Moray and Aberdeenshire Forest District

Monaughty Forest

Land Management Plan

Plan Reference No: LMP 3

Plan Approval Date:

Plan Expiry Date:

FOREST ENTERPRISE - Application for Forest Design Plan Approvals in Scotland

Forest Enterprise - Property

Forest District:	Moray & Aberdeenshire FD
Woodland or property name:	Monaughty
Nearest town, village or locality:	Elgin
OS Grid reference:	NJ 131 585

Areas for approval

	Conifer	Broadleaf	Open
Clear felling	68.6ha		
Selective felling	30.0ha		
Restocking	48.4ha	0.5ha	1.4ha
New planting (complete appendix 4)	None	None	

1. I apply for Forest Design Plan approval*/~~amendment approval*~~ for the property described above and in the enclosed Forest Design Plan.

2. * ~~I apply for an opinion under the terms of the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999 for afforestation* /deforestation*/ roads*/ quarries* as detailed in my application.~~

3. I confirm that the initial scoping of the plan was carried out with FC staff on

4. I confirm that the proposals contained in this plan comply with the UK Forestry Standard.

5. I confirm that the scoping, carried out and documented in the Consultation Record attached, incorporated those stakeholders which the FC agreed must be included.

6. I confirm that consultation and scoping has been carried out with all relevant stakeholders over the content of the of the design plan. Consideration of all of the issues raised by stakeholders has been included in the process of plan preparation and the outcome recorded on the attached consultation record. I confirm that we have informed all stakeholders about the extent to which we have been able to address their concerns and, where it has not been possible to fully address their concerns, we have reminded them of the opportunity to make further comment during the public consultation process.

7. I undertake to obtain any permissions necessary for the implementation of the approved Plan.

Signed …… Forest District Manager

Signed …… Conservator

District Moray & Aberdeenshire

Conservancy Grampian

Date ……

Date of Approval ……

Date approval ends: ……

FOREST ENTERPRISE - Request for Approval of Thinnings

To: Conservator

Grampian Conservancy

Portsoy Road
Huntly
Aberdeenshire
AB54 4SJ

I apply for Authority to carry out a programme of thinnings within Monaughty in Moray & Aberdeenshire Forest District during the 10 years commencing from the date of approval.

I undertake to identify any statutory designations which apply to any of the land to be subject to thinning, and to obtain the necessary permissions from the appropriate statutory body before commencing work under any approval which is granted.

Signed	…… Forest District Manager	Signed	…… Conservator
District	Moray & Aberdeenshire	Conservancy	Grampian
Date	……	**Date of Approval**	……

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Land Management Plan Summary

This is the plan for Forestry Commission Scotland's management of Monaughty forest located 2.5miles south west of Elgin. The plan covers an area of approx. 1470ha.

The purpose of the plan is to set out the management objectives and prescriptions for the forest for the next ten years in detail, and in more broad terms for the following twenty years, which will fulfil the requirements of the UK Forestry Standard.

The District Strategic Plan identifies the forest as:

- A key site for the production of high quality timber.
- A forest with a significant number of visitors.
- An area with potential for all abilities access.
- Part of the area delivering management prescriptions complementary to Capercaillie.

Past management activity across the forest has been high, with most stands of appropriate age having been thinned.

The Torrieston area of the block offers a high quality path network suitable for mixed abilities. The path passes through mainly semi-mature/mature Scots Pine. The Black Burn running through the forest, sandy soils and gentle slopes all add to the recreational experience. Visitor numbers are high with a large proportion of the users being local residents.

The scarp slopes of the main woodland block create practical challenges for harvesting. The crop has some high quality specimen trees and a wide range of conifer species showing good growth and form. This area has a high visual impact from minor roads and houses to the south and is the backdrop to designated Area of Great Landscape Value..

The bulk of the main forest block forms a low plateau dropping to the north, and comprises well roaded and easily worked gentle slopes. This area is dominated by Scots pine and Sitka spruce. The landscape impacts of this area are very limited as it is predominantly viewed in profile. The mature Scots pine element in this area is the prime area of interest for Capercaillie.

1.0 Introduction

Refer to Map 1: Location.

1.1 Setting and context

This plan is a review of Forestry Commission Scotland's management of Monaughty located 2.5miles south west of Elgin. The plan covers an area of approx. 1470ha.

The plan area was acquired by the FC during the 1920's, 1950's and 1960's.

The forest has many positive features arising from physical site factors, infrastructure, past and current management and its location. These include:

- Proximity to timber markets.
- Good internal road network and transport links to markets.
- Gentle slopes across much of the forest and good soil bearing capacity which reduces the potential for adverse operational impacts.
- Proximity to centres of population to provide a recreational resource.
- A wide range of tree species present on site with a diverse age class.
- Large scale.
- A history of active silvicultural management.
- Effective deer management with only low populations of roe and red deer present.

However there are a number of negative factors that constrain forestry management of this block. These include:

- Areas of steep slopes on the scarp slope that constrains silvicultural options and increase harvesting cost. They also limit the options for coupe design.
- The road network taken in conjunction with the ride system creates a geometric pattern of windfirm edges which dictates coupe shape. These impacts are reduced by the flat plateau terrain.
- Butt rot has a serious impact on timber quality, has the capacity to reduce rotation length and influence the choice of species for restocking.
- Scots pine regeneration is limited by ground vegetation which includes dense bracken & moss.

- The extensive road network, open stand nature and high recreational usage all act to reduce the area of secluded forest, an important factor for Capercaillie.
- While a diverse tree species mix is to be welcomed, a number of the conifer species with good timber potential have a competitive advantage over Scots Pine, particularly in LISS situations. This creates additional management input to maintain a significant pine element.

The forest is well drained and has few water courses that are very small with intermittent flows. The Black Burn that flows through Torrieston is the most substantial burn and adds significantly to the aesthetics of the forest walk and is a focus for a picnic area. The burn flows through open Scots Pine stands and areas of native broadleaved woodland which creates dappled shade along its length.

1.2 Land Management Objectives

The objectives for managing this land have been identified following a review of the following factors:

- the physical context and current crop;
- neighbouring landuses;
- a review of the land management objectives already established by statutory bodies;
- the physical capability of the land;
- the locational objectives identified in the Moray & Aberdeenshire Forest District Strategic Plan;
- the views expressed by the public and statutory stakeholders (see appendix 1).

From these factors it has been determined that the **primary objective** for the forest is the **production of a quality crop of timber**.

In common with all management across the National Forest Estate the forest will be managed to meet the requirements of the UK Forest Standard (UKFS). This will ensure that the plan meets multiple land use objectives in addition to the primary objective.

Scots Pine P1952 being thinned at the Burgiehill end of the main block.

Torrieston with footbridge over the Black Burn

2.0 Analysis of previous plan

2.1 Aims of previous plan & achievements

The previous plan for Monaughty was approved in 2006.

Since then FES policy themes have been updated and as a consequence previous objectives can not be directly compared with the current aspirations for the National Forest Estate.

The previous plans objectives were based on sustainable management and restructuring to ensure a steady supply of marketable timber while delivering a wide range of social and environmental benefits. Specifically these benefits included:

- Landscape enhancement
- Habitat creation, restoration and maintenance.
- The provision of an open and accessible forest area, for a wide variety of recreational pursuits.

The plan prior to the 2006 plan (approved in 1996/7) had resulted in an expansion of SS at the expense of SP, however the 2006 plan considered that this trend should be reversed, although actions to implement this were constrained by the young age class of most of the SS area.

The implementation of the 2006 plan has achieved many of its objectives including:

- Production of significant volumes of high quality timber from both thinnings and clearfells.
- An active thinning programme has created landscape enhancements both from internal and external perspectives, as well as creating ecological benefits.
- An increased broadleaved element from both planting and widespread birch natural regeneration.
- Road upgrades to facilitate active management.
- The provision of a valued recreational resource for a wide range of abilities.
- Effective deer management with biodiversity benefits and increased silvicultural flexibility.

- Maintenance of tree species diversity and an increase in age class diversity.
- Maintenance of areas of specimen trees.

2.2 How previous plan relates to today's objectives

Objectives of the previous plan that are relevant to the current revision include:

- The multi-purpose objectives of the previous plan. LISS will continue to play a role in the silvicultural management of the forest.
- Enhancing the limited riparian zones remains an objective.
- The proposal to reduce the SS area and substitute this for SP needs to be reconsidered once the full impact of DNB on SP has been established.
- Silvicultural management of the SP stands to create an ecological and productive continuum needs to adapt to local conditions. Planted SP grows very well on site, but regeneration is poor.
- Maintaining productivity in future rotations and maintaining a critical mass of productive forest area are important strategic considerations for the District, and the downstream industries dependent on this flow of timber.
- Increasing economic diversity in forest industries, by marketing a wider range of forest products to a wider range of end users, increases resilience.
- The forest grows a range of hardwoods very well and the site has scope for productive broadleaves. Birch regeneration is also widespread. The more fertile areas in the east of the forest have a dense bracken understorey in places, which suggests that broadleaves or diverse conifers may be better suited to the site than SP.
- Open ground management remains a challenge in that the landscape benefits it delivers are relatively low, and natural regeneration of broadleaves and conifers (other than SP) is very strong. Open ground areas are therefore colonised fairly quickly with shrubs and successional tree cover.

The main new challenges relate to external factors with climate change and the associated disease issues being major new drivers. Increasing the forests resilience to both disease and economic issues are now important considerations and the value of productive forestry in mitigating climate change is generally accepted.

Well thinned mid rotation SP stand with vigorous WH & SS regeneration.

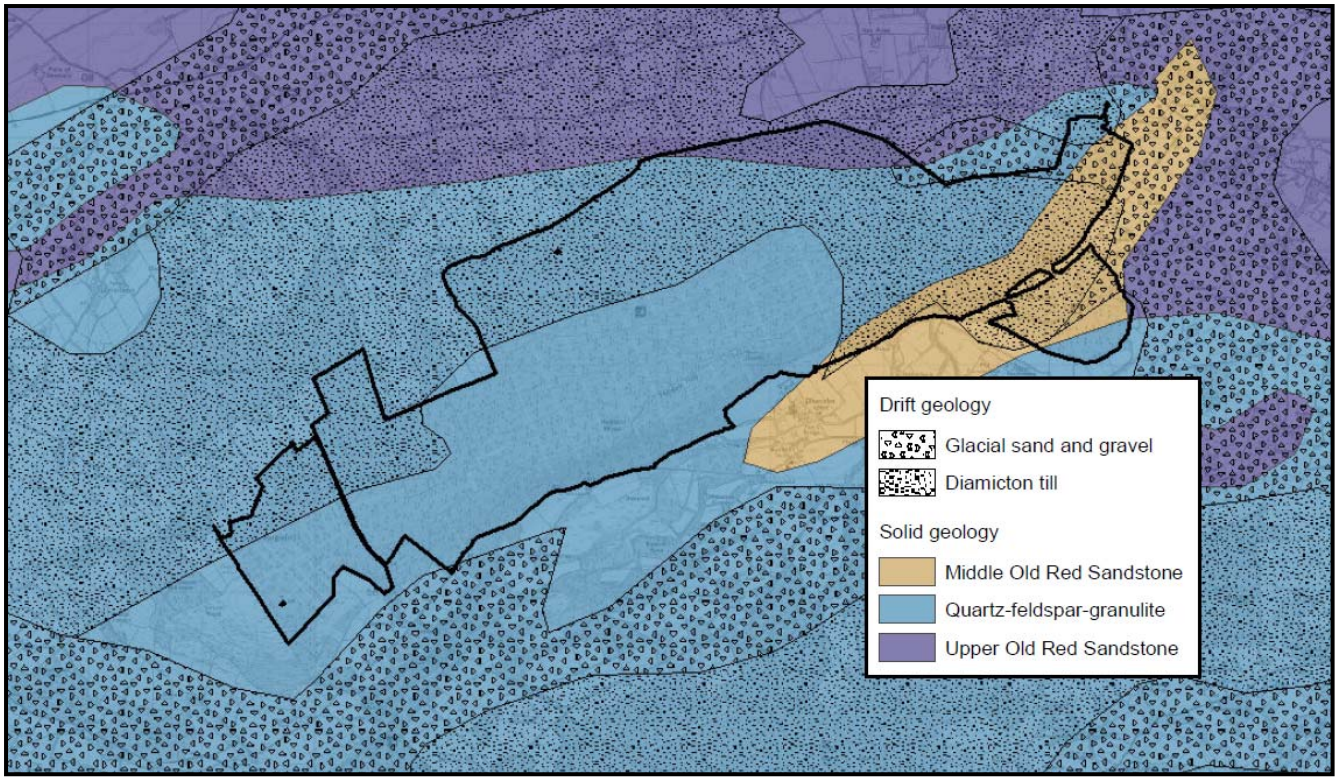
3.0 Background information

3.1 Physical site factors

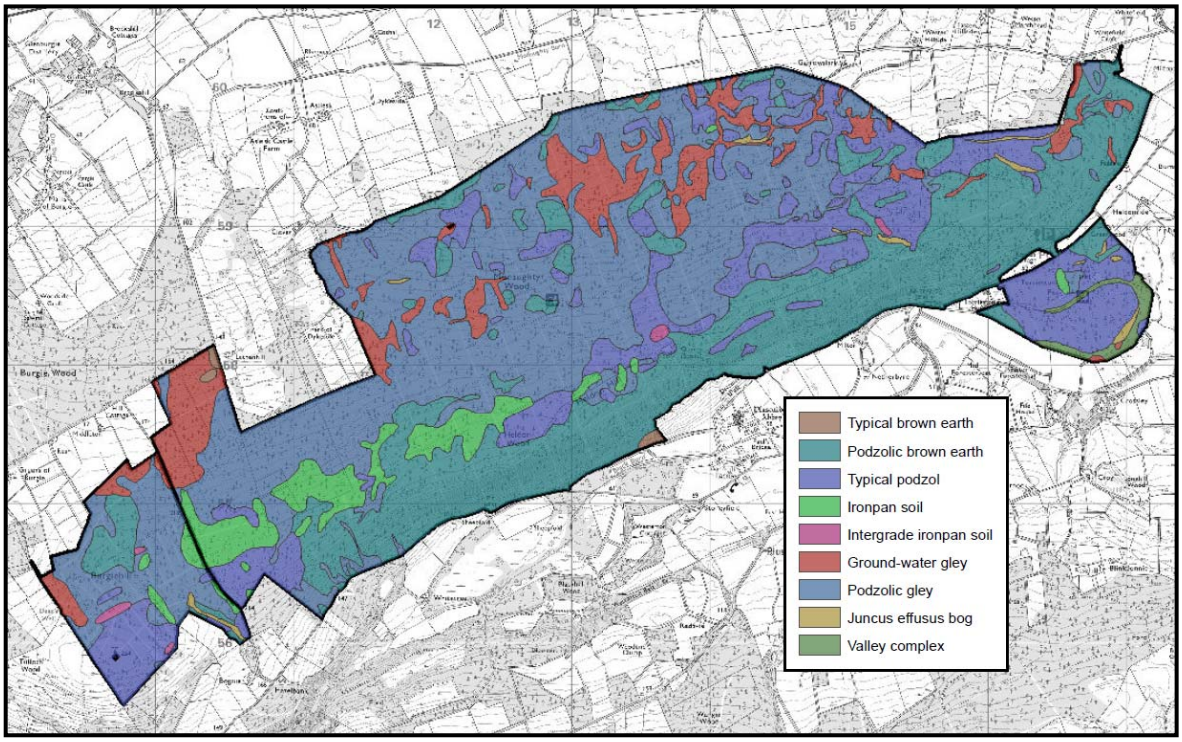
Refer to Map 2: Key Features.

3.1.1 Geology, Soils and Landform

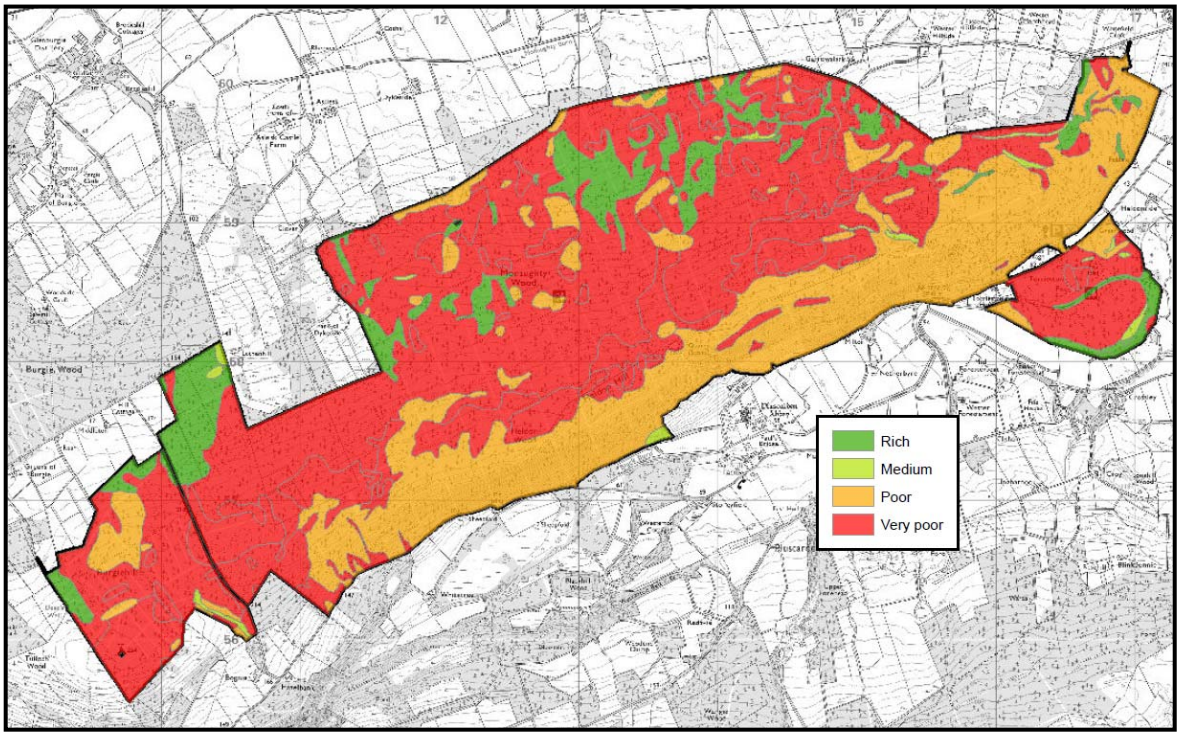
Geology– The solid geology underlying Monaughty is composed mainly of quartzite across the main plateau and southern slopes, with sandstones in the Pluscarden valley and Torrieston area (British Geological Survey, 1999b). Drift deposits of glacial boulder till almost entirely overlay this, with alluvial sands and gravels occurring over the sandstones (British Geological Survey, 1999b).



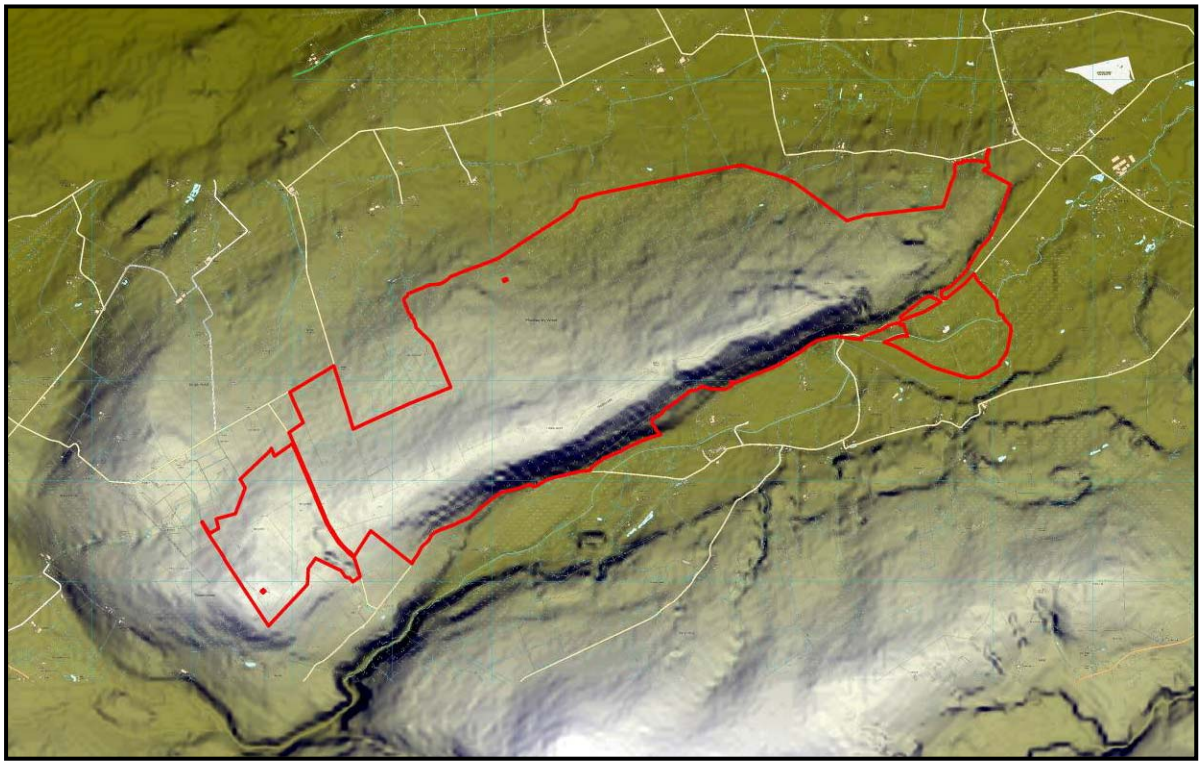
Soils - The influence of the till material gives rise to large areas of podzolic gleys with localised typical podzol and ground-water gleys across the plateau. Better podzolic brown earths occur from Heldon Wood to the valley bottom and around Torrieston.



This combination of geology and soils has led to the block having growing conditions that are poor due to the poor or very poor nutrient regime across most of the area.



Landform – The forest lies between an altitude of 46m & 253m. The landform is a contrast of a steep south facing scarp slope dropping away as a gentle plateau/slope to the north



Terrain map of the site with forest outline in red.

3.1.2 Water

There are no recorded water supplies within the forest, and with the exception of the Black Burn, water courses are very limited and display low flow rates, often drying up completely in dry summers.

The impact of Monaughty forest on flood risks downstream is anticipated to be very low; however any impact is likely to be positive with a large afforested area having the following impacts:

- Reduced water flows by interception and transpiration loss.
- Reduced siltation and improved water quality, with an associated reduction in downstream channel blocking.
- Slowing of water movement through the profile by litter formation.

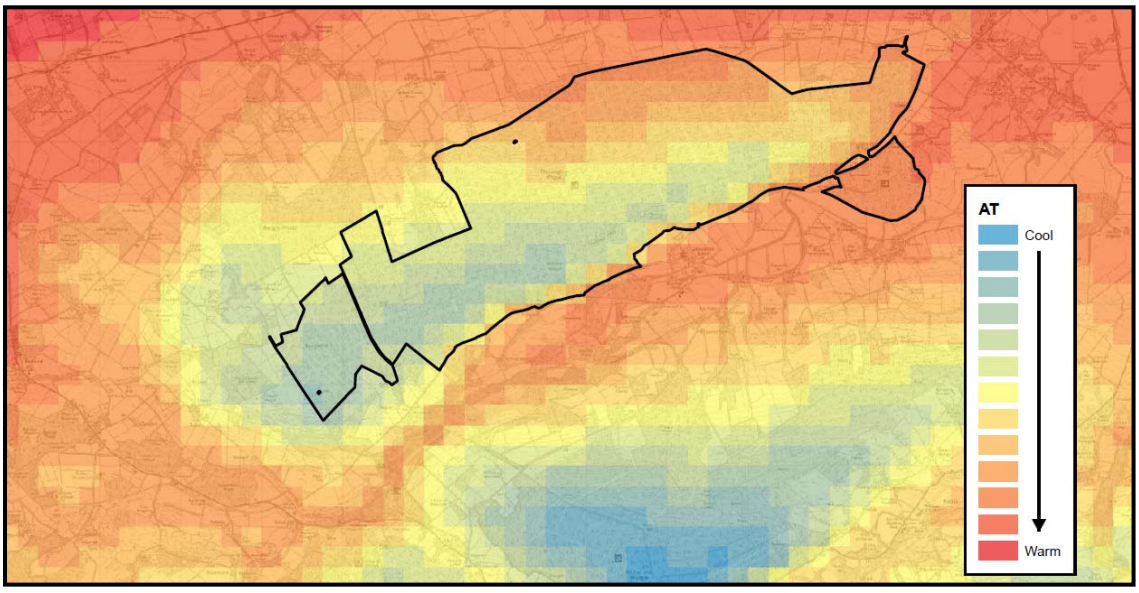
- The small volumes of water moving in the limited number of water courses have a very limited capacity to transport woody debris even in spate conditions.

The Black Burn that flows through Torrieston is the only larger burn with the capacity to transport woody debris in flood conditions. However most of the burns length within the forest passes through mature stable Scots pine or young mixed broadleaves. Both crops are unlikely to produce large volumes of woody debris along the banks.

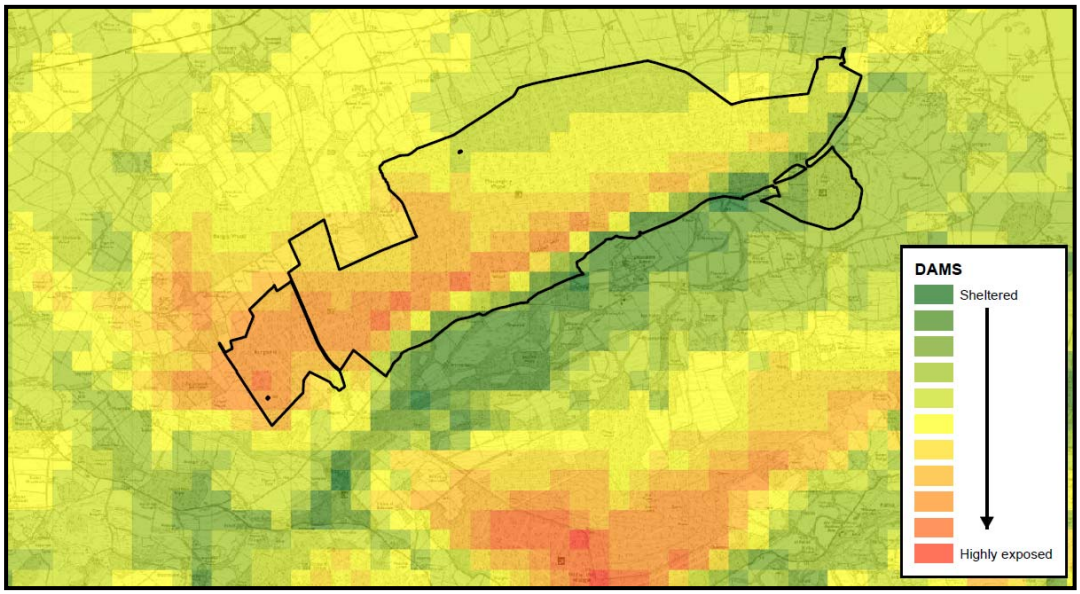
3.1.3 Climate

The climate data for the LMP area is obtained from the Ecological Site Classification system (ESC).
The results of interrogating this system gave the following data.

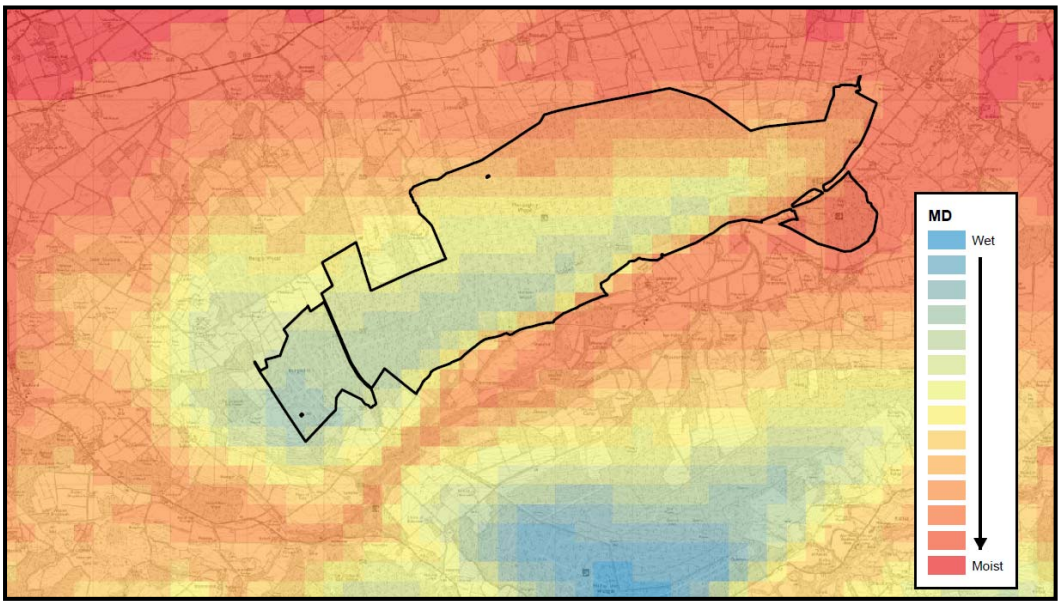
AT5	DAMS	MD
979 – 1222 Cool - Warm	7 – 16 Sheltered – Highly exposed	73 – 129 Wet - Moist



AT5 is the accumulated total of the day-degrees above the growth threshold temperature of 5º, which provides a convenient measure of summer warmth. The results for AT5 place these blocks in the “cool” zone.



DAMS is the Detailed Aspect Method of Scoring. This represents the amount of physically damaging wind that forest stands experience in the year. The range of DAMS is from 3 to 36 and windiness is the most likely limiting factor to tree growth at higher elevations in Britain. The site description based on the DAMS score ranged from “sheltered” to “highly exposed”, with the average (12) being “sheltered”.



MD is the Moisture Deficit for the area. Moisture deficit reflects the balance between potential evaporation and rainfall and therefore emphasises the dryness of the growing season (rather than the wetness of the winter or whole year). These results place the blocks in the “moist” zone.

These results will be used to help assist in the choice of tree species for restocking in this LMP. Each tree species has tolerances for these and other factors and they can be used to identify species suitable for the site conditions.

Further information on these criteria and the application of ESC can be found in Forestry Commission Bulletin 124 - An Ecological Site Classification for Forestry in Great Britain.

3.2 Biodiversity and environmental designations

The adjacent Lethenhill Site of Special Scientific Interest (SSSI) contains a variety of habitats including grassland, rush-pasture, fen-meadow, wet-heath and open Scots Pine woodland. The fen-meadow is influenced by base-rich rocks and is probably the finest in Moray. Among the less common species to be found are globeflower, fragrant orchid and lesser butterfly orchid. The wet heath, characterised by mixtures of heather, cross-leaved heath, deer grass and bog moss, has been colonised by Scots Pine, Birch and Juniper, thus forming open woodland. Flushes with sedges and bog mosses occur within the wet heath and by the open woodland.

The SSSI is in favourable condition maintained. There are significant areas of planted and regenerated tree cover across the site, so the role of any tree seeding in from the forest is unlikely to be as significant as the seed fall from trees on the site. However action to control natural regeneration in the proximity of the SSSI may be required to reduce adverse impacts on the site.

The designated features of the site show little cross over into the forest, possibly due to the long history of plantation forestry in Monaughty, and the lack of grazing. With gorse being a major colonising species in the area, leaving open ground adjacent the SSSI may in the long term lead to dense gorse stands, which are likely to seed across the SSSI. Site monitoring and review by SNH may suggest approaches that will enable the FES to cooperate in enhancing the SSSI site condition.

There are two of the key woodland species recorded in the block, red squirrel and Capercaillie.

The forest creates a diverse habitat for a range of other forest species; in particular the varied structure provides a wide range of niches for birds and mammals.

Open ground area with scattered Scots pine and a healthy heather layer.

3.3 The existing forest

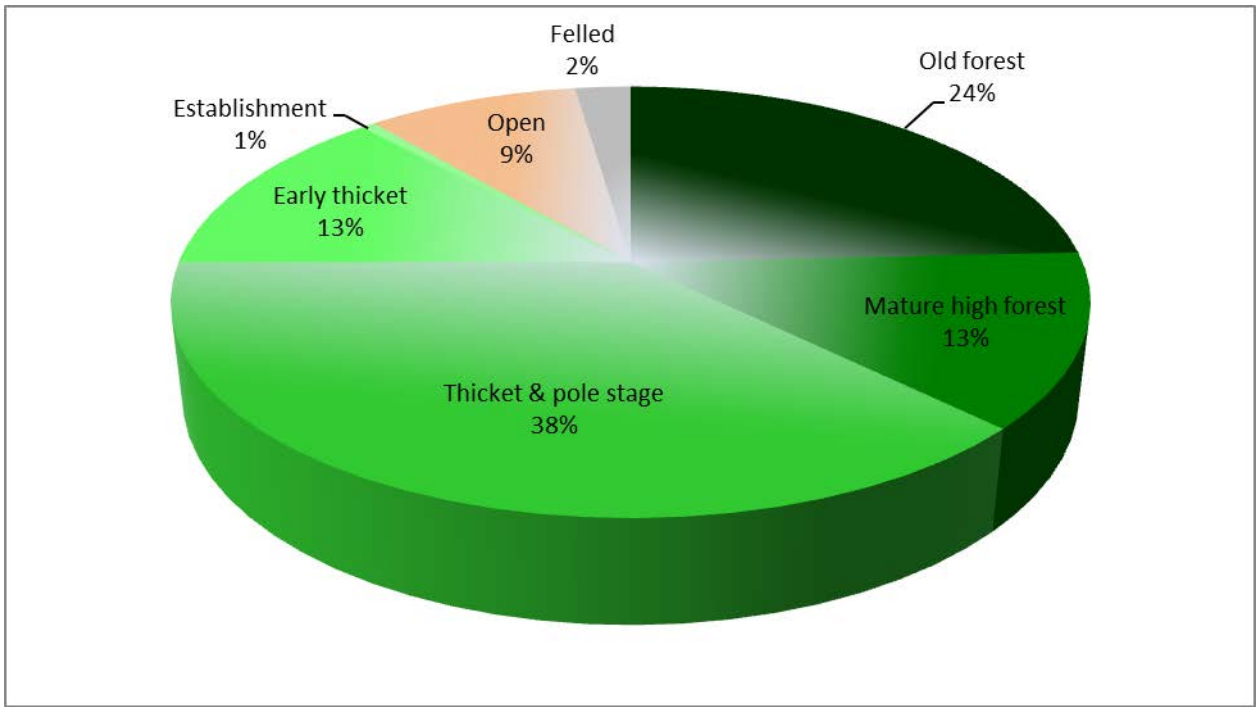
3.3.1 Age structure, species (See Map 3) and yield class

i. Age Structure

Monaughty displays a very wide age class range across the forest area.

Maintaining the age class diversity increases the forest resilience to disease, storms and climatic changes.

Ages of Trees (years)	Successional Stage	Area (ha)	%
0 -10	Establishment	8.6	0.6
11 – 20	Early Thicket	193.5	13.2
21 – 40	Thicket & Pole Stage	554.9	37.7
41 – 60	Mature High Forest	191.5	13.0
61+	Old Forest	356.5	24.2
	Open	131.1	8.9
	Felled	34.2	2.3



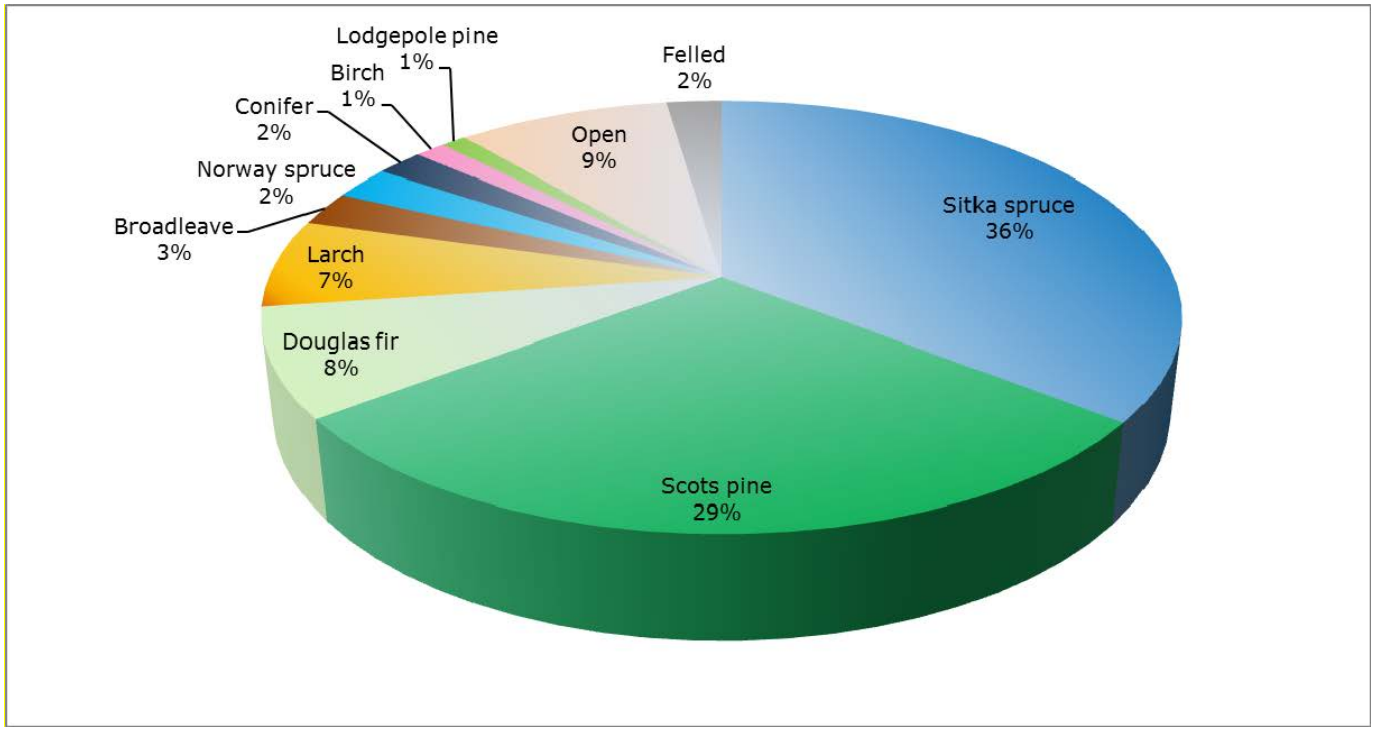
It is clear from the figures above that the current percentage of open ground is slightly short of the UKFS requirement of 10%. This lack of open ground will be addressed in this plan.

ii. Species

The forest carries a wide variety of species. While this diversity is a strength some of the species are very competitive (beech and western hemlock) and under LISS management they may out compete species that may be considered more desirable such as Scots pine. Given the extent and vigour of these more competitive species the most appropriate management regime is accepting their presence and managing them to advantage.

Scots pine is well suited to most of the site with limited areas of poor growth and form which reflects the past active silvicultural management. However natural regeneration of Scots pine across the site is generally poor.

Species	Area (ha)	%
Sitka Spruce	523.1	35.6
Scots Pine	428.1	29.1
Douglas Fir	119.1	8.1
Larch	97.3	6.6
Broadleaf	37.4	2.5
Norway Spruce	36.5	2.5
Conifer	29.2	2.0
Birch	18.9	1.3
Lodgepole Pine	15.4	1.0
Open	131.1	8.9
Felled	34.2	2.3



Scots Pine is well suited to the site and has good form.

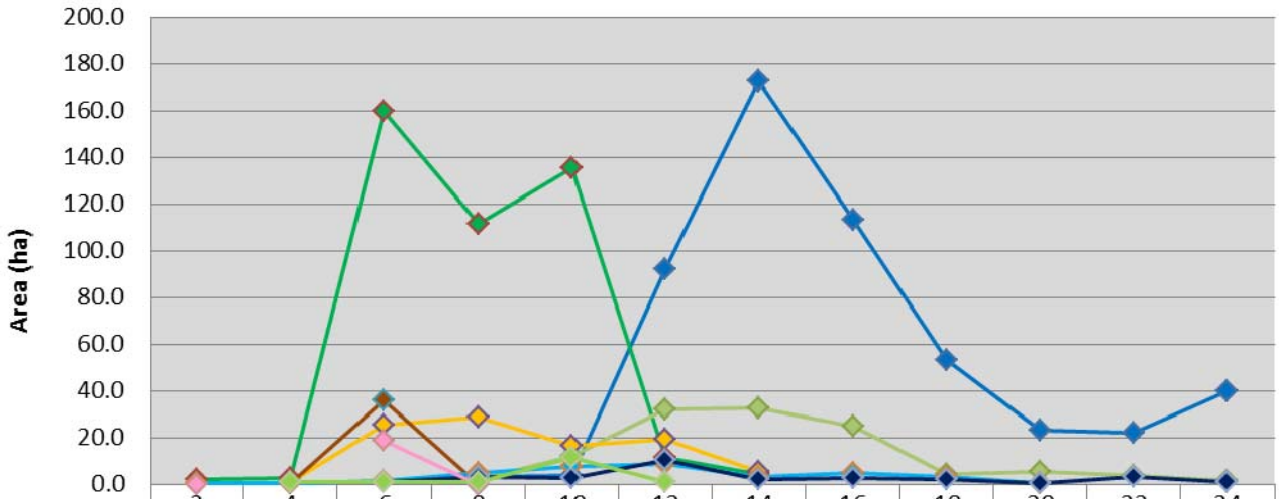
Serbian Spruce P1955

Beech stand with some good quality stems.

iii. Yield Class

SS yield classes range from 8 to 24, although there are areas of checked SS. SP has shown good growth with yield classes of 4 up to 14 in places.

Alternative conifers also show good growth rates with the following ranges.



	2	4	6	8	10	12	14	16	18	20	22	24
Sitka spruce				3.1	3.9	92.3	172.6	113.2	53.0	23.4	21.9	39.9
Scots pine	2.3	2.9	160.0	111.4	135.6	11.4	4.2					
Douglas fir				1.9	12.1	32.4	33.0	24.7	4.2	5.4	3.7	1.6
Larch		1.1	25.3	28.9	16.8	19.4	5.8					
Broadleave		0.3	36.2	0.1								
Norway spruce	0.4	0.5	1.8	5.1	7.8	8.9	3.0	5.2	3.3	0.4		
Conifer			1.2	3.4	2.8	10.5	1.9	2.5	2.3	0.5	3.3	0.8
Birch	0.2		18.6	0.1								
Lodgepole pine		0.8	1.1	0.8	11.5	1.1						

3.3.2 Access

Access throughout the forest is good, with a well constructed road network and good public road links.

There are two areas requiring additional road construction and track upgrade in order to facilitate future forest operations. A key area is along the public road at the south western end of the wood. This area has been largely unthinned due to

access issues. Active management in this area would improve the roadside landscape and increase transport infrastructure resilience.

The well drained soils that dominate most of the block and the active thinning management facilitate access within the stands.

The slope is a severe constraint in some sections of the scarp which is exacerbated by areas of rough boulder strewn ground that occurs on many of the steep areas. Displaced rock poses a risk during harvesting operations.

Steep boulder strewn slope with relatively slow grown pine.

3.3.3 LISS potential

LISS management systems are defined as: 'Silvicultural systems whereby the forest canopy is maintained at one or more levels without clear felling.'

LISS normally implies that no clearfell areas larger than 2 ha will be undertaken.

LISS has been implemented out over much of the forest area with an active thinning programme delivering multiple land use objectives.

The uniform shelterwood approach can meet environmental and landscape objectives while providing economically viable quantities of uniform timber that can be effectively marketed.

One of the critical success factors for LISS is the protection of seedlings from browsing and grazing pressure. Roe deer, hares and rabbits are all present on site, but the high level of public use and effective control to date has keep damage to low levels.

3.3.4 Current and potential markets

The current breakdown of the timber being harvested from this LMP area across the range of sites, species and ages is shown in the table below.

Material	End product	Percentage
Small roundwood	Chip board, Orientated strand board (OSB), Paper, fencing	45
	Firewood/woodfuel	5
Short log	Pallets & slats	5
Log	Construction	45

The vast majority (95%) of this production is sold into markets in the north east of Scotland, with very little travelling more than 50 miles to the processing facility.

3.4 Landscape and land use

3.4.1 Landscape character and value

To the south of the forest lies the Pluscarden Area of Great Landscape Value (AGLV) (Moray District Council 2003). Part of Torrieston Wood lies within the AGLV. The scarp slope forms a prominent backdrop to the AGLV and the setting of the Pluscarden Abbey Designed Landscape.

Scottish Natural Heritage, in partnership with local authorities and other agencies have carried out a National Programme of Landscape Character Assessment. This programme aims to improve knowledge and understanding of the contribution that landscape makes to the natural heritage of Scotland. It considers the likely pressures and opportunities for change in the landscape, assesses the sensitivity of the landscape to change and includes guidelines indicating how landscape character may be conserved, enhanced or restructured as appropriate.

These assessments are considered during all LMP reviews and where appropriate all efforts are made to follow the guidance given, where it matches with current FCS policy.

The design plan area is covered by Scottish Natural Heritage Landscape Character Assessment No101, Moray & Nairn, produced in 1998 by the Turnbull Jeffrey Partnership.

The Landscape Character Assessment (LCA) designates the forest as lying within the Rolling Farmland and Forests landscape character type. The LCA describes the landscape as a transitional landscape between the open fertile plains of Coastal farmland and the extensive open Uplands to the south. It is a complex landform of gently rounded hills and broad incised valleys which are often contained and divided by smooth stepped ridges.

Mixed woodlands and irregular grassland fields create a colourful and diverse landscape with woodland often forming the backdrop to the many traditional buildings which add to the landscape character.

Mature and diverse commercial conifer woodland is a key element of the landscape. Above Pluscarden the management of the scarp slope should replicate the diversity and intricacy of the adjacent landscape.

Scrub, heath and Birch woodlands are a characteristic of the area and play a role in the transition between the forest and the open farmland.

The scarp face viewed from the south.

The scarp face viewed from the south west.

3.4.2 Visibility

The main visual impacts are from the minor road networks directly to the south of the forest, where the scarp face has a high visual impact and creates a backdrop for Pluscarden Abbey.

The A96 which links Forres and Elgin lies to the north of the forest. From this perspective the gentle slopes of the plateau area reduce the landscape impact, however the sheer size of the forest establishes a landscape presence albeit lacking in fine detail.

3.4.3 Neighbouring land use

The surrounding land use is a mixed one with agriculture being the main industry. Commercial woodland in the vicinity is managed with similar objectives and in a similar style to Monaughty. Areas of smaller woods and disperse broadleaves across the lower ground are only lightly managed and provide cover for pheasant shooting enterprises. While the woodland provides shelter for adjacent grazing land, the options for agricultural integration are low.

Pluscarden Abbey is a Roman Catholic Benedictine monastery dating from medieval times. The forest provides a backdrop to the Pluscarden designed landscape and a recreational area for walking linked to the Abbey grounds.

View of Monaughty from the Abbey grounds.

3.5 Social factors

3.5.1 Recreation

The forest is heavily used for recreational activity with most of the users being regular visitors from Elgin, Forres and the surrounding area. Many of who know the wood and the paths intimately. In addition to waymarked routes there are a number of informal but well used routes through the forest used by both walkers and mountain bikers. The forest road and track network provides a range of access routes.

The car park, waymarked routes and recreational infrastructure are centred at Torrieston as this area offers a fine recreational facility for all abilities. The surrounding forest of well thinned SP and mixed broadleaves creates a forest environment that can accommodate a large number of people. The sandy soils and well-made paths facilitate access in all weathers. The Black Burn that runs through the forest with its two bridges adds a focus and point of interest for all users including families. The two bridges have very contrasting characters which adds to the experience on the circular walk.

Over the wider forest most of the users are walkers, runners and mountain bikers. There are good views across the Moray Firth from open ground created in the forest and from the forest roads that drop away to the north.

The terrain is very suitable for mountain biking and although there are no official routes a number of informal tracks have been created. Sled dog racing uses a number of forest roads through the forest.

3.5.2 Community

Community involvement in the forest is currently low. This may be because the forest is not adjacent to any village or town.

The recreational infrastructure is well established and local users appear happy with the provision and management of the woodlands so engagement is limited which may reflect satisfaction rather than indifference.

3.5.3 Heritage

There are several non-scheduled archaeological sites within the plan area. A check of both internal records and the SMR has been undertaken to establish the location of these features. The details of which will be included in the work plan that is drawn up for every operation carried out within the plan area

Most of the features relate to previous agricultural activity on the forest margins and Bronze Age and Iron Age features within the forest. This suggests a long history of forest cover on site. Open ground around many of these features has been developed and their setting enhanced.

Pluscarden Abbey is linked to the forest in terms of landscape and cultural setting. The beech element and specimen trees in the landscape link the Abbey with the scarp edge of the forest.

3.6 Pathogens and diseases

The upsurge in the disease threat over the last decade has a range of causes linked to globalisation and associated with climate change. Disease risk management has always been an integral part of forestry management; however the pace of recent events has created a great deal of uncertainty. While specific outcomes for species are hard to predict, the general principles for creating resilient forests are well known, and these include such actions as promoting diversity in all its forms.

3.6.1 Dothistroma needle blight

Dothistroma needle blight is a fungal pathogen affecting the woods within Moray & Aberdeenshire forest district and is present within Monaughty.

Dothistroma needle blight is an economically important disease affecting a number of coniferous trees, pines in particular. The disease has a world-wide distribution but until recently was mainly of concern in the southern hemisphere. In much of the world, including Britain, it is caused by the fungus *Dothistroma septosporum*. Dothistroma needle blight causes premature needle defoliation, which results in the loss of timber yield and, in severe cases, tree mortality. Since the late 1990s the incidence of the disease has increased dramatically in Britain, particularly on Corsican pine. More recently the disease has caused significant damage and death to Lodgepole pine and Scots pine.

Due to the extent and severity of the disease there is a moratorium on the planting of Corsican Pine on the national forest estate.

The reasons for the increase in the incidence of this disease are unclear but could be due to increased rainfall in spring and summer, coupled with a trend towards warmer springs, optimising conditions for spore dispersal and infection. Such conditions may become more prevalent in Britain over the next 20 years if current trends in climate change continue. On the national forest estate disease management is currently focused on silvicultural measures to reduce inoculum loads and the use of alternative, less susceptible species in future rotations.

A thinning regime is in place to remove lodgepole pine when it is in mixture in order to help control the spread of the disease. We will keep up to date with the latest research and implement the guidelines produced.

3.6.2 Heterobasidion annosum

Heterobasidion annosum is a fungus that can infect most of the conifer tree species regularly planted. It spreads by spores that readily colonize freshly cut stump surfaces, enabling it to spread over long distances between forests and to build up rapidly within forests. It lives by decaying infected wood. The highest levels of disease are usually found on sites with a woodland history extending for two or more rotations, which is the case for Monaughty.

H. annosum causes root and butt rot in most commercial conifers and on site types that favour the disease trees of most species may be killed. Losses from butt rot in second or third rotation spruce may reach 30% of volume, with 70-80% of trees affected. This concurs with observations made during past harvesting operations in the block.

This will be a major factor in the choice of restocking species. Broadleaves together with firs and pines show some resistance to butt rot and will be considered for planting where butt rot is present. Many butt rot sites show high fertility and can grow good broadleaves.

3.6.3 Hymenoscyphus fraxineus

Ash dieback is an aggressive fungal disease caused by

Hymenoscyphus fraxineus (previously *Chalara fraxinea*). The disease causes leaf loss and crown dieback in affected trees, and usually leads to tree death. Despite the fact that the nearest known outbreak of ash dieback is over 10km from the Deeside woods there will be no planting of ash trees as there is currently a moratorium on the planting of ash within FC woodlands to try and help slow the spread of the disease.

3.6.4 Phytophthora ramorum

Phytophthora ramorum is a fungus-like plant pathogen which attacks a wide range of tree and shrub species. European and hybrid larch are particularly susceptible to P. ramorum but current evidence indicates that the impact of the disease is greatest on Japanese larch, which can die within one to two seasons, with consequential economic, environmental and amenity impacts. Therefore there is currently a moratorium on the planting of larch within FC woodlands to try and help slow the spread of the disease.

3.7 Statutory requirements and key external policies

This LMP has been drafted to ensure that planning and operations functions will comply with the following legislation and policies:

Biodiversity

- Conservation (Natural Habitats) Amendment (Scotland) Regulations 2007
- Nature Conservation (Scotland) Act 2004
- Wildlife and Natural Environment (Scotland) Act 2011
- Land Reform (Scotland) Act 2003
- The Water Environment and Water Services (Scotland) Act 2003
- Water Environment (Controlled Activities)(Scotland) Regulations 2011
- UK Woodland Assurance Standard 2008
- UK Forestry Standard 2012
- Open habitats Strategy 2013
- Action for Juniper 2007
- Joint Agency Statement on Deer Fencing 2010

Climate Change

- The United Nations Framework Convention on Climate Change
- The Kyoto Protocol
- EC Directive 2003/87/EC
- Climate Change (Scotland) Act 2009

Historic Environment

- Ancient Monuments and Archaeological Areas Act 1979
- Planning (Listed Buildings and Conservation Areas)(Scotland) Act 1997
- Treasure Trove Scotland
- UNESCO World Heritage Convention
- European Convention on the Protection of the Archaeological Heritage Valetta 1992
- Managing Change in the Historic Environment: Battlefields 2011

Forests & People

- Control of Substances Hazardous to Health Regulations 2002
- Employers Liability (Compulsory Insurance) Act 1969
- Equality Act 2010
- Gangmasters (Licensing) Act 2004
- Health and Safety at Work Act 1974
- Management of Health and Safety at Work Regulations 1999
- Occupiers' Liability (Scotland) Act 1960
- Provision and Use of Work Equipment Regulations 1998
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- The Highways Act 1980

Soils

- Control of Pesticides Regulations 1986
- The Waste Management Licensing Regulations 1994
- European Soil Charter

4.0 Analysis and Concept

Refer to Maps 4: Analysis and concept.

Issue	Analysis	Concept
Adapting to climate change	Most of the forest area is underlain with soils that have poor or very poor nutrient status.	The poor soils limit the range of species that can be successfully grown so where there are areas of better soils use these to diversify the range of species planted.
Timber supply	The steep ground along the southern boundary of the block makes harvesting operations difficult, dangerous and expensive.	LISS is not the most suitable management regime for this area. Clearfelling and restocking of appropriately sized coupes taking into account the landform and the adjacent area of great landscape value is more appropriate.
Timber quality	The presence of tree diseases such as DNB and butt rot needs to be addressed to improve the resilience of the forest.	Where site conditions allow restock with a wider range of species to diversify the species composition of the block.
Recreation	The car park and associated recreation routes at Torrieston are located on some of the flatter ground within the forest area.	Maintain the recreation provision to retain the all abilities trails to a high standard.
Designated sites	The neighbouring SSSI at Lethenhill is designated to protect the fen meadow on drainage impeded soils.	Ensure forest operations adjacent to the SSSI do not compromise the status of the site and help improve it if possible.
Species & habitats	There are limited areas of open ground within the block. Most of what is present is associated with the forest road network.	New areas of open ground to be created to achieve the UKFS guideline figure of 10%. These areas will be selected to achieve multiple benefits including improving the limited riparian areas, landscaping and deer control.

5.0 Land Management Plan Proposals

5.1 Management

Refer to Map 5: Management.

Thinning

Wherever possible the district will continue to maximise the area managed through thinning. FCS policy assumes that all productive conifer crops will be thinned. The only exceptions are where:

- Thinning is likely to significantly increase the risk of windblow;
- A single thinning operation is likely to require an unacceptably large initial investment in relation to the potential benefits due to access or market considerations; and
- Thinning is unlikely to improve poorly stocked or poor quality crops.

An active thinning programme is essential for LISS.

Where Lodgepole Pine occurs in mixtures with other crops it will be targeted for removal during thinning operations. Early thinning of Scots Pine areas will also be a priority subject to budgetary constraints to reduce the potential impact of DNB.

All thinning decisions will be guided by Operational guidance Booklet No 9 ‘Managing thinning.’

Low impact silvicultural system (LISS)

‘Low impact’ is defined as the use of silvicultural systems whereby the forest canopy is maintained at one or more levels without clearfelling. Clearfelling is defined as the cutting-down of all trees on an area of more than 2.0ha.

The attraction of low impact forestry lies in the fact that this approach is suited to an era of multi-purpose forestry where environmental, recreational, aesthetic and other objectives are as important as timber production. In particular, low impact forestry is seen as a means of reducing the impact of clearfelling and the associated changes that this produces in forest landscapes and habitats.

Prescriptions for each area managed under LISS are shown in appendix 3. Each prescription will be included in the site management plan before any operation commences.

Restocking by natural regeneration will be the aim in these areas. However where this does not occur successfully enough to create a fully stocked crop (stocking density required dependent on site objectives) enrichment planting will be undertaken with appropriate species. In the SP areas it is anticipated that replanting will be essential due to ground flora conditions constraining regeneration.

Enrichment planting may also be used to increase species diversity, target key recreational/visual areas, or to ensure the rapid establishment of ground cover.

Selective respacing will also be an essential tool to ensure wider species diversity, crop health and stem quality, and to retain areas of less competitive crops such as SP.

Clearfell

The main silvicultural system employed in British forestry is ‘patch’ clear-felling followed by planting or occasionally natural regeneration.

Although clear-felling can appear to have a negative impact on landscape and habitat it is still an important management system.

Clear-felling, to a degree, mimics natural disturbances such as fire or windblow in a forest and as such allows the forester to alter the even aged structure of the canopy over a relatively short period of time. The adoption of a ‘fallow’ period before restocking, (replanting), also creates transient open habitat that is exploited by several species such as voles, deer and raptors.

The main areas proposed for clearfelling will be the steep scarp slope and the SS & LP areas in the north of the block. The felling of LP areas will be prioritised in order to increase the DNB resilience of the core SP areas. The restocking of these clearfells will be with a range of site appropriate species, both conifer and broadleaved, with the aim of creating woodlands with diverse species and structures. This should ensure that they are more

robust to face the future and the potential issues caused by future climate change and pathogens.

5.2 Future Habitats and Species

Refer to Map 6: Future habitats and management.

Restocking & Regeneration

The choice of species for restocking has been guided by the ESC results for this climatic zone and soil types. The primary areas for large scale restocking activity are the clearfells associated with the removal of LP stands. To achieve the best results ESC needs to be used as a guide in conjunction with local site specific knowledge and experience. The base data used in the ESC process can be fairly broad brush and can overlook the opportunities and pitfalls presented by small scale site characteristics and microclimate. Site specific planting plans following a restock site survey will guide the final species choice.

The wide range of species already grown on Monaughty will in itself act as a guide to future restocking. Species that have grown well on site in terms of growth rate & quality include: broadleaved species, Scots Pine, Douglas Fir, Grand Fir, Larch species, Western Hemlock, Western Red Cedar, Serbian Spruce and Norway Spruce. Sitka spruce has shown generally good growth, but there are pockets of partially checked crop where alterative species may be appropriate.

Typically LISS seeks to perpetuate tree cover by natural regeneration which is aided and manipulated by managing the seed sources available and light levels on the forest floor. However enrichment planting can also play a key role in LISS. In the case of Monaughty this specifically relates to ensuring SP is represented in successor crops and reducing the dominance of SS.

In LISS there is an element of having to make do with what the site delivers in terms of regeneration and using adaptive management to achieve the desired outcomes. In the short term a wide range of regenerating species should be accepted in all areas including broadleaves, NS, larch & SP.

Enrichment planting will be actively considered to increase species diversity and to increase the density of the ground cover as required to create a more uniform crop that facilitates management and marketing. In particular areas

targeted for SP regeneration may require planting, although this approach will be monitored periodically as each site is different.

In common with the majority of the national forest estate, most restocking in the design plan area has traditionally taken place within two years of sites being clearfelled. However this has left them vulnerable to *Hylobius* attack. The current management system utilises restocking after 4 years to reduce *Hylobius* damage, and thus reduce chemical usage, unless there is a compelling reason and a positive result from *Hylobius* billet monitoring traps which indicate low populations of this pest. See section 5.9 Pathogens for details of how this threat will be dealt with.

All areas identified for restocking by natural regeneration have been recorded and programmed for inspection on a five yearly basis. At each inspection an assessment will be made to establish if the natural regeneration is or is likely to achieve the objectives for the site. If it is decided that the objectives are not being met then replanting with an appropriate species will be undertaken. If natural regeneration is occurring but not yet at the required density then the option to review the site in a further five years may be taken. If after two such inspections, that is ten years following felling, it is felt appropriate to wait a further period for natural regeneration then a discussion and agreement will be reached with the Conservancy woodland officer.

Non Commercial Areas

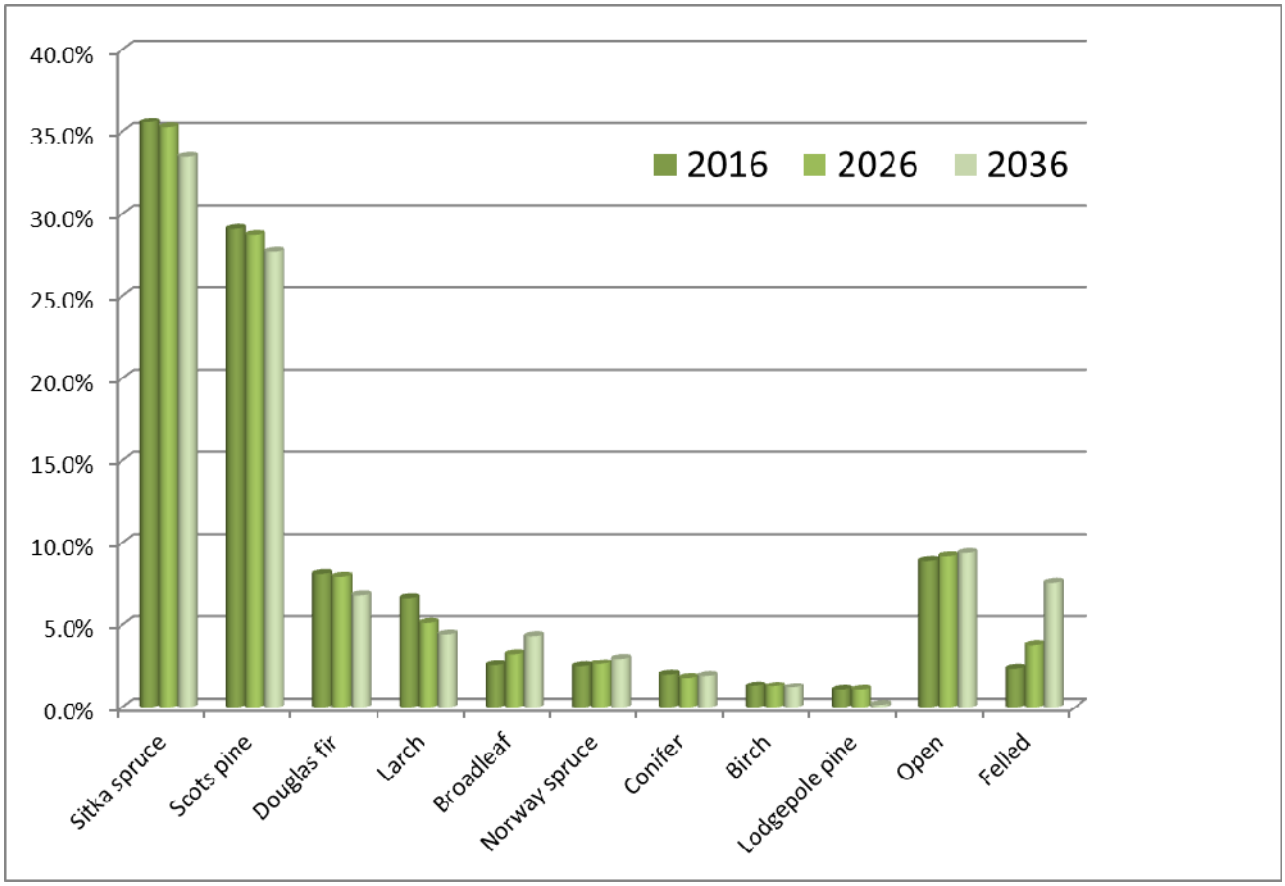
Areas not considered appropriate for commercial management will include permanent woodland reserves and open habitats, which will require monitoring to ensure they deliver the required objectives. Non-desirable species, such as non-native conifer regeneration, may require removal. In Monaughty there is a tendency for open ground to infill with a range of tree and shrub species due in part to effective deer management, good drainage and a rich seed bank from a long history of forest cover.

Additional open ground is needed to meet the 10% requirement under UKFS. The current ten year plan will not fully meet the target but it will increase the area of open ground and move the block towards the 10% target. Additional open ground will be targeted to riparian zones, a network of organically shaped road and ride sides to create windfirm felling boundaries for coupes at the next rotation and within the LISS coupes as the conversion phase is reached. These areas will be implemented when it is economic to undertake the felling, therefore the timescale for reaching the 10% target is beyond the

scope of this plan. However a map and table showing the longer term plan of how the target figure will be met is included at appendix 5.

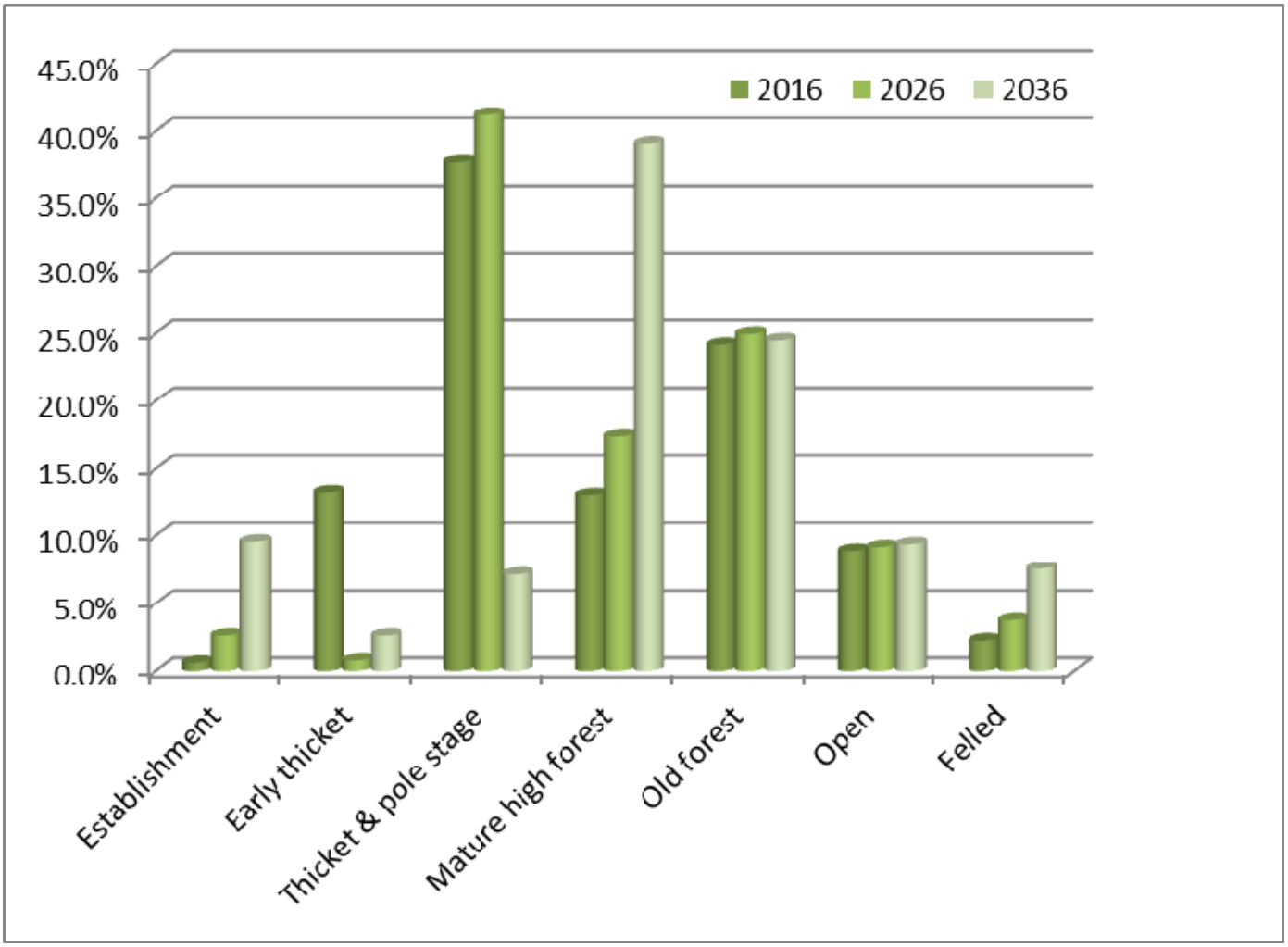
5.3 Species table

Species	Current distribution 2016	Projected distribution 2026	Projected distribution 2036
Sitka spruce	35.6%	35.3%	33.5%
Scots pine	29.1%	28.8%	27.7%
Douglas fir	8.1%	7.9%	6.8%
Larch	6.6%	5.1%	4.5%
Broadleaf	2.5%	3.2%	4.4%
Norway spruce	2.5%	2.6%	3.0%
Conifer	2.0%	1.8%	1.9%
Birch	1.3%	1.3%	1.2%
Lodgepole pine	1.0%	1.0%	0.2%
Open	8.9%	9.2%	9.4%
Felled	2.3%	3.8%	7.6%



5.4 Age structure

Age of Trees (years)	Successional Stage	Current distribution 2016	Projected distribution 2026	Projected distribution 2036
0 -10	Establishment	0.6%	2.7%	9.6%
11 – 20	Early Thicket	13.2%	0.8%	2.7%
21 – 40	Thicket & Pole Stage	37.7%	41.2%	7.2%
41 – 60	Mature High Forest	13%	17.4%	39.1%
61+	Old Forest	24.2%	25.0%	24.5%
	Open space	8.9%	9.2%	9.4%
	Felled	2.3%	3.8%	7.6%



5.5 Deer management

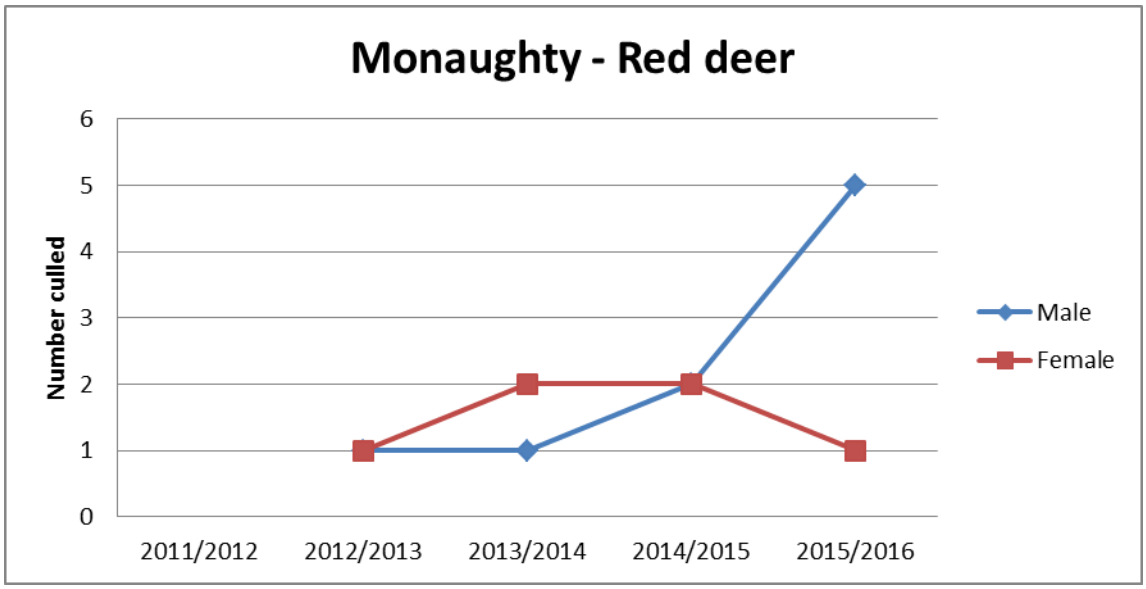
All deer management will be carried out in accordance with OGB 5 - Deer management.

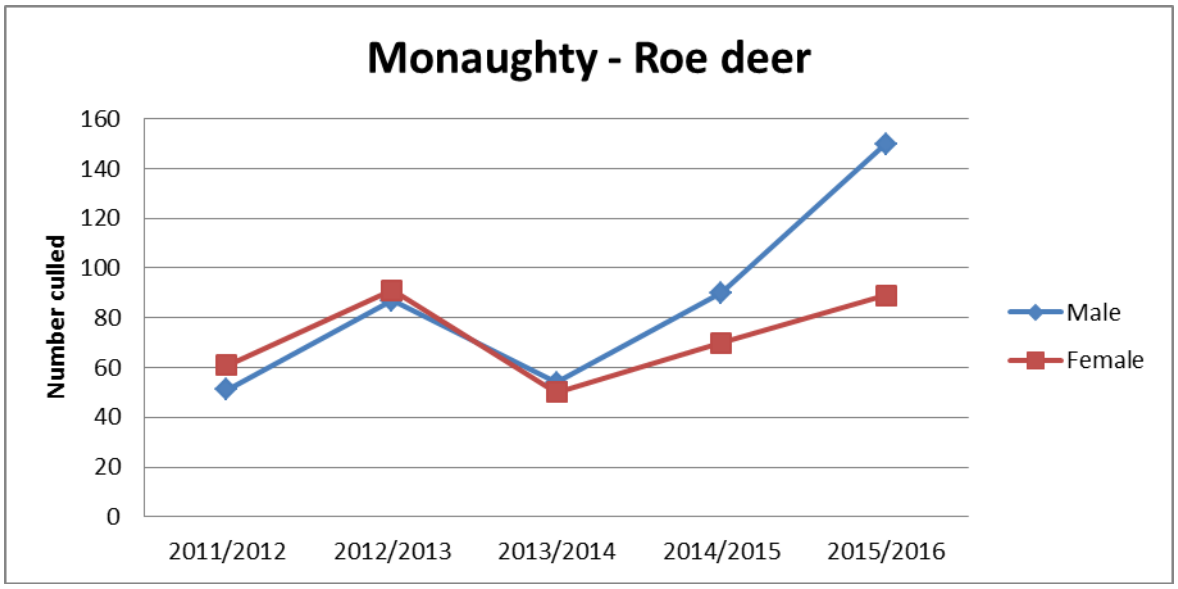
Our aim is to manage deer density safely and humanely at a level which is consistent with acceptable impacts on forests and other habitats. This is likely to be at a deer density level of 5 to 7 deer per 100 hectares.

Deer cull plans are prepared for each Deer Management Unit and are the responsibility of the Wildlife Ranger Manager. Monaughty forms part of a larger deer management unit which includes Wangie & Newtyle Forests.

Since 2014 the cull of roe deer has been increasing due to a change in the deer control practices within the block. A contractor has taken over the deer control which has allowed more time to be spent on deer control. This in part also accounts for the increase in the red deer cull. However the large increase in male red deer is indicative that more deer are moving into the area and the overall population is likely to rise in the future. Contract deer culling will continue to be used in the foreseeable future and all efforts will be made to try to ensure that the likely increase in red deer population does not have a negative impact on the forest block, particularly the establishment of natural regeneration which is essential to the success of the LISS planned for the block.

We will work collaboratively with neighbours where their deer management objectives are consistent with those on the national forest estate. We will join deer management groups where these exist.


Monaughty - Red deer
Number culled
6
5
4
3
2
1
0
2011/2012
2012/2013
2013/2014
2014/2015
2015/2016
Male
Female


Monaughty - Roe deer
Number culled
160
140
120
100
80
60
40
20
0
2011/2012
2012/2013
2013/2014
2014/2015
2015/2016
Male
Female

5.6 Access

No new forest roads are required in the period of this plan. However several forwarder tracks will need some maintenance and/or upgrade to allow all areas planned for thinning and felling in this plan to be completed.

5.7 Pathogens

Hylobius can cause extensive feeding damage to young trees used to restock clearfell sites but damage is often highly variable. Previously it has not been possible to predict damage and so insecticides have been routinely used to protect the trees to try to safeguard this valuable young crop. However, on clearfells where *Hylobius* numbers are low this treatment may be unnecessary and conversely when numbers are very high the treatment may be unable to protect the trees. Both of these situations result in the loss of valuable resources.

The *Hylobius* Management Support System (MSS) is based on a simple monitoring protocol using billet traps to measure *Hylobius* numbers on a sample of clearfell sites. The numbers recorded are entered into the *Hylobius* MSS software, to determine the best way to manage clearfell sites for successful, cost effective and environmentally friendly restocking. This Support System will be used on a sample of all restock sites.

In 2008 FES introduced a four-year fallow period for clearfell sites. This allows the *Hylobius* population to peak and then drop to acceptable levels before restocking is carried out. Fallowing has been shown in studies to be the most effective method of establishing trees without intensive chemical input. Restocking may take place before the full four year fallow period if monitoring using the *Hylobius* MSS shows that it is safe to do so. Please refer to the district fallow policy for details.

The impact of DNB has been considered previously.

Ash would be an ideal species for Monaughty but current levels are low and restocking is not currently permitted due to Ash dieback. No cases of Ash dieback have been recorded within 10km of the block currently but there is a moratorium on planting ash on the national forest estate.

Phytophthora ramorum is not currently recorded within the vicinity of the forest, however the disease has expanded recently and a precautionary approach is being adapted with Larch plantings currently on hold. Larch is a

species well suited to the forest, so this is a situation that will be kept under review.

5.8 Critical Success Factors

- Manage the LISS area by continuing with an active thinning programme.
- Expand species and structural diversity to increase forest resilience, while retaining SS as a major crop element.
- Improve the quality of existing riparian buffer zones by NBL establishment, and continue restructuring to create open ground/NBL matrix where watercourses are affected by dense conifer stands.
- Maintain the current recreational infrastructure in Torrieston.
- Follow the guidelines in relation to DNB with heavy thinning and LP removal being priority actions.
- React positively to any disease impacts; seek to use any dramatic change in forest structure to deliver un-anticipated benefits. For example open transient views and greater species/structural diversity.
- Continue the current deer management regime.

Appendix 1 – Consultation record

Consultee	Date contacted	Date response received	Issue raised	Forest District Response
Moray Council – Ian Douglas. Access Manager	28/09/15 By email.	26/09/2015 & 02/11/2015	The forest is very popular with a range of recreational users. Popularity could be increased by expanding recreational effort/expenditure across the wider forest area. Potential to link with the new tourist developments at Pluscarden abbey. The site is ideal for mountain biking and dedicated tracks to separate walkers and mountain bikers would be desirable. Potential to link the Moray forest network with a cycle route. Parking and signposting are important.	The MC response raises a number of issues that are commendable and in line with FC policy. Budgetary constraints mean many of the suggestions are not currently feasible due to the ever tightening budget. While many of the suggestions will remain aspirations the approach will be to focus on retaining the quality all abilities recreational infrastructure in Torrieston, while focussing the recreational infrastructure provision within the main forest block to one main route that takes in the prime forest areas.

			Visibility for timber lorries exiting onto the public road is important. NBL species may enhance the recreational value of the forest.	Many of the more active recreational users of the main forest block require little support in terms of infrastructure in order to be able to enjoy the forest. The targeting of the limited recreational resource has been based on trail counts, in order to provide the greatest benefits to the highest number of users. Sight lines on access points to the public road network will be managed, and NBL will be expanded in line with the UKFS.

Scottish Natural Heritage – Shirley Reid	28/09/15 By email.	21/10/15 By email.	Management of riparian corridors, open ground, broadleaves and specimen trees will enhance the natural heritage interests of the forest. Management of the buffer area around the SSSI (which is out with the forest) is important as although the site is currently categorised as “favourable, maintained” the site is informally considered to be on the threshold, with condition possibly deteriorating due to excessive gorse and tree regeneration. Caper habitat management was welcomed as would be removal of redundant fencing. Pine marten utilise the forest, and fruit bearing trees such as cherry and rowan can enhance the habitat for this species and others.	The management of these key elements will be an important objective within the plan. Management of the buffer area to enhance the SSSI will be in consultation with SNH. Simple removal of tree cover adjacent to the SSSI may be counterproductive. Consideration will be given to fence removal subject to budgetary constraints. The lengths of deer fence in the forest are fairly limited. A proportion of fruit bearing trees are expected to naturally regenerate where these are appropriate to the site.

			The main area used by families and dog walkers is Torrieston, while the main forest area is used for more active recreation including, mountain biking, horse riding and dog sleds. Some of the paths have become unpassable with gorse encroachment. Motorbike scrambling occurs on the site.	Active recreation often requires less infrastructure and signposting than more family oriented recreational areas. The main forest block, with its extensive road network is well suited to this style of recreational activity. Natural constraints to access in some areas may enhance the site for caper, by reducing disturbance. Illegal access by motor vehicles is actively discouraged and is a problem for management operations and other forest users. Some of the organised motor bike scrambling is with permission.
Scottish Environment Protection Agency – Planning service	28/09/15 By email.	22/10/15 By email	Maintain or improve the status of water bodies within the Forest. Show any proposals relating to water/peat on a 2,500 scale map or more detailed scale.	All operations will be undertaken in accordance with the UKFS “Forests and Water” guidelines. Appropriate CAR authorisations will be sought as appropriate. Provision of map information on wider forest operations at a 2,500 scale is not practicable.

			Identify and manage INNS. Comply with the Water Environment Controlled Activities (Scotland) Regulations as amended. Flooding issues downstream needs to be considered when planning works, such as culvert design, management of woody debris and so on. Significant areas of tree cover in catchments, can play a positive role in flood management. The Black Burn to the SE of the site is at moderate status due to distillery abstraction rather than any forestry impacts, but forestry operations need to be carefully managed to avoid becoming part of the problem rather than part of the solution.	No INNS are identified on site. Forest cover can play a very positive role in flood management. Operations will consider the impact on flood risk.

Royal Society for the Protection of Birds – Gareth Marshall	28/09/15 By email.	26/10/15 By email.	Increasing forest diversity & ongoing LISS management are welcome as the area has historically supported a meta population of capercailzie. Areas of current SP LISS with a heather and blueberry understorey were considered good environments for caper, but SS regeneration was considered to be a potential threat to these areas being optimal caper habitat. Drain blocking was considered desirable for caper to increase habitat diversity. If caper do return to the forest, then avoiding disturbance of leks by timing of forest operations was considered desirable.	Current management has created a diverse forest with many features already identified as being suitable for caper. Areas of SP and LISS areas create diversity, and clearfells can lead to flushes of heather & blaeberry in amongst the young crop, all ideal caper habitat. Control of SS regeneration is expensive and requires an ongoing financial commitment which might not be feasible given current budget constraints. A more effective way of promoting SP regen and offering scope for targeted control of SS for a defined duration may be to undertake LISS group shelterwood rather than uniform shelterwood.

				The increased light levels on targeted areas of the forest floor associated with this approach may increase the competitive advantage of SP verses SS and would create a targeted and limited area for SS control while the SP crop became established in these glades. Many of the restructuring proposals under the UKFS will favour caper. Drain blocking has limited application on site due to the underlying geology, but specific sites will be considered during detailed establishment site planning. Monitoring of populations will inform any actions on harvesting timing, but in the absence of a resident population this will depend on voluntary and informal observation due to budget constraints.

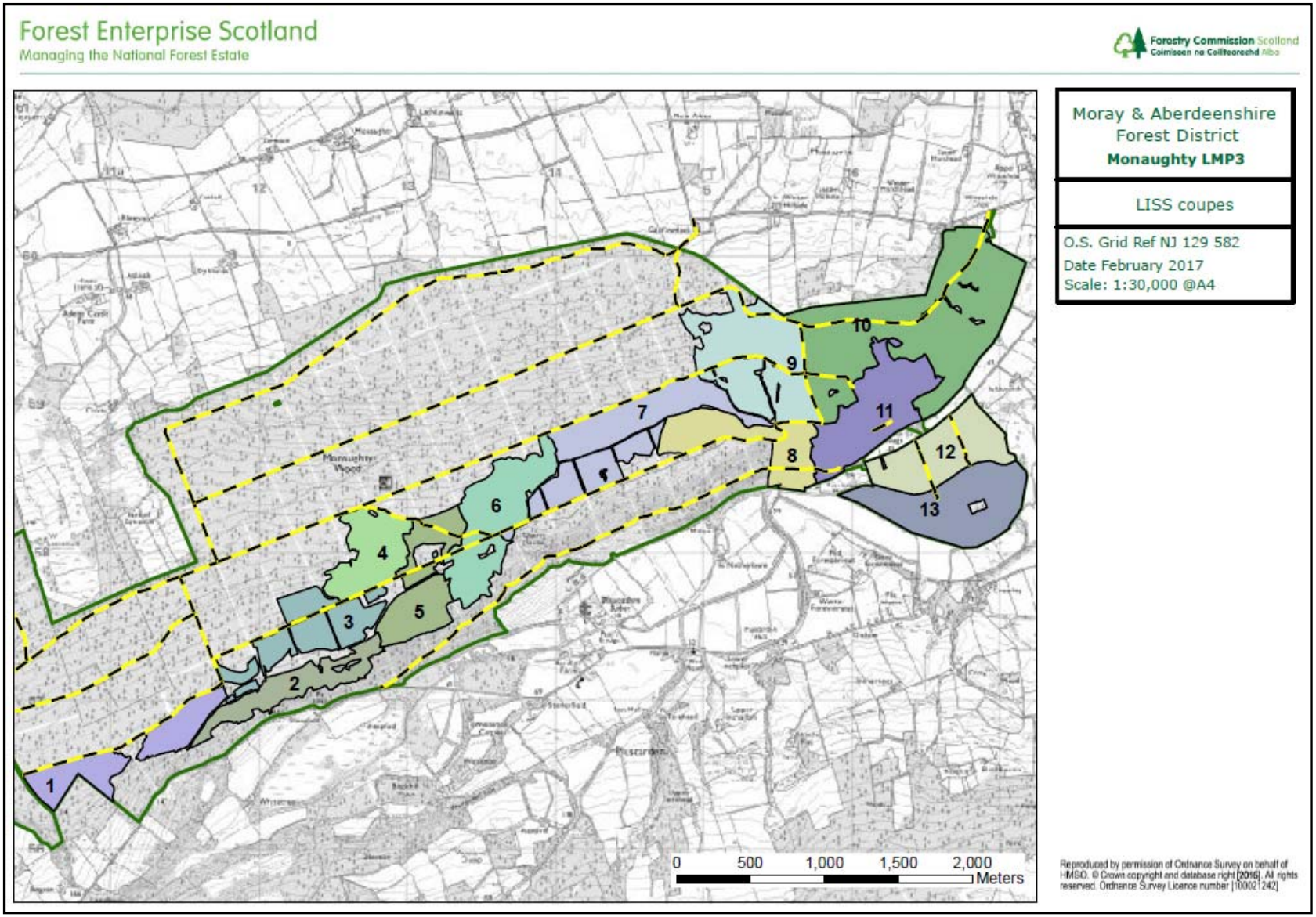
				Because of the extensive road network and open nature of much of the forest, disturbance is likely to be a major limiting factor for caper in the forest. Thick SS/SP regen, which often occurs along the road margins offers scope for screening the core woodland areas, and may provide an enhanced habitat for caper breeding and feeding. Where public access is constrained by ground cover or reduced path infrastructure, then this may benefit caper.
Heldon CC	28/09/15 By email.	No response		
Burgie Estate	28/09/15 By email.	No response		
Pluscarden Abbey	28/09/15 By email.	No response		
Public meeting, Pluscarden village hall	23/11/16	Approx 20 attendees.	A presentation of the draft plan followed by general discussion.	No significant issues raised that need to be addressed.

Appendix 2 – Tolerance table

	Adjustment to Felling period	Adjustment to felling coupe boundaries	Timing of restocking	Change to species	Changes to roadlines	Designed open space	Windblow Clearance
FC Approval not normally required	Fell date can be moved within 5 year period and between phase 1 and phase 2 felling periods where separation or other constraints are met	Up to 10 % of coupe area	Normally up to 2 planting seasons after felling. Where hylobius levels are high up to four planting seasons after felling subject to the wider forest and habitat structure not being significantly compromised.	Change within species group e.g. conifers, broadleaves.		Increase by up to 5% of coupe area	
Approval by exchange of letters and map		Up to 15 % of coupe area	Between 2 and 5 planting seasons after felling subject to the wider forest and habitat structure not being significantly compromised.		Additional felling of trees not agreed in plan Departures of more than 60m in either direction from centre line of road.	Increase by up to 10%. Any reduction in open ground within coupe area.	Up to 5 ha
Approval by formal plan amendment may be required	Advanced felling (phase 3 or beyond) into current or 2nd 5 year period	More than 15% of coupe area	More than 5 planting seasons after felling subject to the wider forest and habitat structure not being significantly compromised.	Change from specified native species. Change between species group.	As above depending on sensitivity.	More than 10% of coupe area. Colonisation of open areas agreed as critical.	More than 5 ha

Appendix 3 – LISS prescriptions

- The size and number of groups in the group selection is indicative only. The actual size will depend on the conditions found in each coupe.
- The shape of the groups in the group selection coupes do not have to be circular. Oval shaped with the long axis orientated to receive the most light is preferred.
- The location of the felling areas in the group selection coupes will be located to reflect the conditions in each coupe. Felling areas will be located to:
    - expand existing groups,
    - start new groups taking advantage of existing natural regeneration,
    - start new groups in areas where there is currently no natural regeneration.
- The preferred restocking method is by natural regeneration. However if restocking by natural regeneration is not successful within 10years of felling then the option of replanting will be discussed with FCS.


Forest Enterprise Scotland
Managing the National Forest Estate
Forestry Commission Scotland
Coimisean na Coilltearachd Alba
Moray & Aberdeenshire
Forest District
Monaughty LMP3
LISS coupes
O.S. Grid Ref NJ 129 582
Date February 2017
Scale: 1:30,000 @A4
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0 500 1,000 1,500 2,000
Meters
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LISS no. (See map above)		Management objective/Reason for selection	Long-term structure* and desirable species	Age Trans. period and return time (years)	Regeneration and ground flora	Observations (e.g. likely barriers to achieving objective)	Next treatment required**	Proposed monitoring	Other useful information
1	Group selection 26ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 35% DF, 30% SP 20% Larch 15% MB	Age:Mostly 20–40yrs Trans:120yrs Return:7yrs	Some SS regeneration under mature SP. In the other parts no regeneration due to age of crop. Mostly heather.	Light levels to low.	Crown thin. Plus fell 1ha of groups in mature SP. (2 x 0.5ha)	Crop validation prior to next thinning.	
2	Group selection 29ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 90% SP 10% MC	Age:Mostly 20–40yrs Trans:150yrs Return:7yrs	Young crops so no regeneration. Heather where present.	Crop to young.	Selective thinning when stand reaches 12m top height.	Crop validation prior to next thinning.	
3	Group selection 23ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 50% SP 30% NS 20% MC	Age:60+yrs Trans:120yrs Return:7yrs	Some SS and WH below mature SP. Heather and moss.	Crop validation prior to next thinning.	Crown thin. Plus fell 5ha of groups in mature SP/EL/NS. (10 x 0.5ha)	Crop validation prior to next thinning.	

4	Group selection 27ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 90% SP 10% MC	Age:Mostly 10–40yrs Trans:150yrs Return:7yrs	Young crops so no regeneration. Heather where present.	Crop to young.	Selective thinning when stand reaches 12m top height.	Crop validation prior to next thinning.	
5	Group selection 37ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 80% SP 10% Larch 10% MC	Age:60+yrs Trans:150yrs Return:7yrs	Very little regeneration. Heather and blaeberry.	Light levels to low.	Crown thin. Plus fell 4ha of groups in mature SP/EL. (8 x 0.5ha)	Crop validation prior to next thinning.	
6	Group selection 48ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 55% SP 25% Larch 20% MC	Age:Mostly 20–40yrs Trans:150yrs Return:7yrs	Young crops so no regeneration. Heather where present.	Crop to young.	Selective thinning when stand reaches 12m top height.	Crop validation prior to next thinning.	
7	Group selection 27ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 60% SP 25% Larch 15% MC	Age:60+yrs Trans:150ys Reteurn:7yrs	Very little regeneration. Heather	Light levels to low.	Crown thin. Plus fell 3ha of groups in mature SP/EL. (6 x 0.5ha)	Crop validation prior to next thinning.	
8	Group selection 49ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 30% SS 20% SP 20% DF 30% MB	Age:Mostly 20–60yrs Trans:100yrs Return:7yrs	Young crops so no regeneration. Heather where present.	Crop to young.	Selective thinning when stand reaches 12m top height.	Crop validation prior to next thinning.	

9	Group selection 95ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and landscape reasons.	Complex 30% DF 20% SS 40% MC 10% MB	Age:Mostly 20–60yrs Trans:100yrs Return:7yrs	Some SS regeneration under mature SP. In the other parts no regeneration due to age of crop. Mostly heather.	Light levels to low.	Crown thin. Plus fell 5ha of groups in mature crops. (10 x 0.5ha)	Crop validation prior to next thinning.	
10	Group selection 38ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity, recreation and landscape reasons.	Complex 60% SP 30% MC 10% MB	Age:60+ yrs Trans:150yrs Return:7yrs	Very little regeneration. Heather	Light levels to low.	Crown thin. Plus fell 4ha of groups in mature crops. (8 x 0.5ha)	Crop validation prior to next thinning.	
11	Group selection 32ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and recreation reasons.	Complex 80% SP 15% MB 5% MC	Age:20–40 & 60+yrs Trans:150yrs Return:10yrs	Some beech regeneration under mature SP. In the other parts no regeneration due to age of crop. Mostly heather.	Light levels to low.	Crown thin. Plus fell 3ha of groups in mature SP. (6 x 0.5ha)	Crop validation prior to next thinning.	
12	Group selection 40ha	Produce a quality timber crop while also creating a diverse forest structure for biodiversity and recreation reasons.	Complex 80% SP 10% MB 10% MC	Age:20–40 & 60+yrs Trans:150yrs Return:10yrs	Some SS regeneration under mature SP. In the other parts no regeneration due to age of crop. Mostly heather.	Light levels to low.	Crown thin. Plus fell 5ha of groups in mature SP. (10 x 0.5ha)	Crop validation prior to next thinning.	

Appendix 4 – LISS management

LISS is an approach to forest management in which the forest canopy is maintained at one or more levels without clearfelling.

The word 'approach' is important because:
• we are not following a system;
• there are no standard prescriptions; and
• flexibility is important – to take advantage of opportunities as they arise.

Any preconceived ideas about systems of managing forests can act as a 'straight jacket' to thinking about CCF.

Stands that have been regularly thinned are more likely to be successful with CCF. Crown thinning will be undertaken when transforming stands to CCF rather than low or intermediate types, as used in plantations. The basis of crown thinning is to remove competition from around selected trees (Frame trees), even if the trees to be removed are as big. Using crown thinning usually increases the average tree size, so there is potential for more income.

There are two main types of structure:
• Simple – in which there will be one or two canopy layers of trees
• Complex – where there are three or more canopy layers of trees

1. Transformation of a young (<40 yrs) stand to a simple structure

The objective is to achieve reasonably even regeneration of the desired species and then remove the canopy in a number of thinnings.

Early crown thinning will be heavier (10-20%) than management table intensity and aim to develop 100 equally distributed 'frame' trees per hectare.
'Frame' trees are well-formed dominant trees with good crowns at reasonably even spacing.
When the trees begin to cone (see table 1 below) stands will be thinned to the basal areas shown in table 2 to develop good conditions for regeneration to establish.
If/when natural regeneration occurs it will be more variable than on a planted site, giving more variability in age, density and species.

Canopy removal will aim to maintain a leader-to-lateral ratio of >1 in the regeneration (see figure 1), generally this will be achieved using the basal areas in table 2.
The final removal of the overstorey may not involve all the trees depending on management objectives and windthrow considerations (green tree retention).
If natural regeneration is only partially successful in terms of number and species mix planting will be undertaken. Planting will be concentrated so the location of trees is known and they can be maintained. This will be by using a minimum of 16 trees in distinct group with the trees planted at 1.5 m x 1.5 m to form robust groups.
If natural regeneration has been completely unsuccessful and CCF is still seen as appropriate planting will be undertaken to form the new canopy layer.
Before planting the stand will be thinned to the basal areas for 'seedling growth' in the table 2.
The felling and extraction of the canopy trees will be considered when deciding where to plant.
Planting will be at 2500 trees per hectare in a well-defined pattern so they can be found for subsequent maintenance. 'Blanks' will be left when the planting position is close (<1 m) to canopy trees. This should ensure restocking compliance with OGB 4, as the area under the canopy is not part of the net area.
Attention will be paid to site preparation, vegetation management, plant quality and reducing the impact of mammals to make sure of successful establishment. In general opportunities for site cultivation will be constrained by the overstorey.
If the established crop is between the ages of 20 and 40 years, a transformation period of up to 50 years is expected.

Table 1. Species seed production details.

Species	Age of first good seed crop	Age of max seed production	Interval between good seed crops (yrs)
Sitka spruce	25-35	40+	3-5
Scots pine	15-20	60+	2-3
Douglas fir	30-35	50+	4-6
European larch*	25-30	40+	3-5
Japanese larch*	15-20	40+	3-5
Hybrid larch*	15-20	40+	3-5
Western hemlock	25-30	40+	2-3
Corsican pine	25-30	60+	3-5
Lodgepole pine	15-20	30+	2-3
Norway spruce	30-40	50+	**
Noble fir	30-40	40+	2-4
Grand fir	35-45	40+	3-5

Table 2. Basal area guidance for natural regeneration

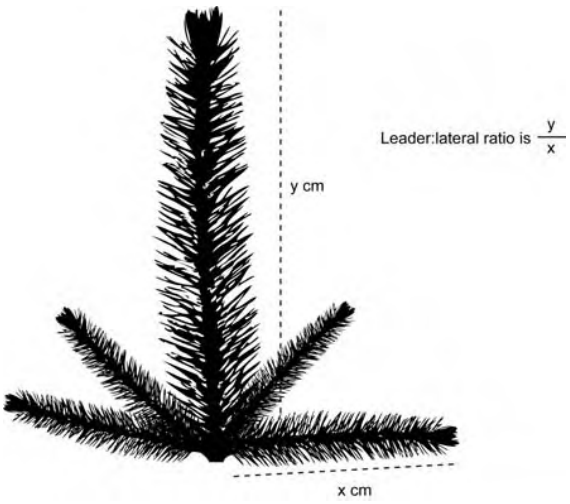
Species / group	Shade tolerance of seedlings	BA (m2 ha-1) Establishment*	BA (m2 ha-1) Seedling growth**
Larches	Intolerant	20-25***	15-20
Pines	Intolerant	25-30***	20-25
Sitka spruce	Intermediate	30-35	25-30
Douglas fir	Intermediate	35-40	30-35
Norway spruce	Tolerant	40-45	35-40
Western hemlock	Tolerant	40-45	35-40

* On moderate to fertile sites where vegetation regrowth will be faster and more severe the BA for establishment will be increased.

** Seedlings and saplings are growing well under a canopy when the ratio of the length of the leader to the length of laterals in the upper whorl is ≥1, as shown in figure 1.

*** Stands of larch and pine at these basal areas will usually have well-developed ground vegetation layer and control or cultivation will be needed to start regeneration.

Figure 1. Leader-to-lateral ratio.



2. Transformation of a young (<40yrs) stand to a complex structure

The objective is to create a wider dbh range than under a simple system by:

- retaining small trees; and
- encouraging fast growth of selected frame trees

The pattern of regeneration will be different to a simple structure, and will be arranged in groups that only cover up to 20% of the area at any one time.
Up to 50 'Frame' trees will be selected per hectare and these will be crown thinned so as to keep as many small trees as possible.
'Frame' trees are stable, well-formed dominant trees. They may need to be present on the site for a long time; spacing should be 'clumpy' and not regular. Stable trees will have a larger diameter for a given height.
The stand will be thinned to a residual basal area of about 18-25 m2 per ha for larches and pines, and 25-35 m2 per ha for spruces and Douglas fir. The choice within this range will depend upon the site and the balance between the overstorey and any regeneration. If there is little or no regeneration a higher value will be chosen to provide suitable conditions for seedlings to establish. If there is enough regeneration, which needs to be released, then a lower value will be favoured. The aim at each thinning is to remove enough trees to achieve the chosen residual basal area.
If there is too much regeneration thinning will be concentrated on releasing the best regeneration and attempting to hold it back in other areas.
Planting in complex structures will be considered to increase chances of success.
Trees will be planted in canopy gaps of 0.1 ha minimum size.
Trees will be planted in half the area of the gap in the centre.
Close spacing (1.5 m x 1.5 m) will be used to make the groups robust. For example, when planting a canopy gap of 0.1 ha 200 trees will be planted at 1.5 m spacing on half the area in the middle of the gap. Close spacing will ensure rapid canopy closure and planting only half the area ensures minimal competition from the canopy trees, allowing opportunities for natural regeneration and increasing operational access.

3. Transformation in older (>40yrs) stands

- Transformation of stands older than 40 years may be possible, especially on wind-firm sites, but the opportunity to steer the development of the young stand in thinning has been lost.
- The main implications of this are:
- for simple systems there will be reduced opportunities for developing the crowns of 'Frame' trees and the window for natural regeneration is reduced. Therefore more 'frame' trees will be retained and a longer regeneration period used.
- in complex systems the main risks are that 'Frame' trees will become too large to be marketable, and the stand will still be quite uniform when windthrow starts. The aim is to establish groups of regenerating seedlings under an irregular overstorey while older trees are progressively felled.

Appendix 5 – Future open space