



Scottish Lowlands
Forest District
Fife Woods
Land Management Plan

Scottish Lowlands Forest District

Fife Woods (Benarty, Cardenden & Cullaloe)

Land Management Plan

Approval date: ***

Plan Reference No: ****

Plan Approval Date: *****

Plan Expiry Date: *****

Approvals page GLM6 - Insert here and delete this page

Contents

1.0 Introduction.....	4
1.1 Setting and context.....	4
1.2 Site history	4
2.0 Analysis of previous plans.....	5
3.0 Background information	7
3.1 Physical site factors.....	7
3.2 The existing forest	8
3.3 Landscape and landuse.....	13
3.4 Biodiversity and environment	15
3.5 Heritage	15
3.6 Recreation and Community	15
4.0 Analysis and Concept	17
5.0 Management Proposals.....	18
5.1 Forest Stand Management	18
5.2 Future habitats and species.....	19
5.3 Prescriptions	21
5.4 Biodiversity & Heritage	22
5.5 Water Quality	24
5.6 Community & Recreation	24
Appendices.....	26

Version History

Version	Date	Comments
1.0		Initial draft
1.1	Apr 2015	Revised following internal review
1.2	July 2015	Revised following submission to FCS

1.0 Introduction

1.1 Setting and context

Benarty, Cardenden and Cullaloe Forests are located in Fife, situated east of the M90 and west of Kirkcaldy in the vicinity of the A92.

Benarty covers approximately 60ha, and lies between Loch Leven and Loch Ore. The wood sits on the southeast slopes of Benarty Hill, and is highly visible in the surrounding landscape. The north-eastern half of the wood is largely comprised of conifers, whilst the western half is a mix of mature conifers and broadleaves of various ages.

Cardenden covers approximately 139 ha, and is bisected by the A92 dual carriageway running from Dunfermline to Glenrothes. It is mainly comprised of a mixture of mature conifer and broadleaved woodland, with some small areas of open ground, and several fields immediately to the north of the A92 which have previously been used for agriculture but which will be planted early 2015. It is situated immediately adjacent to South Dundonald which is also owned by the Forestry Commission, comprising a mixture of newly created woodland and a starter farm, and which is covered by a separate Forest Design Plan approved in 2013.

Cullaloe covers approximately 35 ha, and is situated immediately west of the A909 running from Cowdenbeath to Burntisland. It is largely comprised of a mixture of mature conifer and broadleaf woodland with one or two small pockets of open ground on the northern and southern boundaries.

Table 1.1 - Current land usage

Land Type	Benarty	Cardenden	Cullaloe
Existing woodland	55.8	118.9	32.1
Open ground	3.6	10.1	3.0
Agriculture		9.6	
Total (ha)	59.4	138.6	35.1

See **Map 1 - Location**

1.2 Site history

All three sites have been predominantly woodland at least as far back as the mid 19th Century, when old OS maps show mixed broadleaf and conifer plantations. They were acquired by the Forestry Commission in the mid 20th Century, and much of the current wood was planted in the 1930's and 40's.

2.0 Analysis of previous plans

The current Forest Design Plans for Benarty and Cullaloe are due to expire shortly. Cardenden is covered by an existing Forest Design Plan which expires in 2018, although this is fairly minimal, and so the opportunity is being taken to produce a more detailed plan.

Objective	Proposed Management Actions	Progress to date 1 – Little/No progress 2 - Some progress 3 – Progress as per FDP
<p>Maintain a supply of timber Increase age & species diversity</p>	<p>Benarty – Undertake small scale felling to minimise the appearance of change, and encourage the retention of crops whilst they remain stable.</p> <p>Cardenden – Undertake one thinning during plan period.</p> <p>Cullaloe – Undertake felling and thinning of small areas to diversify age classes and species diversity.</p>	<p>2 – Small windblown SS coupe near eastern edge felled following 2012 storms. CP on top ridge needs to be felled due to DNB, and restock species revised in light of DNB and <i>P. ramorum</i>.</p> <p>1 – Thinning initially scheduled for 2012/13, but has been repeatedly deferred due to operational constraints. SS in coupe 1007 has now missed the thinning window.</p> <p>2 – Conifers at SW corner and E edge felled and restocked with MB. Original intention to continue as predominantly pine/larch wood needs to be revisited in light of DNB and <i>P. ramorum</i>.</p>
<p>Protection and enhancement of wildlife habitats</p>	<p>Benarty – Diversify age structure and increase edge habitat.</p> <p>Cardenden – undertake programme to control <i>Rhododendron Ponticum</i>.</p> <p>Cullaloe – Transform overall structure to CCF, and control spread of Sycamore.</p>	<p>2 – Some small areas felled, and due to be restocked.</p> <p>3 – Several areas in NE have been mulched, and follow up spraying programme undertaken on a bi-annual basis.</p> <p>2- Thinning undertaken across block in 2008, and is due for another thinning shortly.</p>
<p>Preserve features of archaeological interest</p>	<p>Benarty – Maintain buffers around old well, dykes etc.</p> <p>Cardenden – clear regenerating</p>	<p>3 – Features preserved as per management prescriptions.</p>

	<p>broadleaves from old burial site.</p> <p>Cullaloe – Conserve two non-scheduled monuments situated within or adjacent to site</p>	
--	---	--

3.0 Background information

3.1 Physical site factors

3.1.1 Soils and Landform

Soils are primarily a mixture of well drained upland brown earths and surface water gleys, with the exception of the Tullylumb plantation at Cardenden which is mainly comprised of peaty gleys and bog.

See **Maps 3.1.1a, b & c – Soils**

Soil Moisture Regime provides an indication of the moisture and oxygen availability within the soil, both of which are essential for root growth. The majority of the forest ranges between Very Moist to Slightly Dry, with the exception of the marshy ground at Tullylumb which is classified as Wet, implying periods when waterlogging occurs within the soil that may potentially impair rooting depth.

Soil Nutrient Regime is a measure of both the availability of soil nutrients for plant growth, and the acidity of the soil (which impacts on the solubility and hence availability for uptake of most nutrients). Most of the forest has soil of Medium to Rich nutrient status, making it eminently suitable for growing a wide variety of tree species, with the exception once again of Tullylumb, which is primarily Poor or Very Poor.

Benarty sits on the south east face of Benarty Hill, and consists of a series of slopes of varying steepness, with some rocky outcrops, rising up from the public road before levelling off at the top edge of the wood. Cardenden has several contrasting parts, due to terrain, with a rocky ridge, boggy flats, gentle slopes and steep-sided valley gorges. Cullaloe is situated on the ridge of the Cullaloe Hills, and the majority of the site slopes down to the south east, although there also are some northwest facing slopes, and a valley running east-west at the northern end of the site.

3.1.2 Current Climate and Exposure (DAMS)

The majority of the forest area falls within the Warm/Moist climate zone, except for the north facing slopes at Cullaloe, which are Cool/Moist, and the upper margin at Benarty which is Cool/Wet.

Detailed Aspect Method Scoring (DAMS) is a measure of windiness of a site using the angle to the horizon in the eight compass points, weighted towards the prevailing wind direction. Scores range from 0-24: The higher

the score the greater the exposure, with scores below 13 regarded as sheltered and above 22 as too high for commercial forestry.

The majority of the forest area is relatively sheltered, with DAMS scores of 13 or lower, and hence potentially suitable for thinning.

See **Maps 3.1.2a, b & c - Exposure**

3.1.3 Future Climate

Climate data projections for 2050 and 2080 have been used to predict the anticipated future climate, which is expected to be both warmer and drier across all three sites. Although this suggests that the range of suitable species may expand to accommodate more demanding species, and that the growing season may extend, it may also indicate an increased risk of drought which may limit the site suitability of e.g. Sitka spruce during the next rotation.

3.1.4 Hydrology

Several small burns flow down through Benarty, before ultimately draining into Loch Ore. Within Cardenden, most water drains via the Den Burn into the River Ore, a tributary of the River Leven, which meets the Firth of Forth at Leven. Within Cullaloe there are few watercourses in the forest (the most significant being that running through the valley to the north end of the site), but water drains from the ridge into a series of minor burns draining to the Firth of Forth between Inverkeithing and Kirkcaldy.

3.2 The existing forest

3.2.1 Age structure, species and yield class

All three sites are predominantly mature woodland, with approximately 10% open ground within each site. Cardenden is split roughly equally between conifers and broadleaves, Cullaloe is 2/3rds conifer to 1/3rd broadleaves whilst Benarty is roughly $\frac{3}{4}$ conifer to $\frac{1}{4}$ broadleaves.

There is a relatively small proportion (less than 10%) of young (20 years or less) trees across the sites, with the majority of the woodland classified primarily as either pole stage (20-40 years) or Mature (over 40 years).

See **Maps 3.2.1a, b & c – Existing Woodland**

Table 3.2.1 – Current species breakdown

Species	Benarty	Cardenden	Cullaloe
Ash			0.74
Beech	0.16	7.51	
Birch		10.14	
Corsican pine	8.54	3.89	1.32
Douglas fir	0.83		
European larch		0.86	5.39
Hybrid larch	4.47		
Japanese larch	2.21	0.84	
Lodgepole pine		0.4	
Mixed broadleaves	10.84	27.29	6.14
Mixed conifers			0.07
Norway spruce		4.11	4.02
Oak		0.98	
Scots pine	1.52	24.95	10
Sitka spruce	21.88	28.89	0.56
Sycamore		6.76	3.6
Open	3.6	19.7	3.0
Total (ha)	59.4	138.6	35.1

Figure 3.2.1a – Current species breakdown (Benarty)

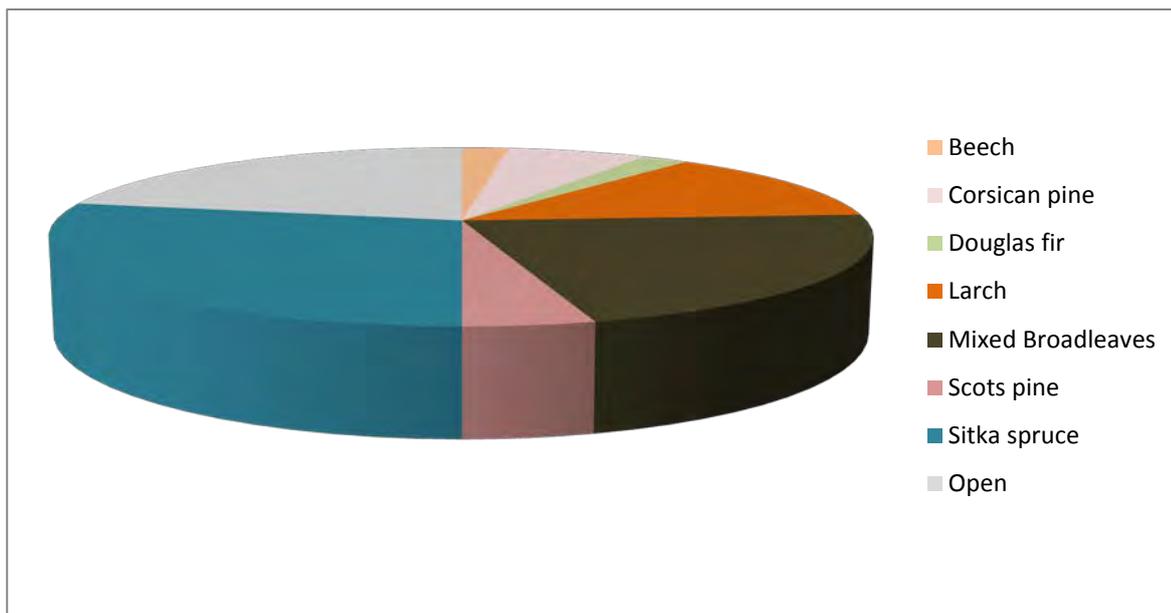


Figure 3.2.1b – Current species breakdown (Cardenden)

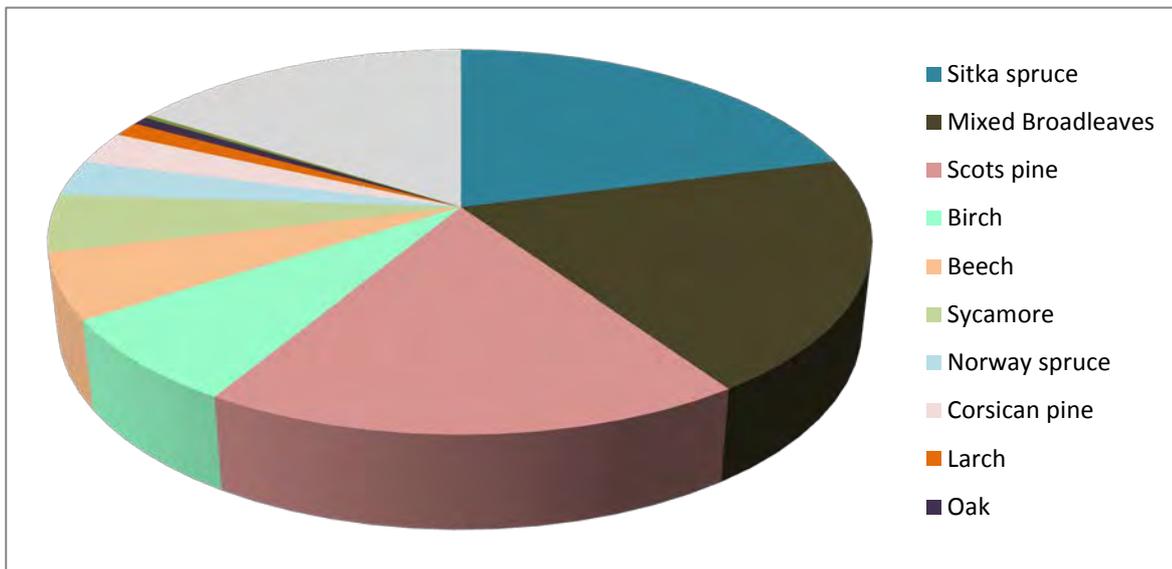


Figure 3.2.1c – Current species breakdown (Cullaloe)

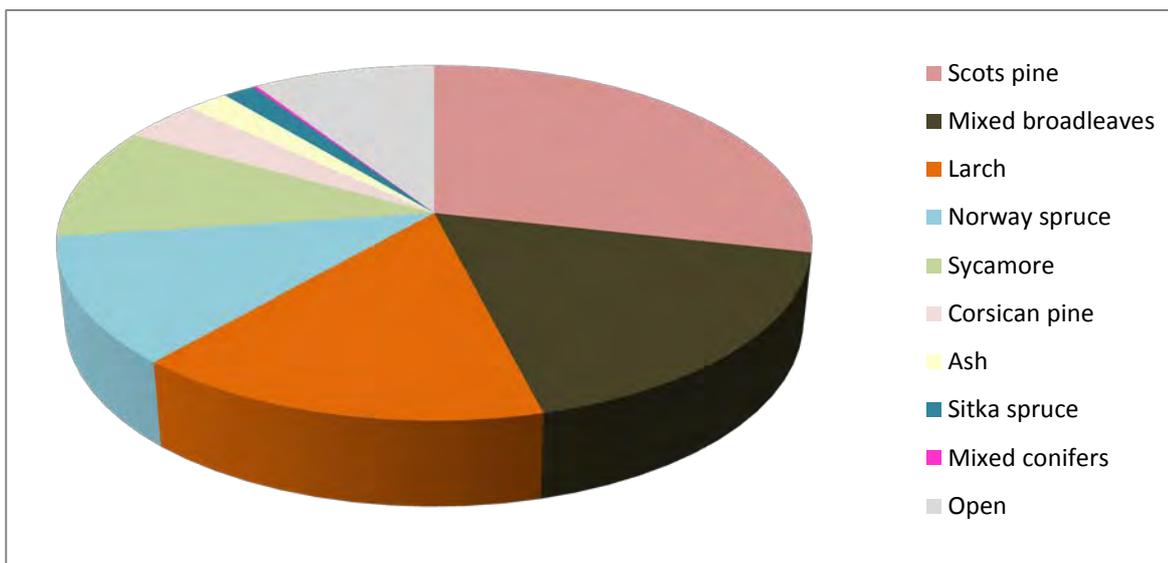
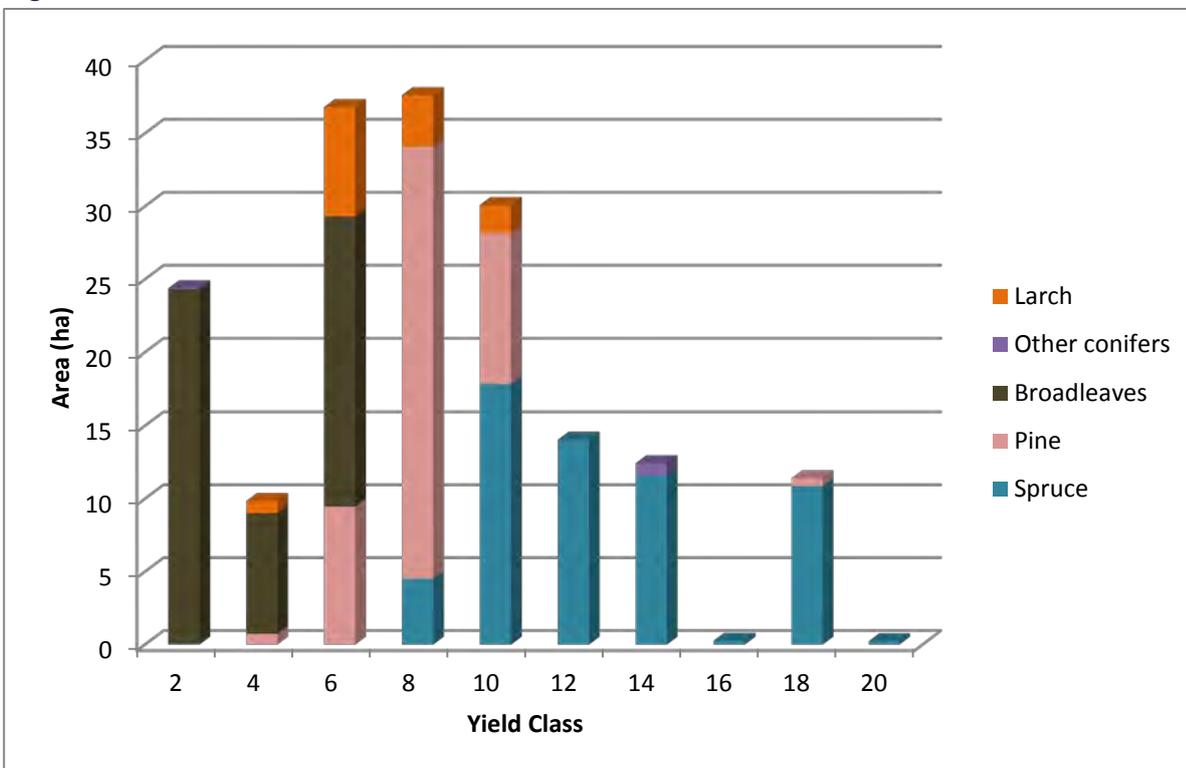


Figure 3.2.1d – Current age structure



Figure 3.2.1d – Yield Class



3.2.2 Operational Access

At Benarty, the Sitka and Larch coupes to the north east have good access via a well surfaced forest road. Access to the western half of the site is more difficult, with the surfaced road gradually petering out into a footpath and the steep slopes limiting options for accessing the top edge.

Cardenden has a reasonably extensive network of forest roads through the various sections of the site, although some would require upgrading before being suitable for timber extraction. The steep slopes and limited extraction options within the main Den valley represent the greatest operational challenge across the site.

The existing road through Cullaloe provides reasonable access for all envisaged future operations.

3.2.3 LISS potential

All three sites currently have an element of LISS (Low Impact Silvicultural Systems) management in place, in the form of a group selection system. In addition some areas currently managed as Clearfell or Long Term Retention may have the potential for conversion to Continuous Cover Forestry, given the relatively low DAMS scores across the sites. The main limiting factor across all sites for the implementation of any LISS management is likely to be the access restrictions imposed by steep terrain.

3.2.4 Pathogens

3.2.4.1 Dothistroma Needle Blight (DNB)

DNB (also known as Red Band Needle Blight because of the colourful symptoms it shows on pine) causes premature needle defoliation, resulting in loss of yield and, in severe cases, tree death.

Recent surveys have shown outbreaks of DNB across Scottish Lowlands Forest District and infected pine trees have been found on all three sites, with Corsican pine being particularly affected.

3.2.4.2 *Phytophthora ramorum* (*P. ramorum*)

P. ramorum is a fungus-like pathogen of plants that is causing extensive damage and mortality to trees and other plants in parts of the United Kingdom. Larch in particular is extremely vulnerable, and high infection and mortality levels are currently causing significant issues in Galloway Forest District.

No *P. ramorum* has been detected within any Scottish Lowlands Forest District forest blocks at the time of writing, and all three sites fall within the lowest risk zone in the FCS Action Plan for Larch in Scotland.

3.2.4.3 *Chalara fraxinea* (Ash Dieback)

Ash dieback is a serious disease of ash trees caused by a fungus, resulting in leaf loss, crown dieback and, potentially, tree death.

No sign of *Chalara* has been found at any of the sites at the time of writing, and ash forms a very minor component within the woodland.

3.3 Landscape and land use

3.3.1 Landscape character

Although in close geographic proximity to each other, Cardenden and Cullaloe fall within different landscape areas as classified by SNH in their Landscape Character Assessment of Fife, key elements of which are reproduced below:

	Benarty	Cardenden	Cullaloe
Landscape type	Upland Slopes	Lowland Hills & Valleys	Volcanic Hills & Craigs
Key characteristics & features	<ul style="list-style-type: none"> Highly conspicuous slopes & skylines. Gentler, smoother, open regular landform and land cover of the Benarty slopes. Natural, steep often dramatically contrasting and pronounced vertical physical landform Woodland cover strongly related to landform, shelter, aspect etc. Extensive, panoramic and elevated views across substantial distances and many other landscape types 	<ul style="list-style-type: none"> Variety & subtlety of landform Extensive areas of plantations, shelter planting, roadside planting Woods are variable in extent, but rarely absent. Extensive areas of afforestation, planting and policy planting to the west, and some to the east (e.g. south of Cardenden) 	<ul style="list-style-type: none"> The Cullaloe Hills comprise a series of hills generally falling towards the coast, with a steep sided, densely wooded ridge along its western edge (Cullaloe Woods). Especially on middle and lower slopes, woodland makes an important contribution to the landscape, enhancing its character Combination of steep sided, rugged, open landform and land cover on the hills, and shallow, smoother, more vegetated and more intensively used lower slopes As existing plantations reach maturity, there will be opportunities to implement a phased programme of felling and replanting which will allow a more varied and 'natural' woodland form to be created, respective topography and local variations in soils and drainage and with a much more varied species and age mix, and a higher proportion of open space.
Landscape Guidelines	<ul style="list-style-type: none"> Benarty slopes require low key management, sustaining present day activities. When softwood plantations reach commercial maturity, restructuring should be undertaken to incorporate more open ground and broadleaves. Some of the harsh, straight edges on Benarty slopes could be softened by further, mixed planting. 	<ul style="list-style-type: none"> New woodland could be in a variety of forms ranging from small groups of trees to small broadleaved woodlands, mixed species plantations, linear belts along burns and roads and larger mixed plantations where these would relate to and not obscure the subtle topography The restocking and management of over-mature, neglected or declining woodlands and shelterbelts should be encouraged. 	<ul style="list-style-type: none"> Replanting should result in a varied age and species structure, a greater proportion of open space and woodland which closely reflects the underlying landform. Middle, lower less steep areas have the capacity for absorbing much more woodland planting. Upper slopes should ensure that planting does not detract from their generally open nature. Encourage the interlinking of new woodlands to existing plantations and semi-natural woodlands.

3.3.2 Visibility

Benarty, and to a lesser extent Cullaloe, are prominent in the wider landscape, whereas Cardenden is generally most significant at a closer scale in those sections of woodland which sit in close proximity to some of the neighbouring residential areas.

3.3.3 Neighbouring land use

The majority of the surrounding land at all three sites is given over to agriculture in one form or another. In addition there are residential areas to the east of Benarty and at the north end of Cardenden. Cullaloe has some private forestry to the south, and quarries immediately to the north and south.

3.4 Biodiversity and environment

The diverse age and species range within the existing woodland benefits the biodiversity value of all three sites, with the main focus being the potential for red squirrel habitat.

In recent years, an extensive clearance programme has been initiated within Tullylumb plantation at Cardenden to eradicate *Rhododendron ponticum*, which is a non-native invasive species.

3.5 Heritage

Benarty contains little in the way of archaeological note, although minor items of interest include the remains of an old well, and a former quarry noted on OS maps in the mid 18th century.

Several mapped features of historic interest are present at Cullaloe – a temple folly towards the southwest (although the building actually lies slightly outwith FC land) and a small tower situated on the upper ride. During 2012 a bronze age urn was discovered on site, located in the root plate of a windblown tree, and several other features are present including the remains of a small settlement near the entrance and several old quarry workings. An archaeological survey of the site was undertaken in September 2014, but no new features of interest were identified. See **Appendix VI – Cullaloe Archaeological Survey**

The main features of archaeological interest at Cardenden are the remains of Carden Tower and the Kier Brae burial ground. Other features relating to more recent activity are located at various points across the site and include mine entrances, building remnants and former lime kilns.

3.6 Recreation and Community

Benarty is used extensively by walkers along the roads and paths, and a link path with numerous steps links a small layby at the southwest edge with the forest road. Additional space for several cars is also available at the main entrance, and a well-used footpath leads from here to Ballingry.

At Cardenden, the forest roads are heavily used for recreation, and there are a number of Rights of Way running through the various blocks. Despite the off-road bike course adjacent to the site some misuse of the wood by trail bikes still occurs. Access on foot, cycle and horse is easy from many places and the network of formal and informal paths, in addition to the forest roads, shows how popular it is for recreation.

At Cullaloe there is space for a couple of cars to park at the entrance beside A909 and a Right-of-Way runs from there along the forest road and out to the south. No formal recreation provision has been made, but there is a ride which forms an alternative route through the forest and makes a useful circular route.

See **Maps 3.6 a, b & c - Access**

Minor antisocial aspects (including Fly tipping, poaching, drinking dens, fire setting and illegal motorbike use) are an issue at all three sites, although to a lesser degree at Cullaloe.

4.0 Analysis and Concept

Through survey work and research, a broad range of factors have been identified which are potentially relevant to the future makeup and management of the land. These have been analysed in order to better understand the way these interact, and to draw out the most important features and trends.

This analysis was used to develop an initial design concept highlighting the general trends most relevant across the three sites, and outlining for each site key considerations and activities which are likely to be most relevant during the plan period.

See **Map 4.0 Design Concept Overview**

Maps 4.0 a, b & c Initial Design Concept

5.0 Management Proposals

5.1 Forest Stand Management

All proposals have been designed in accordance with sound silvicultural and environmental principles, falling within the framework outlined by the UK Forestry Standard, the UK Woodland Assurance Scheme, FC Bulletin 112 Creating New Native Woodlands, FC Bulletin 115 Alternative Silvicultural Systems, FC Bulletin 124 Ecological Site Classification for Forestry and the current FC edition of Forest and Water Guidelines.

5.1.1 Clear felling

Although large areas within the forest blocks will be managed under LISS, clearfelling operations are also proposed, as outlined below:

Table 5.1.1 Felling proposals

Site	Phase 1	Phase 2
Benarty	<ul style="list-style-type: none"> Fell Sitka spruce up to windblown edge at NW corner by burn Fell DNB infected Corsican pine at top of site Fell p1957 Japanese larch and p1985 Sitka spruce east of burn Fell Scots pine at west edge Fell Sitka spruce at SW corner Fell Sitka spruce below road in northern plantation 	<ul style="list-style-type: none"> Fell Sitka spruce above road in northern plantation. Fell larch above road in northern plantation.
Forecast Volume (m ³)	4,650	4,760
Cardenden	<ul style="list-style-type: none"> Fell mature Sitka on slope south of Den burn near Shawsmill bridge Fell mature Sitka to clear wayleave around powerline north of A92 Fell DNB-infected Corsican pine at Kier Brae 	<ul style="list-style-type: none"> Fell Sitka spruce east of forest road at Beatons wood, and small component west of road at entrance
Forecast Volume (m ³)	590	1,000
Cullaloe	<ul style="list-style-type: none"> Fell roadside strip 	
Forecast Volume (m ³)	80	
Total Volume (m³)	5,320	5,760

See **Maps 5.1.1 a-c Proposed Felling**

5.1.2 Thinning

FCS policy generally assumes that all productive crops will be thinned, unless:

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

All thinning decisions will be guided by Operational Guidance Booklet 9 - Managing Thinning, and the current SLFD Thinning Plan.

All proposed thinning operations are covered within the individual LISS management plans for each site.

5.1.3 Low Impact Silvicultural Systems (LISS)

The generally favourable conditions in Fife (in terms of both climate and soil suitability), in combination with the favourable condition of the existing mature woodlands have resulted in sizeable areas across all three sites which lend themselves to management through LISS regimes, which should be beneficial in terms of biodiversity, recreational usage and visual amenity.

Where this is the case, a separate LISS plan has been drawn up for each site detailing the specific management proposals for each area.

See **Appendix V(i) Benarty LISS Plan, Appendix V(ii) Cardenden LISS Plan & Appendix V(iii) Cullaloe LISS Plan**

5.2 Future habitats and species

Taking into account all the survey and analysis information, and the objectives set out in the brief, a mix of productive conifer, productive broadleaf and native woodlands are proposed, along with areas of open ground.

The woodlands will be matched to the soils and ground vegetation, using the guidelines set out in the Forestry Commission's Ecological Site Classification (ESC) Bulletin 124, which uses climatic zone, exposure, soil moisture, and soil nutrient levels to inform the type of woodland most suited to particular areas within the site.

5.2.1 Proposed Species

Productive conifers will continue to constitute a significant proportion of the woodland – approximately 1/3rd of Benarty and Cardenden, and ¼ of Cullaloe; and productive broadleaves will comprise roughly 1/10th of Benarty and Cullaloe, and 1/3rd of Cardenden.

Designed open ground occupies approximately 5-10% of each woodland, with significant additional open space resulting from variable density planting (particularly in mixed broadleaf areas).

Table 5.2.1a Proposed Species (Benarty)

Species/Habitat Type	Gross Area (ha)	%	Net Area (ha)
Sitka spruce	9.4	16%	8.5
Douglas fir	4.3	7%	3.9
Larch	2.6	4%	2.4
Norway spruce	3.9	7%	3.5
Aspen	3.7	6%	3.3
Birch	1.8	3%	1.7
Oak	1.4	2%	1.3
Mixed broadleaves	26.8	45%	20.3
Open ground	5.6	9%	
Total	59.5	100	

Table 5.2.1b Proposed Species (Cardenden)

Species/Habitat Type	Gross Area (ha)	%	Net Area (ha)
Birch	26.1	20	22.8
Sitka spruce	18.2	14	17.2
Douglas fir	13.9	10	11.0
Aspen	7.5	6	6.7
Beech	6.9	5	6.0
Norway spruce	5.5	4	4.9
Sycamore	4.9	4	3.3
Oak	2.7	2	2.4
Sequoia	0.4	0.3	0.4
Mixed broadleaves (W4, W7, W11)	47.3	34	39.6
Open ground	5.2	4	
Total	138.6	100	

Table 5.2.1c Proposed Species (Cullaloe)

Species/Habitat Type	Gross Area (ha)	%	Net Area (ha)
Norway spruce	6.0	17	5.1
Douglas fir	2.6	7	2.3
Sycamore (productive)	1.9	6	1.6
Oak (productive)	0.7	2	0.3
European larch	0.3	1	0.3
Mixed conifers	0.4	1	0.4
Mixed broadleaves (W7, W9)	5.1	15	3.6
Open ground	1.2	3	
Quarry option	16.9	48	
Total	35.1	100	

See **Maps 5.2.1 a-c Future Species**

5.3 Prescriptions

In addition to Sitka spruce, a range of alternative conifers including Norway spruce, Douglas fir, and Sequoia will be planted at **2,800 trees/ha**. Although no additional larch will be planted due to the risk of *P. ramorum*, natural regeneration will be encouraged in existing larch stands.

Small seeded broadleaves, in the form of Birch and Aspen, will comprise the principal productive broadleaved element in order to maximise the habitat potential for red squirrels. In addition, regeneration of Beech and Sycamore will be accepted in existing areas, and some small isolated 'islands' of Oak will be planted where conditions are most suitable. Productive broadleaves will be planted at **5,100 trees/ha**.

The following native woodland types (as classified in FC Bulletin 112) have been identified as suitable for the sites:

- W4 Birch woodland
- W7 Wet woodland
- W9 Upland mixed broadleaved woodland
- W11 Upland oak-birch woodland

Within riparian areas along existing watercourses, planting will generally be a variant on W7 woodland, and will include a significant (30% or more) element of open space. In accordance with current Forest & Water Guidelines, a 5-10m buffer zone will be left open, dependent on localised width.

Around the edges of the main, more densely planted stands, a more open 'transitional' woodland will be planted. This will incorporate a relatively high level (typically around 50%) of open ground, with the woodland planted in clusters whose density decreases with distance from the main stands.

5.4 Biodiversity & Heritage

5.4.1 Habitat Management

At Cardenden, the area identified as Minimum Intervention along the Den Burn will have a programme scheduled in order to maintain and improve the current Lowlands Mixed Deciduous/Wet Woodland UKBAP habitat types (principally through the clearance of Sitka spruce and Sycamore from the immediate vicinity of the burn).

The ongoing District-wide programme of non-native invasive clearance will continue, resulting in periodic visits to Cardenden to remove any regrowth of *Rhododendron ponticum*.

5.4.2 Protected Species

Careful design, particularly with regard to species choice, has been used in order to maximise the potential benefit to red squirrel within the future woodland habitat. The use of Norway spruce, Douglas fir and small seeded broadleaves such as birch and aspen should all increase the potential of the woodland to provide a beneficial habitat.

5.4.3 Deadwood

The aim is to use natural processes by retaining dead, windblown or snapped stems or those created during previous operations. Deadwood can be trees or limbs in the early stage of decomposition, e.g. veterans or dying individual trees. These should be retained wherever possible to create an even mix of standing, fallen or stacked deadwood.

Deadwood will be concentrated in areas where it will provide the highest ecological benefit, such as;

- Riparian and wet woodland areas
- Natural reserves and long-term retentions
- Ancient semi-natural woodland
- Areas of significant existing deadwood

The UKWAS target is for an average of 20m³/ha, although it is expected that actual concentrations will vary widely across the site.

Table 5.4.3 Assessed Deadwood Ecological Potential (DEP)

Site	Assessed DEP	Area (ha)	Future Vol. Estimate (m ³ /ha)	Total Future Vol. (m ³)
Benarty	High	2	100	200
	Medium	37	30	1110
	Low	20	15	300
Cardenden	High	18	100	1800
	Medium	10	30	300
	Low	11	15	165
Cullaloe	High	2	100	200
	Medium	15	30	450
	Low	1	15	15

Total future potential is thus estimated at **35 m³/ha**.

Given that a relatively high total volume of deadwood is expected to come from High & Medium DEP areas, in line with FES Deadwood Policy the following approach should be adopted in the remaining Low DEP areas:

- Take any obvious opportunities to retain deadwood in a coupe e.g. large veterans, deadwood in wet areas or inaccessible areas.
- Consider harvesting wind blow only when it is economic or required to make site safe.

5.4.4 Wildlife Management

Deer control is vital to successful crop establishment, and the proposed increase in 'soft' conifer and productive broadleaves species means that there will be potentially vulnerable crops in a number of areas across the site, and deer numbers will need to be controlled by culling to minimise damage. Although deer fencing will only be considered as a secondary option, the use of potentially vulnerable tree species may require small enclosures to be erected in order to minimise damage during establishment. Careful planning will be required as to the size and location of such enclosures so that deer welfare is not compromised.

Full details of proposed deer management can be found within Scottish Lowlands Forest District Deer Management Strategy (in conjunction with the Deer Overview Map), but the relevant objectives within the Fife Deer Management Unit are:

- Where possible, enable restocking to take place without the need for deer fencing, and to achieve a suitable stocking density at year five.
- Keep leader damage levels below 10% in productive coupes.
- Maintain a sustainable deer population.

5.4.5 Heritage

A suitable buffer will be maintained around all non-scheduled archaeological features, which will be kept open and free of trees. All operations in the vicinity of such features will be conducted in accordance with UK Forestry Standard Guidelines on Forests and the Historic Environment, with suitable steps taken to ensure their protection.

5.5 Water Quality

All operations will follow best practice as detailed in the current Forest and Water Guidelines. Timber extraction will normally avoid crossing burns or main drains, but, where necessary, each crossing point will be piped or bridged. Branches will be kept out of watercourses and trees will generally be felled away from the watercourses. Restocking of areas around watercourses will take into account suitably sized buffer areas as per Forest and Water Guidelines.

5.6 Community & Recreation

Scottish Lowlands Forest District Staff will actively engage the local community to encourage use of the forest, and FD Ranger staff will look for opportunities to build links with local community groups and schools.

In order to help address some of the antisocial issues which are a factor across the sites (in particular fly tipping), greater emphasis will be placed on the general appearance of the forest estate in general – and entrances in particular – in order to encourage more positive usage of the woodlands. A structured programme of maintenance and scheduled management, targeted at some of the most heavily used or problem site entrances at Benarty and Cardenden, has the potential to increase responsible usage of the woodlands which is often one of the most cost effective ways to discourage antisocial usage.

General recommendations:

- Footpaths to be strimmed on each side to an immediate distance of at least 0.5m on a monthly basis (Spring-Autumn)
- Where relevant, grass cutting at entrance areas on a 3-4 weekly period (Spring-Autumn)
- Weekly checks of problem site entrances for fly tipping
- Water courses to be cleared of debris and litter.

Additionally, in conjunction with the District Landscape Architect, three entrances at Benarty and six entrances at Cardenden have been identified which would benefit from additional maintenance work and/or a schedule of improvements as and when funding is available in order to provide a more positive entrance welcome zone (see **Maps 5.6a & B Entrance Locations**).

Appendices

Appendix I: Land Management Plan Consultation Record

Consultee	Date contacted	Date response received	Issue raised	Forest District Response
SNH	9/10/2014	9/10/2014	No comments offered as proposals fall below threshold for consultation.	N/A
Timber Transport/Rural Development Initiatives	9/10/2014	9/10/2014	Request contact with Local Authority Roads Service prior to timber harvesting and haulage operations. Consider timber transport issues with respect to Benarty, since access is limited to a single carriageway road.	Liaison will be undertaken as part of standard Work Plan procedures. Largest clearfell (in Phase 1) will be likely to involve significant felling to waste due to poor state of DNB-infected pine and access issues, reducing timber loads off site. Move to LISS management in other areas will help reduce likelihood of substantial timber loads coming offsite at any given time.
Historic Scotland	9/10/2014	23/10/2014	No designated assets in area covered by proposals. Recommend contact with Fife Council archaeologist for advice on impacts to unscheduled archaeology.	Council archaeologist included in original list of consultees, no response received.
Cardenden Primary School	9/10/2014	23/10/2014	Generally supportive of proposals, and keen to involve pupils more.	Beat Forester liaising with school to explore opportunities for more

Fife Woods Land Management Plan 2015-2025

				involvement.
Fife Council Roads Network Management	9/10/2014	28/10/2014	Requested update on trees adjacent to A907 at Cullaloe	Explained that felling was scheduled to occur as part of operations earlier this year, but standing sale attracted no buyer. Currently awaiting re-scheduled sale early 2015.
RSPB	9/10/2014	2/11/2014	<p>Welcome objectives to increase diversity of open & native woodland habitats.</p> <p>Welcome control of non-native species, commitment to protect and expand forest habitat networks and priority habitats, and to develop riparian woodland when restocking.</p> <p>Request to explore potential for open wet areas where appropriate when restocking Cardenden to benefit a range of invertebrates.</p>	Wetter areas will generally be restocked with mixture of mixed broadleaves and open ground.
Mr John Bennett (Cardenden)			Lives next to Cardenden, and would like to be kept informed about proposals. Pointed out entrance which wasn't included on design concept.	Dundonald Crescent entrance included in detailed plans, and is one of entrances identified for improvements.
Mr Ian Johnston (Cardenden)			Generally supportive of proposals. Would like to see more work done to limit anti-social use by motorcycles, and clearance of weed/bulrushes from pond in Carden Den.	Beat Forester to monitor situation with regard to motorcycle use and liaise with police as appropriate.
Mrs Aileen Morris (Cardenden)			Expressed concern about trees close to their property, which is adjacent to New Carden Plantation.	Beat Forester visited property to review situation. Confirmed no immediate issues but will include on standard inspection regime.
Ms Elaine Laidlaw (Cullaloe)			Expressed concern at the fact that any operations are to be undertaken, and	Existing woodland has arisen as a result of

Fife Woods Land Management Plan 2015-2025

			the potential impact of proposals on wildlife, but welcomed proposed archaeological investigation.	previous management over a long period, and this is simply another step in this process. Whenever operations are undertaken, all necessary checks are undertaken to mitigate against impact on wildlife.
Mr & Mrs Waddell (Cardenden)			Expressed concern about trees close to their property, which is adjacent to New Carden Plantation.	Beat Forester visited property to review situation. Confirmed no immediate issues but will include on standard inspection regime.

Fife Woods Land Management Plan 2015-2025

Appendix II: Tolerance Table

	Adjustment to felling coupe boundaries	Timing of restocking	Change to species	Windthrow response	Adjustment to road lines
FC Approval not normally required (record and notify FC)	<10% of coupe size.	Up to 5 planting seasons after felling (allowing fallow periods for hylobius).	Change within species group E.g. Scots pine to birch, Non-native conifers e.g. Sitka spruce to Douglas fir, Non-native to native species	Low sensitivity area Where windthrow represents more than 50% of the crop the area including standing trees may be felled plus up to 5Ha beyond in order to seek a windfirm edge.	Low sensitivity area Creation of turning points/ loading bays. Deviation of <100m either side of predicted centre line. High sensitivity area Deviation <75m in either direction from centre of road/track.
Approval by exchange of letters and map	10-15% of coupe size.	5 years +	Change of coupe objective that is likely to be consistent with current policy (e.g. from productive to open, open to native species).	Low sensitivity area As above to include 5-10 Ha of standing crop to seek a windfirm edge. Areas where windthrow represents <50%. High sensitivity area Areas where windthrow represents >50%.	Low sensitivity area Deviation of 100-150m in either direction from centre of road/track. High sensitivity area Deviation of 75-100m in either direction from centre of road/track.
Approval by formal plan amendment	>15% of coupe size.		Major change of objective likely to be contrary to policy, E.g. native to non-native species, open to non-native,	Low sensitivity area As above. Windblown area + an area >10 Ha to find a windfirm edge. High sensitivity area Felling of standing trees beyond the area of windblow.	Deviations exceeding the above.

Appendix III. Brief & Objectives

1. Background Information

The Fife Woods Forest Design Plan covers three Forest Enterprise Scotland (FES) woodlands within Fife – Benarty, Cardenden & Cullaloe.

- Benarty covers approximately 60 ha, and lies between Loch Leven and Loch Ore, Cardenden covers approximately 139 ha, and is bisected by the A92 dual carriageway running from Dunfermline to Glenrothes, and Cullaloe covers approximately 35 ha, and is situated immediately west of the A909 running from Cowdenbeath to Burntisland.
- Previously, all three sites were covered by individual Forest Design Plans. However, given the similarities between the three in terms of climate, soils and current woodland composition the opportunity is being taken to amalgamate them into one single plan.
- Current woodland cover is generally fairly consistent across the three sites, at around 90%, although the makeup varies somewhat (Benarty is split approximately $\frac{3}{4}$ conifer/ $\frac{1}{4}$ broadleaves, Cullaloe is $\frac{2}{3}$ conifer and at Cardenden the split is roughly 50:50).
- Ground conditions are generally good, with well drained, relatively fertile soils for the most part. Steeper slopes are a potential issue (in terms of operational access) on all three sites.
- The prevailing warm, moist climate is conducive to good tree growth for a broad range of species, and all three woods are relatively sheltered and hence potentially suitable for thinning. Climate change predictions suggest that Fife will become generally warmer and drier, which may result in an expansion of the range of suitable species that can be grown (especially broadleaves) but could also see some species which presently grow well (e.g. Sitka spruce) become less suitable due to the increased risk of drought.
- Dothistroma Needle Blight (DNB), a disease causing premature needle defoliation, has affected pine trees on all three sites, with Corsican pine in particular being badly affected.
- Thinning and/or felling operations have been undertaken at all three sites over the last ten years,

Fife Woods Land Management Plan 2015-2025

although operational access issues (primarily due to steeper slopes) have resulted in some planned operations being deferred. The current age and structure of the woodlands is such that the main operational focus over the next ten years will be thinnings, and the intention is to move away from a clearfell approach towards lower impact silvicultural systems (e.g. CCF) wherever feasible.

- The main biodiversity focus is the potential of all three woodlands as red squirrel habitat, although there is also significant potential to broaden the overall biodiversity value of the woodland through the envisaged thinning operations and moves toward CCF. As a non-native invasive, *Rhododendron ponticum* has been an issue in Cardenden in the past, although a previous programme to remove it has largely been successful, and management is now chiefly targeted towards monitoring and occasional follow-up spraying to control new seedlings.
- Benarty, and to a lesser extent Cullaloe, are prominent in the wider landscape, whereas Cardenden is generally most significant at a closer scale in the sections of woodland in close proximity to some of the neighbouring residential areas.
- Both Benarty and Cardenden are partially designated as WIAT (Woodlands in and around Town), and this is reflected in their relatively high levels of recreational usage. Although the situation has improved over the last few years, anti-social use (primarily fly-tipping, fires, illegal motorbike use, drinking dens and poaching) can still be an issue.
- There are various elements of known archaeological interest (both scheduled and non-scheduled) across the three sites.
- Deer numbers within the woodland are low due to ongoing active management, although they are relatively high in the surrounding area.

2. Strategic Priorities

The work of FES is guided by the Scottish Forestry Strategy 2006, which sets out seven Key Themes:-

- Climate Change
- Timber
- Business Development
- Community Development
- Access & Health
- Environmental Quality
- Biodiversity

From this Strategy, Scottish Lowlands Forest District prepared the Scottish Lowlands Forest District Strategic Plan 2009-2013 which draws on the most important strands of the Key Themes relevant to the forest areas we manage and sets out the policies and objectives under which other District plans are prepared and monitored.

In preparing the Brief and Objectives for this Forest Design Plan (FDP), issues were grouped under these Key Themes and assessed for their importance. Those relevant are set out in Table 1 below.

Fife Woods Land Management Plan 2015-2025

Table 1. Relevant issues under the SFS Key Themes

SFS Key Theme	Issues assessed as relevant by staff team for the Fife Woods FDP	Scottish Lowlands Strategic Plan Reference
Climate change	<ul style="list-style-type: none"> Adapting to Climate Change with site suited species choices and habitat connectivity Forest designs will include good riparian management 	1.05, 1.10
Timber	<ul style="list-style-type: none"> Productive forestry with quality timber production (conifers and broadleaves) Low Impact Silvicultural Systems (LISS) Thinning and niche marketing Maximise the use of improved and site suited growing stock 	2.02, 2.06, 2.07, 2.08, 2.12, 2.13
Business Development	<ul style="list-style-type: none"> Development of skills projects Income diversification, including consideration of agriculture, mineral workings Contribute to rural development through the use of local suppliers and contractors where possible 	3.01, 3.03, 3.05, 3.07, 3.10, 3.13, 3.14
Community development	<ul style="list-style-type: none"> Develop a community engagement approach that considers the immediate neighbours, key users groups and the wider area. Support the development of a Central Scotland Green Network Ensure forest thresholds are well maintained and signposted Involve local communities and stakeholders in the forest design planning process Encourage local schools to include visits to nearest woodlands 	4.02, 4.04, 4.05, 4.09, 4.10, 4.17
Access & health	<ul style="list-style-type: none"> Woods in and around Towns (WIAT) initiative Work with Communities, Council and Police to manage antisocial behaviour Make woodlands more accessible, support core paths and protect public rights of way 	5.02, 5.04, 5.08, 5.09, 5.10
Environmental quality	<ul style="list-style-type: none"> Comply with all relevant FC regulations and guidelines Landscape prominence Use LISS for detailed management of the local landscape Suitable protection of scheduled and unscheduled monuments 	6.01, 6.03, 6.06, 6.07, 6.08
Biodiversity	<ul style="list-style-type: none"> Native woodland (LEPO) and potential to expand Use LISS in native woods and other suitable areas Control invasive plant species (rhododendron) Increase structural and tree species diversity during restructuring Consideration of important species e.g. red squirrel, badger, bats, butterflies, nesting birds Ongoing deer management 	7.01, 7.02, 7.04, 7.05, 7.06, 7.16

3. Draft Management Objectives

Following the analysis above, Table 2 sets out the Brief and Objectives agreed for developing the management proposals for Benarty, Cardenden and Cullaloe.

Table 2. Initial Brief and Objectives for developing management proposals

Brief	Objectives
Maintain productive potential and develop existing woodland to contribute to carbon capture targets and increase diversity	<ul style="list-style-type: none"> • Maintain productivity through sound silvicultural practice including Low Impact Silvicultural Systems (LISS). (e.g. Continuous Cover Forestry) • Plant broadleaves for timber production where site conditions are suitable • Include productive conifers where appropriate in the landscape • Suitable pest management to ensure success of planting and regeneration • Select species using Ecological Site Classification principals to maximise productive potential and develop resilience to climate change
Work with current and potential users of the site to improve recreational opportunities	<ul style="list-style-type: none"> • Maintain clean access points and develop improved access facilities for foot, horse and cycle • Develop contacts with local communities
Preserve important landscape and historic features	<ul style="list-style-type: none"> • Preserve the most important views within the site and enhance where possible • Protect known historic features
Increase biodiversity value	<ul style="list-style-type: none"> • Increase the diversity of open and native woodland habitats to benefit existing species such as Red Squirrel • Protect and expand forest habitat networks and priority habitats • Control Rhododendron (Cardenden)
Increase community development	<ul style="list-style-type: none"> • Encourage partnerships and volunteering • Engage local schools (Forest School) • Maintain an attractive woodland • Reduce anti-social behaviour

Appendix IV : Maps

The following maps are referenced within this design plan:

- 1 - Location
- 3.1.1a – 3.1.1c Soils
- 3.1.2a – 3.1.2c Exposure
- 3.2.1a, b & c – Existing Woodland
- 3.6a - c Access
- 4.0 Design Concept Overview
- 4.0a, b & c Initial Design Concept
- 5.1.1 a-c Proposed Felling
- 5.2.1 a-c Future Species
- 5.6a & b Entrance Locations

Appendix V : LISS Management Plans

- Appendix V(i) Benarty LISS Plan
- Appendix V(ii) Cardenden LISS Plan
- Appendix V(iii) Cullaloe LISS Plan

Appendix VI : Related Documents

The following documents are referenced within this design plan:

- Cullaloe Archaeological Survey



Forestry Commission Scotland serves as the forestry department of the Scottish Government and is responsible to Scottish Ministers

Contact

Forestry Commission Scotland
Scottish Lowlands Forest District
Fives Sisters House
Fives Sisters Business Park
West Calder
EH55 8PN

Tel: 0300 067 6700

E-mail: scottishlowlands@forestry.gsi.gov.uk

Web: www.forestry.gov.uk/scotland