pp 120–135

Marshall, W, 1796 *Rural Economy of the West of England,* reprinted in 1970 by David and Charles, Newton Abbot

Mathews, JH 1892 *A History of the Parishes of Saint Ives. Lelant, Towednack and Zennor*, Elliot Stock, London

Mattingly, J 2009 *Cornwall and the Coast, Mousehole and Newlyn*, Phillimore, Chichester

Mays, N, 2022 The Conquest of Milk: The Rise of Lactase Persistence and the Fall of Scandinavian Hunter-Gatherers, *James Madison Undergraduate research Journal*, **9.1**, 54-64

Menneer, R, 1994 *Wildlife Revival in Cornish Hedges, History, Traditions and Practical Guidance*, Dyllansow Truran, Redruth

Menneer, R, 2017 *Unusual old features in Cornish hedges*, Cornish Hedges Library, http://www.cornishhedges.co.uk/PDF/features.pdf

Mercer, RJ 1981 Excavations at Carn Brea, Illogan, Cornwall a Neolithic Fortified Complex of the Third Millennium bc, *Cornish Archaeology*, **20**, 1-204

Mercer, RJ, 1997 The excavation of a Neolithic enclosure complex at Helman Tor, Lostwithiel, Cornwall, *Cornish Archaeology*, **36**, 5-63

Middleton, ER and Antón, SC 2014 *Homo erectus*, in C Smith (ed) Encyclopedia of Global Archaeology. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-0465-2_687

Ministry of Housing, Communities and Local Government (MHCLG), 2021 *National Planning Policy Framework*

Mitchell, FJG, 2005 How open were European primeval forests? Hypothesis testing using palaeoecological data, *Journal of Ecology*, **93**, 168-177

Mithen, SJ 1990 *Thoughtful Foragers, A study of Prehistoric Decision Making*, Cambridge University Press, Cambridge

Mithen, SJ, 2003 *After the Ice, a global human history 20,000-5000BC*, Weidenfeld and Nicolson, London

Nance, RM 1963 *A Glossary of Cornish Sea-Words*, Federation of Old Cornwall Societies

National Meteorological Library and Archive, nd (no date) *Fact Sheet 7 Climate of South West England*

Natural England 2010 South West Region Agricultural land Classification

Natural England 2019 *An approach to landscape sensitivity assessment – to inform spatial planning and land management*, Natural England

Newman, P, 2011 *The Field Archaeology of Dartmoor*, English Heritage, Swindon

Nicholls, D de L, 1967 The Field Walls of Cornwall, *Old Cornwall* **6.12**, 540-543

Nikulina, A, MacDonald, K, Scherjon, F, Pearce, EA, Davoli, M, Svenning, J-C, Vella, E, Gaillard, M-J, Zapolska, A, Arthur, F, Martinez, A, Hatlestad, K, Mazier, F, Serge, MA, Lindholm, K-J, Fyfe, R, Renssen, H, Roche, DM, Kluiving, S and Roebroeks, W, 2022 Tracking Hunter-Gatherer Impact on Vegetation in Last Interglacial and Holocene Europe: Proxies and Challenges, *Journal of Archaeological Methos and Theory*, 2022. https://link.springer.com/article/10.1007/s10816-021-09546-2

Noall, C 1964 Nineteenth Century Discoveries at Lelant, *Cornish Archaeology*, **3**, 34-36

Norden, J, c1600 *Speculi Britanniae Pars, A Topographicall & Historical description of Cornwall*, first published by Bateman, London in 1728, reprinted by Frank Graham, Newcastle upon Tyne, 1966

Nowakowski, JA, 2016a Prehistoric settlement – roundhouses and fields, 2nd to 1st millennia BC, in Herring *et al* 2016, 138-159

Nowakowski, JA, 2016b Remarkable landscapes of ancient fields – the later prehistoric and Romano-British legacy, in Herring *et al* 2016, 160-191

Nowakowski, JA, Quinnell, H, Sturgess, J, Thomas, AC, and Thorpe, C, 2007 Return to Gwithian: shifting the sands of time, *Cornish Archaeology*, **46**, 13-76

Nwafor, IC, Shale, K, Achilonu, MC, 2017 Chemical Composition and Nutritive Benefits of Chicory (Cichorium intybus) as an Ideal Complementary and/or Alternative Livestock Feed Supplement, *The Scientific World Journal*, https://doi.org/10.1155/2017/7343928

Odling-Smee, J, Erwin, DH, Palkovacs, EP, Feldman, MW, and Laland, KN, 2013 Niche construction theory: A practical guide for ecologists, *The Quarterly Review of Biology, 88*(1)

Oldfather, CH, 1939 *Diodorus of Sicily*, Loeb Classical Library

Oosthuizen, S, 2013 *Tradition and Transformation in Anglo-Saxon England. Archaeology, Common Rights and Landscape*, Bloomsbury, London

Ostrom, E., 1990. *Governing the Commons; the evolution of institutions for collective action*, Cambridge, Cambridge University Press

Oswald, A, 1996 *Trencrom Castle, Ludgvan, Cornwall*, Royal Commission on the Historical Monuments of England, Cambridge

Oswald, A, 2018 *Prehistoric Linear Boundary Earthworks, Introduction to Heritage Assets*, Historic England, Swindon

Padel, OJ, 1985 *Cornish place-name elements*, English Place-name Society, Nottingham

Padel, OJ, 1988 *A popular dictionary of Cornish place-names*, Alison Hodge, Penzance

Padel, O, 2011 The vocabulary of Cornwall's rough ground and documentary evidence for its historic uses, in Dudley 2011, 75-83

Parkes, C, 2022 *Heritage of the Well, Chapel, and Water Supply at Madron Well, Penzance*, Cornwall, Cornwall Archaeological Unit, Cornwall Council, Truro

Pattinson, JP 1893 *British Railways: Their Passenger Services, Rolling Stock, Locomotives, Gradients, and Express Speeds*, Cassell, London

Pears, B, 2015 *Digging the Dirt: Anthropogenic Soils in Cornwall – A Rare Archaeological Resource*, a talk delivered to the Cornwall Archaeological Society

https://www.academia.edu/10785761/Cornish_Archaeological_Society_2015_Digging_the_dirt_Anthropogenic_Soils_in_Cornwall_A_Rare_Archaeological_Resource

Pettitt, P, and White, M 2012 *The British Palaeolithic: Human Societies at the Edge of the Pleistocene World*, Routledge, Abingdon

Phibbs, J, 2017 *Place-making; the art of Capability Brown*, Historic England, Swindon

Pollard, J and Healy, F 2007 Neolithic and Early Bronze Age, in Webster 2007, 75-102

Pool, PAS, 1977 *A Cornish Farmer's Diary, James Stevens of Zennor and Sancreed*, Pool, Penzance

Pool, PAS, 1985 *The place-names of West Penwith*, second edition, Pool, Penzance

Pool, PAS, 1990 *The field-names of West Penwith*, Pool, Hayle

Potts, R, 1974 *A Calendar of Cornish Glebe Terriers, 1673-1735*, Devon and Cornwall Record Society, vol 19, Torquay

Pounds, NJG, 1944 The Lanhydrock Atlas and Cornish Agriculture about 1700, *Rep. Roy. Cornwall Poly. Soc.* **11**, 113-125

Pounds, NJG, 1945 *The Historical Geography of Cornwall*, PhD thesis University of London

Pounds, NJG, 1973. Barton Farming in Eighteenth Century Cornwall, *Journal of the Royal Institution of Cornwall,* **7.1**, 55-75

Powell, T, Salmon, S, Clark, AH and Shail, RK 1999 Emplacement styles within the Lan's End granite, west Cornwall, *Geoscience in South-West England*, **9(4)**, 333-339

Preston, CD, Pearman, DA and Hall, AR, 2004 Archaeophytes in Britain, *Botanical Journal of the Linnean Society*, **145**, 257-294

Priestland, G and Priestland, S, 1980 *West of Hayle River*, Wildwood House, London

Pryor, F, 2006 *Farmers in Prehistoric Britain*, second edition, Tempus, Stroud

Pugsley, HW, 1904 A new Fumaria, *Journal of Botany, British and Foreign*, **XLII**, 217-220

Pye, K, Saye, S and Blott, S 2007 *Sand dune processes and management for flood and coastal defence, Part 3: the geomorphological and management status of coastal dunes in England and Wales*, DEFRA, London

Quinnell, H, 2013 Pottery from the 2011 and 1984 roundhouse excavations, in Jones 2013, 149-152

Rackham, O, 1986 *The History of the Countryside*, Dent, London

Radford, R, 1962 The Neolithic in the Southwest of England, *Cornish Archaeology*, **1**, 4-8

Randall, C, 2020 Animal bone, in Jones and Lawson-Jones 2020, 151-2

Ravenhill, W, 1972 *John Norden's Manuscript Maps of Cornwall and its nine Hundreds*, University of Exeter, Exeter

Resler, L, 2016 Biogeography, *Oxford Bibliographies* https://www.oxfordbibliographies.com/display/document/obo-9780199874002/obo-9780199874002-0116.xml#:~:text=Biogeography%20is%20a%20broad%20and,of%20phenomena%20over%20the%20earth.

Richards, H, 1944 Market Gardening History, *Cornishman*, 9.11.1944

Rightmire, GP, 2020 *Homo heidelbergensis*, in C Smith (ed) *Encyclopedia of Global Archaeology*. Springer, Cham. https://doi.org/10.1007/978-3-030-30018-0_690

Rose, P, 2009 *Mulfra Hill, Madron, Cornwall, archaeological survey 1988-9*, Cornwall Council, Truro

Rose, P, and Preston-Jones, A, 1995. Changes in the Cornish countryside, in D Hooke, and S Burnell, eds, *Landscape and settlement in Britain AD 400-1066,* University of Exeter Press, Exeter, 51-68

Rowe, J, 1996 *Changing Times and Fortunes; A Cornish Farmer's Life 1828-1904*, Cornish Hillside Publications, St Austell

Sandom, CJ, Ejrnaes, R, Hansen, MDD, and Svenning, J-C, 2014 High herbivore density associated with vegetation diversity in interglacial ecosystems, *Proceedings of the National Academy of Sciences, USA*, **111 (11)** https://doi.org/10.1073%2Fpnas.1311014111

Saville, A, 1981 The flint and chert artefacts, in Mercer 1981, 101-152

Scaife, RG 1997 Pollen analysis of the Bronze Age cairn and a peat profile in G Smith Archaeology and Environment of a Bronze Age cairn and prehistoric and Romano-British field system at Chysauster, Gulval, *Proceedings of the Prehistoric Society*, **62**, 203-209

Scaife, RG and Langdon, CT, 2023 Pollen assessment analysis from core T1/3, in Jones and Allen 2023, 62-67

Scherjon, F, Bakels, C, MacDonald, K and Roebroeks, W, 2015 Burning the Land: An Ethnographic Study of Off-Site Fire Use by Current and Historically Documented Foragers and Implications for the Interpretation of Past Fire Practices in the Landscape, Current Anthropology, 56(3), 299-326

Scourse, JD, 1987 Periglacial sediments and landforms in the Isles of Scilly and West Cornwall. In: Boardman J (ed) *Periglacial processes and landforms in Britain and Ireland*. Cambridge University Press, Cambridge, pp 225–236

Scourse, JD, 1999 St Loy, in Scourse and Furze 1999, 108-112

Scourse, JD, Furze MFA (eds) 1999 *The Quaternary of West Cornwall*. Quaternary Research Association, London

Sharpe, A, 2016 The industrialisation of the West Penwith landscape, in Herring *et al* 2016, 238-291

Sheldon, J, 1978 Report on the charcoal in Christie 1978, 431-2

Shepherd, D 2013. Propped stones: the modification of natural features and the construction of place. Time and Mind, **6.3**, 263-286

Shotton, FW 1977 *British Quaternary Studies: Recent Advances*, Oxford University Press, Oxford

Site of Special Scientific Interest Citation, 1995 *Aire Point to Carrick Du*

Skene, KR, Sprent, JI, Raven, JA and Herdman, L, 2000 Myrica gale L. *Journal of Ecology*, **88**, 1079-1094

Smith IF 1981a Stone artefacts, in Mercer 1981, 153-160

Smith IF 1981b The Neolithic Pottery in Mercer 1981, 161-179

Smith, J, 2012 *Coastguard Stations, Introduction to Heritage Assets*, Historic England

Smith, N, 2017 *Conserving Historic Water Meadows*, Historic England, Swindon

Stace, CA and Crawley, MJ, 2015 *Alien Plants, The New Naturalist Library, 129*, HarperCollins, London

Staines, SJ, 1979 *Soils in Cornwall, Soil Survey Record no. 57, Sheet SW53 (Hayle)*, Soil Survey, Harpenden

Stanes, RGF, 1981 Landlord and tenant and husbandry covenants in 18th century Devon, in Minchinton, W (ed) *Agricultural Improvement: Medieval and Modern, Exeter Papers in Economic History,* **No 14**, 41-64

Stevens, B, 2023 Richard Trevithick and a breakwater for St Ives, *Old Cornwall*, **16.3**, 35-45

Stockdale, FWL 1824 *Excursions through Cornwall*, reissued in 1972 by D Bradford Barton, Truro

Straffon, C (ed) 1986 – 2023 *Meyn Mamvro, ancient stones and sacred sites in Cornwall*, Penzance

Straffon, C, 1992 *The Ancient Sites in West Penwith*, Meyn Mamvro, Penzance

Straffon, C 2004 *Megalithic Mysteries of Cornwall*, Meyn Mamvro, Penzance

Straker, V, 2011a A review of the palaeoenvironmental literature, in Dudley 2011, 66-72

Straker, V, 2011b Appendix 1 Palaeoenvironmental studies in west Cornwall, in Dudley 2011, 161-166

Suddendorf, T, 2018 Inside our heads: two key features created the human mind, *Scientific American*, **319.3**, 42-47

Sutherland, CHV, 1936 'The Hayle hoard' *Numism. Citron, ser.* 5, *XVI(\936)* 202-9

Symons, A, 1992 *Tremedda Days, A View of Zennor, 1900-1944*, Tabb House, Padstow

Thomas, C, 1956 Evidence for Post-Roman occupation of Chun Castle, Cornwall, *Antiquaries Journal*, **36**, 75-78

Thomas, C,1994 *And shall these mute stones speak? Post Roman Inscriptions in Western Britain*, University of Wales Press, Cardiff

Thomas, J, 1991 *Rethinking the Neolithic*, Cambridge University Press, Cambridge

Thomas, N, 1990 *Chapel Carn Brea, archaeological assessment*, Cornwall County Council, Truro

Thomson, EM and Avis, EL 1983 *Soil Map of England and Wales*, Lawes Agricultural Trust, Rothampsted

Tilley, C 1995 Rocks as resources: landscape and power, *Cornish Archaeology*, **34**, 5-57

Tilley, C, 1996 The power of rocks: topography and monument construction on Bodmin Moor, *World Archaeology*, **28(2)**, 161-176

Tilley, C and Bennett, W, 2002 An archaeology of supernatural places: the case of West Penwith, *Journal of the Royal Anthropological Institute*, **7(2)**, 335-362

Tilley, C, Hamilton, S, Harrison, S, Anderson, E 2000 Nature, culture, clitter. Distinguishing between cultural and geomorphological landscapes; the case of hilltop tors in south-west England, *J Mater Cult* **5**,197–224

Timberlake, S, 2017 New Ideas on the Exploitation of Copper, Tin, Gold, and Lead Ores in Bronze Age Britain, The Mining, Smelting, and Movement of Metal. *Materials and Manufacturing Processes*, **32**,1–44.

Timberlake, S, and Hartgroves, S, 2018, New evidence for Bronze Age tin and gold mining in Cornwall: the date of the antler pick from the Carnon valley streamworks, Devoran, near Truro, *Cornish Archaeology*, **57**, 107-122

Tinsley, H, 2004-5 Pollen analysis, in Jones 2004-5, 48-72

Todd, AC and Laws, P, 1972, *Industrial Archaeology of Cornwall*, David and Charles, Newton Abbot

Tompsett, A, 2006 *Golden Harvest, the story of daffodil growing in Cornwall and the Isles of Scilly*, Alison Hodge, Penzance

Towers, J, Mainland, I, Montgomery, J and Bond, J, 2016 Calving seasonality at Pool, Orkney during the first millennium AD: an investigation using intra-tooth isotope ratio analysis of cattle molar enamel, *Environmental Archaeology*, **22(1)**, 40-55

Trow-Smith, R, 1957 *A History of British Livestock Husbandry to 1700*, London

Tudor, C, 2014 *An Approach to Landscape character Assessment*, Natural England

Tunon, H and Bele, B, 2019 *Fäbod and seter, summer farming on the Scandinavian peninsula*, Swedish Biodiversity Centre, Uppsala

Turk, FA 1967 Notes on Cornish Mammals in Prehistoric and Historic Times: 1, *Cornish Archaeology*, **7**, 73-79

Turk, FA 1968 Notes on Cornish Mammals in Prehistoric and Historic Times: 2, *Cornish Archaeology*, **8**, 100-104

Turk, FA 1970 Notes on Cornish Mammals in Prehistoric and Historic Times: 3, *Cornish Archaeology*, **10**, 121-127

Turner, S, 2006 *Medieval Devon and Cornwall; shaping an ancient countryside*, Windgather, Macclesfield

Ugawa, K, 1962 The Economic Development of some Devon Manors in the 13th century, *Transactions of the Devonshire Association,* **94**, 630-683

UKNEA (United Kingdom National Ecosystem Assessment) 2011 The UK National Ecosystem Assessment: Synthesis of the key findings. http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/EcosystemServices/tabid/103/Default.aspx

United Nations 1997 *Glossary of Environment Statistics, Studies in Methods, Series F, No. 67*, United Nations, New York

Ussher, WEA, 1879 Pleistocene geology of Cornwall, IV, Submerged forests and stream tin gravels, *Geological Magazine*, **ns II.6**, 251-263

Veldhuis, D, Kjærgaard, PC, Maslin, M 2020 Human Evolution: Theory and Progress. In C Smith (ed) *Encyclopedia of Global Archaeology*. Springer, Cham. https://doi.org/10.1007/978-3-030-30018-0_642

Vera, F, 2000 *Grazing Ecology and Forest History*, CABI Publishing, Wallingford

Vervust, S, Kinnaird, T, Herring, P and Turner, S, 2020 Optically stimulated luminescence profiling and dating of earthworks: the creation and development of prehistoric field boundaries at Bosigran, Cornwall, *Antiquity*, **94**, 420-436

Vickery, R, 1995 *Oxford Dictionary of Plant-Lore*, Oxford University Press, Oxford

Walker, TM 2014 *Shifting sand: the palaeoenvironment and archaeology of blown sand in Cornwall*, PhD thesis, University of Reading https://core.ac.uk/download/pdf/159922168.pdf

Warinner, C, Hendy, J, Speller, C, Cappellini, E, Fischer, R, Trachsel, C, Arneborg, J, Lynnerup, N, Craig, OE, Swallow, DM, Fotakis, A, Christensen, RJ, Olsen, J, Liebert, A, Montalva, N, Fiddyment, S, Mackie, M, Canci, A, Bouwman, A, Rühli, F, Gilbert, MTP, and Collins, MJ,2014 Direct Evidence of Milk Consumption from Ancient Human Dental Calculus, *Scientific Reports* **4**, article 7104. doi:10.1038/srep07104

Warner, Rev R, 1809 *A Tour through Cornwall in the Autumn of 1808*, Wilkie and Robinson, London

Watson, HC, 1847 *Cybele Britannica: or British Plants and their Geographical Relations*, Longman and Co, London

Weatherhill, C 1981 *Belerion, Ancient sites of Land's End*, Alison Hodge, Penzance

Weatherhill, C, 2016 Castle Anowthan – Lost and found, *Meyn Mamvro*, **84**, 10-11

Weatherhill, C, 2017 *The place-names of the Land's End peninsula*, Penwith Press, Cornwall

Weatherhill, C, 2017 Carn Kenidjack tor enclosure, *Meyn Mamvro*, **94**, 8-9

Webb, A, 2011 *Food Britannia*, Random House, London

Webster, CJ (ed), 2007 *South West Archaeological Research Framework, Resource Assessment and Research Agenda*, Somerset County Council, Taunton

Whetter, J, 1974 *Cornwall in the Seventeenth Century,* Lodenek, Padstow

Whitehouse, HLK, 1961 The Occurrence of *Tortula stanfordensis*, Steer in Cornwall, new to Europe, *Transactions of the British Bryological Society*, **4**, 84-94

Whitehouse, HLK and Paton, JA, 1963. Bryological notes: The distribution of *Tortula stanfordensis* Steele in Cornwall, *Transactions of the Penzance Natural History Society*, 4, 462-463

Whyte, KP, 2013 On the role of traditional ecological knowledge as a collaborative concept: a philosophical study, *Ecological Processes*, **2:7** doi:10.1186/2192-1709-2-7

Williams, J, 1985 *Trevega, National Trust Archaeological Survey*, National Trust Archaeological Survey

Wilkinson, K and Straker, V, 2007 Neolithic and Early Bronze Age Environmental Background, in C Webster 2007, 63-

Wylie, J, 2007 *Landscape*, Routledge

Yalden, D,1999 *The History of British Mammals*, T and AD Poyser Natural History, London

Appendix 1: Summary of palaeo-environmental evidence for West Penwith

Introduction

The 2011 publication, *Goon, Hal, Cliff and Croft* (Dudley 2011) included a section on the palaeo-environmental literature of West Cornwall (including the Lizard and Carnmenellis as well as West Penwith) prepared by Vanessa Straker, then Regional Science Adviser for the South-West Region for English Heritage. Vanessa had long experience either advising or working on projects in Cornwall (and elsewhere in the South-West) that included sampling for and analysing evidence of past environment: including pollen and plant macrofossils (like fruits, seeds, wood, bud scales) and molluscs extracted in samples from:

- soils, usually those buried beneath early monuments like Bronze Age barrows, under hedges or beneath dunes,
- undisturbed sediments,
- from the peats that developed in waterlogged places, such as around springs (Straker 2011a, 66).

Vanessa was therefore well-placed to summarise the then state of knowledge of west Cornwall's prehistoric and historic environment.

Most of the palaeo-environmental evidence for West Penwith is from pollen records (rather than from macrofossils, though there are a few records of charred seeds and wood). It is also relatively sparse compared with some other parts of the country. However, in the acid soils of the granite area the preservation of pollen is generally good, while preservation of bones and shell is poor (as calcareous material is dissolved). In direct contrast the soils in dunes, or those affected by sand-blow, have substantially higher pH levels and here shell and bone survive well, but pollen does not. Killas-based soils, on the fringe of the granite, tend to be less acid and therefore pollen preservation is poorer (Straker 2011a, 66-7).

With help from Vanessa Straker, and from Pete Dudley of the Cornwall Archaeological Unit (CAU), Emily Forster and David Earle Robinson of English Heritage's Archaeological Science team undertook new exploratory work to address gaps in our knowledge of west Cornwall's vegetational history and prehistory that Vanessa's review had identified.

The project also set out to examine the established narrative that has heathland developing in parts of Britain like west Cornwall in later prehistory (from the Bronze Age onwards, the 2nd and 1st millennia BC) as human activity removed woodland from brown spoils leaving them vulnerable to leaching and acidification, as described for the soils of Chysauster by Richard Macphail (see Soils). Climatic deterioration (cooler, wetter) in the Later Bronze Age and Iron Age is also supposed to have accelerated development of the peaty soils that can support heathland vegetation.

That narrative did not fit well with evidence gathered from palaeo-environmental studies undertaken in West Penwith, and elsewhere in Cornwall, which tended to indicate that the uplands were either a form of rough grassland or open woodland in

early prehistory, including in the Holocene Climate Optimum of the Mesolithic period (Straker 2011a; Caseldine 1980).

The English Heritage project sampled peats and sediments at five sites selected in consultation with Pete Dudley and Pete Herring of CAU, both familiar with the historic environment of west Cornwall. Identification of potential sites for sampling undisturbed peats is made problematic in the granite uplands of west Cornwall due to extensive disturbance of valley bottoms by early tin streamworking. The five places examined, initially by extracting monoliths or cores, were as follows.

Lower Lancarrow in Carnmenellis (monolith)

Tregantallan in Carnmenellis (core)

Carn Galva in Zennor (monolith)

Treen Common in Zennor (monolith)

Lizard Downs (monolith)

For each monolith or core, pollen and testate amoebae were examined, and samples were submitted for radiocarbon dating. These initial examinations led to the monoliths from Carn Galva and the Lizard Downs being rejected as they did not contain long-term undisturbed records of vegetation and environmental change. Full and detailed pollen analyses were then carried out on the three other sites (see Forster and Robinson 2011, 3-6 for details of their method).

As noted, a key aim was to establish the histories in West Cornwall of the cross-leaved heath (*Erica tetralix*) and the Cornish heath (*Erica vagans*), a form of *Erica ciliaris*. Their pollen is similar but distinguishable as illustrated here, in figure 3 of Forster and Robinson 2011).

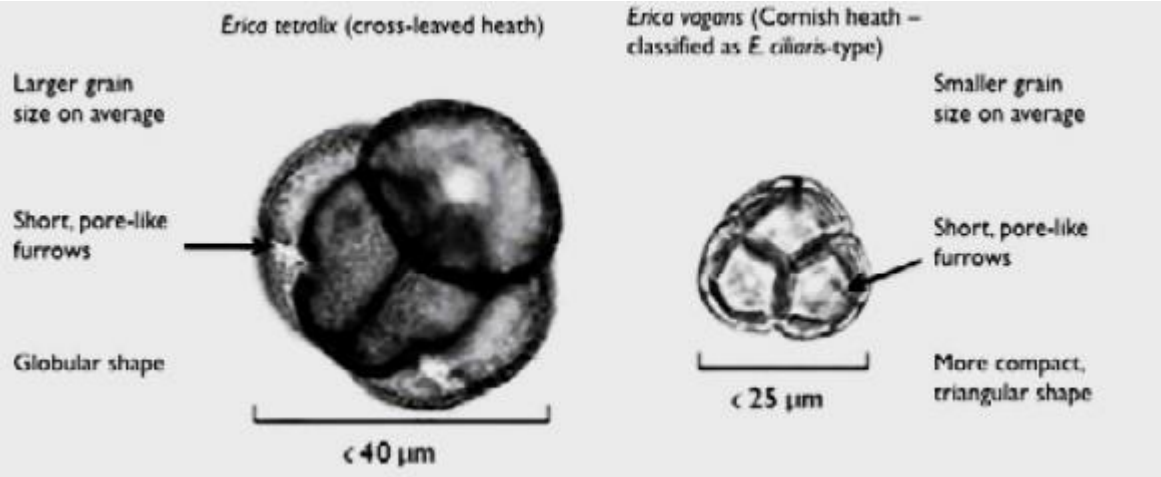


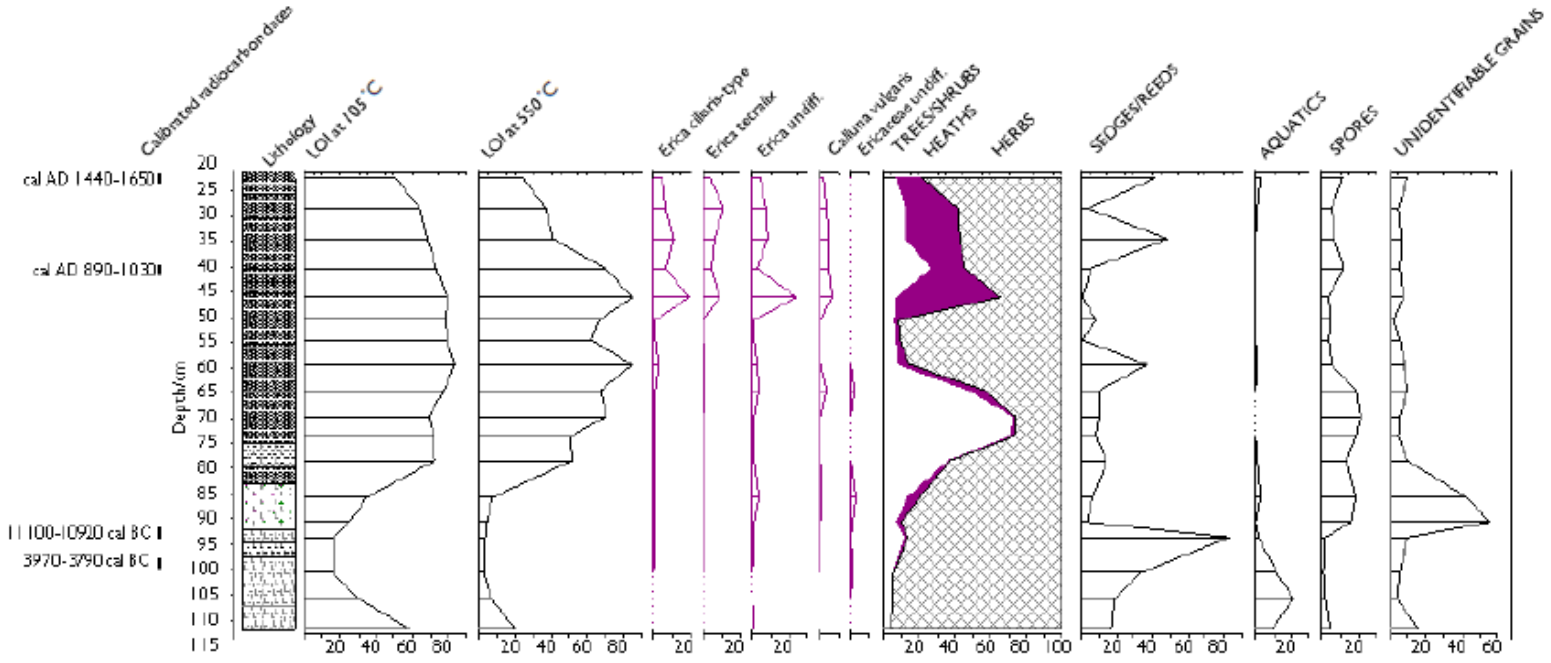
Figure 3: Criteria for separation of Erica tetralix and E. ciliaris-type pollen (represented here by E. vagans). The measurements shown are accurate for the grains pictured, which were prepared using standard procedures and mounted in silicon oil.

The HEATH site of most direct interest to this study of the environment of West Penwith is on Treen Common, on the downlands of the parish of Zennor.

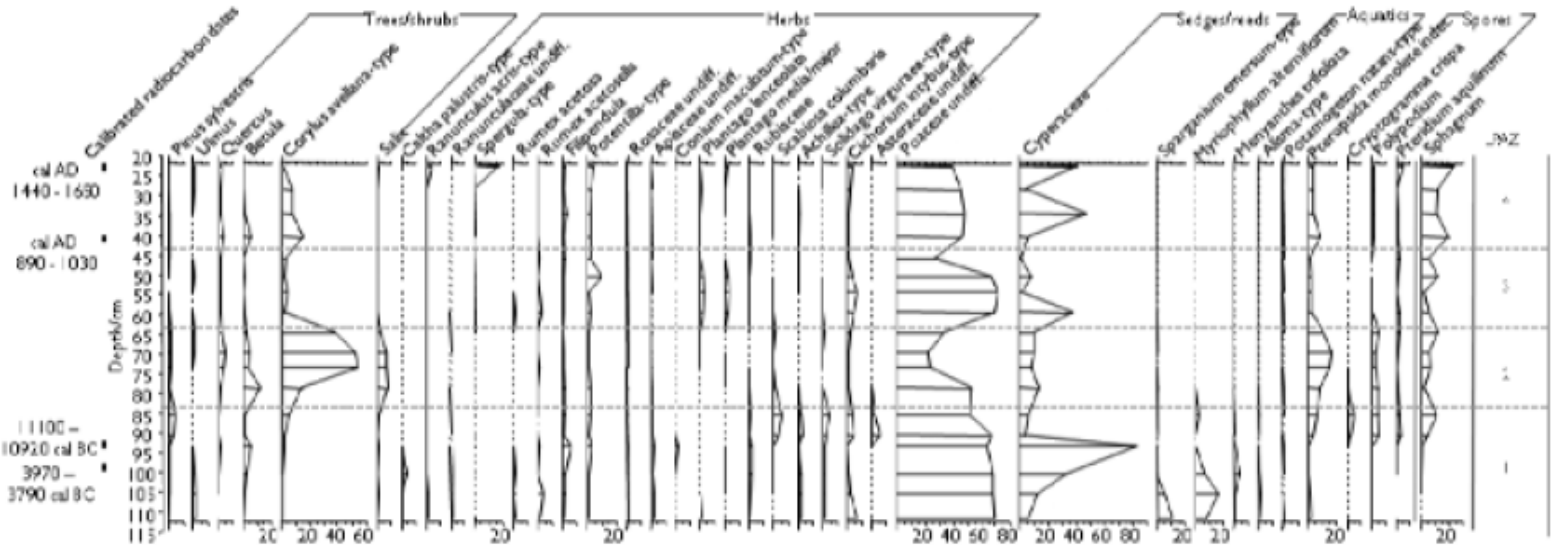
Palaeoenvironmental evidence from Treen Common, Zennor

The HEATH project coring sample site lies on the north-eastern slopes of Treen Common as the ground falls into the shallow valley of the stream forming the

boundary between the medieval tenements of Treen and Gear, at SW 44666 36638 and at an altitude of around 185 metres (or 606 feet). Radiocarbon dates here indicated that sediments dated from 3970-3790 cal BC, that is from the very end of the Mesolithic period or very early in the Neolithic, right through to the early post-medieval period (cal AD 1440-1650).



Summary pollen diagram of the deep peat core sampled at Treen Common, Zennor. Oldest pollen (from the very early Neolithic) is at the base, most recent (the end of the medieval period) at the top. 'Herbs' are dominated throughout by grasses; heath (purple) expands greatly in the early medieval period. The mid-prehistoric rise in trees/shrubs is largely Corylus avellana-type (hazel or bog myrtle). (From Forster and Robinson 2011, fig 6).



More detailed pollen diagram for Treen Common, showing how Corylus avellana dominated the trees/shrubs and Poaceae undifferentiated (the grasses) dominated the herbs. (From Forster and Robinson 2011, fig 7).

The column at Treen Common was divided into four Local Pollen Assemblage Zones, beginning with the deepest and thus earliest one. They are summarised below.

Local Pollen Assemblage Zone 1

From 112 cm deep to 83 cm deep, with a radiocarbon date of 3970-3790 at 98-100 cm deep.

The pollen from the lowest, earliest levels at Treen Common, broadly from the very end of the Mesolithic period and through the whole of the Neolithic, the period when gathering and hunting was gradually replaced by managed grazing using domesticated livestock and by limited arable farming, indicate a 'largely open landscape, dominated by grasses and a variety of herbs' (Forster and Robinson 2011, 14).

The pollen of Herbs was overwhelmingly dominated by the grasses (*Poaceae* undifferentiated) with all other plants being regarded as members of a grassland community – with scattered trees, shrubs and herbs, each presumably concentrated in niches where they thrived or survived. The vegetation is astonishingly rich, and we may imagine a shimmering mosaic kept open by the effects of grazing animals, presumably a mix of wild ungulates and those domesticated livestock of Neolithic communities.

- *Poaceae,* undifferentiated grasses, made up over 70% of all pollen in this earliest prehistoric zone.
- Some types of herbs came and went through this early time zone, but the following appear to have been ever-present.
    - *Ranunculaceae*, buttercups
    - *Filipendula*, meadowsweet
    - *Potentilla-type*, cinquefoils
    - *Rosaceae*, rose family
    - *Apiaceae*, umbellifers
    - *Rubiaceae*, madders
    - *Achillea*, yarrows
    - *Solidago virgaurea*, goldenrods
    - *Cichorium intybus*, chicories [an archaeophyte, an alien either deliberately or unintentionally introduced by people – see Section12. Chicory was a food crop for humans and livestock, its leaves, flowers and roots all being eaten, and it also had medicinal properties]
    - *Chenopodiaceae*, goosefoot
    - *Silene vulgaris*, bladder campion
    - *Campanula*, bellflowers
    - *Artemisia*-type, daisies
- The following appear to have been more sporadic. This first list includes those that appeared in the first half of the phase and then disappeared, some for a while, others to return in later phases.
    - *Caitha palustris*, kingcups or marsh marigolds
    - *Rumex acetosa*, sorrel
    - *Rumex acetosella*, red or sheep's sorrel
    - *Plantago lanceolata*, ribwort plantain
    - *Plantago media*, hoary plantain

    - *Saxifraga granulate*, meadow saxifrage
    - *Saxifraga stellaris*, starry saxifrage
    - *Sorbus type*, rowan
    - *Lotus*, bird's foot trefoil
    - *Epilobium*, willowherb
    - *Cornus suecica*, dwarf cornel or bunchberry
    - *Lactuceae*, lettuces
- The following emerged in the second half of the first phase, usually for just a short while, disappearing again either before the phase's end or shortly after the next phase started.
    - *Centaurea nigr*a, common knapweed
    - *Conium maculatum*, poison hemlock [an archaeophyte, used as a poison, and in very small quantities as a medicine]
    - *Scabiosa columbaria*, small scabious
    - *Asteraceae* undifferentiated, asters
    - *Urtica urens*, small nettle [an archaeophyte, a plant that could be consumed in broths, had medicinal properties, and whose stems produced fibres that could be used in clothmaking]
    - *Trifolium* type, clover
    - *Fabaceae*, legumes
    - *Circaea*, nightshades
    - *Valeriana dioica*, marsh valerian
    - *Valeriana officinalis*, valerian
    - *Succisa pratensis*, devil's bit scabious

There was minimal tree pollen, just small percentages of the following.

- *Pinus Sylvestris,* pine
- *Ulmus*, elm
- *Betula*, birch
- *Quercus*, oak
- *Corylus avellana*-type, hazel or bog myrtle, or both
- *Salix*, willow
- *Ilex aquifolium*, holly
- *Frangula alnus*, buckthorn

Similarly, there was little pollen from heath vegetation, though it was present in small amounts including undifferentiated *Erica* from the basal sample alongside *Vaccinium* type pollen (which includes cowberry, bilberry, whortleberry and cranberry). Then both *Erica Tetralix* (cross-leaved heath) and *Erica vagans* (Cornish heath) and other *Erica ciliaris*-type pollen were found. *Empetrum nigrum*, black crowberry, was also recorded towards the end of this early phase.

Some cereal-type pollen grains were found at the base of the monolith.

- They were mainly of *Hordeum* type that includes 'wild grasses' as well as barley
- A few were *Avena* / *Triticum* type (wheat and oat species), 'indicative of agriculture in the catchment area', an interpretation supported by the presence of other species often found in disturbed or cultivated ground, like *Chenopodiaceae* (Goosefoot/fat hen), *Urtica* sp (nettles) and *Artemisia*-type (mugworts/wormwood) (see above, Herbs)

Sedges (*Cyperaceae*), reeds and aquatic plants are common in this zone, indicating wet conditions at or near the site; the Treen/Gear stream is just 60m to the north.

- *Nymphaea alba*, white water lily
- *Myriophyllum spicatum*, spiked water milfoil
- *Litorella uniflora*, shoreweed
- *Lemnaceae*, duckweeds
- *Equisetum*, horsetails
- *Ophioglossum*, adder's tongue

Local Pollen Assemblage Zone 2

From 83 to 63 cm deep

This zone, broadly covering the Bronze Age (late 3rd millennium and through the 2nd millennium BC), has an expansion of tree pollen, especially *Corylus avellana* type, either hazel (*Corylus avellana*) or bog myrtle (*Myrica gale*) which at times produced over 50% of the pollen recorded. Birch (*Betula*), willow (*Salix*) and oak (*Quercus*) also increased, and alder (*Alnus*) appeared for the first time, though in small quantities. There was still a little pine (*Pinus sylvestris*) and also small quantities of holly (*Ilex aquifolium*), buckthorn (*Frangula alnus*), ash (*Fraxinus excelsior*) and honeysuckle (*Lonicera periclymenum*).

This appears to have been a period of woodland regeneration or colonisation, though the nature of that deciduous flora depends to a large degree on establishing whether the *Corylus avellana* type pollen derived from hazel, a fairly substantial tree, or bog myrtle (*Myrica gale*), a relatively low (less than 2 metres) and multi-branched deciduous shrub (Chambers *et al* 2010-11, 7; Skene *et al* 2000). The pollen of the two are virtually identical in appearance (Rackham 1986, 7; Forster and Robinson 2011). Given the damp exposed site it may be supposed that the pollen is more likely to be bog myrtle (which thrives in damp acidic soil – Skene *et al* 2000, 1081) than hazel, even though there is a long tradition of envisaging extensive oak-hazel woodland in prehistoric Britain and Cornwall (see Section 3, above).

At various times and places in Europe and beyond its leaves were used as a flavouring in alcoholic drinks, including being used in beers before hops became popular; it gave a headiness to beer or ale, speeding drunkenness. It was a savouring for roast meat, a tea-like infusion, and a perfume for linen. Its catkins and cones when boiled in water produce a 'scum beeswax' used to make candles while its roots and bark were used to tan calfskins and to dye wool yellow, and its nuts were used as a spice.

It was believed by some in Ireland that bog myrtle had dwindled to a low shrub that could not grow large because its wood had been used to make Christ's cross, and furthermore he had been scourged with branches of it before the execution. So it brought ill luck and Irish people did not use its branches as switches for hurrying cattle (Grigson 1958, 243). Branches of bog myrtle fixed to the eaves of Scandinavian houses helped to repel witches (Grigson 1958, 143; Skene *et al* 2000, 1090-1091).

As well as keeping witches at bay, bog myrtle was efficacious against insects, including midges, because of its sweet resinous scent. Sprigs were placed among bed-clothes to keep fleas and moths away (Lightfoot 1777, 614; Dixon 1890), flies when hung up in kitchens (Vickery 1995, 42), and intestinal worms when its top

leaves were made into an infusion (Evans 1800, 149; McNeill 1910, 167). It was also used as an emetic (to encourage vomiting) in north Wales in the later 18th century (Evans 1800).

Bog myrtle is now mainly found in the centre of Cornwall, usually in valley bogs, with all historical records in West Penwith having been made before 1950, and those were confined to the south-eastern part (French 2020, 187). Bog myrtle was called Gale in Cornwall (and in several other western arts of Britain). 'It provided faggots for the cloam oven' (Grigson 1958, 243)

The grasses (*Poaceae*) declined a little in this phase, but 'grasses remain[ed] an important vegetation type in the landscape' and heathland or ericaceous pollen was present, though in small amounts, throughout the zone, which is presumed to end in the early part of the 1st millennium BC, around the turn of the Later Bronze Age and Early Iron Age (Forster and Robinson 2011, 27). Sedges continued to be important elements of the vegetation, as did ferns and sphagnum mosses. Bracken (*Pteridium aquilinum*) was present, but not dominant.

Several herbs dropped away in this period, the sorrel, poison hemlock, goosefoot, bellflowers, daisies, meadow and starry saxifrage, bird's foot trefoil, willowherb, lettuce types, legumes, nightshades and valerian.

Others continued from the previous phase into this one, the meadowsweets, cinquefoils, roses, umbellifers, goldenrods, chicories, small scabious and marsh valerian.

A herb that emerges in this phase is the field forget-me-not (*Myosotis arvensis*), which is another archaeotype, an alien introduced by people which has some medicinal properties.

Local Pollen Assemblage Zone 3

63 to 43 cm deep, ending immediately below the radiocarbon date of cal AD 890-1030 taken at 40-42 cm deep.

This was a period, broadly the later Bronze Age and Iron Age, to roughly 0 BC, when tree pollen declined dramatically, and grasses and herbs increased. The herbs included *Plantago* spp (plantains) and *Cichorium intybus*-type (dandelion/chicory) that normally suggest grazing rather than agriculture, and it is noticeable that no cereal pollen was found in this period. There appears then to have been a return to summer grazing of this upland part of West Penwith in this period, the whole of the 1st millennium BC.

Fern records remain low, as do heathland species although *Erica ciliaris*, *E tetralix*, *E* undifferentiated, *Calluna vulgaris* and *Ericacea* undifferentiated are all present throughout, in small quantities, perhaps indicating small stands at the edges of grasslands.

Regarding the trees, the *Corylus*-type pollen (hazel or bog myrtle) remained the largest type, albeit in significantly smaller numbers. Pine, elm, oak, birch, willow, alder and buckthorn were also still present, but holly and ash disappeared from the pollen record.

Several herbs that had disappeared in the previous phase returned, including sorrel, red or sheep's sorrel, yarrows, bird's foot trefoil and bellflowers. Some continued from the first and second periods, like the buttercups, meadowsweet, cinqufoils,

roses, umbellifers, small scabious, goldenrods, chicories and clovers. Others disappeared during this phase, including the asters, bladder campion, rowan, forget-me-not and marsh valerian. And others emerged for the first time, including spurrey (*Spergula* type), purging flax (*Linum catharticum*) and hedge bindweed (*Calystegia*).

Local Pollen Assemblage Zone 4

43 to 22 cm deep, ending at the final radiocarbon date (at 22-24 cm deep) of cal AD 1440-1650.

This was the period when heathland expanded on Treen Common, quite dramatically, 'with *Erica ciliaris* type dominant over *E tetralix* until at least the medieval period when both are present in similar percentages. So, it seems likely that the spread of cross-leaved heath at the expense of Cornish heath is a relatively recent phenomenon (post-medieval)'. Crowberry (*Empetretum nigrum*) and whortleberry (*Vaccinium*) returned in this phase.

Examination of the pollen diagram shows an early peak in heathland pollen in this phase, in what are presumed to be the Romano-British and early medieval periods, when it may be suggested that the use of the upland pastures became less intensive and may have been used largely as common land. There was a gradual decline in levels of heathland in the later medieval period, when outfield cultivation and establishment of medieval pasture boundaries also indicate closer and more intensive management of the uplands (see Herring 2016 for the archaeological evidence for medieval land use in West Penwith and Vervust *et al* 2020 for earlier medieval intensification of agriculture in west Penwith).

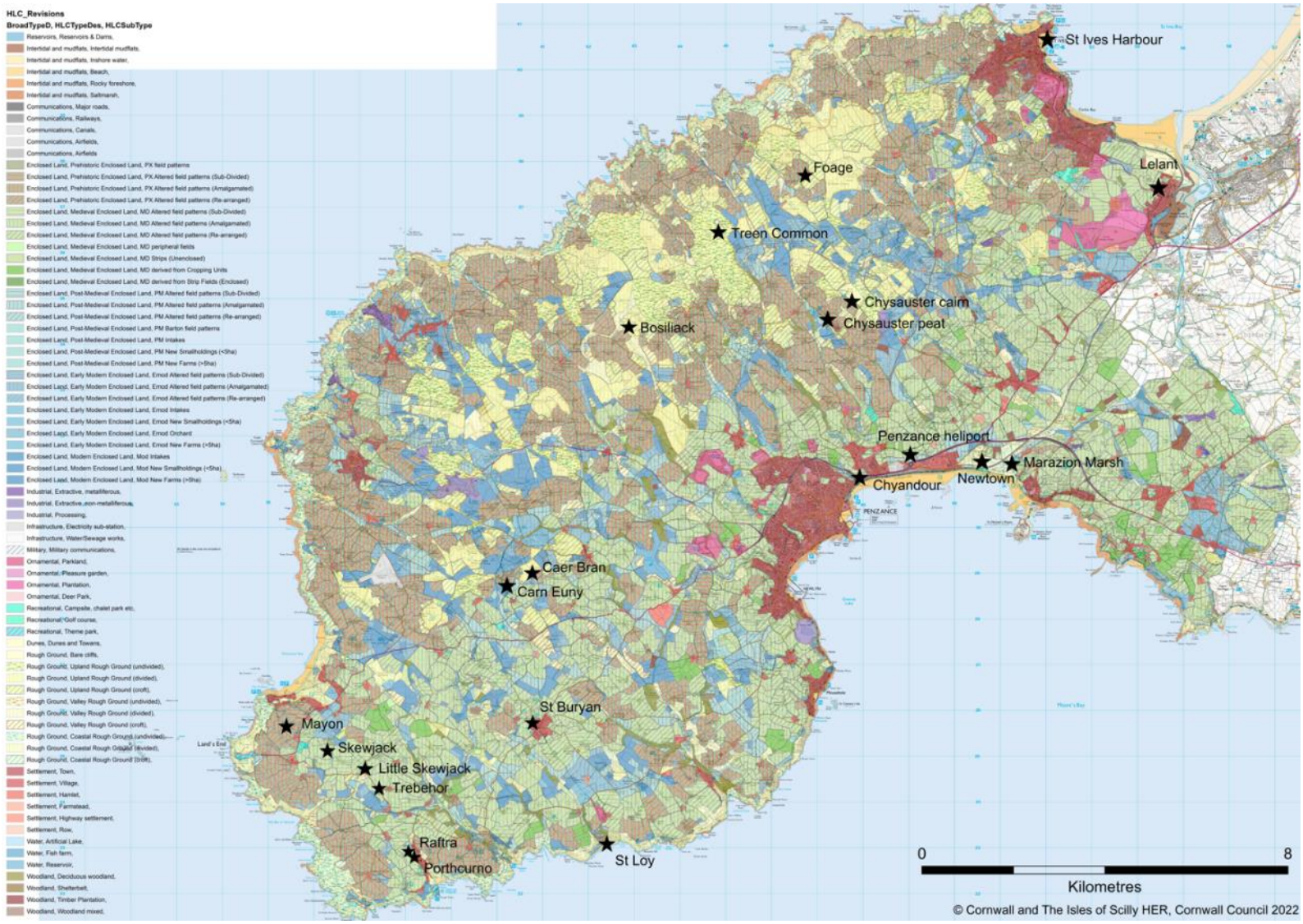
Grasses (*Poaceae*) were at a slightly lower level than in the previous phase but remained steady throughout period. There is some rye pollen (*Secale cereale*) as well as barley and wheat type cereals (*Avena/Triticum*, *Hordeum?Avena/Triticum* type, *Hordeum* type) and a slight increase in plantains (*Plantago*-type), suggesting further arable farming in the vicinity. Treen Common was subdivided into outfield strips in the medieval period; their low stony banks still survive (Herring 2006, fig 23). Sedges, rushes, cotton-grasses and *Sphagnum* mosses increased, all suggesting wetter conditions, reflected also in the presence of waterlily (*Nymphaea alba*). Ferns (*Pteropsida monolete* and *Polypodium*) also increased in this phase (Forster and Robinson 2011, 14-18).

The herbs that were recorded in this period are as follows; all had quite low counts as it seems that they and other herbs that disappeared entirely were the principal losers with the rise of the heathland vegetation. Biodiversity appears to have been at its greatest on the West Penwith downlands in the earlier periods of more extensive grazing (the prehistoric phases of Local Pollen Assemblage Zones 1 and 3).

- *Ranunculaceae*, buttercups
- *Spergula* type, spurrey
- *Filipendula*, meadowsweet
- *Potentilla-type*, cinquefoils
- *Rosaceae*, rose family
- *Apiaceae*, umbellifers
- Plantago lanceolata, ribwort plantain
- Plantago media, hoary plantain
- *Rubiaceae*, madders
- Scabiosa columbaria, small scabious

- *Achillea*, yarrows
- *Cichorium intybus*, chicories
- *Chenopodiaceae*, goosefoot
- Saxifraga stellaris, starry saxifrage
- Lotus, bird's foot trefoil
- Trifolium type, clover
- Fabaceae, legumes
- *Myosotis arvensis*, forget-me-not
- *Campanula*, bellflowers
- *Cirsium*, creeping thistle

Tree pollen from this period include recurrence of elm, oak, birch, willow, alder and buckthorn as well as the *Corylus avellana* type (hazel or bog myrtle). But there were also new trees in the vicinity, albeit in small numbers: beech (*Fagus sylvaticus*), hornbeam (*Carpinus betulus*) and lime (*Tilia undifferntiated*).



Locations of sites subjected to palaeo-environmental sampling and analysis, plotted against the 2012 revision of the Historic Landscape Characterisation (Base map © Cornwall Council)

Other palaeo-environmental records from West Penwith.

The Treen Common results from a deep and rich core taken in the heart of the uplands provide an invaluable outline framework of West Penwith's environmental history. Information gained from other investigations of sites with shorter time-frames may be placed alongside it to extend understanding by considering other types of environment in the peninsula.

The other principal sites in West Penwith from which palaeoenvironmental information has been drawn are arranged here in chronological sequence of the established or presumed earliest date of the environmental material.

See map for locations.

St Loy, St Buryan

SW 422 232, on southern coast of St Buryan

Type of environment: Sandy silt of probably former lake now immediately inland from rocky shoreline. From glacial period and probably a form of tundra grassland.

Form of evidence: pollen.

Periods covered: Devensian; c30,000 BP; Straker considers the radiocarbon date of uncertain reliability (2011b, 164).

Context and simplified stratigraphy: 'Organic sandy silts (low organic content of 3.5%) of lacustrine or pedogenic origin, probably the former and likely to have been 'impounded by solifluction flows' (Straker 2011b, 164).

Summary of findings: 'Herbaceous assemblage consistent with open temperate or Arctic tundra grassland containing *Gramineae* (grasses), *Solidago*-type, *Ranunculus repens*-type, (buttercups), *Achillea* (yarrow), *Caryophyllaceae* with small pools of standing water suggested by *Sparganium*-type (bur reed) and *Potamogeton* (pond weed). Scourse considers most likely to relate to Arctic rather than temperate conditions' (Straker 2011b, 164).

Reference: Scourse 1999

Penzance Heliport (Ponjou), Gulval

SW 48974 31522, a short way north of the northern fringe of Mount's Bay.

On low-lying alluvium that had been laid down on raised beach. Shown on the boundary between two pieces of moor (i.e lowland wet ground) on the 1843 Tithe Apportionment; The Withey Moor to the north (TA 2391) and Hall West (presumably using *hal*, Cornish for moorland) to the south (TA 2389).

Of interest in relation to coastal change and major Ice Age rivers whose palaeovalleys within Mount's Bay have been investigated and which were probably significant local features in the early Holocene period (Camm 1999).

Type of environment: palaeosol beneath a Bronze Age barrow.

Form of evidence: geoarchaeology; deposit modelling (especially of buried peat layers) using cores; pollen; diatoms.

Periods covered: Mesolithic to Early Bronze Age. Three radiocarbon dates from the barrow: 33912±9 BP, 1750-1622 cal BC (95.4%); 3169±29 BP, 1503-1400 cal BC (95.4%) and 3089±29, 1426-1276 cal BC (95.4%)

Context and simplified stratigraphy: peats and silts in soils near early Bronze Age barrow. Five main sedimentary unites were identified, from top to bottom:

- Holocene colluvium. Silt loams 'probably represents colluvium resulting from human activity (clearance, tillage) upslope' (Allen 2019, 57). The fields are near the southern edge of the area referred to as The Golden Mile, important for horticultural land use in the 19th and 20th centuries (see Section 15), though as noted the fields themselves were recorded as Moor and Hall (probably from Cornish *hal*, 'moor') in 1843.
- Humose deposits. Also referred to as 'peat'. Between 0.95 and 1.25m deep. A silty peat in places; elsewhere a humified peat. 'These deposits may represent a stasis, and soil formation in local wet conditions, typically standing water ponding at the base of the slope' (Allen 2019, 58). Expected to contain pollen.
- Alluvium. Greyish-brown silt, fine-grained and well-sorted, 'suggesting fluvial, slow water, or overbank flood deposits' (Allen 2019, 58). May contain pollen.
- Basal colluvium. Possibly a Pleistocene Head.
- Sand. Probably the result of local sand blow and dunes.

The report recommends further detailed assessment using selected cores, for pollen, diatom, wood and geoarchaeological information that would provide a palaeoenvironmental context for the archaeological work on the barrow.

Reference: Allen 2019 (embedded within Lawson-Jones 2020). *NB The full report on this work was published just as the present project was completing: see Jones and Allen 2023.*

Marazion Marsh, Ludgvan

SW 511 312 at NE corner of Mount's Bay

Type of environment: low-lying marshland; fresh and salt-water.

Form of evidence: pollen and diatoms.

Periods covered: Late Mesolithic onwards.

Context and simplified stratigraphy: 'Organic sediments under Phragmites reed bed, resting on seaward- sloping bedrock of kaolinized slate. Overlain by a discontinuous layer of organic and minerogenic sediments. Sequence depth varies; approximately *c*1.75m deep from *c*4.5m OD.' (Straker, 2011b, 164)

Summary of findings: 'Rising water table and increasing salinity between 5500 and 4500BP, behind a barrier penetrated by sea water. Sometime after 4500 BP substantial and rapid marine accumulations of sands and removal of direct marine access by *c*1600 BP. Vegetation history complex with alder-dominated fen carr and reed marsh before marine incursion and after it grass/sedge dominated vegetation, colonised by some trees and shrubs including *Salix* and aquatics. Sequence indicative of wet lagg, increasingly wet towards the surface' (Straker, 2011b, 164).

References: Heyworth and Kidson, 1982; Healy 1993; 1995; 1996; 1999; summarised by Vanessa Straker in 2011b.

Newtown, Ludgvan

SW 50541 31345, near the mouth of the former tidal inlet of the Red River, now Marazion Marsh.

Type of environment: coastal marsh.

Form of evidence: pollen, diatoms, waterlogged plants.

Fieldwork (watching brief during site works and auger coring to develop a clearer understanding of the palaeo-environment of Marazion Marsh, of which this forms a western part.) was undertaken in 2019 during coastal protection works.

Periods covered: Mesolithic to post-Roman. Radiocarbon dates from each end of the sequence: 5060-4850 cal BC (later Mesolithic) and cal AD 420-540 (early post-Roman).

Context and simplified stratigraphy: series of sands, a *c*1m thick peat layer, sands, gravels and silts over bedrock were recorded. A total of 212 samples were selected for pollen and diatom assessment and radiocarbon dating, and 23 samples processed for waterlogged plant remains and shells.

Summary of findings: The peats provided evidence for of an alder, birch and hazel dominated wooded landscape, and rising water levels leading to local peat formation. Rising water tables and increased marine influence led to a considerably more open environment and the development of backwater fen, with willow and a very strong pastoral element. Later prehistoric and early historic activity saw the change from saline to freshwater conditions and marsh and lake formation. The open alder, birch and hazel woodland was replaced by dry ground and creation of extensive pasture.

These data have the potential for providing a long land-use and landscape history relating to the marsh (freshwater/brackish water); a number of archaeological sites on the margins of the marsh; the landscape of Mounts Bay and St Michael’s Mount; as well the wider development of the coastal zone.

	Raw Data	% Data
Betula	6	3.8
Pinus	15	9.6
Picea	1	0.6
Quercus	5	3.2
Ilex aquifolium	2	1.3
Alnus glutinosa	20	12.7

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Corylus avellana type	95	60.5
Calluna	1	0.6
Brassicaceae undiff.	1	0.6
Chenopodiaceae	6	3.8
Plantago major type	1	0.6
Poaceae	3	1.9
Unidentified/degraded	1	0.6
Cyperaceae	1	0.6
Dryopteris type	5	2.5
Polypodium vulgare	35	17.8
Trees	-	31.2
Shrubs	-	61.1
Herbs	-	7.6
Aquatics	-	0.6
Spores	-	20.3
Total pollen	-	157
& Aquatics	-	158
& Spores	-	197

Raw pollen data from sample at 526cm (prior to 5060-4850 cal BC at 283cm); this is Zone 1 and was dominated by hazel, birch and alder woodland.

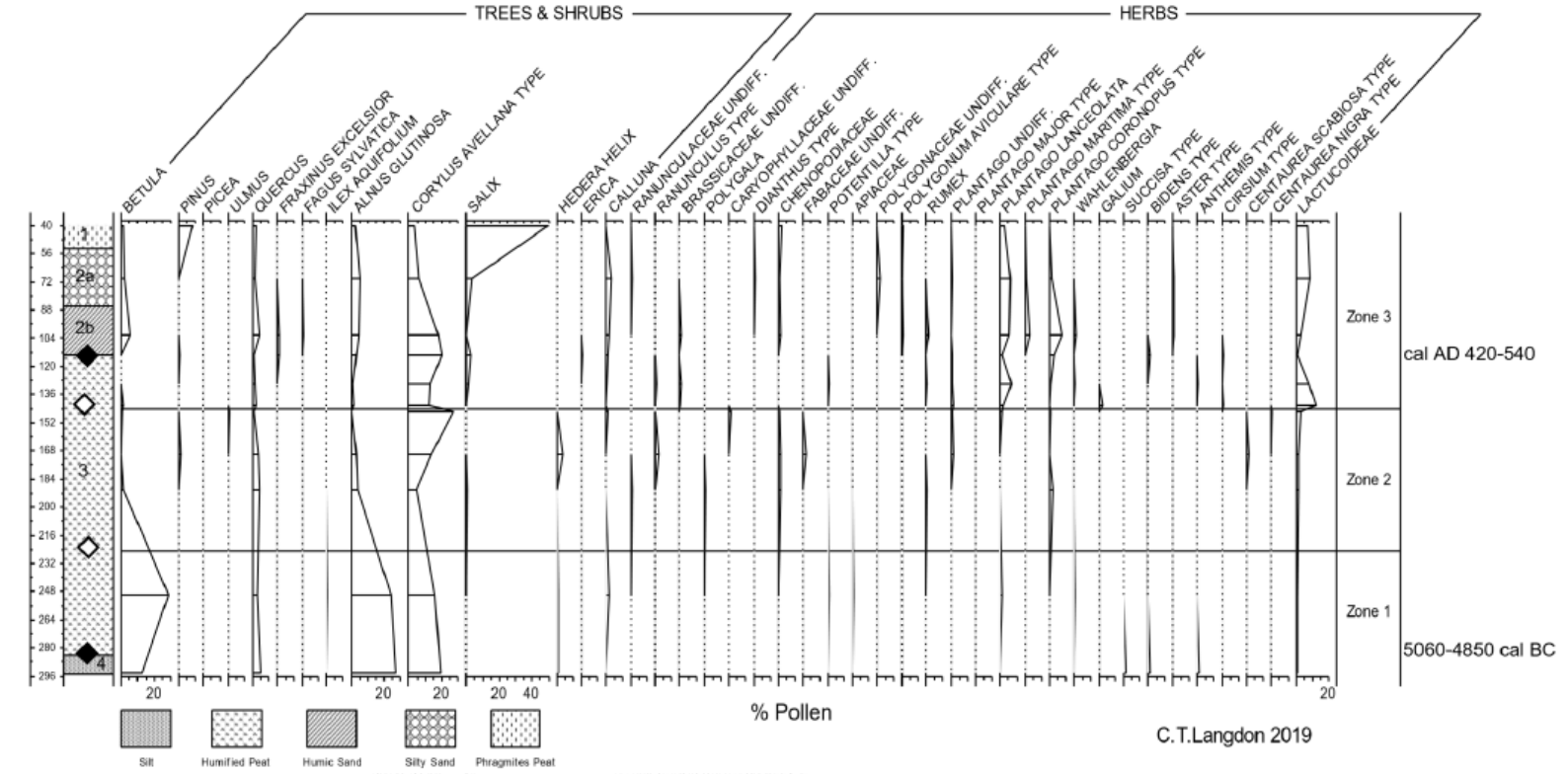
Zone 2 is dominated by grasses (*Poaceae*) which make up to 80% and hazel or bog myrtle (*Corylus avellana* type), which increases as the zone progresses reaching 25% by the end of the zone. Trees recorded include pine (*Pinus*), elm (*Ulmus*), alder (*Alnus*) and oak (*Quercus*) (5% or less), whilst small numbers of willow (*Salix*) and common heather (*Calluna*) are noted.

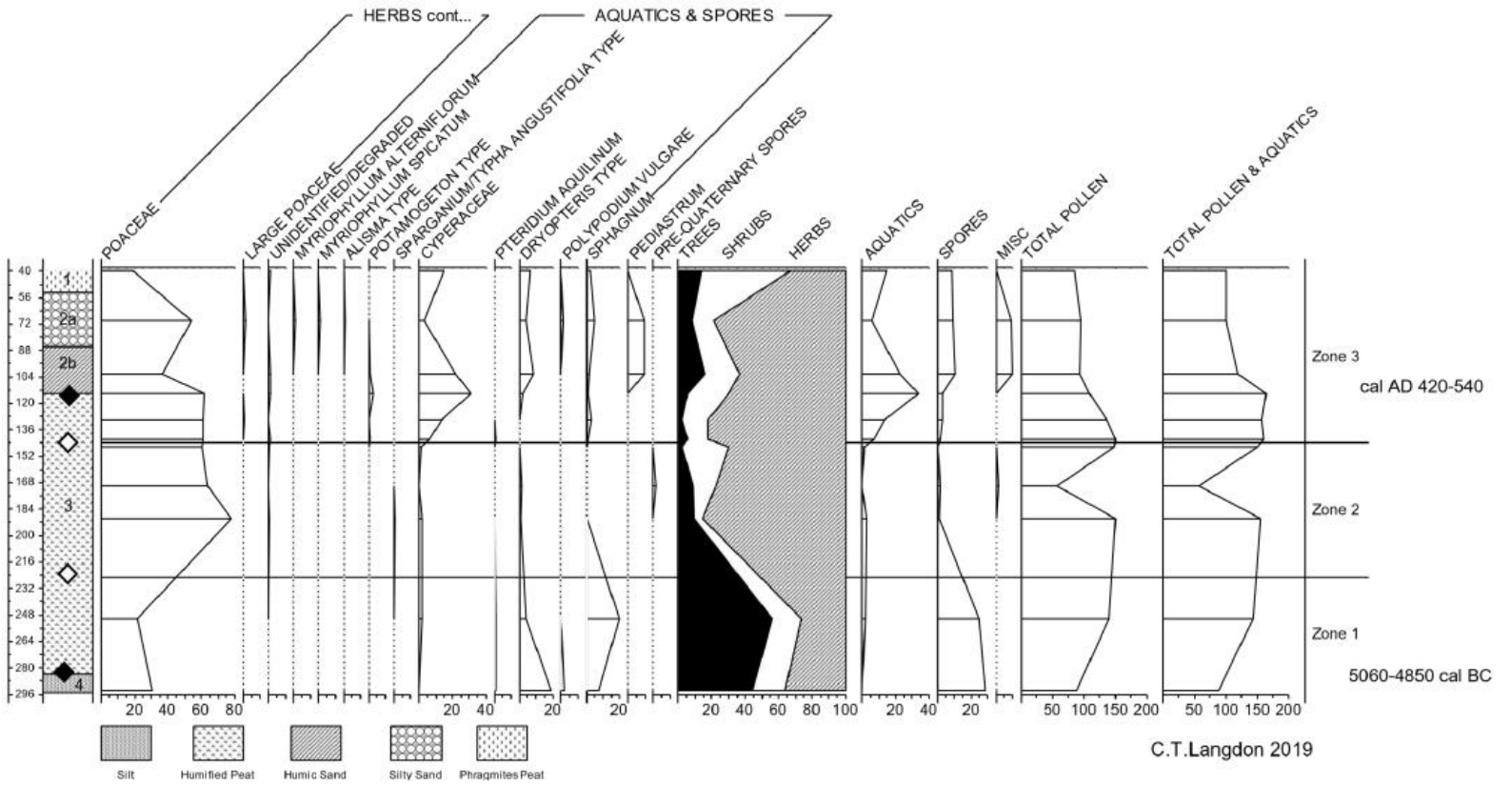
Herbs include buttercups (*Ranunculus* types), milkworts (*Polygala*), goosefoots (*Chenopodicaceae*), buck's horn plantation (*Plantago coronopus* type) and greater knapweed (*Centaurea Scabiosa*). Some bur-reed (*Sparganium*) is recorded whilst there are small numbers of sedges (*Cyperaceae*) and wood fern (*Dryopteris* type).

Zone 3 is also important for the grasses (*Poaceae*) whose values reach 60% and then decline to 30% by the end of the zone. Sedges (*Cyperaceae*) increase to 40% as the zone progresses from less than 5% in zones 1 and 2.

Dandelions (*Lactucoideae*) and ribwort plantain (*Plantago lanceolata*) dominate among the herbs which remain between 5% and 10% throughout. Trees include Birch (*Betula*), pine (*Pinus*), oak (*Quercus*) and alder (*Alnus*) (<5%), whilst hazel or bog myrtle (*Corylus avellana* type) pollen declines from 20% to 5% by the end of the zone. Willow (*Salix*) is present at <5% until the end of the zone when it peaks to 40%. Other herbs present include goosefoots (*Chenopodicaceae*), knotweeds (Polygonaceae types), buck's horn plantation (*Plantago coronopus* type), *Wahlenbergia* type and Aster type. A few large grasses were recorded.

Reference: Allen *et al* 2020 (bound within Jones 2020). NB The full report on this work was published just as the present project was completing: see Jones and Allen 2023.





Newtown preliminary pollen assessment diagram (tree shrubs and herbs) (Allen et al 2020, fig 6)

Chysauster, Gulval

SW 46937 34781, Peat from spring near valley bottom, downhill of Chysuster ancient settlement.

Type of environment: spring-line peat.

Form of evidence: pollen.

Periods covered: uncertain but presumed to be Neolithic and Bronze Age.

Context and simplified stratigraphy: complex stratigraphy

Summary of findings: 'Formed as a result of raised ground water table clearance. Complex stratigraphy possibly dating to the Neolithic. Fluctuating alder and willow on the wetland with oak and hazel woodland round about. Three phases of human activity and agricultural impact, possibly from the Neolithic; later phases probably related to Bronze Age activity. Merits re-study and dating' (Straker 2011b, 165).

Reference: Scaife 1996.

Tyringham Road, Lelant

SW 5437 3741, on higher east-facing slopes of Hayle estuary, close to the edge of an area of towans (sand dunes).

Type of environment: Anciently Enclosed Land on the edge of towans.

Forms of evidence: Charcoal and animal bones.

Periods covered: Early and later Neolithic (Beaker period)

Context and simplified stratigraphy: Sandy layers intermixed with plough soil layers. Animal bone from Layer 2 was radiocarbon dated to the later medieval period (AD 1433-1512 at 89% probability). A circular pit 0.7m in diameter and 0.16m deep was cut into the natural. A deliberate deposit of around 45 sherds of Beaker pottery (presumed to be of the later part of the 3rd millennium cal BC) was placed at the base of the pit. A radiocarbon date was obtained from a piece of charred hazel: 3794-3662 cal BC, i.e. from the early Neolithic period.

Summary of findings: Charcoal collected from the pit was examined by Dana Challinor. The largest and most numerous fragments were of *Taxus baccata* (yew), but there were also *Alnus*/*Corylus* (alder / hazel, probably the latter) and *Maloideae* (hawthorn, apple, whitebeams, etc) (Challinor 2020, 152-3). The date obtained from the charred hazel indicates human activity in the area long before the Beaker pottery was placed in the pit; the charcoal is presumed to have been residual in the soil that eventually filled the pit. The animal bones collected from the sandy layers and dated by a radiocarbon determination on one bone were in quite poor condition, but nevertheless represent a valuable collection for west Cornwall where the acidity of the soil normally destroys bone. Only 9 bones could be identified with certainty: 5 cattle and 4 sheep/goat. There was also a tip of a deer antler. All bones were from limbs and some showed signs of butchery (Randall 2020, 151-2).

Reference: Jones and Lawson-Jones 2020.

Maen, Sennen

SW 3523 2557, exposed west facing slope of rounded hill at 85m (280 feet) altitude.

Type of environment: Anciently Enclosed Land on western slopes of hill that has Sennen church near its summit.

Form of evidence: charcoal and charred plants.

Periods covered. Beaker period in Early Bronze Age.

Context and simplified stratigraphy: group of pits and post-holes around a setting of stones. Field 4 of the project.

Summary of findings: Charcoal evidence indicated that wood burnt, and possibly also used in structures, was overwhelmingly dominated by *Quercus* (oak), but with *Maloideae* (hawthorn, pear or apple) also present (Challinor 2012, table 11).

Charred plant remains were found in three pits.

> Pit [13]. *Corylus avellana* (hazel) one nut; *Danthonia decumbens* (heath-grass); *Plantago lanceolata* (ribwort plantain); *Lathyrus /Vicia* (vetch).
>
> Pit [15]. Several *Triticum* (wheat) grains; *Rumex* (dock); *Ajuga reptans* (bugle); *Arrhenatherum elatius* (onion couch tuber); *Carex* (sedge); *Danthonia decumbens* (heath-grass); Galium aparine (cleavers); *Lathyrus /Vicia* (vetch); *Plantago lanceolata* (ribwort plantain); *Stellaria media* (chickweed); Poaceae (grasses).
>
> Pit [42]. *Ulex* (furze) in the lower fill; *Danthonia decumbens* (heath-grass); *Lathyrus /Vicia* (vetch); *Vicia Tetrasperma* (smooth tare), 'typical of rough grassy places'. Also *Arrhenatherum elatius* (onion couch tuber); *Lathyrus /Vicia* (vetch); *Plantago lanceolata* (ribwort plantain); Poaceae (grasses) (Jones 2012, 42).

Reference: Jones *et al* 2012.

Skewjack, Sennen

SW 3621 2523, on south-eastern slopes of hill. At 90 metres (295 feet).

Reference: Jones *et al* 2012.

Type of environment: Anciently Enclosed Land on eastern slopes of hill that has Sennen church near its summit.

Form of evidence: charcoal and charred plants.

Periods covered. Beaker period; Early Bronze Age.

Context and simplified stratigraphy: Sub-oval oval hollow regarded as a structure of the Beaker period. Contains an area of burning, regarded as a possible hearth or a site of several fires. Some post-holes and pits adjacent to the structure. Field 13 of the project.

Summary of findings: Charcoal analysis found that the burnt wood was overwhelmingly dominated by *Quercus* (oak), but with *Betula* (Birch), *Alnus* (alder), *Corylus* (hazel), *Prunus* (cherry), and *Maloideae* (hawthorn, pear or apple) also present (Challinor 2012, table 11).

Charred plant remains were found in the following features.

> 'Beaker structure' [108]: *Triticum* (grain); *Arrhenatherum elatius* (onion couch tuber); Poaceae (grasses); *Persicaria maculosa* (lady's thumb). Corylus (hazel) charcoal gave a date of 2300-2060 cal BC.
>
> Oval hearth [105]: *Triticum* (grain); *Avena* (oats); *Bromus* (brome grass); *Corylus avellana* (hazel).
>
> Other features: *Triticum* (grain); *Avena* (oats); *Bromus* (brome grass) (Jones 2012, 43-45).

Reference: Jones *et al* 2012.

Trebehor, St Levan

SW 3740 2435, on western slope of valley side. At 80m (263 feet).

Reference: Jones *et al* 2012.

Type of environment: Anciently Enclosed Land on western slopes of gentle valley.

Form of evidence: charcoal and charred plants.

Periods covered. Beaker period; Early Bronze Age.

Context and simplified stratigraphy: Four pits. One was stone-lined and contained the sherds of five Beakers. Another pit [277] had a charcoal rich deposit. Field 24 of the project.

Summary of findings: Trees dominated by *Quercus* (oak), but with *Betula* (Birch), *Alnus* (alder), *Corylus* (hazel), *Prunus* (cherry), and *Maloideae* (hawthorn, pear or apple) also present (Challinor 2012, table 11).

Charred remains of plant types found in disturbed ground were recovered from a 'Beaker pit' [261]. They included *Chenopodium Album* (fat hen); *Atriplex* (orache); *Persicaria maculosa* (redshank or lady's finger); and *Corylus* (hazel) (Jones 2012, 45).

Reference: Jones *et al* 2012.

Chyandour, Gulval

SW 480 312, close to northern shore of Mount's Bay

References: James 1990; 1996; French 1999; James and Guttman 1992. Summarised in Straker 2011b, 164.

Type of environment: peat immediately adjacent to shoreline.

Form of evidence: pollen.

Periods covered: Early Bronze Age onwards.

Context and simplified stratigraphy: peat core 2.37m long extending below sea-level.

Summary of findings: 'Alder carr on mire surface. The surrounding vegetation is oak/birch woodland which is replaced by hazel with a rise in bracken and grasses. Subsequent fluctuations in hazel and increase in grasses and sedges. This may be a landward extension of the submerged forest in Mount's Bay, but is not stratigraphically linked' (Straker 2011b, 164).

References: James 1990; 1996; French 1999; James and Guttman 1992. Summarised in Straker 2011b, 164.

Chysauster, Gulval

SW 4716 3535, west-facing higher slopes of valley-side at 190m altitude (623 feet).

Type of environment: palaeosol beneath a Bronze Age cairn.

Form of evidence: pollen.

Periods covered: Early Bronze Age. Radiocarbon date: HAR-6548, 3650±80 BP 2280-1780 cal BC on charcoal in palaeosol.

Context and simplified stratigraphy: palaeosol beneath early Bronze Age cairn.

Summary of findings: 'Bronze Age oak-hazel woodland on acid brown earth with little evidence for heathland. Some evidence for agriculture prior to cairn in the form of greater diversity of herbs including grasses, cereals and plantain. Some supporting evidence from micro-morphology' (Straker 2011b, 165).

Reference: Scaife 1996.

Tower Meadows, St Buryan

SW 40696 25781, on the higher north-western slopes of the rounded hill on which St Buryan church stands. At an altitude of 123m (400 feet).

Type of environment: Anciently Enclosed Land HLC Type on gently sloping but exposed land.

Form of evidence: charred plant remains and charcoal.

Period covered: Middle Bronze Age.

Context and simplified stratigraphy: A shallow pit included charcoal in its fill and a spread of charcoal rich material filled a shallow hollow from which fragments of at least two Middle Bronze Age Trevisker ware vessels were retrieved. More pits and post-holes were recorded in the vicinity and charcoal rich fills were sampled.

Summary of findings: The charred plant fragments from the spread in the shallow hollow were the most significant. They included small numbers of charred cereal grains, both hulled wheat and hulled barley, and a whole seed of a Celtic or field bean. There were also charred remains of weeds that are often found associated with crop husbandry: *Chenopodium album* (fat hen), *Persicaria lapathifolia* (pale persicaria), *Fallopia convolvulus* (black bindweed, another archaeophyte, an alien, possibly introduced as a food plant), *Plantago lanceolata* (ribwort plantain), and *Danthonia decumbens* (heath grass). There were also fragments of *Pteridium aquilinum* (bracken) and *Ficaria verna* (lesser celandine), suggestive of damp grassland nearby.

Reference: Allen *et al* 2020.

Porthcurno, St Levan

SW 3809 2270, south-eastern slopes of ridge above steep valley. At 75 metres (245 feet).

Type of environment: Anciently Enclosed Land on south-eastern slopes of ridge to the west of the deep valley down to Porthcurno.

Form of evidence: charcoal and charred plants.

Periods covered. Early or Middle Bronze Age.

Context and simplified stratigraphy: Pit with alternating layers of charcoal and burnt layers also contained sherds of plain Bronze Age vessels. Field 38 of the project.

Summary of findings: Trees overwhelmingly dominated by *Quercus* (oak), but with *Corylus* (hazel), *Maloideae* (hawthorn, pear or apple) and Cytisus / Ulex (broom or furze) also present (Challinor 2012, table 11).

Charred plant remains were recovered from a pit [355]. They included: Poaceae (grasses); *Rubex* (bramble) and *Rumex* (dock) (Jones 2012, 45).

Reference: Jones *et al* 2012.

Bosiliack, Madron

SW 4283 3439 on western midslopes of valleyside at 185 metres (606 feet).

Type of environment: Upland Rough Ground on valley side on edge of upland area.

Form of evidence: Charcoal.

Periods covered: Middle Bronze Age.

Context and simplified stratigraphy: Floor layers of House 3. Charcoal was from *Quercus* (oak) and either *Cytisus* (broom) or *Ulex* (furze). Broom or furze was the dominant form of charcoal in the 1984 excavations of houses in the same settlement, with small quantities of *Quercus* (oak), *Corylus* (hazel) and *Prunus* (cherry type, possibly blackthorn?) (Challinor 2011; 2013).

Reference: Jones 2013

Caer Bran, Sancreed

SW 4074 2902, immediately SE of summit of rounded downland at 224 metres (735 feet).

Type of environment: upland rough ground, beneath the rampart of a hillfort, or an early Bronze Age enclosure.

Form of evidence: pollen

Periods covered: Presumed to be Iron Age, though there is uncertainty as the inner rampart of the 'hillfort' may be from an earlier Bronze Age hilltop enclosure.

Context and simplified stratigraphy: A 'clear palaeosol' beneath the rampart of Caer Bran hillfort.

Summary of findings: Pollen analyses 'show it to be somewhat more complex than expected' (Dimbleby 1978, 427). Four distinct phases were noticed, from top to bottom, latest to earliest.

Samples 17-12 Mixed material, 'undoubtedly forming the base of the rampart' (ibid). Presumed Iron Age.

Samples 11-10 Ground surface when rampart was thrown up; 'enriched with pollen as the result of being exposed as a surface in which farming was taking place' (ibid). Presumed Iron Age.

Sample 9 From a woodland floor, possibly 'transported to overlie a truncated profile which itself has strong woodland characteristics (ibid). Possibly Bronze Age

Samples 8-6 Presumed to be 'the lower levels of a pollen profile *in situ*' (ibid).

		Percentages; younger to older, left to right			
		SS 17-12	SS 11-10	S 9	SS 8-6
TREES					
Alnus	Alder	0.7	0.9	0.5	0.6
Betula	Birch	0.1	0.4	0.5	
Fagus	Beech			+	
Fraxinus	Ash		0.2		
Pinus	Pine	0.1	+		+
Quercus	Oak	4.7	3.8	10.9	5.0
Tilia	Lime	0.1			0.1
Ulmus	Elm		0.1		
Corylus	Hazel / Bog myrtle	12.7	7.7	20.4	33.0
OTHERS					
Hedera	Ivy	+		+	0.3
Lonicera	Honeysuckle	+	+	+	
Calluna	Heather / ling	0.8	0.6	0.8	1.0
Misc. *Ericaceae*	Heath	0.2	0.7	+	0.1
Gramineae	Grasses	41.5	52.6	23.2	12.2
Cerealia	Cereals	0.2			
Campanulaceae	Bellflower	1.2	2.0	0.8	0.1
Caryophyllaceae	Pink / carnation	0.1	+	+	0.1
Chenopodiaceae	Goosefoot	+			
Compositae liguliflorae	Asters	4.1	6.0	1.6	0.5
Compositae tubuliflorae	Daisies	0.1	0.2		0.1
Cyperaceae	Sedges	0.1	0.5		
Plantago lanceolata	Ribwort plantain	2.0	2.0	3.0	0.9
P. major	Broadleaf plantain	0.4	0.7		0.1

Polygonum persicaria	Knotweed	0.1			
Ranunculaceae	Buttercup	0.1	0.1	0.8	
Rosaceae potentilla	Cinquefoil	3.7	5.7	3.5	1.0
Rubiaceae	Madder	1.0	1.1	0.3	
Rumex cf. acetosa	Common Sorrel	0.1	0.1		
Succisa	Devil's-bit scabious	0.1	0.2	+	0.4
Trifolium	Clover				
Umbelliferae	Umbellifers			+	0.3
Varia		1.7	1.4	2.8	1.2
Dryopteris type	Buckler Fern	3.0	1.0	9.0	20.9
Polypodium	Polypody	3.0	1.7	2.5	10.7
Pteridium	Bracken	18.0	10.0	19.3	11.2

Reference: Dimbleby 1978.

Carn Euny, Sancreed

SW 40224 28858, south-facing slopes of a hill at c165m altitude (540 feet).

Type of environment: in Anciently Enclosed Land, within a later prehistoric settlement.

Forms of evidence: pollen; charcoal and soils.

Periods covered: Iron Age (pollen and soils) and Romano-British

Context and simplified stratigraphy: Pollen on land surface predating the settlement, probably 5th century BC or earlier.

Summary of findings: 'The early part of the sequence shows relatively wooded conditions, mainly oak and hazel. This is consistent with charcoal of a variety of woodland species. Pre-settlement clearance was pastoral. At the time of the settlement, oak and hazel had declined but grass pollen had become more frequent. Both arable and pasture are indicated with weeds such as *Rumex* (sorrels), *Cruciferae*, *Plantago major*, *Urticaceae* and *Umbelliferae*' (Straker 2011b, 165).

References: Dimbleby 1978; Limbrey 1978; Sheldon 1978.

Foage, Zennor

SW 4663 3774, high on west-facing slope of a valley-side at 200m (656 feet).

Type of environment: Anciently Enclosed Land close to a ruined courtyard house.

Form of evidence: pollen.

Periods covered: uncertain, but beneath an Iron Age or Romano-British field boundary.

Context and simplified stratigraphy. Two contexts: one beneath a built boundary, the other beneath a bank.

Summary of findings: 'Open landscape dominated by herbaceous grassland at 80% TLP, with localised restricted heathland in close vicinity and occasional trees and shrubs perhaps on field or valley margins. The herbaceous grassland included Caryophyllaceae, *Compositae*, *Umbelliferae*, *Potentilla* (tormentil), *Galium* (bedstraw), and traces of *Scabiosa* (Scabious), *Succisa* (devil's bit scabious), *Plantago* (plantains, *Filipendula* (meadowsweet) and *Ranunculus* (Buttercups). *Coryloid* (hazel/bog myrtle). Heathers and traces of oak, elm, holly and birch from 5-10% TLP. No cereal pollen. Boundary profile more or less homogenous with a slight increase in sedges (*Cyperaceae*) towards the profile top, suggesting damper grassland, and slightly greater herb diversity. Some ferns and bracken throughout' (Straker 2011b, 165).

Reference: Herring *et al* 1993.

Samples of uncertain date

St Ives harbour, St Ives

SW 51890 40638, within harbour.

Type of environment: Low-lying peat in harbour.

Form of evidence: plant macrofossils and insects.

Periods covered: uncertain, presumed to be prehistoric.

Context and simplified stratigraphy: '0.9m peat above shale and overlain by sand. Base of peat at *c* -2.5m OD' (Straker 2011b, 165).

Summary of findings: 'Herb species-rich alder fen carr, with some oak and understorey of hawthorn, hazel and holly in drier areas. Towards the top, fen carr gives way to sedge fen with slow flowing or standing water. Charcoal fragments and some dung beetles may indicate burning of v egetation to e ncourage grazing (suggestion, VS). Specific insect remains identified, but no detailed analysis' (Straker 2011b, 165).

Reference: Gilbert 1995.

Two un-dated samples of charred plant remains were analysed from the Sennen to Porthcurno water pipeline project.

Lower Skewjack, St Levan

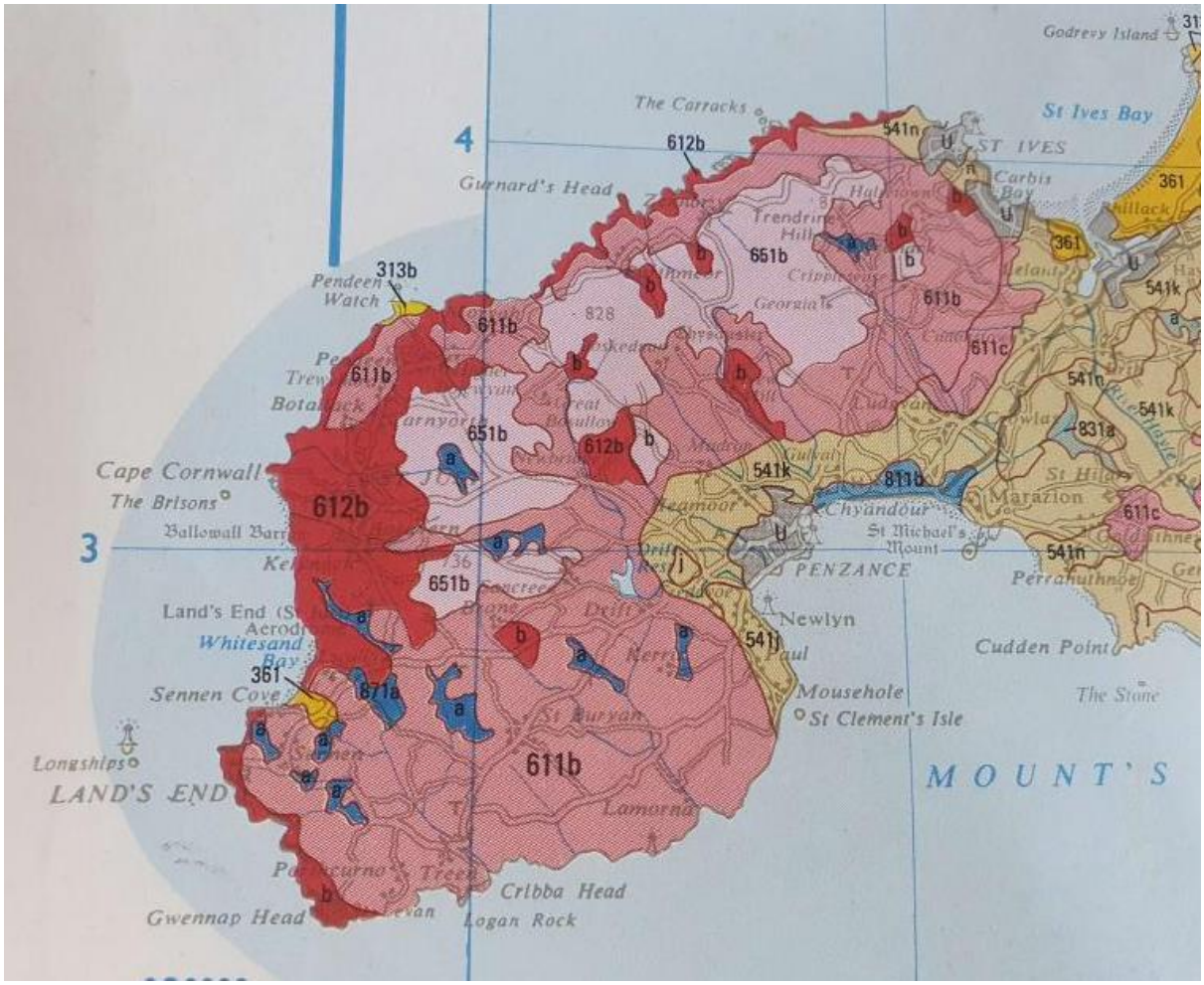
SW 37265 24600 (Field 22), came from what appeared to be a natural hollow [context 389]: *Arrhenatherum elatius* (onion couch); *Danthonia decumbens* (heath grass) (Lawson-Jones *et al* 2009; Jones 2012, table 14).

Raftra, St Levan

SW 3797 2293 (Field 37). The deposit in a rectangular pit (context [319], 2.0 by 1.1 metres and 0.45m deep) also included 60 fragments of burnt clay. Charred plant remains included *Arrhenatherum elatius* (onion couch); *Lathyrus / Vicia* (pea / vetch);

Odontites / Euphrasia (red bartsia / eyebright) (Lawson-Jones *et al* 2009; Jones 2012, table 14).

Appendix 2: Summary of soils



Extract from 1983 Soil Survey of England and Wales mapping for West Penwith (Thomson and Avis 1983). See below for discussion of each numbered soil series.

Soil Series in West Penwith

Based on Cranfield University 2022:
https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=31302

Soil Group 3 Lithomorphic soils.

'These are shallow soils in which the only significant pedogenic process has been the formation of an organic or organic-enriched mineral surface horizon. They are formed over bed-rock, or little altered, soft unconsolidated material at or within 30 cm depth' (Cranfield University 2018, 4).

3.1.3b Brown Rankers: Powys

Part of Soilscape 13 'Freely draining acid loamy soils over rock'

Locations: small area at Pendeen Watch.

HLC Types: Broad Type: Rough Ground; HLC Type: Bare Cliffs

'Shallow well drained loamy soils over rock. Many steep slopes with some gently sloping interfluves. Bare rock locally.' 'In Devon and Cornwall the association

generally occurs in strongly dissected coastal country on steep slopes and ridge crests.'

'Apart from the steep slopes, the main limitation on cropping in the South West is droughtiness, which affects grass more seriously than cereals.' 'Wetness in spring favours autumn cultivations and, the chief crop, winter barley…' 'Elsewhere much land is under permanent pasture, production from which is restricted by limited soil moisture reserves which are insufficient to sustain growth through dry summer periods. There is, however, little risk of poaching and farm operations can be carried out well into the autumn in most years. Temperatures are sufficiently high for grass to grow in both early and late season. Much steep, and sometimes rocky land is in rough grazing because of difficulties in management. Some slopes have deciduous oak woodland or scrub partially replaced by conifers.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=31302)

Powys soils are 'brown topped soils [loamy brown rankers] with rock within 30 cm depth, lacking subsoil B horizons; they form on convexities and around crags, outcrops and screes' (Devon, 184).

Rare in England (2.6%). Fertility = 2/5 (low). Land cover is typically grassland and rough grazing.

3.61 Sand-pararendzinas

Soils formed in little altered calcareous soft, unconsolidated sandy deposits other than alluvium' (Cranfield University 2018, 4).

Sandwich

Soilscape 4 Sand dune soils

Locations: small area on Whitesand Bay near Sennen Cove; larger area at Lelant Towns and across the Hayle estuary at Hayle, Upton and Gwithian Towans.

HLC Types: Broad Type: Dunes; HLC Type: Dunes and Towans

'Mainly deep well drained calcareous and non-calcareous sandy soils.' Usually on sand dunes that are unstable in places. 'It is exposed everywhere to sea winds. Soil development on the dunes largely depends on the vegetation and the degree to which this has stabilized the dune system. The most extensive soil is the Sandwich series, typical sand pararendzinas, found on fixed dunes, usually over 100 years old and often considerably older. Here the vegetation is dominated by herbs, brambles, grasses and deciduous scrub. Younger, unstable dunes, particularly those nearest the sea, are unvegetated or only thinly colonized by marram grass (Ammophila arenaria) and lyme grass (Leymus arenarius). Their shape constantly alters as a result of wind erosion and deposition and raw sands predominate there.'

'There are large dunes at St Ives Bay, where they are up to 1 to 2 km wide.' 'The sands are usually extremely calcareous and consist mainly of shell fragments. The dunes are mostly stable and carry Towans soils, but unstable dunes carry raw sands. Small alluvial tracts in dune slacks have the extremely calcareous Loggans series. Where sand has been blown further inland the association includes Phillack series.'

‘The land is rarely used for agriculture because the soils are droughty, and unstable when ploughed. Topography, exposure and local salinity also help to limit land use to recreation (mainly golf courses) and amenity use, nature reserves or military training. There is some rough grazing in the moist hollows and on stabilized dunes. Because there is little clay and organic matter, even in the surface horizons, the soils are easily eroded. Disturbance along paths and tracks through the dunes, usually to the beaches beyond, increases vulnerability to erosion, which is common during strong winds.’ (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=36100)

Rare in England (0.2%). Fertility 3/5, lime-rich.

5.41 Typical Brown Earths

‘Non-alluvial loamy soils with a non-calcareous subsoil without significant clay enrichment’ (Cranfield University 2018, 5).

Denbigh soils are brown soils with brownish or reddish subsoils mainly developed on permeable materials below c300m OD. Most are in agricultural use (Cranfield University 2022: https://www.landis.org.uk/soilsguide/series.cfm?serno=305&sorttype_series=series_name). Divided into two subtypes in west Cornwall.

Fairly common (15.5% of England). Fertility 2/5 (low). Carbon levels are low

Locations: in west Cornwall the Denbigh soils are confined to southern and eastern margins, off the granite and on sedimentary rocks from Mousehole, Newlyn and Penzance and their immediate hinterlands through Gulval and Ludgvan parishes to Lelant and along the eastern side of the peninsula as far north as St Ives.

5.41j Denbigh 1

= part of Soilscape 6, ‘Freely draining slightly acid loamy soils’

Locations: found in Paul parish on the coastal strip from around Drift south to Mousehole.

HLC Types: Broad Type: Enclosed Land: HLC Type: Medieval Enclosed. Broad Type: Settlement; HLC Type: Town [Newlyn and Mousehole]. Broad Type: Ornamental; HLC Types: Parkland, Pleasure Garden, Plantation.

‘Well drained fine loamy and fine silty soils over rock. Some similar soils with slowly permeable subsoils and slight seasonal waterlogging. Shallow soils and some bare rock locally.’

‘Brown stony well drained soils of moderate depth over Palaeozoic sedimentary rocks.’ Slaty mudstone and siltstone.

‘Formerly mapped widely in the South West as Highweek series, Denbigh series covers most of the cultivable slopes on low ground, but Manod soils are found on steeper land and on relatively level, higher ground around the moors, while Powys series occurs on brows and ridges.’

‘Stock rearing in uplands, dairying and some cereals in moist lowlands.’ ‘Long-term grass is traditionally the most common crop although the soils are more frequently

cultivated in the drier districts. The land is firm enough to carry farm vehicles and resist poaching. The growing season is usually seven to nine months (Smith 1976) but the livestock grazing period is often a month or two less to avoid damage to sward and soil structure. Rainfall is the main limitation to arable crops, particularly in the west where August is usually one of the wettest months. Apart from steeper land, the Denbigh soils are suitable for direct drilling. Patchy distribution of the wetter soils can reduce the time available for working some fields.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=54110).

In west Cornwall this is confined to the land south of Newlyn on the west side of Mount's Bay, including Paul churchtown and Mousehole town, and to the designed landscape of Trewidden.

5.41k Denbigh 2

Part of Soilscape 6, 'Freely draining slightly acid loamy soils'

Locations: found on the southern slopes of the West Penwith peninsula as far north as Madron and Ludgvan churchtowns and north-eastwards to Trevethoe in Leland parish. On the Middle Devonian sedimentary rocks adjacent to the West Penwith granite.

HLC Types: Broad Type: Enclosed Land: HLC Type: Medieval Enclosed. Broad Type: Enclosed Land: HLC Type: Early Modern Orchard.

'This association, of mainly fine loamy typical brown earths, is extensive in the gently undulating Devonian slate country of Cornwall.' 'Denbigh series are brown, permeable finely structured clay barns with slate or very stony layers within moderate depth.' 'Phillack and Ludgvan soils are found in Cornwall adjacent to dunes and where sea weed and sand has been added.' '… long-term additions by farmers of beach sand, seaweed and other organic manures has produced highly-valued coarse loamy man-made soils of the Ludgvan series (see below) with thick dark topsoils.' 'On low ground in west Cornwall and near the sea the warm winters give a very long growing season. Exposure to strong salt-laden winds can be severe close to coasts and wind exposure is a general problem at higher altitude.'

'The soils are naturally acid and regular liming is necessary, especially where rainfall is high. In parts of west Cornwall, Phillack, Ludgvan and many Denbigh soils have a high topsoil pH as a result of liming, occasionally giving rise to trace element problems in stock.' 'Regular phosphorus applications are often necessary on the main soils although the need for this depends upon past management. Forestry is generally unimportant although the few steep valley sides provide suitable sheltered sites.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=54111).

5.41n Trusham

'Well drained fine loamy soils over deeply weathered rock'

Part of Soilscape 6, 'Freely draining slightly acid loamy soils.'

Locations: small areas immediately west and south of St Ives and in the St Erth part of the isthmus.

HLC Types: Broad Type: Enclosed Land: HLC Type: Prehistoric Enclosed Land, Medieval Enclosed Land. Broad HLC Type: Settlement; HLC Type: Town. Broad Type: Ornamental; HLC Types: Parkland, Pleasure Garden, Plantation.

‘Fine loamy typical brown earths over hard rocks or stony Head. Mainly in Devon and Cornwall on basic tuffs and lavas interbedded with Devonian slates or on intrusions of altered dolerite and greenstone around the granite outcrops.’

‘In west Cornwall there is a long growing season and the soils allow a wide range of crops to be grown, though dairying is the major enterprise. Near Hayle, most slopes are relatively gentle and arable cropping is widespread. The soils can be worked soon after periods of rain. Generally, working conditions in spring are less suitable than in autumn. Around Marazion calcareous beach sand is added regularly to land used for the production of brassica crops.’ ‘Droughtiness limits grass growth on shallow soils during dry summer months though this is compensated for by the length of the growing season which extends almost throughout winter. Exposure is a severe limitation to cropping on west-facing coasts and on hill tops.’(Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=54114).

6 Podzolic soils.

‘These are soils with a black, dark brown or ochreous subsurface horizon resulting from pedogenic accumulation of iron and aluminium or organic matter or some combination of these. They normally form as a result of acid weathering conditions and, under natural or semi- natural vegetation, have an unincorporated acid organic layer at the surface’ (Cranfield University 2018, 6).

6.1 Brown podzolic soils, ‘have a dark brown or ochreous subsoil with no overlying “bleached” layer’ (Cranfield University 2018, 6)

6.11b Moretonhampstead Podzols
Part of Soilscape 13 ‘Freely draining acid loamy soils over rock’.

Locations: In West Penwith, the great majority of the area recorded as Soilscape 13 is of the Moretonhampstead type of podzol; the only exception is the small area of Manod series (see below). Moretonhampstead type soils cover around 50% of the whole peninsula, wholly on the granite and metamorphic geology. Topographically it includes the lower downlands, coastal plateaux, valleys and cliffs (especially on the south coast).

In West Penwith the predominant soil on the granite within enclosed land. Much of the broad southern plateau of Sennen, St Levan, St Buryan, Sancreed and Paul parishes an the central parts of the several valleys running southwards off the northern hills. Curves around the eastern end of the high granite ground through Lelant, St Ives and Towednack parishes and along the Zennor, Morvah and St Just coastal plateau.

HLC Types: Broad Type: Enclosed Land: HLC Type: Prehistoric Enclosed Land, Medieval Enclosed Land, Post-medieval Enclosed Land. Broad HLC Type: Settlement; HLC Type: Village, Hamlet. Broad Type: Woodland; HLC Type: Deciduous Woodland.

‘Well drained gritty loamy soils with a humose surface horizon in places. Some steep slopes. Boulders and rock locally. Over granite and other acid igneous rock.’ ‘well drained podzolic soils over acid igneous rocks. In South West England and the Lake District the parent material is a gritty, sometimes bouldery, granitic Head passing down into deeply weathered and weakly coherent granite. Hard rock is exposed in places as tors and buttresses and adjacent slopes are often strewn with granite blocks.’

‘In west Cornwall the granite Head, known locally as growan, is overlain by silty aeolian drift to give siltier soils which predominate south west of Penzance, but become less important eastwards. Moor Gate (6.12b) and Cucurrian (6.31) soils are found on steep slopes or bouldery ground where agricultural improvement is not possible. On Land's End and the Isles of Scilly intense cultivation over a very long period has produced thick dark topsoils, many qualifying as man-made soils.’

‘Represents most of the enclosed land on granite in Devon and Cornwall, over which there is considerable climatic range. West Cornwall and the Isles of Scilly have significant arable and horticultural cropping but on Bodmin Moor and Dartmoor grassland farming predominates. Where cultivation is not limited by slope or boulders, the soils are easily worked over a range of soil moisture. Though conditions are drier in the autumn and winter cereals are grown in sheltered parts, spring cultivation for arable crops is often carried out with little damage to soil structure. The mild climate of the extreme south-west allows the production of early potatoes and broccoli on sheltered ground on the Land's End peninsula, and narcissi and potatoes on the Isles of Scilly. Many topsoils in these areas have been modified by long term addition of seaweed and by deep cultivation. In west Cornwall, where the soils are slightly droughty for grass, dairying is sometimes on a rotational system with horticultural crops. Under the higher rainfall of the moorland fringe, the soils are better suited to grassland though steep slopes and bouldery ground limit access and some pastures are infested by bracken and provide only rough grazing.’ (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=61102).

Rare, 2.6% of England. Fertility 2/5 (low). Carbon content Medium.

6.11c Manod, Podzols

= Soilscape 13 ‘Freely draining acid loamy soils over rock’

Locations: in West Penwith, this is only recorded along the SE fringe of the uplands, from Crowlas in Ludgvan to Splattenridden in Lelant.

HLC Types: Broad Type: Enclosed Land: HLC Type: Prehistoric Enclosed Land (very small amont), Medieval Enclosed Land, Post-medieval Enclosed Land. Broad HLC Type: Settlement; HLC Type: Village, Hamlet. Broad Type: Woodland; HLC Type: Deciduous Woodland. Broad Type: Ornamental; HLC Types: Parkland, Pleasure Garden, Plantation (especially Trevethoe).

‘Well drained fine loamy or fine silty soils over rock. Shallow soils in places. Bare rock locally. Steep slopes common.’ Over palaeozoic slate, mudstone and siltstone. ‘In the South West, Manod association overlies Devonian and Carboniferous rocks, on steep land at low altitudes and on high moorland margins with more variable slopes, and was formerly mapped as Dartington series. It occurs also on the

metamorphic aureoles of the granite masses of Devon and Cornwall.' Permeable and well-drained.

'Most of the land is in permanent grass, leys or grazing. There is very little arable cropping but cereals are grown locally on gentle slopes, usually at low altitudes, and brassica and root crops are sometimes grown for feeding sheep and cattle. The land is well suited for producing hay and silage where slopes are not too steep. The growing season is about 7.5 months (Smith 1976) and in good years there are over 5 months available for grazing without risk of damage to the sward or soil structure. The soils are naturally acid and phosphate deficient, but when adequately limed and fertilized grass grows well. Where grazing pressure is light, as on steep slopes marginal to moorland, the bent-fescue sward is infested with bracken and gorse. Care is needed to prevent erosion when cultivating or otherwise improving steeply sloping land.' (Cranfield University 2022, https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=61103).

6.12b Moor Gate, Podzols

= Soilscape 13 'Freely draining acid loamy soils over rock'

'Well drained humose gritty loamy soils. Occasionally with thin ironpan. Many steep slopes. Often bouldery or rocky.' On granite or other acid igneous rock.

Locations: in west Cornwall Moor Gate soils are largely confined to the northern and western fringes of the granite, often quite narrow belts on the unenclosed clifftops as on the St Levan and Land's End coasts and on the northern cliffs from Morvah to St Ives. There is a wider area in St Just parish and eight valley-side patches, where the ground steepens.

HLC Types: Broad Type: Rough Ground; HLC Types: Coastal Rough Ground, Valley Rough Ground. Broad Type: Enclosed Land: HLC Type: Prehistoric Enclosed Land, Medieval Enclosed Land, Post-medieval Enclosed Land, Early Modern Enclosed Land, Modern Enclosed Land. Broad HLC Type: Settlement; HLC Type: Village, Hamlet.

'Podzolic soils developed over acid igneous rocks in South West England and in Wales. It is extensive on granite in Devon and Cornwall where the parent material is gravelly granitic Head (growan) with local additions of silty drift. Widespread on the unenclosed moorland margins of Dartmoor, and at lower altitude in west Cornwall.' 'Ranges from sea level in west Cornwall to 550 m O.D. on Dartmoor, the relative proportions of component soil series altering as climate changes with altitude. Moor Gate and Moretonhampstead series are the main soils on cultivated land on the Land's End and Carnmenellis Granites, where aeolian drift gives some silty soils, and Trink and Cucurrian soils occupy steep uncultivated slopes.'

'The most productive land is in west Cornwall where climate is favourable. In West Penwith and on Carnmenellis much has been reclaimed from dry heathland, boulders having been cleared from gentler slopes to provide good grassland. Available water is limited by stoniness to about 100 mm, but there are larger reserves in the more silty soils. The soils are easily cultivated under a wide range of moisture conditions but they are usually on exposed land so are rarely used for arable crops, though some early potatoes and broccoli are grown on Land's End

around St Just. The soils are well suited to grassland being capable of maintaining ample growth throughout the long grazing season. While at most times there is little risk of poaching, the humose topsoils have slightly increased susceptibility when wet compared with the adjacent Moretonhampstead soils.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=61202).

6.31 Cucurrian, Podzolic soil.

Locations: Small patches on valley sides of the Red River in Ludgvan parish.

HLC Types: Broad Type: Rough Ground; HLC Type: Valley Rough Ground.

'With black, dark brown or ochreous humus and iron-enriched subsoils formed as a result of acid weathering conditions. Under natural or semi-natural vegetation, they have an unincorporated acid organic layer at the surface. Well drained, with a bleached subsurface horizon and no thin iron pan. Light loamy material over lithoskeletal acid crystalline rock.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/series.cfm?serno=266&sorttype_series=series_name)

This was identified and described by SJ Staines on very steep ground at Cucurrian in Ludgvan parish, c1km SE of Nancledra and in one or two other patches nearby. It is very stony and was used as rough grazing (Staines 1979, 114-118).

6.5 Stagnopodzols

These are 'mainly upland soils with a peaty topsoil and/or a periodically wet, faintly mottled bleached subsurface horizon, overlying an iron-enriched layer' (Cranfield University 2018, 6).

6.51b Hexworthy, Stagnopodzols

Part of Soilscape 16.' Very acid loamy upland soils with a wet peaty surface'.

All of the Soilscape 16 mapped in West Penwith is of the Hexworthy series.

Locations: in west Cornwall Hexworthy soils are those of the highest ground, on the largely unenclosed uplands from Bartinney and Caer Bran in the south-west through Woon Gumpus and Chun Downs to Watch Croft, the Galvas, Treen and Kerrow Downs to Zennor Hill and the eastern hills of Zennor, Gulval and Towednack as far north as Rosewall and as far south as Castle-an-Dinas, with Trink Hill as an eastern outlier.

HLC Types: Broad Type: Rough Ground; HLC Types: Upland Rough Ground. Broad Type: Enclosed Land: Post-Medieval Enclosed Land, Early Modern Enclosed Land, Modern Enclosed Land, Prehistoric Enclosed Land (small amounts).

Rare, 1.6% of England; Fertility 1/5 (very low); carbon content High.

'Gritty loamy very acid soils with a wet peaty surface horizon, thin ironpan often present. Bare rock and boulders locally. Some steep slopes.' On granite and other acid igneous rock.

'Consists mostly of podzolic soils and extends over the granite outcrop of South West England from 510 m O.D. on Dartmoor to sea level on the Isles of Scilly. In Devon and Cornwall most of the soils are coarse loamy and developed in gritty

granitic Head. On drier granite outcrops on lower ground in west Cornwall Trink soils are widespread under heath and Cucurrian soils are common on steep slopes.'

'The land is open heather moorland with mire vegetation on wetter soils. The grazing is poor because of the low fertility of the acid soils, and the rocky mountainous terrain makes improvements uneconomic. In west Cornwall the soils are mostly unreclaimed because of steep slopes or bouldery ground. The large retained water capacity of humose or peaty topsoils makes them susceptible to poaching and traffic damage during wet periods. With the generally high rainfall in the uplands they are suitable for seasonal grazing only. The heavier grazing pressure on Bodmin Moor has suppressed much of the heather and encouraged Molinia or acid bent-fescue grassland.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=65102).

6.52 Trink, Podzolic soils

Locations: Trink Hill in Lelant.

HLC Types: Broad Type: Rough Ground; HLC Type: Upland Rough Ground.

With black, dark brown or ochreous humus and iron-enriched subsoils formed as a result of acid weathering conditions. Under natural or semi-natural vegetation, they have an unincorporated acid organic layer at the surface.

With a peaty topsoil and periodically wet bleached subsurface horizon over an iron-enriched subsoil. Mainly found in uplands. with humus enriched subsurface horizon over a thin ironpan.

This was identified and described by SJ Staines who mapped it only on the higher slopes of Trink Hill in Lelant parish. It is very stony and the ground surface bouldery and was being used as rough grazing, with thin grasses, bracken and sedges (Staines 1979, 119-123). The land has since had many of its boulder removed.

8 Ground-water gley soils

'These are soils, normally developed within or over permeable materials, that have prominently mottled or uniformly grey subsoils resulting from periodic waterlogging by a fluctuating groundwater-table' (Cranfield University 2018, 6-7).

8.71a Laployd

Seasonally waterlogged soils

Soilscape 19 'Slowly permeable wet very acid upland soils with a peaty surface'

Locations: Twelve patches of such soil were large enough to map. From west to east these are as follows; other smaller patches can be expected in other poorly drained valley bottoms throughout west Cornwall. Wetlands south-east of Mayon Castle in Sennen, north of Trevilley, Sennen, north-west of Brew, Sennen, north of Bosistow, St Levan, on Trevorian Common, Sennen, in the Nanquidno valley, St Just, north of Alsia, St Buryan, east of Bostraze, St Just, north of Grumbla, Sancreed, in Trevider Moor, St Buryan, in Chyenhal Moor, Paul, south of Coldharbour, Towednack.

HLC Types: Broad Type: Woodland; HLC Type: Deciduous Woodland. Broad Type: Rough Ground; HLC Type: Valley Rough Ground.

Rare (2.9% of England); Fertility 2/5 (low); Carbon content High.

‘Consists predominantly of ground-water gley soils formed in drift derived mostly from acid igneous rocks with some slate. The soils occupy low-lying ground affected by groundwater mainly in South West England on the granite outcrops. Coarse loamy humic gley soils of the Laployd series are characterized by a humose or peaty topsoil overlying mottled sandy silt loam or sandy loam which becomes very stony at shallow depth. The soils are permeable but are waterlogged most of the time unless artificially drained. Wetness is caused by a high groundwater-table or from flushes.’

‘Included are narrow strips of wet alluvium, which in Cornwall has usually been disturbed in the search for alluvial tin or china clay. ’ (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=87101).

8.11b Conway

Part of Soilscape 20, ‘Loamy and clayey floodplain soils with naturally high groundwater’

Locations: found along the northern shore of Mount’s Bay from Chyandour to Marazion. Much is now built up with settlement and transport infrastructure.

HLC Types: Broad Type: Enclosed Land; HLC Types: Post-medieval Enclosed Land, Early Modern Enclosed Land, Modern Enclosed Land. Broad Type: Settlement; HLC Types: Town, Village. Broad Type: Rough Ground; HLC Type: Valley Rough Ground.

Rare (2.6% of England), Fertility 3/5 (moderate); Carbon content Medium.

‘Deep stoneless fine silty and clayey soils variably affected by groundwater. Flat land. Risk of flooding.’ On river alluvium.

‘Deep stoneless fine silty soils dominate this association which is found on the floodplains of rivers and streams. The soils are usually greyish brown or grey with yellowish brown mottles and are affected by high groundwater levels. Browner soils occur where the water-table is lower. The association occurs in nearly all parts of England and Wales, as strips along major valley floors. In Cornwall, Devon and Somerset mostly [found] along rivers draining slaty Devonian rocks. Although soils of this association are found in many valleys, most occurrences are too narrow to show on the map.’

‘Winter floods are common and summer flooding also occurs in many areas after heavy rain. This with the high groundwater-table and the difficulty of working wet fine textured soils precludes arable cropping so most of the association is under permanent grass with a little rough grassland and scrub. High groundwater levels and soft wet topsoils lead to a serious risk of poaching especially early and late in the year although field drainage can reduce the risk to some extent. The wildlife habitats provided by the wetter land within the association are becoming increasingly rare with the extension of field drainage. In low backswamps, farthest from the river, field drainage is sometimes prohibitively expensive so these areas can be usefully managed for conservation of wildlife.’ (Cranfield University 2022: https://www.landis.org.uk/soilsguide/mapunit.cfm?mu=81102).

Artificial soils: 11.41 Ludgvan

Part of Soilscape 6, 'Freely draining slightly acid loamy soils', wholly within the Denbigh 2 soil series. Recorded by SJ Staines (1979, 86-96).

Locations: The Golden Mile; the areas with the most intensive market gardening.

HLC Types: Broad Type: Enclosed Land; HLC Types: Medieval Enclosed Land, Post-medieval Enclosed Land, Early Modern Enclosed Land, Modern Enclosed Land. Broad Type: Settlement; HLC Types: Village.

An artificial ('man-modified') soil 'in which the naturally or semi-naturally developed characteristics have been drastically modified in situ as a result of man's intervention. It groups together all soils in which the original biological activity, nutrient relationships and, in some cases, physical properties of the upper layers have been comprehensively modified as a result of disturbance or the addition of material. Although man-modified soils retain some characteristics that enable them to be identified within natural or semi-natural major groups (1 to 8 and 10), the physico-chemical characteristics of their upper layers depend entirely on the type of modification imposed by man. A deeply cultivated, compost-deepened or warp-deepened topsoil.'

'These soils are defined as having either a compost-deepened or warp-deepened topsoil more than 40 cm thick. The group separates all undisturbed soils in which fertility has been substantially increased by the regular addition of bulk manures or earthy materials to the surface. It includes some of the Man-made humus soils originally distinguished by Avery (1980), but excludes those either resulting from unusually deep cultivation or overlying artificially displaced material.'

'All deepened soils with a topsoil horizon more than 40 cm thick resulting from the addition of earth-containing manures or waste materials from former human occupation (middens). The topsoil has a colour value and chroma of 3 or less and contains at least 1% organic matter intimately mixed with the mineral fraction throughout. Artefacts such as pieces of pottery and brick are often present and there may or may not be a sharp lower boundary showing evidence of spade or plough marks. Compost-deepened soils are normally fertile, base-rich and biologically active irrespective of the characteristics of their underlying soil horizons.' (Cranfield University 2022: https://www.landis.org.uk/soilsguide/series.cfm?serno=1145&sorttype_series=series_name).

When Staines recorded this soil type, he noted that it was a soil that had 'been produced by the addition of large quantities of beach sand, dune sand (extremely calcareous), seaweed, town refuse and animal manures' It was unusually rich as a result and 'early potatoes, broccoli, and spring cabbages are widely grown whilst flowers and cereals also occur' (Staines 1979, 87). It is well-drained and tilths are easily generated (ibid, 92-3).