European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Tregonning Hill Special Area of Conservation (SAC)
Site Code: UK0012604

Marsupella profunda western rustwort (photo credit D. T. Holyoak)

Date of Publication: 11 February 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Tregonning Hill SAC.

This advice should therefore be read together with the SAC Conservation Objectives available here

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Tregonning Hill Special Area of Conservation (SAC)
Location	Cornwall
Site Map	The designated boundary of this site can be viewed here the MAGIC website
Designation Date	1 April 2005
Qualifying Features	See section below
Designation Area	5.21 ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Tregonning Hill SSSI
Relationship with other European or International Site designations	N/A

Site background and geography

Tregonning Hill, located approximately 6 km west of Helston, in underlain by the Tregonning Granite, a detached outcrop of the Cornubian batholith. Zones within the granite were altered by kaolinisation (a process of decomposition) and have since been worked for china clay. Granite is composed of three main minerals, feldspar, quartz and mica. Decomposition of the white feldspar component of the granite produces kaolinite, the main constituent of china clay.

China clay was first discovered in Cornwall at Tregonning Hill, by William Cookworthy in 1746. The supply of china clay at Tregonning Hill was limited in quantity and quality, and was overtaken in 1748 by the discovery of a larger and more pure china clay resource in the St Austell area of mid-Cornwall. Evidence of this previous mining activity at Tregonning Hill can be seen in the profusion of disused pits, gullies, spoil tips and granitic debris.

Marsupella profunda western rustwort is an internationally rare liverwort which was first found in Britain at Tregonning Hill in 1993. The site has become progressively overgrown and the lack of suitable habitat has resulted in the decline of *Marsupella profunda*, by 1999 only a tiny relict population was present and the species was lost from this site between 1999 and 2003, and has not been re-found here since (latest survey 2011).However more extensive surveys of china clay sites during the period 1996-1998 discovered large populations of *Marsupella profunda* at sites in the St Austell china clay district and in former clay workings in west Cornwall, near to St Just.

Marsupella profunda is a mobile colonist species and a poor competitor, in Britain it is restricted to soft granite and damp, bare china clay waste. At Tregonning Hill *Marsupella profunda* colonises bare granite outcrops and boulders of weathered granite within and around the former china clay workings. Much of the site supports western lowland heath dominated by heather/ling *Calluna vulgaris*, bell heather *Erica cinerea* and western gorse *Ulex gallii,* with bilberry *Vaccinium myrtillus* and tormentil *Potentilla erecta.* Scrub vegetation, dominated by European gorse *Ulex* europaeus, bracken *Pteridium aquilinum* and

bramble *Rubus fruticosus* agg. has developed on the deeper soils of the hill slopes. Wetter conditions are indicated by the occurrence of cross-leaved heath *Erica tetralix.*

The SAC lies within the Cornish Killas National Character Area (NCA 152).

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying Species:

- **S1390 Western Rustwort *Marsupella profunda***

Marsupella profunda western rustwort is an internationally rare liverwort, endemic to western Europe. It has a strongly oceanic distribution, and is known only from a small number of sites in Portugal, the Azores, Madeira and the UK where it is restricted to Cornwall. The UK population of *Marsupella profunda* is important in a European context and surveys and research have shown that a large proportion of the global population of Marsupella profunda occurs in Cornwall, within disused china clay workings in west Cornwall and within the working china clay district of St Austell in mid Cornwall.

Marsupella profunda is a specialist of open clay substrates and kaolinised granitic material (boulders, rock outcrops) which are bare or in the early stages of colonisation by filamentous algae and other small bryophytes. *Marsupella profunda* often grows intermixed with the similar species, *Marsupella sprucei*, and/or with *Marsupella emarginata*.

Marsupella profunda is a 'mobile' colonist species, which functions as a typical 'metapopulation'. This species is limited by the duration of suitable habitat. The maintenance of the metapopulation relies on a balance between local extinctions due to vegetation succession, and its ability to colonize new sites. The critical requirement of a metapopulation is the continual availability of suitable habitat.

A metapopulation is the overall population within a general area, consisting of a number of, subpopulations which may be temporary in nature, with a balance between local extinctions and colonisation of new sites.

Marsupella profunda is a poor competitor which is soon shaded out as other plants become established. It freely produces wind-blown spores, a typical reproductive strategy of a colonist. Factors influencing the success of colonisation are spore production, dispersal distance, rates of establishment and survival, and most importantly, the availability, proximity and spatial distribution of habitats suitable for colonisation.

Table 1: Supplementary Advice for Qualifying Features: S1390. *Marsupella profunda* *

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance**	Restore the abundance of the population to a level which is above the 1998 baseline population cover of 15 cm^2,	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of	HOLYOAK D. T. 1996 HOLYOAK D. T. 1997 HOLYOAK D. T. 1998 HOLYOAK D. T. 1999 HOLYOAK D. T. 2003 HOLYOAK D. T. 2006 HOLYOAK D. T. 2009 CALLAGHAN D. 2011

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available. The **restore** target has been selected because of the loss of Marsupella profunda from Tregonning Hill SAC: *Marsupella profunda* was first found in Britain at Tregonning Hill in 1993 (very small colony). The population peaked in 1998 but by 1999 only a tiny relict population was found and it was lost from the site between 1999 and 2003. Subsequent surveys, the latest in 2011, have failed to re-find it at this site. Previous population size/cover estimates for *Marsupella profunda*, taken from survey reports: 1996 9 cm^2 1997 10 cm^2 **1998 15 cm^2** 1999 1.5 cm^2 2003 4 cm^2 2005 0 cm^2 2009 0cm^2 2011 0 cm^2	
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Restore the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site. Supporting habitat for this species is bare, soft granitic rock, soft granitic boulders and firm clay substrates	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Because of the meta-population nature of this species, as well as restoring the distribution of supporting within the SAC boundary, opportunities to create / restore suitable habitat outside the SAC boundary should be taken where appropriate.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Restore the total extent of the habitat(s) which support the feature. Baseline values for the extent (area ha) of suitable habitat will need to be determined.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. Tregonning Hill *Marsupella profunda* occurred on bare outcrops, vertical granite rock faces and weathered granite boulders, within this former china clay working. Large areas of bare, soft granitic rock and clayey granitic boulders and spoil need to be re-exposed to provide suitable habitat for re-colonisation by *Marsupella profunda* (see management recommendations in 'Conservation measures' attribute above).	CALLAGHAN D. 2011
Supporting habitat: structure/ function	**Bare ground and vegetation structure**	Ensure the total extent of unshaded, bare ground is at least 80% within areas of suitable habitat, with other pioneer bryophytes, scattered seedlings and grasses at a low level and not out-competing *M. profunda*.	*M. profunda* is readily out-competed by other more vigorous bryophytes, such as *Diplophyllum albicans*, and vascular plants, and thus a sufficiently high level of bare ground should be available for colonisation by this pioneer species. Bare ground includes clay substrates, rocks, stones and thin algal crusts.	CALLAGHAN D. 2011
Supporting habitat: structure/ function	**Hydrological regime**	Maintain the hydrology of sites at a level appropriate for *M. profunda*, which favours humid conditions.	*M. profunda* favours moist substrates and humid conditions, for example it is known to favour boulders in flooded disused pits where humidity is permanently high. It may be beneficial to place suitable boulders within such pits as habitats for the species after sites have been worked. *Marsupella profunda* requires sheltered sites with humid	PORLEY R. & HODGETTS N.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			conditions in well-drained topographic situations.	
Supporting habitat: structure/ function	**Scrub and tree cover**	Restore the total extent of the cover of scrub and trees where *M. profunda* grows, or has the potential to colonise, to less than 10%. Scrub and trees should not directly shade colonies of *M. profunda*.	*M. profunda* is vulnerable to being shaded out by the canopy of scrub and trees. Scrub should be cleared and treated with herbicide at regular intervals. Scrub and tree species which may be of particular concern include gorse, bramble, heather, Rhododendron, sallows (willows) and birch. Tree planting and cultivation should not occur on or near areas colonised *by M. profunda.*	NATURAL ENGLAND, 2015a
Supporting habitat: structure/ function	**Soils, substrate and nutrient cycling**	Restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, within typical values for the supporting habitat.	Soil supports basic ecosystem function and is a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature. *Marsupella profunda* requires bare, soft granitic rock and clayey granitic boulders and clayey substrates. The china clay substrates are acidic.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site.	This recognises the increasing likelihood of supporting habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be	NATURAL ENGLAND, 2015b. http://publications.naturalengland.org.uk/publication/4954594591375360 PORLEY R. 2007

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being moderate taking into account the sensitivity, fragmentation, topography and management of its [habitats/supporting habitats]. This means that this site is considered to be vulnerable overall but moderately so. This means that some adaptation action for specific issues may be required, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. The implications of local and global warming and other aspects of climate change on an oceanic species such as *Marsupella profunda* are not known. It is at the northern limits of its global distribution in Cornwall. Research into the genetic variation within and between sub-populations of *Marsupella profunda* and investigation (modelling) of the functioning of metapopulations in respect of climate change would be valuable in informing the future management of this species.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain or, where necessary, restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	The supporting habitat of this feature is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition (including food-plants) and reducing supporting habitat quality and population viability of this feature. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. It is possible that *Marsupella profunda* could be affected by air pollution.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Restore the management measures within and outside the site boundary which are necessary to restore the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. From 1993 until 2003 Tregonning Hill supported a very small population of *Marsupella profunda*, but subsequent surveys, the latest in 2011, failed to re-find *M. profunda* at this site. The loss of this species is due to scrub encroachment and lack of active management. Hence the reason for selection of the **restore** target. Key conservation management measures (D. Callaghan, email 20/11/2018 and Jonathan Cox email 16/11/2018):	CALLAGHAN D. 2011 HOLYOAK D. T. 1996 HOLYOAK D. T. 1997 HOLYOAK D. T. 1998 HOLYOAK D. T. 1999 HOLYOAK D. T. 2003 NATURAL ENGLAND 2015a

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			• Large-scale vegetation/scrub clearance, focusing on north-facing slopes to expose weathered granite and granitic rocky outcrops • Removal of plant litter to re-expose soft bare granite surfaces and china-clay substrates (this will require access for a mechanical digger) • Carry out monitoring to find out whether *Marsupella profunda* has re-appeared as a result of the management works, and if it has not re-colonised then re-introduction needs to be considered, as outlined below • Importation of a number of small boulders (ca. 10) which support *Marsupella profunda,* from selected donor sites in the St Austell China Clay district (potentially from non-designated sites eg: Penhale or Goonbarrow Pits which both support large populations of *M. profunda*) to aid re-colonisation. *M. profunda* is a Schedule 8 species therefore a licence would need to be obtained before any works occurred. Because of the meta-population nature of this species, as well as restoring the distribution of suitable habitat within the SAC boundary, consideration should be given to the creation and/or restoration of suitable habitat outside of the SAC boundary, where there are opportunities to do so.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Surface disturbance**	Restore high levels of surface disturbance to provide conditions necessary for colonisation by M. profunda.	High levels of surface disturbance may be of benefit by exposing additional areas of bare ground suitable for colonisation by M. profunda.	CALLAGHAN D. 2011
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater maintain water quality and quantity at a standard which provides the necessary	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type.	PORLEY R. & HODGETTS N. 2005.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		conditions to support the feature	Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. *Marsupella profunda* requires sheltered sites with humid conditions in well-drained topographic situations.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: **Surface Disturbance:** The target for Surface Disturbance has been changed from low level of disturbance to **high** level of disturbance, because the site is so overgrown and *Marsupella profunda* has been lost as a consequence of scrub growth and lack of management, it requires large scale re-exposure of suitable habitat - soft granitic rock and clayey substrates.				

References

CALLAGHAN D. 2011 *Bryophyte Survey and Condition Assessment of Tregonning Hill SSSI/SAC, Cornwall* EcoStudy Report for Natural England (available on request)

HOLYOAK D. T. 1996 *Status and Conservation of the Liverwort Marsupella profunda in Cornwall, 1996* Report for English Nature (available from Natural England on request)

HOLYOAK D. T. 1997 *Status, Ecology and Conservation of the Liverwort Marsupella profunda in Cornwall, 1997* Report for English Nature under the Species Recovery Programme SRP (available from Natural England on request)

HOLYOAK D. T. 1998 *Status, Ecology and Conservation of the Liverwort Marsupella profunda in Cornwall, 1998* Report for English Nature under the Species Recovery Programme SRP (available from Natural England on request)

HOLYOAK D. T. 1999 *Status, Ecology and Conservation of the Liverwort Marsupella profunda in Cornwall, 1999* Report for English Nature under the Species Recovery Programme SRP (available from Natural England on request)

HOLYOAK D. T. 2003 *Status and Conservation of Marsupella profunda in Cornwall: Short Interim Report to English Nature on work Carried Out in 2003* (available from Natural England on request)

HOLYOAK D. T. 2006 Tregonning Hill SSSI *Site Monitoring Dossier (*available from Natural England on request)

HOLYOAK D. T. 2009 *Surveys and Habitat Management of Threatened Bryophytes in Cornwall and Devon, 2009* Report to Natural England (available on request)

NATURAL ENGLAND 2015a *Site Improvement Plan: Tregonning Hill SAC.* SIP Profile 249

NATURAL ENGLAND, 2015b. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England

PORLEY R. & HODGETTS N. 2005 *Mosses & Liverworts* The New Naturalist Library. Collins

PORLEY R. 2007 *Marsupella profunda (western rustwort) and Special Areas of Conservation (SACs)* Unpublished internal report (available from Natural England on request)