
7 Land Management Plan Proposals

This section describes the broad actions we propose to undertake across the LMP area over the plan period. For the detailed technical management prescriptions describing forest structure, species choices and stocking densities for future habitats please refer to **Section 4.3 – LMP Presentation**.

This Land Management Plan has been drafted to ensure that the Planning and Delivery functions will comply with the complex raft of legislation and policies that protect and enhance the Scottish Environment. These policies and published guidance used detailed in **Appendix 3 – Key Policies and Publications**.

7.1 Forest Stand Management

The West Sutherland LMP has been produced in accordance with the UK Woodland Assurance Scheme (UKWAS) guidelines and the UK Forestry Standard to restructure the forest to adapt to the climate and biodiversity emergencies and protect globally valuable habitats, while maintaining productive capacity where that is sustainable and desirable.

This will be achieved with species matched to appropriate sites, whilst protecting designated species and sites, restoring peatland habitat, restoring PAWS and creating/expanding native and riparian woodland habitat. Water management is acknowledged as one of the main LMP objectives.

The Activity tables in **Section 2.0 Summary of Planned Operations** detail areas to be clearfelled, restocked, thinned, new planting areas and the forecast of timber volumes in the next ten years. This information can be viewed spatially on **Map 9 – Management Coupes, Map 10 – Thinning, Map 11 – Approved Coupes, and Maps 12a, b & c – Future Habitats**.

7.1.1 Clear Felling (see **Map 9 – Management Coupes**)

Parts of West Sutherland LMP area (e.g. Craggie and Craggan) have seen significant clearfelling, beyond the restructuring objectives set in previous Forest Design Plans (FDPs) - primarily due to forest health issues (*Dothistroma Needle Blight*) but also wind damage. The forests within the LMP area are producing timber of considerably variable quality: from biomass and wood fuel to good quality softwood timber products. There is very limited potential to produce hardwood timber products - the proposed significant increase in area planted with broadleaves will provide mostly environmental benefits, as the trees will be planted in lower densities and maintained as native and/or riparian woodland, with some potential for producing fuel wood.

The majority of clearfell over the next ten years will be driven by an attempt to accelerate restructuring, maximise timber recovery on sites affected by wind damage (January 2015 and 2016 storms) and DNB and to achieve the effective landscape scale mire restoration necessary to address climate and ecological breakdown.

Timber production from the plan area will consist of a wide variety of timber grades from Lodgepole pine crops, suitable for wood fuel and specific export markets, to green sawlogs from Sitka spruce, Scots pine and Larch. Maximising production will be balanced with the need to protect the soils and hydrology on sensitive sites. Clearfell will be undertaken using harvester – forwarder systems on a standing sales basis.

Due to damage caused by both windblow and DNB, some of the crops on very wet sites might not be recovered, leading to creation of deadwood habitats zones, the extent of which is difficult to predict prior to the commencement of harvesting operations but will be decided at work plan stage. However North Region will continue to work with customers and contractors to improve fibre recovery and in some areas may use direct production and low ground pressure machinery to achieve this aim. This is most likely to apply to sites proposed for mire restoration.

Felling will generally exceed restocking area within any five year period due to the practice of fallow and the inclusion of peatland restoration and higher levels of internal open space through restructuring.

7.1.2 Thinning (see **Map 10 – Thinning Coupes**)

Forest health issues (DNB) and a need to market significant extra volumes of timber following windblow events in 2006, 2015 and 2016 had an impact on the thinning programme across the former North Highland District. The need to prioritise recovery of higher value timber that may be rapidly degrading means that some thinning might get delayed. However, increasing demand for lower quality fibre means that this position is improving annually.

Opportunities to thin the crop across the West Sutherland LMP are limited by soil conditions and climate. However there are areas where thinning might and should be undertaken, and it is one objective of this plan to identify the most productive areas and to use available resources to maximise the silvicultural potential of every productive coupe. Given the age structure of crops in the forest blocks covered by West Sutherland LMP proposals (with almost 70% of afforested area covered by 31 to 60 years old crops), the scope for thinning within the current rotation is limited. More focus will be directed at identifying coupes ready for first thinning in the second rotation crops.

During the restructuring transition to riparian woodland it is anticipated that thinning of non-native natural regeneration will be required. This material will be felled to recycle to improve nutrient availability for broadleaf plantings. We also propose to lightly thin some riparian areas to promote the development of a field layer that will help positively influence water run-off. For these reasons the riparian network has been included in the thinning areas proposed on **Map 10 – Thinning**. We propose to maintain areas of the forest that are particularly important for landscape views and this will require some thinning. These areas are identified in **Map 15 – Visitor Zones and Facilities and Map 10 – Thinning**.

7.1.3 Low Impact Silvicultural Systems (Continuous Cover Forestry)

Silvicultural management systems designed to produce timber without clearfelling are variously referred to as low impact silvicultural systems (LISS), continuous cover forestry (CCF) or alternative to clearfell (ATC). These systems are widely practised across Continental Europe and Scandinavia where soils and climate allow regular thinning and can involve the retention of widely spaced seed trees. Conversion of older conifer forests is problematic in an oceanic climate because the risk of catastrophic windblow is high and there is limited age class diversity to provide a more resilient forest structure.

Given the soils (the majority of the area is either deep peat or a peaty surface-water gley), exposure (DAMS scores across majority of the LMP area ranging from 14 to 20) and species composition (mostly LP and SS/LP mix), managing any areas under LISS is not feasible across the West Sutherland LMP area. However opportunities may develop as the forest develops a more complex structure over subsequent rotations but this may be negatively impacted by the increased storm events forecast in climate change predictions.

7.1.4 Restructuring and Forest Change

The proposals in this LMP are designed to meet the challenge of restructuring a large, coniferous forest of low age diversity into a productive, resilient land holding of woodlands with higher age and species diversity and a landscape of restored habitats.

Forest restructuring efforts within the 10 year plan period will be driven by the need to maximise timber recovery from crops affected by wind damage and/or Dothistroma Needle Blight and by peatland restoration. Although the extent of wind damage across the LMP area, and the scale of previous DNB and windblow related felling means that there is relatively small scope for designing felling coupes, the restock coupes are designed to be more wind firm by utilising watercourses, roads, landform, existing and created open spaces as natural boundaries.

Given the scale of the task it needs to be accepted that this might not be achieved within the next rotation, but will allow for both structural diversity and will reduce the risk of catastrophic windblow in subsequent rotations.

7.1.5 Deadwood Habitats (see **Map 13 – Deadwood Priority Zones**)

Deadwood is a vital element of the forest ecosystem, positively affecting biodiversity, carbon storage, soil nutrient cycling, energy flows, hydrological processes and natural regeneration. Consequently, retention of deadwood is a mandatory element of UKFS sustainable forest management. Guidance on quantities required is not specific but an average of 20m³/Ha has long been acknowledged as a minimum industry standard.

Deadwood also plays a vital role in the functioning of river ecosystems. Managing riparian woodland under a Minimum Intervention regime in future will encourage a high proportion of deadwood over time, helping to retain water and sediments, trapping and facilitating the

breakdown of organic matter into food for aquatic invertebrates, diversifying channels by creating pools, falls and riffles and improving physical habitat structure for fish and invertebrates.

Managing Deadwood in Forests and Woodlands – A Practice Guide (Humphrey and Bailey, 2012) and the FLS internal guidance document written and reviewed by the FLS Species Ecologist on proportions and types of deadwood, will be used to guide decisions on the spatial distribution and quantities of retained deadwood and **Map 13** details the high, medium and low priority zones for this LMP area that underpin this approach.

The position and type of deadwood required will be directed by the Environment team in coupe workplans and agreed pre-commencement on harvesting operations. Achievement will be reviewed at each coupe 75% meeting.

Some areas of forest blocks within the West Sutherland LMP area are very prominent in the landscape and highly visible from the A837 tourist route north, therefore the extent and location of deadwood retentions will be a consideration when planning felling in identified visitor zones.

7.2 Future Habitats & Species (see **Maps 12a, b and c**)

Outwith the substantial areas of blanket bog and skeletal soils the forests across the LMP area are capable of growing timber crops of varied quality, from biomass to construction timber. Due to ongoing native woodland restoration and the extent of deep peat suitable for priority habitat restoration, the area available for producing softwood will be significantly reduced, allowing creation of native and riparian woodland and an increase in open habitat area at a landscape scale. In general, this broadleaf woodland will be concentrated in both current and newly created riparian zones and in native woodland zones, however broadleaved species will be encouraged throughout the entire forest, by retaining regeneration and establishing new seed sources by planting.

All native woodland establishment will be designed and delivered within the current FLS guidelines (Rodwell & Paterson, 1994). Planting operations will be aimed at encouraging a suitable National Vegetation Classification (NVC) woodland type appropriate to the soils and indicator vegetation encountered on site. This will be identified subsequent to harvesting operations and will comply with FLS fallow policy. While it is important to acknowledge that climate change may have a significant effect on species choice in the long term and that the concept of 'nativeness' in a Scottish context may have to be revised, within this plan period any adaptation is likely to be restricted to sourcing plants with a more southerly provenance.

Creation of riparian woodland will increase internal open space, fragmenting productive blocks, increasing forest edge habitat and allowing a windfirm network of permanent habitat corridors to develop. This in turn will allow for greater age class diversity in future rotations by providing a 'framework' within which reduced coupe sizes can be managed. Current climate change

predictions under all climate change scenarios indicate that freshwater biota may become threatened by increases in summer temperatures and altered river flows resulting from increased precipitation. Salmonids in particular are susceptible to temperature changes (Broadmeadow, 2002). In addition soil erosion may be exacerbated by increased flood and drought cycles. The increase in dappled shade and soil stability provided by broadleaf riparian woodland will help to protect river ecosystems from the predicted temperature fluctuations predicted to result from climate change.

Across the LMP area planting of native broadleaf species will be carried out along watercourses, to create riparian woodland and improve the aquatic environment. Planting will be undertaken in compliance with UKFS Guidelines (2017), within the footprint of existing forests (where conifers were planted right to the banks of watercourses and subsequently felled). Native broadleaves will be planted where previous crops were kept away from watercourses, to introduce a site-appropriate seed source and establish riparian woodland, with the projected future canopy cover at 60%. We will plant trees in dense groups on suitable ground, avoiding low lying, waterlogged and deep peat areas. Planting along the burn, at the time of restocking of the adjacent coupe, will create a screen for the conifers and will link to native woodland schemes on neighbouring land. Timing will depend on restocking of adjacent coupes, between 2020 and 2030.

In making decisions about future habitats we are conscious that it is the duty of every public body and office-holder, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions, as stated in the Nature Conservation (Scotland) Act 2004.

Productive Restock Planting (see **Maps 12 a-c**)

Restocking in productive areas will aim to maximise the productive capacity of the forest, the brief guidelines below will be followed to ensure adequate restocking:

- To obtain maximum benefits from restructuring, contiguous restocking areas will not be less than 3 Ha per individual shape or exceed 50 ha unless forest health issues, open habitat restoration feasibility or windblow dictate otherwise.
- Restock coupes adjacent to the forest road network should be restocked to within 5 metres of the forest road for at least 30% of the coupe frontage for future access to facilitate soil protection.
- Non - productive broadleaf elements within productive coupes will be located where they will be of greatest benefit; along drainage channels, adjacent to open ground, other broadleaf woodland or around archaeological features to enhance the setting.
- Commercial restocking will not be undertaken on soil types 9e, 11c, 11d due to the intensive drainage regimes and high fertiliser inputs required.

The LMP proposal seeks approval for restocking of areas felled prior to plan approval, species enhancement operations and those coupes felled within the 1st 5 years from the

date of approval. The 5 year fallow period generally means that all coupes felled in the 2nd phase of the plan are being restocked outside the approved plan period.

In order to secure approval for the restocking of coupes felled in the 2nd 5 year phase of the plan, if a shorter fallow period is applied, the proposed areas of 2nd phase restock are also shown on Maps 11 & 12 – Operations: Felling & Restocking.

The Confederation of Forest Industries Ltd (Confor) and the timber processors that Confor indicated would have an interest in this LMP have been consulted during the scoping period of the plan revision. Where those consulted have responded this is recorded in **Appendix I – External Consultation Record**.

New Planting

This plan proposes one coupe of new planting at Stratheskie extending to 7.78 Ha on land currently used for extensive, seasonal grazing of sheep and cattle. The SGRIPD holding number for the grazing is 767/0188 and the area lies within a field of 36.47 Ha with the identifier NC/29417/09117. The coupe is identified spatially on Map 12 – Future Habitats.

The coupe centres around OS NGR NC 29430 08900 and access is gained from the county road at NC 29130 09000.

The FLS Open Habitats Ecologist visited the site on 16th August 2011 to identify new planting opportunities and priority open habitats. His comments were as follows:

"Looking towards the north west the open area opposite Preas a Chranaidh appeared to have much acid grassland and may therefore be potentially suitable for woodland expansion. The FES HAP survey by the Averis's picked up a fair bit of blanket bog in the survey here so any potential woodland expansion would need to be carefully planned and more detailed survey is suggested."

Following this recommendation a detailed peat survey was undertaken to eliminate areas of blanket bog from consideration. The final shape of the coupe was informed by both these surveys and the resulting output was the shape detailed in **Map 12**.



Above: looking north west from the forest road access into Benmore at NC 29680 08450 towards the proposed new planting site – indicated by the blue arrow.

Fertiliser

The extended fallow periods (generally up to five years) that are required prior to restocking, to allow pine weevil populations to abate, have the negative effect of compounding nutrient deficit because nutrient released from decaying leaf litter will largely have been flushed from site by year five. Therefore it is anticipated that post planting applications of fertiliser will be required on the upper margins of the forest and remedial applications may be required in some crops in line with industry best practice (Taylor, 1991).

However appropriate choice of silvicultural mixtures and well-timed heather control will be preferred to fertiliser. Broadleaf species will be incorporated within silvicultural mixtures to improve soil function and encourage the field layer to develop. The overall area of productive woodland will be reduced during the life of the plan through the removal of plantation from riparian and peatland restoration sites.

7.3 Management of Open Habitats (see **Maps 5a, 5b & 12a**)

We recognise the valuable ecosystem services that are provided by open land and in particular active ombrotrophic mire systems such as blanket bog. The benefits include carbon and methane storage, water quality improvement, reduced flooding risks and increased biodiversity. The risks to peatland from forestry are well documented but what is perhaps less well understood is the role that low intensity woodland may have on carbon capture and storage. However given the body of evidence available to demonstrate the detrimental effects of forest establishment on blanket bog our proposals are designed to comply with the Scottish Government's Environmental Strategy (2020) which states that *"where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost effective measures to prevent environmental degradation"*. Adopting this precautionary approach and in full recognition of the global significance of Sutherland's peatlands our proposals for peatland restoration are ambitious and significant.

West Sutherland LMP contains significant areas of afforested deep peat, exposed and located at the outer fringes of forest blocks and throughout many coupes, but also present on low lying ground along A837. Those areas tend to produce slow growing trees (mainly Lodgepole pine, but also Lodgepole/Sitka mix) of poor quality, often suffering from *Dothistroma Needle Blight* (DNB) infection. These areas are also capable of being restored to priority habitat, thereby improving the hydrological function of neighbouring mires, restoring the full extent of the blanket mire systems and contributing to the landscape feeling of 'wild land'.

Future management decisions regarding these areas are based on current UKFS requirements, Scottish Government's Policies on Control of Woodland Removal, The Environment Strategy, The Scottish Biodiversity Strategy, The Peatland Strategy, Scotland's Soil Strategy and the recently published FLS Practice Guide 'Deciding future management options for afforested deep peatland' as well as evidence presented in the JHI Publication *Wise Choices for Peatland* (2013). Together these policies create an overwhelming legislative momentum to restore the valuable peatlands of Caithness and Sutherland. Consequently, where deep peat coupes have the potential to be restored and thereby contribute significantly to biodiversity and the hydrological function of adjacent peatland sites, and there is a good chance of restoration being successful, we will undertake works to smooth ground profile, block drains and furrows and remove regenerating non-native species, so that priority open habitat can be restored.

Additionally the low yield classes recorded for timber crops on these mires (see **Map 7 – Yield Class**) were achieved with the 'advantages' of late twentieth century silvicultural practices of intensive drainage regimes and generous fertiliser applications and cannot be repeated for subsequent crops using the resources available today.

The extent of the overplanted peatland areas across the LMP area can be viewed spatially in **Map 5b – Peat Depths**. These data represent peat depth measurements undertaken at 100m centres across most of the forested blocks and very effectively demonstrate the continuity of the blanket bog systems at a landscape scale.

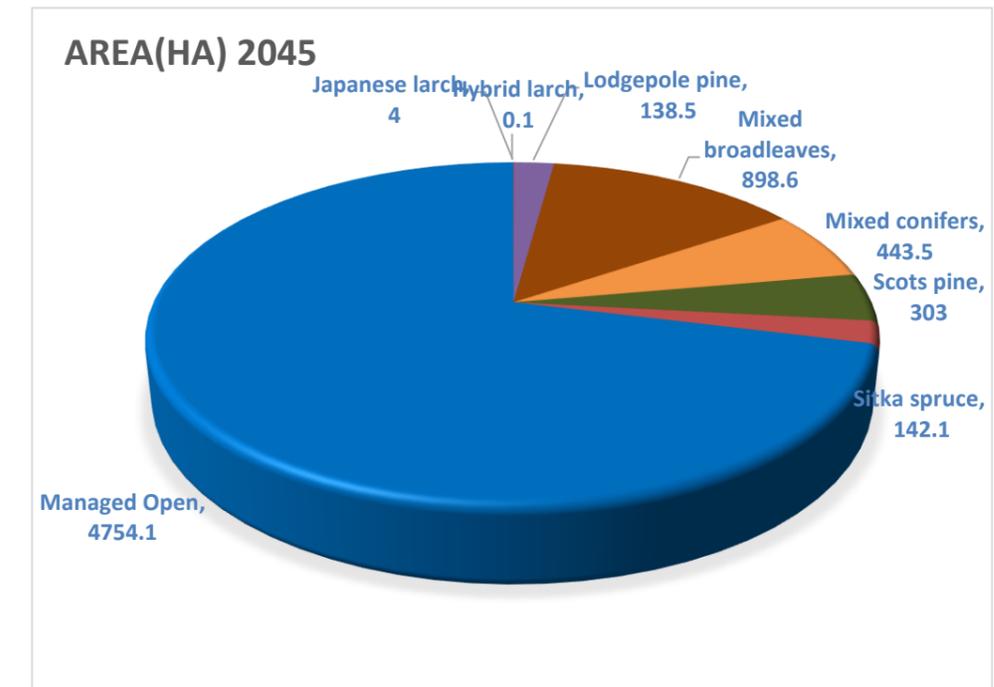
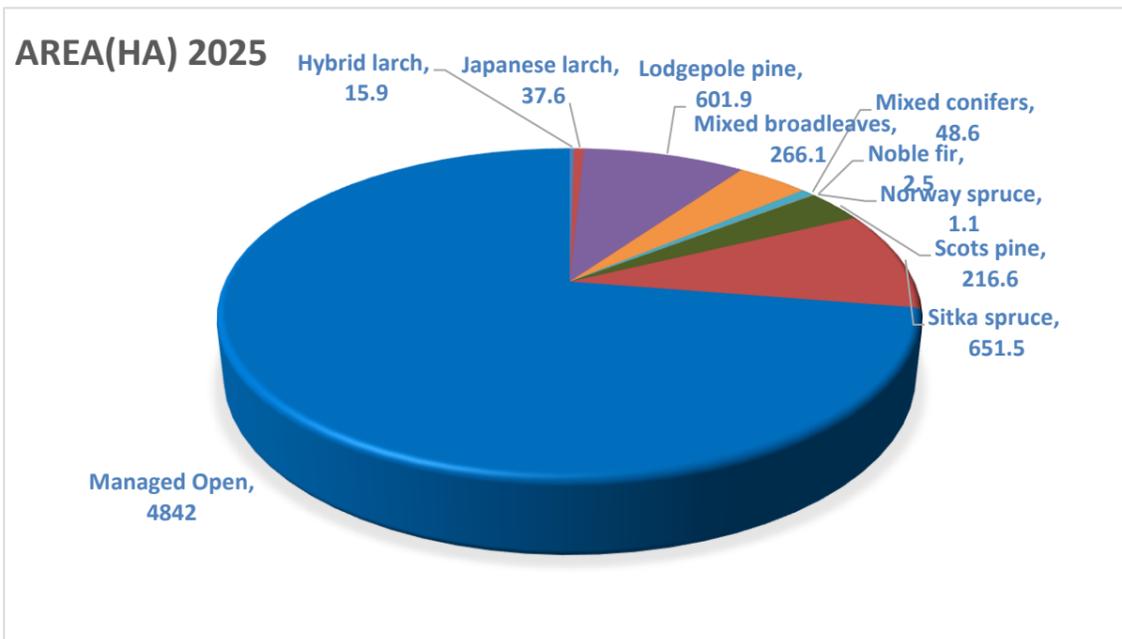
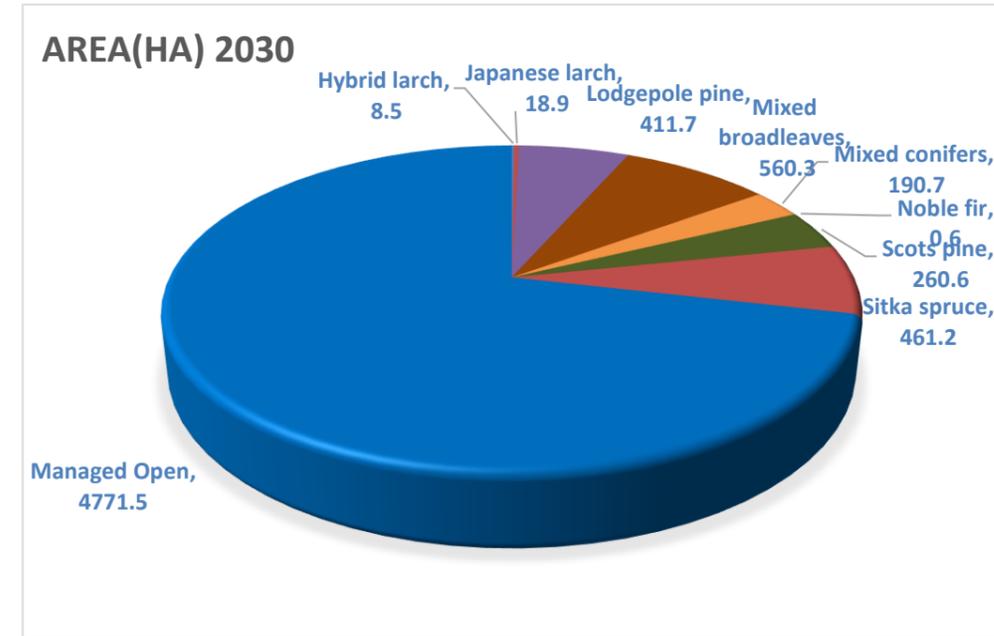
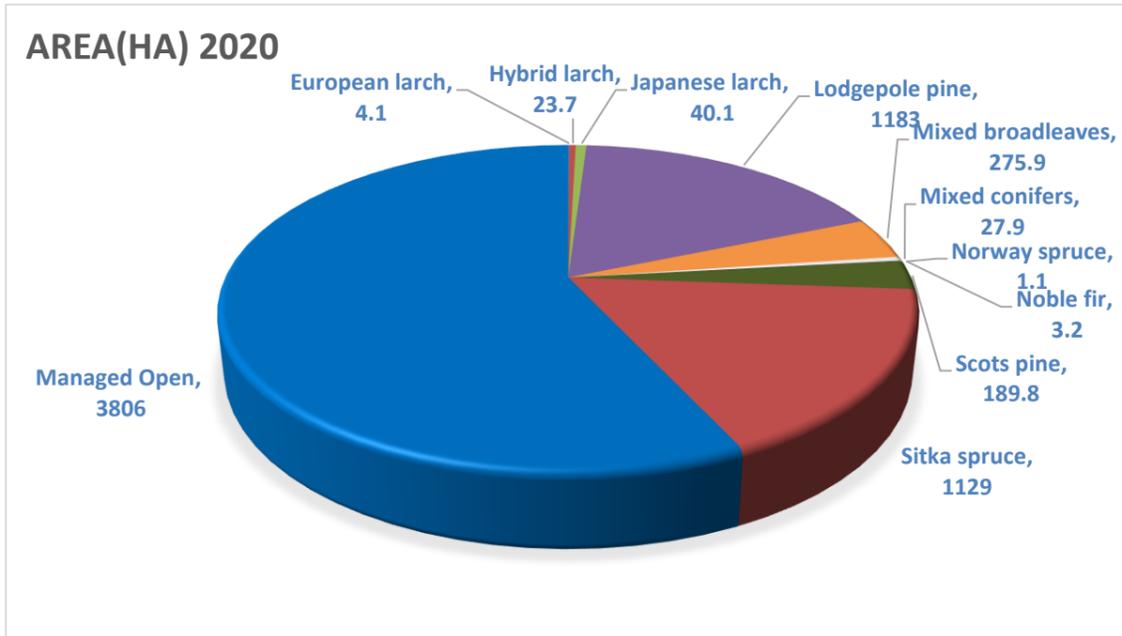
On more fragmented areas of deep peat, where restoration will be less effective due to the level of damage caused by modification during the previous rotation and where we can't expect even a moderate rate of tree growth if restocked with conifers at commercial density, we will aim to promote wet woodland of native character.

Other open areas (including priority open and archaeological features and their protective buffers) will be maintained, using grazing where appropriate, to prevent natural regeneration of trees. Of particular interest in this plan area are flushed upland calcareous grassland habitats at Stratheskie around NC 3003 0838 and at NC 3210 1230 west of the River Oykel. More details about this area and the report produced by the FCS Open Habitat Ecologist in 2011 can be found in Appendix 6 – Key Species & Habitats. Smaller scale open habitat features, associated with the woodland habitat types described above, with buildings and with solid geology has not been mapped.

The management of open land is detailed in section **4.3 Management Prescriptions** and is visualised in **Map 12 – Future Habitats**.

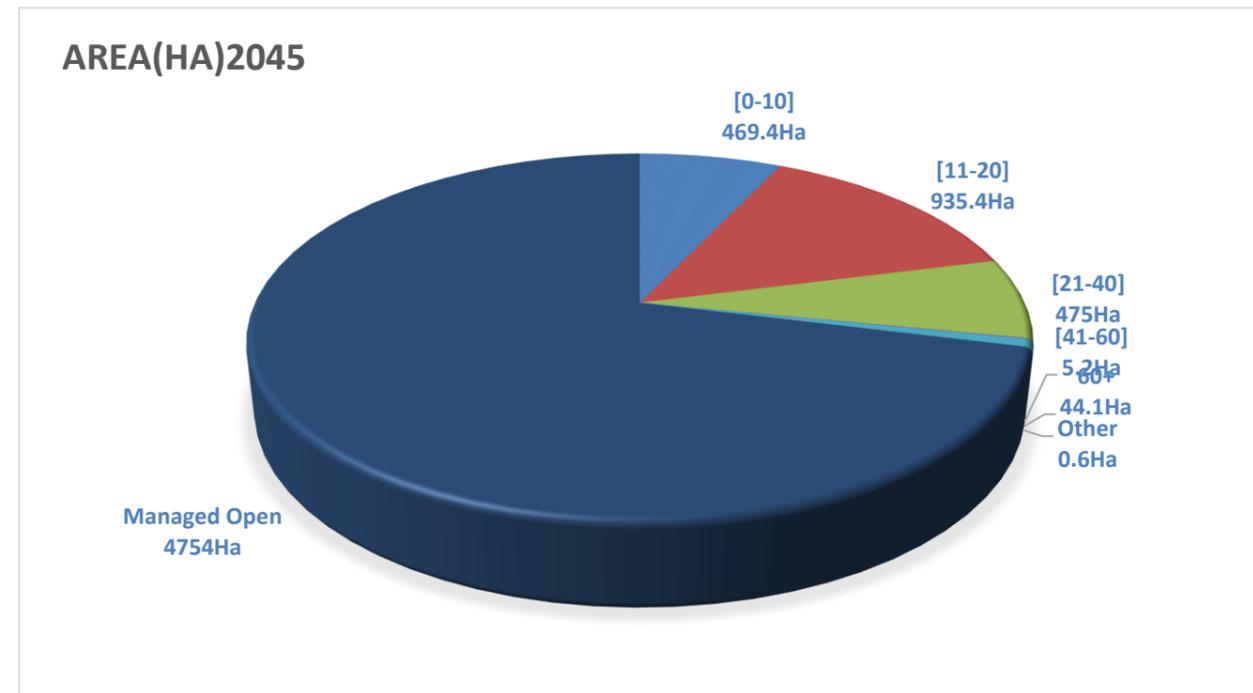
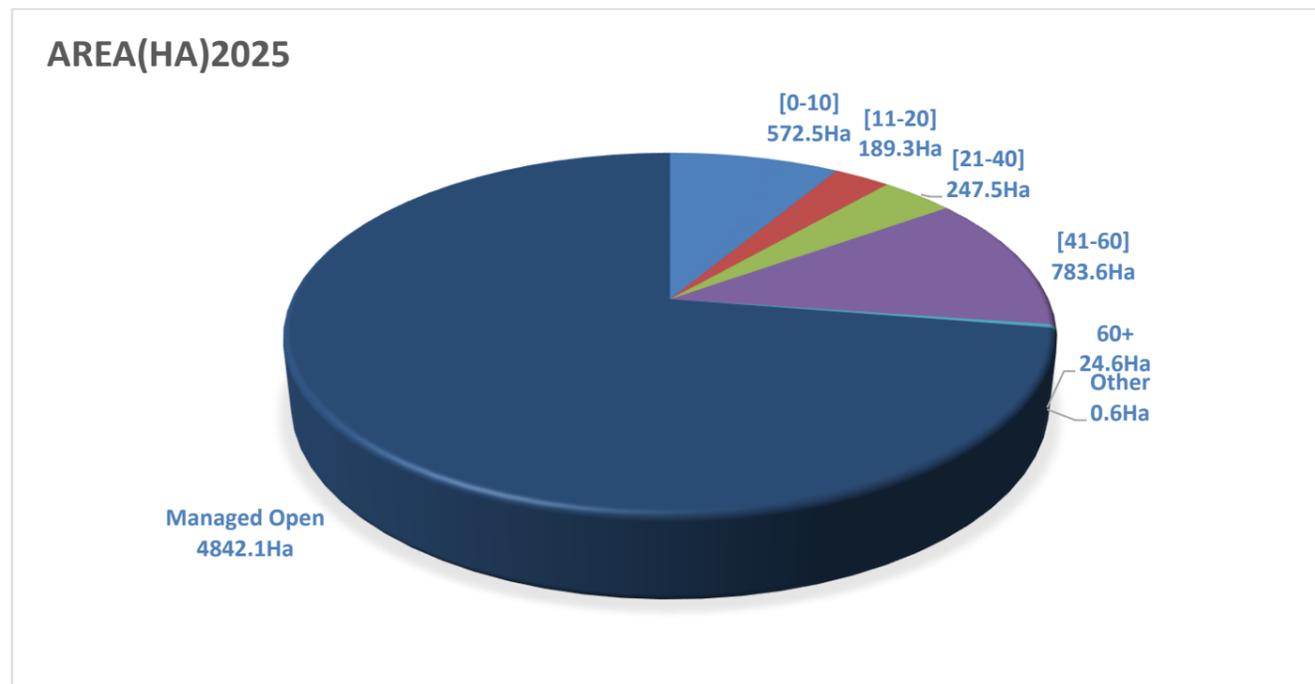
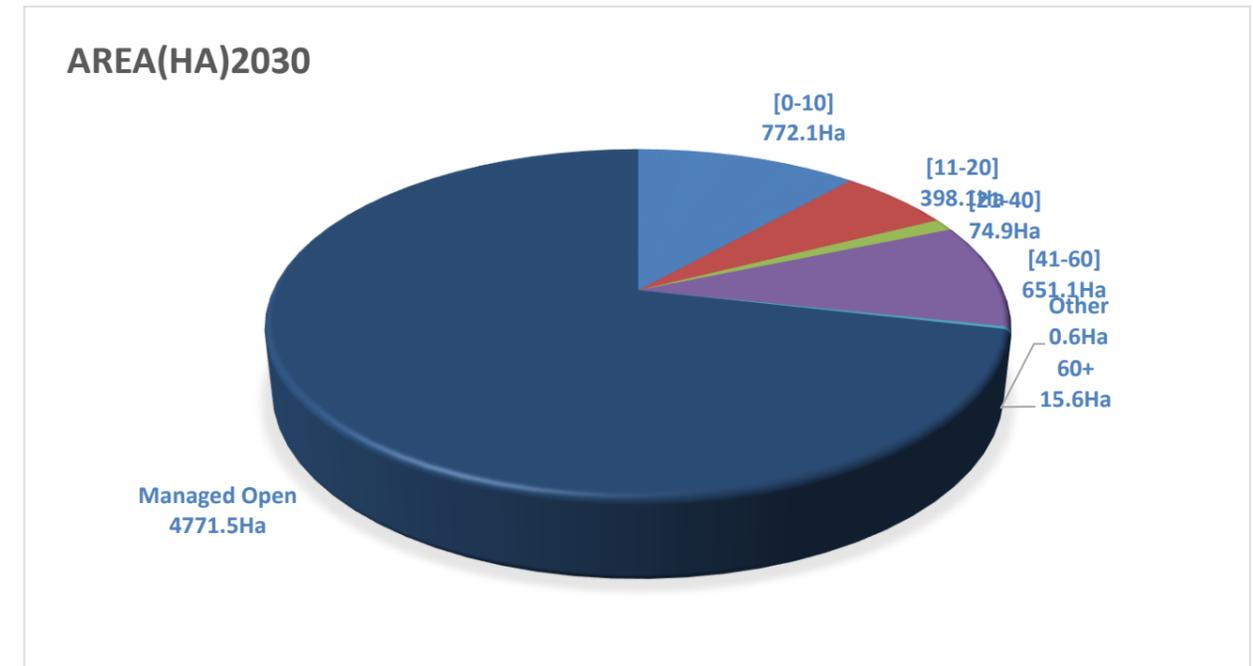
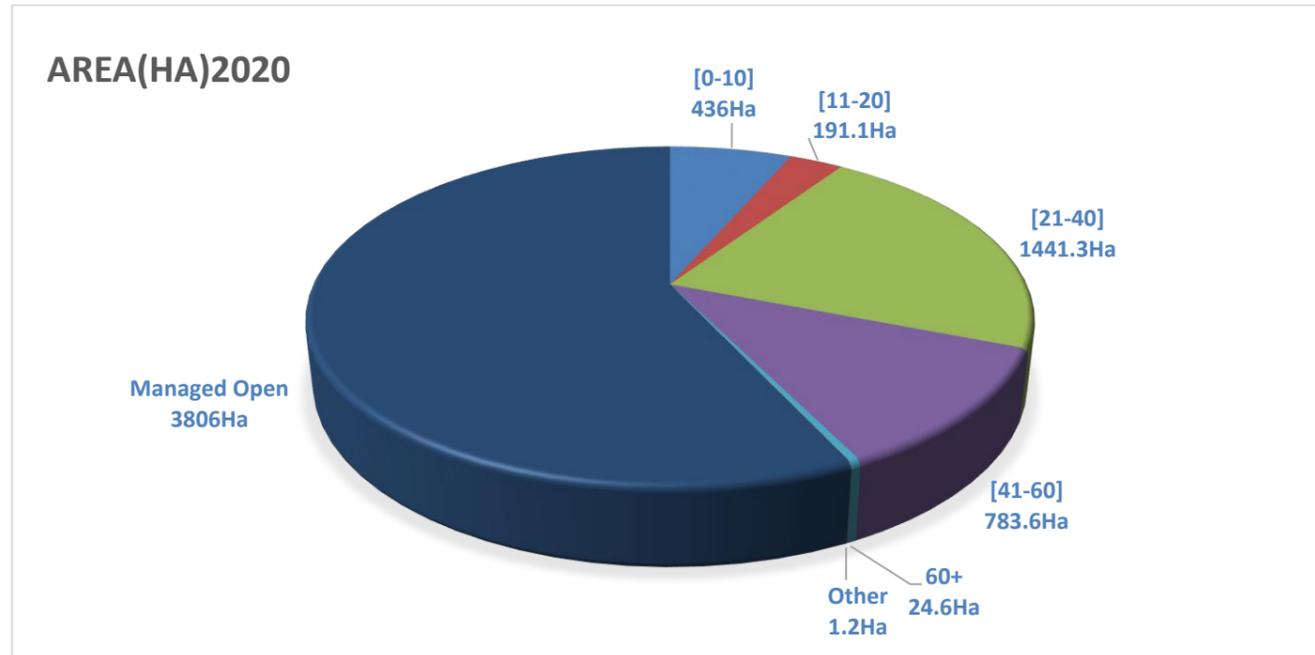
7.4 Species Composition Charts

The charts below illustrate the change of species in time that will result from our proposals:



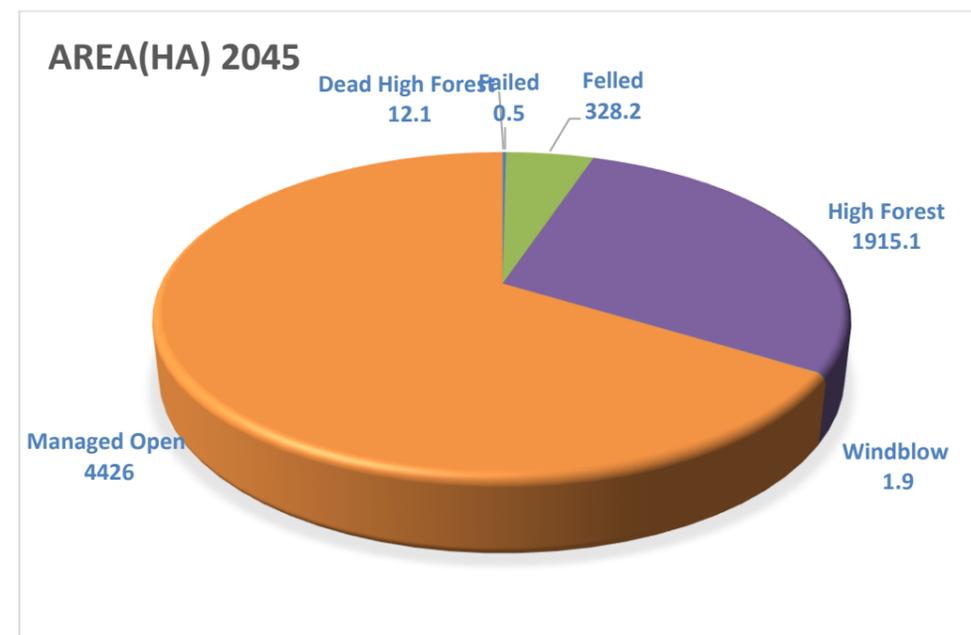
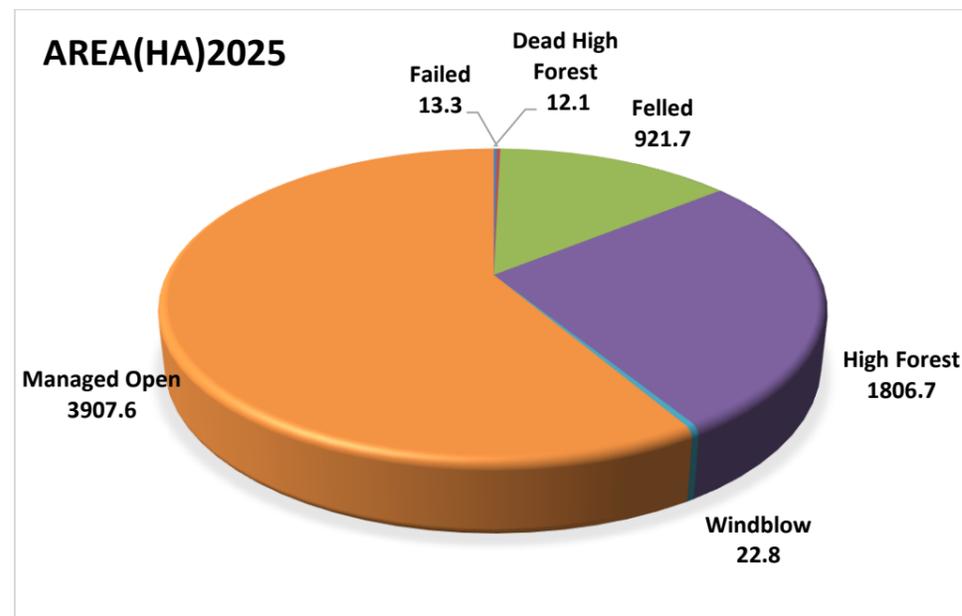
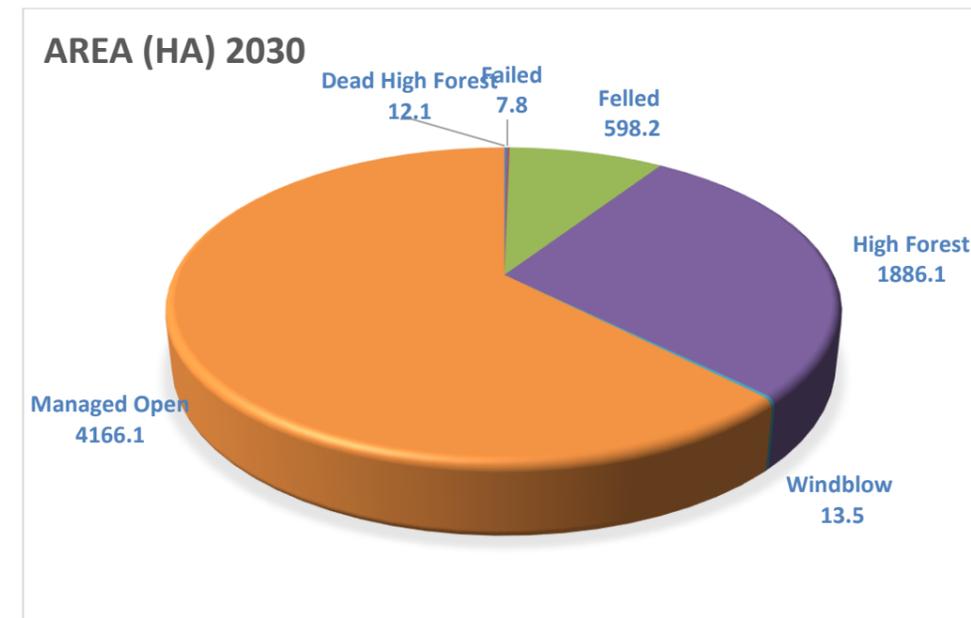
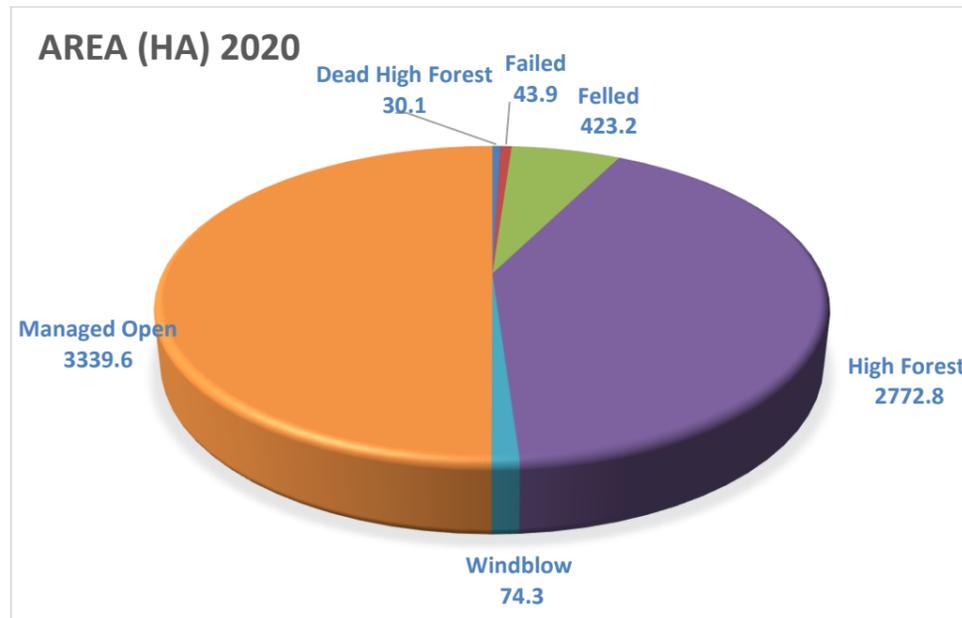
7.5 Age Composition Charts

The charts below illustrate the change of age structure in time that will result from our proposals:



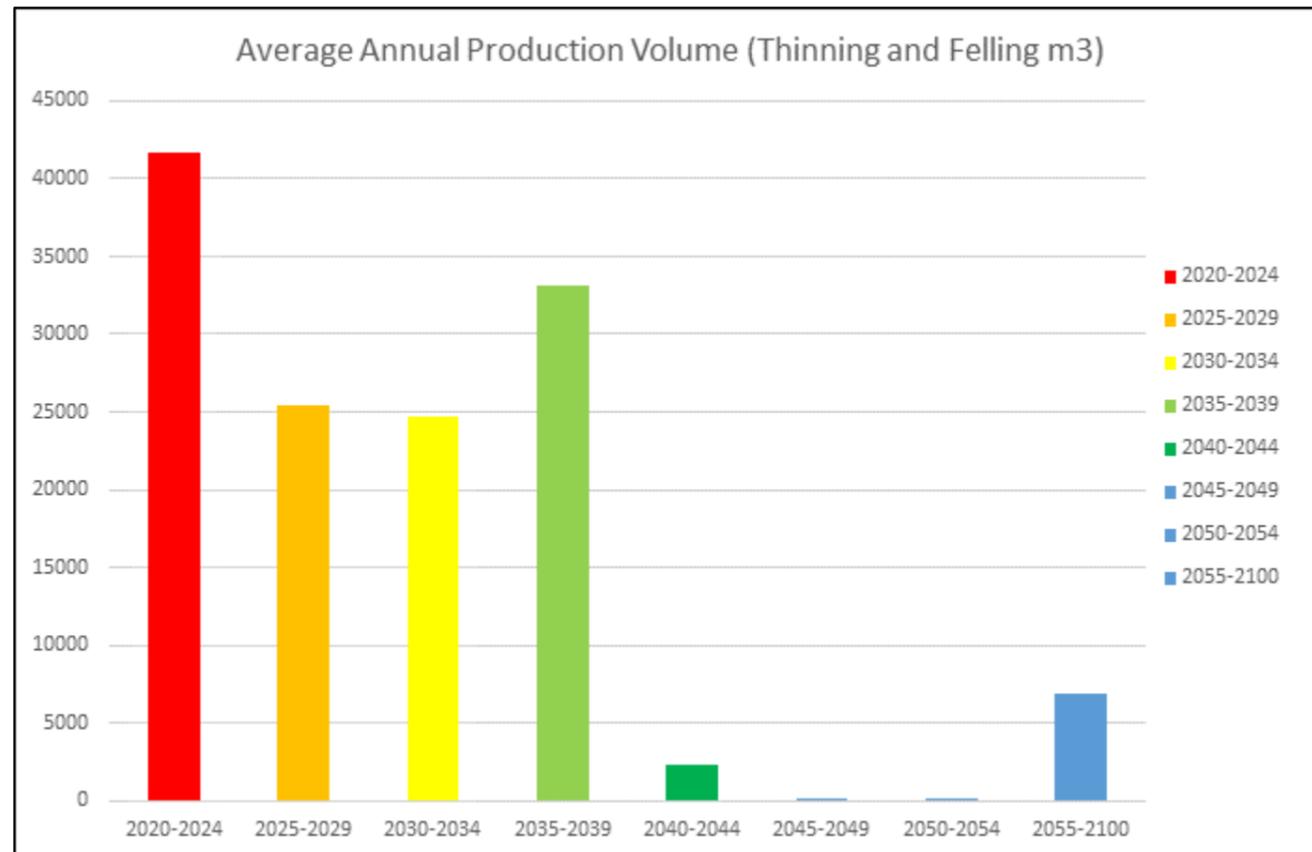
7.6 Land Use Composition Charts

The charts below illustrate the change of land use in time that will result from our proposals:



7.7 Production Forecast Graphs

The graphs below show average annual production split by phase and in the first graph, coloured to match the management coupes map. Production remains consistent across the first four phases with a slight peak in phase one to accelerate the restoration of mire habitats.



7.5 How these proposals align with the FLS Guidelines, Adopting an Ecosystem Approach to Managing Scotland's National Forest Estate (2018)

Guidance Principle	Guidance Defined Broad Aims	LMP Area Proposed Contribution
Significant Natural Assets	Our planning will ensure the positive management of the most significant natural assets on Scotland's National Forest Estate and the multiple ecosystem services that arise from them. We will analyse these natural assets to better understand complex issues, inform our decisions and set balanced management objectives.	The LMP area comprises extensive areas of blanket bog, concentrated areas of native woodland and freshwater ecosystems of global importance for biodiversity and carbon storage. Throughout the revision of this plan, survey and analysis of data has played a key role in identifying the most appropriate mosaic of habitats and the highest priorities for ecosystem restoration. Ongoing monitoring of the water environment has allowed us to quantify the impacts of forest operations and mire restoration, ensuring that proposals maximise positive benefits. We propose to continue this monitoring programme to establish the LMP area as a long term study site of landscape scale land use change.
Ecosystem Integrity & Functioning	Our planning focuses on the integrity of habitats and ecosystems (so we have all the parts) and their various functions (so they work properly).	The proposals to restore blanket bog hydrology and vegetation and create significant areas of native riparian woodland will improve ecosystem function that directly benefits freshwater habitats. These actions are also designed to slow and eventually reverse the release of methane, carbon dioxide and dissolved organic carbon.
Pressures and Risks	Our planning will seek to ease the pressures on (and risks to) Scotland's National forest and lands the wider environment that may degrade our natural assets and impair ecosystem services.	By widely restoring natural ecosystems the proposals for the LMP area seek to reverse damage to habitats created by inappropriate afforestation undertaken in the mid-20 th century. In addition we will seek to utilise the most appropriate species for the site in silvicultural mixtures to enhance the provisioning service of timber production. Deer management will be an important element in achieving successful establishment of the woodland restructuring proposals and a combination of culling and maintaining the external boundary fences is critical to success.
Resilience	Our planning will maintain and enhance the resilience of our forests, woodlands and open habitats so they can recover from threats and continue to develop and evolve. We will also enhance the potential of Scotland's National Forest Estate to make society and the environment more resilient to the impact of climate change.	The LMP area has suffered considerably from disease and windblow in recent years and our proposals will help to restore what has been lost in terms of a healthy forest structure and functioning peatlands. Increasing the area of productive forest that has a wider range of species and reducing the size of individual productive coupes within an improved network of permanent native woodland will increase the forest's resilience to climate and disease impacts over the coming decades. Ensuring that the correct areas of blanket bog are restored and maintained as wetlands will increase the area's resilience to wildfire.
Spatial Patterns & Connectivity	Our planning will identify natural spatial patterns to understand where linkage or enlargement can enhance the functioning of natural assets. These include the way that soils, climate and habitats change across the landscape and the ways different species use landscapes.	The burns and rivers of West Sutherland provide an ideal opportunity to increase habitat connectivity by providing a framework for large scale riparian woodland restoration, improving habitat functionality. In addition we are proposing large areas of forest to bog peatland restoration to establish both internal wetland links and connectivity with peatlands in surrounding ownerships. These restoration proposals have been supported by considerable survey effort and interpretation of spatial data.
Geographic Scale	Our planning will consider natural assets at all scales. It will contribute to landscape-scale ecosystem restoration on our land and adjacent properties, and consider significant small-scale, place-based assets (such as ground-flora hot spots, archaeological sites, ponds,	Our proposals for West Sutherland are based on the premise that ecosystem restoration is most effective at landscape scale. Assynt and West Sutherland are big, dramatic landscapes and our proposals seek to compliment this by ensuring the proportions of habitat restoration are generous. However there are also very important areas of limestone influenced flora and short stretches of

	veteran trees, and roosting / nesting sites) and processes (such as ground flora colonisation).	freshwater habitat that we will seek to enhance and protect with our proposals for open habitat management and riparian woodland expansion.
Timescales & Change	Our planning will cover all timescales because ecological change occurs from the short to the very long term. We will evaluate how our most significant natural assets are changing and state how we intend to influence that change (if at all).	Our proposals for West Sutherland LMP area demonstrate commitment to long term management. The operations being carried out to restore the peatlands are just the first intervention and full restoration and maintenance of these fragile habitats will take many decades. Our proposals demonstrate how we propose to monitor and respond to any changes that may harm these wetlands. The process of restructuring these forests to reach the point detailed in the future habitats maps will take decades to complete, however it has already started and where opportunities are identified to accelerate the changes we will consider these carefully.
People	Our planning will seek to include people in decisions relating to natural assets and the ecosystem approach, and will follow the stakeholder engagement principles set out in our Land Management Planning guidelines.	A full consultation process has been followed during the revision of the West Sutherland LMP and the log can be found at appendix 1 of this LMP. We recognise the important socio-economic role that forestry plays in the far northern counties of Scotland and so our proposals are designed to continue to provide employment opportunities in the forest industry. However we also recognise the continued importance of tourism to the local economy and that the management of the national forests and lands contributes to visitors and locals wellbeing and health. So our proposals seek to strike a balance between productive forestry and woodlands that will enhance the natural environment and provide a recreational resource.