

Appendix 7.1 National Vegetation Classification & Habitats Survey Report

This page is intentionally blank.



MacArthur Green

Douglas West Wind Farm Extension
National Vegetation Classification & Habitats
Survey
Technical Appendix 7.1

Prepared by: Jason Mackay ACIEEM
Authorised by: Brian Henry MCIEEM

Date: 21 March 2019

Tel: 0141 342 5404
Email: brian.henry@macarthurgreen.com
Web: www.macarthurgreen.com
Address: 93 South Woodside Road | Glasgow | G20 6NT

Document Quality Record.

| Version | Status | Person Responsible | Date |
|----------------|-------------------|---------------------------|-------------|
| 0 | Draft | Jason Mackay | 22/11/2018 |
| 0.1 | Reviewed | Brian Henry | 26/11/2018 |
| 0.2 | Updated | Jason Mackay | 12/12/2018 |
| 1.0 | Internal Approval | Brian Henry | 17/12/2018 |
| 1.1 | Updated | Rafe Dewar | 21/03/2019 |

CONTENTS

Executive Summary..... iii

1 Introduction 1

2 The site and Study Area 1

3 Methodology..... 2

4 Survey Details & Constraints..... 2

5 NVC Survey Results and Vegetation Descriptions..... 3

 5.1 Summary of NVC Communities..... 3

 5.2 Mires and Flushes 4

 5.3 Wet Heaths 8

 5.4 Dry Heaths..... 8

 5.5 Calcifugous Grasslands and Bracken-Dominated Vegetation..... 10

 5.6 Mesotrophic Grasslands 12

 5.7 Woodland and Scrub..... 13

 5.8 Swamps and Tall-Herb Fens 15

 5.9 Non-NVC Communities & Categories 16

 5.10 Invasive Non-Native Species 17

 5.11 Notable Species..... 17

6 Correspondence with Phase 1 Habitats..... 17

7 Evaluation of Botanical Interest..... 18

 7.1 Overview 18

 7.2 Groundwater Dependent Terrestrial Ecosystems (GWDTE)..... 18

 7.3 Annex I Habitats 20

 7.4 Scottish Biodiversity List Priority Habitats 22

 7.5 Summary 22

8 Summary 23

Glossary..... 25

References 27

Annex A. NVC Target Notes..... 28

Annex B. Target Note Photographs..... 29

Annex C. General Community Photographs 30

LIST OF TABLES

Table 6-1 Phase 1 Habitat Type Equivalents of NVC Communities and Other Habitats Recorded 17
Table 7-1 Communities Within The Study Area Which May Potentially be Classified as GWDTE..... 19
Table 7-2 NVC Communities Recorded and Corresponding Annex I Habitat Types..... 20
Table 7-3 Summary of Study Area NVC Communities and Sensitivities 22

EXECUTIVE SUMMARY

MacArthur Green was commissioned by Douglas West Extension Ltd ('the Applicant') to conduct and report on National Vegetation Classification (NVC) and habitat surveys at the proposed Douglas West Wind Farm Extension by Douglas, South Lanarkshire (hereafter referred to as the 'Proposed Development').

The aim of the NVC survey is to identify and map the vegetation communities present within the site in order to identify those areas of greatest ecological interest (i.e. Annex I habitats; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE), and Scottish Biodiversity List (SBL) priority habitats). This information is used to inform the Proposed Development design process and the ecological assessment for the Proposed Development Environmental Impact Assessment Report (EIAR).

Surveys were conducted on 20th to 23rd August 2018 by MacArthur Green. In total 27 NVC communities were recorded with various associated sub-communities, however only a small number of communities accounted for the majority of the study area. A number of non-NVC habitat types are also present, in particular conifer plantation and non-NVC *Juncus* spp. grasslands.

Outwith the expanse of dominant conifer plantation, the study area mainly contains a mix of typical mire, acid grassland, woodland and upland marshy grassland and flush communities. Although some large relatively homogeneous stands of vegetation occur across the study area, most of the communities often form complex mosaics and transitional areas across the study area. The habitats in the study area, outside the forestry plantation, are subject to cattle and sheep grazing, and many areas of mire appear to have been drained historically.

The NVC surveys have also revealed the presence of a number of potential GWDTE habitats, as well as Annex I and Scottish Biodiversity List Priority Habitats.

1 INTRODUCTION

MacArthur Green was commissioned by Douglas West Extension Ltd ('the Applicant') to carry out a National Vegetation Classification (NVC) and habitats survey at the proposed Douglas West Wind Farm Extension by Douglas, South Lanarkshire (hereafter referred to as the 'Proposed Development').

The aim of the NVC survey is to identify and map the vegetation communities present within the site in order to identify those areas of greatest ecological interest (i.e. Annex I habitats¹; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE)²; and Scottish Biodiversity List (SBL³) priority habitats).

This report details the findings of the NVC surveys together with an evaluation of those communities described.

2 THE SITE AND STUDY AREA

The Proposed Development is a 13-turbine extension to the Douglas West Wind Farm, located within commercial conifer plantation habitat in Cumberhead Forest. The site extends from Henry's Hill in the south, from the boundary of the operational Hagshaw Hill Wind Farm, and then north-east through Cumberhead Forest, approximately 2.5 km north-west of the settlement of Douglas.

The NVC 'study area' for the Proposed Development is larger than the site boundary, and NVC surveys covered approximately 549 ha (Figure 7.3). The extensive NVC study area is a result of ensuring sufficient survey coverage of earlier proposed infrastructure layouts which have now been refined down through the iterative design process, and also to ensure suitable buffers were surveyed in relation to GWDTEs (as per SEPA, 2017a, 2017b guidance).

The study area has a typical upland habitat assemblage for the local area and is dominated by three main broad habitat types; coniferous plantation, wet modified bog and marshy grassland. The study area reaches an elevation of 465 m above sea level in the south-west on the slopes of Hagshaw Hill.

Large sections of the study area are covered in mature and semi-mature Sitka spruce *Picea sitchensis* commercial forestry. The remainder of the study area is dominated by unplanted or un-forested habitats. The Hagshaw Burn and Shiel Burn, along with their tributaries, drain the study area, both of which flow into the Poniel Water to the north. Outwith the plantation forestry, many of the habitats are also intensively grazed by sheep and cattle. Much of the study area has been impacted anthropogenically over time in a number of ways, mainly through grazing and drainage, which has greatly influenced plant communities in areas.

The site is also surrounded by the operational Hagshaw Hill (and Extension) Wind Farm, Galawhistle Wind Farm and Nutberry Wind Farm.

¹ As defined by the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora – the 'Habitats Directive'

² As defined within SEPA (2017). Guidance Note 31: Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Available for download from http://www.sepa.org.uk/media/143868/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf.

³ <https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/scottish-biodiversity-list>

The study area does not overlap with any designated site with ecological or botanical qualifying features (Figure 7.1).

3 METHODOLOGY

The vegetation was surveyed by a suitably qualified and experienced botanical surveyor using the NVC scheme (Rodwell, 1991-2000; 5 volumes) and in accordance with NVC survey guidelines (Rodwell, 2006). The NVC scheme provides a standardised system for classifying and mapping semi-natural habitats and ensures that surveys are carried out to a consistent level of detail and accuracy.

Homogeneous stands and mosaics of vegetation were identified and mapped by eye and drawn as polygons on high resolution aerial imagery field maps. These polygons were surveyed qualitatively to record dominant and constant species, sub-dominant species and other notable species present. The surveyor worked progressively across the study area to ensure that no areas were missed and that mapping was accurate. NVC communities were attributed to the mapped polygons using surveyor experience and matching field data against published floristic tables (Rodwell, 1991-2000). Stands were classified to sub-community level where possible, although in many cases the vegetation was mapped to community level only because the vegetation was too species-poor or patches were too small to allow meaningful sub-community determination; or because some areas exhibited features or fine-scale patterns of two or more sub-communities.

Quadrat sampling was not used in this survey because experienced NVC surveyors do not necessarily need to record quadrats in order to reliably identify NVC communities and sub-communities (Rodwell, 2006). Notes were made about the structure and flora of larger areas of vegetation in many places (such as the abundance and frequency of species, and in some cases condition and evident anthropogenic impacts). It can be better to record several larger scale qualitative samples than one or two smaller quantitative samples; furthermore, qualitative information from several sample locations can be vital for understanding the dynamics and trends in local (study area) vegetation patterns (Rodwell, 2006).

Due to small scale vegetation and habitat variability and numerous zones of habitat transitional between similar NVC communities, many polygons represent complex mosaics of two or more NVC communities. Where polygons have been mapped as mosaics an approximate percentage cover of each NVC community within the polygon is given so that the dominant community and character of the vegetation could still be ascertained.

Botanical nomenclature in this report follows that of Stace (2010) for vascular plants, Atherton *et al.* (2010) for bryophytes and Purvis *et al.* (1992) for lichens.

4 SURVEY DETAILS & CONSTRAINTS

The NVC survey for the study area was carried out from 20th to 23rd August 2018 inclusive by one surveyor, during the optimal season for habitat surveys. The weather conditions were amenable to survey; bright, with broken cloud and relatively light to moderate winds, and with infrequent light showers. All areas of the study area were accessible.

The NVC system does not cover all possible semi-natural vegetation or habitat types that may be found. Since the NVC was adopted for use in Britain in the 1980s further survey work and an increased knowledge of vegetation communities has led to additional communities being described

that do not fall within the NVC system. Where such communities are found and recorded they are given a non-NVC community code and are described.

It should be noted that the results from this survey, and the matches made in describing communities, represent a current community evaluation at the time of survey (as opposed to one seeking to describe what the community was before any human interference, or what it might become in the future). In light of this, a clear constraint of the vegetation survey and evaluation process as used in this and other surveys is that it offers only a snapshot of the vegetation communities present and should not be interpreted as a static long-term reference.

Ecological surveys are limited by factors which affect the presence of plants such as the time of year and weather. The ecological surveys undertaken to support this project have not therefore produced a complete list of plants and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. However, the results of these surveys have been reviewed and are considered to be sufficient to undertake the assessment.

5 NVC SURVEY RESULTS AND VEGETATION DESCRIPTIONS

5.1 Summary of NVC Communities

The categories of vegetation within the study area include the following 27 NVC communities recorded during the survey:

- Mires and flushes: M3, M4, M6, M19, M20, M23, M25, M23-M25 intermediate;
- Wet heaths: M15;
- Dry heaths: H9, H10, H12;
- Grasslands and bracken: U4, U5, U6, U20, MG9, MG10;
- Woodland and scrub: W4, W7, W11, W17, W21, W23; and
- Swamp and tall-herb fens: S9, S10, S12.

The following sections describe the flora, structure and habitats of these communities and any associated observed sub-communities, as found within this study area. For each NVC community description, the first paragraph refers to the community in Britain or Scotland as a whole, before moving on to the other paragraphs which describe the vegetation as it was found to occur within this study area. The NVC communities within each broad habitat type (e.g. woodland) are described in order of community number within the study area.

The survey results are displayed in Figure 7.3. A number of target notes were also made during surveys, often to pinpoint areas or species of special interest. These target notes are shown in Figure 7.3 and detailed within Annex A, target note photographs are included within Annex B. Further photographs of a number of the typical habitat types found within the study area are provided within Annex C.

5.2 Mires and Flushes

5.2.1 M3 *Eriophorum angustifolium* bog pool community

The M3 community is typically found as small stands on barer exposures of acid peat in depressions, erosion channels or shallow peat cuttings on a wide range of mire types but especially among the M19 *Calluna vulgaris* – *Eriophorum vaginatum* and M20 *Eriophorum vaginatum* mires (Rodwell *et al* 1991; Elkington *et al* 2001). It can occur in permanently flooded pools and natural hollows on surfaces of more or less intact mires, and on dried-up hollows and among erosion features where the peat has been worn down in gullies or redistributed (Rodwell *et al.*, 1991; Elkington *et al.*, 2001; Averis *et al.*, 2004). The typical species, *Eriophorum angustifolium*, can occur as dense and often tall swards, but equally commonly it occurs as sparser shoots scattered over expanses of bare peat (Averis *et al.*, 2004).

M3 was recorded within two areas, one within a mosaic of M19 and M25 mire and the other as a small patch of habitat (Figure 7.3). Both areas of M3 were found along forest rides, close to the Shiel Burn within the east of the study area. The community consisted of abundant *Eriophorum angustifolium* with occasional patches of *Juncus squarrosus* integrated with the acrocarpous moss *Polytrichum commune*. *Sphagnum* mosses were abundant with *Sphagnum fallax*, *S. capillifolium*, and *S. palustre*.

5.2.2 M4 *Carex rostrata* - *Sphagnum fallax* mire

The M4 community is characteristic of pools and seepage areas on peat soils of topogenous and soligenous mires where the waters are fairly acid and only slightly enriched. It can occur in bog pools on the surface of basin mires but is more common in obviously soligenous areas as in mire lags and the wettest parts of water-tracks (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). This mire typically has a cover of sedges over a carpet of semi-aquatic *Sphagnum* spp.

M4 is very rare within the study area, it was found as a small percentage of some flush mosaics, however two larger mappable stands were recorded in the very north-east of the study area along the edge of two ponds. The stands were species poor with *Carex rostrata* being very dominant along with lesser amounts of *C. nigra*, *Juncus effusus*, *Potentilla erecta*, and *Ranunculus repens*. The field layer also included carpets of *Sphagnum fallax* and, to a lesser extent, *S. palustre*.

5.2.3 M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire

Communities/sub-communities recorded: M6c, M6d

This mire is the major soligenous community of peats and peaty gleys irrigated by base poor waters in the sub-montane zone of northern and western Britain. It typically occurs as small stands among other mire communities, grasslands and heaths, and is sometimes found with swamp and spring vegetation. It is commonly found in tracts of unenclosed pasture on upland fringes, particularly between 200 m and 400 m (although it may also be found much higher) and is ubiquitous in the upland fringes of Britain (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). The M6 community has a distinct general character but includes a wide variation in species composition, expressed as four sub-communities (two of which are visually similar to the M23 community). It is essentially a poor-fen with small sedges or rushes dominating over a carpet of oligotrophic and base-intolerant *Sphagna* (Rodwell *et al.*, 1991; Elkington *et al.*, 2001).

M6 is widespread throughout the study area, present mostly as small flushes, runnels or soakways, and along and within occluding ditches and around minor watercourses or as small components of modified bog; however, it also occurs as a notable component of many larger basin/valley/floodplain areas in mosaics with other wetland communities, in particular M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush-pasture.

The vast majority of M6 areas are of the species-poor M6c *Juncus effusus* sub-community; however, there are some stands of the very similar M6d *Juncus acutiflorus* sub-community. A tall sward of *Juncus effusus* over a species-poor lawn of *Sphagnum fallax*, *S. palustre* and *Polytrichum commune* indicates the M6c sub-community; *Juncus acutiflorus* dominates in M6d. In many stands its extent encompasses little more than these species listed. Where other species were recorded, they tended to be of very low cover, and included typical species such as *Eriophorum vaginatum* and *Carex* spp.

5.2.4 M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire

Communities/sub-communities recorded: M19, M19a

This is the typical blanket bog vegetation of high-altitude ombrogenous peats in the wet and cold climate of the uplands of northern Britain. In particular, it occurs on high-level plateaux and broad watersheds, usually above 300 m, and is confined to deeper peats on flat or gently-sloping ground (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). It is generally dominated by mixtures of *Eriophorum vaginatum* and ericoid sub-shrubs (especially *Calluna vulgaris*). *Sphagnum* spp. can be prominent over wetter ground but are not as luxuriant or rich as in M17 mire (Rodwell *et al.*, 1991; Elkington *et al.*, 2001).

M19 is patchy within the study area and does not form large homogenous stands. The M19a *Erica tetralix* sub-community is most often found within the north-west of the study area, within the forest rides or along the forest margins, both within mosaics with other mire communities or as a standalone community. These areas are characterised by the co-dominance of *Eriophorum vaginatum* and *Calluna vulgaris*. Other species noted throughout these swards included lesser amounts of typical species including *Carex nigra*, *Erica tetralix*, *Vaccinium myrtillus*, *Deschampsia flexuosa* and the mosses *Sphagnum papillosum*, *S. capillifolium*, *S. compactum*, *S. fallax*, *Dicranum scoparium*, *Pleurozium schreberi* and *Polytrichum commune*.

5.2.5 M20 *Eriophorum vaginatum* blanket mire

Communities/sub-communities recorded: M20, M20a, M20b

M20 *Eriophorum vaginatum* blanket mire is a community characteristic of ombrogenous peats on bogs where certain treatments have greatly affected the vegetation; grazing and burning have been of greatest significance, but drainage has also played a part in the development of M20 (Rodwell *et al.* 1991; Elkington *et al.* 2001). It is commonest on blanket mires where these factors have contributed both to floristic impoverishment and to erosion of the peats. The peats are generally drier than in M17 - M19 bogs, often showing surface oxidation (Rodwell *et al.* 1991; Elkington *et al.* 2001).

M20 was found within the central study area, along the forest rides, often noted as the M20a species poor sub-community (see Annex C, photograph C1). These swards are often identified by the tussocky dominance of *Eriophorum vaginatum*, it is likely the M20 within the study area is a

consequence of woodland planting resulting in the loss of most sub-shrubs in the sward, exacerbated by forest drainage and shading effects. More extensive areas of the community are found within the south of the study area, within the more open areas and which are subject to sheep grazing. These areas of M20 are becoming quite grassy as a result of the grazing legacy and transitions can be seen to juxtaposed acid grasslands, such as U5 *Nardus stricta* – *Galium saxatile* grassland. The M20b *Calluna vulgaris* – *Cladonia* sub-community is also present; M20b identifying areas where some sparse sub-shrubs remain in the sward.

Eriophorum vaginatum dominates all areas of M20, other species found with lesser frequency included *Calluna vulgaris*, *Juncus squarrosus*, *Trichophorum germanicum*, *Eriophorum angustifolium*, *Vaccinium myrtillus*, *Potentilla erecta*, *Galium saxatile*, *Anthoxanthum odoratum*, *Deschampsia flexuosa* and *Luzula multiflora*. The moss layer includes *Hylocomium splendens*, *Rhytidiadelphus squarrosus*, *Pleurozium schreberi* and *Polytrichum commune* and the *Sphagnum* mosses *S. fallax* and *S. capillifolium*.

5.2.6 M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush-pasture

Communities/sub-communities recorded: M23a, M23b

This rush-pasture is a community of gently-sloping ground in and around the margins of soligenous flushes, as a zone around topogenous mires and wet heaths, and in poorly drained, comparatively unimproved or reverted pasture. It can be found on a variety of moderately acid to neutral soils that are kept moist to wet for most of the year (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). As a result, this community can be, at least partially, potentially dependent on groundwater; however, it is also commonly associated with surface water flows and surface water collection. This vegetation is characterised by the abundance of either *Juncus effusus* or *J. acutiflorus* (sometimes both), with a ground layer of mesophytic herbs common in moist or permanently wet grasslands; associates are quite diverse. Acidophilous *Sphagna* and *Polytrichum commune* are rare in the M23 community (Averis *et al.*, 2004).

M23 is quite common throughout the study area, the larger expanses are found around watercourse floodplains and in damp grazing pastures and gently sloping ground within the woodland plantation and, more extensively, along the eastern side of the study area. Both the M23a *Juncus acutiflorus* sub-community and M23b *Juncus effusus* sub-community are present. M23b is more common, as small stands, although both sub-communities appear together within larger mosaics with areas of acid grassland and mire, particularly M25 *Molinia caerulea* – *Potentilla erecta* mire and U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland.

The community as a whole is quite species-poor throughout the whole study area, being dominated by mixtures of *Juncus effusus* and/or *Juncus acutiflorus* with patches of a low diversity of grasses such as *Deschampsia cespitosa*, *Holcus lanatus*, *Poa trivialis*, *Anthoxanthum odoratum* and *Agrostis* spp. The herb layer, where present, is usually dominated by *Trifolium repens*, *Rumex acetosa*, *Ranunculus repens* with the occasional appearance of *Epilobium palustre*, *Galium palustre* and *Achillea millefolium*. Many areas contain little more diversity than this.

Some of these *Juncus acutiflorus* stands are species-poor and lack much in the way of mesophytic herbs, and in a lot of cases could be referred to as the non-NVC *Juncus effusus* neutral grassland as

described by Averis & Averis (2015), rather than M23a. The vegetation here is rather like the MG10a *Holcus lanatus*-*Juncus effusus* rush-pasture typical sub-community with a species composition close to that of an acid grassland, such as U4 described below. As noted by Averis & Averis (2015), it occurs patchily on moist and neutral soils at low altitudes, mostly in grazed farmland in the lowlands and upland margins; this fits the setting of most of these *J. effusus* stands, and to a certain extent, the *J. acutiflorus* stands within the study area, located along the eastern margins, outwith the plantation forestry.

Wefts of mosses are also common between these species and patchily carpeting the ground, with the main species including *Calliergonella cuspidata*, *Kindbergia praelonga* and *Rhytidiadelphus squarrosus*. These species are widely frequent to occasional but are abundant locally.

5.2.7 M25 *Molinia caerulea* – *Potentilla erecta* mire

Communities/sub-communities recorded: M25a, M25b

M25 mire is a community of moist, but usually well aerated, acid to neutral peats and peaty soils (Rodwell *et al.*, 1991). It generally occurs over gently-sloping ground, marking out seepage zones and flushed margins of topogenous mires, but also extends onto the fringes of ombrogenous mires (Rodwell *et al.*, 1991; Elkington *et al.*, 2001; Averis *et al.*, 2004). *Molinia caerulea* is the most abundant species found in this community. The associated flora is usually species-poor and consists largely of *Juncus* spp. and a few dicotyledons; occasionally sub-shrubs can be quite common, particularly *Calluna vulgaris* and *Erica tetralix*. Treatments such as burning, grazing and drainage are likely to be largely responsible for the development of this community over ground that would naturally host some other kind of mire or wet heath vegetation (Rodwell *et al.*, 1991; Elkington *et al.*, 2001).

M25 is found in small scattered stands within the study area. It appears relatively dry and located on shallow peat within a wider matrix of acid grasslands, wet heath and mires. Two sub-communities were recorded, by far the most common is the mire like M25a *Erica tetralix* sub-community, with the grassier M25b *Anthoxanthum odoratum* sub-community being less common.

Through the *Molinia*, areas of M25a contained sparse additional associate species such *Calluna vulgaris*, *Erica tetralix*, *Empetrum nigrum*, occasionally *Eriophorum vaginatum*, *Narthecium ossifragum*, *Galium saxatile*, *Potentilla erecta*, *Deschampsia flexuosa*, *Vaccinium myrtillus*, and the mosses *Polytrichum commune* and *Pleurozium schreberi*. Areas of M25b tend to lack many of the mire species of M25a and instead contain more grasses and grassland forbs, such as *Agrostis* spp., *Festuca* spp., *Holcus lanatus*, *Deschampsia flexuosa*, *D. cespitosa*, *Anthoxanthum odoratum*, *Juncus effusus*, *J. acutiflorus* and *Rumex acetosa*.

Transitions into areas of rush mire are common, particularly within the wetter areas dominated by the M25b *Anthoxanthum odoratum* sub-community and also the presence of intermediate stands (e.g. see section 5.2.8 below).

5.2.8 M23 – M25 intermediate community

Several areas of ground were mapped as an M23 – M25 intermediate community as the vegetation was characterised by a co-dominance of *Molinia caerulea* and *Juncus effusus*. This intermediate community was found within mosaics of acid grassland, rush pasture and more flushed areas to the

north-east of Arkney Hill, within the eastern study area, north of the existing access track. An isolated stand was also recorded to the north, east of Shiel Burn. Much of this community was species poor with only some sparse associates such as *Rumex acetosa*, *Ranunculus repens* and *Potentilla erecta*. The vegetation in this stand was of a nature that it could not be accurately defined as either M23 rush pasture or M25 mire, and was therefore mapped as an intermediate community.

5.3 Wet Heaths

5.3.1 M15 *Trichophorum germanicum* – *Erica tetralix* wet heath

Communities/sub-communities recorded: M15, M15b

This wet heath community is characteristic of moist and generally acid and oligotrophic peats and peaty mineral soils in the wetter western and northern parts of Britain. It is also associated with thinner or better drained areas of ombrogenous peat (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). It is a vegetation type with few constant species and wide variation in its flora and dominant species. *Calluna vulgaris*, *Molinia caerulea*, *Trichophorum germanicum* and *Erica tetralix* are usually all of high frequency, and it is mixtures of these species that give the vegetation its general character. However sometimes one or two of them may be missing and their relative proportions can be very diverse (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). Grazing and burning have important effects on the floristics and structure of this community and draining and peat-cutting have extended its coverage to formerly deeper and wetter peats in which blanket mire communities (i.e. M17-M19) were initially present (Rodwell *et al.*, 1991; Elkington *et al.*, 2001).

M15 wet heath is present at two locations within the study area outside the plantation forestry. The larger of the two swards can be found to the east and the smaller one to the south-west of Arkney Hill, which forms a mosaic with M25 *Molinia caerulea* – *Potentilla erecta* mire. The wet heath present includes the M15b Typical sub-community.

The dominants can be variable within this M15b sub-community. Due to the intensive level of grazing, particularly over the larger sward, certain obvious components, such as *Calluna vulgaris*, *Trichophorum germanicum* and *Vaccinium myrtillus* are very short making it difficult to distinguish from the surrounding acid grassland communities (see Annex C, Photo C2). Other species present found within the community are *Molinia caerulea*, *Juncus squarrosus*, *Deschampsia flexuosa*, *Carex echinata* and *Anthoxanthum odoratum*. The moss layer contains mostly *Pleurozium schreberi*, *Polytrichum commune*, *Dicranum scoparium* with some dense patches of *Sphagnum fallax* and *S. papillosum*.

5.4 Dry Heaths

5.4.1 H9 *Calluna vulgaris* – *Deschampsia flexuosa* heath

Communities/sub-communities recorded: H9, H9c

This heath is a characteristic sub-shrub vegetation of acid and impoverished soils at low to moderate altitudes. It is normally found on very base-poor soils, highly oligotrophic and at least moderately free-draining, often excessively so, which have been derived from a wide variety of parent materials (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). *Calluna vulgaris* is typically the most abundant plant in this community, often forming a fairly low and open canopy. The only other vascular constant is

Deschampsia flexuosa, although even in open *Calluna* it often occurs only as sparse tufts, and under dense canopies it can almost disappear. Other herbs are also few and are of low cover. Bryophytes and lichens are rarely abundant and associated species diversity is low (Rodwell *et al.*, 1991; Elkington *et al.*, 2001).

All of the patches of H9 were recorded within the north of the study area, with two of the largest patches being found along the steep slopes flanking the Poniel Water. *Calluna* is overly dominant within these areas with some sparse *Deschampsia flexuosa*, *Molinia caerulea* and *Potentilla erecta*. Small patches of *Pteridium aquilinum* extend above the *Calluna* and the moss *Pleurozium schreberi* can be found where the *Calluna* canopy is not so dense. Due to the lack of species diversity the H9c species poor sub-community was considered the best-fit for the vegetation recorded.

5.4.2 H10 *Calluna vulgaris* – *Erica cinerea* heath

Communities/sub-communities recorded: H10

H10 *Calluna vulgaris* – *Erica cinerea* heath is a dry heath community that occurs widely throughout the more oceanic sections of Scotland and around the east-central part of the Highlands. It is a community characteristic of acid to circumneutral and generally free-draining soils and is typically dominated by *Calluna vulgaris*. *Erica cinerea*, a constant, is frequent but generally subordinate to *C. vulgaris*. H10 is commonly found in zonation and mosaics with grasslands, other heath types and mire communities (Rodwell *et al.*, 1991; Elkington *et al.*, 2001).

A single small patch of the H10 community was recorded in the very north of the study area, to the north-west of an old sheepfold. The H10 was recorded on a slope above the Poniel Water within an area that includes the similar H9 and H12 dry heath and the U4 acid grassland communities. The vegetation was co-dominated by *Calluna vulgaris* and *Erica cinerea* with occasional tufts of *Deschampsia flexuosa* and *Vaccinium myrtillus* being found amongst the *Calluna*. Mosses were restricted to *Pleurozium schreberi* and *Polytrichum commune*.

5.4.3 H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath

Communities/sub-communities recorded: H12, H12a

H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath is a typical sub-shrub community of acidic to circumneutral, free-draining mineral soils throughout the cold and wet sub-montane zone, generally between 200 m and 600 m. H12 is generally dominated by *Calluna vulgaris* although the cover of this species can be open and degenerate. *Vaccinium myrtillus* is constant, though it is usually subordinate to *Calluna*. The ground layer is generally characterised by bulky mosses (Rodwell *et al.*, 1991; Elkington *et al.*, 2001). H12 heaths are rather uniform and they cover extensive areas throughout large parts of Scotland.

Just a few isolated stands of H12 were recorded within the north and north-west of the NVC study area. The H12a *Calluna vulgaris* sub-community was the main type recorded. This sub-community is species-poor and heavily dominated by *Calluna*, and contained a low density of interweaved sprigs of *Vaccinium myrtillus*. Other species found in the sward included *Deschampsia flexuosa*, *Molinia caerulea*, *Juncus squarrosus*, *Potentilla erecta*, *Galium saxatile* and the mosses *Pleurozium schreberi* and *Dicranum scoparium*.

5.5 Calcifugous Grasslands and Bracken-Dominated Vegetation

5.5.1 U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland

Communities/sub-communities recorded: U4, U4b, U4d

The U4 *Festuca ovina* - *Agrostis capillaris* - *Galium saxatile* grassland is a form of predominately upland grassland of well-drained, acidic and base-poor mineral soils throughout the wet and cool regions of north-west Britain where it dominates extensive areas of pastureland (Rodwell *et al.*, 1992; Cooper, 1997). Throughout this geographic range the community can often be found forming a distinctive component of larger mosaics of grasslands, heaths, and mires.

U4 grassland communities are generally identified on the presence of an often close-cropped, grass-rich sward dominated by various combinations of *A. capillaris*, *F. ovina* and *Anthoxanthum odoratum*, with *G. saxatile* and *Potentilla erecta* consistent associates. A well-developed moss layer is also characteristic, but in the U4b sub-community it may be limited by the dense, relatively productive sward of grasses.

U4 is found and is most abundant within the north and north-west of the study area and in patches along the Shiel Burn. Many of the areas are isolated with a tall sward height suggesting grazing intensity is lower and generally more unimproved as the grassland is smaller and patchier amongst a mosaic of mires, heaths and other acid and marshy grasslands. These areas are for the most part the U4b *Holcus lanatus* - *Trifolium repens* sub-community, where the impacts of historic and more recent grazing levels remain evident, or the U4d *Luzula multiflora* - *Rhytidiadelphus loreus* sub-community where the coarser looking swards with *Deschampsia cespitosa* dominate the vegetation.

Overall, the stands of U4 within the study area tend to have variable amounts of the grasses *A. capillaris*, *F. ovina*, *H. lanatus* and *A. odoratum*, and the mosses *Rhytidiadelphus squarrosus*, *Hylocomium splendens* and *Pleurozium schreberi*. Typical quantities of these species and associate species differ between the respective sub-communities. Other species common to U4 within the study area includes *Galium saxatile*, *Potentilla erecta*, *Rumex acetosa*, *Luzula* spp., and *Juncus effusus*.

Swards of U4b tend to have a lush cover of broader leaved grasses, an increase in the number of herbs associated with improvement, and a decrease in the abundance and diversity of mosses. In these areas *Holcus lanatus* and *Trifolium repens* are abundant characteristic associates that grow with lesser amounts of the main community grasses, other species appearing in the areas of U4b include *Cynosurus cristatus*, *Festuca rubra*, *Plantago lanceolata* and occasional patches of *Cirsium arvense*.

5.5.2 U5 *Nardus stricta* – *Galium saxatile* grassland

Communities/sub-communities recorded: U5

U5 grassland tends to be found on damp mineral soils which have peaty upper horizons. U5 typically occupies slopes where the depth and wetness of the soil are intermediate between those of the drier podsols under U4 grasslands and wet shallow peats found under U6 grassland. The underlying

rock can be anything from acid to basic, but the soils are generally acidic (Rodwell *et al.*, 1992; Averis *et al.*, 2004). U5 is common on the higher hill slopes of the cool, wet north and west of Britain (Rodwell *et al.*, 1992; Cooper, 1997). It is also commonly found on well-drained but moist alluvial soil along the margins of streams (Averis *et al.*, 2004).

U5 was found to be limited to the very south of the study area, both as homogenous small stands and as part of mosaics with more rush dominated communities. U5 here, as is typical, is dominated by a sward of *Nardus stricta*. Other associates noted through the sward included *Agrostis capillaris*, *Festuca ovina*, *Anthoxanthum odoratum*, *Juncus squarrosus*, *Potentilla erecta*, *Galium saxatile*, *Molinia caerulea*, *Deschampsia flexuosa*, *Vaccinium myrtillus*, *Juncus effusus*, *Carex* spp., *Luzula* spp. and the mosses *Rhytidiadelphus squarrosus*, *Hylocomium splendens* and *Pleurozium schreberi*.

5.5.3 U6 *Juncus squarrosus* – *Festuca ovina* grassland

Communities/sub-communities recorded: U6, U6a

U6 *Juncus squarrosus* - *Festuca ovina* grassland is characteristic of moist peats and peaty mineral soils, almost always base-poor and infertile, over gentle slopes and plateaux at higher altitudes (400 m to 800 m) in the cool and wet north and west of Britain (Rodwell *et al.*, 1992; Cooper, 1997). U6 is often a secondary vegetation type, strongly encouraged by particular kinds of grazing and burning treatments in damper upland pastures and on the drying fringes of blanket mires. The spread of *J. squarrosus* in upland pastures tends to be encouraged where uncontrolled heavy and selective grazing has been applied over rather ill-drained ground (Rodwell *et al.*, 1992; Cooper, 1997).

This community appears in isolated patches along the north of the study area, most frequently as pure stands of U6. Isolated patches were also recorded in the very south although were more often found to be within mosaics with other grassland, rush and more flushed communities compared to the northern locations. At times areas of U6 were seen to be transitional with M23, M6 and M25 mires in some parts. The largest patches of U6 are found on Arkney Hill and on gently sloping to flat ground to the south-west.

Areas of U6 in the study area are dominated by *Juncus squarrosus* with heathier associate species including; *Calluna vulgaris*, *Nardus stricta*, *Molinia caerulea*, *Potentilla erecta*, *Galium saxatile*, *Vaccinium myrtillus*, *Deschampsia flexuosa*, with occasional patches of *Holcus lanatus* and *Juncus effusus*. Typical acid grassland mosses are also abundant including *Dicranum scoparium* and *Pleurozium schreberi*, along with occasional patches of *Sphagna*. The U6a *Sphagnum* sub-community was found to be present where the *Sphagnum* mosses were more prominent; particularly *Sphagnum capillifolium* and *S. fallax*.

5.5.4 U20 *Pteridium aquilinum* – *Galium saxatile* community

Communities/sub-communities recorded: U20, U20a

The U20 *Pteridium aquilinum* – *Galium saxatile* community is vegetation dominated by *Pteridium aquilinum*, which can form extensive stands. The community is most common on lower hill slopes and on marginal ground, including abandoned fields, where it forms mosaics and transitions with heaths, grasslands and woodlands. The community covers fairly deep, well aerated but often moist, base-poor and infertile soils (Rodwell *et al.*, 1992; Cooper, 1997). It is largely absent from wet

ground and strongly flushed slopes. *Pteridium aquilinum* is the sole dominant and is overwhelmingly abundant in some stands. This is a community of little ecological value.

Areas of U20 can be found along the north of the study area, often following the slopes around the Poniel Water and generally on steep slopes and dry soils in the gullies of the Shiel Burn. These stands are generally of the U20a *Anthoxanthum odoratum* sub-community, here *P. aquilinum* is accompanied by a grassland species assemblage reflecting close affinities to the U4 grassland described above.

5.6 Mesotrophic Grasslands

5.6.1 MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland

Communities/sub-communities recorded: MG9, MG9a

MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland is characteristic of permanently moist, gleyed and periodically inundated circumneutral soils across large areas of the British lowlands. It can exist on level to moderately sloping ground in areas of pasture or meadow, but can also be found along woodland rides and fen/wetland margins. MG9 typically contains a coarse and tussocky sward dominated by *D. cespitosa* (Rodwell *et al.*, 1992; Cooper, 1997).

The MG9 community is found scattered in small stands around the study area in places that are more permanently moist areas, often in mosaics with the rush dominated M23 community and the U4 acid grassland community. Usually found within marshy areas, *D. cespitosa* is most often dominant with other associates such as *Juncus acutiflorus* and *H. lanatus*. Species diversity was often limited to *Rumex acetosa*, *Galium palustre*, *Cirsium palustre* and *Equisetum palustre*. Moss cover included *Calliergonella cuspidata* and *Rhytidiadelphus squarrosus*. These areas were found to be species poor, often in close proximity to watercourses. Many of the stands were found to relate to the MG9a *Poa trivialis* sub-community.

5.6.2 MG10 *Holcus lanatus* – *Juncus effusus* rush-pasture

Communities/sub-communities recorded: MG10a

MG10 is a form of rush-pasture characteristic of areas with strongly impeded drainage over a wide range of usually acid to neutral mineral soils on level to gently sloping ground (Rodwell *et al.*, 1992; Cooper, 1997). This community requires consistently high soil moisture (Rodwell *et al.*, 1992). It occurs across most of the British lowlands, with the typical sub-community being particularly prominent towards the north and west. Although found on various soil types including brown earth and calcareous earth throughout its range, this habitat can also have close associations with various types of mire vegetation and can form significant parts of rush-dominated mire mosaics in areas of suitably moist soils.

MG10 is only found within a small area to the north of the study area, partly as a pure stand and also partly within a mosaic with M23 and U4. Both stands are of the MG10a typical sub-community.

MG10a in the study area is dominated by a thick, dense, tussocky, species-poor sward of *Juncus effusus*. Growing through the tussocks there is usually and typically variable amounts of *Holcus lanatus*, *Agrostis* spp., *Ranunculus repens*, *Rumex acetosa*, *Trifolium repens*, *Cirsium palustre* and *C.*

arvensis. Mosses such as *Polytrichum commune* and *Rhytidiadelphus squarrosus* often form diffuse wefts over the damp soil and among the larger plants.

5.7 Woodland and Scrub

5.7.1 W4 *Betula pubescens* – *Molinia caerulea* woodland

Communities/sub-communities recorded: W4, W4b

W4 is a community of moist, moderately acidic, though not necessarily highly oligotrophic, peaty soils. It is characteristic of thin or drying ombrogenous peats which are isolated from the influence of base-rich or eutrophic groundwaters, but is also found on peaty gleys flushed by rather base- and nutrient-poor water (Rodwell *et al.*, 1991; Hall *et al.*, 2004). *Betula pubescens* is the most common woody species and is usually dominant. The great abundance of *Molinia caerulea* is the most distinctive feature of the field layer and other species may be limited to areas between tussocks. A number of bryophytes can be found within W4; *Sphagnum* spp. are usually present (Rodwell *et al.*, 1991; Hall *et al.*, 2004).

Only four small stands of W4 were recorded within the study area; the most notable area is found in the east of the study area. All stands were formed from young planted saplings of *Betula* spp., *Quercus* spp., and *Sorbus aucuparia* over field layers of *Molinia caerulea* and *Pteridium aquilinum*. The field layer was almost exclusively *Molinia caerulea* in each stand, in some cases there were patches of *Pteridium aquilinum* and wetter areas contained patches of *Juncus effusus*. *Sphagnum* did not appear in abundance with only *Sphagnum fallax* being found within these wetter areas.

5.7.2 W7 *Alnus glutinosa* – *Fraxinus excelsior* – *Lysimachia nemoreum* woodland

Communities/sub-communities recorded: W7, W7c

W7 is typical of moist to very wet mineral soils which are only moderately base-rich and not very eutrophic (Rodwell *et al.*, 1991; Hall *et al.*, 2004). It is most extensive in the wetter parts of Britain, but usually occurs in soils where there is no great tendency for peat accumulation. *Alnus glutinosa* is the main tree species and is commonly accompanied by other species such as *Fraxinus excelsior*, *Betula* spp., *Salix* spp. and *Acer pseudoplatanus*. The field layer can be very varied; the wetness and nutrient status of the soil determines what other species may occur, these being mainly grasses and herbaceous dicotyledons (Rodwell *et al.*, 1991; Hall *et al.*, 2004). There are three sub-communities; differences between them are related to the extent of waterlogging, the nature of the water supply and its movement.

A few small planted stands of W7, mostly the W7c *Deschampsia cespitosa* sub-community, were recorded. These areas generally have a canopy of *Alnus glutinosa* and *Betula* spp. with occasional *Salix* spp. and *Sorbus aucuparia*. The field layer contains abundant to almost pure *Deschampsia cespitosa* and a range of other more occasional species including *Juncus effusus*, *Agrostis* sp., *Dryopteris* spp., and the moss *Rhytidiadelphus squarrosus*.

5.7.3 W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* woodland

Communities/sub-communities recorded: W11

W11 is a community of moist, free-draining base-poor brown earth soils in the cooler, wetter north-west of Britain. It is characteristic of substrates that are neither markedly calcareous nor strongly acidic. The character of the community is often heavily influenced by grazing (Rodwell *et al.*, 1991; Hall *et al.*, 2004). These woodlands have a canopy of *Betula* spp. and/or *Quercus* spp. and a field layer dominated mainly by grasses. The canopy composition reflects its affinities with the W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* community, and from which it is distinguished mainly by the swards of grasses including *Agrostis* spp., *Holcus mollis* and *Anthoxanthum odoratum*, rather than one dominated by pleurocarpous mosses, sub-shrubs and *Deschampsia flexuosa*.

W11 is scarce and found in three small areas within the study area, the most significant being to the north of the study area and along the Shiel Burn, within the conifer plantation. All three stands have been planted. The canopy varies with *Betula* spp., *Alnus glutinosa*, *Quercus petraea*, *Crataegus monogyna*, and occasional *Salix* spp. over a field layer resembling the U4 and U20 calcifugous communities described above.

5.7.4 W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland

Communities/sub-communities recorded: W17

W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland is a community of very acid, often thin and fragmentary soils in the cool, wet north-west of Britain where there is a strong tendency for mor accumulation and where high rainfall leads to strong leaching (Rodwell *et al.*, 1991; Hall *et al.*, 2004). Local differences in climate and topography have a strong influence on the vegetation and frequently interact with grazing to determine the distinctive floristics of the sub-communities (Rodwell *et al.*, 1991). In this community *Quercus petraea* and/or *Betula pubescens* usually dominate although *B. pubescens* is particularly frequent to the north-west where *Quercus* spp. are scarce. The field layer is usually characterised by ericoid shrubs, *Pteridium aquilinum* and grasses; bryophytes are also particularly abundant within this community (Rodwell *et al.*, 1991; Hall *et al.*, 2004).

A single stand of W17 was mapped within a mosaic area dominated by dry heath within the north of the study area along the Shiel Burn. These patches of woodland were young planted saplings of *Betula* spp. and *Quercus* spp. with a field layer of *Calluna vulgaris*, *Deschampsia flexuosa*, *Potentilla erecta*, *Vaccinium myrtillus* and the mosses *Pleurozium schreberi* and *Dicranum scoparium*.

5.7.5 W21 *Crataegus monogyna* – *Hedera helix* scrub

Communities/sub-communities recorded: W21

W21 *Crataegus monogyna* – *Hedera helix* scrub is the typical sub-climax woody community of circumneutral to base-rich soils throughout the British lowlands. It usually develops by the invasion of neglected bare ground or untreated herbaceous vegetation or where woodland has been degraded (Rodwell *et al.*, 1991). The vegetation is always dominated by various mixtures of smaller trees and shrubs, undershrubs and woody climbers (Rodwell *et al.*, 1991). The woody component of the vegetation can be quite varied, influenced by edaphic differences and availability of seed parents. However, *Crataegus monogyna* is the most common plant overall, and can be a sole dominant in some stands (Rodwell *et al.*, 1991).

W21 was recorded within a single mosaic to the north of the study area alongside U4 and W23 scrub. The community was dominated by a mix of *Crataegus monogyna* and *Sorbus aucuparia*.

5.7.6 W23 *Ulex europaeus* – *Rubus fruticosus* scrub

Communities/sub-communities recorded: W23

The W23 community is dominated by *Ulex europaeus* and has a usually sparse and species-poor ground flora which may be totally absent. It is a community of acidic and free draining soils on gentle to steep, rocky slopes at low altitudes. The vegetation often develops after woodland clearance of, or on, abandoned pasture (Rodwell *et al.*, 1991; Averis *et al.*, 2004).

W23 was recorded within a single mosaic to the north of the study area alongside U4 and W21 scrub. The community was dominated by *Ulex europaeus* with occasional *Rubus fruticosus*.

5.8 Swamps and Tall-Herb Fens

5.8.1 S9 *Carex rostrata* swamp

Communities/sub-communities recorded: S9

S9 swamp is generally a community of the north and west of Britain. The vegetation is typically a swamp of shallow to moderately deep, mesotrophic to oligotrophic standing waters with organic substrates. It also occurs more fragmentarily in peat cuttings (Rodwell *et al.* 1995). The S9 community is readily recognised by the tall, dense growth of *Carex rostrata* rooted in shallow water. Separation from other communities in which *C. rostrata* is present is based on its almost exclusive dominance in this community and the low cover and richness of associates.

This community appears at two locations within the north and north-east of the study area (see Annex C, photograph C4). Species diversity is low with a dominance of *C. rostrata*, and occasional *Equisetum fluviatile* and *Juncus effusus*.

5.8.2 S10 *Equisetum fluviatile* swamp

Communities/sub-communities recorded: S10

S10 occurs in similar situations to S9 above, being found in shallow to moderately deep, eutrophic to oligotrophic, standing waters in both lowland and upland lakes and pools. This community is comprised of open or closed vegetation up to around 50 cm high in which *Equisetum fluviatile* is the most abundant species. No other species is frequent throughout, although in each sub-community some of the associates may be locally abundant (Rodwell *et al.*, 1995).

This community only appears in a single location to the north-east of the study area within a mosaic with the other swamp community S9 and M23 rush mire community. Species diversity is low with a pure dominance of *E. fluviatile*.

5.8.3 **S12 *Typha latifolia* swamp**

Communities/sub-communities recorded: S12

S12 is most characteristic of standing or slow-moving, mesotrophic to eutrophic, circumneutral to basic waters with silty substrates. It is frequent around lowland lakes ponds and reservoirs and along canals and sluggish streams. *Typha latifolia* is always dominant in this type of swamp, forming an open or closed cover of shoots usually 1-2 m tall.

This community appears at two locations within the north-east and east of the study area, both within a mosaic of W7 wet woodland and M23 rush mire, and as a single pure stand. Again, species diversity is low with generally a complete dominance of *T. latifolia*.

5.9 **Non-NVC Communities & Categories**

5.9.1 **Overview**

A number of non-NVC vegetation types or features were mapped during the survey. These were classified as follows. Codes used in the results Figures are given in parentheses:

- Conifer plantation (CP);
- Buildings (BD);
- Bare ground (BG);
- *Juncus effusus* acid grassland community (Je); and
- Standing water (SW).

The plantation areas form the most dominant habitat within the study area (see Figure 7.3 and Annex C, photograph C5) and were generally unremarkable in terms of their flora and species composition. Most of the conifer plantation is mature with no ground flora except some scattered mosses, the ground instead being blanketed in woody debris and conifer needles. Younger plantations generally have a grassy understorey, most often resembling that of the U4 grassland community. These woodland plantation areas, along with areas of bare ground, standing water and buildings are floristically impoverished and of negligible botanical importance. The non-NVC vegetation type Je is described below.

5.9.2 ***Juncus effusus* (Je) acid grassland community**

The Je acid grassland community is present here as patches of a *Juncus effusus* dominated calcifuge grassland. This is vegetation in which very dominant and tall tussocks of *J. effusus* grow abundantly among a few shorter 'acid grassland' swards including frequent to occasional *Holcus lanatus*, *Rumex acetosa*, *Potentilla erecta* and *Galium saxatile*. This vegetation does not fit into any NVC community as it lacks the wetland element of M6 and M23 *Juncus* spp. mires and has a more acidophilous flora than MG10 *Juncus effusus* rush-pasture; it is therefore classed separately.

This vegetation is of limited botanical interest, but in light of the SEPA classification of potential GWDTEs this non NVC type Je should also qualify for potential GWDTE status. The classification of moderate sensitivity is in line with other similar *Juncus* spp. dominated grassland communities (e.g. MG10).

5.10 Invasive Non-Native Species

No invasive non-native species (INNS) were incidentally recorded during the habitat surveys; however, this does not preclude their presence from the study area.

5.11 Notable Species

No notable or rare species were incidentally recorded during the habitat surveys; however, this does not preclude their presence from the study area.

6 CORRESPONDENCE WITH PHASE 1 HABITATS

For each of the above-described vegetation and habitats types found in this survey, Table 6-1 shows the equivalent habitats according to the Phase 1 habitat classification (JNCC, 2010) for this study area, taking into account the species composition and habitat quality. For instance, typical blanket bog communities such as M19 and M20 have been classed as wet modified bog due to the evident impacts from forestry, drainage and grazing upon the mire present.

Many other NVC communities can also span different Phase 1 types. For example, M25 mire can be classified as a blanket or modified mire, or a marshy grassland depending on peat depth. M25 in the study area has been separated between the two Phase 1 Habitat types E1.7 wet modified bog and B5 marshy grassland. M25a has been classified as wet modified bog due to its features being closer to that of a mire based upon its species composition, the species-poor nature of the vegetation, impacts from forestry, drainage and grazing. In contrast, M25b was classified as marshy grassland based upon its grassier assemblage where many of these areas were found to contain an abundance of *Juncus* spp., they appear to be located on shallower peaty soils and, at times, makes a transition into an intermediate community becoming closely associated with the M23 *Juncus effusus/acuteiflorus* - *Galium palustre* community (see sections 5.2.7 and 5.2.8 above).

Stands of woodland such as W4, W7, W11, and W17 can often be either semi-natural or plantation, these therefore have been assigned the different respective Phase 1 codes. In this case all of the woodland stands have been recorded as plantation woodland.

The Phase 1 results are also shown on Figure 7.3 and have been interpreted from field surveys, mapping data, and the NVC polygon data broadly using Table 6-1. Polygons where there are mosaic NVC communities have generally been assigned a single Phase 1 classification based on the dominant NVC type (despite many polygons containing multiple Phase 1 types, often in low percentages). Therefore, Figure 7.3 is a broad overview, and the NVC data should be consulted for further detail in a specific area.

Table 6-1 Phase 1 Habitat Type Equivalents of NVC Communities and Other Habitats Recorded

| Phase 1 Equivalents | NVC & Other Habitats/Features Recorded |
|--|--|
| A1.1.2 Woodland: broadleaved, plantation | W4, W7, W11, W17 |
| A1.2.2 Woodland: coniferous, plantation | CP |
| A2.1 Scrub: dense-continuous | W21, W23 |
| B1.1 Acid grassland: unimproved | U4, U5, U6 |
| B2.1 Neutral grassland: unimproved | MG9 |

| Phase 1 Equivalents | NVC & Other Habitats/Features Recorded |
|------------------------------------|--|
| B5 Marsh/marshy grassland | M23, M25b, MG10, M23-M25, Je |
| C1.1 Bracken: continuous | U20 |
| D1.1 Dry dwarf shrub heath - acid | H9, H10, H12, |
| D2 Wet dwarf shrub heath | M15 |
| D5 Dry heath/acid grassland mosaic | Mosaics of B1 and D1.1 communities |
| E1.7 Bog: wet modified | M3, M19, M20, M25a |
| E2.1 Flush/spring: acid/neutral | M4, M6 |
| F1 Swamp | S9, S10, S12 |
| G1 Open water – standing water | SW |
| J3.6 Buildings | BD |
| J4 Bare ground | BG |

7 EVALUATION OF BOTANICAL INTEREST

7.1 Overview

NVC communities can be compared with a number of habitat classifications in order to help in the assessment of the sensitivity and conservation interest of certain areas. The following sections compare the survey results and the NVC communities identified against three classifications:

- SEPA guidance on GWDTEs;
- Habitats Directive (92/43/EEC) Annex I habitats; and
- Scottish Biodiversity List (SBL) priority habitats.

7.2 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

SEPA has classified a number of NVC communities as potentially dependent on groundwater (SEPA, 2017). Wetlands or habitats containing these particular NVC communities are to be considered GWDTE unless further information can be provided to demonstrate this is not the case. Many of the NVC communities on the list are very common habitat types across Scotland, and some are otherwise generally of low ecological value. Furthermore, some of the NVC communities may be considered GWDTE only in certain hydrogeological settings.

Designation as a potential GWDTE does not therefore infer an intrinsic biodiversity value, and GWDTE status has not been used as criteria to determine a habitats respective conservation importance. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment (see Chapter 11: Hydrology, Hydrogeology and Geology).

Using SEPA's (2017) guidance, Table 7-1 shows which communities recorded within the study area may be considered GWDTE. Those communities which may have limited (moderate) dependency on groundwater in certain settings are marked in yellow and NVC communities recorded that are likely to be considered high, or sensitive GWDTE in certain hydrogeological settings are highlighted in red.

Table 7-1 Communities Within The Study Area Which May Potentially be Classified as GWDTE

| NVC Code | NVC Community Name |
|-----------------|--|
| M15 | <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath |
| M25 | <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire |
| MG9 | <i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland |
| MG10 | <i>Holcus lanatus</i> – <i>Juncus effusus</i> rush pasture |
| U6 | <i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland |
| Je ⁴ | <i>Juncus effusus</i> acid grassland |
| W4 | <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland |
| W7 | <i>Alnus glutinosa</i> – <i>Fraxinus excelsior</i> – <i>Lysimachia nemoreum</i> woodland |
| M6 | <i>Carex echinata</i> – <i>Sphagnum fallax/denticulatum</i> mire |
| M23 | <i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush pasture |

The location and extent of all identified potential GWDTE are provided on an appropriate NVC map; see Figure 7.4.

Within Figure 7.4 the potential GWDTE sensitivity of each polygon containing a potential GWDTE is classified on a four-tier approach as follows:

- ‘Highly – dominant’ where potential high GWDTE(s) dominate the polygon
- ‘Highly - sub-dominant’ where potential high GWDTE(s) make up a sub-dominant percentage cover of the polygon
- ‘Moderately – dominant’ where potential moderate GWDTE(s) dominate the polygon and no potential high GWDTEs are present
- ‘Moderately - sub-dominant’ where potential moderate GWDTE(s) make up a sub-dominant percentage cover of the polygon and no potential high GWDTEs are present.

Where a potential high GWDTE exists in a polygon it outranks any potential moderate GWDTE communities within that same polygon.

GWDTE sensitivity has been assigned solely on the SEPA listings (SEPA, 2017). However, depending on a number of factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependant on groundwater at all. Determining the actual groundwater dependency of particular areas or habitat requires further assessment which is provided in Chapter 11 of the Proposed Development EIAR.

⁴ In light of the SEPA classification on potential GWDTEs the non NVC type ‘Je’ should also qualify for potential GWDTE status. The classification of moderate sensitivity is keeping in line with other similar *Juncus* spp. dominated grassland communities (e.g. MG10).

7.3 Annex I Habitats

7.3.1 Overview

A number of NVC communities can also correlate to various Annex I habitat types. However, the fact that an NVC community can be attributed to an Annex I type does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its Annex I status can depend on various factors such as quality, extent, species assemblages, geographical setting, substrates and so on.

Using Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions⁵, which have then been compared with survey results and field observations, the following NVC communities within the study area which constitute Annex I habitat are shown in Table 7-2.

Further details on the inclusion or omission of certain NVC communities/sub-communities and/or Annex I types are also provided below.

Table 7-2 NVC Communities Recorded and Corresponding Annex I Habitat Types

| NVC Code | NVC Community Name | Annex I Code | Annex I Title |
|-----------|--|--------------|---|
| M4 | <i>Carex rostrata</i> - <i>Sphagnum fallax</i> mire | 7140 | Transition mires and quaking bogs |
| M15, M15b | <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath | 4010 | Northern Atlantic wet heaths with <i>Erica tetralix</i> |
| M19, M19a | <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire | 7130 | Blanket bog |
| M20 | <i>Eriophorum vaginatum</i> blanket mire | 7130 | Blanket bog |
| H9 | <i>Calluna vulgaris</i> – <i>Deschampsia flexuosa</i> heath | 4030 | European dry heaths |
| H10 | <i>Calluna vulgaris</i> - <i>Erica cinerea</i> heath | 4030 | European dry heaths |
| H12, H12a | <i>Calluna vulgaris</i> – <i>Vaccinium myrtillus</i> heath | 4030 | European dry heaths |

7.3.2 7130 Blanket bog

The blanketing of the ground with a variable depth of peat gives the habitat type its name and results in the various morphological types according to their topographical position. Blanket bogs show a complex pattern of variation related to climatic factors, particularly illustrated by the variety of patterning of the bog surface in different parts of the UK. Such climatic factors also influence the floristic composition of bog vegetation.

‘Active’ bogs are defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as *Sphagnum* spp. and *Eriophorum* spp., or *Molinia caerulea* in certain circumstances, together with *Calluna vulgaris* and other ericaceous species. The most abundant NVC blanket bog types are M17, M18, M19, M20 and M25.

Annex I type 7130 Blanket bog can therefore correlate directly with a number of NVC communities within the study area such as the M19, M20 and M25 mires. However, 7130 blanket bog can also include bog pool communities (M1-M3) where these occur within blanket mires such as M17-M20.

⁵ <http://jncc.defra.gov.uk/page-1523>

Both M19 and M20 appear within the study area. M19 is found to be patchy across the study area, most often within forest rides or along the forest margins. M20 was found to be in a species-poor grassy form across the study area, again often found within forest rides or in a few more extensive areas outwith the plantation forestry. As a result of both communities being subject to the effects of forest drainage, shading effects and sheep grazing, they are deemed to be poor or degraded forms of Annex I habitats.

As noted above, M25 mire can also fall within the blanket bog Annex I type, usually where the underlying peat depth is greater than 0.5 m and the habitat is wet and contains peat forming species. As described in section 5.2.7 above, M25 within the study area is for the most part species-poor and at the drier end of the scale. Many areas are a ubiquitous swathe of *Molinia* tussocks with few associate species and generally lack many of the main peat forming species such as *Sphagnum* mosses. Much of the M25 within the study area is also grazed, in some areas quite intensively, and this has resulted in many areas of M25 appearing transitional to acid grassland communities (U4 – U6) and the rush mire community M23, often in intricate mosaics with these same communities. General field observations of M25 also indicate that this habitat is unlikely to be on deep peat within the study area. Given the character of the majority of M25 within the study area it has not been considered to be of Annex I habitat quality in this case.

The M3 bog pool community recorded is limited to two small areas within the study area, as described in section 5.2.1 above, and while this community does include some peat forming bog-mosses, these areas are not deemed extensive enough, are not part of wider M19/M20 blanket bog areas, nor incorporate the often distinctive bog pool surface patterning to be considered Annex I habitat in this case.

7.3.3 4010 Northern Atlantic wet heaths with *Erica tetralix*

Wet heath usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures *Erica tetralix*, *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses. All examples of M15 wet heath were included within the 4010 Northern Atlantic wet heaths category.

7.3.4 4030 European dry heaths

European dry heaths typically occur on freely-draining, acidic to circumneutral soils with generally low nutrient content. Ericaceous dwarf shrubs dominate the vegetation. The most common dwarf shrub is *Calluna vulgaris*.

All dry heath in the study area is semi-natural and derived from a long history of grazing and burning. The dry heath communities recorded – H9, H10, and H12 – all fall within this Annex I type. These NVC types can also be included within the Annex I type H4060 Alpine and Boreal heaths, but only where they are at higher altitudes and include arctic-alpine floristic elements. These communities within the study area are lower altitudinal examples so they all fall under the 4030 European dry heaths Annex I type.

The most common forms of dry heath in the study area, as noted in the community descriptions above, are species-poor, relatively botanically impoverished forms of *Calluna* dominated heath.

7.3.5 Annex I Woodlands

None of the woodlands within the study area (W4, W7, W11, and W17) were considered to be referable to Annex I woodland types such as 91A0 Old sessile oak woods with *Ilex* and *Blechnum*, 91D0 Bog woodland or 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, as the species assemblages, specific geographical, plantation origin or landscape settings did not align with any of these Annex I habitat types.

7.4 Scottish Biodiversity List Priority Habitats

The SBL is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL was published in 2005 to satisfy the requirement under Section 2(4) of The Nature Conservation (Scotland) Act 2004.

The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland: these are termed 'priority habitats'. Some of these priority habitats are quite broad and can correlate to a large number of NVC types.

The relevant SBL priority habitat types (full descriptions of which can be found on the SNH website⁶), and associated NVC types recorded within the study area are as follows:

- **Wet woodland:** W7;
- **Upland birchwoods:** W4 and W11;
- **Blanket bog:** M19 and M20;
- **Upland flushes, fens and swamps:** M4, M6, S9, S10, and M23a;
- **Upland heathland:** M15, H9, H10, and H12.

These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats⁷.

7.5 Summary

Table 7-3 provides a summary of all the NVC communities recorded within the study area, and any associated habitat sensitivities as described in the sections above.

Table 7-3 Summary of Study Area NVC Communities and Sensitivities

| NVC Codes Recorded | Potential GWDTE Status | Annex I Type Code | SBL Priority Habitat Type |
|------------------------------|------------------------|--|---------------------------------|
| Mires & Wet Heath | | | |
| M3 | | | |
| M4 | | 7140 Transition mires and quaking bogs | Upland flushes, fens and swamps |
| M6c, M6d | High | | Upland flushes, fens and swamps |
| M15, M15b | Moderate | 4010 Northern Atlantic wet heaths with <i>Erica tetralix</i> | Upland heathland |
| M19, M19a | | 7130 Blanket bogs | Blanket bog |

⁶ <https://www.nature.scot/scotlands-biodiversity/habitat-definitions>

⁷ <http://jncc.defra.gov.uk/page-5718>

| NVC Codes Recorded | Potential GWDTE Status | Annex I Type Code | SBL Priority Habitat Type |
|------------------------------------|------------------------|--------------------------|---|
| M20, M20a, M20b | | 7130 Blanket bogs | Blanket bog |
| M23a, M23b, M23-M25 intermediate | High | | Upland flushes, fens and swamps (applies to M23a only) |
| M25a, M25b | Moderate | | |
| Dry Heaths | | | |
| H9, H9a | | 4030 European dry heaths | Upland heathland |
| H10 | | 4030 European dry heaths | Upland heathland |
| H12, H12a, | | 4030 European dry heaths | Upland heathland |
| Calcifugous Grasslands | | | |
| U4, U4b, U4d | | | |
| U5 | | | |
| U6, U6a | Moderate | | |
| U20, U20a | | | |
| Mesotrophic Grasslands | | | |
| MG9, MG9a | Moderate | | |
| MG10a | Moderate | | |
| Woodland & Scrub | | | |
| W4, W4b | High | | Upland birchwoods |
| W7, W7c | High | | Wet woodland |
| W11 | | | Upland birchwoods |
| W17 | | | |
| W21 | | | |
| W23 | | | |
| Swamps & Tall-Herb Fens | | | |
| S9 | | | Upland flushes, fens and swamps |
| S10 | | | Upland flushes, fens and swamps |
| S12 | | | |

8 SUMMARY

MacArthur Green carried out NVC and habitat surveys within the study area in August 2018 in order to identify those areas of vegetation communities with the greatest ecological or conservation interest.

In total 27 NVC communities were recorded within the respective study area along with various associated sub-communities; a number of non-NVC habitat types are also present, in particular conifer plantation and non-NVC *Juncus* spp. grasslands.

Outwith the expanse of dominant conifer plantation, the study area mainly contains a mix of typical mire, acid grassland, woodland and upland marshy grassland and flush communities. Although some

large relatively homogeneous stands of vegetation occur across the study area most of the communities often form complex mosaics and transitional areas across the study area. The habitats in the study area, outside the forestry plantation, are subject to cattle and sheep grazing, and many areas of mire appear to have been drained historically.

GLOSSARY

acidophilous: plants/bryophytes that prefer to grow in an acidic environment.

base-poor: environments which have few chemical bases, they are dominated by environmental acids (usually organic acids) and so are acidic.

base-rich: environments which are neutral or alkaline.

base-richness: the level in soil or water of chemical bases, such as calcium or magnesium ions. Chemical bases are alkalis. Many plants and bryophytes are restricted to base-rich or base-poor environments.

calcareous: calcareous grassland forms on soils that are base-rich.

calcicolous: a plant that grows and thrives in soil rich in lime.

calcifugous: growing or living in acid soil.

circumneutral soil: nearly neutral, having a pH between 6.5 and 7.5.

dicotyledon: a plant that produces flowers and has two cotyledons (i.e. embryonic leaves).

forb: a herbaceous flowering plant that is not a graminoid (grasses, sedges and rushes).

graminoid: grasses; monocotyledonous, usually herbaceous plants with narrow leaves growing from the base. They include the true grasses, of the family Poaceae (also called Gramineae), as well as the sedges (Cyperaceae) and the rushes (Juncaceae).

mesophytic: a land plant that grows in an environment having a moderate amount of moisture, neither a particularly dry nor particularly wet environment.

mesotrophic grassland: neutral grassland, characterised by vegetation dominated by grasses and herbs on a range of circumneutral soils.

lagg: zone where water draining a bog meets that from adjoining mineral soils. A characteristic of the lagg zone is that normally it has more available plant nutrients, is more alkaline and hence shows greater species diversity.

monocotyledons: flowering plants group which have just one cotyledon.

mor: forest humus that forms a layer of largely organic matter distinct from the mineral soil beneath.

mosaic: a pattern of two or more vegetation types disposed in intimate relationships to one another.

oligotrophic: lacking in plant nutrients.

ombrogenous: dependant on rain for its formation. Ombrogenous bog is a peat-forming vegetation community lying above groundwater level: it is separated from the mineral soil, and is thus dependent on rain water for mineral nutrients. The resulting lack of dissolved bases gives strongly

acidic conditions. Two types of ombrogenous bogs are commonly distinguished: raised bogs and blanket bogs.

pleurocarpous: A type of moss in which the female sex organs and capsules are borne on short, lateral branches, and not at the tips of branches. Pleurocarpous mosses tend to form spreading carpets rather than erect tufts.

podsol: a soil that develops in temperate to cold moist climates under coniferous or heath vegetation; an organic mat over a grey leached layer.

soligenous: where water movements are predominantly lateral. Produced by inflow of surface water or rise of groundwater and not completely by locally precipitated water.

topogenous mire: a type of mire that forms under climatic conditions of reduced rainfall, with consequent lower humidity and summer drought, which restrict the growth of wetland vegetation to areas where precipitation is concentrated (e.g. valley bottoms).

REFERENCES

Atherton, I., Bosanquet, S. & Lawley, M. (2010). *Mosses and Liverworts of Britain and Ireland: a field guide*. British Bryological Society.

Averis, A., Averis, B., Birks, J., Horsfield, D., Thompson, D., & Yeo, M. (2004). *An Illustrated Guide to British Upland Vegetation*. JNCC, Peterborough. ISBN 1 86107 553 7.

Averis, B. and Averis, A. (2015). *Plant communities found in field surveys by Ben and Alison Averis but not described in the UK National Vegetation Classification*. Online: http://www.benandalisonaveris.co.uk/downloads_13.html

Cooper, E.A. (1997). *Summary Descriptions of National Vegetation Classification grassland and montane communities*. ISBN 1 86107 433 3.

Elkington, T., Dayton, N., Jackson, D.L., & Strachan, I.M. (2001). *National Vegetation Classification: Field guide to mires and heaths*. ISBN 1 86107 526 X.

Hall, J.E., Kirby, K.J., & Whitbread, A.M. (2004). *National Vegetation Classification: Field guide to woodland*. ISBN 1 86107 554 5.

Joint Nature Conservancy Council. (2010). *Handbook for phase 1 habitat survey – a technique for environmental audit*. JNCC, Peterborough.

Purvis, O. W., Coppins, B.J., Hawksworth, D. L. H., James, P.W. and Moore, D.M. (1992). *The Lichen Flora of Great Britain and Ireland*. Natural History Museum, London.

Rodwell, J.S. (Ed), et al. (1991 – 2000). *British Plant Communities* (5 volumes). Cambridge University Press, Cambridge.

Rodwell, J.S. (2006). *NVC Users' Handbook*. ISBN 978 1 86107 574 1.

Scottish Government (2013). *Scottish Biodiversity List*. Available at: <https://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL>. Accessed: August 2018.

SEPA. (2017). Land Use Planning System SEPA Guidance Note 31: *Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems*. Version 3. Issue date: 11/09/2017.

Stace, C.A. (2010). *New Flora of the British Isles*. 3rd Edition. Cambridge University Press.

ANNEX A. NVC TARGET NOTES

A number of target notes were also made during surveys, often to pinpoint springs/flushes, or an area or species of interest, these target notes are shown on Figure 7.3 and detailed within Table A-1 below. Target note photographs are provided in Annex B.

Table A. 1 Study Area Target Notes

| Target Note ID | Easting | Northing | NVC Community | Description | Photo Reference |
|----------------|---------|----------|---------------|--|-----------------|
| TN1 | 279281 | 632496 | SW (non-NVC) | No aquatic vegetation with only small patches of <i>Sphagnum</i> moss along the fringes. | B.1 |

ANNEX B. TARGET NOTE PHOTOGRAPHS

The following photographs correlate to the target notes described within Annex A, Table A.1.

Photo B. 1 Target Note 1



ANNEX C. GENERAL COMMUNITY PHOTOGRAPHS

The following selected photographs are provided to give a visual representation to a number of the community types present within the study area.

Photograph C1: M20 species-poor mire within forestry ride



Photograph C2: M15b heavily grazed wet heath



Photograph C3: M25 mire



Photograph C4: S9 *Carex rostrata* swamp



Photograph C5: Mature conifer plantation

