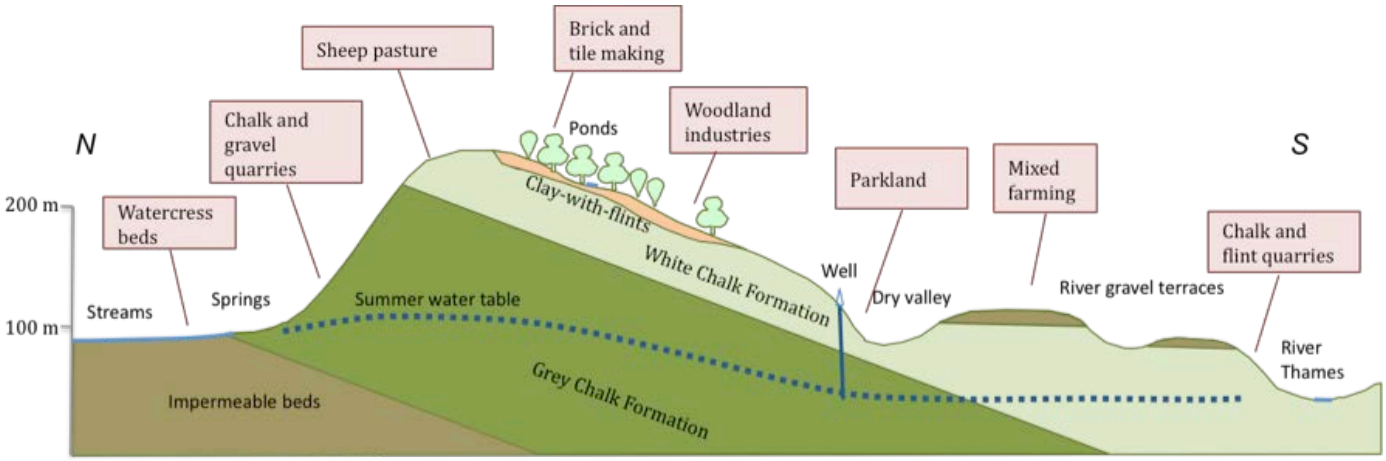
Livelihoods from Chalk

in the Oxfordshire Chilterns

The Chilterns area is distinctive not only in terms of its Natural Beauty, but also in terms of its heritage of regionally-specific livelihoods. Discover here the link between its past and present livelihoods and the underlying chalk geology.

Historically people's livelihoods were closely tied to their local surroundings. They depended on their immediate environment for food and water, and for the materials used in their buildings, crafts and trade. In the Chilterns, the chalk bedrock determined the available resources and hence the livelihoods of those living there; presenting both opportunities and challenges.

The schematic N-S cross section below summarises some of these links between the underlying geology, landscape, land use and associated livelihoods across the Oxfordshire Chilterns:



How did the Chalk form?

Chalk is a very fine-grained limestone whose properties determine the soils, vegetation, drainage and water supply of the Chilterns. It was deposited as a calcareous ooze in clear, sub-tropical seas during the Upper Cretaceous Period from around 100 to 65 million years ago. The different Chalk formations vary in character dependent on their clay content and cementation. The lower Grey Chalk, as its name implies, is grey in colour, due to its higher clay content. The overlying White Chalk consists almost entirely of calcium carbonate but also contains bands of black flint nodules. Flint is a glassy, non-crystalline form of silica thought to be derived from the dissolution of fossil sponges in the watery ooze.

Above the Chalk, sands and clays of the Lambeth Group were deposited. Millions of years later, all these beds were tectonically tilted to the southeast and pushed up above sea level. Fractures formed within the Chalk and erosion removed much of the overlying sands and clays of the Lambeth Group, leaving just a thin residual deposit, the so-called Clay-with-flints, capping the higher levels of the Chilterns.

During the permafrost conditions of the Ice Ages, water could not seep into the Chalk, so surface streams flowed over the frozen ground, carving out valleys which are now dry. Fanlike deposits of flinty gravels were deposited at the base of the steep north-facing escarpment. These are the Wallingford fan gravels of the Ewelme area in which Paleolithic hand axes have been found, - the oldest evidence of human activity in this area. Meanwhile, the ancestral River Thames was finding a route southwards through the Chilterns, leaving behind gravel terraces at various levels as it cut down through the chalk strata.

Livelihoods from Chalk

in the Oxfordshire Chilterns

Chilterns Water Supply and Settlements

Chalk is a highly porous rock. About 40% of the rainfall reaching the ground soaks into the chalk, moving downwards through cracks and fissures until it reaches the water table (the level below which the pore spaces are saturated with water). The rest of the water either evaporates, or is taken up by plants.

Human settlements require a reliable water supply. Rainfall over the Chiltern Hills averages over 700mm per year, yet the scarcity of surface streams on the Chalk has historically restricted both settlement and industry. The earliest villages lay either along the Thames, or near springs along the margins of the hills. The parishes of the Thames villages were elongate strips, running up from the river into the hills, thereby incorporating a variety of habitats for different livelihoods. A riverside village often had its corresponding hill hamlet. Thus the parish of Littlestoke on the Thames incorporated the hamlet of Checkendon in the hills.

Pond "The Sea" in former clay pit overlying chalk at Nettlebed

Ponds: Where impermeable surface clays overlie the Chalk, water is retained in ponds at the surface. Thus, in the area of Clay-with-flints, small surface ponds historically provided water for the hill hamlets such as Russell's Water, Cray's Pond, Nettlebed, Woodcote and Checkendon. However these ponds often dried up in times of drought and other sources of water were needed. Water was once hauled up to Woodcote from the River Thames in horse-drawn carts, to be sold at a penny per bucketful!

Springs: Water cannot percolate down through the impermeable beds (such as the Gault Clay) underlying the Chalk, so at the base of the Chalk, water flows sideways to emerge as surface springs, most notably along the base of the Chilterns escarpment. These springs enabled the development of spring-line villages (from Wallingford to Chinnor) along the route of the ancient Icknield Way. A variety of industries developed along these chalk streams including milling (with watermills built at Watlington and Ewelme), trout fisheries and, most successfully, watercress cultivation.

Ewelme watercress beds

Watercress is considered to be a "natural superfood" and grows best in streams such as those fed by chalk springs, with a regular flow of slightly alkaline water. Many Chilterns villages had watercress beds, but those at Ewelme were the largest, and gained a national reputation. The constant temperature of the springwater at 10.3 ˚C allowed year-round growth. Large-scale cultivation at Ewelme began in 1886 with the construction of a series of 39 cascaded, shallow beds. Commercial production lasted until 1988. Sadly, these beds no longer comply with modern standards of food safety and water purity, and now the "Friends of Ewelme Watercress Beds" maintain these beds as a thriving wildlife habitat.

Wells: For a reliable water supply, villages on the Chiltern uplands needed to sink wells to reach the water table which in some cases could be up to 130m below the surface. At Grey's Court, a well dating from the 12th century was dug to 60 m below the surface. A wooden donkey-operated tread-wheel was built in Tudor times to raise the buckets of water. This can still be seen today.

This leaflet was produced by Oxfordshire Geology Trust with the support of the Chilterns Conservation Board

The Chilterns Conservation Board

Livelihoods from Chalk
in the Oxfordshire Chilterns

At Stoke Row the famous Maharaja's well was dug to 110m below the surface. It was completed in 1864 and paid for by the Maharajah of Benares. An ornate Mughal-style superstructure protects the winding mechanism, which is surmounted by a gilded elephant. Some modern, large-diameter boreholes in the chalk can flow at a rate of 125 litres per second due primarily to the presence of fractures in the chalk enhancing its permeability. Piped water now supplies villages throughout the Chilterns and has led to rapid expansion of some of the upland settlements. The population of Woodcote was around 500 until the 1950s, but had grown to 2550 by the year 2000.


Maharaja's Well

The Chalk Aquifer: The Chalk is one of the most important aquifers (underground water storage system) in southern Britain. It supplies 55% of all the UK drinking water abstracted from underground sources. The Chalk layers dip underneath the London Basin, so rainwater falling in the Chilterns also supplies wells in the London area, making an important contribution to the Capital's economy.

Agriculture and Land Use

Soils result from the action of weathering and biological processes on the underlying rocks. Land use reflects soil quality, which varies primarily with the nature of the underlying geology and superficial deposits.

Steep chalk escarpment and valley slopes: Here soils tend to be well-drained but thin and nutrient-poor. Prior to human intervention, the natural vegetation was woodland, but grassland was created from as early as the Bronze Age through woodland clearance, burning, and grazing.
The chalk pastures of these downlands have long been an important resource for grazing sheep (and cattle), but without such grazing the habitat eventually reverts to scrub.


Chalk grassland on escarpment slope at Christmas Common


Beech woodland on Clay-with-flints

Clay-with-flints on the Chilterns uplands: The Clay-with-Flints covering the higher plateau areas of the Chilterns, provides acidic, poorly-drained, reddish clayey soils. The area was originally covered with woodland of native oak, hazel and beech. In medieval times these woods were coppiced to provide timber, firewood and charcoal for local use. During the 16th and 17th century growth of London, they provided increasing quantities of firewood for the capital.

This leaflet was produced by Oxfordshire Geology Trust with the support of the Chilterns Conservation Board

The Chilterns Conservation Board

Livelihoods from Chalk

in the Oxfordshire Chilterns

However, as coal replaced firewood for domestic use, this trade declined and alternative woodland industries developed, especially the production of chairs and other turned items. Individuals known as *bodgers* set up camp in the woods to cut and split logs into wooden *billets.* From these they turned the spars and legs for Windsor chairs, using a simple pole lathe. Beech was the preferred timber, and as a result the mixed woodlands were gradually replaced with beech high forest, which became the dominant woodland by the 19th century. Local pubs such as the "Crooked Billet" in Stoke Row served as collection points for billets that were then supplied to furniture workshops in local towns. The 1851 census recorded 43 chair-makes living in Chinnor. However, by the end of the 19th century, machine tools had mostly taken over from bodgers. The Oxfordshire Chilterns are still covered with some 30% of woodland.
Cherry orchards were widespread in villages such as Stoke Row. During the 1920s, up to 2 tons of cherries would be carted from the village daily during the season, mainly to the Oxford Market.

Owen Dean, the last itinerant Chilterns bodger, at work in 1958 in the beechwoods. Photo courtesy of Chiltern Society Photogroup archive)

Calcareous soils of the valley floors, dip slopes and gravel river terraces: Loamy brown-earth soils with good drainage are the predominant type. These thicker soils support a mixture of arable and livestock farming with scattered woodlands, often managed as part of large estates. Wheat and barley are the most important crops grown , with some oats and oilseed rape.

Beehive kiln, Chinnor. Photo Quiller Barrett (courtesy of Chiltern Society Photogroup archive)

Making use of chalk, flint and clay

Quarrying: Calcium carbonate, the principal component of chalk, is an important industrial raw material. It is a source of the lime used in mortar, plaster, limewash and for improving acid soils. It is also the main input for cement production and many industrial processes.

At Chinnor, chalk was initially quarried as an input to the six beehive-shaped kilns of W. E. Bentons Limeworks, which produced lime from 1909 to 1938. One of these kilns survives as a listed building. From 1919 cement was also produced on an industrial scale. The significant clay content of the Grey Chalk quarried here reduced the need for other input minerals. At their peak the cement works employed 120 workers, but production closed in 1999. This former industrial site has been demolished and is currently being redeveloped as the location for 178 new homes.

The Wallingford Fan Gravels have been quarried from a number of sites in the Ewelme area since the 19th Century, but active gravel removal has now ceased. These quarries were taken over in the 1940s by a London company, Grundon, which began a landfill operation in the disused quarries. This major firm's national headquarters remain in Ewelme. its location a consequence of the earlier quarrying history of this site. It is an important local employer.

Les Westcott, formerly employed at the Chinnor cement works, in front of the flooded chalk quarries. Photo by M. Bowker (courtesy of Chiltern Society Photogroup archive)

This leaflet was produced by Oxfordshire Geology Trust with the support of the Chilterns Conservation Board

The Chilterns Conservation Board

Livelihoods from Chalk

in the Oxfordshire Chilterns

Brick, tile and pottery making: Nettlebed and Stoke Row lie in the wooded Chilterns uplands, on similar small outcrops of the clays and sands of the Lambeth Group. These provided the raw materials for clay-based industries from as early as the 15th century. The commons and woods south of Stoke Row are riddled with clay pits, and traces of kilns and works survive nearby. Brick and tile making, and lime burning were often combined with pottery making. Many kiln men also worked on the farms as the season demanded.

Parish records from the 17th and early 18th centuries show 17 wills of tilers, brick makers, bricklayers and kiln men from Nettlebed, Crocker End and Rotherfield Greys. "The Nettlebed Pottery" manor house and kiln owned by Thomas Wood is recorded on the Stonor Estate Map of 1725. A directory entry for this pottery in 1915 advertises that it had been established since 1706. It is likely that pottery ceased to be made before World War 1, although brick making and lime burning continued until its closure in 1938. The last kiln used at the Nettlebed Pottery was an 18th century bottle kiln that was adapted for lime burning. This survives today and is preserved by local subscriptions and grants from various Trusts and government.

Brick kiln, Nettlebed

Swyncombe church: field flints in roughly-coursed rubble walls.

Building Stones – Chalk and Flint: Historically, builders in the Chilterns area exploited materials that lay close at hand. Loose flints were abundant in the upland fields and could also be quarried from the White Chalk. Rough flints were used from an early time to build rubbly walls held together by lime mortar. Flint, being irregular in shape was unsuitable for the corners, door and window surrounds of a building, for which either imported limestone or bricks were used. By the mid-19th century knapped (shaped) flints were being used, either laid in courses or used in elaborate chequerwork patterns with limestone.

Ewelme church: Knapped flint and limestone chequerwork

Berrick Salome: wall of banded flint and chalk clunch, with brick dressings

Although chalk is generally a poor building stone, harder bands in the Grey Chalk provided a building stone known locally as chalk clunch. It was often used in combination with flints and bricks. A local walling style used chalk clunch in alternating bands with flint. Mortar was made from lime derived from ground-up chalk, together with sand and gravel from the deposits of Clay-with-flints.

This leaflet was produced by Oxfordshire Geology Trust with the support of the Chilterns Conservation Board

The Chilterns Conservation Board