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1.0 Introduction:

1.1 Setting and context

The forest is situated on the north-east coast of Fife between St Andrews and Tayport. The forest was planted on the sand dunes at the mouth of the River Tay. It is an example of lowland predominantly coniferous forest in a flat landscape. It extends to 1573 ha with the northern block of Tentsmuir Forest (including Morton Lochs) and Reres Wood in the south. The coastal location has an effect on soil structure, characteristic and climatic influence.

The land was acquired by the Forestry Commission in the 1920s and planted predominantly with Scots pine and Corsican pine. There are still a few sites with the first rotation of pines planted between 1922 and 1925. In addition to commercial forestry, careful management has created an interesting mixture of open space, ponds, trees and sand dunes that are rich in wildlife. Through time other species were introduced: Lodgepole pine, Sitka spruce and broadleaved species.

The forest is under the process of converting to continuous cover forestry which started with the implementation of the previous plan in 2002. The process has been complicated by a significant and widespread infection of Dothistroma Needle Blight (DNB).

The fungus was first recorded in the forest in 2005 on Corsican pine and since then almost all pine stands have been affected including Scots pine, which was initially thought to be resistant. Young stands appear to be the most affected. Young trees have lost 1 to 2 years of needles and growth has practically stopped. A new thinning regime has been implemented, following guidance from Forest Research, to remove around 50% of standing trees in order to decrease humidity levels under the canopy and decrease infected material. Pruning is also being considered to improve timber quality.

Minimising the effects of DNB infection will have a big impact on the current plan. However maintaining a pine forest will remain a priority and influence other aspects of Tentsmuir management.



Tentsmuir: location map

1.2 History of plan

Tentsmuir is the subject of an existing forest plan: 504/01/59 for 2002-2012.

1.3 Planning Context

The management of the Forestry Commission Scotland's national forest estate is guided by The Scottish Forestry Strategy (SFS) 2006, which sets out seven key themes:

- **Climate change**
- **Timber**
- **Business development**
- **Community development**
- **Access & Health**
- **Environmental quality**
- **Biodiversity**

Table 1. Relevant issues under the SFS and Tay Forest District Key Themes

SFS Key Themes	Relevant issues identified for Tentsmuir FDP
Climate Change	Carbon sequestration is increased by extending low impact silvicultural systems (continuous cover forestry). Renewable energy opportunities are limited by conservation and recreation importance; however the small dimension thinnings have a local biofuel market. There will be a particular emphasis on suitable species choice for the site under climate change and Dothistroma threat.
Timber	Continue to grow quality timber sustainably by using Continuous Cover Forestry (CCF) management. Production may be reduced due to heavier thinning and poor growth in stands affected by DNB. This may be compensated by an increased growth response in thinned stands and restocking with better performing species. Pruning in open stands will be required to improve timber quality.
Business Development	Developing tourism opportunities, upgrading and enhancing facilities and actively exploring opportunities to work in partnerships with local communities and businesses.
Community Development	Pressure from surrounding communities as the only forest in a wide area, identifying communities expectations, cooperation with interest groups (bikers, runners, horse riders, husky racing etc.)
Access and Health	Working closely with the Local Authority access officer to improve information flow and to identify potential impact of existing paths and informal routes.
Environmental Quality	Good operational practice: following prescriptions for protected areas, protection of water quality, cultural heritage, cooperation with environmental agencies and understanding of the landscape value.
Biodiversity	Continuing protection of priority species and habitats. Surveys to identify new species, dune restoration, managing natural regeneration and managing potentially invasive species such as rhododendron.

Table 2. Initial brief and objectives for developing management proposals

Brief	Objectives
Minimise DNB and climate change influence on the forest	<ul style="list-style-type: none"> • Maintaining pine forest while reducing risk by introducing new species • Continue to manage on CCF principle for pine with necessary adjustments • Change thinning regime in affected stands
Considering restock options for different scenarios of disease behaviour	<ul style="list-style-type: none"> • Decide on restocking needs (new species consideration) and natural regeneration management for individual stands • Restock using good silvicultural practice regarding species selection and planting density
Maintain existing natural habitats	<ul style="list-style-type: none"> • Protect statutory sites according to agreed guidelines • Identify areas of conservation importance (eg. Bats, badgers, herons, reptiles habitats)
Preserve historic features	<ul style="list-style-type: none"> • Protect all known features including scheduled and unscheduled ancient monuments
Emphasis on public involvement	<ul style="list-style-type: none"> • Identify existing and potential future users (schools, interest groups) and their impact • Identify and accordingly manage prioritised visitor zones • Maintain good communication with council, environmental agencies, public bodies
Treating biodiversity as an insurance	<ul style="list-style-type: none"> • Restoration of key access of dunes as a priority with possible volunteer involvement • Maintain areas capable of becoming biological retentions • Diversify species mixtures with suitable plants, provided they do not compromise valued habitat.
Improving landscape character	<ul style="list-style-type: none"> • Manage forest in harmony with other land features (coastal strip, historical features) and land use types (farms, recreational areas) • Look for opportunities to improve internal views

3.0 Background Description

3.1 Site factors

3.1.1 Neighbouring landuse

Tentsmuir is the only forest of any size within north east Fife. It is positioned at the mouth of the Tay Estuary on an extensive area of sand and old dune slacks. The seaward side is subject to coastal changes creating a specific habitat protected as a National Nature Reserve, SSSI, SPA, SAC and Ramsar sites designations. To the west and south the forest is surrounded by agricultural land of varying quality from arable to wetland. Within the forest is a private farm used to keep horses. Reres Wood is located a short distance south of the Tentsmuir main block. Leuchars airfield and the River Eden neighbour it to the south.

3.1.2 Statutory and legal requirements and key external policies

The forest embraces numerous protected areas including international, national and local designations listed in the table below.

Table 3

Type	Name	Location	Protection objectives
Ramsar Sites	Firth of Tay and Eden Estuary	Along the coast, partially overlap the forest.	Complex of estuarine and coastal habitats for bird populations.
Special Areas of Conservation (SAC)	Firth of Tay and Eden Estuary	Along the coast, partially overlap the forest.	Habitats for qualifying protected bird species.
Special Area of Conservation (SPA)	Firth of Tay and Eden Estuary	Along the coast, partially overlap the forest.	Qualifying habitats and protected species.
Sites of Special Scientific Interest (SSSI)	Tayport – Tentsmuir Coast	Along the coast, partially overlap the forest.	Geological and biological site: coastal geomorphology, mudflats, dunes with specific fauna and flora.
Sites of Special Scientific Interest (SSSI)	Morton Lochs	Overlap the part of forest in NW.	Biological site: areas of open water, fen and reed-swamp, dune grassland, scrub and woodland habitats.
Sites of Special Scientific Interest (SSSI)	Eden Estuary	SE of the forest, partially overlapping Reres.	Biological site: contains extensive intertidal flats of mud and sand with a rich invertebrate fauna.
Sites of Special Scientific Interest (SSSI)	Earlshall Muir	Area between N and S block. A direct neighbouring of the forest.	Biological site: remaining tract of unforested lime-poor sand dunes with representative examples of dune ridge and dune slack plant communities.
National Nature Reserve	Tentsmuir	Consists of three sites; Tentsmuir Point, Tayport Heath and Morton Lochs.	Coastal sandflats and banks remain largely undisturbed with a variety of habitats.

Additionally there is one scheduled (wartime military defences) and 29 unscheduled ancient monuments within the forest.

3.1.2 Geology Soils and landform

Tentsmuir is underlain by Lower old red sandstone bedrock. The surface is overlain almost entirely by sand brought by sea, river and wind. Gravel, silt and clay are also present in places.

These soil conditions are uncommon in Scottish forests. The sands within the forest are differentiated by the relevant water conditions:

- sands with shallow water table (15g)
- sands with moderately deep water table (15i)
- excessively drained sands (15e)
- dunes (15d)

The soils range from very moist (15g in places) to medium dry and are of poor nutrition. The availability of water in the soil is sometimes limited, but the sand is well aerated providing less resistance to root penetration and promoting greater root depths. These dry conditions rule out species that have a high demand for water, eg. Sitka spruce, in all but the wetter soils found within the forest.

The forest is situated in a flat lowland area with no hills or valleys. The altitude is around 5 m above sea level.

3.1.4 Water

The area of Tentsmuir lies within the Tay river basin district which is covered by the Scotland River Basin Management Plan for 2009-2015 published by SEPA in 2009.

The main surface water bodies are the coastal waters surrounding the Tentsmuir peninsula are the Firth of Tay to the North, the North Sea to the East and the Eden Estuary to the South. Their ecological status is described as good. Coastal waters provide one of the most valuable habitats for wildlife including plants, invertebrates, fish, birds and mammals.

Tentsmuir forest has an established drainage system which requires regular maintenance, not only to maintain forest health, but to manage received drainage from upstream neighbouring farms and properties. SEPA describes the ecological condition of two watercourses as poor and one as of poor ecological potential (heavily modified). SEPA's target objective is to improve the quality of the watercourses to moderate status by 2015 and good by 2027. All water courses are located within North Fife Coastal catchment area.

Morton Lochs were created in 1906, aiming to provide shelter and protection for birds. The lochs and the surrounding forest form the Morton Lochs SSSI and part of the Tentsmuir National Nature Reserve.

The ground water bodies' ecological status is currently classified as "good, poor" and it is aimed to improve this status to good by 2015.

When felling and restocking are carried out, the Forest and Water Guidelines (5th Edition) will be strictly adhered to. Timber extraction will normally avoid crossing the burns or main drains but, where necessary, each crossing point will be piped or bridged. Branches will be kept out of watercourses and trees will generally be felled away from the watercourses.

3.1.5 Climate

The major climatic zone in Tentsmuir is described as warm, moist and sheltered. The average annual rainfall is around 325 mm in summer and 345 mm in winter and the approximate annual average temperature around 8-10°C.

The accumulated temperature AT5 for the most of the area is over 1200 with a moisture deficit of 90-160 mm.

Tentsmuir forest lies on flat land and most of the area is sheltered; wind hazard classification shows that almost the whole area is classified as class 3 (by the shore) to 4 (in the west); DAMS ~ 11. Thinning options are not limited by wind, but recent experience shows that wind damage may occur.

According to the ESC (Ecological Site Classification) soil moisture regime is the limiting factor for species choice. Many species can grow in these conditions but only a few can achieve high yields. Climate change scenarios show that species demanding more moisture, such as spruce, may not be suitable for this site in the future.

3.1.6 Landscape value and character, visibility, recreational use, heritage.

Landscape value and character

The landscape of Tentsmuir is on a relatively large scale. It is described by SNH as lowland coastal flats sands and dunes. The location of the forest is attractive and the value of the landscape is high.

There are many factors that make Tentsmuir's landscape unique:

- Tentsmuir is an integral part of the local landscape
- a large forest in a mostly non-forested area
- sea shore location on a peninsula: sea views, dune habitats, transitional zone views, forest views, historical features within forest, nature reserves, lochs, farmland contained by forest, internal open ground, natural succession sites
- excellent example of coastal pine forest
- other conifer and broadleaved species
- various mixtures of species

Visibility

The landscape is flat and only the forest edges are visible, but Tentsmuir is a prominent element of wider landscape. It is visible from across the Tay and from St Andrews, when travelling on the B945 between Tayport and Leuchars and on the East Coast mainline rail service.

Internal views are important, especially along key recreational routes.

Recreational use

Tentsmuir is an important tourist attraction in Fife. The local usage is high, both from the Tayport end and from Kinshaldy car park. The car park has amenities such as a picnic area and children's play area. The car park is the focal point for a number of routes, including access to the beach. There are a number of formal routes for cycling and walking, some of which are linked to long-distance routes passing through the forest, such as the Fife Coastal path. Horse riding also takes place.

Husky training takes place in part of the forest and race events take place each year.

The road network provides access to almost every part of the forest and there are also 6 claimed Rights of Way running through the forest.

Heritage

There is one scheduled monument in Tentsmuir – Tentsmuir coastal defences which comprises a complex of linear defences, running from Leuchars Airfield to Lundin Bridge, and the remains of the Polish army camp. The defences were intended to protect a stretch of the coastline, which was considered vulnerable to attack by German forces in the Second World War. They were constructed in late 1940 by Polish troops. There is an existing Monument Management Plan approved by Historic Scotland, which includes details of operations permitted and required within and surrounding the scheduled areas.

Within close proximity to forest boundary three other ancient scheduled monuments are located:

- Fetterdale, unenclosed settlement
- Morton, Mesolithic settlement
- Morton, timber hall and enclosure

There are 29 unscheduled monuments within the forest but The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) holds information about over 90 archaeological sites, mainly associated with wartime.

In the eastern part close to sea shore, a 19th Century [Icehouse](#) is located; historically used to store salmon but now an important bat roost. Hut circles and shell middens are also present within the forest.

3.1.7 Biodiversity (woodland, open ground, lochs and rivers)

Tentsmuir has a high biodiversity value; there are many areas designated and protected by international and national law (table 3).

Additional areas have been classified by FCS as natural reserves. The ecological value has also been raised by converting the forest to continuous cover forestry along with creating open habitats for succession (wetland areas).

Maintaining the variety of habitats supports key species for this area:

- red squirrel (Tentsmuir is identified as priority woodland for red squirrel)
- herons
- badgers
- goshawk
- buzzard
- bats
- coral root orchid
- other rare orchids

The main habitats of Tentsmuir are:

- conifer forest with large proportion of native species
- broadleaved areas with native species
- open habitats
- areas of mature trees
- coastal strip with sand dunes
- transitional zone between forest and coastal strips
- open water habitats

There are different types of open space in Tentsmuir:

- open space within the coupes (gaps, rides)
- open space associated with other land use: roads, rides, ancient monuments, conservation areas, agricultural land
- for recreational purposes – picnic area, parking
- associated with sea shore and dune habitats
- awaiting restock after clearfell
- within natural reserve

There are 5 areas (sum area ~ 65 ha) classified as Long-Established (of plantation origin) woodlands, which means that they were Interpreted as plantation from maps of 1750 or 1860 and have been continuously wooded since.

3.1.8 The existing forest: (Age structure, species and yield class, access and LISS potential)

Around 50% of area is mainly Scots pine and Corsican pine planted from 1920s, almost 40% is second rotation planted from the 1960s. Pure crops still dominate but intimate mixtures are present. The average yield class (all species) is close to 8-10. Sitka spruce can achieve up to YC 20 and the pine typically YC 10 - 14. During the last plan an area of 50.8 ha was clearfelled. It comprised removing trees from areas designated to become Natural Reserve, a stand of Lodgepole pine and a few small fellings in the northern area on the NNR. The current species composition is shown table 4.

Table 4 Current species composition

Species	Area (ha)	% of area
Scots pine	664	42.2
Corsican pine	315.2	20.0
Sitka spruce	151.2	9.6
Birch	110.9	7.0
Mixed		
Broadleaves	41.8	2.7
Lodgepole pine	35.1	2.2
Other species	52.1	3.3
Other land	204.1	13.0
Total	1574.4	100.0

The pine stands have been managed by continuous cover forestry since the last plan was approved in 2002. Recently the emphasis has changed to perform heavy thinnings early in young stands affected by DNB.

Natural regeneration is appearing in places, birch is common throughout, but there is also successful pine (Scots, Corsican and Lodgepole) but also Sitka spruce, larch and beech.

There are areas of windblow from previous years (Reres).

2.0 Analysis of previous plan

The previous plan approved for 2002-2012 aimed to convert the forest to continuous cover forestry. It was intended to manage the forest (excluding several clearfell areas) under shelterwood systems by successive opening of the mature forest canopy to encourage natural regeneration of pine. Coupes had been divided into groups (similar species and age structure) and each group was given a rotation length, conversion period and return period. However, prescriptions and targets for conversion periods have had to be reconsidered due to the significant impact of DNB. The thinning regime has changed- immediate, heavy and wide spread thinning is the currently recommended management in order to minimise the damage.

The wetland area has been cleared of conifers and the majority of the poorer Lodgepole pine stands have been removed with a few areas remaining to be clearfelled. Where appropriate, Sitka spruce is being removed from mixtures through thinning and there are a few pure stands that will be felled when mature.

Natural regeneration has appeared only in patches and its management needs to be considered in the view of DNB.

The recreational infrastructure has improved. Currently there is a picnic area; toilets and a children's play area by the car park. In 2006 an automatic pay barrier was installed.

Removal of natural regeneration from the dunes adjacent to the forest has continued with the involvement of volunteers (Reres) and cooperation with local farmers (cattle for grazing). Historic features have been protected and the management plan (implemented in 2008) for Scheduled Ancient monuments has been followed. The National Nature Reserve is still under SNH management.

4.0 Analysis and Concept

4.1 Constraints and opportunities for each site factor.

The Analysis and Concept map shows the factors which, through consultation have significantly influenced the design and long term vision of this forest.

Main factors indentified are:

- significant influence of DNB

- importance of conservation and recreation functions
 - management of coastal strip, wetland area
 - new conservation sites (herons, badgers)
 - recreation needs and expectations

Table 5

Core area	Opportunity	Constraint (limitation or restriction)	Concept development
Potential timber production	Pines proved to be the most suitable species for the sandy soils with high moisture deficit.	Significant influence of DNB, especially in young stands when growth rates are close to zero.	Maintain pine as the main species despite DNB, continue to thin to open canopy for regeneration in older stands, but thinning focus mainly on stands planted 1980-2002. Try other options: pruning, species trials, monitoring and implementing research developments. If no improvement, restock with alternative species.
Management of the wrong provenance of LP and SS as species unlikely to be suitable in the future forest structure	Remove remaining poor LP and SS.	Some of stands not mature enough for felling, some in mixtures	Do not use for restocking, remove SS and LP as mixture components during thinning operations, fell pure crops when mature (SS~55) and remove as regenerating element.
Future tree species	Introduce species most suitable for site conditions.	DNB as a threat for pines and also other conifers.	Introduce species other than pine if DNB management appears unsuccessful, use ESC to identify patches suitable for other species, choice of species based on biodiversity and landscape priorities.

Landscape impact	Improve internal views.	Species choice limited due to site conditions.	Enrichment along roads, routes and new parking, underplanting around Ice house, supported by ESC.
Management of protected areas	Support and implement management objectives for designated areas from table 3.	Coastal strip partially covered by forest, natural regeneration appears on dunes.	Cooperate with and agree management prescriptions agreed with SNH, continue to remove natural regeneration from coastal strip.
Natural Reserves	Identify new sites for NR.	Possibilities for new NR sites limited.	Some of the wetland area is regenerating with very good birch and will be managed for productive broadleaves. Consider new areas linked to existing biological retentions.
Wildlife species	Support and create favourable habitats.	Red squirrel habitat potentially at risk from DNB, increasing recreational use	Review existing sites; identify new sites and species, emphasis on redirecting recreation tracks away from sensitive areas, bear in mind during forest operations.
Increasing recreational use	Adjust existing facilities to number of visitors; improve attractiveness of the forest for recreation.	Some areas are sensitive and many tracks are not suitable for increased use, forest operations	Prioritise visitor zones, relocate parking to more suitable location, develop existing parking as a picnic area, and continue to work with the council (access issues) and communities.

4.2 Design Concept

The intention with this plan is to maintain Tentsmuir as a forest which performs various functions (production, biodiversity, recreation and landscape) in accordance with the UK Forestry Standard and national and local strategies. A key point is to retain flexibility to adapt to climate change in both the short and long term.

The concept encompasses core areas described below:

Timber production

Pine is a major component of Tentsmuir forest. It seems to be the most suitable species for sandy soils with high moisture deficit. Corsican pine gives especially good growth rates. The aim is to maintain pine as a main species despite DNB impact. Timber production for CCF management is based on thinning to open up the canopy and encourage natural regeneration. This process will be continued, but thinning will also be focused on younger stands which are most affected by DNB.

Timber production will be significantly disrupted by DNB. The growth rates in some affected young pine stands are close to zero so there are concerns that pine might not survive the long term impact of the disease. However it has been decided to try all possible options to maintain pine as a major component. These options are detailed in paragraph 5.1. Monitoring will be required to record the results of those prescriptions. If the conditions do not improve other species will be considered for restocking. A flexible approach will have to be maintained in response to disease management and research developments will influence future management.

Landscaping

The visibility of Tentsmuir is limited due to its peninsular location and flat terrain. External views have limited significance. However, there would be benefits from improving internal views. Available options include enrichment planting along the roads and trails with species attractive to visitors and heavier more varied thinning around main visitor zones.

Recreation

Tentsmuir is a highly popular destination for recreational use not only from surrounding locations (Dundee, Tayport, Leuchars, and St Andrews) but also from more distant parts of the UK. It is estimated that around 160 000 people visit the forest each year. To meet their expectations and protect the forest at the same time, four visitor zones have been identified:

ZONE 1 - parking and picnic area

aims: change location of the parking, develop picnic area (improve facilities, waste management)

ZONE 2 – public access roads

aims: keep up with road maintenance, waste management

ZONE 3 – most popular trails and tracks

aims: improve visitors experience: internal views improvement, information points

ZONE 4 – informal tracks

aims: upgrade the trails where pressure rises significantly, direct visitors away from conservation areas

All visitor zones will be considered during forest operations; information will be passed to the council access officers and signage will inform the public about safety, work duration and diversions.

It is also very important to communicate with local communities and the wider public.

Conservation

CCF systems introduced with the previous plan provide opportunities to create an irregular structure forest; maximising the role of natural regeneration. The forest provides valuable habitat for red squirrels and bats and this will be maintained by supporting pine as the main species.

Coastal strip management is focused on restoring dune habitat on the forest edge essential for survival of rare fauna and flora species. The annual programme of grazing and removing natural regeneration from the dunes is being continued.

Wetland areas had been identified as Natural Reserve within the previous plan and during this plan duration it was decided to monitor the broadleaved natural regeneration occurring (around 50ha) and the potential for an element of productive broadleaves.

The forest area around the Morton Lochs is part of the Tentsmuir National Nature Reserve and is leased to and managed by SNH.

A few species have been identified to be removed or significantly reduced at Tentsmuir. Unsuitable provenances of Lodgepole pine will be removed over time. Pure stands of SS will be thinned, clearfelled when they reach MAI and replaced with more suitable species. Removing buckthorn from the coastal strip has already started and will be continued on a regular basis. Rhododendron will be eradicated from all areas in a phased cutting and spraying programme over the next 5 years.

Heritage

Management of the scheduled monument will follow the guidelines of the management plan agreed with Historic Scotland. All unscheduled monuments within the forest will be left undisturbed where possible.

There is opportunity to increase the visibility of some of these at the site level planning stage, which will add to the interest of the forest to visitors using the walks network.

5.0 Management Proposals

5.1 Future Management

The future management of Tentsmuir is dominated by minimising the impact of DNB in order to maintain it as a pine forest managed on CCF principals. The measures identified below will be used to achieve this.

Managing the disease:

- annual review of pine stands condition and disease spread
- heavy thinning – removal of at least 50% of trees in the most affected stands (pine <30years old)
- pruning
- respacing of natural regeneration
- trials of less susceptible origins of pines
- following Forest Research advice for disease control
- reacting to changes of circumstances
- use of alternative species

5.1.1 Clear felling

There are only a few stands proposed to be felled during the approval period. They are mainly Lodgepole pine and Sitka spruce stands affected by windblow. They will provide a place for planting pine species with some broadleaves which with time will be included in CCF management. These areas are contained in table below.

Tab 6 Areas of clearfell (ha)

Area for FDP approval	15.9
Remaining area to be felled after the approval period up to 2042	49.3
Sum	65.2

5.1.2 Thinning

It is proposed to maintain the thinning regime from the previous plan with adjustments necessary to minimise the impact of DNB. All stands have been divided into groups (management units) to allow management at the sub-compartment level with general prescriptions. For detailed information refer to Map 6 and Appendix IV. Assigning the stands to each group is only shown as guidance and flexibility is given when making the decision concerning individual stands.

5.1.3 CCF (Continuous Cover Forestry)

The whole forest will continue to be managed using CCF. During this plan more emphasis will be placed on establishing natural regeneration in places that it has not previously appeared and to manage it where it occurs. Where regeneration does not appear under optimal light conditions then underplanting will be considered. The understorey needs to be fully established before removing the last of the overstorey trees.

A balance has to be achieved between the needs of establishing regeneration of pine and maintaining healthy conditions to minimise DNB. The current advice is to maintain airy conditions within the stand to decrease conditions for spread of disease. This may be achieved by planting at a lower than normal density and respacing natural regeneration.

5.2 Future habitats and species (Map 6)

5.2.1 Pine forest

Tentsmuir was planted primarily with Corsican pine and Scots pine which are the most suitable species for local site conditions. They will continue to be the main species planted, but alternative species have been identified to potentially replace pine (map 7). Those species listed in table below have been described as suitable for Tentsmuir with the support of the Ecological Site Classification (ESC). Species choice will be made at the time of planting if pine shows little chance of surviving DNB. All pine stands will be monitored on an annual basis to check the progress of the disease. Choosing species from the alternative list should take into consideration conservation needs (red squirrel priority habitat), landscape and internal views and productivity (Douglas fir has a high potentially yield). Open space will be maintained within the stands as gaps and racks.

Table 7 Alternative species for eTentsmuir (also map 7)

Soil type	Conifers	Broadleaves
15d, 15e, 15i	Douglas fir, Western red cedar	sycamore, silver birch, beech
15g	Norway spruce, larch, Western red cedar	sycamore, aspen, silver birch, downy birch, alder

5.2.2 Other species

Stands with species not affected by DNB will continue to be managed under CCF principle by maintaining thinning and encouraging regeneration.

5.3 Restructuring (see Map 5 and Map 6)

Restructuring options for the forest may be dramatically influenced by the progress of DNB and ways of controlling, managing and minimising the impact of the disease. If pine can be maintained as the main species for Tentsmuir then no significant restructuring is planned during the period of this plan. If these solutions fail new species will have to be introduced.

The scale of species change will be dependent on the areas requiring felling for health and marketing reasons. (Once pine succumbs to DNB the timber quality deteriorates rapidly and if not felled soon, becomes unmarketable). It is not possible to predict these potential changes and a plan amendment would be required in the worst case scenario.

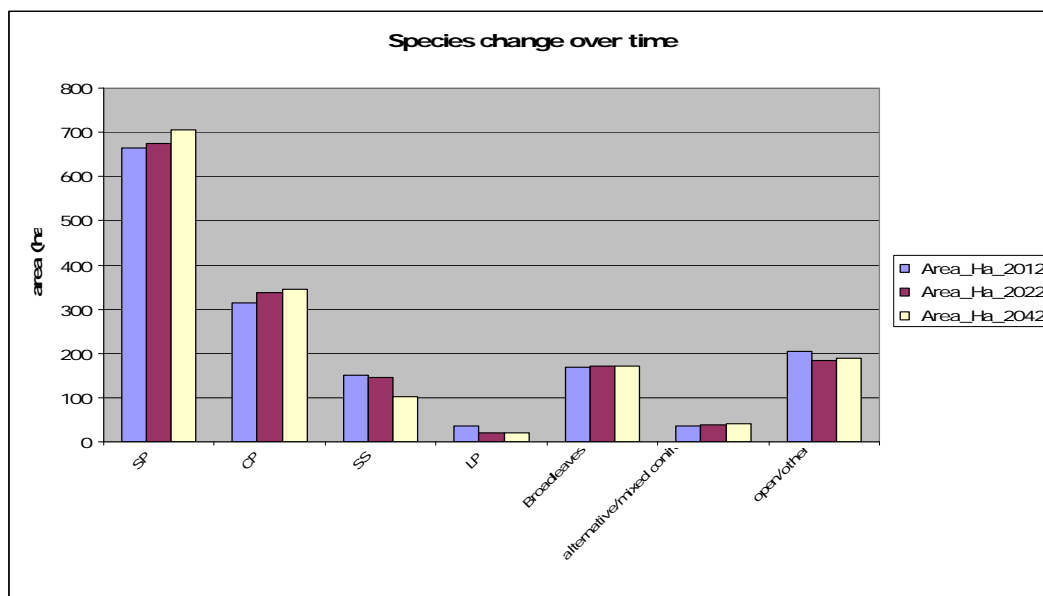
5.4 Species tables

The table and chart below show the approximate changes in species that will result through the implementation of this plan and in the further future.

Table 8 Species change over time (ha)

Species	Area_Ha_2012	Area_Ha_2022	Area_Ha_2042
SP	664	674.8	704.5
CP	315.2	336.6	344.6
SS	151.2	145.6	103.1
LP	35.1	20	19.3
Broadleaves	167.6	171.3	170.3
alternative/mixed conifers	35.8	38.6	40.6
open/other	205.5	183.2	189.7

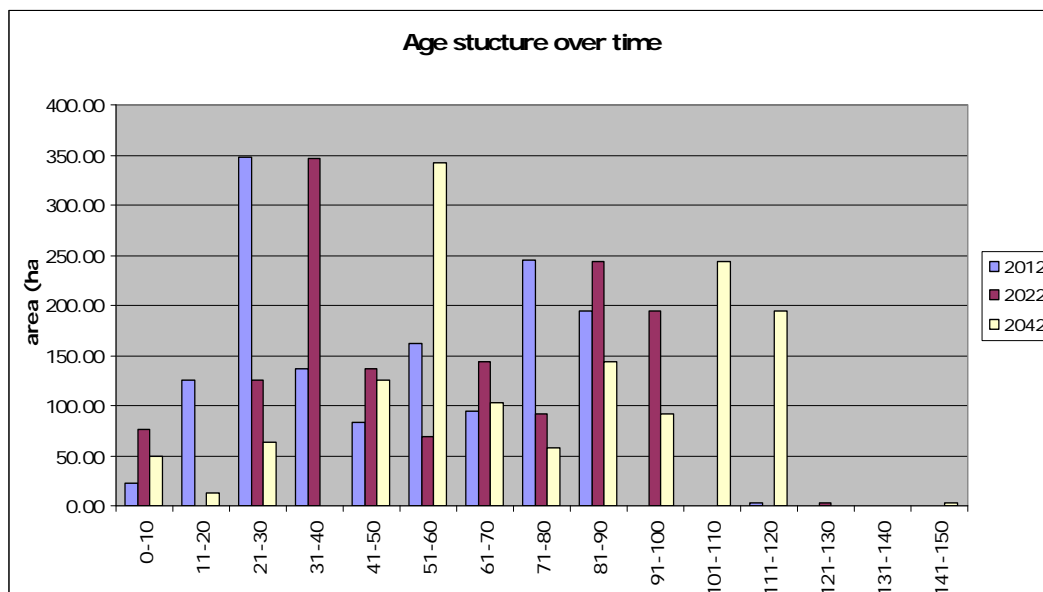
Some outcomes are not possible to predict while generating future data. The species table and chart do not account for a reduction in area of species (mainly LP, SS) as the result of thinning of mixtures nor the introduction of new species as a result of DNB impact.



5.5 Age structure

Table 9 Age structure change over time

age class	2012	2022	2042
0-10	23.11	76.05	49.33
11-20	124.80	0.00	13.09
21-30	348.07	124.66	62.97
31-40	136.47	346.28	0.00
41-50	83.54	136.47	124.66
51-60	162.55	69.49	342.85
61-70	93.72	143.39	102.40
71-80	244.92	90.92	57.64
81-90	194.76	243.21	143.39
91-100	0.25	193.88	90.92
101-110	0.00	0.25	243.21
111-120	3.43	0.00	193.88
121-130	0.00	3.19	0.25
131-140	0.00	0.00	0.00
141-150	0.00	0.00	3.19
open	153.44	141.27	141.27
sum	1569.06	1569.06	1569.06



5.6 Ancient and long established native woodland restoration

There are no existing Plantation on Ancient Woodland sites (PAWS) within the forest.

There are 5 areas (sum area ~ 65 ha) classified as Long-Established (of plantation origin) woodlands, which means that they were interpreted as plantation from maps of 1750 or 1860 and have been continuously wooded since. They are still forested (mainly pine species but also SS) and under CCF (SS will be clearfelled when mature and restocked with pine).

5.7 Deer Management

The only species of deer present in Tentsmuir are roe deer and at fairly low densities. The deer management aim is to maintain the current population levels.

5.8 Critical factors

The success of this plan is very much dependant on the management of the DNB.

Production: The critical factor both in terms of DNB and future CCF management is achieving the thinning programme.

The other critical factor will be achieving sufficient natural regeneration to develop an understorey and successor crop.

Recreation: Maintaining and improving a healthy forest with a varied species and age structure contributes to the visitor experience and is dependent on achieving the planned thinning and regeneration.

Biodiversity: over the past 90 years a range of species have become established and dependant on a healthy and extensive forest environment and so continued management by CCF and maintaining the forest structure is critical.

Appendix I

Forest Panel Meeting Report

Meeting held on Monday 14th November 2011 in Tentsmuir forest in order to review forest plan objectives.

Background

Tentsmuir Forest is 1569 ha of established woodland in the northeast corner of Fife between St Andrews and Tayport. It is owned and managed by Forestry Commission Scotland. It has an existing plan that is now due for revision. Contractor responsible for plan preparation is Highfield Forestry Ltd.

Stakeholders were identified and notified of the plan review process and asked for comments. A group of key stakeholders were invited for Forest Panel meeting on 14/11/2011. The meeting was organised in order to discuss the new Forest Plan objectives, gain suggestions, advice and to identify standpoints towards to new objectives proposed in a design objectives draft.

Participants are listed in the table below:

Robin Lofthouse	FCS Beat Forester, Fife and Angus
Chris Ford	FCS Planning Manager, Fife and Angus
Rob Coope	FCS Biodiversity Forester, Fife and Angus
Mat Cope	FCS Operational Forester, Fife and Angus
Caroline Gallacher	Scottish Natural Heritage
Tom Cunningham	Scottish Natural Heritage, Tentsmuir NNR Reserve manager
Alex Easson	FCS Tentsmuir ranger
Bruce Anderson	RSPB
Sarah Johnston	Fife Council, Access Officer
Geoff Moy	Fife Council, Development Services Department
Sophie Eastwood	Fife Coast and Countryside Trust, Red Squirrel Officer
Iain Peddie	Highfield Forestry Ltd (FCS contractor)
Weronika Rapa	Highfield Forestry Ltd (FCS contractor)
Apologies	
Steve Archibald	Scottish Environment Protection Agency, Fife
David Bruce	Woodland Officer, Perth and Argyll Conservancy
Victoria Clements	Heritage Management Officer East, Historic Scotland
Ashley Birrell	Projects Officer, Fife Environmental Trust

They were no written responses.

Sites visited:

1. Coastal Strip

The discussion started with an introduction from Robin Lofthouse about the condition of dunes and an issue with natural regeneration expanding from the forest. He explained which operations are undertaken to remove that regeneration with emphasis on the continuity and cost of this process. All members agreed that maintenance of dunes by removing natural regeneration is a priority. Those operations will be included as prescriptions for as long as the next plan remains in force. Tom Cunningham informed about the actions of regeneration removal undertaken in Reres by volunteers. That solution might be worth expanding to other parts of the beach.

Another option considered was recommendation for the existing forest covering the dune. RSPB and SHN underlined those dunes as a habitat for biodiversity is an EU priority site. They suggested that removal of the existing stand should be considered in the future in order to restore dunes. It was agreed as a next possible step after priority of controlling the regeneration. Fife council officers noticed that restoring dunes is a part of forestry strategy for Fife as well as forestry. The conflict between those two remains an open discussion. Other projects of this type in UK should be investigated in order to gain information about success with undertaking those kinds of actions. FCS officers pointed out that many factors should be taken under account i.e. specific drainage issues in Tentsmuir forest. Access officer emphasised the role of public consultation and good communication between FCS, council and environmental units while undertaking any actions related to removing trees.

This option was left as an idea to develop with future plans but not yet necessary for the next 10 years.

2. Stands affected by Dothistroma Needle Blight

Dothistroma Needle Blight (DNB) also known as Red Band Needle Blight was first discovered in Tentsmuir on Corsican Pine. FCS officers exposed the weight of the problem presenting symptoms in one of the young pine stands and the map showing all infected stands in Tentsmuir forest. Every year surveys are undertaken by FCS staff to update the range and dynamics of disease spreading. Planning forester updated panel members with the current disease status and action undertaken to prevent expanding, for example: thinning regime, provenance trials to identify resistant specimens, consideration of alternative species. All members agreed that this issue is a priority and all necessary actions should be undertaken to maintain the forest in Tentsmuir.

3. Wetland

The final site visited was an area of around 50 ha which was clearfelled a few years ago in order to consider remaining as a natural reserve. Open space was a field for natural regeneration of surrounding trees and a few birches left on a site. Currently birch is the main species visible on the site growing in dense groups in places but mainly as non regular dispersed specimens. Few other species are visible (single pines, beeches).

The main options under consideration were: allowing the site to be further colonized through natural spreading, accept the birch crop and try to manage it as a productive stand, re-wet the area creating new conditions for biodiversity.

Caroline Gallacher supported by others proposed leaving the area as it is to let the natural processes continue. It might be a good gene reserve for future and a valuable different site in a mainly pine forest. Sophie Eastwood noticed that it would not be a favourable habitat for red squirrel but the population benefits from high proportion of Scots pine in the remaining forest. Biodiversity FCS officer identified this site as good habitat for reptile's population. Tom Cunningham suggested getting in touch with voluntary groups willing to survey this site in order to identify existing or potential reptile's habitats.

Other raised issues and discussions:

- conservation priorities grow in Reres forest, need to include new heronry
- raising pressure of recreational use of Tentsmuir will take effects on maintaining roads, paths (in light of neighbouring RAF regiment and informal runners)
- identify badgers habitats near Morton Lochs
- growth of conservation priority should determine objectives for all forest groups

Appendix II: Tolerance Table

	Adjustment to felling coupe boundaries	Timing of restocking	Change to species	Windthrow response
FC Approval not normally required	0.5 ha or 5% of coupe – whichever is less.	Variation of less than 2 planting seasons from standard restock year, 4 years post-felling.	Up to 5% species exchange	Up to 1.0 ha.
Approval by exchange of letters and map	0.5 ha to 2.0 ha or 10% of coupe – whichever is less.		>15% species change	1.0 ha to 5.0 ha – if mainly windblown trees. Between 5.0 ha to 10.0 ha in areas of low sensitivity.
Approval by formal plan amendment	Greater than 2.0 ha or 10% of coupe.	Variation of greater than 2 planting seasons from standard restock year, 4 years post-felling.	Change from broadleaf to Conifer	Greater than 5.0 ha in areas of medium to high sensitivity.
			Reduction in native broadleaves by >5%	
			Reduction of >10% of productive net area	

Appendix III

Table 2. Initial brief and objectives for developing management proposals

Brief	Objectives
Minimise DNB and climate change influence on the forest	<ul style="list-style-type: none"> • Maintaining pine forest while reducing risk by introducing new species • Continue to manage on CCF principals for pine with necessary adjustments • Change thinning regime in affected stands
Considering restock options for different scenarios of disease behaviour	<ul style="list-style-type: none"> • Decide on restocking needs (new species consideration) and natural regeneration management for individual stands • restock according to good silvicultural practice for species selection and planting density
Maintain existing natural habitats	<ul style="list-style-type: none"> • protect statutory sites according to agreed guidelines • identify areas of conservation importance (eg. Bats, badgers, herons, reptiles habitats)
Preserve historic features	<ul style="list-style-type: none"> • protect all known features including scheduled and unscheduled ancient monuments
Emphasis on public involvement	<ul style="list-style-type: none"> • Identify existing and potential future users (schools, interest groups) and their impact • Identify and accordingly manage prioritised visitor zones • Keep good information flow with council, environmental agencies, public bodies
Treating biodiversity as an insurance	<ul style="list-style-type: none"> • Restoration of dunes as a priority with possible volunteer involvement • Maintain areas capable of becoming diversity banks (biological retention) • Diverse species mixtures with valuable specimens (natives)
Improving landscape character	<ul style="list-style-type: none"> • Manage forest in harmony with other land features (coastal strip, historical features) and land use types (farms, recreational areas) • Look for opportunities to improve internal views

Appendix IV

Management prescriptions for groups of stands (management units):

Stands with similar species and age class have been grouped into management units. This has been done at Sub-compartment level rather than geographic location. The groups should not be identified with thinning/management coupes despite the use of thinning regimes from the previous plan.

All groups with species susceptible to DNB will be checked on annual basis.

Group 1 – main component CP/SP age <30

- strong thinning within next 2-3 years, removal of 50% of trees
- review after 5 years and choose one of the options dependently of the response from thinning:
 - If growth was significant and conditions of the stand changed back to 'susceptible to infection' – consider another thinning, intensity to be estimated at the time, review in 5 years. Carry out a programme of pruning as required to maintain timber quality.
 - If growth restarted but it is slow – leave the stand with no intervention and review in next 3-5 years
 - If no signs of growth but the condition of the stand did not deteriorate, – consider either clearfell and restock with alternative species or leave for another 3-5 years. and reassess
 - If no signs of growth and the condition of the stand has declined – clearfell and restock with alternative species

Group 2 – main component SS

- younger stands - start thinning at canopy closure
- older stands - maintain standard thinning cycle from the previous plan (5, 7 years) with removal of 25% of trees
- if SS well producing or in the mixture with the pine seriously infected by DNB thinning in favour of SS
- if SS poor quality and growth thinning in favour of other species

Group 3 – main component CP/SP age 30-80

- maintain standard thinning cycle from the previous plan (5, 7 years)
- aim for target basal area of 25-30m²/ha
- monitor the health condition
- Carry out a programme of pruning as required to maintain timber quality.

Group 4 – main component CP/SP age >80 with no signs of natural regeneration

- maintain standard thinning cycle from the previous plan (5, 7 years) until target basal area of 25-30m²/ha is reached
- start underplanting with either SP/CP or alternative species; decision will be made at the time considering DNB risk and research improvement
- if bracken/grass present on the site scarify before planting
- planting density according to Forestry Standard, might be lowered to 2m spacing for SP/CP to avoid creating optimal conditions for fungal growth

Group 5 – main component CP/SP age >80 with natural regeneration

- maintain the thinning cycle from the previous plan (5, 7 years) with removal of ~30% of remaining trees
- support pine regeneration if acceptable health condition, remove SS/LP regeneration
- regeneration management: respacing and pruning to decrease humidity levels and decrease the volume of infected material
- if natural regeneration is at a low density underplant at 2m spacing with either SP/CP or alternative species (after next thinning of the mature crop); decision will be made at the time considering of the DNB risk and research improvement

Group 6 – main component broadleaves/other conifers/mixtures of species not mentioned before

- maintain the thinning cycle from the previous plan
- start thinning at canopy closure