Appendix 1: The Forest Planning Framework in Scotland

FC Scotland prepares Land Management Plans within the following planning framework:

1. The National Level

Document name: **The Scottish Government's Scotland Performs 2007 – Present**

Document purpose: Reports on the Scottish Government's attempts to create a more successful country through the seven purpose targets.

Document name: **The Scottish Government's Land Use Strategy 2011 – Present**

Document purpose: Takes a strategic approach to achieving a more sustainable and integrated approach to land use in Scotland. Focusing on common goals for different land users it provides a set of principles for use as a policy guide and decision making tool.

Document name: **The Scottish Forestry Strategy 2006 – 2016**

Document purpose: Describes how the Scottish Government will deliver its forestry policies in Scotland and sets out the priorities for the next five to ten years.

Intended audience: Local Forestry Commission Scotland team; Forestry Commission conservancy team; key stakeholders; statutory consultees; general public.

2. The Regional Level

Document name: **Highland Forest & Woodland Strategy 2006 - Present (Consultative Draft)**

Document purpose: Provides a regional expression of the Scottish Forestry Strategy, describing priorities and programmes for using trees, woodlands and forestry to help meet the needs of the Highlands.

Intended audience: Local Forestry Commission Scotland team; key stakeholders; statutory consultees; general public.

3. District Level

Document name: **The Forest District Strategic Plan 2014 – 2017**

Document purpose: Serves as a guide to the management of forests within Inverness ,Ross and Skye Forest District.
This document describes the role and strategic directions for Inverness Ross & Skye Forest District in managing approximately a tenth of Scotland's National Forest Estate (NFE) over the three years from 2014-2017. Actions against key commitments of the National Startegic Directions are applied to relevant areas of the district to reflect the local, economic, social and ecological individuality of the forests. Strategic objectives are presented within the context of the Scottish Executive's strategic priorities for forestry in Scotland (e.g. to create a diverse forest resource for the future; make a positive contribution to the

4. The Forest Level

Document name: **Land Management Plan (Covering a ten year period from date of approval)**

Document purpose: Takes a holistic view of management at the landscape scale, outlining the medium to long term management for each forest.

Intended audience: Local Forestry Commission Scotland team; key stakeholders; statutory consultees; general public.

5. Coupe Level

Document name: **Work Plans (permanent coupe record)**

Document purpose: Each major forest operation has its own Work Plan. At this stage, a visit is made by local staff who identify site specific interests and outline the constraints and opportunities that are relevant to the site at a level of detail that far greater than a LMP

Intended audience: Local Forestry Commission Scotland team; key stakeholders; statutory consultees where required;

APPENDIX 2: KEY POLICIES AND GUIDANCE

- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- Equality Act 2010
- Control of Substances Hazardous to Health Regulations 2002
- Provision and Use of Work Equipment Regulations 1998
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- The Highways act 1980
- Management of Health and Safety at Work Regulations 1999
- Health and Safety at Work Act 1974
- Occupier's Liability (Scotland) Act 1960
- Land Reform (Scotland) Act 2003
- Employers Liability (Compulsory Insurance) Act 1969

- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- Policy on Control of Woodland Removal 2008
- Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999

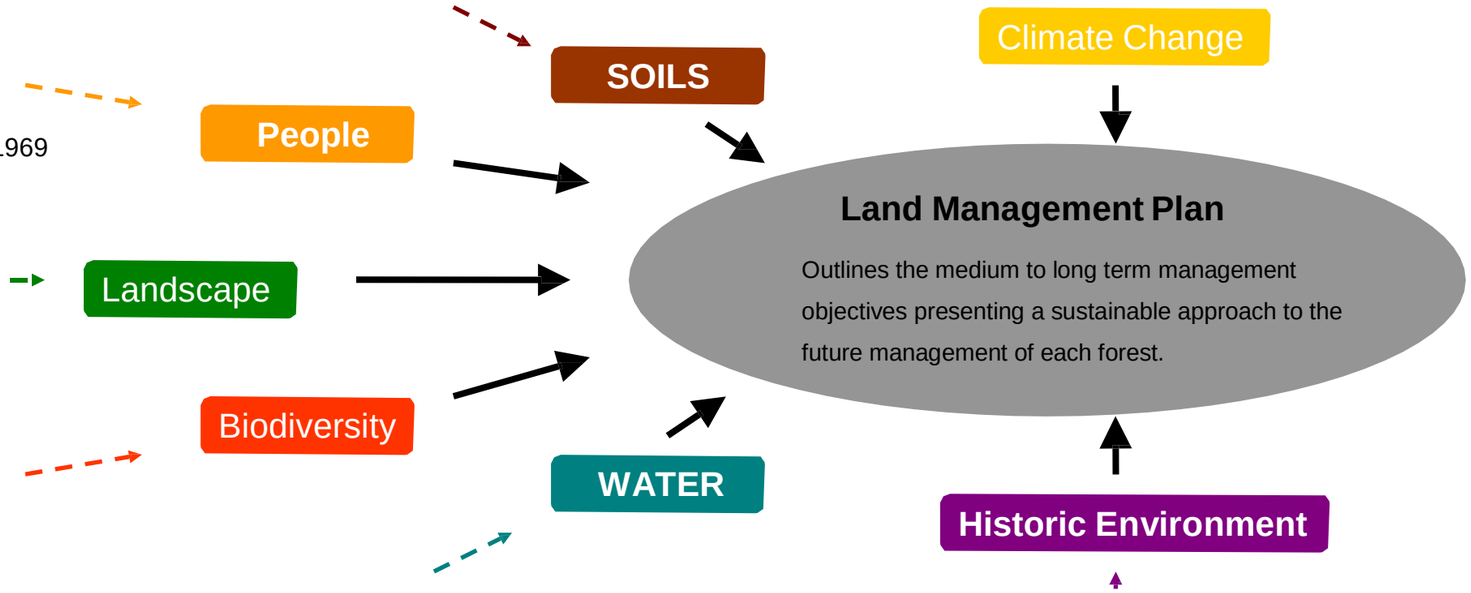
- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- Wildlife and Natural Environment (Scotland) Act 2011
- Conservation (Natural Habitats) Amendment (Scotland) Regulations 2007
- Nature Conservation (Scotland) Act 2004
- Deer (Scotland) Act 2003
- Protection of Badgers Act 1992
- EC Birds Directive 2009
- Convention on Biological Diversity 1992
- EU Habitats Directive 1992

- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- World Soil Charter
- European Soil Charter
- The Waste Management Licensing Regulations 1994
- Control of Pesticides Regulations 1986
- Integrated Pollution Prevention and Control Directive 2008
- Environmental Liability Directive 2004
- Control of Pesticides Regulations 1986
- The Scottish Soil Framework 2009

- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- EU Water Framework Directive 2000
- Water Environment and Water Services (Scotland) Act 2003
- Water Environment (Controlled Activities) (Scotland) Regulations 2005
- Water Environment (Diffuse Pollution) (Scotland) Regulations 2008
- Environmental Protection Act 1990

- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- The UN Framework Convention on Climate Change
- The Kyoto Protocol
- EC Directive 2003/87/EC
- Climate Change (Scotland) Act 2009

- UK Forestry Standard 2011
- UK Woodland Assurance Standard 2012
- UNESCO World Heritage Convention
- Ancient Monuments and Archaeological Areas Act 1979
- European Convention on the Protection of the Archaeological Heritage Valetta 1992
- Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997
- Treasure Trove Scotland



Raasay

Land Management Plan Brief

Vision

Raasay forest provides an opportunity to manage and enhance a designed landscape of great historical and cultural importance. The forest structure will be diversified to produce a more varied age structure and also divided in to smaller, windfirm coupes that will allow small volumes of timber and firewood to be harvested for use on the island. The future forest will enhance the visitor experience, specifically around archaeological and historical sites.

1. Project Background

Raasay

Landscape setting

Raasay is made up of 2 forest blocks: Inverarish in the south near the village and Brochel in the north. Inverarish is made up of steep sided glens that run up to Can nan Eun, it is highly visible from the ferry and within the village. The majority of Inverarish is a designed landscape that dates back to the 18th century. Brochel is a steep, terraced slope with an Easterly aspect; it is visible from the sea and also the popular tourist destination of Applecross.

Geology, soil, climate, slope stability

Inverarish

Complex geology with granite intrusions on the higher ground in the south produce an acidic soil that is mostly unflushed blanket bog, previously planted with Sitka spruce and lodgepole pine. Oskaig plantation is overlying gabbro producing a fertile basic brown earth soil. The remainder of the forest is underlaid with a mixture of micaceous and calcareous sandstones which has created typical brown earth in the inverarish glen with peaty surface water gleys to the north of this. The torridonian shales on Raasay contain the oldest fossilized plant remains yet found. A unique type of loam in the centre of the island indicates that Raasay may not have been glaciated and therefore shows a rare flora community.

The climate varies from warm and wet with minimal exposure below 100m altitude to cool, wet and moderately exposed above this. There are no slope stability issues in this block.

Brochel

This block is a mixture of sandstone, mudstone and siltstone with 3 basalt dykes running through it. This has created the terracing of the site due to the relative resistance to erosion and weathering. The soils are upland brown earth along the coastline. Above 100m the soil is unflushed blanket bog in the south and peaty surface water gley in the north. This whole site is currently felled and there is some regeneration of native broadleaves, mostly in the incised gullies that run down the site. The photo below shows how much tree regeneration can be achieved if grazing pressure is reduced.

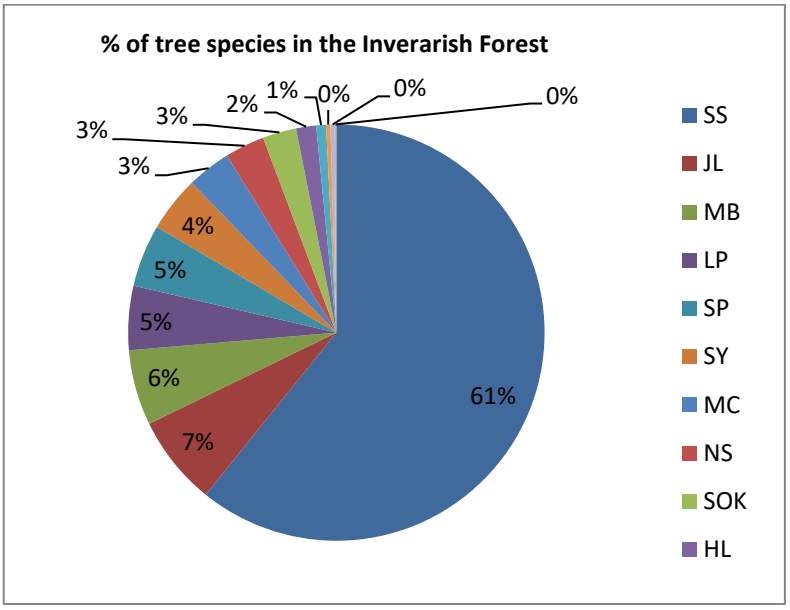
Small exclosures in Brochel with tree regeneration inside.

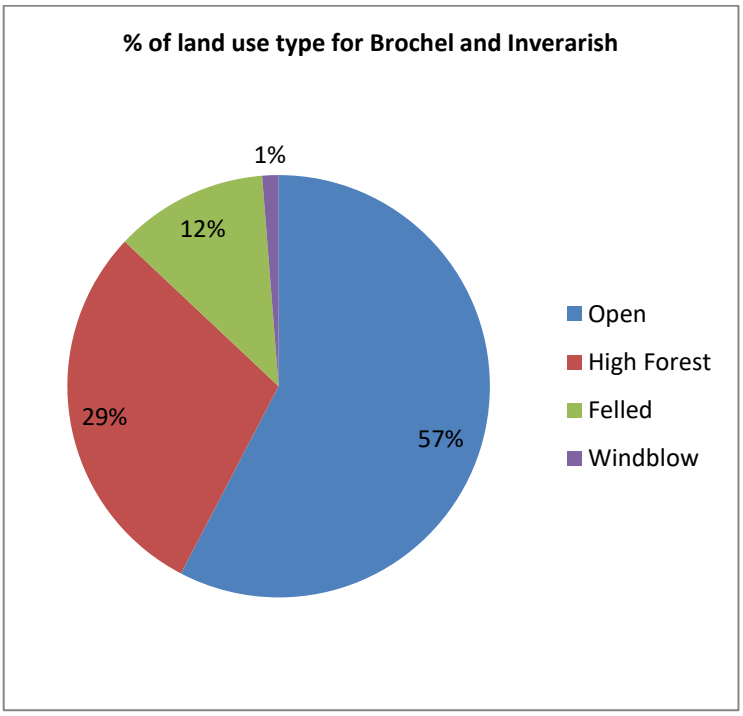
The climate varies from warm, moist and sheltered at the coast to cool, wet and moderately exposed above 100m altitude. There are no slope stability issues in this block.

Forest composition

Inverarish has a mixture of conifers and broadleaves on the west of the block with policy woodlands dating back to the 18th Century and more traditional productive conifer plantations in the east of the block at higher altitudes and poorer soils and climate. Since 2016 there has been considerable felling of larch due to infections of *Phytophthora ramorum*, this has left 33ha to be restocked. Restocking since 2013 has been with mixtures of native broadleaves and some productive conifers. Sitka spruce is the most prevalent species occupying 61% of the forest. The pie chart below shows the proportion of tree species in the Inverarish block.

Brochel was felled in 2001 and is mostly open with some patches of natural regeneration of native broadleaf. The land use of both Brochel and Inverarish combined is shown in the chart below.





2. Project Objectives /Outcomes

Design Inverarish forest for future small scale management to produce a sustainable resource of timber and firewood.

Long term management of deer and rabbit populations at levels to allow future woodland establishment.

Maintain and enhance the designed landscape associated with Raasay House and reduce the impact on the landscape in the future.

Remove larch from the forest to prevent further *Phytophthora ramorum* infections in larch.

Control Rhododendron to reduce the inoculum levels of *Phytophthora ramorum*.

Maintain current path network and provide additional informal paths where operations allow.

Maintain archaeological sites within the forest to allow visitors to understand the significance of the sites and improve the visitor experience of the sites.

Develop a Land Management Plan delivered in accordance with United Kingdom Forestry Standard (UKFS) and the UK Woodland Assurance Standard.

Develop a Land Management Plan which delivers against the relevant objectives of the Inverness, Ross and Skye District Strategic Plan and Scotland's National Forest Estate and Strategic Directions

2.1 Strategic objectives

- **Healthy**: Adapting the National Forest Estate to climate change and build resilience to extreme weather events by diversifying structure and species and creating more windfirm stands.
- **Productive**: Continue to produce a sustainable supply of timber and firewood to contribute to Scotland's economy and recognise the potential of the Estate to assist transition to a low carbon economy.
- **Treasured**: Investigate opportunities for partnership working with communities, government bodies and NGOs.
- **Access**: Help visitors to experience and enjoy the outdoor environment, encourage use of the estate for health benefits and outdoor learning.
- **Cared for**: Manage key habitats for white tailed eagle and the Raasay water vole.

3. Project Scope

3.1 Key features that will influence the development of management proposals

- Harvesting timber on Raasay to ship off the island is an expensive operation. The future harvesting will focus on producing timber for processing on the island and for firewood for the local community and the Raasay house wood chip boiler.
- The forest is known to provide habitat for Golden Eagle, Sea Eagle and herons. The forest will continue to be managed in a way to maintain and enhance these habitats. Raasay is also important as it supports a unique sub-species of the bank vole, darker and twice the weight of the mainland species called the Raasay vole.
- The current larch on the island is at risk of infection by *Phytophthora ramorum*. In order to remove this risk the larch will be felled in the first 5 years of the LMP. To reduce future infection in Rhododendron this will also be controlled by cutting and treating the stems, burning and spraying regrowth.
- There are many important archaeological sites within the forest that need to be maintained,

enhanced and in some cases protected. This includes the designed landscape which is related to the early policy woodlands associated with Raasay House.

- Inverarish is well used and enjoyed by the local community and visitors for recreation. The core path network will be maintained and opportunities for more informal paths will be taken if practical during operations.

- The Inverarish block is especially visible from the ferry and many viewpoints around and the village. The forest will be designed to have minimal impact on the landscape of the island in balance with the other objectives.

3.2 Known issues & opportunities to be investigated

The soil and climate of Raasay provide opportunities to replant with alternative tree species of conifers and broadleaves, this would be in keeping with the designed landscape associated with Raasay House.

Raasay is a popular tourist destination and as such the forest needs to be designed to minimise impact to landscape and recreation.

The risk of *Phytophthora ramorum* on the island means that larch needs to be felled and rhododendron needs to be controlled to manageable levels.

All operations on Raasay are expensive due to the additional cost of getting people and machinery on to the island. Harvesting and extracting timber from the island is an at cost operation, as such it is planned that future felling and restock of the forest would provide timber in small parcels that could be sawn for timber on the island, used for firewood supplies on the island and supply wood chips for a boiler due to be installed in Raasay House.

Because of the community and tourist benefits that the forest provides, the community of Raasay have shown interest in purchasing the forest from FES. The Land Management Plan will design the forest to be suitable for community management in the future.

Tree protection during establishment is an issue with rabbits and deer in Inverarish and sheep in Brochel. This may be improved with better control in the future and installing the correct grids to keep deer out and maintaining the perimeter deer fence. This will be increasingly important as more palatable species are used in the restocking.

In the areas clearfelled for Phytophthora ramorum infections there are some areas that have regenerated naturally with western hemlock and Sitka spruce. This will be managed to produce a future firewood resource. Forest management will take advantage of natural regeneration to restock clearfelled sites where possible and a seed source exists.

Where clearfell sites are highly visible they will be replanted in the following season to establish tree cover as quickly as possible.

4. **Inclusion** (Key documents to be produced)

- Management map
- Future habitat & species map
- Designed landscape map
- CSM6 maps
- Water map
- Deer management plan

- SSSI management plan
- Open habitat management prescriptions
- Landform analysis & plan visualisations
- Summary of activities
- EIA determination

5. Exclusion

- Detailed site specific management plans (work plan)

6. Project Organisation

LMP TEAM- responsible for undertaking the revision	
Ben Griffin	Planning Forester
Isabelle Destor	Environment Forester
Chris Nixon	Operations Forester
Mike Beveridge	Operations Forester
Russell Cooper	Wildlife Ranger Manager
Renate Jephcott	Landscape Architect
Ross MacMillan	Wildlife Ranger
Sally Phillips	Civil Engineer
Bruce Taylor	Recreation Forester
GOVERNANCE- Responsible for overall management of the project	
Project Sponsor	Doug Mitchell (Planning Manager)
Strategic direction	IRS FD Management Team
Forestry Commission Scotland	Agata Baranska (Development and Operations Advisor)
Silvicultural Advisor	Tor Stokes

7. Time frame

Community Scoping Meeting	May 2018
Internal and Community Meeting	June 2018
External Stakeholder and Community Consultation	June 2018-July 2018
Draft plan completion	August 2018
Detailed consultation internal and external.	August 2018
Review of commentary & amendments	August 2018
Internal review	August 2018
Submission of final plan	September 2018

8. Risks

- Plan takes longer to put together than September 2018.
- Stakeholders & community consultation is more complex and time consuming than anticipated.

Mitigation: If the above project milestones are not being met then this will be reported to the project sponsor. If the final deadline will not be met then an extension will be applied for from Forestry Commission Scotland however this will impact other Land Management Plans in the Forest District.

9. Stakeholders

Statutory Stakeholders:

Scottish Natural Heritage
Scottish Environmental Protection Agency
Highland Council Tree Officer
Skye District Salmon Fishery Board

Other Interest:

RSPB
Raasay Development Trust
Raasay Community Council
Grazing Committee
Raasay House Community Company
Raasay Heritage Trust
Scottish Water
Mountaineering Council for Scotland
Scottish and Southern Electricity
Historic Scotland
Skye Fisheries Trust

Neighbouring Landowners:

SGRPID
Raasay Development Trust

Appendix 4: Review of the previous plans 2004-2019

The objectives and management prescriptions within the former Forest design plans were influenced by the rationales of the Inverness, Ross and Skye Forest District Strategic Plan. The plan was extended with approval from Highland Conservancy until 2017.

The table below details a review against the stated FDP objectives.

Objective	Review against progress
Heritage Conserve and enhance the setting of the grade A listed Raasay House and the key features of the associated designed landscape. Protect and enhance the setting of archaeological features. Promote understanding of the significance of these features and pride in place.	Work has been undertaken to upgrade the cemetery road. Paths within the forest have been maintained Loch a Mhuilin has been opened up and rhododendron removed as part of the SPHN in 2015. All trees within the designed landscape have been retained. Dun borodale has also been opened up by the SPHN felling Additional interpretation has been installed during the plan period.
Social and recreation Develop and promote the recreation use of the forest and enhance the setting of recreation routes to help support the island tourist industry. Facilitate the use of locally grown timber on the island.	Paths in the forest have been maintained and upgraded to ensure safe use by the public. The path network has not been extended. FES policy is to maintain current paths but not take on liability for additional recreation routes. Views within the forest have been opened up mostly as a result of the larch felling required for SPHNs in 2015 and 2017. SPHN felling has provided timber for the local sawmill to produce products on the island. Additional interpretation boards were installed and sign posts and waymarkers installed on the main paths.
Landscape Retain the contrast between the wilder open hill and the sheltered managed policies identified as a key landscape feature in the designed landscape conservation report. Limit the visual intrusion of felling on sensitive views from the village and on the internal landscape. Improve the relationship between the forest and the broader landscape.	Felling has been undertaken of the Lodgepole pine and mature conifer south of the mine road. It has been partly restocked in 2015 with Sitka spruce. The coupe at the head of Inverarish burn has been felled and restocked in 2015 with oak and native broadleaves. The main landscape impact has been some large clearfells due to SPHNs served in 2015 and 2017 due to larch becoming infected by *Phytophthora ramorum*.
Timber The woodland should be actively managed to avoid wind damage while minimising financial losses. Reduce dependence on mainland markets.	Felling has focussed on removing dense conifer plantations and where wind damage had already occurred (2004-2005) More recent SPHN fellings have resulted in most timber leaving the island, however significant volume was sold to the community for firewood and larch logs were sold to the local sawmill.

Biodiversity Improve riparian habitats Increase species and structural diversity Protect the habitats of known priority species.	Riparian zones have been left unplanted or with variable spacing native broadleaves. Restock species have increased species diversity. Rhododendron clearance has been undertaken as a result of SPHNs served for larch and Rhododendron. This will continue to be sprayed to prevent re-growth. Policy woodlands have been retained for structural and species diversity. Known sites of priority species have been protected during operations such as sea eagle nests and heron nests.

Appendix 5: Consultation record

Consultee	Contact Name	Consulted	Contact	Contact sent/Response received /Issue raised	FES response
Statutory & regular consultees					
RSPB	Alison MacLennan	Email 27/6/2018	alison.maclennan@rspb.org.uk		
Scottish Natural Heritage	Sarah McGrory	Email 27/6/2018	Sarah.McGrory@snh.gov.uk		
Highland Council	Nick Richards	Email 27/6/2018	nick.richards@highland.gov.uk for the North Highland area (Caithness, Sutherland, Ross-shire, Skye and Lochalsh)		
Highland Council	Kirsty Cameron	Email 27/6/2018	kirsty.cameron@highland.gov.uk 01463 702504 (Archeology dept HC)		
Mountaineering Scotland	David Gibson	Email 27/6/2018	david@mountaineering.scot		
Scottish Water	John Stoddart	Email 27/6/2018	John.Stoddart@SCOTTISHWATER.CO.UK		
Scottish Environment Protection Agency	Aden McCorkell	Email 27/6/2018	planning.dingwall@sepa.org.uk		
Scottish and Southern Electricity	John Sharpe	Email 27/6/2018	John.sharpe@sse.com		
Skye District Salmon Fisheries Board	Jim Rennie	Email 27/6/2018	clerk@skyedsfb.org.uk		
CONFOR	Jamie Farquhar	Email 27/6/2018	Jbfarquhar@btinternet.com		

Neighbours & local community					
Raasay Commuity	N/A	Community Meetings Raasay Village Hall 3/5/18 And 12/6/18 Email 27/6/18		All comments summarised in list form (see separate record of meeting notes) Summary of email queries: 1. Impact of felling in the Home Loch area, could this be replanted sooner? 2. The restock map shows that there will be a large open south of the Home loch, could this be planted with an alder type woodland? 3. Could you provide replanting dates? 4. Will there be any restocking of Brochel or will this be done through natural regeneration? 5. Is there any evidence that planting broadleaf trees in Scotland is commercially successful? 6. Will the deer management plan propose specific ways of resolving the problem of deer damage? 7. Will there be a guaranteed supply of timber in the future? 8. Please keep key vistas open such as temptation hill	List shows response to each comment 1. Fallow period of 5 years is followed due to weevil populations and reduced use of pesticide 2. This has been altered to plant this area with willow, downy birch, rowan and alder. See new maps here. 3. Not due to point number 1, however fallow period will be a maximum of 5 years. 4. This will be using natural regeneration 5. Yes, this is possible if deer can be controlled- depending upon your definition of commercially successful. 6. Yes 7. There will be timber sold in the future and FES would prefer this to stay on the island, however these sales will be open market sales and it cannot be guaranteed that it would go any specific buyer. 8. These viewpoints will be maintained as open- see the future habitat and species showing this.

Appendix 6: Forestry & Water

The Scottish Environmental Protection Agency (SEPA) is implementing the Water Framework Directive (WFD) in Scotland. This is a legal framework for the protection, improvement and sustainable use of all water bodies in the environment across Europe. All significant water bodies across Scotland have been assessed for ecological and chemical status and catchment plans have been drawn up to ensure water bodies are brought up to an acceptable level. IRSFD lies entirely within the Scotland River Basin Management Plan Area and the LMP area is located within the Isle of Skye Coastal catchments.

FES recognise the importance that the proposed forest restructuring, felling, restocking etc., including the proposed road construction within this LMP, does not lead to any deterioration of the water bodies or water dependent areas within the plan area and any of the neighbouring water bodies.

There are no forestry related pressures on any of the water bodies.

The potential impact of future run of river hydro proposals will be assessed through individual planning applications submitted by the developer and are not included as part of the LMP.

Rhododendron ponticum is the only invasive non-native species (INNS) recorded within the plan area. These are only present at low levels and as such there are no plans to undertake control of these species, they will however be monitored and action will be taken if they start to threaten native species and habitats.

As standard all forestry and associated Civil Engineering (new road creation, bridges and culverts) operations must comply with the Forest and Water Guidelines 2011 and The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). The requirement for registration or SEPA authorisation for projects will be undertaken at the site planning (work plan) stage and this level of information is not detailed in the LMP. Routes for forest road creation are provided at a 1:20000 scale on Map 5: Management.

A link to further information on the Forest and Water Guidelines (2011) and the Water Environment (Controlled Activities) (Scotland) Regulations 2011 is located below;

Forestry Commission - UKFS - Water

SEPA Water Regulations

Map 7- Natural Hazards shows the areas where there could be potential flooding. This highlights the lower Inverarish burn near Mill Park. This area has flooded in the past when a natural debris dam has been breached causing a large volume of water to be released. To prevent future flooding, woody debris post harvesting will be removed from the any water courses on site.

The role of forestry and woodland in natural flood management is increasingly being recognised as a sustainable means of protection which can deliver multiple benefits. The plan has been developed in accordance with current best practice (UKFS). Clearfelling is being phased with an aim to gradually restructure the forest where possible. Felling coupe size has been considered to achieve an appropriate balance between operational practicality, environmental impact and cost effectiveness; this has included consideration of any potential downstream effects on flood risk.
A central aim of the restocking of the next rotation (outlined on **Map 6: Future habitat and species**) is to restore riparian woodland and manage these areas under minimum intervention post establishment. This will provide a long-term protective buffer along the significant watercourses and contribute to flood mitigation through increased hydraulic roughness and protection against siltation.

Opportunities for internal wetland and peatland habitat restoration are largely only revealed after felling, when landform is clear and hydrology can be accurately assessed. Therefore site level proposals of this nature are agreed at work plan stage with the Open Habitat Ecologist and the FD Environment team. Sites for peatland restoration will be assessed for restoration suitability using the criteria as set out in the FC Practice Guide – Deciding future management
options for afforested deep peatland (Forestry Commission, 2015).

Historic drainage which does not meet UKFS will be addressed as following;

- During forest road maintenance and upgrade operations the associated forest road drainage will be assessed and where necessary realigned to ensure that water is discharged slowly into buffer areas.
- At the restocking stage active forest drains which do not meet UKFS standard will be remediated to meet the current standard.
- At the restocking stage inactive (blocked) forest drains, which did not meet UKFS standard, will be left to revegetate.

At the restocking stage consideration will also be given to remediate any forest drains which flow directly into watercourses, where practicable and reasonable to do so.

Branches and tree tops (lop and top) produced by felling and thinning operations are not considered as waste in terms of this plan, because the material will be incorporated in the brash mat to aid machine traction and flotation thus protecting fragile soils. Additionally material will be retained on site to achieve deadwood objectives. Other branches and material left after harvesting contribute to the

functional ecology of the woodland and are an important feature of nutrient recycling that will increase biodiversity and may assist future productive woodland establishment. Where the felling to recycle of non-native species occurs the arisings have subsequent use including protecting vulnerable native tree regeneration from grazing mammals and again, contributing to the functional ecology of the woodland. On steep ground sites where whole tree harvesting systems are implemented techniques for the utilisation of residues will be explored.

Appendix 7 – Summary of activities

Table 1 – Clearfell (2019 -2029)
The table below outlines all of the clearfelling as illustrated on the CSM6 Management Map.

Phase	Fell Year	Coupe No	Area (ha)	Volume (m3)	Notes
1	2023	20004	4.31	2080	Larch to be removed
1	2023	20040	1.04	334	LP and SP heavily infected with DNB
2	2025	20022	6.88	4683	SS and NS may be at risk of windblow
2	2024	20038	2.70	1971	SS /LP with substantial area of windblow

Total area of clearfell over plan period: **14.93 ha**
Total volume production over the plan period: **9068m^3**

Species	Area to be felled (ha)
Larch	4.3
Lodgepole pine	1.0
Norway Spruce	0.1
Scots pine	0.2
Sitka spruce	9.1
western hemlock	0.1
Grand Total	**14.8**

Table 2: Restocking (2019 – 2029)

The table below outlines all of the restock planting as illustrated on the CSM6 Establishment Map.

Phase	Planting Year	Number	Area (ha)	Species 1	Species 2	Type of restocking
1	2021	20052c	1.1	Beech	Oak	Replanting
1	2021	20052a	2.01	Norway spruce	Oak	Replanting
1	2021	20054c	1.81	Mixed BLs	Mixed Conifers	Replanting
1	2021	20054b	4.07	Sitka spruce	Douglas fir	Replanting
1	2021	20051b	3.63	Douglas fir	Sitka spruce	Replanting
1	2021	20053a	3.1	Douglas fir		Replanting
1	2021	20051c	1.16	Common Alder	Willow	Replanting
2	2027	20004a	3.69	Douglas fir		Replanting
2	2027	20040a	1.04	Beech	Mixed BLs	Replanting

Total area of restock over plan period: **21.61 ha (16.4ha Conifer, 5.21ha Broadleaf)**

Table 3: Natural Regeneration

The table below outlines all land allocated for natural regeneration as illustrated on the CSM6 Establishment Map. Sites designated for natural regeneration will assessed on a 3 – 5 Year cycle.

Phase	Establishment Year	Coupe no	Area	Species 1	Species 2	Type of

						restocking
1	2021	20030a	93.89	Mixed BLs		Natural Regeneration
1	2021	20013a	17.1	Sitka spruce	Mixed BLs	Natural Regeneration

Total area of natural regeneration: 111ha

Table 4: Forest road upgrade and new roads

The table below outlines the proposed new forest road as illustrated on the CSM6 Management Map.

Phase	Name	Length (m)	Operation	Year
Phase 1	Church Wood	120	New Road	2020/21

Table 5: Summary of activities in the first phase (2019-2025)

District team	Activity	Area/ Location	Indicative date
Environment	Natural Regeneration Monitoring	94 ha	2021
	Species monitoring & surveying – Black Grouse, Juniper, Scottish Crossbill, Crested tit, watervole etc	Clearfell coupes	As per clearfell programme
Recreation & Tourism	Create new rough walking path around Home Loch in partnership with community.	Loch a Mhuillin	2020
Deer Management	Increased Deer culling, focussed on reducing overall deer population in Inverarish to 5 deer per 100ha and Brochel to 2 deer per 100ha.	Whole Plan area	2019
	Extend deer fencing around No 1 mine with pedestrian and vehicle gate on forest road to avoid the deer grid that is not functioning properly.	Forest Entrance nr Mine No1	2019
	1700m of stock fencing along lower path of Brochel to prevent sheep access into the block.	1700m	2019
	Look for opportunities with local community to decrease the deer population around Inverarish.	Inverarish Block	2019
	Deer fence restock coupe	20052a,b and c	2021
Civil Engineering	Grid over Mine No 2 entrance to prevent access	Mine No 2	2019
	Fence around Mine No 2 to make safe	Mine No 2	2021
	See Table 4 above, new spur road to access coupe 20004	Church wood/120m	2020/21
Harvesting and Restock Operations	See coupe summaries above	Whole plan area	In alignment with LMP sequence
Planning	Prior notification for new road building if required.	Church Wood	2020
	Plant health monitoring – DNB surveys	Pine sub-compartments	Every 3rd year
	SDA surveys of restocked coupes	Restocks coupes at year 1 and 5	Sept-March Annually

Appendix 7a – Coupe summary

1.1 Table of Clearfelling (Phase 1)											
Coupe No.	**Total Area (Ha)**	**Spp by Ha (SS)**	**Spp by Ha (SP)**	**Spp by Ha (LP)**	**Spp by Ha (NS)**	**Spp by Ha (Larch)**	**Spp by Ha (WH)**	**Spp by Ha (BLeaf)**	**Open Land by Ha**	**Restock Year**	**Monitoring Comments**
20004	4.31					4.31				2028	
20040	1.05		0.2	0.84		0.01				2028	
20055	0.54					0.54				2026	Restocked via natural regeneration
20012	0.94	0.7					0.2			2026	Restocked via natural regeneration
Totals	5.36		0.2	0.84		4.32					
1.2 Table of Clearfelling (Phase 2)											
20022	6.88	6.74			0.14					2030	
20038	4.13	2.41		0.23			0.11		1.38	2034	1.38ha of windblow which is treated as open for the production forecast
Totals	11.01	9.15		0.23	0.14		0.11		1.38		

1.3 Table of CCF Felling (Phase 1)												
Coupe No.	**Total Area (Ha)**	**Volume (M^3)**	**Spp by Ha (SS)**	**Spp by Ha (SP)**	**Spp by Ha (LP)**	**Spp by Ha (NS)**	**Spp by Ha (Larch)**	**Spp by Ha (X con)**	**Spp by Ha (BLeaf)**	**Open Land by Ha**	**Silv.Method**	**Monitoring Comments**
Totals												
1.4 Table of CCF Felling (Phase 2)												
Totals												

Appendix 7a – Coupe summary

1.5 Table of Thinning (Phase 1 & 2)						
Coupe No.	**Total Area (Ha)**	**Species**	**Thin-able Area (Ha)**	**Prescription for Thinning**	**Final Thinned Area (Ha)**	**Final Vol Removed**	**Monitoring Comments**
20005	1.3	Sitka spruce	1.3	First thin, racking and matrix, standard intermediate thinning	1.3	135	
20014	2	Sitka spruce	2	First thin, racking and matrix, standard intermediate thinning	2	214	
20016	1.2	Sitka spruce	1.2	First thin, racking and matrix, standard intermediate thinning	1.2	129	
20017	1.3	Sitka spruce	1.3	First thin, racking and matrix, standard intermediate thinning	1.3	139	
20035	4.4	Sitka spruce/ Norway Spruce	4.4	Standard Intermediate thinning	4.4	207	
20031	1.1	Sitka spruce/ Norway spruce	1.1	Standard Intermediate thinning	1.1	108	
20032	5.8	Sitka spruce/ Lodgepole pine	5.8	Standard Intermediate thinning	5.8	234	
20036	1.9	Sitka spruce	1.9	Standard Intermediate thinning, poor stocking	1.9	202	
20037	2.1	Sitka spruce/ Lodgepole pine/ western hemlock	2.1	Standard Intermediate thinning	2.1	98	
20045	0.6	Sitka spruce	0.6	Standard Intermediate thinning	0.6	61	
20046	2.8	Sitka spruce	2.8	Standard Intermediate thinning, poor stocking	2.8	294	
20047	2.1	Sitka spruce	2.1	Standard Intermediate thinning, poor stocking	2.1	219	
20034	1	Scots pine	1	Light thinning	1	21	

1.6 Table of Total Felling for Approved Plan Period											
Method	**Total Area (Ha)**	**Total Volume (M^3)**	**Spp by Ha (SS)**	**Spp by Ha (SP)**	**Spp by Ha (LP)**	**Spp by Ha (NS)**	**Spp by Ha (Larch)**	**Spp by Ha (X con)**	**Spp by Ha (BLeaf)**	**Open Land by Ha**	**Comments**
Clearfell	**16.37**	**5645**	**9.15**	**0.2**	**1.07**	**0.14**	**4.32**	**0.11**	**0**	**1.38**	
Thinning	**27.9**	**2040**	**24.7**	**0.97**	**0.25**	**1.49**	**0**	**0.48**	**0**	**0**	
CCF											
			Grand Total of Felled Timber Proposed for Plan Period								

1.7 Table of Restocking													
Coupe No.	**Total Area (Ha)**	**SS (Ha)**	**LP (Ha)**	**SP (Ha)**	**NS (Ha)**	**Larch (Ha)**	**Other Con. (Ha)**	**Native Mixed B/Leaf**	**Other B/Leaf**	**Open (Ha)**	**Year**	**Restock Method & Density (Restock/Nat Regen/Alt Area/Coppice/Open)**	**Monitoring Comments (Including any reason not to restock)**
20052c	1.1							0.55	0.55		2021	BE/OK line mixture restock, tubed	
20052a	2.01				1			1.01			2021	NS/OK line mixture restock, oak tubed	
20054c	1.81						0.91	0.90			2021	MB/MC 50/50 blocky mixture	
20054b	4.07	2.03					2.04				2021	SS/DF 50/50 line mixture restocking	

20051b	3.63	1.81					1.82				2021	SS/DF 50/50 line mixture restocking	
20053a	3.1						3.1				2021	DF restocking	
20051c	1.16							1.16			2021	Alder/ willow 50/50 intimate mixture	
20013a	17.1	6						6		5.1	2025	Natural regeneration of SS/MB with approximately 30% open	
20040a	1.04							0.52	0.52		2027	BE/MB intimate mixture restock	
20030a	93.89							50		43.89	2029	Natural regeneration of mixed broadleaves in Brochel with approximately 50% open space.	
20012a	0.94						0.50	0.44			2026	Natural regeneration around power house	
20055a	0.54						0.54				2026	Natural regeneration around the hydro scheme intake	

1.8 Table of New Planting / woodland creation

Coupe No.	Total Area (Ha)	SS (Ha)	LP (Ha)	SP (Ha)	NS (Ha)	Larch (Ha)	Other Con. (Ha)	Native Mixed B/Leaf	Other B/Leaf	Open (Ha)	Year	Planting Method & Density (Planting/Nat Regen)	Monitoring Comments

1.9 Table of Civil Engineering

Proposed Activity (Road/Quarry)	OS Grid Reference	Forest/Coupe	Description (Length/Area/Construction)	Monitoring Comments
Road	NG55633656	20004	120m long new road required to allow access to harvest and extract larch volume see Map 15 – Felling Approval Map.	

Other Tree Felling in Exceptional Circumstances

FLS will normally seek to map and identify all planned tree felling in advance through the LMP process.

However, there are some circumstances requiring small scale tree felling where this may not be possible and where it may be impractical to apply for a separate felling permission due to the risks or impacts of delaying the felling.

Felling permission is therefore sought for the LMP approval period to cover the following circumstances:

- Individual trees, rows of trees or small groups of trees that are impacting on important infrastructure (as defined below*), either because they are now encroaching on or have been destabilised or made unsafe by wind, physical damage, or impeded drainage.

*Infrastructure includes forest roads, footpaths, access (vehicle, cycle, horse walking) routes, buildings, utilities and services, and drains.

The maximum volume of felling in exceptional circumstances covered by this approval is 40 cubic metres per Land Management Plan per calendar year.

A record of the volume felled in this way is detailed below will be considered during the five year Land Management Plan review:

1.10 Table of Other Felling				
Date	**Forest/Coupe**	**OS NGR**	**Volume**	**Comments**

Woodland Management in Visitor Zones

Visitor Zones have been identified in areas where FLS encourage and manage access or where the woodland managed by FLS interacts with popular visitor sites or access routes. These are shown on maps 11a and 11b.

In these areas, single trees or small groups of trees will be removed when necessary to protect facilities, infrastructure and trails, or to enhance the setting of features, or to maintain existing views.

Woodland in these zones will also be thinned, or trees re-spaced, for safety reasons (including to increase visibility to ensure that sites are welcoming and feel safe) and where it is necessary to enhance the experience of the forest setting, through the development of large trees, or preferential removal of trees to favour a particular species.

Appendix 7a – Coupe summary

Thinning

Any thinning will normally be carried out at, or below, the level of marginal thinning intensity (i.e. removing no more than 70% of the maximum MAI, or YC, per year). Higher intensities (no more than 140 % of maximum MAI, or YC, per year) may be applied where thinning has been delayed, larger tree sizes are being sought or as part of a LISS prescription. In all cases work plans will define the detailed thinning prescription before work is carried out and operations will be monitored by checking pre and post thinning basal areas for the key crop components.

Appendix 8: Tolerance Table

	Adjustment to felling coupe boundaries	Timing of restocking	Change to species	Wind throw or environmental response	Adjustment to road lines
Scottish Forestry's approval not normally required (record and notify SF)	<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 (allowing for changes to facilitate Ancient Woodland policy).		Departures of up to 60m from the centre of the roadline
Approval by exchange of letters and map	10-15% of coupe size	5 years +	Change of coupe objective likely to be consistent with current policy (e.g. from productive to open, open to native species).	Up to 5 ha	Departures of greater than 60m from the centre of the roadline
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,	More than 5 ha	As above, depending on sensitivity

Appendix 9: Management prescriptions on the National Forest Estate- Native Woodland

Soil Group	Soil Types Relevant to IRS FD	Characteristics	Aim*	Species Prescription for Habitat Types Predominating in IRS Forest District
1	Brown Earths	Soils with typically good aeration and drainage throughout the profile and well-incorporated organic matter. These soils are mainly * fertile and allow deep rooting. Likely vegetation to be encountered includes fine grasses, holcus, bracken, bramble, foxgloves, violets and a diverse range of herbs. * However Podzolic Brown earths where nutrients have been leached are "Very Poor"	NW	W19 Juniper wood with sorrel on 1, 1u, 1z and 1b from sheltered sites up to sub alpine areas with DAMS < 22 W18 Scots pine with heather on 1z in cool to warm with DAMS < 18 W11 Upland oak-birch with bluebell on 1, 1u and 1z in cool to warm with DAMS < 18
3 & 4	Podzols & Ironpan Soils	Developed on Acid * soils with high rainfall where nutrients are flushed into the lower horizons of the soil profile. Frequently induration or an impenetrable pan will prevent good drainage, resulting in a need to break this impediment with suitable cultivation that will allow freer draining and greater rooting depth. Vegetation common to these soils are ericaceous plants, grasses including deschampsia flexuosa, nardus, carex and molinia. Light bracken and feather mosses may also be present. * NOT fertile soils	NW RW	W18 Scots pine with heather on 3, 3m, 4, 4z and 4b Not in Sub-alpine climate, (Cool to Warm) DAMS < 18. W19 juniper wood with sorrel on 3 and 4b Possible up to Sub-alpine zone W17 Upland oak-birch with blaeberry on 3s and 3ms Mainly in Lower Cool to warm climate zone. DAMS < 18.
5	Groundwater Gleys	Dominant vegetation is commonly Deschampsia caespitosa, Holcus, salix spp and herbs. Occuring where a shallow water table causes waterlogging and therefore subject to compaction and poorly oxygenated. The soil is permeable but is affected by a fluctuating ground-water table. Moderate nutrient availability.	NW RW	W7 Alder-ash with yellow pimpernel on 5 and 5f Cool to Warm. Sheltered to Moderatedly exposed. (DAMS <16)
6	Peaty Gleys	Very Poor to medium nutritional availability, these soils are indicated by Molinia, Calluna and Erica spp, with sphagnum prevalent in the North and West. High winter water table can be expected and good drainage will be required to achieve best results.	NW	W18 Scots pine with heather on 6z "moist" to "fairly dry" W4 Birch with purple moor-grass on 6 and 6b. Cool to Warm. DAMS < 18.
7	Surface Water Gleys	Differing from groundwater gleys in that waterlogging is caused not by a high water table, but by induration preventing adequate drainage leading to a seasonally fluctuating water table. Resulting anaerobic conditions will restrict rooting. Indicative vegetation includes Holcus, Juncus, Nardus and Deschampsia *caespitosa*. Again poor to moderate nutritional availability can be expected. Drainage will be required along with micro site cultivation such as mounding.	NW	W11 Upland oak-birch with bluebell on 7b W18 Scots pine with heather on 7z possibly on margins leading to drier knolls. W7 Alder-ash with yellow pimpernel on 7, 7b and 7z Cool to Warm. Sheltered to Moderatedly exposed. (DAMS <16)
8	Flushed Basin Bogs	Juncus spp are prevalent. A shallower peat type, nutrient rich and containing some mineral grains. Peat is black in colour.	NW	W4 Birch with purple moor-grass on 8b and 8c.
9	Molinia Bogs	Often existing on hillsides where flushing is more pronounced. Moderate nutrition available.	NW	W4 Birch with purple moor-grass on 9a, 9b, 9c and 9d suitable for the transitional areas at the margins between productive forest blocks and peatland restoration sites.
			OG	9e Trichophorum, Calluna, Eriophorum, Molinia Bogs will not be planted or restocked - restoration of peatland.
10	Unflushed Flat or Raised Bogs	Sphagnum dominated bogs, formed as peat levels rose to form a dome, reliant on precipitation for moisture and nutrients. Mineral grains are absent and the peat is reddish-brown and tends to be deeper.	OG	10b Upland flat or raised bogs – priority areas for peat restoration.
11	Unflushed Blanket Bogs	Calluna, Eriophorum, Trichophorum Bogs including the hill peats located on upland plateaux and hillsides deeply dissected by burns.	OG	11a A rare peatland type mainly restricted to the driest eastern uplands
			OG	11b,c,d Unflushed blanket bogs - priority areas for peatland restoration
14	Eroded Bogs	Very poor nutritional status characterised by bog asphodel, deer grass, bog cotton etc. Can be dominated by either deep and frequent eroded areas (haggs) or frequent pools of standing water (flows). Very deep peat.	OG	14 & 14h Hagged bogs – unsuitable for forestry or woodland – peatland habitat
			OG	14w Pooled bogs – common across Northern Scotland forming the 'Flows' – peatland.
15	Littoral Soils	Formed on coastal sands and shingles, such as the dunes found at Morrich More near Tain. The category is split into shingle (15s), dunes (15d) and then sands with varying water table depths (15e,w,g,i). These sands can be distinguished by various levels of mottling. Coastal grasses and heathland plants predominate.	NW	W16 Lowland oak-birch with blueberry limited to "Warm" climate

*NW – Native Woodland Expansion / RW – Riparian Woodland Expansion / OG – Managed Open Ground e.g. peatland restoration

NB – These prescriptions must be adopted within the local context set out in the main body of this FDP. Climate must be included as a determining factor in final species selection.

- Planting will generally become a mosaic of the woodland types recommended above, dictated by local conditions and agreed after "75% Site Completion Visits"
- Particular note should be made of the inadvisability of planting the peatland types 10 – 14 that may predominate on marginal FD sites
- No native woodland type likely to be suitable on sites wetter than SMR "Very Moist" and veg indicating SNR <4.5
- Due to Chalara fraxinea no new planting / restocking of Ash will be undertaken, this will be reviewd with new guidance from Forestry Commission Plant Health.
- Natural regeneration of Ash will be accepted where it occurs.

References:

Kennedy F (2002) *The Identification of Soils for Forest Management*, Edinburgh: HMSO

Pyatt, G; Ray, D; Fletcher, J (2001) *An Ecological Site Classification for Forestry in Great Britain; Bulletin 124*, Edinburgh: FCS

Rodwell J.S. and Paterson G.S. (1994) *Creating New Native Woodlands; Bulletin 112*, London: HMSO

Thompson, R (2009) *Management of PAWS on the National Forest Estate in Scotland*, Edinburgh: FCS

Appendix 10: Management prescriptions on the National Forest Estate - Productive Forestry

Soil Group	Soil Types Relevant to IRS FD	Characteristics	Species Prescription for Commercial Restocking
1	Brown Earths	Soils with typically good aeration and drainage throughout the profile and well-incorporated organic matter. These soils range from very rich to poor and usually allow deep rooting. Likely vegetation to be encountered includes broad leaved grasses, (e.g. Yorkshire fog, Bent), bracken, bramble, foxgloves, violets and a diverse range of herbs.	Douglas Fir on Poor (must be without heather) to Rich fertility with Moist to Dry soil moisture. Desirable intimate or group mixture; European Larch*, Norway Spruce or Western Red Cedar. Generally in sheltered areas with sufficient rainfall Sitka or Norway Spruce on Poor to Medium fertility with Wet to Fresh soil moisture. Desirable intimate or group mixture; each other or European/Hybrid Larch Scot's Pine in Podzolised areas on Poor to Medium fertility with Moist to Dry soil moisture. Desirable intimate or group mixture; Japanese/Hybrid or European Larch* European Larch on Medium to Rich fertility with moist to Moderately Dry soil moisture. Desirable intimate or group mixture; Scot's Pine or Douglas Fir Japanese/Hybrid Larch* on Poor to Medium fertility with Very Moist to Fresh moisture. Desirable intimate or group mixture; Scot's Pine Sycamore on Medium to Rich fertility with Moist to Fresh soil moisture. Desirable intimate mixture: Ash† or European Larch* Where improved climatic conditions allow: Sessile Oak on Medium to Rich fertility with Moist to Slightly Dry soil moisture. Pedunculate Oak (Local seed source if possible) on Medium to Rich with Very Moist to Fresh soil moisture. Desirable intimate/group or blocky mixtures include; Norway Spruce, European Larch*, Western Red Cedar, Silver Birch or Ash Silver Birch on Poor to Medium with Very Moist to Fresh soil moisture. Desirable intimate or group mixture: Oak or Scot's Pine *Ash on Rich fertility with moist to Fresh soil moisture and less acidic sites. Mix in groups with; Sycamore, Oak or Beech
3	Podzols	Develop on unfertile acid soils with high rainfall where nutrients are flushed into the lower horizons of the soil profile. Very poor fertility. Induration or an impenetrable pan will prevent good drainage, resulting in a need to break this impediment with suitable cultivation that will allow freer draining and greater rooting depth. Vegetation common to these soils are ericaceous plants, grasses including Wavy hair, Matt and Purple moor grass. Light bracken and feather mosses may also be present.	Scot's Pine with Moist to Dry soil moisture. Desirable mixture; intimate mixture with Hybrid Larch* Sitka Spruce with Wet to Moist soil moisture. Mix with; Lodgepole Pine in wetter areas or Japanese/Hybrid Larch* Japanese/Hybrid Larch* with Very Moist to Fresh soil moisture Where improved climatic conditions allow: Sessile Oak (not on 3m) with Moist to Fresh soil moisture. Desirable mixture; Hybrid Larch, Scot's Pine or limited Norway Spruce
4	Ironpans	Develop on free draining acid soils with high rainfall. The transfer of aluminium and iron in solution down through the soil profile develops an ironpan that is impervious to water and root penetration. Breaking of the ironpan is desirable, so as to allow drainage of the site and a potential increase in soil rooting volume and nutrient availability. Vegetation and fertility is similar to that of Podzols above	Scot's Pine with Moist to Dry soil moisture. Desirable mixture; Japanese/Hybrid Larch Japanese/Hybrid Larch* with Very Moist to Fresh soil moisture. Desirable mixture; Scot's Pine Lodgepole Pine in elevated areas with Wet to Fresh soil moisture Sitka or Norway Spruce (4 & 4b) with Wet to Fresh soil moisture. Desirable intimate or group mixture; Lodgepole Pine in wetter areas or Japanese/Hybrid Larch or Scot's Pine. Sycamore (4b only) with Moist to Fresh soil moisture. Consider intimate mixture with Japanese/Hybrid Larch* Cultivation that includes amelioration of the ironpan will be considered.
5	Groundwater Gleys	Dominant vegetation is commonly Tufted hair grass, Willows and herbs. Occurring where a shallow water table causes waterlogging and therefore subject to compaction and poorly oxygenated. The soil is permeable but is affected by a fluctuating ground-water table. Moderate nutrient availability.	These areas are generally presumed to be open or riparian zones.. Where rooting depth is adequate: Sitka or Norway Spruce on Medium to Rich fertility with Very Wet to Moist soil moisture. Consider adding blocks of Downy Birch and Alder Intimate mix of Downy Birch and Common Alder on Poor fertility with Very Wet to Moist soil moisture
6	Peaty Gleys	Very Poor to Rich nutritional availability, these soils are indicated by Purple moor grass, Calluna and Cross-leaved heath, with sphagnum prevalent in the North and West. High winter water table can be expected and good drainage will be required to achieve best results.	Sitka Spruce on Poor to Medium fertility with Wet to Fresh moisture. Experience in IRS FD suggests this crop will rarely establish as a pure stand without fertiliser input. Intimate mix with Lodgepole Pine in wetter and poorer areas or with Japanese/Hybrid Larch* in more Pozolised areas. Consider adding blocks of Downy Birch Downy Birch on Poor to Medium fertility with Very Moist to Fresh soil moisture

7	Surface Water Gleys	Differing from groundwater gleys in that waterlogging is caused not by a high water table, but by lateral surface-water movement through the soil profile developing a seasonally fluctuating water table. Resulting anaerobic conditions will restrict rooting. Indicative vegetation includes Tussock grass and Creeping Buttercup. Again poor to moderate nutritional availability can be expected. Drainage will be required along with micro site cultivation such as mounding.	Sitka or Norway Spruce on Medium fertility with Wet to Fresh soil moisture. Desirable mixture; each other, Japanese/Hybrid Larch* or with Lodgepole Pine in wetter poorer areas Where improved climatic conditions allow: Pedunculate Oak on 7b Medium to Rich fertility with Moist to Fresh soil moisture. Desirable group or blocky mixture; Norway Spruce
8	Flushed Basin Bogs	Rushes are prevalent. A shallower peat type, nutrient rich and containing some mineral grains. Peat is black in colour.	Please note that there is a presumption against planting areas of deep peats where reasonable productive growth rates are not achievable due to intact hydrology and/or challenging climate. Forestry Commission Scotland has developed guidelines for dealing with these soil types. Where areas of deeper peat are encountered in intimate mosaic with more favourable soils Sitka Spruce (QSS) will be favoured in a mixture with Lodgepole Pine of disease resistant provenance or hybrid larch. On these more nutritionally challenged sites a proportion (up to 20%) of soil improving species such as birch will be considered.
9	Molinia Bogs	Often existing on hillsides where flushing is more pronounced. Moderate nutrition available.	
10	Unflushed Flat or Raised Bogs	Sphagnum Moss dominated bogs, formed as peat levels rose to form a dome, reliant on precipitation for moisture and nutrients. Mineral grains are absent and the peat is reddish-brown and tends to be deeper.	
11	Unflushed Blanket Bogs	Calluna, cotton-grass, deer grass bogs including the hill peats located on upland plateaux and hillsides deeply dissected by burns.	
14	Eroded Bogs	Very poor nutritional status characterised by bog asphodel, deer grass, bog cotton etc. Can be dominated by either deep and frequent eroded areas (haggs) or frequent pools of standing water (flows). Very deep peat.	
15	Littoral Soils	Formed on coastal sands and shingles, such as the dunes found at Morrich More near Tain. The category is split into shingle (15s), dunes (15d) and then sands with varying water table depths (15e,w,g,i). These sands can be distinguished by various levels of mottling. Coastal grasses and heathland plants predominate.	Corsican cannot be considered due to the current DNB moratorium on planting therefore Scot's Pine either pure or in intimate, group or blocky mixture with Birch. Downy/Silver Birch depending on climate

NB – These prescriptions must be adopted within the local context set out in the main body of this Forest Design Plan. Climate, (along with soils) must be included as **the** determining factor in final species selection.

- Planting will generally become a mosaic of the species recommended above and will include areas of non-productive open ground and broadleaf riparian zones. Species choide will be dictated by local conditions and agreed after site visits by management staff.
- No commercial forestry type likely to be suitable on sites wetter than SMR "Very Moist" and vegetation indicating SNR <4.5
- Origin for SS is QSS. However where conditions are sub-alpine then ASS is preferred
- Mixed stands mean that each species occupies at least 20% of the canopy. Blocky areas should aim to cover the area that 3-4 mature trees would cover. Mixtures may need management to favour one or more species. Intimate mixtures of broadleaves with Sitka Spruce or Scot's Pine will normally result in the conifer's dominating overtime so planitng in blocks is often the better option.
- * Due to current plant health restrictions there will be no planting of Larch species, Ash or Lodge pole pine (with the exemption of Alaskan provenance Lodge pole pine), this will reviewed throughout the life of the plan in accordance with industry best practice.
- For new plantations of productive conifers, UKWAs recquirement section 3.3.2 (proportions of different species depending on site suitability) will be met.

References:

Kennedy F (2002) *The Identification of Soils for Forest Management,* Edinburgh: HMSO

Pyatt, G; Ray, D; Fletcher, J (2001) *An Ecological Site Classification for Forestry in Great Britain; Bulletin 124,* Edinburgh: FCS

Savill, P.S. (1991) The Silviculture of Trees used in British Forestry, Oxfordshire: CAB International

Mason, B (2006) Managing Mixed Stands of Conifers and Broadleaves in Upland Forests of Britain, Information Note, Edinburgh: FCS

Wilson, S (2011) Using alternative conifer species for productive forestry in Scotland, Glasgow: Bell & Bain Ltd

http://www.forestry.gov.uk/fr/INFD-8CVE4D

Appendix 11: Restock Prescriptions

Legend	Species	Prescription
	Sitka spruce	100% Sitka spruce planted at 2700 stems per hectare (sph) in order to achieve 2500 sph at year 5
	Sitka spruce/ Lodgepole pine	This is Sitka spruce and Lodgepole pine planted at 2700sph in order to achieve 2500 sph at year 5. They will be planted in row mixtures of 3 and 3, 50/50 mix. This will be applied to sites where heather is prevalent (drier heath sites). There will also may be a hand application of Phosphate fertiliser and possible nitrogen if required.
	Sitka spruce/ (Larch, Douglas fir, other conifers)	This is a resilient mixture planted at 2700sph to achieve 2500 sph at year 5. This will be planted 3:3 rows. This will be planted on ground that is accessible for thinning machines and where the windblow risk is low. This allows thinning to be undertaken in the future to improve the final crop trees and select the most appropriate species, the mixed species can have a benefit on the yield and it also spreads the risk in case of pathogens/ climate change. Larch / Sitka spruce mixture have been planted before and are establishing well. Larch is currently not planted by FES due to the risk of infection from Phytophthora however this is specified for future restocking in case the situation changes.
	Beech	Pure Beech to create an edge of mature broadleaves.
	Conifer	Productive conifer of alternative species such as Grand fir or Pacific Silver fir planted 100% at 2700 sph in order to achieve 2500 sph at year 5.
	Broadleaves (none productive)	Planting of mixed native broadleaves at 1100 sph (none productive). Along riparian zones this will mostly be in groups with open space surrounding.
	Beech/ Broadleaves (none productive)	This will be beech mixed with native broadleaves. These may be planted in tubes to prevent deer damage. These will be planted in intimate mixtures at 1100 stems per hectare.
	Douglas Fir	Pure Douglas fir planted at 2700 sph in order to achieve 2500 sph at year 5
	Douglas Fir/ European Silver Fir	Mixture of Douglas fir and European Silver fir planted in line mixture of 3:3 at 2700 sph to achieve 2500 at 5 years old.
	Douglas fir/ Sitka spruce	Mixture of Douglas fir and Sitka spruce planted in line mixture of 3:3 at 2700 sph to achieve 2500 at 5 years old.
	Norway spruce	Pure planting of Norway spruce at 2700 sph to achieve 2500 sph at year 5
	Norway spruce/ oak	This will be planting of Norway spruce and oak in line mixtures of 3:3. This is a common mixture and will provide an early thinning of conifer for firewood and improve the final crop trees of oak.
	Oak/ Broadleaves	A non-productive intimate mixture of Oak and other broadleaves, established at 1100 sph
	Sitka spruce/ Douglas fir	Mixture of Sitka spruce and Douglas fir planted in line mixture of 3:3 at 2700 sph to achieve 2500 at 5 years old.
	Sitka spruce/ Norway spruce	Mixture of Sitka spruce and Norway spruce planted in line mixture of 3:3 at 2700 sph to achieve 2500 at 5 years old.
	Sitka spruce/ broadleaves	This site is naturally regenerating with a mix of Sitka spruce, rowan, birch and willow.

Forestry Commission Scotland
Coimisean na Coillteareachd Alba

Deadwood management

Summary guidance for FES staff

1. POLICY CONTEXT AND FOREST CERTIFICATION REQUIREMENTS

This document summarises the policy and management guidance that Forest Enterprise Scotland (FES) staff need to follow in relation to deadwood. It describes the approach that FES staff should adopt when planning and delivering the deadwood resource on the national forest estate (NFE). This document should be regarded as a FES-specific supplement to the Forestry Commission Scotland (FCS) Practice Guide entitled: *Managing deadwood in forests and woodlands (Humphrey & Bailey, 2012)*, which provides fuller details on some of the following content.

Current government policy (Box 1) requires FES to create a deadwood resource within forests and woodlands on the NFE, and many deadwood-dependent species are listed on the government's Scottish Biodiversity List. Furthermore, the Scottish Forestry Strategy (SFS) implementation plan (2015-18) includes mean deadwood volume as a progress indicator for delivery of the SFS. All of these policy objectives are reinforced by the requirements of forest certification, and this guidance complies with the United Kingdom Woodland Assurance Scheme (UKWAS) Fourth Edition; this is the certification scheme under which FES is certified.

Box 1

The UK Forestry Standard (UKFS) sets out the governments' approach to sustainable forest management in the UK. The UKFS Guideline document entitled: 'Forests and biodiversity' requires the following good forestry practice for deadwood:

23. Leave a proportion of standing and fallen deadwood: concentrate it in areas of high ecological value, where there is existing deadwood and where linkages can be provided between deadwood habitats – avoid uniform distribution across management unit.

24. Retain existing veteran trees and select and manage suitable individuals to eventually take their place

The UKWAS Fourth Edition has the following ***requirements***:

I. The owner/manager shall plan and take action to accumulate a diversity of both standing and fallen deadwood over time in all wooded parts of the WMU [woodland management unit], including felled areas.

II. The owner/manager shall identify areas where deadwood is likely to be of greatest nature conservation benefit, and shall plan and take action to accumulate large dimension standing and fallen deadwood and deadwood in living trees in those areas.

In addition, the UKWAS Fourth Edition gives the following ***guidance***:

- The owner/manager should refer to deadwood guidance produced by relevant statutory conservation agencies, forestry authorities and others when identifying areas of greatest nature conservation benefit and when planning actions to accumulate deadwood.
- Current evidence suggests that, over the long term, deadwood (not including stumps, which are usually retained after felling) should accumulate to roughly 20 m^3 per hectare averaged – though not uniformly distributed – across the WMU.
- In most hectares there should be a few standing and fallen stems contributing to the overall deadwood provision.
- Deadwood management should not conflict with safety of the public or workers or the health of the woodland.

The UKWAS guidance of 20m^3ha^{-1} is an average and deadwood will not be evenly dispersed across a WMU. For example, ancient semi-natural woodlands and natural reserves will have much more than 20m^3ha^{-1} and productive stands will have much less.

Mueller & Buetler's (2010) review found published thresholds ranging from 10 to 80 m^3/ha for boreal forests, and from 10 to 150 m^3/ha for lowland forests. A threshold is a critical volume of deadwood above which a deadwood–dependent species (or group of species) is more likely occur. These threshold studies are useful for giving an indication of the range of deadwood volumes that are ecologically significant. Encouragingly, Humphrey *et al* (2003) demonstrated that even 'normal' plantation management systems in the UK seem to deliver enough deadwood to satisfy the UKWAS guidance. However, their measurements included low stumps (left after felling), which are explicitly excluded from the UKWAS guidance. Nevertheless, this finding is encouraging from the perspective of FES, which has to follow UKWAS guidance.

2. DEADWOOD MANAGEMENT PRINCIPLES

Deadwood provides a habitat and food resources for thousands of species of animals, plants, bryophytes, lichen and fungi (and unknown but enormous numbers of microbes). This habitat is 'partitioned' into innumerable ecological niches, with each species occupying a different niche according to parameters such as tree species, diameter, age, and exposure (the drying effects of sun and wind). Furthermore, because the physical nature of deadwood changes through time due to processes of decay, different assemblages of organisms use a piece of deadwood at different stages of decay. Deadwood is therefore a diverse and dynamic habitat and different organisms require different kinds of deadwood spread differently through space and time. This is problematic for woodland managers trying to create the 'best' deadwood resource to enhance biodiversity on their land. Simply put, it is impossible for managers to provide habitat for all saproxylic (deadwood dependent) species all the time.

Given there is no single 'solution' to providing deadwood habitat, it is best to adopt a set of management principles when planning and delivering deadwood on the NFE. The following set of principles reflects the consistent findings of research across various deadwood taxa and will maximise the overall biodiversity benefits that can be accrued by FES. The principles have been developed with experts from SNH and the underpinning science is expanded upon in Appendix 1.

1. *Retain and create as much deadwood as possible and create new deadwood on a continuing basis*.
2. *Retain and create as many kinds of deadwood as possible.*
3. *Favour native tree species when creating and retaining deadwood.*
4. *Favour the retention and creation of large-diameter deadwood.*
5. *Retain and create high stumps and snags (standing deadwood) within woodland and permanent open areas (but not on clear fells that will be restocked).*
6. *Design the distribution of deadwood to maximise connectivity at the WMU and coupe scale.*

2.1 How to create deadwood

UKWAS guidance recommends the creation of snags. However, FES staff must not kill standing trees using techniques like ring barking and chemical injection to create standing deadwood, irrespective of where this 'artificial' deadwood is located. The potential liabilities and health and safety implications associated with such features are too significant for FES. Cutting of high stumps by harvesting machines is also no longer acceptable because the machines are not designed for such work and the safety of the machine operators may be compromised. This means that snags will not be created on the NFE. Therefore, the creation of deadwood, to augment retained, naturally-occurring deadwood, should be achieved using only the methods listed below to create 'new' deadwood and 'future' deadwood:

Creating new deadwood

- Retaining large-diameter (> 20cm) logs at the edge of coupes following operations.
- Retaining smaller-diameter logs in deadwood piles at the edge of the coupe.
- Creating brash piles at the edge of coupes.
- For specific, project-based reasons (e.g. to create standing deadwood for a single-species project) creating high stumps or standing deadwood using a qualified and certified arboriculturist, or a qualified chainsaw operator if creating high stumps of 1.5m or less. This is an expensive option and is only recommended for the purposes of creating habitat for an endangered species on a very small scale.
- For specific, project-based reasons, drilling tree stumps to create water-filled holes for larvae e.g. pine hoverfly *Blera fallax*.

Creating future deadwood

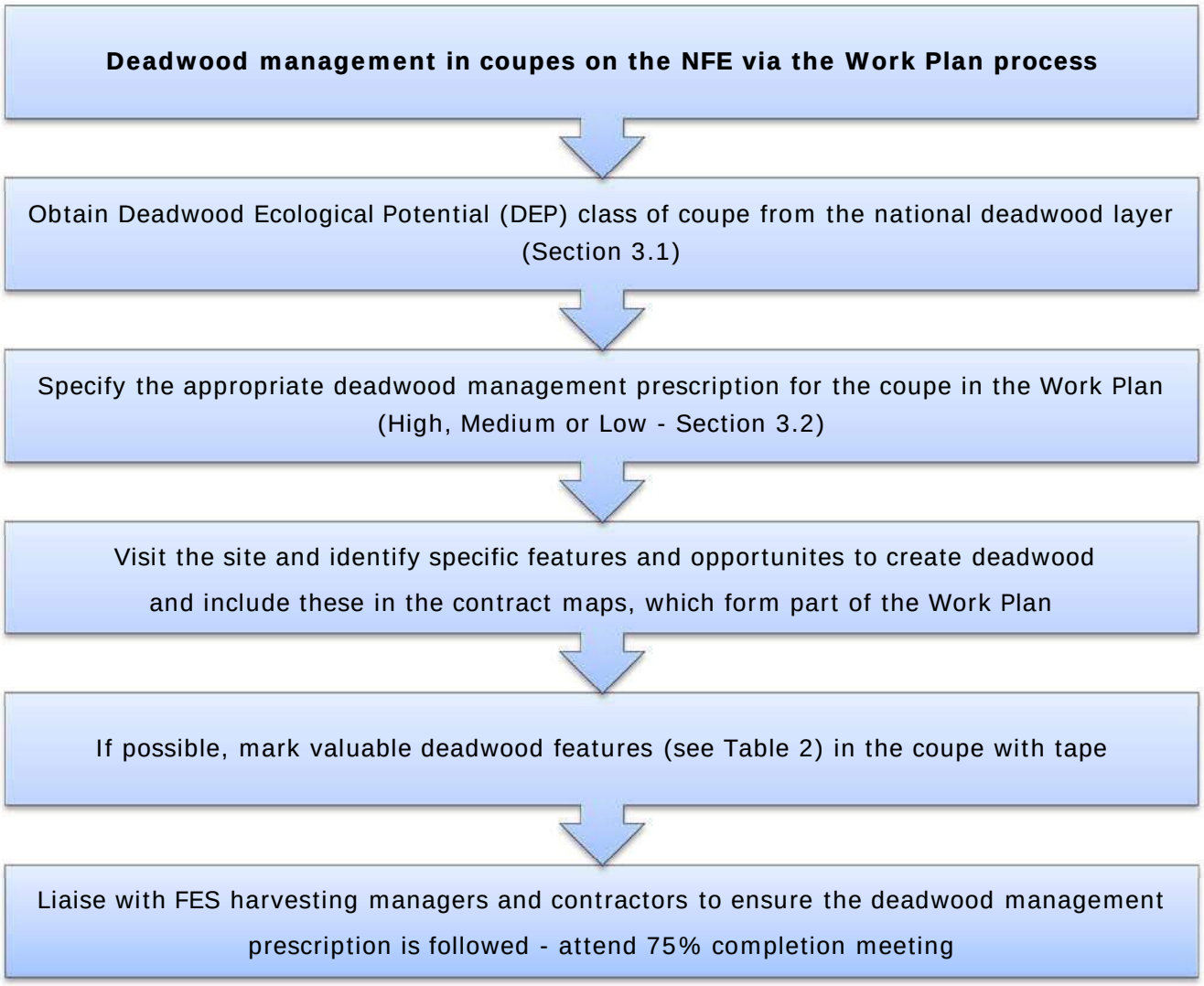
- Retaining damaged and dying trees wherever possible (providing they do not pose an obvious health and safety risk).
- Retaining wind-blown trees in appropriate locations
- Retaining individual live trees or small groups of live trees on clear fell sites. These are likely to be damaged by wind or blown over at some point and are therefore 'future' deadwood.

Note – Ongoing research suggests that deadwood that dies naturally is more valuable for biodiversity than deadwood that is created by cutting or killing of the tree. This is because trees that go through the entire process of dying and the subsequent decay stages support a wider spectrum of species, in successional stages. Trees that are killed artificially can be colonised rapidly by a small number of generalist species that subsequently inhibit colonisation by more specialist species. Research in Finland is detecting this pattern in fungal communities on deadwood. FES guidance on deadwood management will be revised in light on new research, but meantime the focus is on deriving deadwood from trees that die through natural processes.

3. DEADWOOD MANAGEMENT ON THE NFE THROUGH THE WORK PLAN PROCESS

Retaining and creating deadwood is probably the most cost-effective method of enhancing biodiversity on the national forest estate. FES Environment staff are responsible for ensuring the delivery of deadwood on the NFE, and should therefore make deadwood management a priority and allocate sufficient time and resource for this work. The overall objectives of deadwood management on the NFE are: i) to minimise the operational inconvenience caused by deadwood; ii) to satisfy UKWAS and other policy requirements; and iii) to maximise the biodiversity gains by adopting the management principles listed in Appendix 1.

The following flowchart summarises the approach FES Environment staff should follow to manage deadwood at the coupe level via the Work Plan process, and further details are provided in Sections 3.1 to 3.4:



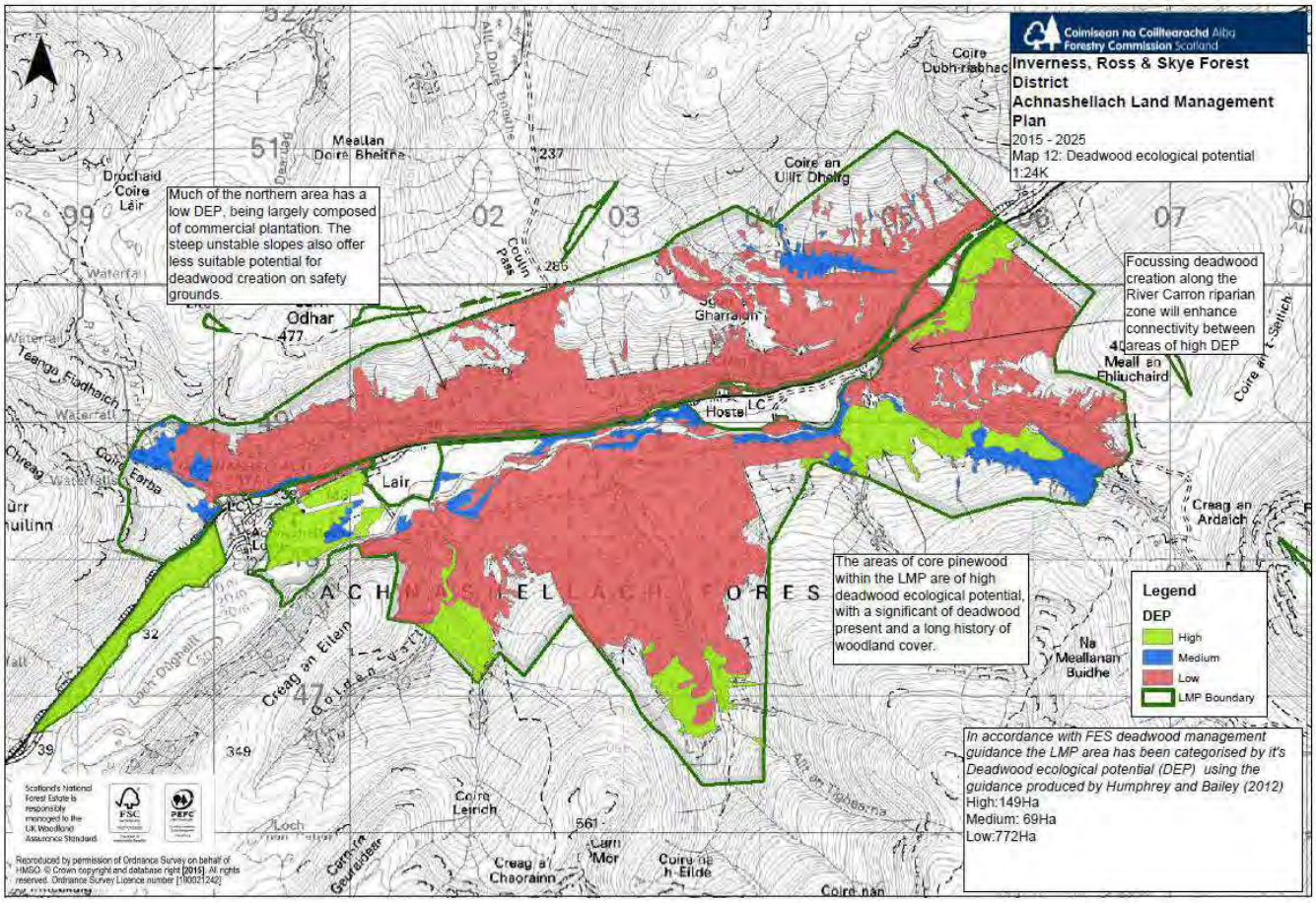
3.1 WMU deadwood ecological potential classes

The UKWAS term 'woodland management unit' (WMU) equates to an FES Land Management Plan (LMP), and therefore a WMU may include several individual blocks. For each WMU, all areas have been assigned the appropriate 'deadwood ecological potential' (DEP) class in a national deadwood layer, based on different woodland management categories (see Table 1). This layer is available on ForesterWeb and also on forest district servers. A map showing the DEP classes for the whole WMU should be included in Land Management Plans at the time of the plan production or revision (see Map 1 below).

Table 1 – Deadwood Ecological Potential classes of FES woodland management categories

Deadwood ecological potential (DEP) class	**FES woodland management categories included in this DEP class**
High	Natural reserves, ancient semi-natural woodlands, native pinewoods, riparian buffers along watercourses, PAWS with high ecological potential, wood pasture.
Medium	Minimum intervention areas of broadleaved woodlands, PAWS, LEPOs, long-term retentions, LISS coupes.
Low	All other stands (i.e. stands where timber production is the priority)

Map 1 – Deadwood Ecological Potential map for Achnashellach Land Management Plan



3.2 Deadwood management prescriptions for coupes

When a coupe comes up in the Work Plan process, apply the appropriate deadwood management prescription (High, Medium or Low). The deadwood management prescriptions for each DEP class are shown in Table 2 below; this is a simplified and FES-specific version of the measures detailed in Table 2 of Humphrey & Bailey's (2012) FCS Practice Guide.

Wherever possible during pre-operational surveys, identify particularly valuable features and record these features in work plans, so that they can be included in contracts and retained during operations. Particularly valuable features should be marked using tape prior to commencement of operations. Liaise with FES harvesting managers and contractors to ensure deadwood management prescription is followed and that valuable features are retained during harvesting

Particularly valuable features are veteran and dying trees; large-diameter standing deadwood, particularly of native species; and deadwood from native broadleaves. These deadwood types are under-represented on the NFE and increasing their abundance is a priority.

Table 2 – DEP class deadwood management prescriptions

DEP class	Deadwood management prescription
High	1. Retain all existing veteran trees and deadwood apart from that which is a health and safety risk [a] 2. Retain all wind blow apart from that which is a health and safety risk 3. Deadwood distributed throughout the coupe 4. Seek opportunities to create particularly valuable deadwood e.g. import some large-diameter logs from nearby coupes when they are thinned or clear felled
Medium	1. Retain all existing veteran trees and deadwood apart from that which is a health and safety risk 2. Only harvest wind blow of significant value or which poses a health and safety risk 3. Seek opportunities to create particularly valuable new deadwood e.g. when felling big trees, retain some large diameter logs at the edge of the coupe 4. Where wind blow is harvested, retain some blown trees in a group as 'future deadwood' [b]
Low	***During thinning*** 1. Retain all existing deadwood apart from that which is a health and safety risk 2. Take obvious opportunities to create particularly valuable new deadwood e.g. when felling big trees, retain one or two large diameter logs at the edge of the coupe 3. Where wind blow is harvested, take opportunities to retain a few blown trees in a group as 'future deadwood' in a location that will not restrict future operations e.g. in the corner of a coupe ***During clear felling*** 1. Retain all deadwood and living trees in areas that are uneconomic or too difficult to harvest (e.g. wet, steep or rocky areas) 2. Where an obvious opportunity arises, create new deadwood in a location that will not restrict future operations e.g. a pile of logs and brash in the corner or along the edge of a coupe ***Additional notes for Low DEP class areas*** 1. Deadwood should only be retained in areas that will not restrict future operations 2. Standing deadwood (snags) should not be retained on clear fells, except in areas that will not restrict future operations and that do not pose a health and safety risk e.g. in the corner of a coupe 3. Large diameter (>20cm) deadwood logs and snags are particularly scarce on the NFE. Take opportunities to retain this kind of deadwood. When harvesting large diameter trees, seek opportunities to retain some standing deadwood, if safe to do so, and consider retaining a few large-diameter logs on site in a location that will not restrict future operations. 4. Large diameter deadwood from native broadleaves is particularly scarce. When harvesting large diameter native broadleaves, retain standing deadwood, if safe to do so, and retain some large diameter logs on site in a location that will not restrict future operations.

Notes for Table 2: a. A health and safety risk equates to deadwood that has the potential to fall on recreation routes, or other places likely to be used by people, or buildings, or other infrastructure; b. These retained, living trees will have a high likelihood of being damaged by wind, or blown over, and dying naturally, thereby becoming high-value deadwood.

3.3. Riparian zones and in-stream deadwood

Riparian zones often have large accumulations of deadwood and are an important resource in terms of planning linkages between High and Medium DEP class areas. The deadwood in riparian zones can make a significant contribution to the overall deadwood volume in a WMU, and regeneration or planting of riparian trees should be a priority to provide future deadwood.

The maintenance and management of buffer strips of riparian trees, and the consequent input of woody debris, influences a wide range of physical habitat characteristics within watercourses; including light, temperature, flow, sediment transport and substrate conditions, thereby promoting high levels of biodiversity within the river environment (Gurnell *et al* 1995).

Photo 1 – Riparian woodland with abundant deadwood.

Riparian woodland is the main source of inputs of large woody debris into watercourses, which has beneficial impacts for many species, including fish (Howson *et al* 2012). Inputs of large woody deadwood are probably inadequate in most areas of the NFE (i.e. below natural levels of input) and the direct input of woody debris into watercourses should be employed as a management action – particularly into watercourses used for breeding by trout and salmon and where riparian deadwood is limited or absent. The design and management of riparian woodland to sustain the delivery of large woody debris to watercourses is an explicit action in the UK Forestry Standard Guidelines on forests and water. Further advice on large woody debris input to watercourses is available from the FES ecologists.

Photo 2 – Fallen trees are a major source of woody material within rivers. Such natural events are important for the ecology of fish and invertebrates.

3.4 Visitor Zoning Operations

The FC Practice Guide (Humphrey & Bailey, 2012; pages 15 to 16) gives advice on minimising risks to public and worker safety. Where dangerous trees, wind blow or dead stems have to be removed from within priority Visitor Zoning areas:

- Retain as many as possible on site.
- Move the stems to an area where they would provide significant ecological benefit (as identified above).
- Alternatively, they could be cut into manageable blocks and moved out of site as per the visitor zoning guidance.
- Larger diameter native species are likely to provide the highest benefit and retention of these stems on site should be a priority.
- Opportunities should be taken to retain significant native standing deadwood in place and use them as a focus for highlighting their biodiversity benefit through interpretation. This will always have to be weighed up against H&S and the practicalities of doing so.

The health and safety of people on site and members of the public is paramount. Environment staff should work with CRT staff to ensure standing deadwood within one tree length of roads, tracks and paths are risk assessed. Two documents provide guidance in this regard: OGB1 and the NTSG guidance entitled 'Common sense risk management of trees' (see references). New paths and tracks should be designed to avoid veterans (important future deadwood) and areas of minimum intervention where possible.

Antisocial behaviour is not sufficient reason for removing or minimising deadwood in WIAT sites. Following guidelines above, retention on-site of large diameter lengths of broadleaf, particularly native species, moved to shady damp areas (protected by shrubs such as bramble) will reduce potential for burning.

4. GLOSSARY

Ecological niche – The place occupied by an organism within an ecosystem, including its habitat and its effect on other organisms and the environment

Saproxylic – Pertaining to species that live on or in deadwood for at least part of their life cycle

Snag – Standing dead tree

Species diversity – A measure of the diversity within an ecological community that incorporates both species richness and the evenness of species' abundances

Species richness – The number of species within an ecological community or within an otherwise defined area or volume

Woodland Management Unit – The area to which management planning documentation (e.g. Forest Design Plan or Land Management Plan) relates. A WMU is a clearly defined woodland area, or areas, with mapped boundaries, managed to a set of explicit long term objectives.

5. ACKNOWLEDGEMENTS

This guidance draws upon previous work by Keith Black, Kenneth Sinclair, Philippa Murphy, Graeme Findlay and Yvonne Grieve (especially for Visitor Zoning section). Many other FES staff – including Richard Thompson, Dave Anderson, Giles Brockman, Charles Hutchinson and Colin Leslie – have provided invaluable views and information on this subject. Andrew Jarrott kindly provided several photos.

APPENDIX 1 – RESEARCH-BASED DEADWOOD MANAGEMENT PRINCIPLES

1. ***Retain and create as much deadwood as possible and create new deadwood on a continuing basis***. As explained above, UKWAS guidance recommends about 20m^3/ha, which is an average, but in some sites much higher volumes will exist or the creation of higher volumes per hectare will have even greater ecological gains. As the deadwood volume increases, so does the deadwood diversity and therefore the species richness and diversity of associated organisms. For example, Mueller & Buetler (2010) demonstrated that the number of critically endangered saproxylic beetle species was positively correlated with the amount of deadwood available in their sampling plots. They recommended establishing several forest stands with deadwood amounts >20 to 50 m^3/ha within a network (WMU). Constant inputs of new deadwood are necessary to maintain a spectrum of ages and stages of decay into the future – so new deadwood needs to be created on a continuing basis. This is necessary because deadwood changes continually. For example, Makinen *et al* (2006) found that all Scots pine, Norway spruce and birch stems (snags) had fallen down by forty years after their death. Veteran trees are important in this regards as they represent future deadwood, and have the potential to capture the entire spectrum; starting with newly dead wood when the veteran dies.

2. ***Retain and create as many kinds of deadwood as possible.*** As the number of kinds of deadwood increases in an area, the number of microhabitats increases. Consequently, the species richness and diversity of associated organisms increases. For example, Hjalten *et al* (2010) showed that there were clear differences in saproxylic beetle assemblages between different deadwood substrate types. Brunet & Isacsson (2009) conclude that for high species diversity there is a requirement for snags in different stages of decay, size and degree of sun exposure. Therefore, FES managers should attempt to create and maintain deadwood of as many different ages (from newly dead to nearly completely decayed), heights (stumps to high snags), sizes (from small branches on the ground to large-diameter snags), types (snags, logs, stumps, log piles, felling debris etc), and degree of exposure (always shaded at one extreme to always exposed to direct sunlight at the other) as possible. In addition, deadwood from a wide range of tree species should be retained to support more exacting species of fungi (Hielmann-Clausen 2003), bryophyte (Rothero 2008), lichen and invertebrate. There is no exact recipe for the provision of this varied resource, so FES managers should simply aim for as much variety at the coupe level as is reasonably possible, taking advantage of the available opportunities.

3. ***Favour native tree species when creating and retaining deadwood.*** Deadwood retention and creation should utilise native tree species wherever possible. However,

deadwood from non-native tree species is still valuable and is certainly better than no deadwood.

4. ***Favour the retention and creation of large-diameter deadwood.*** Numerous studies show that bigger snags and logs support more species, particularly rare species. For example, Brin *et al*. (2011) showed that more indicator saproxylic species were observed in large logs than in small logs. Studies in Scandinavia (e.g. Kruys et al 1999) confirm that decaying logs >20cm provide a much richer habitat for bryophytes than smaller diameter logs. This is thought to be due to larger logs holding more moisture, providing a greater range of micro-habitats, decaying more slowly and being less likely to become over-grown by competitive vegetation. One informative conclusion of Humphrey *et al* (2003) was that large diameter, well-decayed deadwood, which is particularly valuable for biodiversity, occurs at a very low frequency and volume in most forest and stand types in the UK. The UKWAS Standard defines large as greater than 20cm diameter.

5. ***Retain and create high stumps and snags within woodland and permanent open areas (but not on clear fells that will be restocked).*** Several studies (e.g. Hjalten *et al* 2010) indicate that there are clear differences in species' assemblage composition between substrate types e.g. low stumps compared to high stumps. Low stumps left after harvesting provide important habitat for many deadwood species, including fungi and beetles. However, the higher parts of high stumps and high snags (>2m high) support different species, and can be particularly important for lichens (see Photo 3).

   High snags (frequently called standing deadwood) on clear fell sites are much less valuable for deadwood species in Scotland. This is because of the extreme exposure makes the wood unsuitable for most deadwood species. Additionally, in Scotland, we have a much-reduced invertebrate fauna due to past extinctions, and none of the remaining species are dependent on exposed deadwood snags. Exposed wood is good for some lichens, but replanting of clear fells means that snags will shaded by dense conifers within a relatively short timescale and lichens cannot survive without light. Snags on clear fells are not important for birds

   Therefore, it is important to retain and create (but see Section 2.1) high stumps and snags within woodland and permanent open areas, in order to provide habitat for a wide range of species. Snags on clear fells are ecologically much less important and are a significant constraint on operational activity. Snags should not be retained on clear fells that will be restocked, except in locations that will not constrain future operations e.g. along the edges or in the corner of coupes.

Photo 3 – Naturally-occurring Scots pine 'bones' within woodland and open woodland are particularly important for lichens in Scotland. These valuable features should be retained (unless they pose a health and safety risk e.g. by being close to tracks).

6. ***Design the distribution of deadwood to maximise connectivity at WMU and coupe scales.*** Numerous papers indicate that the spatial distribution and connectedness of the deadwood resource is an important determinant of occurrence of many saproxylic species. Studies of saproxylic beetles show that they respond to habitat factors (e.g. amount of deadwood) at different spatial scales i.e. at both the forest stand and landscape scales. For example, Bergman *et al* (2012) showed that some beetle species respond to both local (e.g. forest stand) and landscape (e.g. forest block) habitat factors. In this study, 16 oak-dependent saproxylic species showed a clear relationship with substrate (snag) density at scales ranging from 52m to >5200m. How large and connected areas of High deadwood volumes (>20 to 50 m^3/ha) need to be is still unknown for most groups, even though some information indicates that the surroundings also play an important role (Oakland *et al* 1996). Several research projects (e.g. Franc *et al* 2007, Ranius & Roberge 2011) recommend concentrating deadwood into a network of low-intensity-management sites within a more intensively-managed-forest matrix.

APPENDIX 2 – EXAMPLES OF GOOD DEADWOOD MANAGEMENT

Retain and create as much deadwood as possible and create new deadwood on a continuing basis.

Photo 4 – A long-term retention on a hillside that will be subject to wind blow, which will cause many of the trees to die naturally at different times. This will create large amounts of deadwood on a continuing basis for many years.

Photo 5 – Retention of native tree species within a crop of exotic tree species. Such retentions act as 'life boats' for many species of invertebrates, fungus and lichens, allowing them to persist in the coupe. The retention also facilitates and maintains dispersal of many species within a forest block. Many of the trees in the retention will be subject to wind damage, which will create a range of deadwood habitats on the tree and on the ground. The trees will be damaged and will die at different times, thereby providing a range of deadwood habitats at different stages of the decay process. This is a far more valuable way of creating deadwood than retaining lots of dead and bark-less snags across a restock.

Photo 6 – A large retention of wind thrown trees and six living trees at the edge of a coupe. The blown trees will die at various times in the future, thereby creating inputs of new deadwood on a continuing basis. Dying trees are extremely valuable deadwood habitats. This is because changing assemblages of species colonise the wood as it goes through the varying decay stages: from weakened and dying, to recently dead, and right through to the stage where the tree is almost decomposed. So, from death to decomposition, each tree provides a spectrum of changing habitats that are invaluable for literally thousands of species. The standing trees are likely to snap in the wind and die or blow down and die. Either way, it creates very valuable deadwood habitat in the future.

Retain and create as many kinds of deadwood as possible.

Photo 7 – Log and brash piles created in a corner of a coupe that was not going to be restocked. This 'deadwood centre' provides habitat for many species of invertebrate, fungus and lichen. In addition, such features are often used as resting places or breeding sites by protected species such as otters and pine martens, and reptiles and amphibians. By providing these features in appropriate locations (e.g. in riparian zones or at the edge of permanently open ground), it minimises the likelihood that protected species will rest or breed in the middle of productive areas. This reduces the constraints associated with these widely-distributed species.

Photo 8 – A ‘deadwood centre’ at the edge of a productive coupe. The opportunity to create this feature arose because of the accumulation of different types of deadwood in a location that will not hinder future operations. Off cuts have been placed in the deadwood centre and a few living pines with poor form have been retained. These will likely be damaged by wind at some stage and are therefore ‘future deadwood’. Having ongoing inputs of new deadwood over time is important because different species use different decay stages of deadwood.

Photos 9, 10 and 11 – Examples of deadwood retained in locations that will not impinge on future operations. In all cases, a variety deadwood has been collected into 'deadwood centres' along of edge of coupes that will be restocked in the future. The bottom photo shows an area with a retained snag, a large-diameter stump with retained log section, and a variety of brash and small diameter deadwood.

Favour native tree species when creating and retaining deadwood.

Photo 12 – Retained birch snag. Deadwood from native tree species is more valuable than deadwood from non-native tree species.

Photo 13 – Rot holes in dead and dying broadleaf are very valuable habitats for a range of saproxylic species. Such habitats are very scarce on the NFE and should be retained.

Photo 14 – Retained Scots pine snags following removal of spruce crop.

Favour the retention and creation of large-diameter deadwood.

Photo 15 – Large-diameter deadwood supports remarkable biodiversity but is rare on the NFE. Large diameter deadwood from native broadleaves is particularly valuable and scarce.

Photo 16 – These large diameter and flared butts are valuable deadwood habitat, but have been left over the drain at roadside. In such cases, ask the machine operator to lift them into the edge of the adjacent coupe.

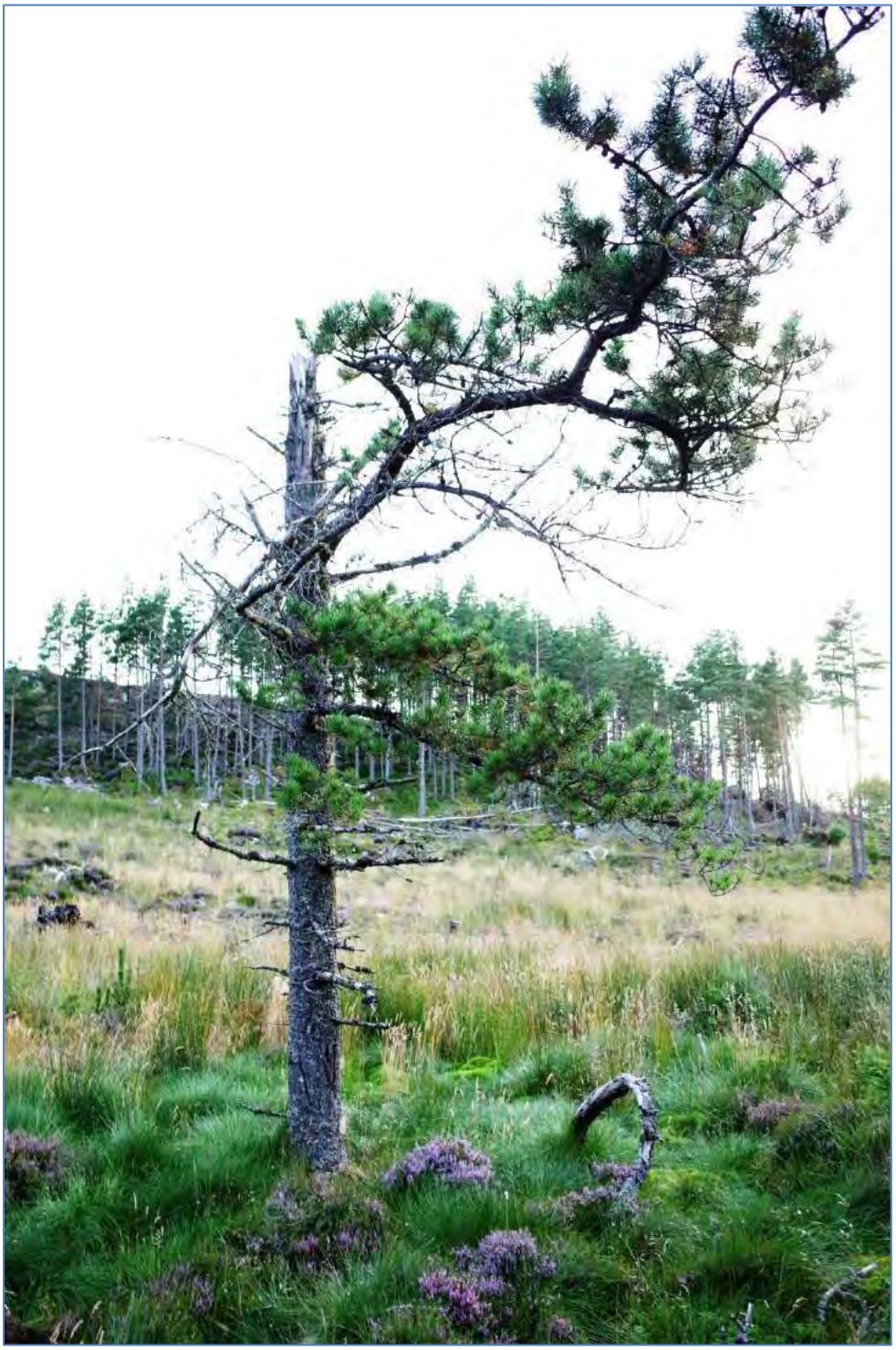
Photo 17 – Large diameter, windblown tree left in-situ on the boundary of two productive coupes. An extremely valuable and ever-changing habitat, left in a location that will not hinder future operations.

Retain and create high stumps and snags (standing deadwood) within woodland and permanent open areas (but not on clear fells that will be restocked)

Photo 18 – High stumps resulting from trees snapping should be retained during thinning operations (unless they pose a health and safety risk e.g. by being close to tracks).

Photo 19 – High stumps with cavities are particularly important for a range of birds, mammals and invertebrates and should be retained.

Photo 20 – Snapped trees such as this provide a range of deadwood habitats, including dying branches. These trees are likely to die standing and go through much of the decay process whilst standing. This provides different habitat to stems on the ground. On clear fells, retain any such trees along edges of coupes.



Design the distribution of deadwood to maximise connectivity at the WMU and coupe scale.

Photo 21 – A network of retentions of dead, dying and living trees (future deadwood) in Galloway Forest Park.

Some species have extremely limited dispersal ability (e.g. see Jackson *et al* 2012), and habitat fragmentation occurs for some saproxylic insects at a local scale through the isolation of single deadwood pieces (Schiegg 2000). Therefore, as a general rule, deadwood at the coupe level should have a high level of connectivity to benefit such species. In practice, this means that there should only be a few metres between individual logs and snags, or that it should be clumped and touching or nearly touching in the case of felling debris such as branches and logs (Photo 18). This approach is compatible with minimising operational inconvenience as deadwood can be clumped along coupe edges or in corners.

Photo 22 – Felling debris and logs clumped to ensure habitat connectivity for dispersal-limited species.

REFERENCES

Bergman, K-O., Jansson, N., Claesson, K., Palmer, M.W. & Milberg, P. (2012) How much and at what scale? Multiscale analyses as decision support for conservation of saproxylic oak beetles. Forest Ecology and Management, **265**, pp 133-141.

Brin, A., Bouget, C., Brustel, H. & Jactel, H. (2011) Diameter of downed deadwood does matter for saproxylic beetle assemblages in temperate oak and pine forests. Journal of Insect Conservation, **15**, Issue 5, pp653-669.

Brunet, J. & Isacsson, G. (2009) Influence of snag characteristics on saproxylic beetle assemblages in a south Swedish beech forest. Journal of Insect Conservation, **13** (5), pp 515-528.

Franc, N., Gotmark, F., Okland, B., Norden, B. & Paltto, H. (2007) Factors and scales potentially important for saproxylic beetles in temperate mixed oak forest. Biological Conservation, **135** (1), pp 86-98.

Gurnell, A. M., Gregory, K.J. & Petts, G. E. (1995) The role of coarse woody debris in forest aquatic habitats: Implications for management. Aquatic Conservation: Marine and Freshwater Ecosystems, **5** (2), pp 143-166.

Heilmann-Clausen 2003. Wood-inhabiting Fungi in Danish Deciduous Forests - Diversity, Habitat Preferences and Conservation. Unpublished PhD thesis, Royal Veterinary and Agricultural College.

Hjalten, J., Stenbacka, F. & Andersson, J. (2010) Saproxylic beetle assemblages on Low stumps, High stumps and logs: Implications for environmental effects of stump harvesting. Forest Ecology and Management, **260**, pp 1149-1155.

Howson, T.J., Robson, B.J., Matthews, T.G. & Mitchell, B.D. (2012) Size and quantity of woody debris affects fish assemblages in a sediment-disturbed Lowland river. Ecological Engineering, **40**, pp 144-152.

Humphrey, J.W. & Bailey, S. (2012) Managing deadwood in forests and woodlands. Forestry Commission Practice Guide. Forestry Commission, Edinburgh. i-iv + 1-24 pp.

Humphrey, J.W., Ferris, F. & Quine, C, C.P. eds. (2003) Biodiversity in Britain's Planted Forests. Forestry Commission, Edinburgh. i-vi + 1-118pp. (41-49pp).

Jackson, H.B., Baum, K.A. & Cronin, J.T. (2012) From logs to landscapes: determining the scale of ecological processes affecting the incidence of a saproxylic beetle. Ecological Entomology, **37** (3), pp 233-243.

Kruys, N,, Fries, C. Jonsson, B.G., Lamas, T. and Stahl, G. (1999) Wood-inhabiting cryptogams on dead Norway spruce (***Picea abies***) trees in managed Swedish boreal forests.

Makinen, H., Hynynen, J., Siitonen, J. & Sievaneni, R. (2006) Predicting the decomposition of Scots pine, Norway spruce, and birch stems in Finland. Ecological Applications, **16** (5), pp 1865-1879.

Mueller, J. & Buetler, R. (2010) A review of habitat thresholds for dead wood: a baseline for management recommendations in European forests. European Journal of Forest Research, **129**, pp 981-992.

Common sense risk management of trees. (2011) National Tree Safety Group.

Oakland, B., Bakke, A., Hagvar, S. & Kvamme, T. (1996) What factors influence the diversity of saproxylic beetles? A multiscaled study from a spruce forest in southern Norway. Biodiversity & Conservation, **5**, pp75-100.

Operational Guidance Booklet 1: Tree safety management. (2009) Forestry Commission, Edinburgh.

Ranius, T. & Roberge, J-M. (2011) Effects of intensified forestry on the landscape-scale extinction risk of dead wood dependent species. Biodiversity & Conservation, **20** (13), pp 2867-2882.

Rothero, G. (2008) Looking after Green Shield Moss (*Buxbaumia viridis*) and other mosses and liverworts on deadwood. Plant Life

Schiegg, K. (2000) Effects of dead wood volume and connectivity on saproxylic insect species diversity. Ecoscience, **7** (3), pp 290-298.

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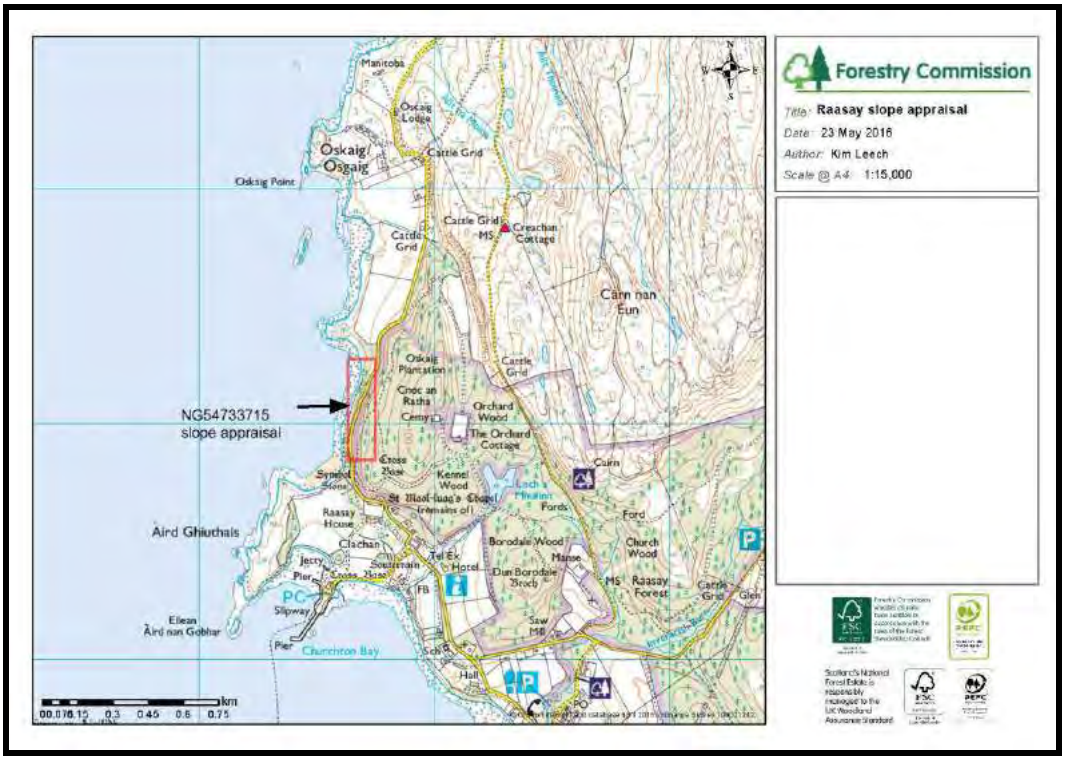
Rassay Geotechnical Appraisal

18th May 2016

Attended by Kim Leech, Chris Nixon and Kenney Sinclair

Site location



Background information

This site is currently undergoing treatment to eradicate Rhododendron, and due to the presence of nesting Golden Eagles nearby, has been suspended until a suitable time to proceed. The site is located directly above an unclassified single track road that carries a low volume of traffic. A small amount of loose material (small rocks) have appeared on the public road prompting an appraisal of the slope to identify hazards and risks and recommend any mitigation as necessary.

Weather on the day of the appraisal was fair with sunny spells and little or no wind present.

The photographs below depict the current condition of the site since treatment began to eradicate rhododendron in the area and proximity to the public road.




Observations and Hazards

A few rocks have appeared on the single track public road at the bottom of the slope, which may have become dislodge due to the Rhododendron treatment and clearing of debris off the slope as part of that treatment. However, local residents have reported that rocks have historically been falling onto the road along this stretch of road for many years, before intervention to treat rhododendron. The dimensions of the rocks cleared off the road are approximately 20cm x 30cm x 20cm. The photograph below illustrates 2 rocks recently removed by a local resident.

The volume of traffic using this road is very low. Traffic are forced to move very slowly due to the road being single track with bends over a short distance and negotiating passing of any oncoming vehicles. For this reason elements at risk of impacting with rock fall are thought to be low. The hazards on the slopes, mainly small rocks are thought to be low-to medium.

Table 1. Rassay - Slope Stability and Risk (STAR) Assessment

Inspected 18 May 2016				Slope Stability And Risk (STAR) Assessment						
Hazard Source Area	**Hazards (in order of hazard)**	**Location of Element at Risk**	**Element at Risk (EAR)**	**Hazard**	**Hazard Category**	**Receptor Type**	**Vulnerability**	**Pathway**	**Score**	**Risk Category**
Rassay site	Rock Crags	Working Areas Below	Personnel	1	Low	4	4	0.2	3.2	Low
		public road	Public - road users	1	Low	4	4	0.2	3.2	Low
	Boulders	Working Areas Below	Personnel	2	Low to Moderate	4	4	0.4	12.8	Low to Moderate
		public road	Public - road users	2	Low to Moderate	4	4	0.4	12.8	Low to Moderate

Recommendations

It was agreed that the site presents' low to moderate risk' and that no further geotechnical advice or specific geotechnical mitigation measures are required. Staff need to be made aware of hazards and monitor the site (see fig.1 below).

Fig.1

Risk Values, Categories and Actions

Risk Value	Risk Category	Action
<10	Low	Normally accepted
10 to < 25	Low to Moderate	Significant Risk - need to be made aware of hazards and monitor
25 to < 75	Moderate to High	Significant Risk requiring remedial measures / risk management actions
75 to < 100	High	Significant Risk requiring major remedial measures
100 or >	Very High	Significant Risk requiring urgent action e.g. evacuation or interim measures followed by remedial measures

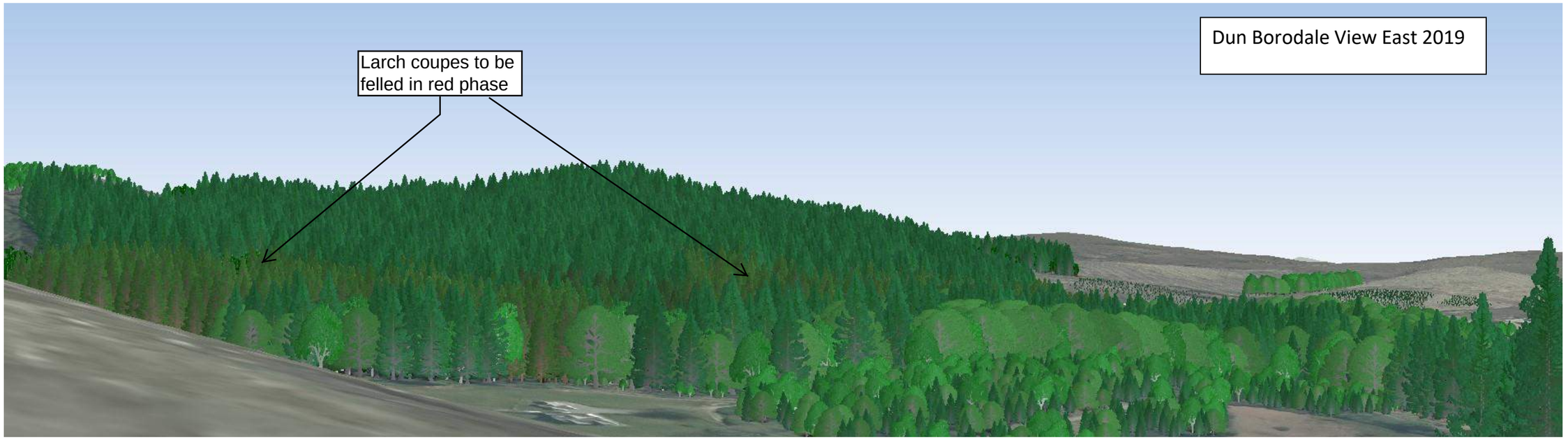
FCS personal will monitor the site for changes in condition and maintain a record of inspection. Ideally this should be done each time personnel visit Raasay. Hazards that are perceived to be a potential risk to road users, pedestrians and personnel, must be addressed as soon as possible and further advice should be taken if further instability appears imminent. A risk assessment must be done in advance.

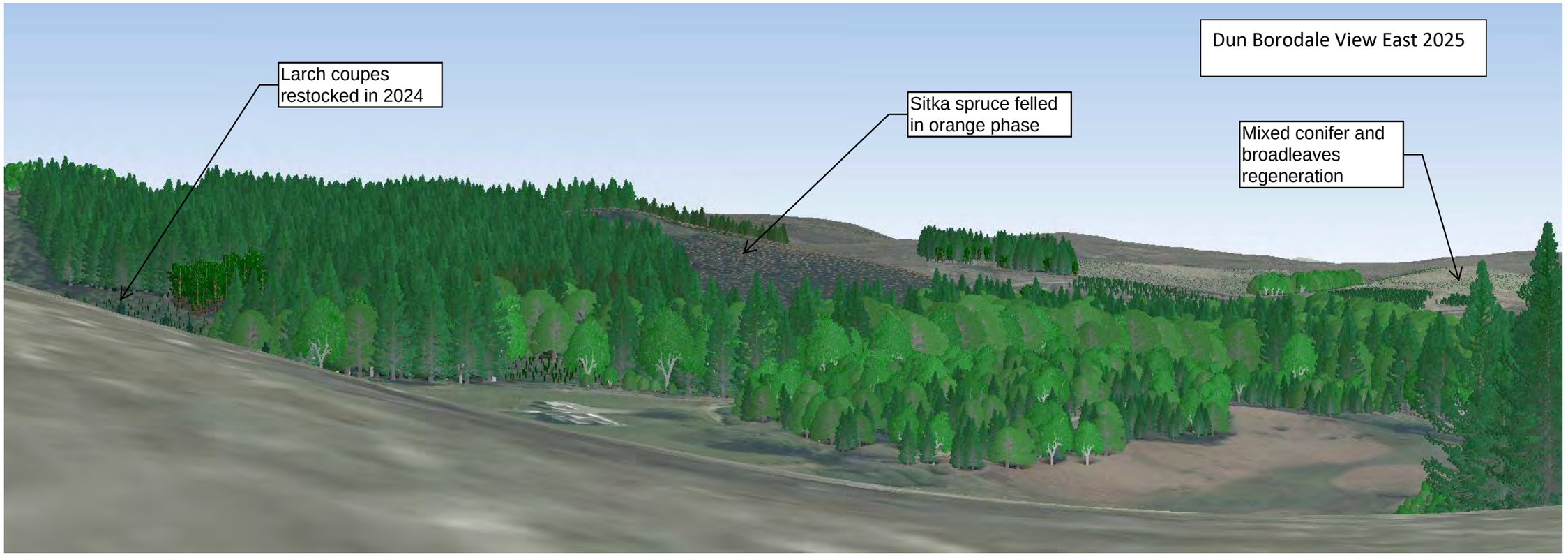
A record of inspection must be held by IRS FD. Table 1: *Rassay - Slope Stability and Risk (STAR) Assessment,* represents the condition of the slope as of 18th may 2016. The table can be used for additional inspection and must be saved as a new version with the date of the inspection carried out on the spreadsheet. An excel version of this table accompanies this report.

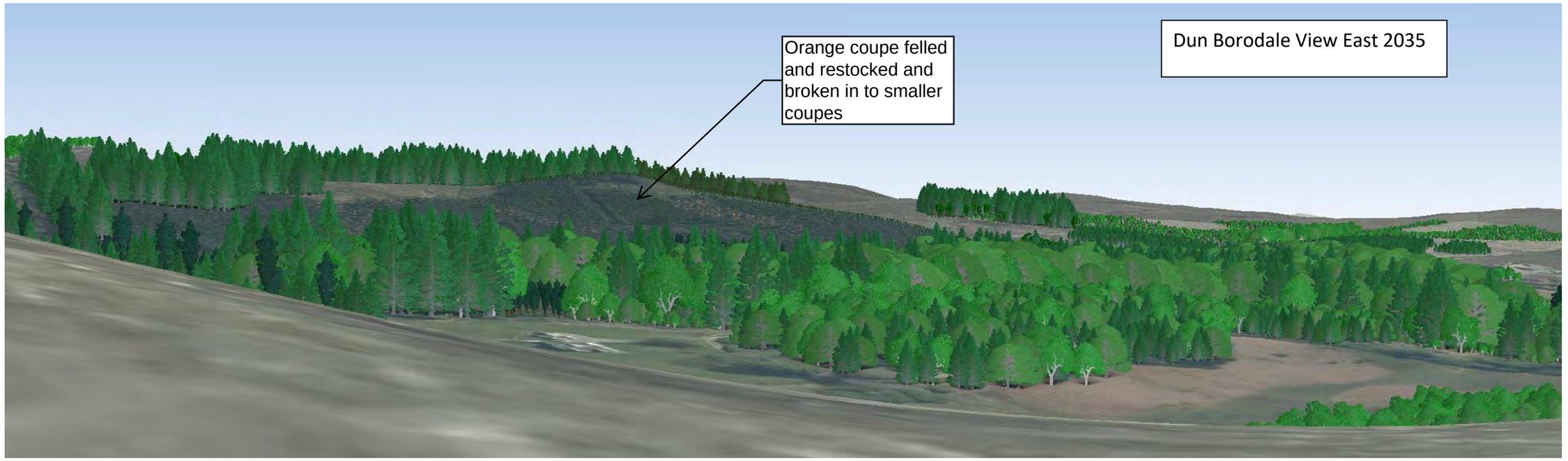
It was noted that there is already a rockfall hazard warning sign on the approach to the site.

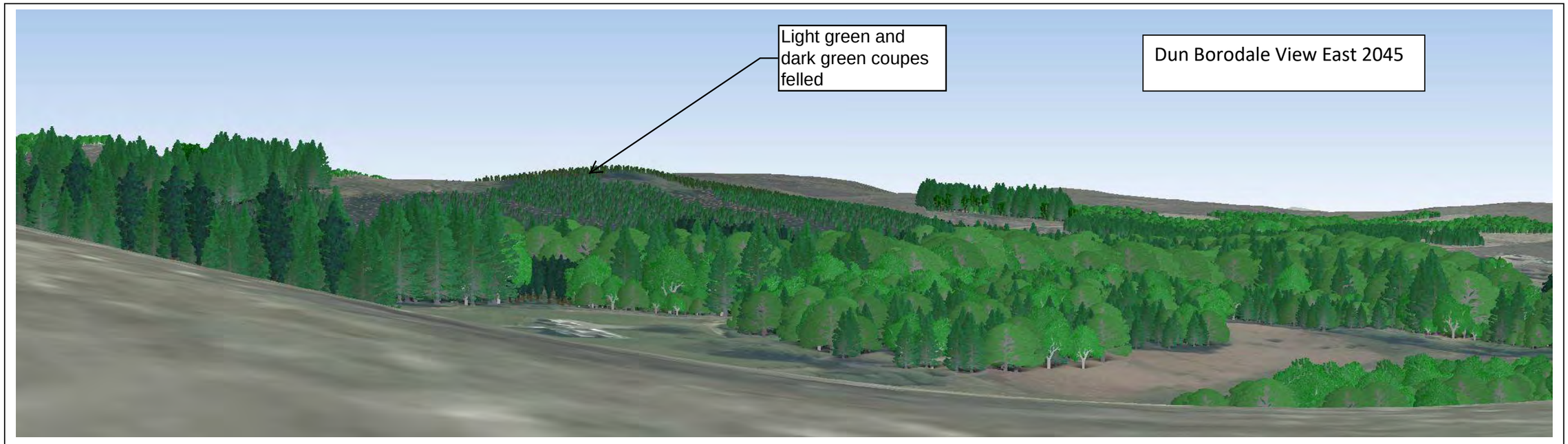
There are a number of standing larch trees on the site and it was agreed that these should be contour-felled to help protect the road from falling debris.

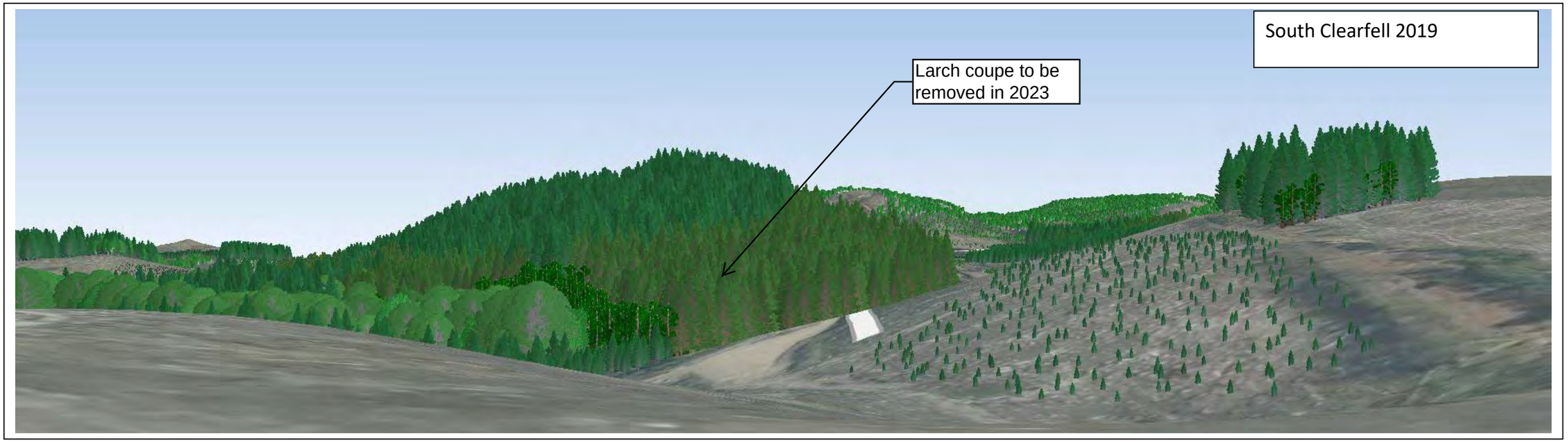
Care must be taken to prevent dislodging of debris when working on the site in future and ensure road is clear of debris.

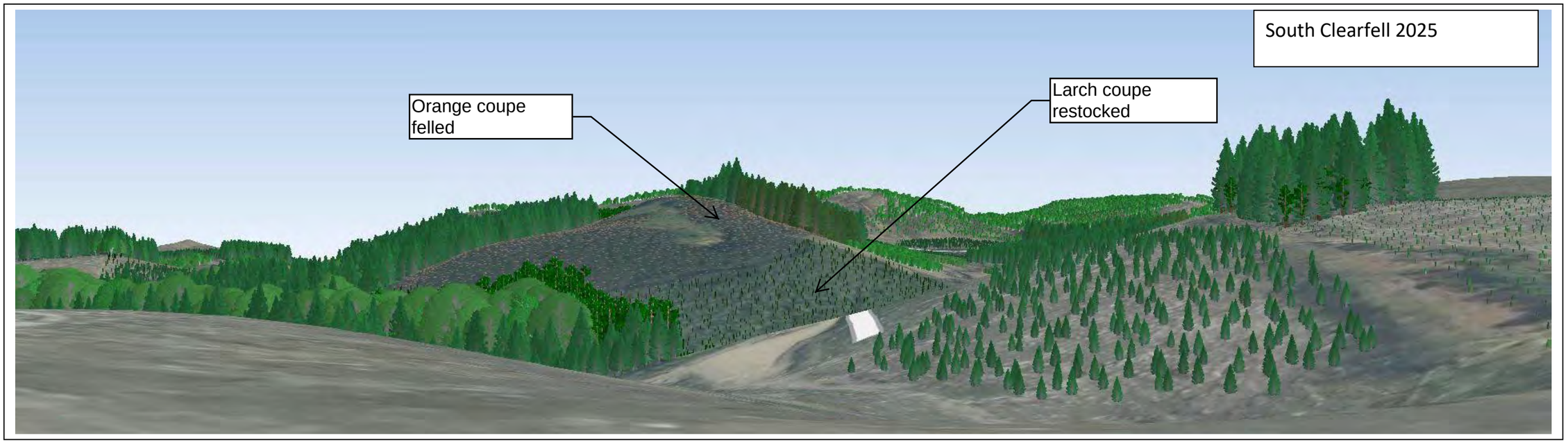

Dun Borodale View East 2019
Larch coupes to be felled in red phase


Dun Borodale View East 2025
Larch coupes restocked in 2024
Sitka spruce felled in orange phase
Mixed conifer and broadleaves regeneration


Orange coupe felled and restocked and broken in to smaller coupes
Dun Borodale View East 2035


Light green and dark green coupes felled
Dun Borodale View East 2045


South Clearfell 2019
Larch coupe to be removed in 2023


South Clearfell 2025
Orange coupe felled
Larch coupe restocked

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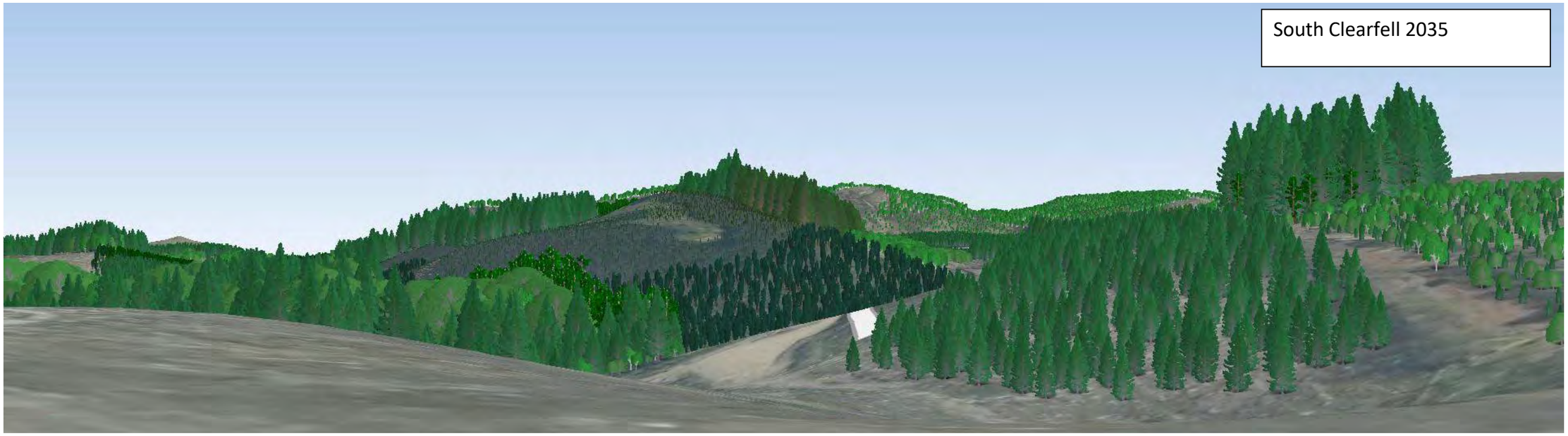
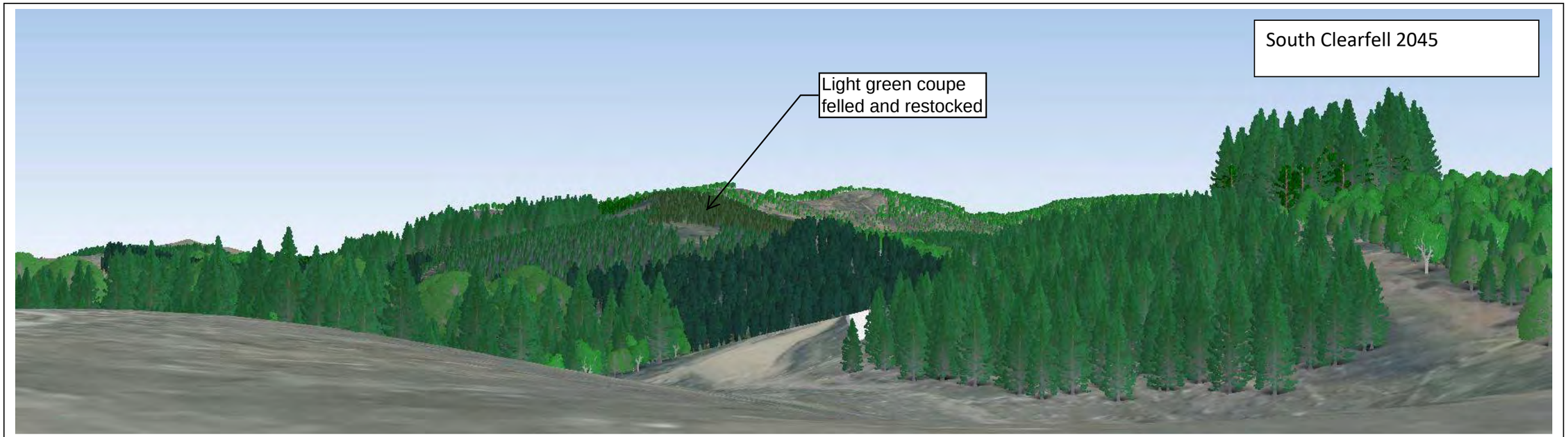
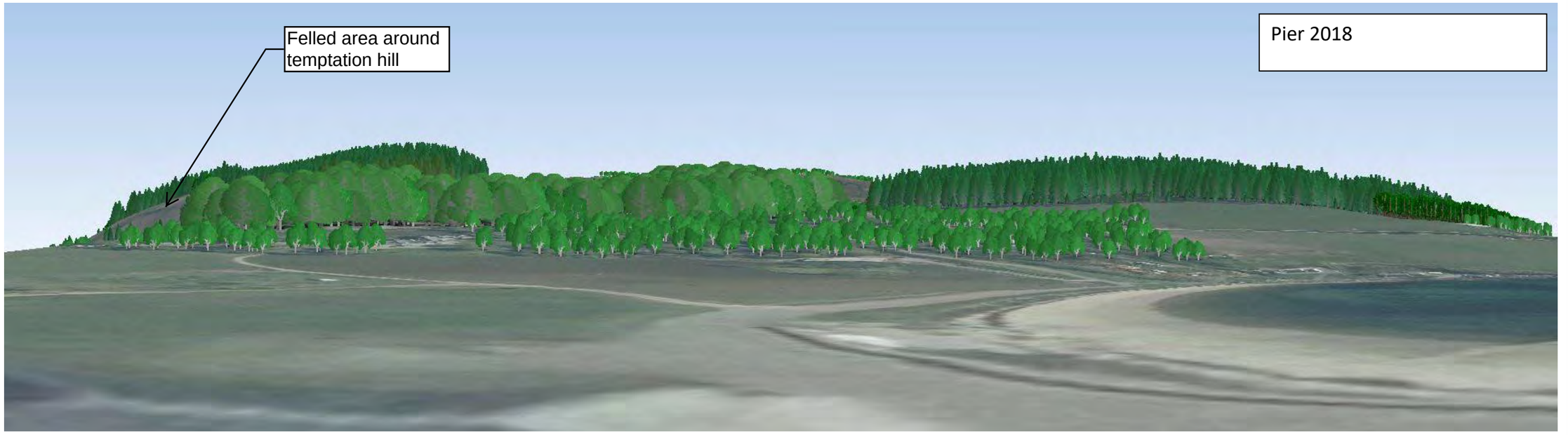
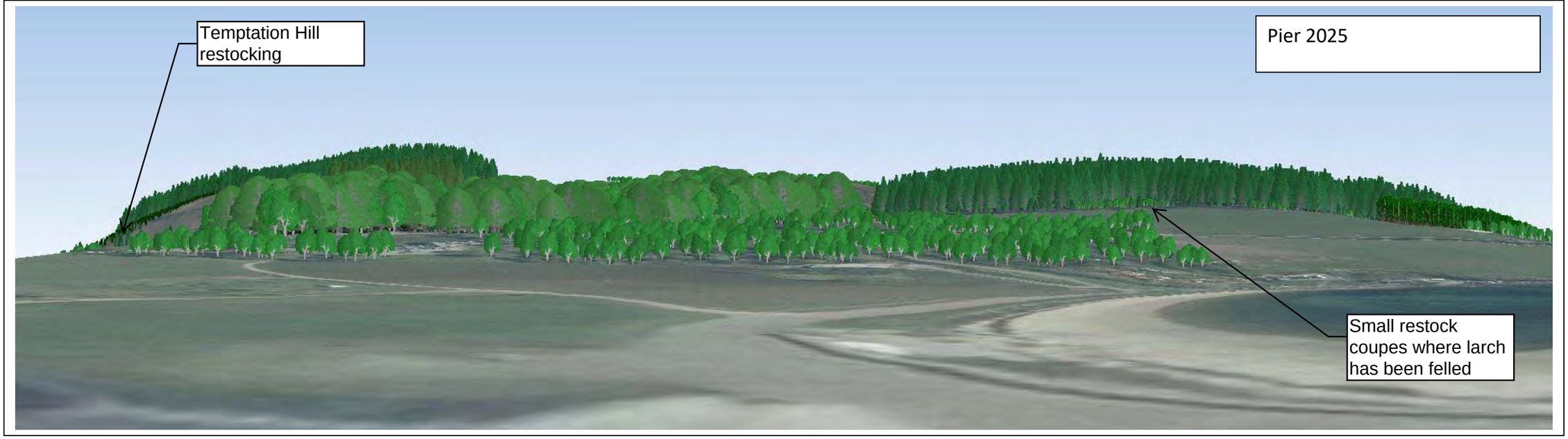
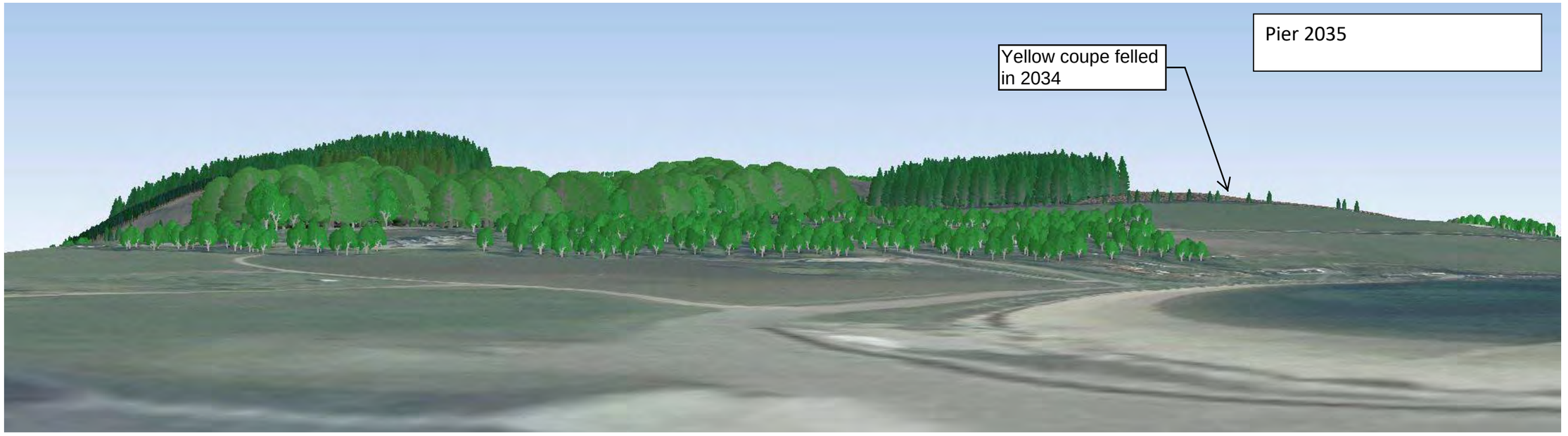
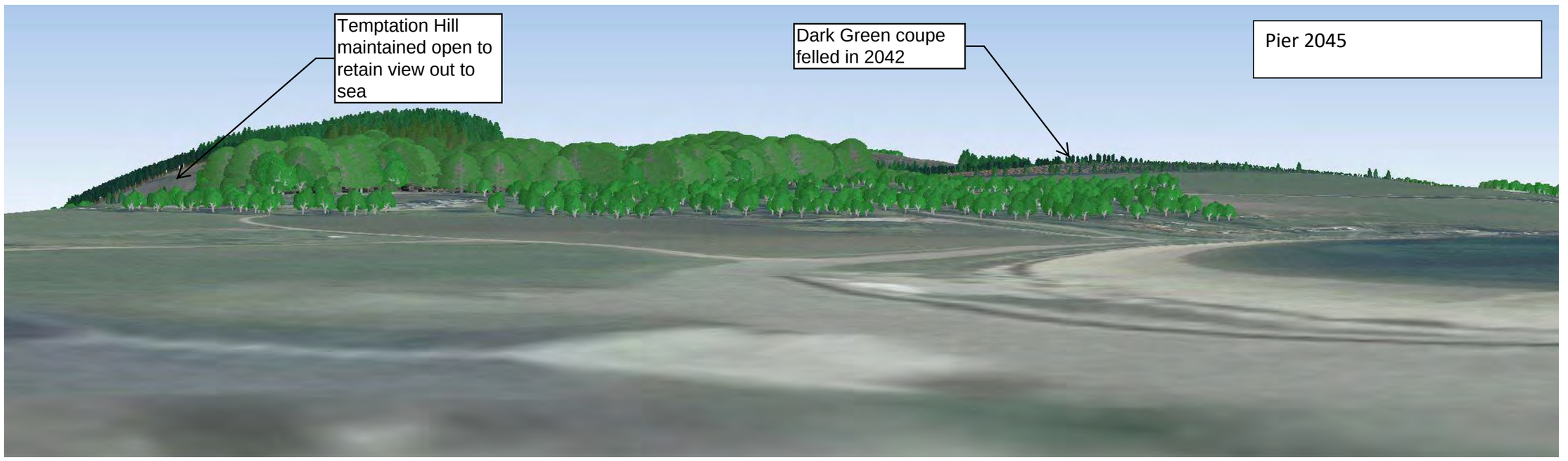





Felled area around temptation hill
Pier 2018


Temptation Hill restocking
Pier 2025
Small restock coupes where larch has been felled


Yellow coupe felled in 2034
Pier 2035


Temptation Hill maintained open to retain view out to sea
Dark Green coupe felled in 2042
Pier 2045

Pier Viewpoint

Dun Borodale Viewpoint

South Clearfell Viewpoint

Orchard Wood Viewpoint

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Environmental Impact Assessment
Screening Opinion Request Form

Please complete this form to find out if you need consent from Forestry Commission Scotland, under the **Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017**, to carry out your proposed forestry project. Please refer to Schedule 2 Selection Criteria for Screening Forestry Projects under Applying for an opinion. If you are not sure about what information to include on this form please contact your local Conservancy office.

Proposed Work

Please put a cross in the box to indicate the type of work you are proposing to carry out. Give the area in hectares and where appropriate the percentage of conifers and broadleaves

Proposed Work	select	Area in hectares	% Conifer	% Broad-leaves	Proposed work	select	Area in hectares
Afforestation	☐				Forest roads	☒	0.3
Deforestation	☐				Forest quarry	☐	
Location of work		New Forest road spur 120m long starting at NG55633656					

Description of Forestry Project and Location

Provide details of the forestry project (size, design, use of natural resources such as soil, and the cumulative effect if relevant).

Please attach map(s) showing the boundary of the proposed work and other known details.

This new forest road would allow harvesting of the larch coupes 20004 and 20040 (maps 5a, 15 and 19 shows the line of the new road)

Provide details on the existing land use and the environmental sensitivity of the area that is likely to be affected by the forestry project.

The current land use is forestry and would have minimal impact when viewed from the Broch.

Description of Likely Significant Effects

Provide details on any likely significant effects that the project will have on the environment (resulting from the project itself or the use of natural resources) and the extent of the information available to assist you with this assessment.

This forest road would be carefully designed to minimise any wash out on to the public road. Harvesting machinery may need to cross the public road, where this is done steel plates will be used to protect the tarmac.

Include details of any consultees or stakeholders that you have contacted in order to make this assessment. Please include any relevant correspondence you have received from them.

Statutory consultees such as SNH and SEPA have been consulted as part of the Land Management Plan consultation. The community have also seen final versions of the Land Management Plan.

Mitigation of Likely Significant Effects
If you believe there are likely significant effects that the project will have on the environment, provide information on the opportunities you have taken to mitigate these effects.
The new road is kept to a minimal length. The gradient will be as low as possible to reduce the effect of water on the road.

Sensitive Areas	
Please indicate if any of the proposed forestry project is within a sensitive area. Choose the sensitive area from the drop down below and give the area of the proposal within it.	
Sensitive Area	Area
Select...	
Select...	
Select...	
Select...	
Select...	

Property Details			
Property Name:	Raasay Forest		
Business Reference Number:	n/a	Main Location Code:	n/a
Grid Reference: (e.g. NH 234 567)	NG55633656	Nearest town or locality:	Portee
Local Authority:		The Highland Council	

Owner's Details				
Title:	Mr	Forename:	Ben	
Surname:	Griffin			
Organisation:	Forest Enterprise Scotland	Position:	Planning Forester	
Primary Contact Number:	03000676017	Alternative Contact Number:	07774926051	
Email:	ben.griffin@forestry.gsi.gov.uk			

Address:	Tower Road, Smithton, Inverness		
Postcode:	IV2 7NL	Country:	Scotland
Is this the correspondence address?		Yes	

Agent's Details			
Title:		Forename:	
Surname:			
Organisation:		Position:	
Primary Contact Number:		Alternative Contact Number:	
Email:			
Address:			
Postcode:		Country:	
Is this the correspondence address?		Select...	

Office Use Only	
GLS Ref number:	