

# **LENDALFOOT HILLS COMPLEX SPECIAL AREA OF CONSERVATION (SAC)**

## **CONSERVATION ADVICE PACKAGE**



Image: Ailsa Craig viewed from Knockbain (Knockdaw Hill SSSI and Lendalfoot Hills Complex SAC)  
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## Site Details

Site name:	Lendalfoot Hills Complex
Map:	<a href="https://sitelink.nature.scot/site/8288">https://sitelink.nature.scot/site/8288</a>
Location:	South Western Scotland
Site code:	UK0013592
Area (ha):	1,308.02
Date designated:	17 March 2005

## Qualifying features

Qualifying feature	SCM assessed condition	SCM visit date	UK overall Conservation Status
Wet heathland with cross-leaved heath	Unfavourable No change	13 July 2008	Unfavourable-Bad
Dry heaths	Unfavourable Declining	18 July 2002	Unfavourable-Bad
Grasslands on soils rich in heavy metals	Unfavourable Declining	3 June 2003	Unfavourable-Bad
Species-rich grassland with mat-grass in upland areas*	Unfavourable No change	13 July 2008	Unfavourable-Bad
Very wet mires often identified by an unstable 'quaking' surface	Unfavourable Declining	18 July 2002	Unfavourable-Bad
Base-rich fens	Unfavourable Recovering	13 July 2008	Unfavourable-Bad

### 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.

\*a priority habitat under the Habitats Directive

## Other overlapping Protected Areas

[Pinbain Burn to Cairn Hill SSSI](#), [Littleton and Balhamie Hills SSSI](#), [Aldons Hill SSSI](#), [Knockdaw Hill SSSI](#), [Millenderdale SSSI](#)

## **Key factors affecting the qualifying features**

### Wet heathland with cross-leaved heath

Wet heath usually 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.

The key management issues for this habitat in Scotland are the nature and extent of deer pressure, grazing generally, burning, forestry, non-native species, air pollution and habitat loss for development. When last assessed through NatureScot's site condition monitoring programme in 2008 this feature of the SAC was found to be in unfavourable condition. This was apparent in the dominance of purple moor-grass in places, with a corresponding low cover and diversity of positive indicator species. This was attributed to the lingering effects of historical burning, while grazing levels were considered suitable for the recovery of the feature in the absence of further burning. However, more recent monitoring of constituent SSSIs indicates that overgrazing remains a concern over part of the site, while a further isolated incident of burning elsewhere contributes to the continuing unfavourable condition of the feature.

Further information about wet heathland with cross leaved heath can be found [here](#).

### European dry heaths

European dry heaths are widely distributed in Scotland although most extensively in the central and north western Highlands. With such a broad geographic range they can dominate the landscape but exhibit a considerable variation in their structure and form. They typically occur on freely-draining, acidic to almost neutral soils with generally low nutrient content. Ericaceous dwarf-shrubs dominate the vegetation but all heaths vary in their flora and fauna according to climate, altitude, aspect, soil conditions (especially base-status and drainage), maritime influence, and grazing and burning intensity.

Nearly all dry heath is semi-natural, being derived from woodland through a long history of grazing and burning. Most dry heaths are managed as extensive grazing for livestock (sheep, cattle and deer) or, in upland areas, as grouse moors. Additional contemporary influences are tracks and paths that can cause fragmentation, degradation and erosion. Other key management issues include forestry, problematic native and non-native species and currently renewable energy proposals.

When last assessed through NatureScot's site condition monitoring programme in 2002 this feature of the SAC was found to be in unfavourable declining condition. This was due to the impacts of grazing on habitat structure and composition, with signs of excessive browsing on dwarf shrubs, low diversity of positive indicator species, burning, and localised overabundance of negative indicators like bracken and soft rush. Subsequent monitoring of dry heath on component SSSIs indicates a substantial improvement in condition due to reductions in grazing pressure,

cessation of burning, and bracken control, so future monitoring is expected to find the SAC dry heath feature is recovered or recovering.

Further information about European dry heath can be found [here](#).

#### Grasslands on soils rich in heavy metals

This habitat occurs on soils that have levels of heavy metals, such as lead, zinc, chromium and copper that are toxic to most plant species. The greatest extent of the habitat occurs on artificial sites associated with past mining activities, with near-natural examples – such as found in the Lendalfoot Hills Complex SAC – much more localised.

This habitat can be highly variable in composition and structure. The defining characteristic is the substrate, which must be ultra-basic.

Key management issues include inappropriate levels of grazing and air pollution leading to eutrophication of the nutrient poor soils. When last assessed through NatureScot's site condition monitoring programme in 2003 this feature of the SAC was found to be in unfavourable declining condition. This was due to insufficient diversity of habitat structure (sward heights too high or too low in places) and localised overabundance of negative indicators; both likely to reflect excessive or insufficient grazing depending on the location.

Further information about Grasslands on soils rich in heavy metals can be found [here](#).

#### Species-rich grasslands with mat-grass in upland areas

Species-rich grassland with mat-grass in upland areas tend to develop where there is flushing through base-rich strata on siliceous bedrock. These may include moderately base-rich metamorphic and igneous rocks. The soils have an acidic pH (<7.0 and mainly <6.0) and are derived from bedrocks with at least some silica.

The altitudinal range varies from near sea level to an upper limit of between 800 and 900 m.

This habitat is particularly susceptible to changed nutrient status, e.g. agricultural improvement, burning, over and under-grazing, forestry, air pollution and damage from recreational pressure. When last assessed through NatureScot's site condition monitoring programme in 2008 this feature of the SAC was found to be in unfavourable condition. This was due to grazing levels being too high in places, causing the sward to be too low and reducing the cover of plants other than grasses.

Further information about Species-rich grasslands with mat-grass in upland areas can be found [here](#).

#### Very wet mires often identified by an unstable 'quaking' surface

This feature is also known as transition mires and quaking bogs. The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich.

Transition mires and quaking bogs can occur in a variety of situations, related to different geomorphological processes: in flood plain mires, valley bogs, basin mires and the lagg zone of raised bogs, and as regeneration surfaces within mires that have been cut-over for peat or areas of mineral soil influence within blanket bogs (e.g. ladder fens).

Key factors affecting this habitat type in Scotland are alterations to the hydrology, over/undergrazing and disturbance to the surface i.e. trampling. When last assessed through NatureScot's site condition monitoring programme in 2002 this feature of the SAC was found to be in unfavourable declining condition. This was due to excessive cover of negative indicator species in some locations, likely to be the product of high grazing pressure and associated nutrient enrichment.

A fuller account of the habitat can be found [here](#).

### 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.

Key factors affecting this habitat type in Scotland are land use changes/development, pollution to ground or surface water and, inappropriate grazing pressure. When last assessed through NatureScot's site condition monitoring programme in 2008 this feature of the SAC was found to be in unfavourable recovering condition. Unfavourable condition was due to insufficient cover of positive indicator species, although the failure was marginal and attributed to historical pressures (chiefly burning) that no longer affect the feature. In the absence of ongoing negative pressures, feature condition is considered to be recovering.

Further information about base rich fens can be found [here](#).

## **Conservation Priorities**

Most of the qualifying interests are habitat types whose distributions are mutually exclusive due to their requirement for particular substrates and/or hydrological conditions.

However, two of the qualifying habitat types – *dry heaths* and *species-rich grassland with mat-grass in upland areas* – can occupy similar soil types, and the occurrence of one rather than the other will depend wholly on current and historical management factors, chiefly grazing and burning regimes.

*Species-rich grassland with mat grass in upland areas* is the only priority habitat among the six qualifying interests of the SAC. As such, management decisions should generally favour this habitat over *dry heaths* where the two are effectively in competition. However, exceptions should be made where dry heath is the dominant habitat in a given management (grazing) unit – for example in the eastern half of Aldons Hill SSSI.

In some management units, management allows the two habitat types to co-exist, and this should be supported in any decision-making. Typically, this is where species-rich grassland dominates on the lower (and more heavily grazed) parts of a hill field close to in-bye fields, while dry heath occurs on the upper and/or more remote parts of the hill.

Although other qualifying interests are not in competition with species-rich grassland and dry heath habitats, management decisions favouring one over the other may have some bearing on the condition of those other interests. *Base-rich fens* and *wet heathland with cross-leaved heath* will both benefit from light grazing to maintain an open habitat structure, but heavy grazing risks changing the vegetation composition and causing excessive ground damage (poaching). This should be taken into consideration when making management decisions around grazing regimes.

The qualifying interests *grasslands on soils rich in heavy metals* and *very wet mires often identified by an unstable 'quaking' surface* are relatively tolerant to a range of grazing pressures, as both tend to occur in wider grazing units and are not favoured by grazing animals. Furthermore, habitat structure and composition in these habitats is determined largely by substrate, although a degree of grazing/browsing is desirable to help maintain an open vegetation structure and prevent scrub encroachment.

## Conservation Objectives

### Conservation Objectives 1 and 2 for all Qualifying Features

**1. To ensure that the qualifying features of Lendalfoot Hills Complex 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 Lendalfoot Hills Complex SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature**

The aim at this SAC is to restore the habitats to 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 habitat is 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 habitat’s 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 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 Wet heathland with cross-leaved heath (also known as Northern Atlantic wet heaths with *Erica tetralix* [H4010])**

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

Maintain at approximately 329.62ha. 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. However there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site.

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

Wet heathland with cross-leaved heath is sensitive to inappropriate grazing or burning that may affect the habitat structure and function in two main ways. A combination of

overgrazing and burning can lead to creation of a grass sward if this is continued over many years. Overgrazing, by livestock, can also result in high levels of nutrient input and trampling. Under grazing can lead to the habitat type being colonised by non-typical species if this management is continued over many years. An appropriate level of grazing is therefore needed to maintain this habitat.

In general, the main requirement for wet heath is limiting active drainage in conjunction with the appropriate levels of grazing and burning; such levels will vary according to a number of factors such as altitude, aspect, location. Management effort should therefore be directed to maintain (or restore) 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.

At this site, overgrazing is the main negative pressure affecting feature condition, so key to restoring the structure, function and supporting processes of the wet heath will be reducing grazing in the relevant locations to an appropriate level.

### **2c. Restore 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.

Key indicator species for wet heathland with cross-leaved heath include:

<i>Calluna vulgaris</i>	common heather
<i>Carex</i> species	sedges
<i>Drosera</i> species	sundews
<i>Empetrum nigrum</i>	crowberry
<i>Erica</i> species	heaths
<i>Eriophorum angustifolium</i>	common cottongrass
<i>Myrica gale</i>	sweet gale
<i>Narthecium ossifragum</i>	bog asphodel
<i>Non-crustose lichens</i>	(lichens)
<i>Racomitrium lanuginosum</i>	woolly hair moss
<i>Sphagnum</i> species	(mosses)
<i>Trichophorum cespitosum</i>	deer grass
<i>Vaccinium</i> species	(heaths)

Typically associated birds are red grouse (*Lagopus l. scotica*), meadow pipit (*Anthus pratensis*), snipe (*Gallinago gallinago*), merlin (*Falco columbarius*) and hen harrier (*Circus cyaneus*).

At this site, excessive grazing pressure is believed to be the cause of a low cover and diversity of positive indicator plant species. Restoring the distribution and viability of typical species of the wet heath will therefore require a reduction in grazing pressure in the relevant locations.

## **Conservation Objectives for European dry heaths [H4030]**

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

Maintain the extent of dry heath at approximately 117.72ha. The area figure has been taken from the Standard Data Form, and is an estimate based on the fact that European dry heaths can form complex mosaics with habitats such as grasslands, wet heaths and

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

The habitat is found on freely-drained, nutrient-poor, acidic soils. This can determine the extent and distribution of the habitat throughout the SAC, although it is also dependant on management to maintain its extent including:

- an appropriate level of grazing (not too high or too low);
- the avoidance of any loss of habitat through increased extent of successional or adjacent natural habitats, afforestation or invasion by alien species;
- the avoidance of negative effects of access and recreation.

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

At this site, dry heaths typically occur in an intimate mosaic with other habitat types, e.g. wet heaths, flushes, fens and grasslands. While the relative distribution of these habitats is often determined by hydrology, the dry heaths occur under the same soil conditions as unimproved dry grasslands, including both acid grasslands and species-rich *Nardus* grassland. The balance between dry heath and grassland is chiefly determined by grazing practice (burning no longer being carried out). Dry heath typical persists under conditions of lighter grazing, especially during the winter months when heathers are most subjected to browsing by livestock. Where dry heath occurs, it is therefore necessary to establish the appropriate grazing regime, while taking into account the requirements of other habitats in the same grazing unit.

Excessive grazing/browsing has historically affected much of the dry heath habitat, although grazing has since reduced over much of the site to levels consistent with the feature's recovery. Where grazing/browsing remains too high, further grazing reductions will be necessary to restore the structure, function and supporting processes of the dry heath habitat.

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

Typical species include common heather (*Calluna vulgaris*) and bell heather (*Erica cinerea*), which together dominate the vegetation cover. Especially where the dry heaths grow on shallow soils of slopes and outcrops, the influence of the base-rich serpentinite bedrock encourages the occurrence of less common flowering plants such as northern bedstraw (*Galium boreale*) and dropwort (*Filipendula vulgaris*).

In many locations dry heaths occur in intimate mosaic with species-rich *Nardus* grassland, and vegetation of intermediate character is frequent, with heathers occurring at low cover among a diverse sward of grasses and other flowering plants (for typical species of the species-rich *Nardus* grassland see the later section).

Typical associated birds of upland heaths are red grouse (*Lagopus l. scotica*), black grouse (*Tetrao tetrix*), twite (*Carduelis flavirostris*), hen harrier (*Circus cyaneus*) and merlin (*Falco columbarius*).

The diversity and cover of positive indicator species has been found to be low in places, likely due to the lingering effects of historical overgrazing and burning. Burning is no longer carried out, so maintaining (and where appropriate establishing) a lighter grazing regime will be key to restoring the distribution and viability of typical species of the dry heath habitat.

## Conservation Objectives for Grasslands on soils rich in heavy metals (also known as Calaminarian grasslands of the *Violetalia calaminariae* [H6130])

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

The habitat's extent should be maintained at approximately 7.85ha. It is located wholly within the Pinbain Burn to Cairn Hill SSSI, where it occurs on scattered outcrops of serpentinite bedrock.

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

The structure and function of the habitat is most dependent upon the substrate, which here comprises outcrops of serpentinite bedrock. To maintain this habitat type it is important to avoid physical loss and damage of outcrops/substrate, as well as the following management impacts:

- excessive livestock pressure (overgrazing/trampling);
- encroachment of scrub;
- alterations of nutrient status through application of fertilisers, manures, etc.

While excessive grazing pressure can damage the habitat through both overbrowsing and mechanical damage (trampling), undergrazing can also damage the habitat if it allows encroachment of scrub or development of a tall, closed sward that shades out or outcompetes the smaller metallophyte species (noting that sward closure is usually limited by the nature of the substrate).

As the habitat has been found in places to have poor sward structure and excessive cover of negative indicator species associated with nutrient enrichment, achieving more suitable grazing levels (by reducing grazing in some locations, and increasing it in others) will be key to restoring the structure, function and supporting processes of the calaminarian grassland habitat.

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

Here, this is a habitat of soils derived from serpentinite, having more magnesium than calcium, along with the generally plant-toxic nickel and chromium. Such soils are typically species-poor but contain a number of species principally found in this habitat, most notably spring sandwort *Minuartia verna* and alpine penny-cress *Thlaspi caerulescens*, although a number of other species, such as sheep's fescue *Festuca ovina*, bladder campion *Silene vulgaris*, sea campion *Silene uniflora* and thrift *Armeria maritima* are genetically adapted to survive there.

In the Lendalfoot Hills Complex SAC, this habitat is found at scattered locations within the Pinbain to Cairnhill SSSI, occurring on small, localised outcrops of serpentinite rock, where it typically presents as patches of metallophyte plants (chiefly *Minuartia verna* and *Thlaspi caerulescens*) among exposed substrate. Typically, the outcrops occur within closed-sward species-rich grassland, also on soils derived from serpentinite rock, although with the toxic elements sufficiently moderated by soil development that other

plants are able to survive. Such grassland would contribute to the qualifying feature *species-rich grassland with mat-grass in upland areas*.

Many metallophyte species (plants that can tolerate heavy metals) that grow on this habitat type are shade intolerant. Care should be taken when assessing nearby activities that may cause shading e.g. forestry plantation.

In summary, the typical species of this feature at this site are:

<i>Antennaria dioica</i>	mountain everlasting
<i>Anthyllis vulneraria</i>	kidney vetch
<i>Arabis petraea</i>	garden arabis
<i>Armeria maritima</i>	thrift
<i>Campylium stellatum</i>	yellow starry feather-moss
<i>Carex flacca</i>	glaucous sedge
<i>Carex pulicaris</i>	flea sedge
<i>Cochlearia</i> spp.	scurvy grasses
<i>Euphrasia</i> spp.	eyebrights
<i>Koeleria macrantha</i>	crested hair-grass
<i>Linum catharticum</i>	purging flax
<i>Minuartia verna</i>	spring sandwort
<i>Plantago maritima</i>	sea plantain
<i>Schoenus nigricans</i>	black bog-rush
<i>Scilla verna</i>	spring squill
<i>Scorpidium scorpioides</i>	hooked scorpion-moss
<i>Selaginella selaginoides</i>	lesser clubmoss
<i>Silene maritima</i>	sea campion
<i>Thlaspi caerulescens</i> ( <i>T. alpestre</i> )	alpine penny-cress
<i>Thymus polytrichus</i>	wild thyme

As the diversity and cover of these species is affected at this site by over- and undergrazing (depending on the location), achieving suitable grazing levels will be key to restoring the distribution and viability of typical species of the calaminarian grassland.

## **Conservation Objectives for Species-rich grasslands with mat-grass in upland areas (also known as Species-rich *Nardus* grassland, on siliceous substrates in mountain areas [H6230])**

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

Maintain the extent of species-rich *Nardus* grassland at approximately 217.13ha.

The area figure has been taken from the Standard Data Form, and is an estimate based on the fact that species-rich *Nardus* grasslands can grade into unimproved acid grassland on deeper soils, and dry heath where grazing is lighter. However there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site.

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

As with many upland habitats maintaining species-rich grasslands with mat-grass in upland areas is mainly reliant on appropriate levels of grazing. Reduction in grazing may cause a change towards dry heath or to rank grassland dominated by taller grass species. Overgrazing or burning/muirburn may cause increase in unpalatable species e.g. *Prunella vulgaris*, *Cirsium* spp., and mosses, while trampling and nutrient enrichment from dunging etc. can lead to species-poor communities with *Lolium*, *Plantago* and *Poa*.

The grassland at this site is affected by overgrazing in places, causing excessively short swards and a poor diversity of plants other than grasses. Establishing lighter summer grazing regimes in relevant locations will therefore be key to restoring the structure, function and supporting processes of the habitat.

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

Species-rich *Nardus* grasslands are typified by a complex mosaic of grasses, small herbs and bryophytes.

Across Scotland, the species composition of this habitat type will be affected by factors such as altitude and soil moisture levels. Around Lendalfoot the habitat occurs at relatively low altitude, albeit on extensive unimproved 'hill' fields within the relevant farm holdings.

Here, the habitat comprises a dry grassland on shallow soils of slopes and outcrops, where the serpentinite bedrock has greatest influence. The dominant grasses are bents (*Agrostis* spp.), fescues (*Festuca* spp.), with frequent mat grass (*Nardus stricta*), heath grass (*Danthonia decumbens*) and crested hair-grass (*Koeleria macrantha*), the latter characteristic of unimproved, base-rich substrates. A characteristic feature of many grasslands in the Lendalfoot Hills Complex SAC is the presence of crested dog's-tail (*Cynosurus cristatus*), formerly sown in pastures and likely to persist as a relic of historical improvements.

Among the grasses is a diverse range of other flowering plants, of which the most abundant include thyme (*Thymus polytrichus*), mouse-ear hawkweed (*Pilosella officinarum*), rock-rose (*Helianthemum nummularium*), lady's bedstraw (*Galium verum*) and fairy flax (*Linum catharticum*). A maritime influence is evident with the presence of species such as thrift (*Armeria maritima*) and buck's-horn plantain (*Plantago coronopus*).

The grassland at this site is affected by overgrazing in places, causing excessively short swards and a poor diversity of plants other than grasses. Establishing lighter summer grazing regimes in relevant locations will therefore be key to restoring the distribution and viability of typical species of the habitat.

## **Conservation Objectives for Very wet mires often identified by an unstable 'quaking' surface (also known as Transition mires and quaking bogs [H7140])**

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

Maintain the extent of existing transition mires and quaking bogs at 9.16ha.

Accurate measurement of the extent of the transition mires and quaking bogs habitat is hard to achieve due to gradual transitions in vegetation to adjacent habitats. The area figure has been taken from the Standard Data Form and is therefore used as a guide only. There should be no measurable net reduction in the extent of the habitat and its

distribution throughout the site should be maintained. Habitat survey may be needed prior to assessing whether any plans or projects would alter the distribution and extent of the habitat.

On Lendalfoot Hills Complex SAC this habitat is found in greater or lesser amounts in each of the constituent SSSIs, sometimes extensive in relatively low-lying valley bottoms (as at Littleton and Balhamie Hills SSSI), in more discrete basins (Loch Lochton at Pinbain Burn to Cairn Hill SSSI, and at the western side of Knockdaw Hill SSSI), and elsewhere in smaller depressions sometimes on hillsides.

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

This habitat is usually present as a mosaic with other wetland habitats. The term “transition mire” relates to vegetation that, in floristic composition and general ecological characteristic, is transitional between acid bog and alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich.

The maintenance of appropriate hydrology for this habitat is important to retain the structure and function. Management to prevent or reduce detrimental effects of drainage, including in the wider surrounding area, is key.

Colonisation of this habitat by vigorous native species such as common reed and reed canary-grass, tree or scrub growth or invasive non-native species could lead to irreversible habitat loss in the longer term, through shading, drying out of the habitat and possible conversion to other open-ground habitats or woodland. Common reed in particular is considered to be encroaching on some areas of the habitat, notably at Littleton & Balhamie Hills SSSI (possibly related to nutrient enrichment) and on a small area at Pinbain Burn to Cairn Hill SSSI (likely exacerbated by low grazing levels).

Grazing at appropriate 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 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’.

Heavy trampling and/or tracking by livestock and vehicles can also 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.

For the reasons stated above, key to restoring the structure, function and supporting processes of the habitat will be establishing appropriate grazing levels (largely reductions but possibly increases in some areas) and limiting or preventing further nutrient enrichment.

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

This habitat is found in lowland and upland situations in transition with other habitats and the typical species are dependent on the site and location of the habitat. On this site the following NVC types are found:

M9 *Carex rostrata* – *Calliergon cuspidatum/giganteum* mire

M4 *Carex rostrata* – *Sphagnum recurvum* mire

M5 *Carex rostrata* – *Sphagnum squarrosum* mire

S9 *Carex rostrata* swamp

**S27 *Carex rostrata* – *Potentilla palustris* tall-herb fen**

Typical/indicator species at Lendalfoot Hills Complex SAC include bottle sedge *Carex rostrata* (all NVC types), common sedge *Carex nigra* (M4, M5 & S27), common cottongrass *Eriophorum angustifolium* (M4, M5 & S27), marsh bedstraw *Galium palustre* (M5, S9 & S27), marsh cinquefoil *Potentilla palustris* (M5, S9 & S27), bogbean *Menyanthes trifoliata* (M5, S9 & S27), marsh marigold *Caltha palustris* (S9 & S27), water horsetail *Equisetum fluviatile* (M5 & S27), lesser tussock sedge *Carex diandra* (S27) and water mint *Mentha aquatica* (S27).

The quaking bog and transition mire habitats can offer valuable feeding sites for wading birds such as snipe and curlew.

Although the habitat has been found to have a good diversity and cover of typical species, the overabundance of negative indicator species in some locations has been attributed to the impacts of grazing and associated nutrient enrichment. Where these impacts are ongoing, reducing grazing numbers will be key to restoring the distribution and viability of typical species of the habitat.

**Conservation Objectives for Base-rich fens (also known as Alkaline fens [H7230])**

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

Maintain the extent of existing base-rich fen at 53.63ha.

However, due to the 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.

In the Lendalfoot Hills Complex SAC, this habitat is widely distributed across each component SSSI, typically associated with wet hollows, flushes and the margins of smaller watercourses/ditches.

**2b. Restore 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. It can be found up to moderate altitudes, but generally below 600m. Tufa deposition may sometimes occur.

Grazing at appropriate levels can be beneficial in helping to maintain species-richness and in preventing succession. However, over-grazing and excessive poaching 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 restoration of the base-rich fen structure and function across the whole of the site.

Heavy trampling and/or tracking by livestock and vehicles 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 effusus*), 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.

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

On this site, the unfavourable condition of the feature has been attributed to the legacy of historical burning. Since burning is no longer carried out and there are no other negative pressures considered to be affecting the base-rich fen, continuation of current management should be sufficient to restore the structure, function and supporting processes of the habitat.

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

The characteristic vegetation of this habitat is short sedge mire (mire with low-growing sedge vegetation) of the following NVC types:

**M9 *Carex rostrata* – *Calliergon cuspidatum/giganteum* mire**, of which typical/indicator species include the following: brown mosses; bottle sedge *Carex rostrata*; bogbean *Menyanthes trifoliata*; and marsh cinquefoil *Potentilla palustris*.

**M10 *Carex dioica* – *Pinguicula vulgaris* mire**, of which at least 6 indicator species should be present from the following: brown mosses; quaking grass *Briza media*; dioecious sedge *Carex dioica*; glaucous sedge *Carex flacca*; tawny sedge *Carex hostiana*; yellow sedge *Carex viridula*; long-stalked yellow sedge *Carex lepidocarpa*; carnation sedge *Carex panacea*; flea sedge *Carex pulicaris*; jointed rush *Juncus articulatus*; fairy flax *Linum catharticum*; common butterwort *Pinguicula vulgaris*; lesser clubmoss *Selaginella selaginoides*; and marsh arrow-grass *Triglochin palustris*.

On this site, the habitat has been found to be in unfavourable condition due to an insufficient cover and diversity of typical/indicator species in some locations. This has been attributed to the legacy of historical burning. Since burning is no longer carried out and there are no other negative pressures considered to be affecting the base-rich fen, continuation of current management should be sufficient to restore the distribution and viability of typical species of the base-rich fen habitat.

## Conservation Measures

All areas of land within the Lendalfoot Hills Complex SAC are also designated 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

Issue	Measure	Responsible party
Herbivore impacts (grazing and/or trampling) - wet	All of the land is grazed by livestock – mainly sheep, alongside cattle in a few holdings. Grazing is mostly year-round, although where wet heath	Land manager RPID NatureScot

and dry heath, very wet mires, base rich fens	and dry heath is a major component of the management unit it will be beneficial to manage grazing so that livestock densities are low during winter when browsing impacts on heathers are likely to be greatest. This is also the case for very wet mires and base-rich fens to reduce the risk of trampling damage, although a degree of grazing will help to maintain an open vegetation structure. As very wet mires and base rich fens occur within the Lendalfoot Hills Complex SAC as part of wider management units dominated by other qualifying habitats, livestock will spend relatively little time on them, preferring the drier, more productive heath and grassland habitats.	
Herbivore impacts (grazing and/or trampling) - grasslands on soils rich in heavy metals	Land containing the feature is grazed by sheep. Continued moderate grazing helps to discourage the development of a dense sward or scrub. At the same time, grazing levels should not be increased to levels where they would cause overgrazing or erosion of the outcrops where the feature occurs.  As with grazing, light trampling can help to maintain the characteristic open vegetation of the feature, but increases in livestock density should be avoided so that feature damage does not result.	Land manager
Herbivore impacts (grazing and/or trampling) - species rich grasslands	Moderate grazing is key to maintaining a good diversity and sward structure in the species-rich grassland. All of the land is grazed by livestock – mainly sheep, alongside cattle in a few holdings. Grazing is mostly year-round, although in a small part of the site, grazing occurs only in late autumn and winter which favourably permits the development of a taller, flower-rich sward more akin to a hay meadow.  Localised light trampling can benefit the floristic diversity of the sward by creating new germination niches. However, heavier trampling which might reduce diversity and cause erosion is to be avoided	Land manager RPID NatureScot
Muirburn	Burning is no longer routinely carried out within the site, and is especially to be avoided in areas of wet heath as damaging to species richness and composition, and is best avoided in areas of dry heath as potentially damaging to species richness and composition.	Land manager
Drainage	Active drainage is to be avoided, and opportunities for blocking/impeding existing drains/ditches should be explored where these could enhance the extent or functioning of qualifying habitats.	Land manager NatureScot

Afforestation	Tree planting is to be avoided. Some parts of the site are adjacent to conifer plantations, which are a localised source of invasive regeneration of Sitka spruce. Such self-seeded trees should be removed.	Land manager Scottish Forestry
Colonisation by vigorous native and/or non-native species	<p>Colonisation by undesirable native plant species is not a significant concern for the wet heath habitat, although there are areas where a dense heather sward has developed and cutting or swiping could improve habitat structure and diversity.</p> <p>Bracken encroachment affects dry heaths and species-rich grassland in some locations, and may need controlled by chemical or mechanical methods where it becomes dense.</p> <p>Development of a dense sward of native grasses and heathers could impact on feature condition of grasslands on soils rich in heavy metals, although the exposed, friable and metal-rich nature of the substrate inhibits dense vegetation cover.</p> <p>Colonisation of very wet mires and base rich fens by vigorous native or non-native plant species can result in loss of diversity and drying out of the vegetation surface. At Lendalfoot Hills Complex SAC the only species locally encroaching on very wet mires is common reed, possibly encouraged variously by reduced grazing pressure and/or nutrient enrichment.</p> <p>Invasive non-native species are not currently affecting feature condition at the Lendalfoot Hills Complex SAC. Routine monitoring will continue to identify INNS should they occur.</p>	Land manager NatureScot
Vehicle use	<p>Quad bikes are widely used for livestock management, and impacts are occasionally observed as tracks crossing habitats on softer ground, i.e. fens, mires and flushes. Alternative routes on drier habitats should be used where possible.</p> <p>Impacts on dry heath and species-rich grassland tend to be negligible, due to the resilience of the habitat/substrate and relatively infrequent occurrence.</p>	Land manager
Recreation	There is little use of the site for recreation, with public access mainly focused (though still limited in scale) on the Grey Hill Grasslands Scottish Wildlife Trust Reserve, forming part of the Pinbain Burn to Cairnhill SSSI. Such access does not generate significant pressure on the qualifying habitats, and	Land manager Local authority NatureScot

	is encouraged as a way of promoting public awareness and appreciation.	
Habitat Management	Promote positive habitat management through available funding schemes, e.g. AECS.	NatureScot Land manager

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