

STRATH SPECIAL AREA OF CONSERVATION (SAC)

CONSERVATION ADVICE PACKAGE



Site Details

Site name:	Strath
Map:	https://sitelink.nature.scot/site/8384
Location:	Highlands and Islands
Site code:	UK0012785
Area (ha):	1,388.34
Date designated:	17 March 2005

Qualifying features

Qualifying feature	Assessed condition	SCM visit date	UK overall Conservation Status
Base-rich fens	Favourable Maintained	1 August 2006	Unfavourable - Bad
Wet heathland with cross-leaved heath	Favourable Maintained	28 July 2014	Unfavourable - Bad
Alpine and subalpine calcareous grasslands	Unfavourable Declining	26 July 2014	Unfavourable - Bad
Hard-water springs depositing lime*	Favourable Maintained	19 June 2004	Unfavourable - Bad
Calcium-rich nutrient-poor lakes, lochs and pools	Favourable Declining	29 August 2014	Unfavourable - Bad
Plants in crevices on base-rich rocks	Unfavourable Declining	1 August 2006	Unfavourable - Bad
Limestone pavements*	Unfavourable Declining	29 July 2014	Unfavourable - Bad
Mixed woodland on base-rich soils associated with rocky slopes*	Unfavourable No change	19 March 2008	Bad-declining

Notes:

Assessed Condition refers to the condition of the SAC feature assessed at a site level as part of NatureScot's [Site Condition Monitoring \(SCM\)](#) programme.

Conservation status is the overall condition of the feature throughout its range within the UK as reported to the European Commission under Article 17 of the Habitats Directive in 2019.

*Habitats Directive priority habitat.

Overlapping Protected Areas:

[Strath SSSI](#) - Overlaps whole of SAC and has many features in common;
[Cuillins SPA](#) (Golden eagle) - Overlaps north and east parts of SAC.

Key factors affecting the qualifying features

Base-rich fens

Base-rich fen consists of a complex assemblage of vegetation types characteristic of sites where there is tufa and/or peat formation with a high water table and a calcareous base-rich water supply.

There is considerable variation between sites in the associated communities and the transitions that may occur. Such variation can be broadly classified by the geomorphological situation in which the fen occurs, namely: flood plain mire, valley mire, basin mire, hydroseral fen (i.e., as zones around open waterbodies) and spring fen. Another important source of ecological variation is altitude, with significant differences between lowland fens, which are rich in southern and continental species, and upland fens, which are rich in northern species.

On this site the base-rich fens correspond primarily to M10a NVC communities. These occur as damp, often linear, rather stony base-enriched flushes usually within M15 wet heath, CG10 calcareous grassland or U4 acid grassland. They are usually present downslope of the hard-water springs and tufa may be deposited on rocks and plants. However they also occur in other areas where the water seepage is more diffuse and wet heath mapped as M15a can often be mapped at a finer scale as M10a.

There are a few flushes on the western slopes of Ben Suardal and in the Allt nan Leac area which contain a lot of *Saxifraga azoides* and are assigned to NVC M11 although they are floristically very similar to M10. They should also be treated as part of the base-rich fen feature.

Alkaline fens also occur around the inflow of Loch Cill Chrìosd, corresponding to NVC community M9 or M10. Flushes with affinities to M10 also occur around the shore of Loch Lonachan. Again these should also be treated as part of the feature. Key factors affecting this habitat type are land use changes/development, pollution to ground or surface water and, inappropriate grazing pressure. On this site grazing is the main factor, although localised damage due to use of trial bikes and ATVs have also occurred in the past.

Wet heathland with cross-leaved heath

Wet heath occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. Wet heaths occur in several types of ecological gradient. In the drier areas of the south and east, wet heaths are local and often restricted to the transition zone between European dry heaths and constantly wet valley mires. In the uplands they occur most frequently in gradients between dry heath or other dry, acid habitats and blanket bogs.

It is extensive on Strath SAC covering approximately 28% of the site, occurring on gently sloping ground site wherever peat overlays the bedrock. Most of the plant communities are typical for the West Highlands – the M15b sub-community is the most common on the site. The *Cladonia* lichen sub-community M15c occupies the higher ground underlain by granite in the west of the site. The NVC M15a

Trichophorum-Erica sub-community is notable due to the large populations of the scarce oceanic moss *Campylopus shawii* and other oceanic bryophytes.

There are interesting juxtapositions of wet heath and calcareous habitats, with small base-rich habitat islands surrounded by wide expanses of wet heath where limestone outcrops through the blanket of peat.

The key management issues are the nature and extent of deer pressure, stock grazing, and burning. Forestry, non-native species and habitat loss for development are other potential threats. Overall the wet heath on this site has been in favourable condition for an extended period. Localised higher browsing levels do occur but these may relate to seasonal grazing impacts, supplementary feeding or the proximity of grassland habitats.

Alpine and subalpine calcareous grasslands

The habitat occurs on lime-rich soils and consists of short, often grazed, species-rich mixtures of arctic-alpine cushion herbs, grasses and sedges across a broad range of altitudes. This is one of the most important upland habitats in the UK for rare arctic-alpine plants and other rare montane or northern plants and animals.

Strath is one of four sites representing low-altitude Alpine and subalpine calcareous grasslands in north-west Scotland. Although the areas of CG13 *Dryas octopetala* – *Carex flacca* heath on this site are relatively small, they occur widely wherever there are outcrops of Dalradian Durness limestone from near sea level up to around 250 m. A sub-type of the *Dryas* heath containing the calcifuge dwarf shrubs crowberry *Empetrum nigrum* and bearberry *Arctostaphylos uva-ursi* is well-developed. Unusually, there are transitions to one of the most floristically-rich areas of Limestone pavements in Scotland.

At low altitude, colonisation of the grasslands by trees and shrubs is prevented by a combination of exposure and grazing. At high altitude the grasslands are maintained by the harsh climate, though grazing may also alter species composition. On this site grazing is broadly at an appropriate level, maintaining the *Dryas* sward and minimising bracken expansion. Expansion and competition from non-native *Cotoneaster* is a growing concern causing this habitat to be in unfavourable condition and which needs remedial action.

Hard water springs depositing lime

Hard-water springs depositing lime occur as springs and flushes, scattered across the site. At least 33 distinct springs have been mapped, ranging in size from $\frac{1}{2}\text{m}^2$ to 18m^2 (most are $<2\text{m}^2$) so the total area of this habitat type is small. The tufa formation is associated with hard-water springs, where groundwater rich in calcium bicarbonate comes to the surface forming a hard deposit of calcium carbonate (tufa). All of the springs on this site have NVC type M37 plant communities but only around half of them have significant tufa deposits, usually coating plant leaves and rock outcrops. The springs occur in a wide range of vegetation communities including calcareous grassland, wet and dry heath and woodland but never far away from limestone pavement or limestone outcrops.

Tufa-forming springs are often associated with alkaline fens where they may form prominent upwelling masses of short open vegetation around the spring-heads that feed the fen system.

The key management issue for this habitat type is grazing pressure/trampling, primarily from sheep on this site but also deer and cattle. Impacts are patchy and localised.

Calcium-rich nutrient-poor lakes, lochs and pools

The Calcium-rich nutrient-poor lakes, lochs and pools habitat is characterised by water with a high base content. This is usually confined to areas of limestone and other base-rich substrates (e.g. serpentine and boulder clays), or coastal sites based on calcium-rich shell-sands, also known as machair lochs. Such waterbodies are characterised by very clear water and low nutrient status. They are therefore largely restricted to situations where the catchment from which they are supplied with water, remains relatively unaffected by intensive land-use or other sources of nutrients.

Strath SAC includes two calcium-rich lochs (Loch Cill Chriosd and Loch Lonachan) situated over predominantly limestone bedrock. The component lochs represent high quality hard-water, oligotrophic habitat with water clear to the bottom of the lochs at ~ 4 m depth. The excellent water clarity is reflected by the presence of long-stalked pondweed *Potamogeton praelongus*. Characteristic of hard-water waterbodies, both lochs support stoneworts *Chara* spp. In addition, the margins of Loch Cill Chriosd support the rare snail *Vertigo lilleborgi*.

The key management issue on this site is to maintain or the hydrology of the lochs. Concerns have been raised about increasing proportions of reedbed and other emergent vegetation compared to open water habitat at Loch Cill Chriosd, possibly due to lower water levels. Loch Lonachan is used as a public water supply for south Skye and, although risks are minimised via CAR, it remains likely that the frequency, magnitude and duration of drawdown events during drought will be greater than if there was no abstraction. Increasingly unpredictable and extreme weather associated with climate change are likely to exacerbate these issues in the future.

Pollution of surface waters, air pollution, invasive non-native species, fishing and harvesting of other aquatic resources are all potential management issues but no major concerns were raised during previous rounds of monitoring.

Calcareous rocky slopes with chasmophytic vegetation

Chasmophytic (grows in the crevices of rocks) vegetation consists of plant communities that colonise the cracks and fissures of rock faces and is widespread in upland areas but is localised and fragmentary in its occurrence. The type of plant community that develops is largely determined by the base-status of the rock face. Calcareous sub-types develop on lime-rich rocks such as limestone and calcareous schists.

The plants in crevices are found in harsh and sometimes extreme conditions with limited soil development, but where there is some shelter and moisture, and so plants are sparse and scattered. Chasmophytic plant species are adapted to the stresses of drought but can be sensitive to overgrazing and trampling although many

sites are protected by inaccessibility. The base-richness of calcareous rocks may encourage competition from more vigorous native species, or non-native invasives such as *Cotoneaster*.

Strath represents low-altitude Calcareous rocky slopes with chasmophytic vegetation in northern Scotland. This is one of the few sites in this area with a markedly calcareous chasmophytic flora, associated with outcrops of limestone. The habitat is widespread but patchily distributed. It occurs on steep rock faces – sometimes natural and sometimes man-made (quarries). Where it occurs the crevice flora is moderately well-developed but is less extensive and diverse than those at higher altitudes. However, the communities contain an unusual assemblage of species characteristic of both a northern and a more southerly distribution.

Key factors affecting this habitat, and causing it to be in unfavourable condition, include grazing and expansion of non-native *Cotoneaster*. The latter is of particular concern and where this occurs, such as at the Strath Suardal marble quarries, it risks smothering the crevice communities.

Limestone pavements

Limestone pavements are outcrops of rock, typically horizontal or gently inclined, although a few are steeply inclined. The surface has been dissolved by water over millions of years into 'paving blocks', known as clints, with a complex reticulate pattern of crevices, known as grikes, between them. A range of calcareous rock, heath, grassland, scrub and woodland can occur on limestone pavement. The vegetation of limestone pavements is unusual because of the combinations and diverse floristic elements, which in Scotland include northern and arctic-alpine species as well as communities with a maritime influence on some sites. The grikes provide a shady, humid environment favouring woodland plants.

Strath is one of four sites representing Limestone pavements on Cambro–Ordovician Durness limestone in north-west Scotland. It is the most extensive and floristically rich limestone pavement in Scotland and represents a more maritime variant of the habitat type. The pavements are found at a range of altitudes from close to sea level up to 280 m. There is a maritime influence across the whole site. Some of the species on this site are more southern species, while other characteristic species distinctly northern or arctic-alpine. Both wooded and open pavements are present.

Key factors affecting this habitat include inappropriate grazing levels (above low levels) and the presence and cover of invasive native and non-native species such as *Cotoneaster* and bracken. These factors are currently leading the habitat to be in unfavourable condition.

Mixed woodland on base-rich soils associated with rocky slopes

This habitat typically occurs in association with base-rich rocks in the steep-sided immature river valleys, and is found on nutrient-rich soils that often accumulate in the shady micro-climates towards the bases of slopes and ravines. Such forests are not extensive but fragmentary stands that then grade into other woodland types on level valley floors or slopes above are widespread.

At Strath this habitat is represented by scrubby hazel woodland growing in close proximity to (and sometimes over) patches of limestone pavement and limestone rock outcrops. The vegetation conforms to NVC W9 woodland. It is most extensive at Leac na Craobh and between Torrin and Kilbride but there are also patches along the north-facing slopes south of Allt nan Leac.

Key management issues include inappropriate grazing (above low levels) that is causing this feature to be assessed as unfavourable. Further issues that can negatively impact this habitat include, invasive native and non-native species. There are indications that this type of woodland may once have been more widespread when grazing levels were lower.

Further information about these habitats can be found on the [JNCC website](#).

Conservation Priorities

A general ranking would be as follows:

- 1) Limestone pavements (Priority habitat; Category A global ranking). The site holds the most extensive and most floristically rich limestone pavement in Scotland (Ward and Evans 1975).
- 2) Alpine and subalpine calcareous grasslands (Non-priority habitat; Category B global ranking). The site holds the ninth largest extent on SSSI of *Dryas octopetala*-*Carex flacca* heath (NVC CG13) in Scotland, a heath that is restricted to north-west Scotland largely from Skye northwards (Horsfield 2009).
Calcium-rich nutrient-poor lakes, lochs and pools (Non-priority habitat; Category B global ranking). The complex of fen, swamp and reedbed communities at Loch Cill Chriosd has few parallels in Scotland (Horsfield 2009).
Plants in crevices on base-rich rocks (Non-priority habitat; Category B global ranking).
Mixed woodland on base-rich soils associated with rocky slopes (Priority habitat; Category C global ranking).
Hard-water springs depositing lime (Priority habitat; Category C global ranking).
- 3) Base-rich fens (Non-priority habitat; Category C global ranking).
Wet heathland with cross-leaved heath (Non-priority habitat; Category C global ranking).

Limestone pavement is clearly the top priority on this site due to both its European and Scottish importance. However the 2nd category encompasses a large number of habitats which are difficult to separate. Some, like the Alpine and subalpine calcareous grasslands, are clearly of high importance in a national context while others, such as Hard-water springs depositing lime, are particularly important at a European level. In practice many of these habitats are mutually dependent (the base-rich habitats); have clear niche delineations (e.g. wet heath); or can overlap (e.g. both limestone pavement and hard-water springs depositing lime can occur under a woodland canopy or in the open), so there are likely to be few conflicts.

There are potential tensions between Mixed woodland on base-rich soils and Alpine and subalpine calcareous grasslands. Although *Dryas octopetala* can grow on the edge of woodland (e.g. it grows on the edge of Coille Gairealach) it is primarily a plant of open ground (Averis & Averis 2000). However since they are of equal importance efforts should be made to maintain the status-quo through differential grazing in different parts of the site.

There is also a potential tension with the succession of the open-water component of the Calcium-rich nutrient-poor lochs to reedbed, fen and swamp. This may result in an increase in marginal alkaline fen and reed bed but would not be desirable since the open water loch communities have a higher global status than alkaline fen. Recent indications that such changes may be occurring may be due to problems with the outflow weir rather than natural processes and it would be desirable to investigate this further. Activities which may reduce water levels or increase siltation rates into the lochs should be avoided. Otherwise nature should be allowed to take its course.

There is a suggestion that some of the NVC W11 woodlands may be derived from W9 woodlands due to grazing (Averis & Averis 2000). Since W9 is qualifying SAC habitat but W11 is not, a reduction in grazing within the W11 woodlands should be encouraged.

Conservation Objectives

Overarching Conservation Objectives for all habitat features of Strath SAC

1. To ensure that the qualifying features of Strath SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status

Favourable Conservation Status (FCS) is considered at a European biogeographic level. When determining whether management measures may be required to ensure that the conservation objectives for this site are achieved, the focus should be on maintaining or restoring the contribution that this site makes to FCS.

When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case, then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met. Further details on how these appraisals should be carried out in relation to maintaining site integrity is provided by objective 2 (including parts a, b and c). If broader information on the feature is available then it should be used to provide context to the site-based appraisal.

Note that “appropriate” within this part of the conservation objectives is included to indicate that the contribution to FCS varies from site to site and feature to feature.

2. To ensure that the integrity of Strath SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature.

The aim at this SAC is to maintain, or where appropriate restore, the protected habitats in a favourable condition as a contribution to their wider conservation status. Therefore any impacts on the objectives shown in 2a, 2b, or 2c below must not persist so that they prevent the achievement of this overall aim.

When carrying out appraisals of plans or projects the focus should be on restoring site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will be restored. Note that not all of these will be relevant for every activity being considered. Any impacts on the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the restoration of site integrity. Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover.

This objective recognises that the qualifying habitats are exposed to a wide range of drivers of change. Some of these are natural and are not a direct result of human influences. Such changes in the habitats' extent, distribution or condition within the site which are brought about by natural processes, directly or indirectly, are normally considered compatible with the site's conservation objectives. An exception to this is when the favourable condition of a habitat is dependent on halting or managing natural succession. An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case by case basis.

Conservation Objectives for Alkaline fens [H7230] (Base-rich fens)

2a. Maintain the extent and distribution of the habitat within the site

Maintain (or where appropriate restore) the extent of existing base-rich fen which has been estimated at 2.78ha. The area figure has been taken from the Standard Data Form.

However, due to the small and fragmentary nature of this habitat current baseline estimates may not be very precise and any changes in extent estimates as a result of new survey may not represent real change but greater precision. Fundamentally there should be no measurable net reduction the extent of the habitat and, most importantly, its distribution throughout the site and the number of sites should be maintained.

On Strath SAC this habitat is found scattered across the whole site but especially in areas with hard water springs depositing lime.

2b. Maintain the structure, function and supporting processes of the habitat

This habitat is found where there are springs or seepages, fed by base-enriched waters on both peat and mineral soils. In some places tufa deposition occurs but many of the fens do not have tufa.

Grazing at appropriate low levels can be beneficial in helping to maintain species-richness and in preventing succession. However, over-grazing and excessive poaching is detrimental which can result in damage to the fragile tufa formations and/or result in disturbed bare ground. This is where a substrate of bare humus, bare peat, bare mineral soil, bare gravel, or soil covered only by an algal mat, has its surface broken and imprinted by hoof marks, wallows, human foot prints, or vehicle and machinery tracks. The emphasis is on 'disturbed' rather than 'bare'.

Appropriate grazing levels will vary between and within sites, and should be considered at an individual site level to ensure the maintenance of the base-rich fen structure and function across the whole of the site.

Heavy trampling and/or tracking by deer/livestock and motorbikes/ATVs can result in active drainage of the habitat. Drainage should be considered active if it has altered, or is likely to alter, or remove, the original vegetation, and facilitate the removal of water from the site.

Colonisation of this habitat by vigorous native species (common reed *Phragmites australis* and/or soft rush *Juncus effuses*), tree or scrub growth or invasive non-native species could lead to irreversible habitat loss in the longer term, through conversion to other open-ground habitats or woodland. A few trees have been noted in some of the fens in past monitoring and it was noted that a reduction in grazing may result in further colonisation.

This habitat is very sensitive to muirburn and should be avoided in these areas.

2c. Maintain the distribution and viability of typical species of the habitat

The core vegetation of this habitat is short sedge mire (mire with low-growing sedge vegetation). On this site most of the habitat corresponds to NVC type M10 *Carex dioica* – *Pinguicula vulgaris* mire. However some marginal communities around the lochs are transitional between M10 and M9 *Carex rostrata* – *Calliergon cuspidatum/giganteum* mire.

For the base-rich fen on this site the relevant NVC type and indicator species are:

M10a *Carex dioica*-*Pinguicula vulgaris* mire, *Carex viridula oedocarpa*-*Juncus bulbosus/kochii* sub-community. This community consists mainly of scattered *Schoenus nigricans*, *Carex viridula oedocarpa*, *C.panicea*, *C.dioica*, *C.echinata*, *C.hostiana*, *C.pulicaris*, *Festuca vivipara*, *Molinia caerulea*, *Juncus articulatus*, *Pinguicula vulgaris*, *P.lusitanica*, *Succisa pratensis*, *Narthecium ossifragum* and *Eriophorum angustifolium* with patches (sometimes extensive) of the calcicole mosses *Scorpidium scorpioides*, *Campylium stellatum*, *Palustriella commutata* and *Drepanocladus revolvens*. Other species include *Euphrasia* agg, *Bellis perennis*, *Plantago maritima* and *Selaginella selaginoides*. There are usually small tufts of the mosses *Blindia acuta* or *Racomitrium aciculare* on rock surfaces, and sometimes patches of the larger *R.lanuginosum* and *Campylopus atrovirens*. The vegetation is fairly species-rich and occupies damp, often linear and rather stony base-enriched flushes, usually within M15 *Trichophorum-Erica* wet heath or U4 *Festuca-Agrostis-Galium* or CG10 *Festuca-Agrostis-Thymus* grassland. Some tufa may form on rock and stone surfaces.

Fen around the inflow of Loch Cill Chriosd may correspond to *Carex rostrata*-*Calliergon cuspidatum* mire (M9) or *Carex-Pinguicula* mire (M10) in the NVC and support *Carex rostrata*, *C. dioica*, *Eleocharis quinqueflora*, *Scorpidium scorpioides*, *Campylium stellatum*, *Drepanocladus revolvens* and *Sphagnum contortum*.

M11 *Carex viridula oedocarpa*-*Saxifraga aizoides* mire, M11a *Thalictrum alpinum*-*Juncus triglumis* sub-community, M11b *Palustriella commutata*-*Eleocharis quinqueflora* sub-community. These flushes are rare on the upper W slopes of Ben Suardal and in the Allt nan Leac area. They are similar to M10 (see above) but contain a lot of *Saxifraga aizoides*.

Conservation Objectives for Northern Atlantic wet heaths with *Erica tetralix* [H4010] (Wet heathland with cross-leaved heath)

2a. Maintain the extent and distribution of the habitat within the site

Maintain (or restore where necessary) to approximately 388.74ha). The area figure has been taken from the Standard Data Form, and is an estimate. This is because wet heath typically covers large areas, forming complex mosaics with areas of blanket bog, and in dryer areas dry heaths and grassland. Baseline surveys will include smaller areas of other habitats. The vegetation is very variable in composition. Dwarf shrub cover and structure is variable, similar to dry heath in some areas, and to blanket bog in other, usually wetter areas, particularly on degraded bog. However there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site.

2b. Maintain the structure, function and supporting processes of the habitat

Northern Atlantic wet heath with *Erica tetralix* is sensitive to inappropriate grazing or burning that may affect the habitat structure and function in two main ways. Overgrazing/burning, can lead to creation of a grass sward. Overgrazing, by livestock, can also result in high levels of nutrient input and trampling. Under grazing/burning can lead to the habitat type being colonised by non-typical species.

The structure of the habitat is based around the presence of:

- at least 25% (up to 90%) cover of dwarf-shrub heath species with *Erica tetralix* as the defining dwarf-shrub.
- less than 33% of the last complete growing season's shoots of dwarf-shrub species (collectively but excluding *Betula nana* and *Myrica gale*) should show signs of browsing.
- less than 10% of the Sphagnum cover should be crushed, broken, and/or pulled-up.
- less than 10% of the ground cover should be made up from disturbed ground (i.e. bare ground is where a substrate of bare humus, bare peat, bare mineral soil, bare gravel, or soil covered only by an algal mat, has its surface broken and imprinted by hoof marks, wallows, human foot prints, or vehicle and machinery tracks.
- less than 10% of the total feature area should show signs of active (i.e. facilitates the movement of water away from the site) drainage, resulting from ditches or heavy trampling or tracking.
- less than 20% of vegetation cover should be made up of scattered native trees and scrub (excluding *Betula nana* and *Myrica gale*).
- less than 10% of vegetation cover should be made up of bracken.
- less than 1% of vegetation cover should be made up of non-native species.

The goal however should be no bare peat, active drains, bracken cover or non-native species. Where these are present, management should focus on reducing their extent and impact. Management effort, primarily of active drainage, grazing and burning, should therefore be directed to maintain species composition, vegetation mosaics and ground/soil

structure and integrity. This should also avoid surface erosion and deposition, introduction of alien and invasive species and scrub and habitat fragmentation.

2c. Maintain the distribution and viability of typical species of the habitat

Wet heath is an important habitat for a range of vascular plant and bryophyte species. Generally the vegetation is dominated by mixtures of cross-leaved heath, heather, grasses, sedges and *Sphagnum* bog-mosses.

On this site this vegetation is largely made up of a patchy mixture of *Calluna*, *Erica tetralix*, *Molinia* and *Trichophorum cespitosum*, with associates typically including *Potentilla erecta*, *Narthecium ossifragum*, *Succisa pratensis*, *Carex panicea*, *Myrica gale*, *Eriophorum angustifolium*, the mosses *Hypnum cupressiforme*, *Racomitrium lanuginosum*, *Sphagnum denticulatum*, *S. capillifolium* and *Campylopus atrovirens*, the oceanic liverwort *Pleurozia purpurea* and the lichens *Cladonia portentosa* and *C. uncialis*. The vegetation is mostly species-poor. The Typical sub-community M15b is floristically as described above, and is the most frequent kind of M15 wet heath in the survey area. M15b is extensive on gently-sloping ground with a thin covering of damp peat. The *Cladonia* spp sub-community M15c is similar but rather more open, with more *R. lanuginosum* and abundant *Erica cinerea*. It occurs on slightly drier peat than M15b, and occupies part of the higher granite ground in the west of the study area. *E. cinerea* can be more abundant than *E. tetralix*, but the vegetation can be told from H10 *Calluna-Erica cinerea* heath by the abundance of *Trichophorum cespitosum*, *Carex panicea* and *Narthecium ossifragum*. Much of the M15b has frequent *Racomitrium lanuginosum*, and most of the M15c has relatively dense and continuous vegetation for this sub-community. Hence the separation between M15b and c in the study area is not as well marked as in many parts of the western Highlands. The *Carex panicea* sub-community M15a is more of a soligenous mire than a wet heath, and has abundant *Sphagnum denticulatum*, *Campylopus atrovirens*, *Carex panicea* and *Narthecium ossifragum*, with associates including occasional *Eleocharis multicaulis*, *Rhynchospora alba*, *Schoenus nigricans* and the oceanic moss *Campylopus shawii*. Some stands have abundant *Schoenus nigricans* and appear slightly base-enriched. M15a occupies narrow soakways, usually within M15b wet heath or M17 *Trichophorum-Eriophorum* blanket bog. It is common and widespread in the study area.

Typically associated birds are red grouse (*Lagopus l. scotica*), golden plover (*Pluvialis apricaria*), golden eagle (*Aquila chrysaetos*), and merlin (*Falco columbarius*), although none are abundant on this site. Golden eagle hunts over but does not breed on site. Red deer is a typical mammal associated with this site.

Conservation Objectives for Alpine and subalpine calcareous grasslands [H6170]

2a. Maintain the extent and distribution of the habitat within the site

Alpine and subalpine calcareous grasslands occur on lime-rich soils. *Dryas* heath is widespread on the site (as detailed in Map 4 of Averis & Averis (2000)) mostly as small patches in mosaics with CG10 *Festuca-Agrostis-Thymus* grassland, U4 *Festuca-Agrostis-Galium* grassland, H10a *Calluna-Erica* heath, M15 *Trichophorum-Erica* wet heath and limestone pavement.

The objective is to maintain the extent of the habitat to approximately 208.25ha. The area figure has been taken from the Standard Data Form, and is an estimate based on the amount and complex, yet often limited, mosaic of several different high altitude communities.

Fundamentally however there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site.

2b. Maintain the structure, function and supporting processes of the habitat

The main elements that affect the habitat are under-grazing, over-grazing, trampling damage and encroachment of trees and scrub. Inappropriate grazing, above low levels, may facilitate creation of a grass sward.

These heaths, like the CG10 grasslands (see above) are grazed down to short, tight swards rarely more than 5 cm tall. *Dryas octopetala* is rarely grazed, but the leaves are almost all less than 2 cm long - an indication of heavy grazing over many years. The *Salix-Empetrum* sub-community CG13b seems to be grazed less hard than the more grassy *Hieracium-Ctenidium* sub-community CG13a. The sward is often a little taller - up to 15 cm - and the leaves of *D. octopetala* can exceed 2 cm. CG13b often occurs on steeper, more rocky and less accessible slopes than CG13a.

A distinctive characteristic of this habitat is the high proportion of dwarf forbs to grasses accompanied by a relatively high proportion of mosses in the sward. Where appropriate levels of grazing occur habitat structure should meet the below criteria:

- At least 50% of live leaves and/or flowering shoots of vascular plants should be more than 20 cm above the ground.
- Less than 10% of vegetation cover should be made up of bracken and/or scattered native trees and scrub.
- Less than 10% of ground cover should be disturbed bare ground

2c. Restore the distribution and viability of typical species of the habitat

Expansion of non-native *Cotoneaster* is a concern: during monitoring in 2014 almost half the sample points failed or were close to failing the target for there to be less than 1% cover of non-native species. At one of the sample points the *Cotoneaster* appeared to be out-competing *Dryas octopetala*. It is necessary to control the *Cotoneaster* in order to restore the feature as this is currently leading to it being in unfavourable condition.

Bracken too appears to have become more abundant over the last two decades. Averis (1997) reports that no bracken was recorded within stands of CG13 *Dryas-Carex* heath at the time of survey. That is no longer true and a new monitoring baseline has been established to monitor this aspect.

On this site the Alpine and subalpine calcareous grasslands comprises NVC type CG13 - *Dryas octopetala* – *Carex flacca* heath

Two distinct forms of CG13 occur here. The commonest form is floristically similar to CG10b grassland, apart from the dominance of *D. octopetala*, with species such as *Thymus polytrichus*, *Viola riviniana*, *Linum catharticum*, *Carex flacca*, *Festuca ovina*, *Lotus corniculatus* and mosses including *Ctenidium molluscum*, *Tortella tortuosa* and *Hylocomium splendens*. This heath belongs to the *Hieracium pilosella-Ctenidium molluscum* sub-community CG13a.

The other form has a flora similar to CG13a but augmented by other dwarf shrubs: *Calluna vulgaris*, *Erica cinerea*, *Empetrum nigrum*, *Arctostaphylos uva-ursi* and *Salix*

repens. There are also a few calcifuges (lime-hating) and species of damp acid ground such as *Succisa pratensis*, *Molinia caerulea* and *Erica cinerea* accompanying the typical array of calcicoles. This vegetation belongs to the *Salix repens-Empetrum nigrum* sub-community CG13b. It is quite common in the southern and eastern part of the site and often occurs on steeper, more rocky and less accessible slopes than CG13a.

The habitat also supports nationally scarce species artic-alpine species including *Potentilla crantzii*, although many of the locations for this species show more affinity for CG10 grassland than CG13.

Conservation Objectives for Petrifying springs with tufa formation (Cratoneurion) [H7220] (Hard water springs depositing lime)

2a. Maintain the extent and distribution of the habitat within the site

Maintain (or restore where appropriate) the extent of existing hard-water springs depositing lime which has been estimated at 2.78ha. The area figure has been taken from the Standard Data Form.

Due to the small extent and fragmentary and restricted occurrence of this habitat current baseline estimates may not be very precise and any changes in extent estimates as a result of new survey may not represent real change but greater precision.

Individual springs vary in size from 0.5m² up to 18m², although most are 2m² or less. An approximate area for each of the 32 springs recorded in the baseline survey are listed in Table 4 of Averis & Averis (2000). However, other springs are known so this is not an exclusive list.

The springs are widely distributed across the site with the exception of Beinn an Dubhaich part of the site which is granite. The location of most of the springs are mapped on Map 7 of Averis & Averis (2000): grid references are also provided.

Fundamentally there should be no measurable net reduction the extent of the habitat and, most importantly, its distribution throughout the site and the number of sites should be maintained.

2b. Maintain the structure, function and supporting processes of the habitat

This habitat is often associated with alkaline fens, where they may form prominent upwelling masses of short open vegetation around the spring-heads that feed the fen system with more or less complete vegetation cover. There are transitions to a wide range of other habitats from CG10 *Festuca-Agrostis-Thymus* grassland and limestone rock outcrops to wet and dry heaths and woodland.

Tufa is not ubiquitous. It was found in fourteen springs: it was frequent in two, occasional in seven and rare in five. Where it occurs it is found mainly along the lower parts of the springs on the mosses or on rock outcrops, or on rock surfaces just downslope of the springs, grading into alkaline fen.

Over-grazing, above low levels, and poaching/trampling can be detrimental resulting in damage to the fragile tufa formations and/or result in disturbed bare ground. This is where a substrate of bare humus, bare peat, bare mineral soil, bare gravel, or soil covered only by an algal mat, has its surface broken and imprinted by hoof marks, wallows, human foot prints, or vehicle and machinery tracks. The emphasis is on 'disturbed' rather than 'bare'.

Appropriate grazing levels will vary between and within sites, and should be considered at an individual site level to ensure the maintenance of the hard-water springs within the wider habitat structure and function across the whole of the site.

Heavy trampling and/or tracking by deer, livestock and ATVs can result in active drainage of the habitat. Drainage should be considered active if it has altered, or is likely to alter, or remove, the original vegetation, and facilitate the removal of water from the site.

This habitat is very sensitive to muirburn and should be avoided in these areas.

2c. Maintain the distribution and viability of typical species of the habitat

Averis & Averis (2000) recorded a total of 91 plant species in these 32 springs; the number of species in a spring ranged from 5 to 20. The commonest of these species is the moss *Palustriella commutata*, which makes up more than 50% of the cover in most of the springs. *Bryum pseudotriquetrum*, *Calliergonella cuspidata* and *Cratoneuron filicinum* are also common; the latter is the dominant plant in two springs. The moss layer is generally about 4-5 cm deep and covers most of the area of each spring. Vascular plants prick sparsely through the mosses; the most common of these are the grasses *Festuca rubra*, *F. ovina* and *Molinia caerulea*, the sedges *Carex flacca*, *C. panicea* and *C. viridula*, the rush *Juncus articulatus* and the forbs *Succisa pratensis*, *Potentilla erecta*, *Prunella vulgaris*, *Viola palustris*, *Cardamine pratensis* and *Ranunculus flammula*.

Excessive grazing/browsing/trampling by deer and/or livestock can contribute to a deterioration in the habitat structure, leading to a reduction or loss in the typical/indicator species for this habitat and should be only be done in a controlled, appropriate manner that helps maintain the habitat.

Conservation Objectives for Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp [H3140] (Calcium-rich nutrient-poor lakes, lochs and pools)

2a. Maintain the extent and distribution of the habitat within the site

The extent of Calcium-rich nutrient-poor lakes, lochs and pools habitat feature has been estimated at 38ha. The area figure has been measured from the most recent mapped extent since it is not quoted on the Standard Data Form.

The feature comprises two lochs, Loch Cill Chriosd (24ha) and Loch Lonachan (14ha). Fundamentally there should be no measurable net reduction the extent of the habitat and, most importantly, its distribution throughout the site and the number of sites should be maintained.

This should include the total surface area, depth of water and type and distribution of loch substrate sediments. In addition maintenance of the marginal vegetation is important. Both Loch Cill Chriosd and (especially the small loch at) Loch Lonachan are predominantly shallow and relatively sheltered lochs which means that open water areas are dominated by emergent species and of floating leaved vegetation. Marginal vegetation is particularly important habitat for rare snails at Loch Cill Chriosd.

This conservation objective is considered to be met if the conditions to ensure the habitat's long-term existence are in place.

2b. Maintain the structure, function and supporting processes of the habitat

The structure and function of lochs are strongly influenced by activities within their catchment. Changes in land management or development can affect the integrity of the feature which will manifest itself in changes to the loch.

Physical Attributes

-Surface Area

Changes to surface area can indicate pressures on the structure and function of lochs. The surface area of a loch may fluctuate slightly naturally, especially on small lochs such as these. However changes to surface area and the associated change to depth can adversely affect the character of the loch, particularly the edge vegetation.

Changes to the surface area may also indicate a number of pressures such as abstraction, regulation, construction, excessive sediment deposition and natural succession which may occur in the catchment.

-Hydrological regime

The hydrology of the loch affects both water level fluctuations and annual and within year flushing patterns. Flushing is important as it is strongly related to dilution and removal of nutrients and plankton. The frequency and duration of water level fluctuations can affect both the short term and long term abundance and distribution of typical species and the long term balance between habitat types (e.g. the balance of reed beds vs open water plants). Changes to the flushing pattern can be caused by factors similar to those affecting area; abstraction, regulation, construction, excessive sediment deposition and natural succession which may occur in the catchment.

There is a connecting pipe through the sill between the basins at Loch Lonachan which aims to maintain this connection during drought periods.

-Loch substrate character

The type and distribution of sediment particles within a loch will affect the biology of the loch and the availability of habitats. Changes to the substrate character may also be indicative of changes to the area and hydrological regime. Reduction in area or flushing may affect the substrate character as finer sediments become trapped and there is increased input of leaf-litter from scrub encroachment. At Loch Cill Chriosd dead reed/rush material is an important habitat for typical species.

-Natural sediment load

Accumulation of nutrient-rich sediment may have a strong effect on the water quality and biology of the loch. Increases in sediment loading may result from both changes in land management practice in the catchment or on the shoreline and short term events such as construction. Evidence is growing that an increase in storm events associated with climate change may increase the amount of sediment deposited in lochs. Significant natural variations in water clarity are known to occur in these lochs.

-Connectivity between the loch and the surrounding area

While a loch is often perceived as a discrete entity the connections between it and the surrounding area are vital to its functioning as part of a natural system. These natural connections can be reduced or changed by, for example, hard engineering works on the shoreline or loch bed and anything that impedes the exchange of water either on the surface or with the underlying water table. The shorelines of the two lochs are largely unmodified, other than along parts of the southern shore of Loch Cill Chriosd where it has been reinforced to support the single track road and passing places. Further modifications should be avoided.

Water Quality

-Dissolved Oxygen

Oxygen is vital to respiration. An artificially high biomass caused by increased loadings of organic matter or algal blooms can create a heavy demand which causes low levels of dissolved oxygen. Dissolved oxygen is likely to be lowest in July and August. The target is dissolved oxygen >7.0mg/l for lochs classified as at Good Ecological Status (GES) under the Water framework Directive (WFD) or >9.0 Mg/l for lochs classified as High Ecological Status (HES) during July and August. DO in these lochs has been recorded at various times (NCC loch survey, SCM at Loch Cill Chriosd, CAR EIA and subsequent monitoring at Loch Lonachan) and any variation should be judged within those known parameters.

-pH

This influences many of the chemical processes in lochs such as the binding of phosphorus. Artificial changes through eutrophication or acidification can therefore have a significant effect. Oligotrophic lochs should have pH of 5.5 to 7 and Mesotrophic 6.5 to 8. pH in these lochs has been recorded at various times (NCC loch survey, SCM at Loch Cill Chriosd, CAR EIA and subsequent monitoring at Loch Lonachan) and any variation should be judged within those known parameters.

-Chlorophyll a

Chlorophyll a is a good measure for phytoplankton abundance. Phytoplankton is an important part of the processes of a loch ecosystem affecting light penetration and oxygen demand. A high biomass is usually associated with nutrient enrichment and sedimentation of organic matter. Target Chlorophyll a can be calculated for each loch based on site specific targets related to alkalinity and depth. Where a site is in favourable condition current Chlorophyll a can be used to set a baseline.

-Total Phosphorus

Phosphorus is one of the main nutrients required for plant growth and there is strong correlation between TP concentration and phytoplankton biomass. The target for TP is based on an annual mean; for deeper lochs (mean depth >3m) 15ugP/l maximum annual mean TP, very shallow (Mean depth <3m) 20ugP/l. Site specific targets may also be set where there are good records.

-Total Nitrogen

Nitrogen is the other main nutrient important in loch ecosystems. It is generally less likely to be limiting than phosphorus because of the ability of some organisms to fix Nitrogen from the atmosphere. The target for all lochs is that Annual Mean Total Nitrogen should not exceed 1.5mg/l. with no deterioration from baseline. For N limited lochs consideration may be given to setting site based targets.

2c. Maintain the distribution and viability of typical species of the habitat

Hard oligo-mesotrophic waters with *Chara* are often characterised by dense beds of Charophytes. There is no evidence that this structure has ever been present in either loch. Charophytes were only recorded as frequent or "Locally Abundant" during the 1989 Loch Survey. The shallow, relatively sheltered, nature of the lochs means that its open water areas are dominated by emergent species, with areas of floating leaved vegetation. Rough stonewort (*Chara aspera*) and delicate stonewort (*C. virgata*) have been identified from Loch Cill Chriosd. *C. virgata* has been identified in Loch Lonachan.

At least nine characteristic taxa are present in Loch Cill Chriosd: *Littorella uniflora*, *Lobelia dortmanna*, *Baldellia ranunculoides*, *Potamogeton gramineus*, *Potamogeton lucens*, *Sparganium angustifolium*, *Utricularia vulgaris* agg., *U. minor*, and *Nitella translucens*. The

presence of two additional species: *P. x nitens* and *P. lucens* are also awaiting confirmation (Bell 2015). *Isotetes lacustris* and *Subularia aquatica* were recorded in 1989 Loch Survey and are also likely to be present at low frequency and can be easily overlooked during surveys.

The following characteristic plants have been recorded from Loch Lonachan (in 2010/2011): stoneworts (*Chara* spp and *Nitella* spp), quillwort (*Isoetis lacustris*), bulbous rush (*Juncus bulbosus*), shoreweed (*Littorella uniflora*), water lobelia (*Lobelia dortmanna*), alternate-flowered water-milfoil (*Myriophyllum alterniflorum*), white water-lily (*Nymphaea alba*), least bur-reed (*Sparganium natans*), bladderworts (*Utricularia vulgaris* and *U. minor*) and various pondweeds (*Potamogeton natans*, *P. x nitens*, *P. polygonifolius*, *P. praelongus*).

Potamogeton coloratus is a nationally scarce pondweed which grows in Loch Cill Chriosd. Pipewort *Eriocaulon aquaticum* was recorded as rare in Loch Cill Chriosd in 1989 but has not been recorded since then, so should not be considered a 'typical' species. There is also a record of *Isotetes echinospora* in Loch Cill Chriosd but this has never been verified and may be a spurious record (Bell 2015). *Elatine hexandra* is a notable species which has been recorded in Loch Lonachan but not during recent surveys.

The Red Data Book snail *Vertigo lilljeborgi* occurs mainly in decaying vegetation on the shore of Loch Cill Chriosd. The snail was found to be most common on the western and southern shores of the loch where there are well-developed zones of *Carex rostrata* and *Juncus articulatus* with plenty of dead leaf litter from these plants. The wetland fringes to Loch Cill Chriosd also support a number of other uncommon specialist molluscs including *Stagnicola fusca*, *Vertigo antivertigo*, *V. substriata*, *V. pygmaea*, *Leiostryla anglica*, *Columella aspera* and *Euconulus alderi* (Alexander, 2013).

Otters are known to visit both Loch Lonachan and Loch Cill Chriosd. Brook lamprey *Lampetra planeri* have been recorded in sediments where streams enter Loch Cill Chriosd. Together with the Broadford River this is the only known population of brook lampreys on Skye. Characteristic bird species such as Common Sandpiper are summer visitors.

The viability of the characteristic species is determined by water quality and other conditions that support the plant community such as water clarity. Loss or reduction in frequency of species may therefore be an indicator of deteriorating or changing water quality or some other adverse impact.

Alien species can have direct effects upon the natural plant communities through competition. They may also have more subtle effects as the niche they fill is different and this may directly or indirectly affect the rest of the ecosystem. A list of high impact species has been agreed as part of the Water Framework Directive.

Filamentous algae are indicative of high nutrient levels. This can create dense blankets reducing light and which can cause problems when they die and decay. A large amount of filamentous algae was recorded from the south-eastern shore in 2015. The algae appeared to be associated with run-off from near the road and extended along the distance of the inflow, and along the water's edge.

Conservation Objectives for Calcareous rocky slopes with chasmophytic vegetation [H8210] (Plants in crevices on base-rich rocks)

2a. Maintain the extent and distribution of the habitat within the site

The extent of the plants in crevices on base-rich rocks feature has been estimated at 8.33ha. The area figure has been taken from the Standard Data Form. Fundamentally there should be no measurable net reduction the extent of the habitat and, most importantly, its distribution throughout the site and the number of sites should be maintained.

However, due to the localised and fragmentary nature of this habitat current baseline estimates may not be very precise and any changes in extent estimates as a result of new survey may not represent real change but greater precision. On Strath SAC this habitat has only been found in seven locations, widely distributed across the site (as shown on map 6 of Averis & Averis 2000). Three of these are artificial exposures resulting from quarrying (the old marble quarries in Strath Suardal). Other limestone outcrops are very common at this site, but are better classed either as pavement or as smoother outcrops.

2b. Restore the structure, function and supporting processes of the habitat

This habitat is found in harsh and sometimes extreme conditions with limited soil development, but where there is some shelter and moisture, and so plants are sparse and scattered. Chasmophytic plant species are adapted to the stresses of drought.

However, the base-richness of calcareous rocks may encourage competition from more vigorous native species, such as bracken and/or scattered native trees or scrub; or non-native invasives such as New Zealand willowherb and *Cotoneaster*. Colonisation or shading of this habitat by vigorous native species, tree growth or invasive non-native species can reduce or eliminate cover of indicator species. On this site *Cotoneaster* has previously formed a dense and extensive cover on some limestone outcrops within the SAC. As it can grow and spread rapidly (and recover from treatment) and can shade out chasmophytic vegetation, it is a major threat to this habitat and is preventing it being assessed as favourable. Some control has been carried out but follow up control and surveillance is required.

Inappropriate grazing regimes, above low levels, have the potential to harm this feature through over-grazing and trampling damage. However, the inaccessibility of much of the habitat means most of the vegetation is ungrazed or very lightly grazed. Many vascular species are able to flower well, and in some places tall herb species grow vigorously.

2c. Maintain the distribution and viability of typical species of the habitat

Floristic variation within the habitat type is influenced by geographical location, altitude and rock type. On this site the habitat is almost always on steep bare rock with sparse assemblages of species such as *Festuca rubra*, *F. ovina*, *Asplenium viride*, *A. rutamuraria*, *Geranium robertianum*, *Thymus polytrichus*, *Viola riviniana*, *Carex flacca*, *Fragaria vesca*, *Molinia caerulea*, *Hieracium* sp. and the moss *Ctenidium molluscum*. In NVC terms the flora most closely matches the *Asplenium viride*-*Cystopteris fragilis* community OV40, although not all sites conform to any NVC type. Full species lists are provided in Averis & Averis 2000.

Excessive grazing/browsing/trampling by deer and/or livestock can contribute to a deterioration in the habitat structure, having harmful effects on the typical species, and should be only be done in a controlled, appropriate manner that helps maintain the habitat.

Colonisation or shading of this habitat by tree growth and/or woodland expansion can reduce or eliminate cover of indicator species, including bryophytes.

This habitat is very sensitive to muirburn and should be avoided in these areas.

Conservation Objectives Limestone pavements [H8240]

2a. Maintain the extent and distribution of the habitat within the site

The extent of the limestone pavements feature has been estimated 194.37ha. This figure has been taken from the Standard Data Form. Fundamentally there should be no measurable net reduction the extent of the habitat and, most importantly, its distribution throughout the site and the number of sites should be maintained.

However, the current baseline estimates for this habitat may not be very precise and any changes in extent estimates as a result of new survey may not represent real change but greater mapping precision. A lot of the limestone at Strath forms extensive outcrops dissected by open bare runnels, and are not considered to be pavement. The point at which the runnels become grikes can be subjective and where there is doubt limestone outcrops should be treated as if they are pavement.

Limestone pavements are widespread across much of the site. The largest and most conspicuous outcrops of pavement are along the high spine from Ben Suardal south-west to the head of the Allt nan Leac, reaching the coast to the south of Camus Malag. There are also some fine pavements in Strath Suardal and around Torrin. Areas where limestone pavement occurs are shown on map 5 in Averis & Averis (2000).

2b. Restore the structure, function and supporting processes of the habitat

This habitat lies wholly or partly exposed on the surface of the ground and has been fissured by natural erosion. The surface of the pavement has been dissolved by water over thousands of years into 'paving blocks', known as clints, with a complex pattern of crevices, known as grikes (or grykes), between them. The distinctive feature of the limestone pavement flora is the mixture of species.

The limestone outcrops are surrounded by rich grasslands flushed with calcium-charged water which runs down the runnels or grikes and washes the surrounding vegetation. The pavements are often set in green grassy mosaics of CG10 *Festuca-Agrostis-Thymus* grassland, CG13 *Dryas octopetala-Carex flacca* heath and U4 *Festuca-Agrostis-Galium* grassland. At Leac nan Craobh and Coille Gaireallach pavement occurs among W9 *Fraxinus-Sorbus-Mercurialis* woodland and W11b *Quercus-Betula-Mercurialis* woodland.

Grazing pressure is a key factor in determining ecological variation in limestone pavements. Where grazing pressure is low, woodland may cover the pavement and woodland vegetation may mask the limestone surface. Here only the massive areas of pavement may be exposed as clearings. Where there is heavy grazing pressure, vegetation may be found only in the grikes, but, where grazing is lighter, dwarf trees, herbs and ferns may protrude from the grikes.

Grazing levels should be appropriate (at low levels) across the habitat to ensure the maintenance of the herbaceous vegetation cover which needs to be made up of emergent (i.e. growing up out of the grikes) and clint-top plants, with flower heads and fern fronds which are not impacted upon by grazing animals.

The wooded pavements should be restored: seedlings, saplings, mature trees and shrubs should all be present and where grazing/browsing occurs it should be at a low level where

distinct browse lines or shaping of the canopy (topiary-like effects) does not occur. The majority of sample points which had trees or shrubs present failed this target during monitoring in 2014 due to overgrazing.

An expansion of woodland over an increased proportion of the limestone pavement would also be acceptable in the future.

2c. Restore the distribution and viability of typical species of the habitat

Expansion of non-native *Cotoneaster* is a significant and ongoing threat to the distribution and viability of the typical species because it smothers limestone outcrops and competes with native species. It needs to be eradicated or brought under close control in order to restore the habitat as it is currently contributing towards this habitat being in unfavourable condition. Ongoing surveillance is also required.

The vegetation of limestone pavements is unusual because of the combinations of floristic elements, including woodland and woodland edge species.

In the crevices the habitat is moist, shaded and sheltered and many of the plants which grow here are woodland species such as *Sanicula europaea*, *Mercurialis perennis*, *Phyllitis scolopendrium*, *Geranium robertianum*, *Brachypodium sylvaticum*, *Viola riviniana*, *Oxalis acetosella*, *Polystichum aculeatum* and *Hedera helix*. *Festuca rubra* and *Plantago lanceolata* are also common, as are the ferns *Asplenium viride*, *A. trichomanes* and *A. ruta-muraria* and the mosses *Tortella tortuosa*, *Neckera crispa*, *Ctenidium molluscum*, *Hypnum lacunosum* and *Fissidens dubius*. *Rubus saxatilis* is locally common. Other species of interest include *Cirsium heterophyllum*, *Dryas octopetala*, *Hypericum androsaemum*, *Rosa pimpinellifolia*, the mosses *Isopterygium pulchellum* and *Orthothecium rufescens*, the liverwort *Scapania aspera* and the lichen *Solorina saccata*. In some places the grikes are small and shallow with little vegetation apart from grasses such as *Molinia caerulea*. In NVC terms the flora of the limestone pavement at Strath Suardal shows affinities with CG10 grassland, CG13 *Dryas* heath and W9 woodland, but appears closest to that of the *Asplenium viride*-*Cystopteris fragilis* community OV40.

Most of the patches of limestone pavement are floristically similar to each other, but the sloping areas on the upper W side of Ben Suardal are rather different, with some evidence of flushing, as in the associated CG10c *Festuca-Agrostis-Thymus* grassland, and a more montane flora including a lot of *Alchemilla alpina* and some good patches of the distinctive red-coloured moss *Orthothecium rufescens*

The nationally scarce orchid dark red helleborine *Epipactis atrorubens* is locally very common amongst the limestone outcrops in the hazel woodland at Leac nan Craobh, near Torrin. It also occurs in limestone pavement on the southern-central part of the site and on Ben Suardal.

The specialist snail *Pyramidula pusilla* is present in limestone pavement at Kilbride.

In most of the pavements there are a few trees which occasionally thicken up into a sparse and open scrub: the most common species are ash, hazel, sycamore, rowan and hawthorn, and there are smaller amounts of holly, guelder rose and juniper.

Excessive grazing/browsing by deer and/or livestock (above low levels) can lead to a reduction or loss in the typical/indicator species for this habitat and should be only be done in a controlled, appropriate manner that helps maintain the open and restore the wooded habitat.

Colonisation of this habitat by vigorous native species, such as, (false oat-grass *Arrhenatherum elatius*; creeping thistle *Cirsium arvense*; spear thistle *Cirsium vulgare*; crested dogstail *Cynosurus cristatus*; large docks; perennial ryegrass *Lolium perenne*; common ragwort *Senecio jacobaea*; bramble *Rubus fruticosus*; stinging nettle *Urtica dioica*; bracken *Pteridium aquilinum*) can lead to irreversible habitat loss in the longer term, through loss of typical/indicator species. The extent of bracken in particular needs to be monitored as it is currently causing this feature to be assessed as unfavourable.

This habitat is very sensitive to muirburn and should be avoided in these areas.

Conservation Objectives for *Tilio-Acerion* forests of slopes, screes and ravines [H9180] (Mixed woodland on base-rich soils associated with rocky slopes)

2a. Maintain the extent and distribution of the habitat within the site

The extent of the *Tilio-Acerion* forests of slopes, screes and ravines feature has been estimated at 13.88ha. The area figure is an estimate and has been taken from the Standard Data Form. Fundamentally however there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site.

Within Strath SAC the main areas occur at Leac nan Craobh, SW of Torrín. There are other patches of *Tilio-Acerion* woodland either side of the road between Torrín and Kilbride and on the N-facing slope south of the Allt nan Leac.

There are also extensive areas of moderately to heavily grazed W11b woodland at Coille Gairealach, Allt Suardal and Torrín/Kilbride, much of which might have been derived by grazing from W9 *Fraxinus-Sorbus-Mercurialis* woodland. With reduced grazing and an increase of tall herbs the more herb-rich areas of W11b might develop into W9.

This conservation objective is considered to be met if the conditions to ensure the habitat's long-term existence are in place. This will include the avoidance of actions that could lead to a permanent reduction in the extent or distribution of the habitat such as development, agricultural modification and habitat fragmentation.

2b. Restore the structure, function and supporting processes of the habitat

This habitat depends on nutrient-rich and base-rich soils and shady micro-climates found towards the bases of slopes, coarse scree, cliffs, steep rocky slopes and ravines. In the mild moist oceanic climate it can also occur in more open areas. On this site it is characterised by:

- Hazel dominated scrubby woodland which is typical of the habitat on the west coast of Scotland.
- Includes young, mature, dying and dead trees in dense thickets and open glades with a range of shade cast on the woodland floor. Hazel trees are capable of self-coppicing and phoenix regeneration from existing stools.
- Is made up of diverse broadleaved tree and shrub species, but most consistently and abundantly by species with the characteristics (shade, leaf decay, structure, bark pH and obligate/associated dependent species) of ash, hazel and birch spp. The high forest types include long lived trees growing to large dimensions with a variety of niches including furrowed bark, rot-holes, large slow-decaying snags and deadwood.

The ground flora associated with the habitat is linked to variations in moisture and shade, or 'disturbance communities' associated with scree and cliff-bases. A wide range of other basiphilous herbs and grasses may occur within these stands. Many sites support notable

bryophytes, in particular calcicoles associated with base-rich rock outcrops and (in western stands) Atlantic species. Some localities have important assemblages of epiphytic lichens.

These characteristics can be achieved by maintaining an abundance of key tree species, particularly ash, hazel and birch spp., an absence of invasive species which compromise the critical characteristics, and low grazing levels that allow trees, shrubs and ground flora to develop naturally and flower, fruit etc.

Inappropriate grazing pressure, above a low level, predominantly by cattle and sheep is causing this habitat to be assessed as unfavourable. The overgrazing has prevented the establishment and growth of trees resulting in not all age classed being present in the wood as would be expected under natural processes. Furthermore the herbivore pressure is causing this site to fail through and overabundance of bare and disturbed ground.

2c. Maintain the distribution and viability of typical species of the habitat

The NVC type conforming to Tilio-Acerion on this site is the W9 *Fraxinus excelsior* – *Sorbus aucuparia* – *Mercurialis perennis* community.

On this site the canopy is dominated by *Corylus avellana* with some *Sorbus aucuparia*, *Betula pubescens*, *Fraxinus excelsior*, *Salix cinerea* and *Crataegus monogyna*.

Bryophytes form the bulk of the ground vegetation, though most of this is on limestone outcrops, with fewer bryophytes on the intervening areas of soil. The commonest bryophytes on rock surfaces - including thin layers of humus overlying the less steep rocks - are the mosses *Ctenidium molluscum*, *Eurhynchium striatum*, *Neckera complanata*, *Tortella tortuosa*, *Breutelia chrysocoma* and *Thuidium tamariscinum*, and the liverworts *Scapania aspera* and *Plagiochila porelloides*. The mosses *E. striatum*, *T. tamariscinum*, *Hylocomium brevirostre*, *H. splendens*, *Scleropodium purum* and *Plagiomnium undulatum* are common on the ground. The commonest vascular species are the forbs *Primula vulgaris*, *Viola riviniana*, *Potentilla erecta*, *P. sterilis*, *Filipendula ulmaria*, *Geranium robertianum*, *Lysimachia nemorum* and *Alchemilla glabra*, and the grasses *Brachypodium sylvaticum*, *Festuca rubra* and *Agrostis capillaris*. Many other species also occur, including *Geum rivale*, *Angelica sylvestris*, *Succisa pratensis*, *Heracleum sphondylium*, *Rubus saxatilis*, *Hyacinthoides non-scripta*, *Conopodium majus*, *Veronica chamaedrys*, *Athyrium filix-femina*, *Oxalis acetosella*, *Sanicula europaea*, *Urtica dioica*, *Trollius europaeus*, *Hypericum androsaemum* and *Stachys sylvatica*. Some vascular plants such as *Geranium robertianum* and *Oxalis acetosella* grow in small cracks on rock outcrops as well as on the ground. This woodland belongs to the *Crepis paludosa* sub-community W9b.

The base-rich bark of the hazel and ash in particular is important for lichens, although little systematic survey has been carried out on this site.

The arboreal snail *Balea heydeni* has been recorded in the Kilbride woodlands.

Tree Health implications

At present this habitat appears more robust than many similar habitats because Wych elm and Ash (both susceptible to disease) are less common. Ash is present and Ash Dieback (ADB) has been recorded on Skye. While the end point of the disease is not known, it is likely that most of the ash in this woodland type will be damaged or killed, and that no solution beyond the very long term options is currently available. Hence, for this woodland type, the provision of ash-associated critical characteristics is at serious risk.

Conservation Measures

Strath SAC is notified as a Site of Special Scientific Interest and management changes described on the list of Operations Requiring Consent must have prior consent from SNH (NatureScot).

Current and recommended management for spring and fen habitats (Hard water springs depositing lime; Base-rich fen)

Issue	Measure	Responsible party
Herbivore impacts (grazing and/or trampling)	Ensure that herbivore impacts on the features are 'low' based on the NatureScot Herbivore Impact Assessment Process to prevent poaching and/or loss of typical species. Avoid supplementary feeding areas close to these habitats which would increase grazing and trampling impacts and potentially encourage 'weed' species.	Land managers Deer Managers
Heavy trampling and/or tracking	Trampling and/or tracking by deer and livestock to be minimal; tractor, ATV and motorbikes to avoid these areas; to prevent active drainage of this habitat.	Land managers Deer Managers
Colonisation by native and/or non-native species [eg common reed, soft rush, trees]	Ensure colonisation of this habitat by vigorous native species, such as, (common reed <i>Phragmites australis</i> and/or soft rush <i>Juncus effuses</i>), tree or scrub growth or invasive non-native species is minimal to prevent loss of indicator species and conversion to other open ground habitats or woodland. Woodland cover to be maintained where springs emerge within woodland.	Land managers, NatureScot
Habitat Management	Agri-environment and deer management plans should seek to maintain these areas. Muirburn should be avoided in these areas (either by identifying sensitivity in Muirburn plan or by avoiding Muirburn within the SAC).	NatureScot, landowners, land managers.
Development management and maintenance of infrastructure	Direct and indirect (especially drainage) impacts to be considered for all development including permitted development and maintenance. Includes water pipelines, power lines, tracks, roads, ditching.	Land Managers Statutory undertakers (SSE Scottish Water; Roads)

Current and recommended management for Wet heathland with cross-leaved heath

Issue	Measure	Responsible party
Grazing	Overall grazing levels on this habitat appear to be appropriate over a number of monitoring cycles. Localised higher grazing levels do occur on some parts of the habitat. In most cases this is natural (proximity of grassland	Land manager Deer Manager

	favoured by stock; sheltered area adjacent to woodland which may attract seasonal increases in grazing intensity).	
Fire	Muirburn and accidental wild fires are a threat to the habitat, especially those parts of the feature with a high bryophyte interest. Land managers have burnt adjacent areas but have sought to avoid the designated ground.	Land manager
Drainage	There has been little direct or indirect drainage to date and this situation should be maintained.	Land manager SGRPID
Afforestation	There has been no afforestation to date and this situation should be maintained	Land manager Scottish Forestry
Non-native and invasive species	<i>Cotoneaster</i> is present on the edge of wet heath but does not appear to present a threat to the feature because the ground conditions do not favour it. Other invasive species such as Japanese Knotweed and Fuscia are also present nearby and should be controlled to avoid spreading onto the site	Land manager NatureScot
Recreation	There are a number of popular walking/cycle routes through the SAC, particularly the Marble line and Borreraig to Suisnish loop. These are mainly on existing tracks so impacts on adjacent habitats are low. However maintenance (e.g. of cross drains, water bars and culverts is needed to keep these routes in good condition.	Land manager, Local authority, NatureScot
Development management and maintenance of infrastructure	Direct and indirect (especially drainage) impacts to be considered for all development including permitted development and maintenance. Includes water pipelines, power lines, tracks, roads, ditching.	Land Managers Statutory undertakers (SSE Scottish Water; Roads)

Current and recommended management for Alpine and subalpine calcareous grasslands

Issue	Measure	Responsible party
Grazing and levels by wild and domestic stock (appears to be mainly sheep on this site but there is also grazing by cattle, red deer, hare and rabbit)	Grazing is essential to maintain the feature. Past stock grazing levels were probably too high (2000 & 2004) but appear to have gone down more recently. Grazing in 2014 was considered to be around the optimum. An abundance of flowering <i>Dryas octopetala</i> across the site was encouraging, although there were localised signs of heavy browsing considered to be inhibiting growth and flowering. The feature is particularly vulnerable to an uncontrolled increase in browsing intensity occur particularly during winter, for instance through a rise in red deer populations.	Land manager Deer Managers

Competition with non-native <i>Cotoneaster</i>	<i>Cotoneaster</i> is an ongoing threat on this site. There was more than 1% cover of <i>Cotoneaster</i> at 10 out of 28 sample points in 2014 (this in spite of control in earlier years). A further 2 sample points had <i>cotoneaster</i> present but less than 1% cover. In some cases it was well-established and was even out-competing <i>Dryas</i> in one location. It is essential that the <i>Cotoneaster</i> is controlled (likely with chemicals, either as a foliage spray and/or stump treatment. Follow up treatment, especially of older deeply-rooted plants is likely to be needed. Removing the seed source of the <i>Cotoneaster</i> would also be desirable (the biggest patches are on the walls of the graveyard at Kilchrist and in the quarries in Strath Suardal)	Land manager NatureScot
Invasion by bracken.	Bracken appears to have become more abundant over the last two decades. Averis & Averis reports that no bracken was recorded within stands of CG13 <i>Dryas-Carex</i> heath at the time of the baseline survey. A possible loss of extent to calcareous grassland as a result of colonisation by bracken was noted at three sample locations during monitoring in 2014 but since these were new sample points it was not categorical. There appears to be a delicately balanced 'happy medium' for grazing levels where direct grazing impacts on the <i>Dryas</i> heath is acceptable but not so low that bracken expands. Cattle may be more helpful in achieving this than sheep since they will not graze the <i>Dryas</i> heath as close and will also crush bracken fronds and rhizomes.	Land manager
Recreation	There are a number of popular walking/cycle routes through the SAC, particularly the Marble line and Borreraig to Suisnish loop. These are mainly on existing tracks so impacts on adjacent habitats are low. However maintenance (e.g. of cross drains, water bars and culverts is needed to keep these routes in good condition. The proximity of the <i>Dryas</i> heath to the tracks presents a good opportunity for interpretation. Motorbike trials have previously been held in the Strath Suardal area. Abrasion of <i>Dryas</i> heath is a concern for off-road use of motorbikes or mountain bikes and SSSI consents would be required.	Land manager, Local authority, NatureScot

Conservation Measures for Calcium-rich nutrient-poor lakes, lochs and pools

Issue	Measure	Responsible party
Hydrological regime	Monitoring of Loch Cill Chriosd in 2014 suggested that there had been a decline in	SEPA Scottish Water

	<p>loch area and depth, possibly due to a damaged weir. The 2010 monitoring also refers to expansion of <i>Phragmites australis</i> and <i>Schoenoplectus lacustris</i> emergent vegetation. References to expansion of the reed beds go back to 2000 and aerial photos suggest that the weir has been in a state of disrepair for many years. Investigation and discussion with interested parties is needed to establish what the 'natural' level should be and to repair/maintain the weir to achieve that level. Loch Lonachan is managed as a water source for south Skye. Although the abstraction is passive (constant 1.2Ml/d) and subject to CAR controls there remain concerns about whether the abstraction will increase the frequency, magnitude and duration of drawdown and drought events and, in the long term, impact on the conservation objectives. Annual monitoring and 5 year ecology and hydrology reviews are a requirement of the CAR licence and associated operating plan. Both lochs are at risk of increasing drought frequency and duration. Government climate change scenarios for the North of Scotland indicate a probable reduction in the proportion of annual precipitation which occurs during the summer, which would be expected to exacerbate the effect of summer drought events.</p>	<p>Land owner/manager Owners/Managers of fishing rights within Loch Cill Chriosd and Broadford River NatureScot</p>
Water quality	<p>A large amount of filamentous algae was recorded from the south-eastern shore of Loch Cill Chriosd during loch monitoring in summer 2014. The algae appeared to be associated with run-off from near the road and extended along the distance of the inflow, and along the water's edge. Point sources of pollution should be avoided by appropriate siting (e.g. of stock handling facilities and supplementary feeding areas) and avoiding direct drainage into the loch (e.g. through the use of filter drains or buffer strips)</p>	<p>SEPA Land Manager Highland Council Roads</p>
Water chemistry	<p>Nutrient levels, pH, dissolved oxygen etc should be monitored on a regular basis to pick up any trends outside the level of natural variation.</p>	<p>SEPA Scottish Water Land Manager</p>
Non-native and exotic species	<p>No non-native or exotic species have been recorded in these lochs. However Loch Cill Chriosd in particular is adjacent to the road and at risk of accidental introductions by visitors.</p>	<p>SEPA NatureScot Local angling club Land Manager</p>
Water-based recreation	<p>There is currently little recreational use of these lochs but since tourism is increasing this needs to be kept under review.</p>	<p>SEPA Local Authority Landowner</p>

Current and recommended management for Calcareous rocky slopes with chasmophytic vegetation

Issue	Measure	Responsible party
Herbivore impacts	Ensure that herbivore impacts on the feature are 'low' based on the FLS/NatureScot Herbivore Impact Assessment Process. This is likely to remain the case because the habitat is generally inaccessible to grazing animals.	Land managers
Colonisation and/or shading by native and/or non-native species [e.g. <i>Cotoneaster</i>]	Ensure colonisation or shading of this habitat by tree growth; woodland expansion; bracken; invasive non-natives is minimal to maintain cover of indicator species, including bryophytes. In particular control <i>Cotoneaster</i> with the aim of eradicating from within the site (and adjacent sources where appropriate). <i>Cotoneaster</i> control was carried out in 2007-2009 and this needs to be followed up. Particular attention should be paid to well established bushes which has rooted into the crevices where re-treatment is likely to be necessary. Regular surveillance is also needed to pick up newly seeded plants.	Land managers, NatureScot
Muirburn	Any muirburn plan for the site/area should include measures to ensure this habitat is avoided	Land managers.
Recreation activity	Ensure trampling by walkers is minimal to maintain cover of typical species. The Suardal marble quarries are popular with University field trips. Signage on site alerts groups to the sensitivities.	Land owners Land managers NatureScot.

Current and recommended management for Limestone pavements

Issue	Measure	Responsible party
Herbivore impacts (grazing and/or browsing)	Ensure that herbivore impacts on the feature are 'low' based on the FLS/NatureScot Herbivore Impact Assessment Process to prevent excessive browsing and/or loss of typical species. In particular avoid distinct browse lines on the trees which grow over the wooded pavements	Land managers, Deer Managers
Colonisation by invasive non-native species and vigorous native species [eg bracken and nettle]	<i>Cotoneaster</i> is widespread in the Torrin and Suardal parts of the site. Remove <i>Cotoneaster</i> from this habitat by a combination of cutting and stem treatment and chemical spraying by hand depending on size of plant and accessibility of location. Follow up treatment for re-growth/re-colonisation. <i>Cotoneaster</i> control was carried out by NatureScot in the Strath Suardal part of the site in 2007-2009 and this needs to be followed up. Ideally treat 'mother' plants at source (e.g. Kilchrist churchyard and Strath	Land owner Land managers, NatureScot, Church of Scotland

	Suardal quarries. Japanese knotweed and Fuscia are present adjacent to the site in Torrin and control of these species should be continued in order to avoid them spreading into the SAC. Avoid colonisation of this habitat by vigorous native species, such as bracken and nettles by adjusting stock numbers at particular times of year when they may congregate, changing from sheep to cattle where possible and potentially carry out localised manual bracken control	
Habitat Management	Wooded limestone pavement is likely to be most appropriately managed by fencing to exclude stock and, if necessary carry out seasonal grazing with restricted numbers of animals as has been done at Leac na Craobh.	NatureScot, landowners, land managers.
Fire	While deliberate burning is unlikely wildfires resulting from muirburn is a risk.	Land Managers

Current and recommended management for *Tilio-Acerion* forests of slopes, screes and ravines

Issue	Measure	Responsible party
Grazing	Much of the W9 woodland on this site has been fenced and is subject to an appropriate grazing regime under recent agri-environment schemes. This needs to be maintained. However important areas of woodland (especially the Torrin hazel woodland above the road) are still being heavily overgrazed and should be brought under similar management. Larger areas of W11 woodland (such a Coille Gaireallach) would also benefit from reduced grazing which may allow the reversion of some of this woodland to W9. Discussion between land managers, specialist agents and NatureScot is required to explore ways to achieve this while still delivering the crofters agricultural aims.	Land manager NatureScot
Supplementary feeding for stock	Supplementary feeding of livestock is carried out in the winter. This includes hay/straw, draff and neeps. Nutrient enrichment and poaching associated with these areas can cause loss of ground flora, introduction/expansion of weed species (thistles, nettles, dock, ragwort). There can also be increased browsing pressure in the areas close to the feeders. The location of the feeding needs to be carefully selected to avoid these effects. Supplementary feeding must be consented via SSSI consents or approved management plans/agri-environment contracts (e.g. AECS).	Land manager
Road improvements	The main road goes through Torrin hazel woods. Past road widening resulted in tree felling and	Highland Council Roads

	tipping of soil and other material down the bank into the woodland. Discussions should take place in advance of proposals to avoid similar issues arising in the future.	NatureScot
Cutting trees	Cutting back hazel to put in new fences or keep access routes open has been carried out in the past. This should be avoided except where agreed in advance through agri-environment contracts/SSSI consent.	Land Manager NatureScot

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