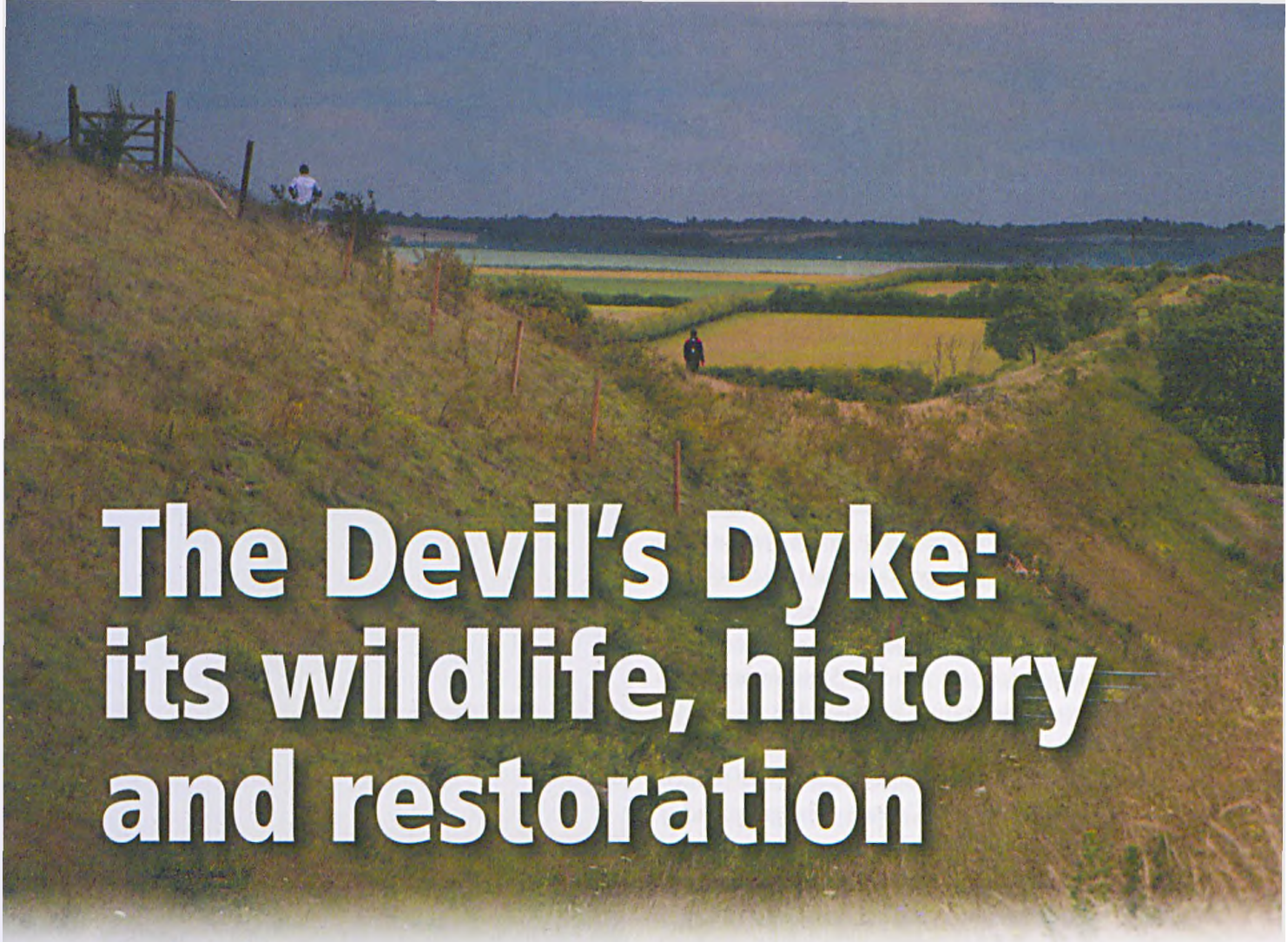

The Devil's Dyke: its wildlife, history and restoration

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The Devil's Dyke stretches for 11.5km and reaches heights of up to 10.5m. Stephen Kelly/Alamy Stock Photo

The Devil's Dyke, in east Cambridgeshire, is the finest Anglo-Saxon earthwork in the country, stretching for 11.5km in a near-straight line from the edge of the fen at Reach, across the open chalk landscape near Newmarket to the woodland at Ditton Green. It would be a striking feature wherever it was situated, but set within the gently undulating and low-lying landscape of East Anglia its visual impact is even more dramatic. The Dyke can be seen from many parts of Cambridgeshire, and it provides extensive views as far as Ely Cathedral. It consists of a ditch (or fosse), open to about 4m below present ground level, and an embankment (or vallum), up to 5m above adjacent ground level. The Dyke is the largest monument of its kind in Britain, with a total area of 89ha. Its highest point is Galley Hill, where it is 10.5m in height, and at its most extensive it is 36.5m wide.

In addition to its historical interest, Devil's Dyke is a chalk grassland of national and international importance for wildlife. The steep slopes and thin soils of its embankments and ditches have, as with many other earthworks, proved perfect for colonisation by a chalk-grassland flora. It is designated as a Site of Special Scientific Interest, and part is a Special Area of Conservation for its orchid-rich grasslands. It has, however, suffered in recent decades from scrub encroachment, a fate that has befallen so many chalk grasslands in southern England. This article explores the natural history of this remarkable feature and describes the work being done to restore it to its former glory.

History

Archaeological investigations have been unable accurately to date the construction of the Dyke, but it is thought to have been built at some time between the 5th and early 7th centuries (Malim *et al.* 1997). It is most likely to have been constructed by East Anglian Saxons to defend against attack by Mercians from the west (Fox 1923). It would originally have spanned the narrow, open chalk landscape that lay between the wet and impassable fens to the north and the rolling, thickly wooded landscape of the clay ridges to the south-east,

thus forming an effective barrier and making circumnavigation difficult. While we shall never know for certain its purpose, it is clear that the construction of the Dyke took many years, although a layer of silt in the bottom of the ditch suggests that it may have quickly become redundant, perhaps overtaken by wider geopolitical events.

Wildlife

After abandonment, the Dyke would have initially been colonised by native plants, before eventually being incorporated into farm holdings. It was used for centuries as grazing land, which, because of its shallow chalk soils, produced a typical chalk-grassland flora. The Dyke also has extensive areas of chalk scrub and, towards its southern end on the higher ground around Stetchworth and Woodditton, some mature woodland.

The embankment is home to a variety of wildflowers, shrubs and insects, many of which are nationally or regionally rare. The grassland is characteristic of chalklands of south, central and eastern England, but such habitat now has a very restricted distribution in Britain, and is particularly rare in Cambridgeshire. The species-rich grassland on the Dyke can be classified under the following community types: CG3 *Bromopsis erecta*, CG4 *Brachypodium pinnatum* and CG5a *Brachypodium pinnatum–Bromopsis erecta* grassland. Species that are typically present within these communities include Salad Burnet *Poterium sanguisorba*, Common Rock-rose *Helianthemum nummularium*, eyebrights *Euphrasia*, Carline Thistle *Carlina vulgaris* and Common Milkwort *Polygala vulgaris*. In botanical terms, however, the site is perhaps most famous for its population of the nationally rare Lizard Orchid *Himantoglossum hircinum*. The numbers of this species on the Dyke fluctuate greatly, but this colony is one of the longest-known, and strongest, in Britain. It is also the only British population of Lizard Orchids known from semi-natural chalk grassland.

The Dyke supports a number of other rarities, many of which were first recorded during visits by the eminent botanist John Ray or the local naturalist Leonard Jenyns. Among these are the nationally vulnerable Spotted Cat's-ear *Hypochaeris maculata* and three nationally scarce species, Pasqueflower *Pulsatilla vulgaris*, Field Fleawort *Tephroseris integrifolia* and Bastard Toadflax *Thesium humifusum*, as

Pasqueflower is one of the specialities of the Dyke. Laura Watson/WTBCN

Devil's Dyke is the only site in Britain at which Lizard Orchids grow in chalk grassland. Kevin Maskell/ Alamy Stock Photo

well as three regionally rare chalk-grassland species, namely Spring-sedge *Carex caryophyllea*, Purple Milk-vetch *Astragalus danicus* and Bloody Crane's-bill *Geranium sanguineum*. The fortunes of these specialities have been mixed. Spotted Cat's-ear had declined to just a handful of plants in one location at the time of the last survey. Field Fleawort has also declined in places, as has Purple Milk-vetch, which appears to have been lost from the top of the ditch as paths have widened owing to increased recreational use. Bastard Toadflax, Bloody Crane's-bill and Pasqueflower remain locally abundant, the last of these being best observed on the racecourse and golf-course sections. Three other species, Marjoram *Origanum vulgare*, Hawkweed Oxtongue *Picris hieracioides* and Saw-wort *Serratula tinctoria*, are rare on chalk but more common on other soils in

the region. While the Dyke still retains a great deal of its botanical interest, some species have been lost: Burnt Orchid *Neotinea ustulata* was last recorded in 1955, while the Breckland specialities Purple-stem Cat's-tail *Phleum phleoides* and Breckland Thyme *Thymus serpyllum* disappeared in the 19th century (Leslie 2011). These species presumably thrived in periods of more intense grazing by sheep and Rabbits *Oryctolagus cuniculus*, but were lost as regular grazing ceased. The chalk scrub is dominated mostly by Hawthorn *Crataegus monogyna*, together with Buckthorn *Rhamnus cathartica*, Wild Privet *Ligustrum vulgare* and wild roses *Rosa*, but Blackthorn *Prunus spinosa* and Dogwood *Cornus sanguinea* are abundant in some parts.

The combination of grassland, scrub and woodland is valuable for a number of insects that are now uncommon in Cambridgeshire. Among the butterflies, the Dyke supports a strong population of Chalk Hill Blue *Polyommatus coridon*, which has increased in recent decades, thus bucking the trend seen in many other parts of southern England. Brown Argus *Aricia agestis*, Dingy Skipper *Erynnis tages* and Green Hairstreak *Callophrys rubi* are also present, as well as Small Blue *Cupido minimus*. The last-mentioned species appears to favour Kidney Vetch *Anthyllis vulneraria* growing on bare clinker and the steep eroding chalk slopes where the former Cambridge-to-Mildenhall railway line cuts through the Dyke. Other notable invertebrates include the Hawthorn Jewel Beetle *Agrilus sinuatus*, Downy Back Beetle *Ophonus puncticollis*, Green Tiger Beetle *Cicindela campestris*, the flies *Cistogaster globosa*, *Dolichopus agilis*, *Eudorylas arcanus* and *Thecocarcelia acutangulata*, and various Hymenoptera, such as Large Garden Bumblebee *Bombus ruderatus*, Two-coloured Mason Bee *Osmia bicolor*, Grey-gastered Mining Bee *Andrena tibialis* and Lobe-spurred Furrow Bee *Lasioglossum pauxillum*. The south-east to north-west orientation of the ancient earthwork means that each side provides notably different conditions, which allows species to make subtle shifts in their distribution in order to adjust to weather conditions. The rare Heath Snail *Helicella itala*, for example, occupies the shaded northern side in hot, sunny summers, and moves to the sunnier southern face in wetter, cooler summers. In a part of the country where cover and semi-natural habitats are scarce, the Dyke is a good nesting area for birds such as Whitethroat *Sylvia communis*, Yellowhammer *Emberiza citrinella*, Skylark *Alauda arvensis* and Meadow Pipit *Anthus pratensis*.

20th-century decline

Changes in agricultural practices over the past two centuries and the increasing specialisation of farms have resulted in most of Cambridgeshire's farmland being converted to arable, which is favoured by the gently undulating land and lack of steep slopes. Much of this conversion took place in the 19th century, but it continued into the 20th century. Chalk grasslands survived only on ancient monuments, former quarries, golf courses, racecourses and their associated training areas, and road verges. As mixed farming and numbers of livestock declined in Cambridgeshire, grazing of Devil's Dyke was eventually stopped and, as a result, scrub began to take hold and expand rapidly – at the expense of species-rich grassland. This problem was exacerbated by the crash in Rabbit populations in the 1950s. With the reduction in the area of grassland on the Dyke, many species suffered heavy decline and some were lost entirely.

Photographs from early in the 20th century show the Dyke to be almost devoid of trees and shrubs, but scrub had expanded to cover large swathes by the 1970s and 1980s. Exceptions to this were Galley Hill, where the landowner, John Clarke, took an interest in wildlife and kept scrub clear from his section of the Dyke, and the Newmarket Racecourse section, which was kept scrub-free by annual burning until the 1980s (Donald 1979). This latter section is where the Lizard Orchid is found.

Early conservation efforts

The earliest recorded scrub clearance for conservation was in 1959, when a Civic Trust party spent a week at the Dyke (Hall 1960). In the 1970s, volunteers from the Cambridgeshire and Isle of Ely Naturalists' Trust (now the Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire [WTBCN]), the Cambridge Conservation Corps and students from the University of Cambridge cleared scrub from patches of surviving grassland. This work was extended to clear areas of dense scrub from two places; these were initially colonised by 'weedy invasive species', and then became dominated by grasses of mesotrophic grassland, mainly Cock's-foot *Dactylis glomerata*

and False Oat-grass *Arrhenatherum elatius*, rather than the desired chalk-grassland species. A study by Grubb & Key (1975) investigated why this occurred by carrying out extensive soil analyses and examining the growth of weedy species (Cleavers *Galium aparine* and Prickly Sow-thistle *Sonchus asper*) in soils from chalk grassland and from under dense scrub. The study demonstrated that there were not only higher total concentrations of nitrogen and phosphorus in topsoil under scrub, but also much greater amounts of available nitrate and phosphate, which resulted in far more vigorous growth of weedy species. A further element of this research tested the hypothesis that the sowing of Upright Brome *Bromopsis erecta* on soil cleared of scrub will lead to a decrease in fertility and thus provide suitable soil conditions for the establishment of chalk grassland. In the late 1970s and early 1980s, some of the areas cleared of dense scrub were sown with Upright Brome seed collected from elsewhere on site. This appeared not to have much impact in the first couple of years, but after six or seven years there had been a significant reduction in soil fertility compared with unsown areas.

In 1991, a new tenant of Ditch Farm – a Cambridgeshire County Council farm tenancy which covers a significant part of the Dyke – entered his portion of land into the Countryside Stewardship Scheme. Grazing was reintroduced and extended to John Clarke's land (which was then being looked after by his son). This allowed one of the largest remaining areas of grassland to be preserved, although the timing and intensity of grazing conflicted occasionally with management for wildlife interest, particularly the maintenance of structurally diverse grassland for invertebrates. In the 1990s, the Cambridge Green Belt Project, based at WTBCN, began organising regular volunteer work parties to maintain some of the remaining open-grassland areas, as well as trying to secure money to extend and link these. This supplemented the work of the Cambridge Conservation Volunteers and local Butterfly Conservation volunteer groups.

Restoration

The organisations involved in management of the Dyke were struggling to slow scrub encroachment, but the advent of the Heritage Lottery Fund (HLF) provided an opportunity to seek the scale of funding required to restore the site. A partnership was formed between Cambridgeshire County Council (landowner, and also holding responsibility for access and archaeology), English Nature (now Natural England), English Heritage (now Historic England) and the WTBCN, supported by the many landowners and the Friends of Devil's Dyke. The Devil's Dyke Restoration Project undertook major work between 2002 and 2007 to restore the site to its former glory, while a condition of the HLF grant was that the partners would continue management of the sensitive habitats and archaeology for a period of at least ten years. The aim at the outset was to restore the site to grassland and to install a

The Galley Hill section of the Dyke in 1910 (left) and 2003 (right). Devil's Dyke, in common with many other chalk grasslands, has suffered from the encroachment of scrub. Photographer unknown (left); James Fisher (right)

grazing infrastructure that would allow landowners effectively to graze or arrange grazing of their land in the future. All landowners would be encouraged to enter into an agri-environment scheme and eventually take on responsibility for the ongoing management of their respective sections.

The restoration aimed to clear 90% of the scrub from the four 'grassland' sections of the Dyke, which covered more than five miles (8km) of its length, between Reach and the Newmarket railway line. This was a compromise between the archaeological objective of no scrub (or at least no trees large enough to fall over and damage the structure of the monument) and the ecological objectives of creating species-rich chalk grassland mixed with chalk scrub habitats, which are of value to invertebrates and birds. The general plan was to work section by section, clearing scrub and treating stumps with an approved herbicide, reseeding cleared slopes, installing fencing and gates, undertaking follow-up treatment of scrub regrowth and finally commencing a grazing and/or flail-mowing grassland management regime. Scrub was cleared in the autumn and winter months, with stock fencing and access gates installed over the spring and summer. Seeding was undertaken in either spring or autumn following scrub clearance, and the seed was applied via a method known as hydro-seeding (spraying a slurry of seeds and mulch), which is widely used in major landscaping schemes on steep slopes such as new motorway road verges.

Upright Brome was seeded with a view to reducing available nutrients, for the benefit of other species. This was sown in a 50:50 mix with Sheep's-fescue *Festuca ovina*, which was chosen because its smaller seeds were more likely to establish on the steep slopes, thereby helping to meet the requirement of the archaeologists that there would be a growth of rapidly stabilising vegetation. Seed of local provenance would have been desirable, but it was possible to collect only Upright Brome locally, from Therfield Heath and Newmarket Heath. Sheep's-fescue had to be brought in from farther afield, but was collected from wild populations in southern England.

Monitoring

In 2007, WTBCN, with advice from Professor Peter Grubb, established two plots to monitor the effects of restoration on plant communities. These were

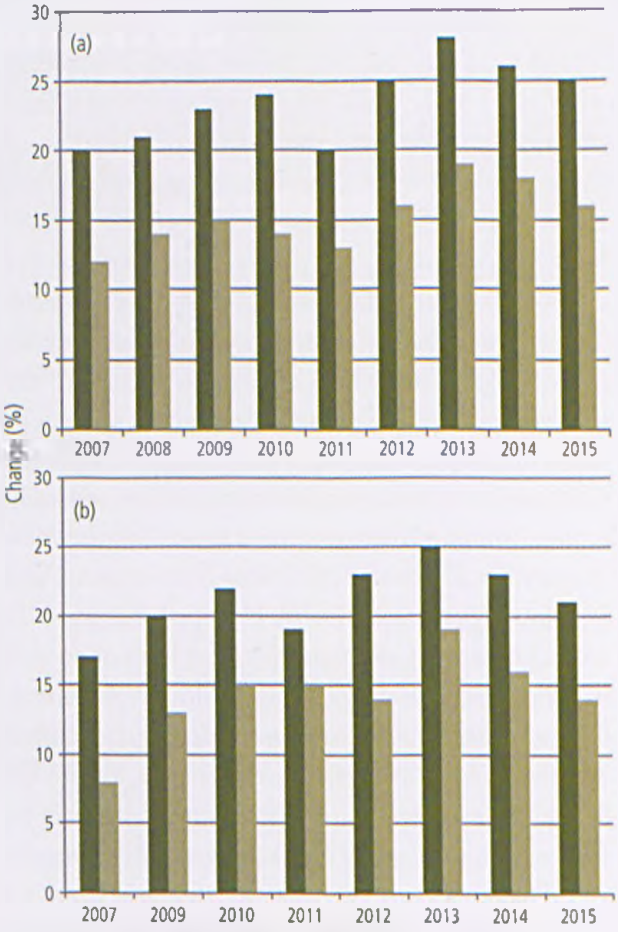

Figure 1. Changes in the numbers of chalk-grassland indicator species at the Ditch Farm section (a) and the railway section (b) of Devil's Dyke following restoration work between 2003 and 2005. ■ All chalk-grassland indicator species; ■ strong chalk-grassland indicator species.

located within two sections of the Dyke (Ditch Farm and Railway) that included small areas of remnant grassland, along with significant areas that had been cleared of dense scrub and reseeded between 2003 and 2005. The presence (or absence) of desirable chalk-grassland species and undesirable weedy species was noted. The monitoring found that the reseeded grass species, Upright Brome and Sheep's-fescue, established well in both plots, while less desirable grasses, such as Cock's-foot and False Oat-grass, generally remained suppressed. Reseeding was, however, less successful in some areas outside the monitoring plots; in these, Cock's-foot and False Oat-grass had become dominant. This failure may have resulted from the fact that the sowing of seeds coincided with spring droughts, which are a common occurrence in Cambridgeshire, one of the driest counties in England.

Chalk-grassland indicator species have increased in each monitoring plot over the recording period (Figure 1). Nearly 80% of the available chalk-

grassland species have colonised (compared with 57–68% in the original 1970s plots when they were at a similar stage). Colonisation is still a slow process, however, and the majority (75–80%) of these species remain rare within the plots. Where reseeding was less successful and coarse grasses have become dominant, fewer than half of the chalk-grassland indicator species have colonised. These figures do, though, mask variations among individual species, which are usually related to the localised presence of plants able to act as sources of seeds or propagating material. Greater Knapweed *Centaurea scabiosa* has constantly colonised well, while Common Rockrose, Wild Basil *Clinopodium vulgare*, Small Scabious *Scabiosa columbaria*, Field Scabious *Knautia arvensis*, Harebell *Campanula rotundifolia* and Common Milkwort have done well in some areas but only colonised slowly elsewhere. Clustered Bellflower *Campanula glomerata*, Carline Thistle, Fairy Flax *Linum catharticum*, Glaucous Sedge *Carex flacca* and Salad Burnet have been slow to colonise, while Quaking-grass *Briza media* and Dwarf Thistle *Cirsium acaule* have yet to colonise the monitoring plots, despite being present nearby.

Scrub is returning to both monitoring plots. The dominant scrub species prior to the restoration project was Hawthorn, with Blackthorn the next most common. These species are still present, but there have been noticeable increases in Wild Privet and Bramble *Rubus fruticosus*. The herbicide treatment was effective on a high proportion of the larger bushes, but was less successful on the smaller scrub. This has been compounded by a lack of sufficient grazing of the newly cleared compartments, which was due to the large extent cleared in each of the five years of the restoration project. Flail-mowing has also encouraged suckering among some of the young scrub, particularly Wild Privet, which has spread. This has, if anything, made future treatment more difficult.

The future

The formerly isolated sections of chalk grassland along the Devil's Dyke are now linked, providing greater scope for the spread of key plants and invertebrates. Recovery over the entire four miles (6.4km) of this linear site is, however, likely to be a slow process. Nevertheless, restoration has created a significantly larger area of potentially high-quality chalk-grassland habitat in a county with very little semi-natural grassland.

The restoration project was largely successful, but challenges remain. The biggest of these is the control of scrub regrowth, which is closely linked to the need to secure sufficient grazing at the right times of year. The encroachment of scrub and coarse grasses is a problem on chalk grasslands across southern England (see, for example, *BW* 29: 184–189). At other chalk-grassland sites nearby, mechanical removal of scrub, including the roots, has been successfully undertaken, significantly reducing the amount of scrub regrowth. This is not an option at the Devil's Dyke, however, as the process would damage the ancient monument. There are also fewer sheep available to graze in Cambridgeshire than on the more extensive downlands of southern England, but grazing has been reintroduced and expanded to cover a greater area of the Dyke. As a result, there are larger areas of chalk grassland in good condition, and others that are in the process of restoration. It will be interesting to revisit the site in 10–15 years' time to examine the long-term effects of restoration.

For now, at least, the Devil's Dyke is once again a visible and impressive monument, and the future of its wildlife is more secure.

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