The Forestry Authority

A part of the Forestry Commission

FORESTRY PRACTICE GUIDE

FOREST DESIGN PLANNING

A Guide to Good Practice

FOREST SERVICE

AN AGENCY OF THE DEPARTMENT OF AGRICULTURE FOR NORTHERN IRELAND

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A Guide to Good Practice

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Cover Picture: The first phase of felling completed to a forest design plan at Craigvinean Forest, Perthshire.
Illustrations: Carol Bramley and Pauline Dear

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INTRODUCTION

This Forestry Practice Guide supports the UK Forestry Standard, the various guidelines and other advisory material produced by the Forestry Commission. Its purpose is to help owners and managers of plantations, forests and woods that are approaching the felling stage to take advantage of the opportunities this presents to make any necessary improvement to the diversity and appearance of the area in balance with other, more functional or economic objectives. It is a straightforward, step-by-step guide as to how to go about this task, referred to here as **forest design planning**, within the wider framework of environmental and operational planning.

The forest itself is the environment. The forest is not only the trees, but also the understorey, the ground vegetation, the open spaces, soils, rocks and water, all of which are integral parts. Any action taken concerning the arboreal component of the forest - the trees - is not just of environmental consequence: it is in itself an environmental act. Silvicultural planning, production planning, road planning and recreation planning are all, therefore, aspects of planning the forest environment as much as landscape and nature conservation planning.

The requirement for planning is quite simply to achieve an understanding of the consequences of an action before embarking on that action. It has been described as both the launching point for the future and the process of learning from the past. Embarking on any action, whether it be felling trees or creating a wildlife pond, without having fully thought through the consequences, runs a grave risk of failing to achieve one's objectives. This is true where there is a single management objective. It is even more true where there are multiple objectives. An action aimed at furthering only one of these will almost certainly affect the ability to achieve the others. With multiple objectives, it is all too easy to sub-optimise if decisions are taken without proper information and planning. The UK Government has a firm policy for increasing the many diverse benefits that forests can provide. The aim is to create attractive and productive forests, which blend with the landscape, are rich in wildlife and are efficient to manage. How this is achieved and what is appropriate in individual circumstances depends on local conditions and priorities. Proper long-term planning needs to take account of all the relevant issues and produce an integrated solution. Compiling a plan requires clear thinking and logical action.

The planning process in forest management is all the more critical because the consequences of actions may be a long way in the future. It is important to remember that every action that we take today will affect the options open to future generations. It is equally important to remember that to take no action, whether a conscious decision or through neglect or procrastination, will also affect the options open to future generations. The planning process must not, in itself, become a barrier to action. Finally the type of plan should be appropriate to the scale of the work envisaged and its purpose.

Application of this Guide to Northern Ireland

This guide has been written primarily for use in Great Britain. However, many of the principles may also be applied to forests elsewhere. Accordingly, where the context permits, the guide may also be a help to woodland owners and managers in meeting the requirements of the UK Forestry Standard in Northern Ireland.

The Policy Background

The Government has adopted certain criteria and standards for the sustainable management of our forests and woodlands and these are set out in the UK Forestry Standard. Forest Design Planning is the process which ensures that plans for change in the structure of existing woods, or the creation of new ones, will meet the requirements of the Standard. The process takes into account the physical, biological, human and cultural resources described in the Standard. The results should therefore conform both to the Standard and to internationally agreed Pan-European Criteria (PEC) for sustainable forest management with which it is compatible.

RELATIONSHIP OF BASIC RESOURCES TO THE PAN-EUROPEAN CRITERIA

Physical resources	**Soils, water, air**	Without proper care of these resources none of the biological or human activity associated with forests are likely to meet the PEC.
Biological resources	**Trees, biological diversity**	Forest ecosystems are complex and involve interactions between trees and other living things in and around them. Again, proper care and management of these living resources is required to meet the PEC.
Human resources	**Workforce, communities**	All the PEC depend on work being carried out competently and safely. The 'maintenance of other socio-economic functions and conditions' acknowledges the need to take account of social interactions among all the PEC.
Cultural resources	**Heritage and landscapes**	People recognise the value of artefacts and amenities found in forests. There is also a fundamental association between our culture (past and present socio-economic activity) and the landscape, where woods often play a significant role.

The Audience

This guide is intended for those people, such as forest owners and their managers or agents, who are managing existing forests or woods of mainly plantation origin and of a size which may necessitate felling and regeneration over more than one phase using more than one felling coupe. It is particularly relevant for owners who intend to draw up a long term forest plan covering phased harvesting and replanting for large forest areas or whole estates, over a period of 20 years or more.

It is also expected to be used by Forestry Authority staff whose job is to evaluate and approve plans. They will be able to help and guide owners, their managers and agents as to what level of sophistication or simplicity is expected in the forest design plan for a particular forest. They will also be able to direct people to extra help by way of design assistance or training.

This guide will also be helpful to other people who are looking at proposals under the Woodland Grant Scheme and for felling licences, for example staff in local authorities and other agencies who have a statutory role in the consultation process. They will know what to expect in the plans presented to them and be better able to direct their comments on the content and standard.

FOREST PLANNING: THE WIDER CONTEXT AND GOALS

In Britain forest planning takes place at three levels: regional level, forest level and site level.

Regional Level Plans

The main regional level plans are indicative forestry strategies intended to guide the type and amount of new planting. They do not cover felling and replanting or management of existing woods and forests.

It can sometimes be helpful to consider a broad scale assessment of an individual forest, wood or ownership unit in its wider context before preparing a forest/woodland level plan. Large owners or companies who manage aggregations of woods, will recognise that the precise balance of objectives, for example timber production and recreation provision, will vary from place to place. This depends on a number of factors such as the sensitivity of the forest or wood its location, access and site potential to deliver various benefits.

Forest/Woodland Level Plans

These apply to a whole forest or wood, a whole estate comprising several woods, or to a distinct part - a landscape unit - of a larger forest.

The forest plan concerns the larger scale spatial layout of the forest, while smaller scale details are built in at the site management level. It is primarily concerned with the location and timing of tree felling, and the distribution of tree species and open space at regeneration. These are the principal tools available to the forest manager for controlling forest structure, and hence the current and future flow of forest products, both tangible and intangible.

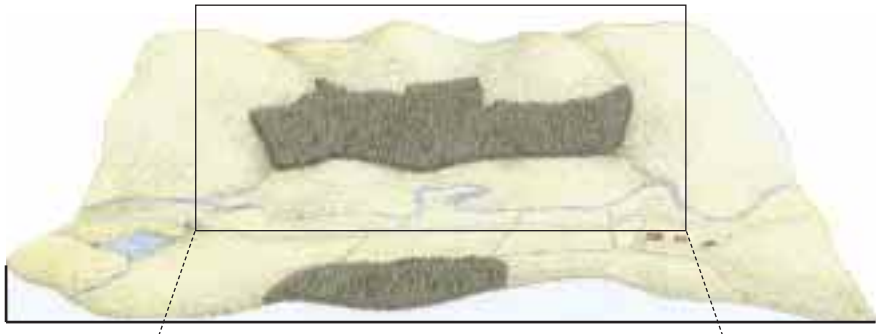
The aim of forest design planning is to move the forest towards a condition in which it can continue indefinitely to meet its management objectives, at the same time retaining a degree of versatility and flexibility to help meet unknown future demands. Forest design planning is a particularly appropriate process for the larger, more complex and more sensitive forests or woods. Some of the steps of analysis and level of detail will be unnecessary for smaller, simpler or less sensitive areas.

Site Level Plans

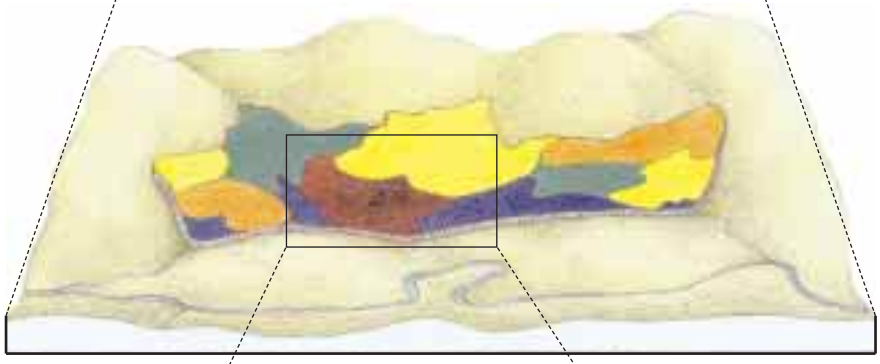
The third level of planning is the site management plan. This has normally been the main level for operational planning and for timber sales, felling licences and restocking plans at the compartment, coupe or stand level. This is a crucial level because it controls the day-to-day activity of the harvesting and restocking operations. A site management plan should be prepared for each felling coupe, before a chainsaw is brought near the first tree.

The site management plan ensures that everyone involved in the harvesting and restocking operation knows what is required for that particular site. It can also be used as a basis for contract specification, to ensure that the contractors meet all their obligations regarding site protection.

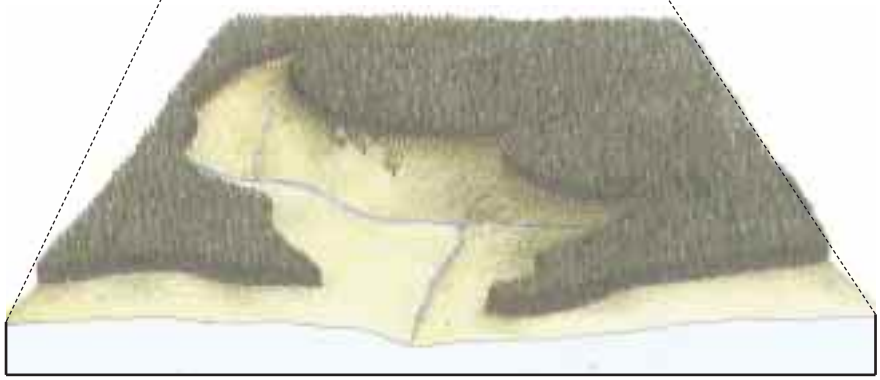
It can be seen from this that plans prepared using the process described in this guide occupy an important position, translating broad objectives into detailed site operations via the forest level assessment, analysis and design. It is too big a leap to go straight from management objectives to site operations and to expect the operation to make sense at fulfiling the requirements of sustainability.



The wider landscape sets the context for the forest unit.



The forest design plan is applied to the forest unit.



The site level plan details the application of a single coupe derived from the forest design plan.

THE DOCUMENTATION OF A FOREST DESIGN PLAN

The content and format of a forest design plan should aim for brevity, clarity and a logical progression through the stages of the plan development. Avoid too much text; use maps, sketches and tables whenever possible. Try to lay it out so that anyone unfamiliar with the area can understand what you are trying to achieve with the design plan.

Format Choice

The format of documentation needs some thought. Small sized pages (A4) are easy to store on file but difficult to use for maps and sketches. Large format (A2 or A1) can keep maps and sketches flat and in good condition but is cumbersome to carry about or store. A3 'landscape' format is an ideal balance between these two. A ring binder or similar plastic folder can hold everything in a form easily carried, stored and photocopied. It is worth considering who has to use the plan: such as managers, Forestry Authority staff or consultees.

A well documented plan is easy to refer to and simplifies its management.

Documentation List

The amount of documentation and its sophistication will depend on:

- the size and significance of the design area (the smaller the area the simpler the plan);
- the sensitivity of the site (the greater the sensitivity the more complex the solution is likely to be);
- its visibility either externally or internally (more visibility means more photographs and sketches);
- the period of the plan (the longer the period the more comprehensive the document);
- the complexity of factors and site (increasing complexity leads to a fuller document).

All design plans need the following (this list is more detailed and comprehensive than that suggested for long term forest plans in general):

- ownership and property details;
- a description of the forests or woods and their wider context and setting, including any relevant historical or background information;
- statement of management objectives;
- location map showing viewpoints, ownership/design unit boundary, neighbouring features such as SSSI, or other designations, major sites and settlements (usually based on a 1:50 000 OS map);
- survey/analysis map or map and descriptions:

  - survey information (soils, windthrow hazard, growing stock, etc.)
  - constraints and opportunities
  - landscape character;

- description of how the proposed concept meets the objectives and takes account of the analysis, especially the constraints and opportunities;
- map of felling proposals colour coded by periods of felling;
- map of restocking proposals showing different species, open space and any change to external margins.

Most areas, except the smallest, simplest, least visible or least sensitive will also need:

- panoramic photographs and sketches showing analysis, felling design and restocking design for each major viewpoint. This may be specifically requested by the Forestry Authority.

The most sensitive, or the main views for other areas may also benefit from being shown as a time sequence demonstrating how the forest will change in appearance over time.

A detailed programme of felling, restocking and thinning, including information covering activities qualifying for grant-aid in the first operational period is required.

An appendix can hold any useful background survey information, cost analysis and tables or graphs of species proportions, timber volume production or any other information deemed useful or necessary to managers and consultees.

All maps and sketches should be dated and a record of amendments kept up to date.

Use of Colour

The availability of colour photocopiers is now so widespread that colour coding on maps and coloured sketches should be used as a matter of course. It is helpful if standard colours are used, but not absolutely essential. The felling plan drawings should use bright contrasting colours that photocopy well, (some colours come out very similar on some copiers which can be confusing). Species plans should use colours typical of winter foliage as it is easier to differentiate between them.

Typical colours to use are:

Examples of colours used to define species. In the case of more predominantly broadleaved landscapes ranges of greens can be used instead, especially various olive shades.

Examples of colours used to show phases of operation.

Flexibility for Revision and Updating

As forest plans are intended to be long term, there is invariably the need for revision after the completion of every period (either the 5 year WGS or 10 years in a longer (20 years or more) term plan), at which time the Forestry Authority may intend to monitor their implementation. This means that plans should be prepared with eventual alterations, updating and amendments in mind. Progress photographs taken from the same viewpoints as the design photos will help to document the implementation and judge the results. Maps should have keys and boxes for amendments, recorded with the dates and signatures of approvers on them. The format of an A3 ring binder lends itself to this, enabling superseded maps to be placed in an appendix, the progress photos to be added and so on.

THE PROCESS OF FOREST DESIGN PLANNING

There are 9 basic steps in developing the forest design plan:

1. **Setting objectives**
2. **Survey of the forest**
3. **Analysis of the information**
4. **Concept design**
5. **Sketch design - felling**
   - restocking
6. **Documentation**
7. **Approval**
8. **Implementation**
9. **Monitoring and revision**

Step 1. Setting Objectives

One of the uses of regional level plans is to help determine the objectives that are appropriate to individual forests or parts of the forest within the region. Current forestry policy is concerned with multi-purpose objectives but this does not mean that every objective should be given equal weight in every forest. (See regional level plans, page 3.) At the outset of the process, it is important to determine what the objectives are at that time. Foresters are often told 'First, decide your objectives', as if the forester has a free hand in making the choice. However, the forest manager usually has little choice in the selection of objectives: they are implicitly determined by the location, context, character and ownership of the forest. The advice should be 'Make the management objectives explicit'.

The precise objectives for any particular forest emerge from four sources.

Firstly, there are the owner's particular objectives for managing the forest. For Forest Enterprise, these are the same as national policy objectives, whereas in the case of a private owner they might, for example, include sporting use, revenue requirements or capital appreciation.

Secondly, if public funding is involved, the national forestry policy objectives, the UK Forestry Standard and guidelines must be met. These include stated requirements such as watercourse or archaeological site protection and percentages of broadleaves, as well as objectives of wood production, improvement of landscape and enhancement of nature conservation. Even where public funding is not involved, legislative and regulatory requirements constrain the way in which objectives can be pursued.

The third source concerns other demands made on the forest apart from those expressed by the owner. These might include the need to protect a certain bird species, the demand for a particular type of timber or a particular type of recreation, or the desire to maintain a valued landscape. These demands may

be expressed or emerge from local circumstances peculiar to the forest in question, although they may overlap with general policies.

The fourth factor concerns the ability of the forest to supply benefits to meet demands. It may be that there are physical limitations on its capacity, for example to supply certain kinds of timber, to carry some forms of recreation, or to support the habitat of a particular animal or bird, due to soil, location and climate.

Thus, it is a matter of determining, rather than selecting, the particular balance of management objectives appropriate to each forest in the region.

Once the objectives have been determined they should be recorded clearly and agreed between client and the person developing or drawing up the plan. This permits the design plan to be assembled with confidence and it also enables the client and subsequent consultees to evaluate its quality. A useful way of expressing objectives is in the form of a table. The following is a typical example:

RESOURCE	OBJECTIVE	INDICATORS OF OBJECTIVE BEING MET
Timber	• To maintain an even flow of timber	• Timber volumes leaving the forest are within a range of ±10% of 10 000 m^3 per year subject to price fluctuations
Financial	• To maintain a positive cash flow	• Revenue exceeds expenditure to overhead level each year • Timber is felled close to max NPV ±5 years
Sporting	• To maintain and enhance sporting values	• Bags of pheasants increase year on year • Revenues from stalking increase by 5%/year
Landscape	• To improve the quality of the landscape	• Existing shape and scale problems are corrected over time • Species and age class diversity increases and blends with the landscape • The special qualities of the waterfall landscape are protected
Biological diversity	• To enhance nature conservation values • To protect peregrine nesting	• Species and structural diversity increases • Open space increases to 20% • Broadleaves increase to 5% sited on good soils and riparian • Cliff nesting site is protected from thieves • 1% of oldest, windfirm stands are maintained to old growth
Recreation	• To increase public access in south end of forest • To maintain RoWs in an open, useable state	• Create access point and marked trails • RoWs can be followed without obstruction • Public are kept away from shooting areas during the season
Archaeology	• To enhance the protection of archaeological features	• The two tumuli are cleared and access to them created

Step 2. Survey of the Forest

Once objectives have been set the design planning process is underway. The information required for planning, its relevance and the degree of detail will vary from place to place, but in general the following checklist will be useful (See Appendix 1 for further details):

Physical	• surface geology • topography (contours) • drainage and watercourses • soils/ecological site classification • windthrow hazard classification
Production	• growing stock inventory • economic felling ages or terminal heights at the onset of windthrow • access roads and harvesting systems
Conservation	• sites of geological/geomorphological interest • sites of archaeological/historic interest • important extensive habitats • sites of specific wildlife conservation value • national vegetation classification maps
Recreation	• actual and potential recreational use • footpath routes - actual and potential
Visual	• viewpoints inside and outside the forest • elements of visual diversity • visual problems with the existing forest layout
Other factors	• powerlines • water supply catchments • public highways

A thorough site visit is needed to become familiar with the forest or wood and to establish the external viewpoints from where the forest is visible (photographs should be taken).

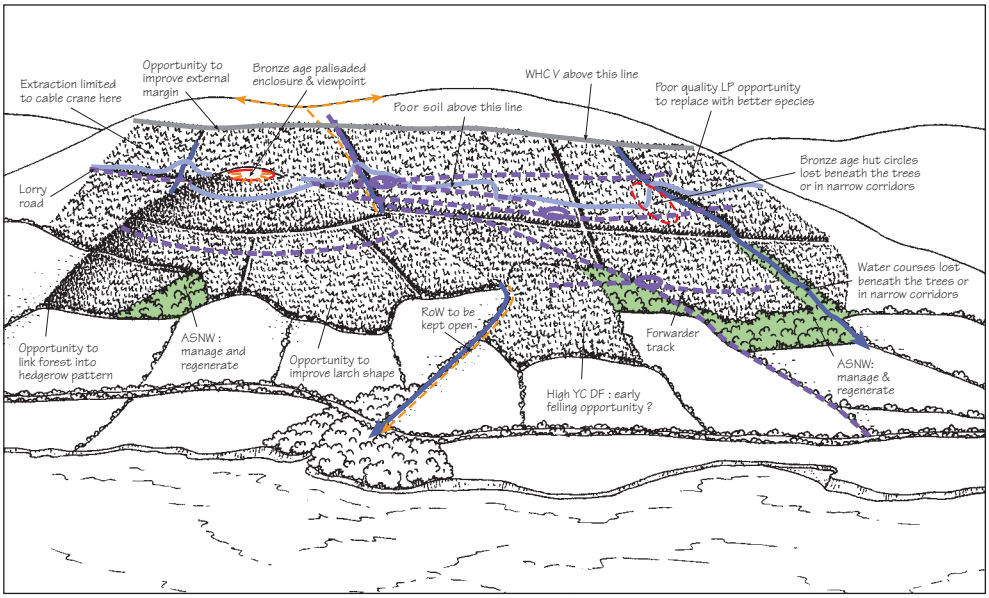
This information is best recorded on maps at the design scale (usually 1:10 000, but for very large areas may be 1:25 000 or for a much smaller one, 1:5000). The information may be obtained from a range of sources: Ordnance Survey maps, aerial photographs, inventories carried out for management purposes by the owner, from other agencies and the local authority or from expert knowledge; specially commissioned local amateur 'experts' such as bird watchers or botanists might have information of value. When presenting it, use clear keys and colour codes. Make sure that maps overlay accurately: sometimes photocopies can be distorted, losing their accuracy of scale. Site photographs should be taken to give comprehensive coverage from all major viewpoints (see Design Techniques - page 23).

Step 3. Analysis of the Information

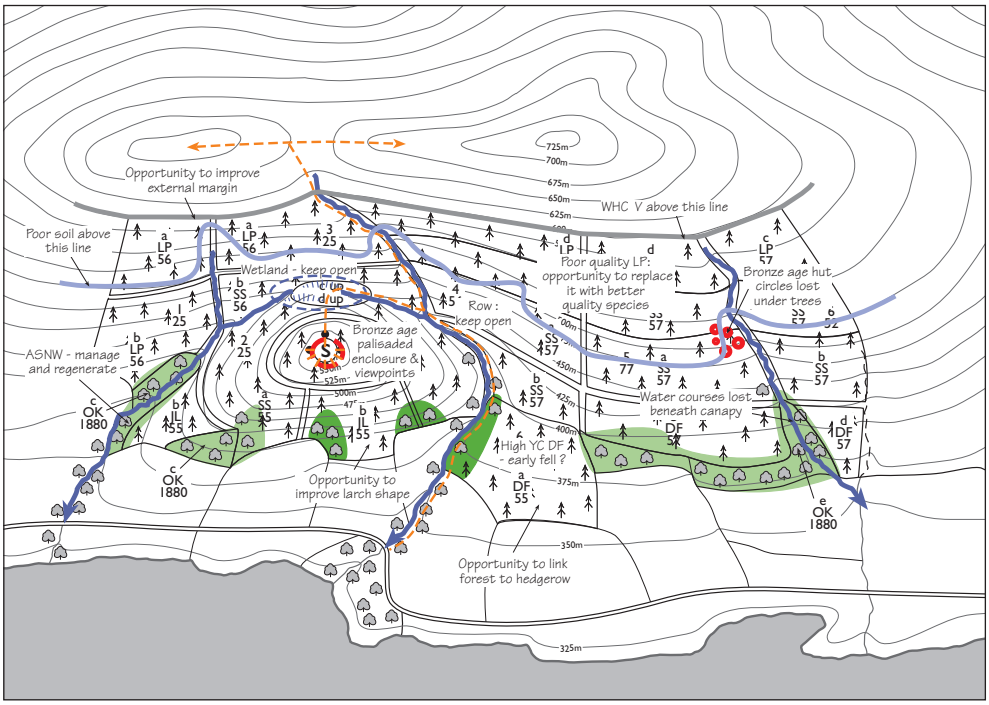
The next stage is to analyse the survey information. This is best done in two parts, the constraints and opportunities analysis and the landscape character analysis.

Constraints and Opportunities Analysis

The survey information is used to determine those factors which reduce freedom of action (constraints), such as poor soil, high windthrow hazard class, physical obstructions and protected sites. Opportunities are the converse of constraints - that is where there is greater flexibility: good soils, low windthrow hazard class, etc. It is useful to show these sieved out on annotated maps and also illustrated on perspective sketches ready for the design stages.



An example of an opportunities and constraints analysis presented in plan and perspective. (See Appendix 2 for more examples.)



It is also a good idea to tabulate them for easy understanding and subsequent evaluation of the design, since it is important that the design is worked around the constraints but maximises the opportunities. This example demonstrates the technique:

FACTOR	CONSTRAINT	OPPORTUNITY
Ownership boundary	• Shape of boundary conflicts with landform. • Scale problems of skyline areas not in ownership	• To correct shape problems by leaving land unplanted at restocking
Age of existing stands	• Need to fell over short period so reducing range of felling ages	• To diversify age class by restocking over longer period
Soils	• Poor soils limit species choice	• Some species choice where limited good soils exist
Windthrow risk	• Few windfirm boundaries other than straight lines of roads or rides	• To create new future coupe boundaries that are windfirm
Rights of way	• Large fellings may be out of scale and detrimental to view	• To improve the landscape along routes through the forest
Archaeological sites	• No machinery or activity on them	• To open up and improve the setting of them
Watercourses	• Accessibility for harvesting across streams may be difficult	• To open them up and meet water guidelines standards
Quarry	• Shape and scale of the faces are difficult to change	• To soften its impact in the landscape by planting around parts of it
Nature conservation	• Lack of existing broadleaved woodland	• To develop old growth, open space and edge habitats

Transferring map based information on to photographs can be difficult but there are techniques available (see Design Techniques, page 23).

Landscape Character Analysis

Where the forest wood is visible in the landscape it is important that it should be designed to blend into it. For this purpose a landscape character analysis should be undertaken. There are two parts to the step. The first is the landform analysis using red and green arrows to pick out convexities and valleys (red arrows down ridges and green arrows up valleys). The analysis should be recorded on both plan and perspective. It is important to rank the analysis, showing the stronger landform features as thicker arrows than the weaker ones. Where the landform is almost flat this is unnecessary.

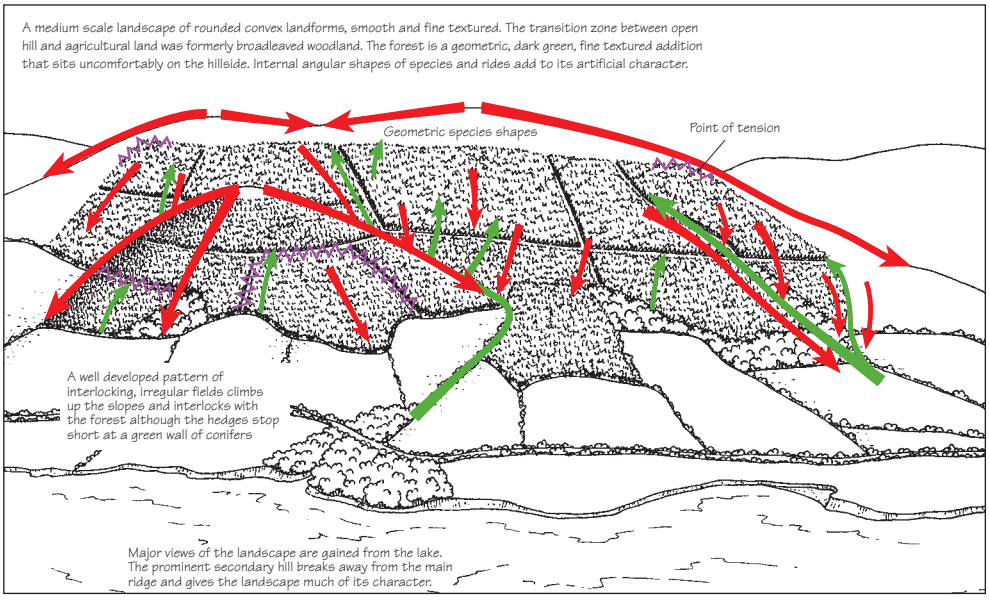
Following landform analysis aspects of landscape character should be recorded, in plan and perspective, particularly the following:

- problems with the existing layout, such as shapes of species, felled areas, the external margins or ride and compartment boundaries;

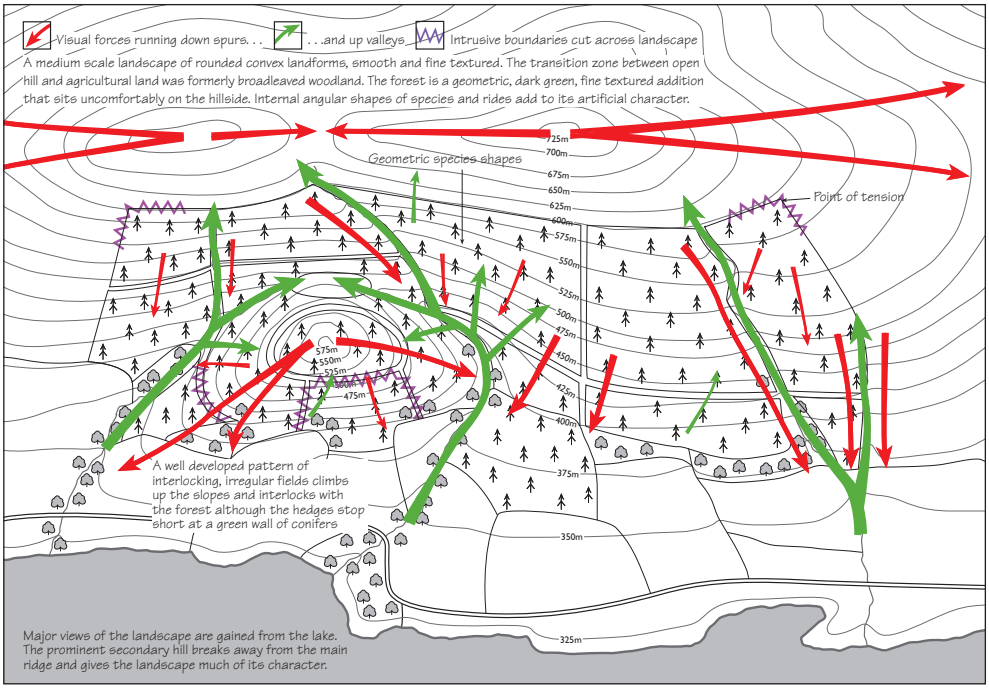
- actual and potential elements of visual and ecological diversity, such as open ground, water, broadleaves, rock outcrops, species variety, viewpoints, archaeological sites, stands of old trees;

- description of the shape and scale of the landscape, landform, and other patterns evident in the landscape, to be used to help guide design.

Overlays on photographs may be used or photocopies or sketches may be made from them. Annotations, colour coded symbols and, the landform arrows should be clear, accurate and crossmatched with the maps.

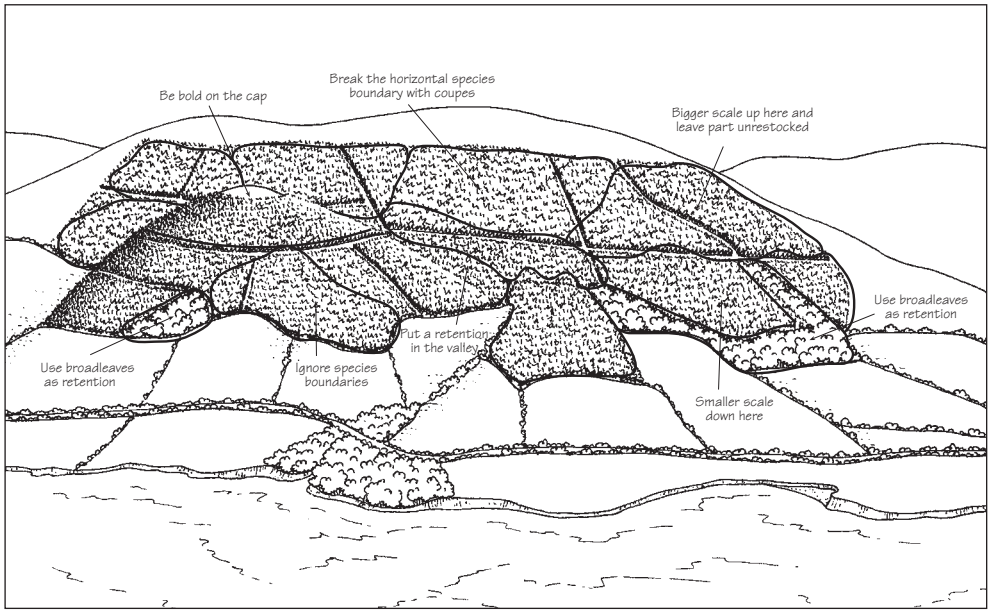


An example of a landscape character analysis presented in plan and perspective. (See Appendix 2 for more examples.)



Step 4. Concept Design

Once analysis is completed but before embarking on the design of felling coupes, etc. it is worth considering the overall options for concepts appropriate for the forest in question. This step helps to clarify the main features and character of the forest at the end of the implementation of the plan. The chosen concept should include the types of shape to be used, the scale of the pattern, the proportions and use of different species and open ground, silvicultural systems and the way the forest sits in the surrounding landscape. It is valuable to check the emerging final concept against the objectives. If it seems to meet them fairly well it will be safe to proceed to the sketch design stage. The concept can be expressed as a statement or as a simple plan or perspective identifying the general breakdown of the forest into areas for different types of treatment.



A concept sketch begins to define the way the forest design plan will develop (see Appendix 2a).

Step 5. Sketch Design

At this stage the concept is worked up by, quite simply, sketching the outline of the external shape of the forest, felling coupes, areas for open space or broadleaves and so on. The process is one of trial and error, erasing and redrawing until the design settles down and becomes progressively refined. It is best done in two parts, the coupe design and the restocking design. In more windfirm forests it is usual to design the felling first, whereas in forests prone to windthrow it may be better to concentrate on the restocking design as the first step. (See Manual Design Techniques on page 26).

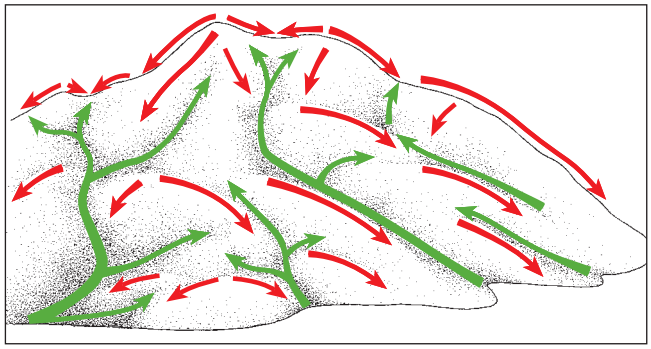
Felling Design

Design the pattern of felling coupes over the whole design unit for both the short and long term. Areas to be retained either in the long term (20-30 years) or indefinitely (for old growth) should also be designed.

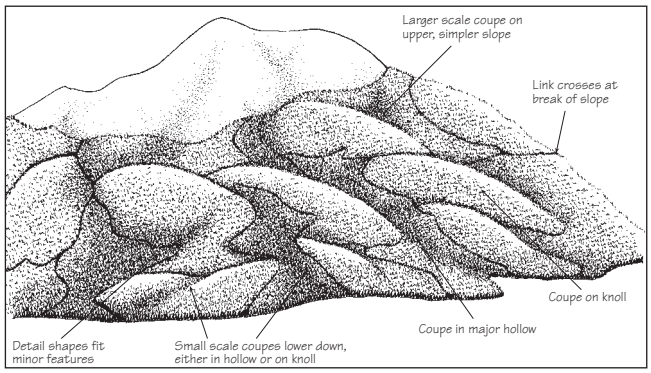
Methods of Coupe Design

Where the landform is prominent and (due to shelter, soils, tree height, etc.) the forest is at low risk from severe wind damage, the coupe pattern should be based on landform. This is where the perspectives of the visual forces analysis are most useful. The major lines of force often subdivide the landscape into a number of obvious major units such as hill top caps, valleys or knolls. The first breakdown of the forest should make use of these, taking care to cross skylines at sensible places like saddles or breaks of slope. These large shapes can then be subdivided using the next most important visual force arrows. The sizes of coupes should reflect the scale of the landscape. They should be larger towards the summit and smaller lower down. The finest visual force arrows are used to help create interlocking coupes, while the type of landform and semi-natural vegetation patterns should dictate the character of the shape, such as rounded and flowing or spiky and angular.

Use tracing paper or acetate laid over the analysis perspectives as a base for the initial sketches. Use the constraints and opportunities analysis to test the practicalities of the early sketches and gradually refine them towards a good balance between all factors.



a. The landform analysis of an area of complex topography.

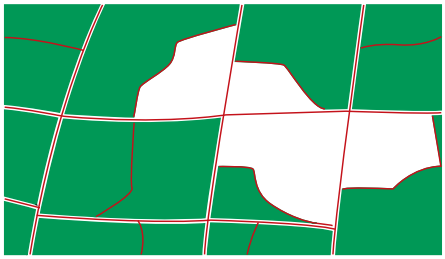


b. The coupe shapes firstly relate to the main landform structure, such as occupying knolls or valleys. The detail of their shape responds to the smaller hollows and ridges.

Design in High Windthrow Hazard Areas

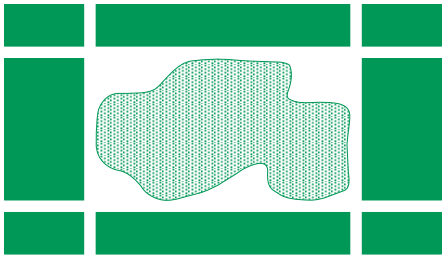
In landscapes where wind is a serious limiting factor it may be necessary, in order to reduce the risk of further damage, to rely on windfirm boundaries which may not be ideal in environmental terms. One approach is to aggregate combinations of the smallest self-contained units present (that could be harvested independently) to make irregular interlocking shapes. Another is to take a risk by felling within a shape where the wind can only blow trees down as far as the nearest green edge. The third method is to accept poor felling shapes but to replant them to a different pattern. It may be better to design the restocking pattern first and fit the felling into it in such circumstances.

a. A coupe design using 'minimum harvestable units' is able to achieve some irregularity of shape and interlock.



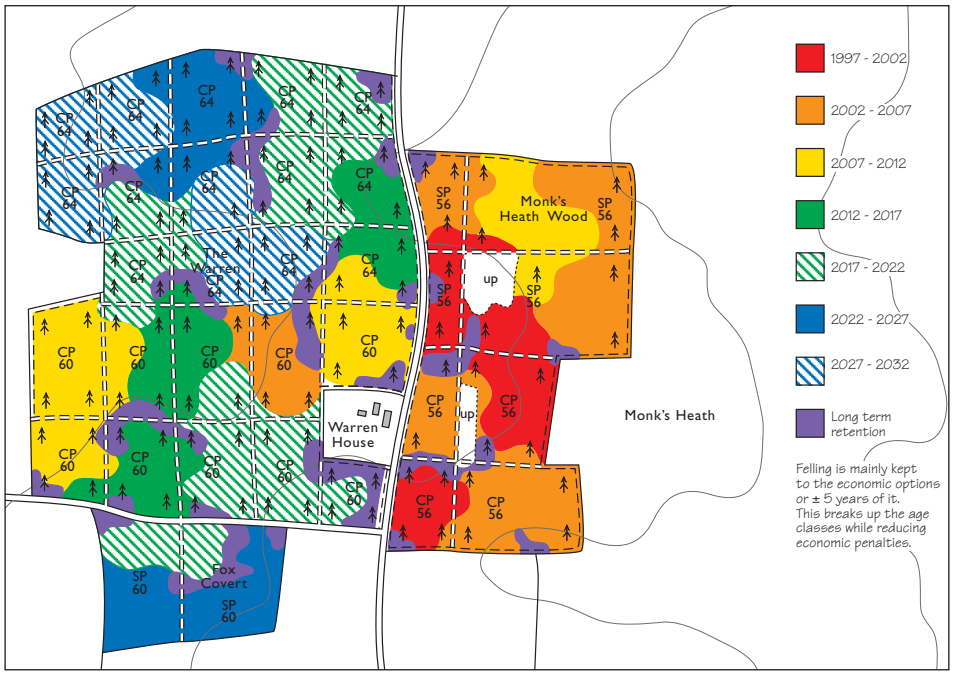
b. A designed shape is felled while taking a risk that the remaining areas will stand for 5 years or so. If windthrow does occur it will be controlled by the nearest green edges.

c. The coupe occupies two square compartments. The redesigned shape is planted with the remaining corners delayed for 5 or more years.



Design in Flatter Areas

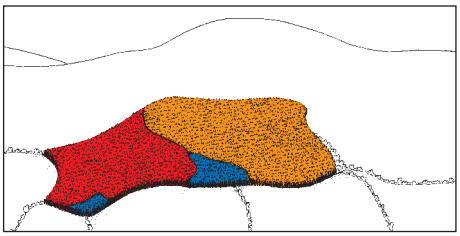
In flatter landscapes internal views of felled coupes are obtained. Organic interlocking shapes are preferred especially where existing gridiron compartment patterns exist. Soil and vegetation changes may be more use than landform, although even slight variations in topography can be used to advantage. Design is carried out in plan.



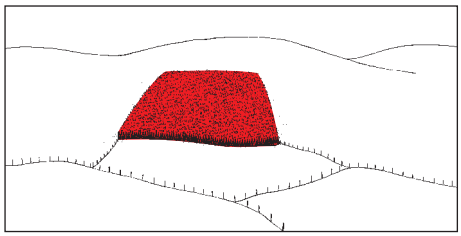
Ideas for laying out felling coupes and retained stands in flatter landscapes (see Appendix 2c).

Design in Smaller Woods

Where the wood is very small it may only be necessary to design two coupes and perhaps an area to be retained. This is obviously a fairly simple task but is still worth doing. The size of the area may limit the options available quite considerably. In the smallest of all it may be better to fell the whole area at once, though there is no need for a long term plan in such cases.



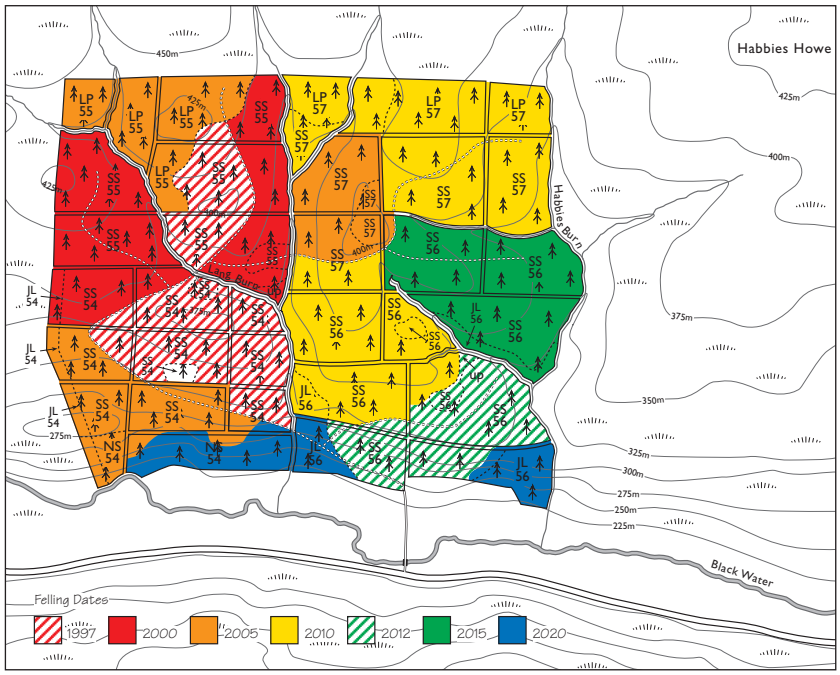
a. This relatively small wood fits into the landscape so it should be felled in two phases with a small area retained.



b. This small wood fits poorly into the landscape and would be best felled at one time.

Timing of Felling

The next decision, once coupes are satisfactorily designed, is to consider the phasing of felling. Ideally the felling of adjacent coupes should be spread so that the restocking on the first to be felled has reached some 2 m in height before the second can be felled. This is easier where flexibility exists due to the age of the standing trees or where the site is windfirm. It makes little difference economically to fell over a 10 year period (5 years either side of the optimum), but the stability may be less certain on some sites. The more coupes that have been designed, a greater choice of timing and spread of age classes is possible. It is worth exploring several possibilities, perhaps starting with the least visually sensitive or the most important ones to open up for nature conservation reasons. In larger plans several dispersed coupes may be felled during one phase.



A plan showing how phases of felling can be distributed over the forest to increase the age variation (see Appendix 2b).

Felling Design with Different Silvicultural Systems

At the coupe design stage the choice of silvicultural system should also be considered. If the whole wood is being treated as one system then there are no separate coupes (but see group felling below). If parts of the wood or forest are to be treated either by different systems or at different times, then coupe design remains necessary, because the texture and rate of regeneration will cause changes to the canopy structure.

The main silvicultural options to consider are:

- clear fell and replant/naturally regenerate: this is currently the most common option;
- uniform shelterwood: this resembles slow clear felling and produces a fairly even-aged successor stand;
- group shelterwood: this breaks up the canopy using small coupes which gradually amalgamate into one larger, almost even-aged stand;
- group selection: the canopy is broken by small coupes that create a more irregular effect over time and lead to an uneven aged stand;
- single tree selection: where the forest achieves a wide range of age classes within a stand and the canopy remains closed at all times;
- minimum intervention for parts of a woodland.

The choice of system depends on the management objectives, the species characteristics, the site conditions and the degree of management available over the rotation.

Coupes to be managed by systems other than clearfelling can often be of a larger scale since their impact on the site and landscape is likely to be less. Landscapes where a slow rate of change is desirable benefit from the use of alternative systems.

Preparing Coupes in Younger Stands

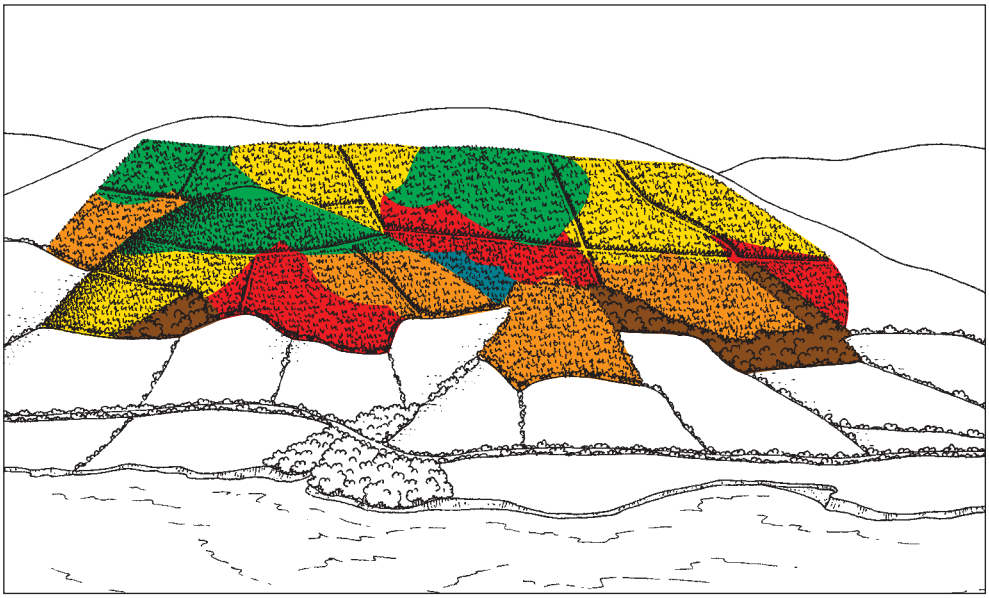
There are opportunities to design future coupes in many areas of young stands where existing green edges are unlikely to be acceptable as boundaries.

The method is to proceed with coupe design as described above with the aim of making severance cuts along the proposed boundaries. This involves removing trees to a sufficient width to allow stable edges to develop that are less likely to blow down when neighbouring stands are eventually felled. The cut swathe should be of a minimum of 20 m wide, made well before the stand has reached critical height for windthrow. The ‘window of opportunity’ for these operations is extremely short, for example, 17 years for YC12 Sitka spruce in WHC6 or 19 years for YC16 in WHC 5 areas. Forest design plans should therefore be prepared well in advance if stand structure is to be manipulated.

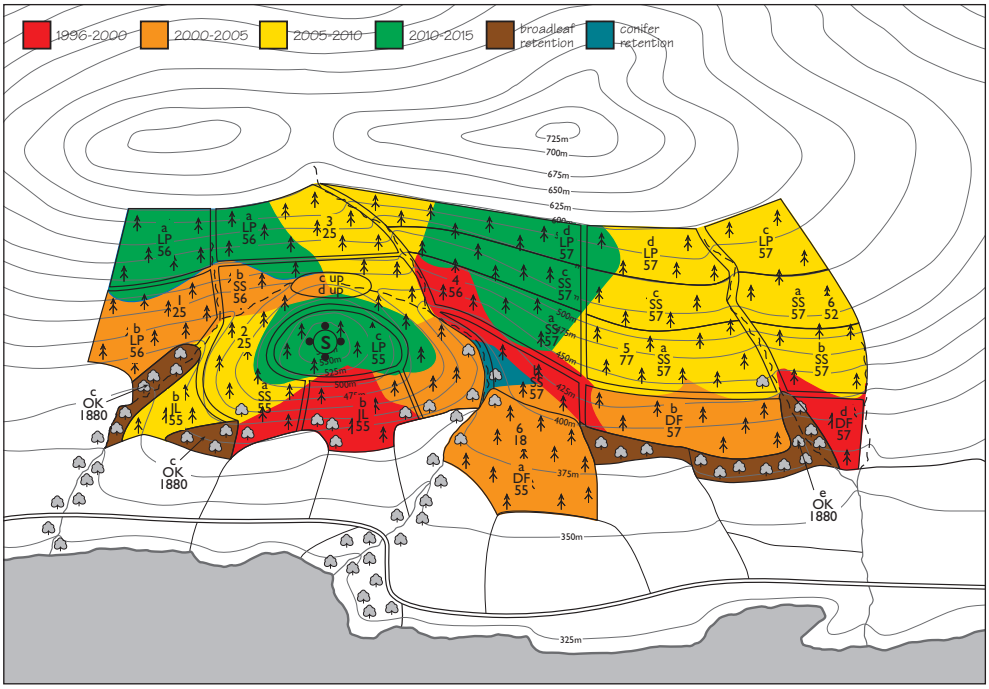
Presentation of the Felling Design

In cases where the landscape is visible the map of coupes colour coded to phases of felling, such as 5 yearly intervals, should be accompanied by perspectives showing the pattern and phasing. Perspectives may also be needed in flatter areas if there are significant internal views such as those from public roads or recreation routes.

In addition to the colour coded maps and sketches some of the most sensitive areas should be shown as a time sequence to demonstrate the visual effect of each phase of felling. (The graphic techniques available to produce such perspectives are described on page 27.)



A typical presentation of a felling design in plan and perspective showing the shapes of the coupes and the phasing of felling (see Appendix 2a).



Restocking Design

Once the felling pattern has been designed the restocking should be considered. If the coupe pattern is well designed in terms of shape and scale then it is a simple task to assign a new species or mixture of species to a complete coupe.

Exceptions to this are:

- where the external margins needs to be re-designed by retreating or advancing from the original boundary;
- where a large coupe needs smaller areas of broadleaves or another species within it;
- where the felling shapes could not be designed to fit the landscape the restocking should resolve this using new shapes (possibly designed ahead of the felling design);
- where open space needs to be created following removal of the existing trees.

The design should be prepared in the same way as the felling coupe layout, using tracing paper or acetate overlaid on to the felling designs and landscape analyses.

Choice of Species

The choice of species may not be equivalent to those used in the first rotation: single or limited species choice the first time round should be diversified using a range of evergreen conifers, larch and broadleaves as appropriate.

Design of Open Ground

Often the design of areas to be left open, either pre-existing or newly created following felling is a more important task than species choice. The attention to detail of their shape is vital in order to avoid parallel sided watercourses, rides or roads for example. Some spaces may need to be bigger than their minimum requirements (for archaeological site protection, for example) in order to suit the scale of the landscape. The method of design in visible areas is to use perspective sketches to ensure that shape and scale are right. It is often a good idea to start with the external margins and then to lay out the species and internal open spaces.

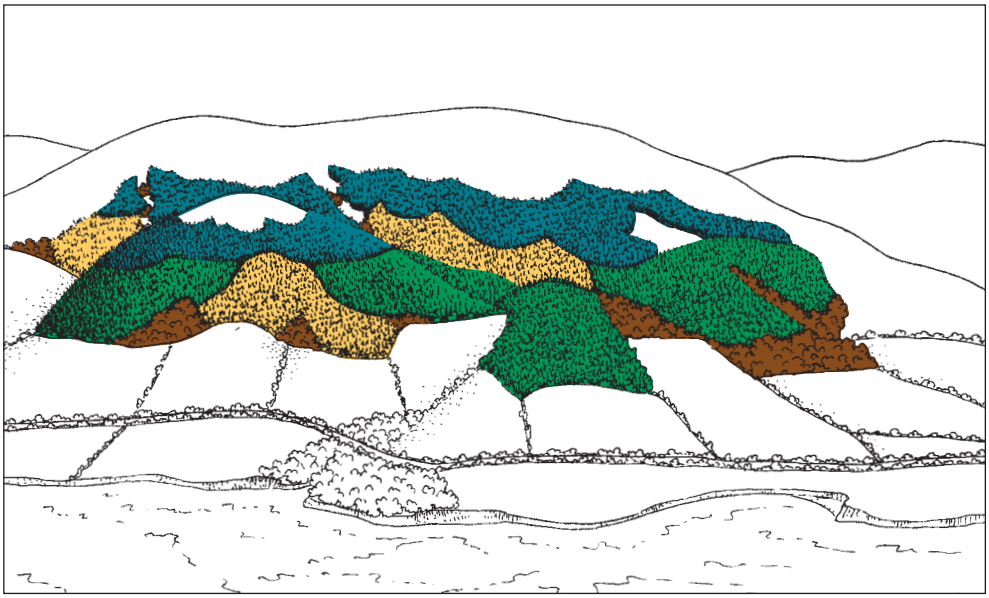
Correction of Previous Layout Problems

Previous old geometric rides in compartment layouts should be eradicated by designing new species/coupe shapes to follow landform and/or vegetation patterns. This may involve delaying the restocking of some areas for a period where felling was forced to follow a poorly designed but windfirm edge. Newly designed rides or linear spaces can be used to separate areas of species in order to develop new windfirm edges. (See severance cuts, page 18.)

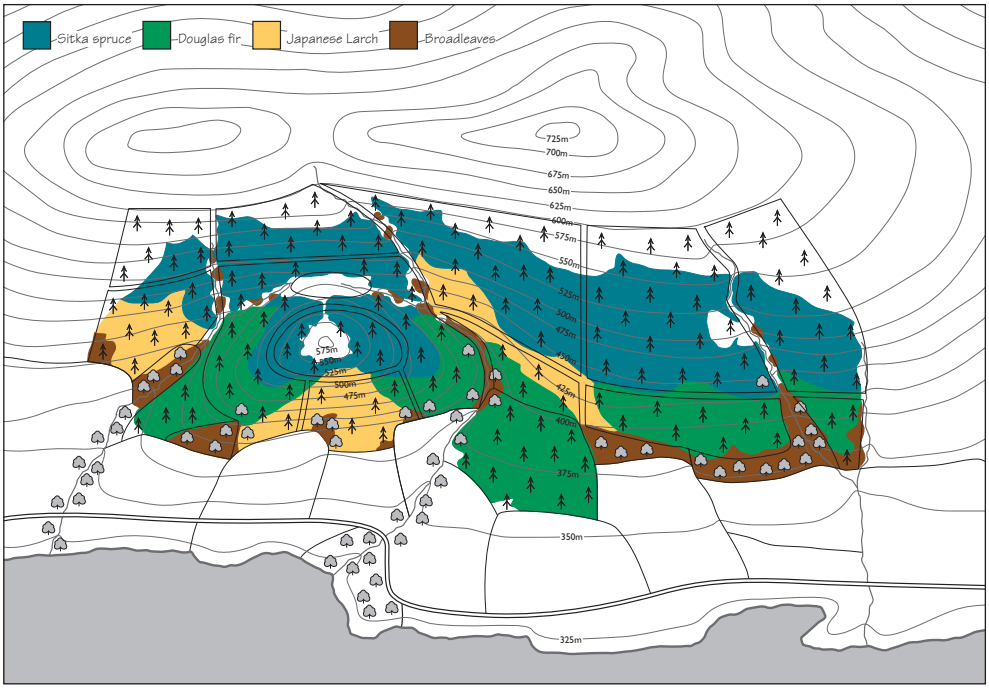
Presentation of the Restocking Design

As for felling, a colour coded map of species and open space is needed. Perspective sketches should be used in visible areas to show how the restocking pattern fits the landscape.

Areas where delayed restocking is planned or where previously stocked areas are to remain as open space need to be identified. Management prescriptions aimed at maintaining them in an open condition, or to develop semi-natural vegetation, should be supplied since the practicalities of retaining open ground in or around the forest may be expensive or difficult to achieve.



The way to present the restocking in plan and perspective. Here the species are shown with some suggestion of the age variation (see Appendix 2a).



Step 6. Documentation

Once the sketch design has reached a satisfactory stage of refinement it should be documented according to the guidance given on pages 5-7. Remember that people unfamiliar with the forest or woodland will be reading it and that they will be forming an opinion on the quality of the plan largely on the basis of the material presented.

Step 7. Approval

The Forestry Authority will undertake the approval process according to the procedures operating at the time the plan is submitted. As some modifications to the plan may be necessary, it is worth remembering to date maps and to design the document to allow parts of it to be altered without reworking the whole. Once approval has been given to the first phase of operations, the detailed planning for implementation can proceed.

Step 8. Implementation

Plans are implemented by action on the ground: silvicultural management, felling and restocking. It is very important to ensure that felling coupes are laid out as closely as possible to the approved design. The shape and size must be adhered to. If problems are met on the ground or amendments are to be made to the plan, approval must be sought from the Forestry Authority before proceeding to change the layout or sell the timber.

Step 9. Monitoring and Revision

Once the first phase of approved work has been carried out it should be monitored to see how well it achieved the plan objectives. Much can be learned from early experience of implementation to be fed back to any revisions necessary before the next phase of action. Records of the work such as photographs can be useful to show progress and to test results against expectations. In this way confidence builds up and it will be easier to gain approval and implement future phases.

DESIGN TECHNIQUES

Here are some hints on the techniques and materials used in forest design.

The designer needs plenty of space to pin up sketches on a wall or pinboard, some large flat surfaces, good light, access to a photocopier and a good quality camera. Access to a colour laser photocopier (perhaps a local copy shop) and computer aided design facilities make fully fledged professional plans to a high standard of presentation and accuracy possible in a shorter time. However, design can be managed without the latter.

The basic materials of design are panoramic photographs, aerial photographs, contour maps, forest stock maps, etc. and photocopies of much of this in both colour and black and white. In addition, computer generated terrain models or 3D contour models can be used if the appropriate facilities exist to create them.

Finally, a selection of felt tip pens, pencils, crayons, tracing paper, acetate sheets and the usual office supplies should be available.

Choosing Viewpoints

It is useful to make a distinction between public viewpoints such as those from which the landscape is normally visible and those which help the designer to see the landscape fully and understand how it is put together. It is best to find a wide number of viewpoints, both 'public' and 'designer' and to select from amongst them the best for design and presentation purposes. Designer's viewpoints may be obtained by climbing up a hillside to a rock outcrop where the view opens out to some degree or where obscuring foreground vegetation can be avoided.

It may be necessary to photograph several views, or there may be only one main view, depending on the size and importance of the area.

Taking Photographs

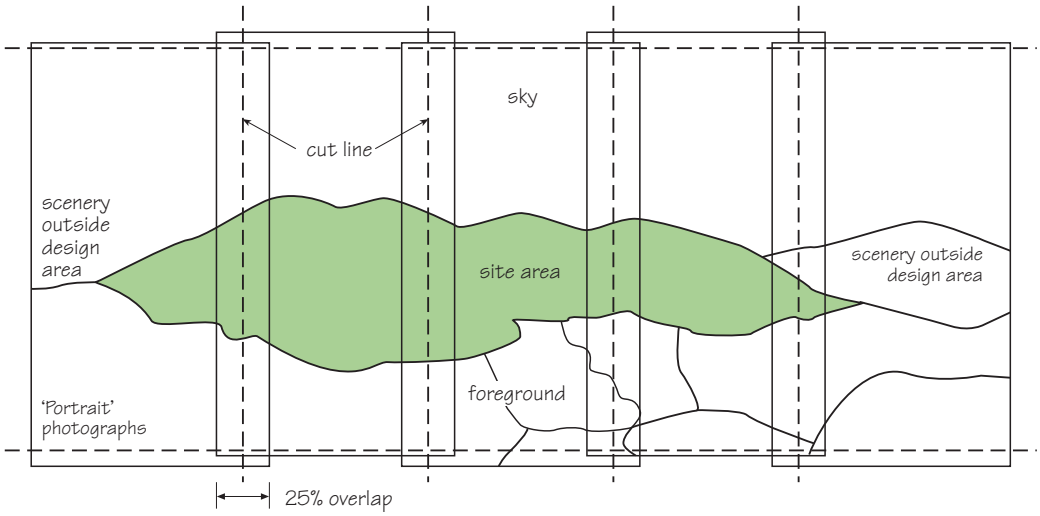
The object of landscape survey photography is to show as much detail of the landscape as possible, especially topography, rather than to create artistic compositions or record interesting lighting conditions.

The most appropriate camera is a 35 mm single lens reflex with through-the-lens metering and a 50 mm lens. Models with manual setting of exposure and shutter are better than completely automatic cameras since the landscape needs accurate exposure which has not been distorted by light from the sky.

Modern compact cameras are improving, especially those which meter the exposure in a balanced view of the landscape rather than on average (where the landform tends to be underexposed). In good light and under front lit conditions, they produce acceptable results.

It is normal that the landscape composition cannot be encompassed in a single photo frame, so a number are taken and subsequently joined into a panorama. To do this properly, an overlap of around 25 per cent is needed from one frame to the next. The format can be 'landscape' or 'portrait' depending on the depth of the scene. Ensure that everything from some sky above down to foreground is included and that the extreme ends of the panorama encompass scenery outside the design area.

A good example of a panoramic photograph, well composed with correct exposure and neatly grafted together.



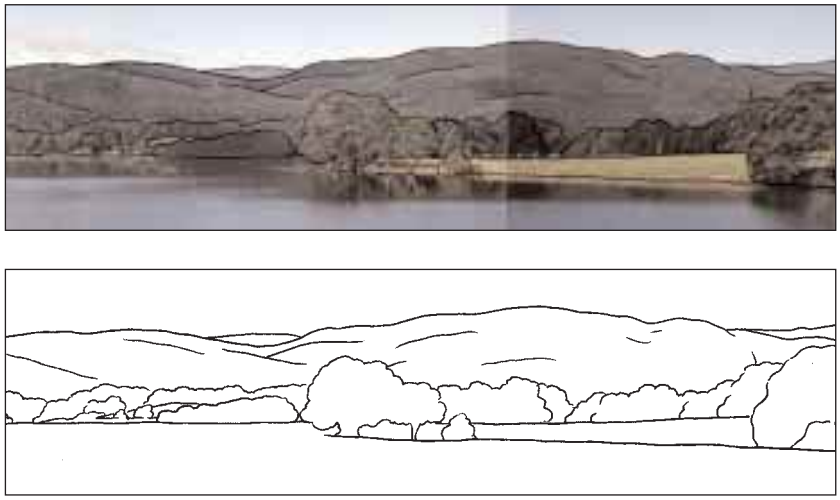
The method of assembling panoramic photographs.

Using the Photographs

Having obtained the photos and selected the sample to design from, they can be used in several ways. Never draw directly on to the prints or they will be spoiled.

a. Cover the photographs with a sheet of acetate and use this to design on. Use water soluble pens suitable for acetate but which can be wiped off so that changes can be made to the design. Acetate can be found in a range of weights. Medium weights are recommended. Rolls are available so that panoramic photos can be covered with a single piece. Secure the acetate with drafting tape to the rear of the photo. The photos and their overlay should be kept flat or loosely rolled.

b. For reproduction purposes, or to provide a design base, a sketch can be made from the photographs on an acetate overlay. A permanent fine point marker should be used. The sketch is basically a tracing of all the relevant detail in line form from the photo. No artistic talent is required. The result can be photocopied and used for basic analysis and design or for presenting solutions.



Using acetate laid over a photograph a tracing of the landscape may be made without needing major artistic skills.

c. The photograph can be photocopied in colour or monochrome half-tone. For this to be successful, the photograph needs to be of good quality, taken on a bright day so that there are a wide range of tonal values. The photocopier must be capable of handling half-tones. The average office copier is not satisfactory but up to date laser copiers produce excellent results. Colour copies are useful for display purposes but monochrome half tones can be better for both design and presentation of analysis and design options. The background detail of the landscape is present yet the information in the analysis or design stands out more obviously. As well as the quality of their reproduction, laser copiers are good at enlarging or reducing photographs, thus saving processing costs. It is also useful to be able to enlarge the design sketches for exhibition purposes or reduce them to fit into folders or binders for documentation.

Maps

Maps are, of course, a major tool for forest planning. For design purposes they are needed in two ways: as survey, to show basic information, and as the document which records the intentions of design for implementation. Contour maps are particularly important for visual force analysis. All information should be presented at the same scale. It may be useful to colour some maps to help to express the patterns and to help to see what relates to the photos. Scales to use are generally 1:10 000, but for small woodlands 1:5000 may be better or 1:25 000 for the largest ones (usually Forest Enterprise). Always mark the scale on the map and put a North point on it.

It is important to remember Ordnance Survey copyright applies to copying their maps. Be careful to avoid scale distortions when photocopying.

Aerial Photographs

Vertical aerial photographs are very useful for design either used in their usual stereoscopic pairs or as single frames, especially for translating the design from elevation into map form. If possible the photos should be at the same scale as the maps. If they are not, it is possible to enlarge or reduce them using a process camera (a piece of technical equipment available at specialist firms) or a laser photocopier although at the risk of a loss of quality.

Stereoscopic pairs emphasise landform and can help pick out subtleties more easily, although they exaggerate features to some degree. Vegetation and other patterns may be more obvious on aerial photos than on maps and can be related to those visible on panoramic photos. Colour aerial photos are more useful in even textured, monotonous landscapes where the subtleties of colour variation may be the only feature which can be identified on both plan and perspective.

Oblique aerial photographs are also very useful. They help as an intermediate step in the conversion from perspective to plan. They also make more of the landscape visible so that the design can be resolved more easily in complex landforms.

Manual Design Techniques

The main method of carrying out a design is with pencil and tracing paper over the top of maps, photos and sketches. Quite a lot can be done in systematic fashion, starting by identifying the important features, site characteristics, patterns, constraints, and opportunities. Another layer over this is then used for sketching shape ideas, erasing and re-drawing as necessary until a satisfactory result is obtained.

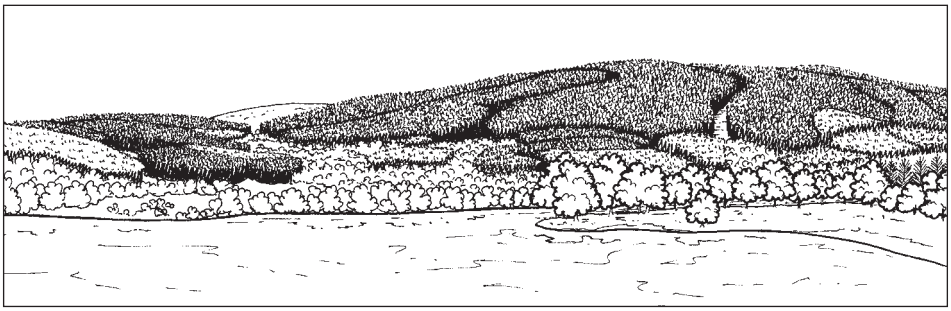
It is best to use the perspective views as the main design base, not the map, unless the landscape is less visible, flat or parts are hidden. However, using both together is more usual and useful, otherwise transferring sketch to map can be difficult.

Sketch design involves trying out ideas for shapes over the photographs and maps. Acetate and tracing paper are both useful.

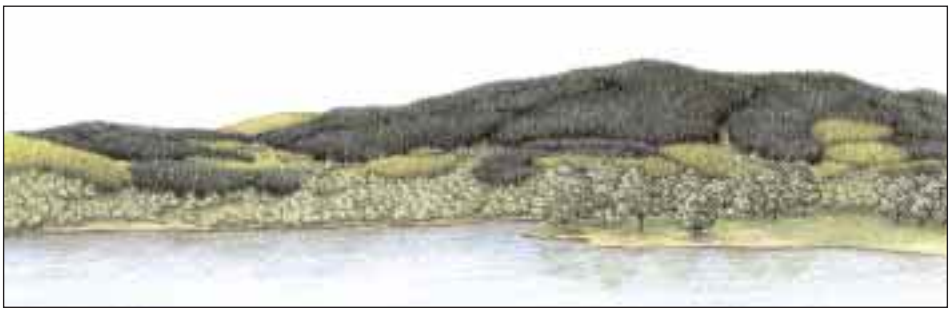
Presentation Graphics

For presentation purposes pencil sketches, coloured pencil or felt tip rendering can be used. These are able to present realistic impressions of the developing forest and are ideal for public presentation.

a. The original photograph of the forest before felling.



b. A black and white sketch depicting the effect of implementing the design. This can be reproduced in monochrome.



c. The same design rendered with coloured pencil can give quite a realistic impression.

d. Felt tip pens are another medium that can be used to present designs.

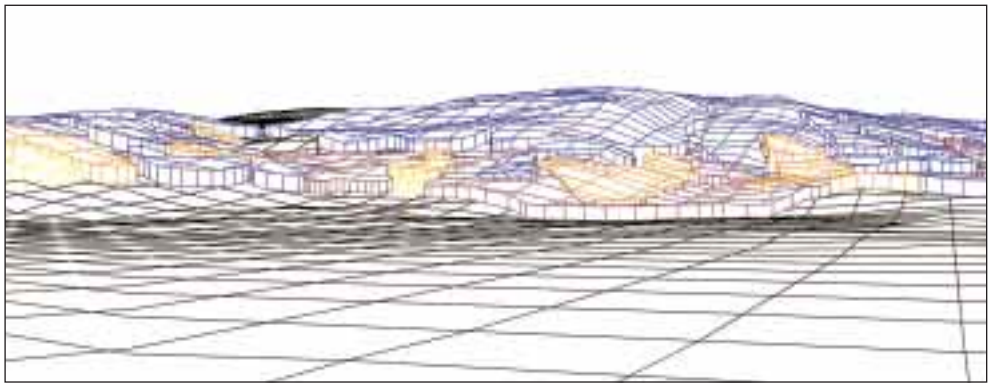
Computer Tools

Computer Aided Design (CAD) systems and Geographic Information Systems (GIS) are increasingly being used to capture, store, analyse and present information about landscapes, forests and other 'land-based' resources. These systems are becoming more and more user-friendly and are rapidly developing more power at reduced cost. Both can now be used on PCs.

CAD is generally used for representing information as maps or as 3-dimensional models to show what the forest will look like when a plan is implemented. It can be used to design in 3-dimensions so that the design can be visualised as it develops.

GIS can also be used to produce maps and 3D images, but in addition can be used to manage large quantities of different types of information (e.g. text, maps, databases, spreadsheets, images, etc.) and develop complex analysis systems to model other outcomes of plans, such as timber volumes or habitat change.

At the time of going to press, CAD systems still offer more flexibility in 3D modelling, however the rapid development of GIS technology suggests that in the short to medium term, user-friendly and affordable GIS will soon be able to offer more than conventional CAD systems for forest planners and managers.



A 3-dimensional model showing the shape and phasing of felling coupes. This has been produced using a computer aided design system. It relates the map to the perspective so that greater confidence in the results of felling can be gained. The system allows options and viewpoints to be tested before finalising the design.

REFERENCES

This brief guide gives anyone needing to design a woodland the main information.
More detailed and helpful advice about design is available in the following references:

Bell, P D, Quine, C P, Wright, J A	(1995)	Use of Digital Terrain Models to Calculate Windthrow Scores for Windthrow Hazard Classification Scottish Forestry, Vol 49 pp 217-225.
Bell, S	(1993)	Elements of Visual Design in the Landscape E & FN Spon, London.
Forestry Commission	(1994)	Forest Landscape Design Guidelines HMSO, London.
Forestry Commission	(1993)	Lowland Landscape Design Guidelines HMSO, London.
Forestry Commission	(1990)	Forest Nature Conservation Guidelines HMSO, London.
Forestry Commission	(1993)	Forests and Water Guidelines HMSO, London.
Forestry Commission	(1992)	Forest Recreation Guidelines HMSO, London.
Forestry Commission	(1995)	Forest and Archaeology Guidelines Forestry Commission, Edinburgh.
Forestry Commission	(1991)	Community Woodland Design Guidelines HMSO, London.
Hibberd, B	(1991) (Ed)	Handbook 6: Forestry Practice HMSO, London.
JNCC	(1992)	UK Nature Conservation No 4: Summary of National Vegetation Classification Woodland Descriptions Joint Nature Conservation Committee, Peterborough.
Pyatt, D G And Suarez, J C	(1997)	Technical Paper 20: An Ecological Site Classification for Forestry in Great Britain, with Special Reference to Grampian, Scotland Forestry Commission, Edinburgh.
Lucas, O W R.,	(1991)	The Design of Forest Landscapes Oxford University Press, Oxford.
Quine, C P	(1997)	Research Information Note 257: An Improved Understanding of Windthrow - Moving from Hazard to Risk Forestry Commission, Edinburgh.
Quine, C P and Wright J A	(1993)	Research Information Note 230: Revised Windiness Scores for the Windthrow Hazard Classification; the Revised Scoring Method
Rodwell, J	(1991-95)	British Plant Communities (5 vols) Cambridge University Press.
Rodwell, J and Patterson , G	(1994)	Bulletin 112: Creating New Native Woodlands HMSO, London.

In addition, the Forestry Authority offers courses on Forest and Woodland Design, aimed at forest managers, agents and others involved in preparing or approving forest and woodland design plans. Details are available from:

Forestry Practice Division
231 Corstorphine Road
Edinburgh EH12 7AT
Tel: 0131 334 0303
Fax: 0131 316 4344

APPENDIX 1

Survey Information: A Description of what to Collect

Here is guidance on the type of information to collect and how to collect it. Not all areas will require the same attention to detail, some can sometimes be amalgamated on one or two maps instead of each category being recorded on a single map.

1. **Ownership:** The ownership boundary/fence line may be a significant issue in terms of changing the external margin of the forest to improve the design. The forest area may be one unit within a wider forest where ownership boundaries may be one of the major factors in the design.

2. **Soils/site types:** carry out a basic assessment of soils, perhaps from vegetation indicators, landforms (there is correlation with slope/form and soil type) or from sampling the site. Site types based on the latest Ecological Site Classification can be broader brush and more meaningful as they can be related to both productive species choice and native woodland types via the National Vegetation Classification.

3. **Archaeology:** records of scheduled and unscheduled sites should be examined. There may be sites already planted over, so an assessment of their state will be needed for restoration purposes.

4. **Recreation and access:** rights of way, viewpoints and existing uses should be recorded. Potential recreation could be identified if it is an objective of management. Private recreation (e.g. by an owner) could also be considered, such as shooting or fishing, determining where access is needed or open areas should be left.

5. **Windthrow Hazard Classification:** this can be constructed from the soil, elevation, aspect/exposure/windiness scores. It may affect the choice of species and whether it is worth replanting some areas, as well as the layout of the forest in terms of future coupe boundaries and the development of windfirm edges. Also, an assessment is needed of whether it is economically worth restocking the highest class areas. Terminal height maps (showing when stands are likely to start blowing over) can also be very useful to give an idea of the flexibility available over timing of felling and its layout.

6. **Water:** the streams should be mapped and the implications of the water guidelines assessed. Wetlands, mires, lakes and ponds, intermittent streams or seasonal watercourses should also be marked. The need to clear existing trees back from streams should be identified.

7. **Nature conservation:** the area should be assessed in terms of special habitats or vegetation communities, the value of all semi-natural vegetation, and the sites where native woodland types could be planted

or regenerated, perhaps as part of the broadleaved component. Significant areas of native woodland will normally require a distinct management plan. The management implications of semi-natural habitats should also be noted. The occurrence of important or rare animal and bird species should be noted and the implications for their survival or enhancement identified.

This assessment should consider the area in its wider context rather than concentrating on what is known about the site alone.

As well as the existing state the potential for increasing biodiversity value should be considered, such as the creation or improvement of some of the semi-natural habitats. Some sites may have good potential, others very little so expenditure should concentrate on those of greatest potential.

Finally, damage to habitats such as ancient woods and mires, caused by previous conifer planting should be assessed, together with opportunities for restoration.

8. **Landscape:** the landscape should be extensively photographed and the location of the viewpoints marked on a map. This includes both external views and any internal to the site. An assessment of the landscape sensitivity should also be made on the basis of its visibility, the numbers of people who see it and its quality in terms of how generally attractive it is considered to be and whether there are any significant detractive features present. Some of these could be improved by design, others may be out of your control. A contour map is also needed for a variety of purposes including an analysis of landform.

9. **Growing stock:** the stock map showing species, planting year and reference to any database for the growing stock in order to link to yield class and timber volume data.

10. **Economic felling ages:** a map showing when areas should be felled according to the ideal timing from NPV (net present value) calculations. These may differ substantially from the terminal height map.

11. **Roads and harvesting:** a map showing existing and proposed roads and tracks, areas to be harvested with various equipment, landings, inaccessible areas, and terrain obstacles will help develop the most operationally sound solution or show where difficulties lie. If a terrain assessment map exists it should be made available.

APPENDIX 2

Worked Examples of Forest Design Plans in Different Landscapes

A. Upland - a medium scale predominantly coniferous forest on a prominent slope and mainly stable soils

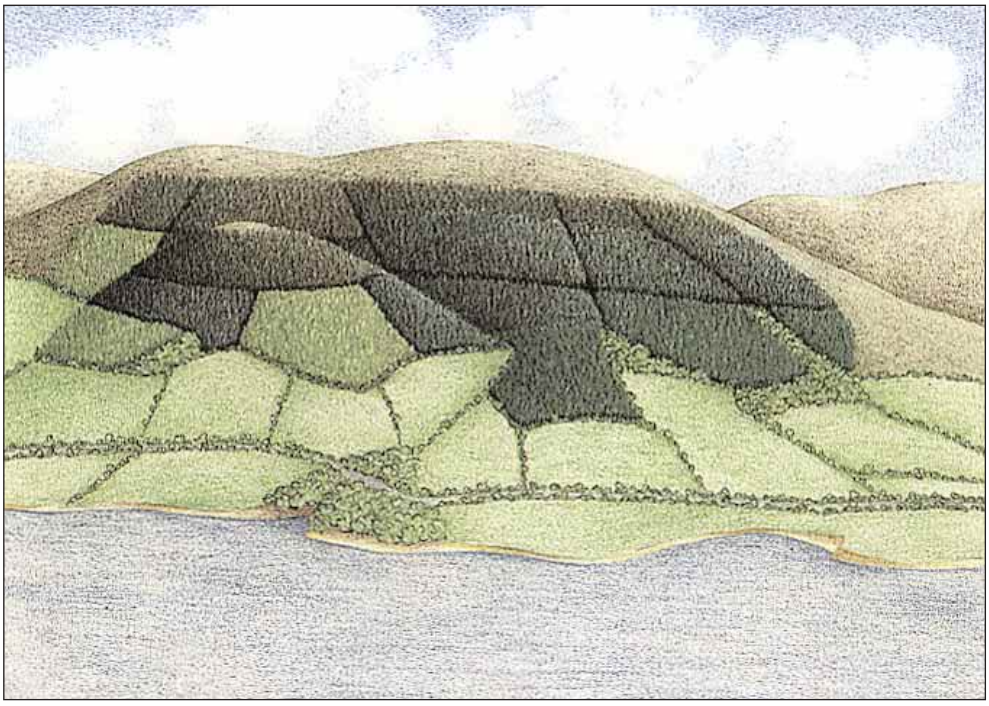
This example is a significant piece of 1950s afforestation on the steep slopes of a hill typical of parts of Wales, the Lake District, or central and highland Scotland. The land was originally low quality sheep grazing lying above enclosed fields. Bracken and heather were the original vegetation cover. The forest is now coming to maturity and presents opportunities to diversify it and improve the way it fits into the landscape as well as to produce timber.

Objectives

The objectives were developed and set out using the table demonstrated in Step 1 on page 9.

RESOURCE	OBJECTIVE	INDICATORS OF OBJECTIVE BEING MET
Timber	•To produce the maximum yield of timber within the limits imposed by the site and environment	•Timber volumes relate to maximum MAI* and yield a large proportion of logs •Productive species suited to the site are used at restocking •Sites unsuitable for timber use avoided
Financial	•To maintain a positive cash flow	•Revenue from timber is gained every year of the plan and exceeds costs •Grants are maximised
Landscape	•To improve the appearance of the forest in the landscape	•Angular geometric shapes are removed by felling and replanting •Shapes of felling and species fit landforms •Species diversity reflects that of the surrounding landscape
Biological diversity	•To enhance the value of the forest for biodiversity	•Open ground habitat will be created •Streams will be kept open •More broadleaves (new native woodland) planted and ASNW** protected •Age class diversity will be increased •Old forest will be developed
Archaeology	•To protect sites of value	•Scheduled sites will be kept open and managed •Unscheduled sites will be opened
Recreation	•To maintain public access	•Rights of way will be kept open •Viewpoint will be kept unobscured

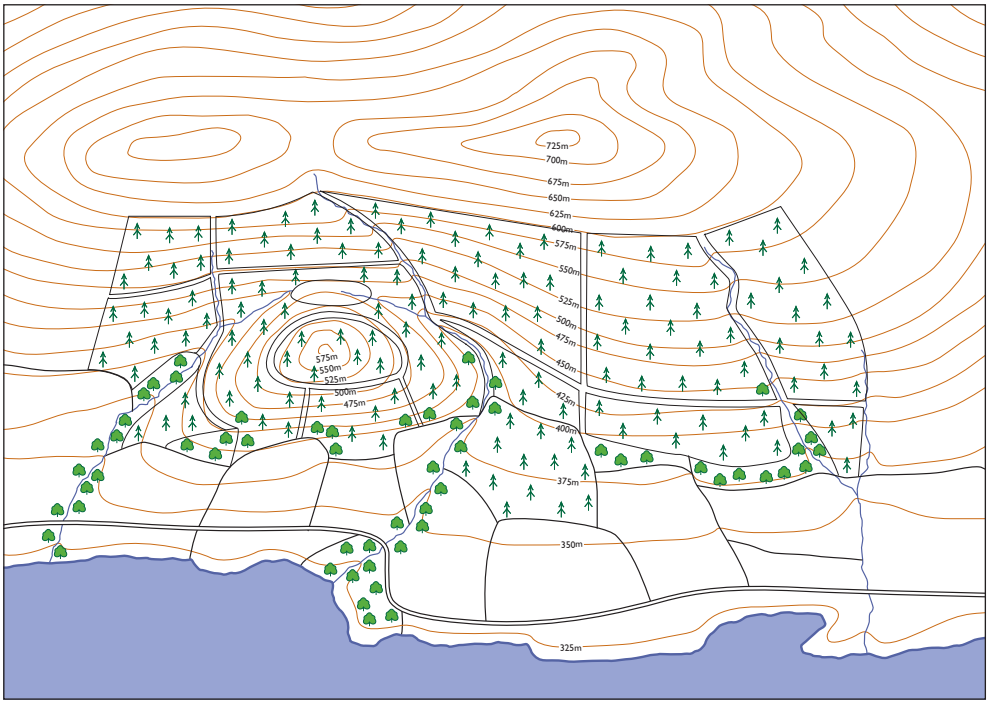
* Mean annual increment
** Ancient Semi-Natural Woodland



View of existing landscape

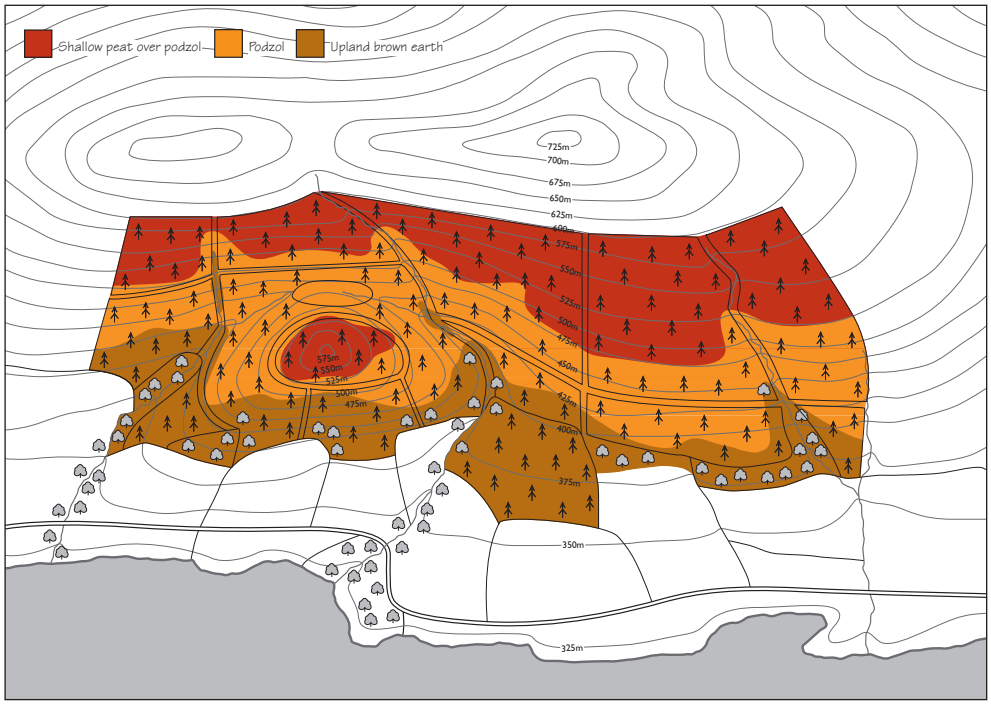
Survey

The survey information was collected as a series of map overlays plus some site photographs (here presented as a sketch of one view).

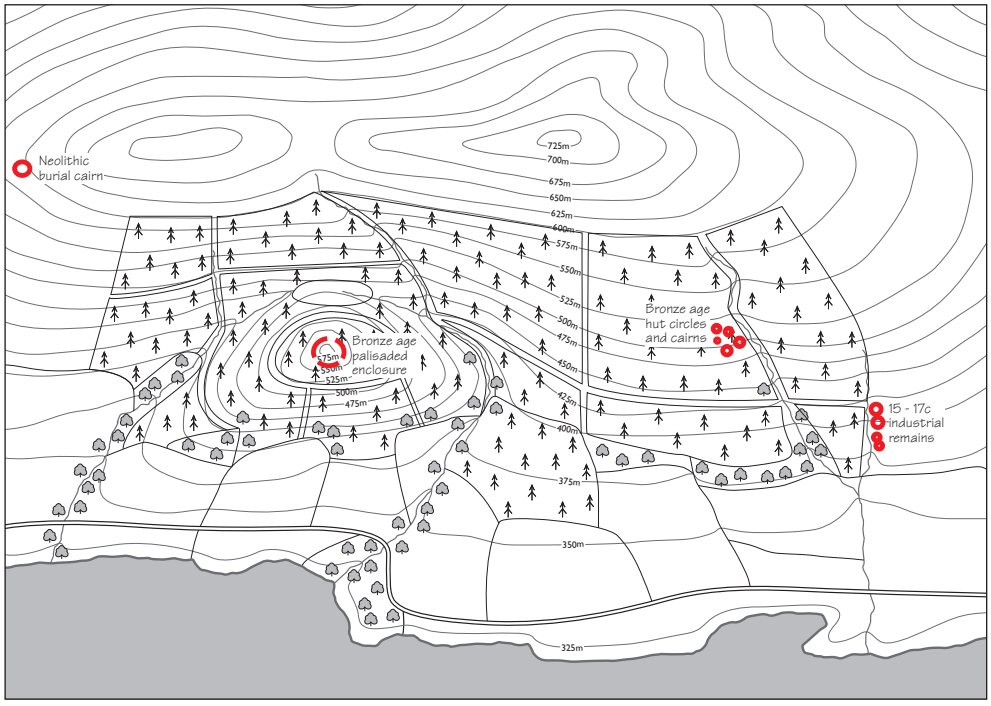


Plan of existing landscape

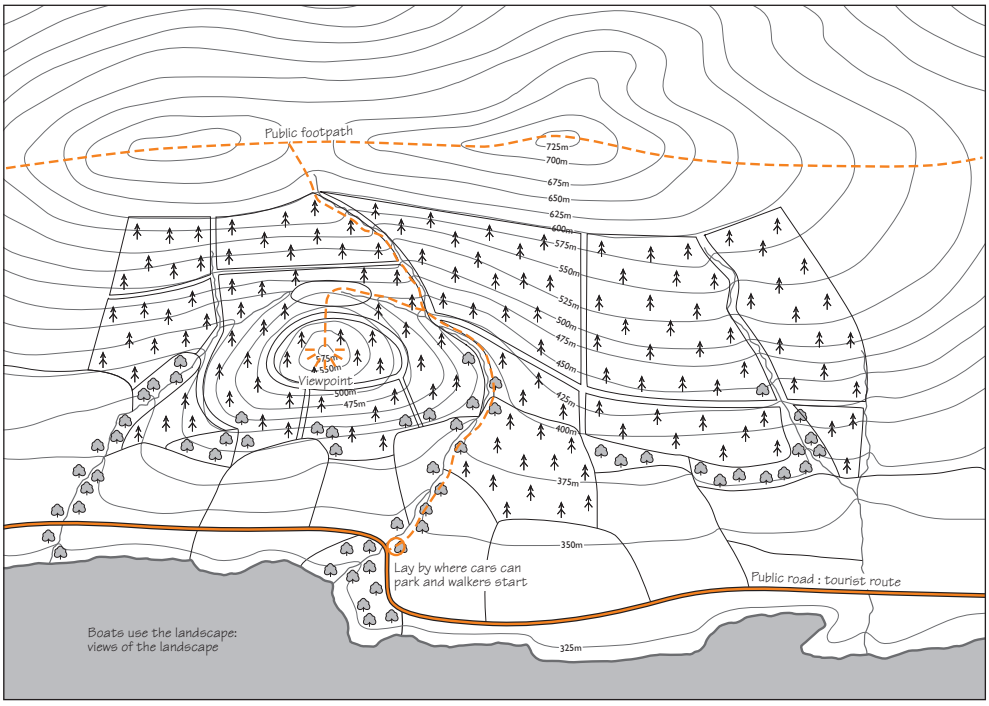
A base map of the area (such as Ordnance Survey) at 1:10 000 scale showing contours.



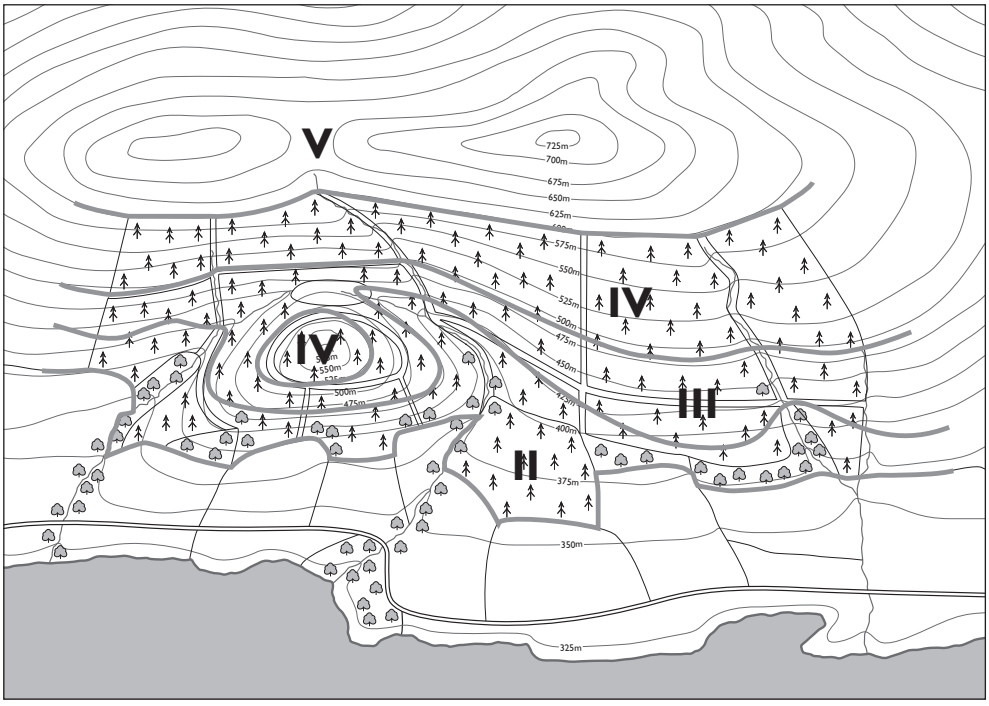
Soils



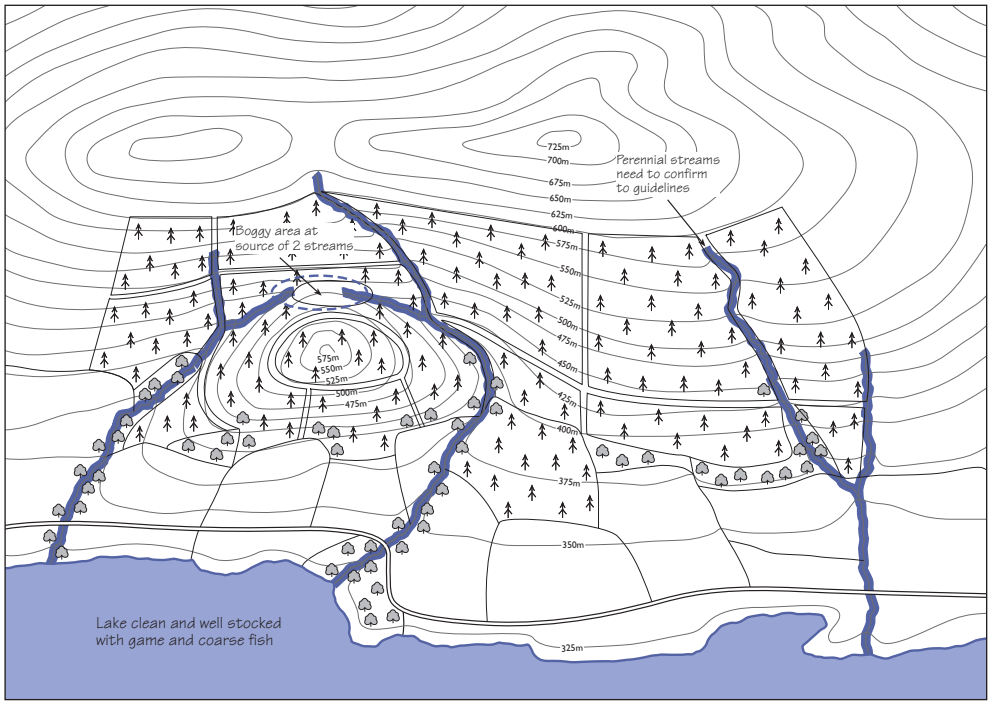
Archaeology



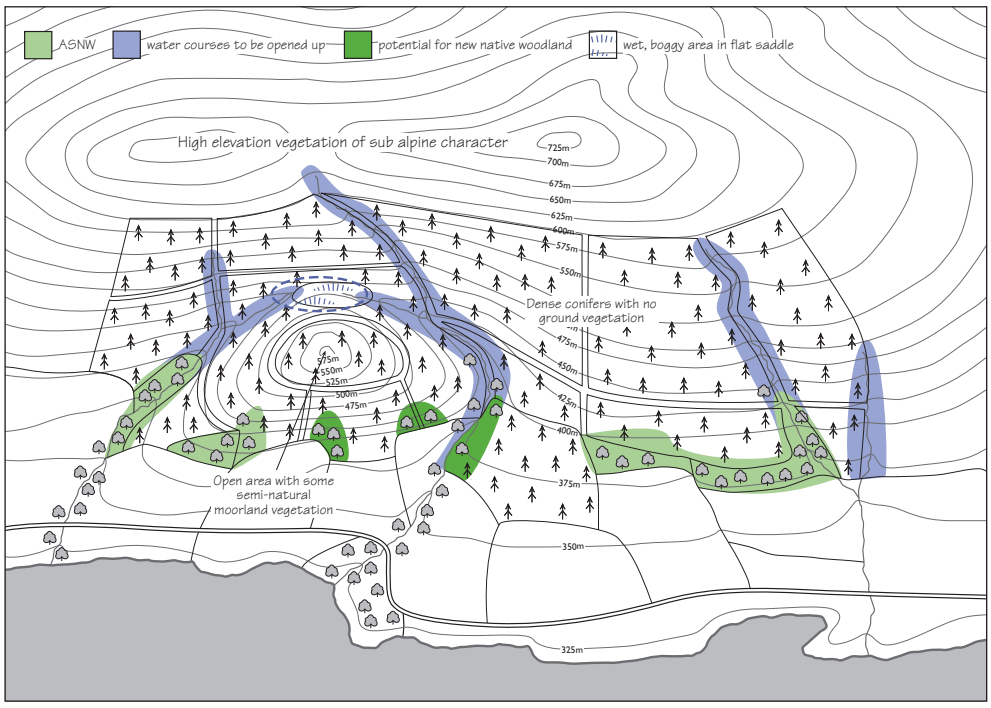
Recreation and access



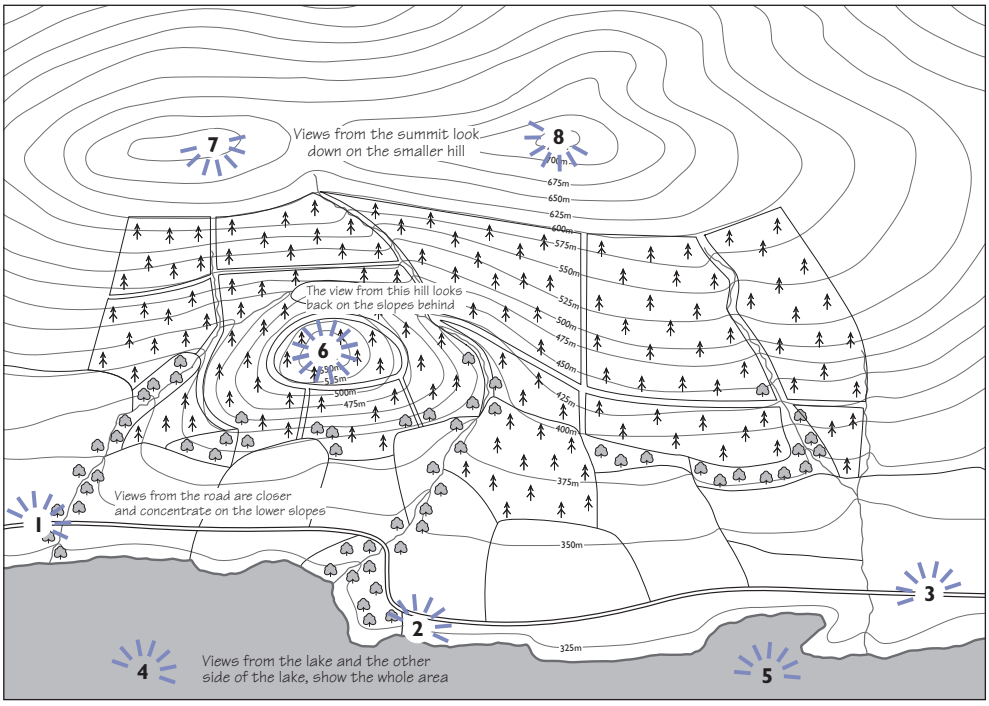
Windthrow Hazard Classification



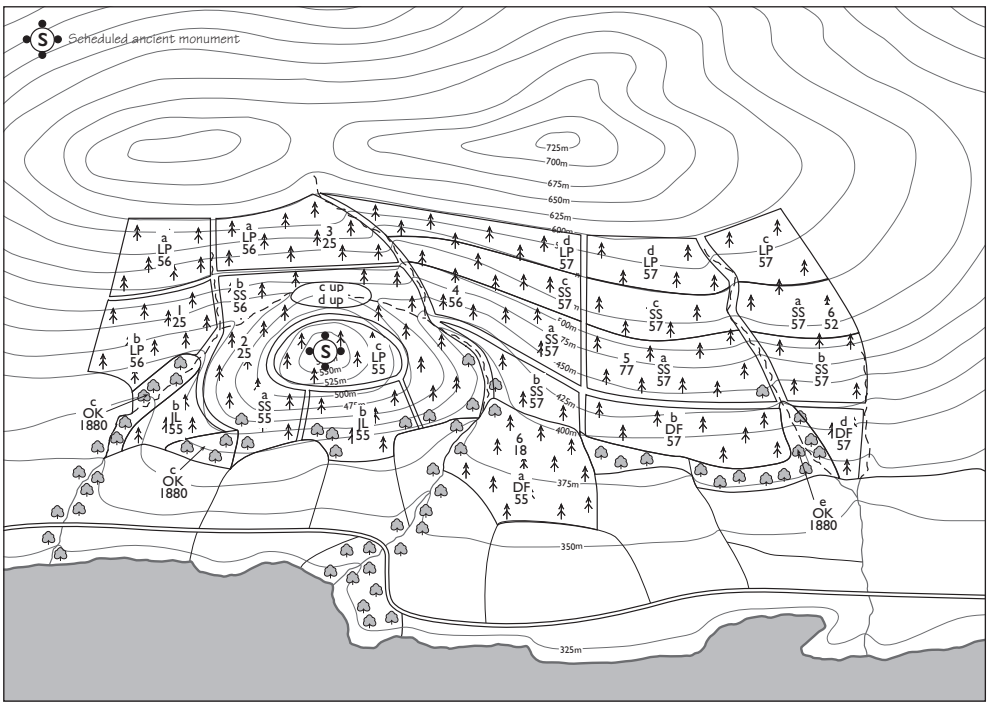
Water



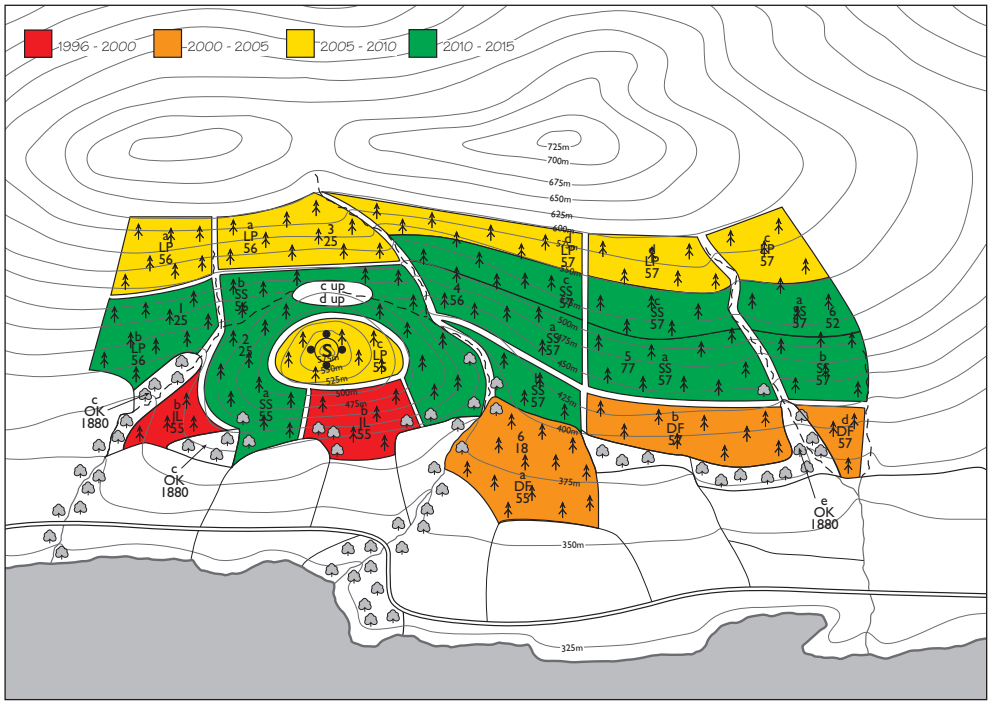
Nature conservation



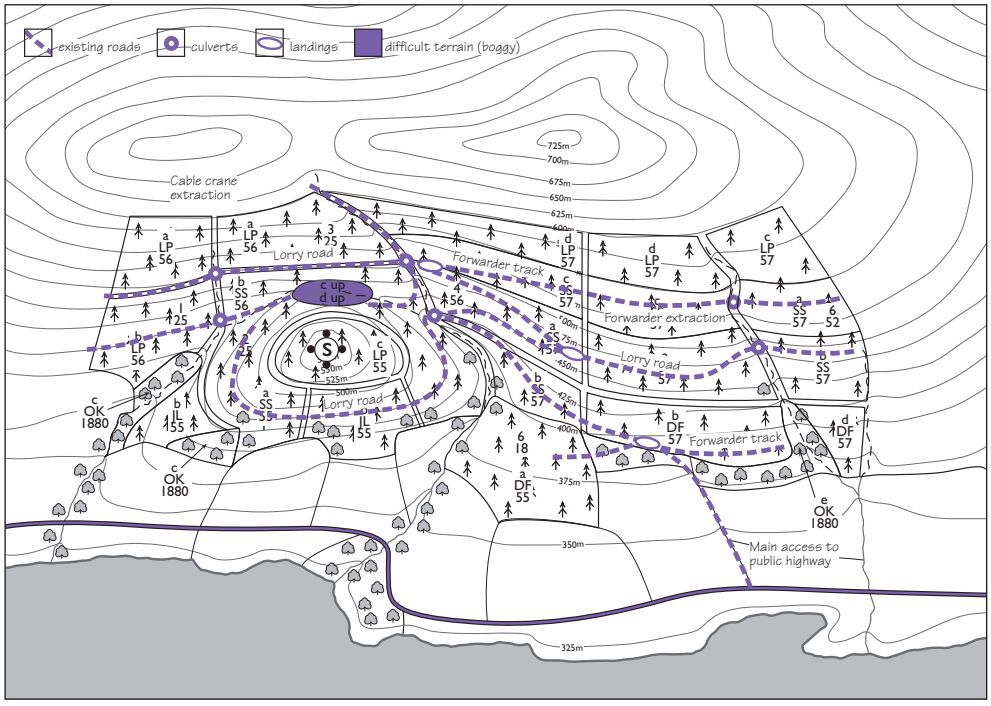
Landscape



Stock map



Economic felling ages



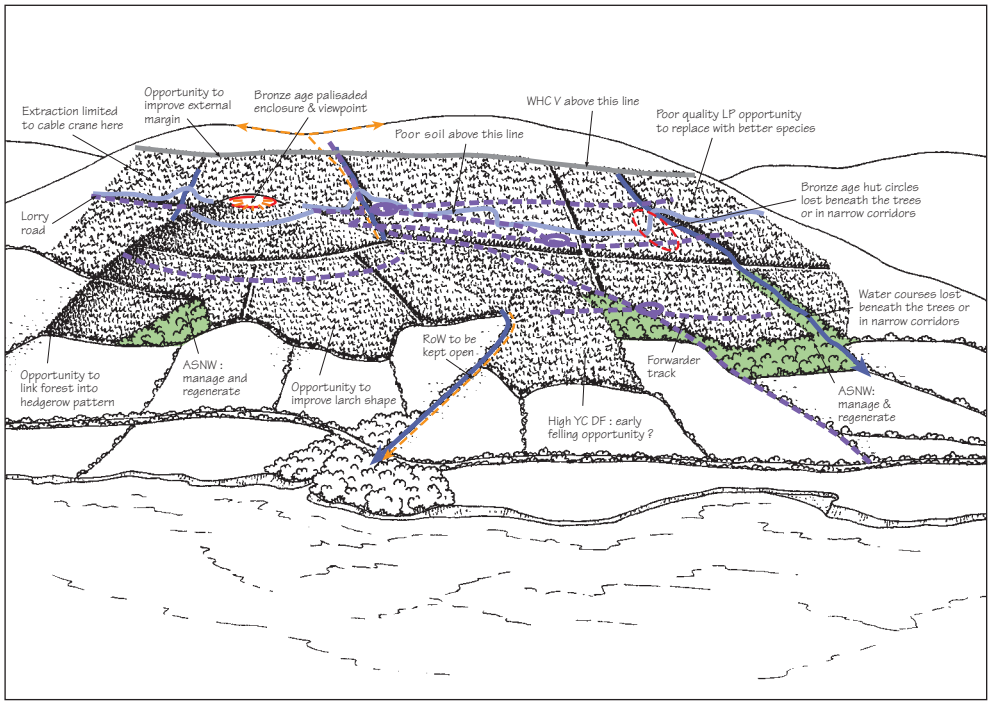
Roads and harvesting

FACTOR	CONSTRAINT	OPPORTUNITY
Ownership boundary	•The planting extends up to the angular ownership boundary so that there will be losses of production if parts are left unplanted	•To correct the angular shape by realigning the fence
Age class of existing forest	•Spreading felling out over time will incur a financial penalty	•To minimise financial penalties by delaying low YC* crops and by felling as close to max NPV** as possible
ASNW	•Low timber production and expensive to manage	•To increase natural diversity and extend new native woodland next to ASNW •To restore native woodland from conifers to link ASNW remnants
Soils	•Poor soils at the upper slopes limit species	•To leave poorest soils unrestocked with little loss of productivity •To vary range of species on better soils
Rights of way	•They run right through the forest so will be difficult to avoid work near to them	•To improve their character as the forest develops
Harvesting systems	•Cable crane extraction limits design of coupe shapes	•To use the roads and ground equipment to best advantage in felling well designed shapes
Archaeology	•Some sites are under trees and may suffer damage	•To open them up and link them to other open spaces

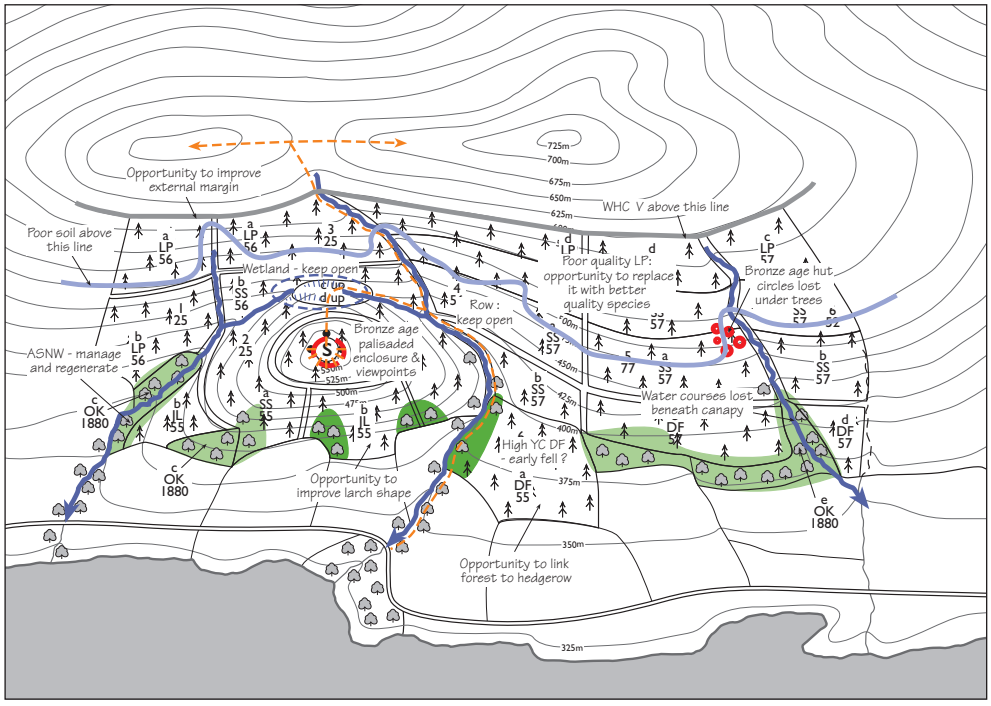
* Yield Class
**Net Present Value

Analysis

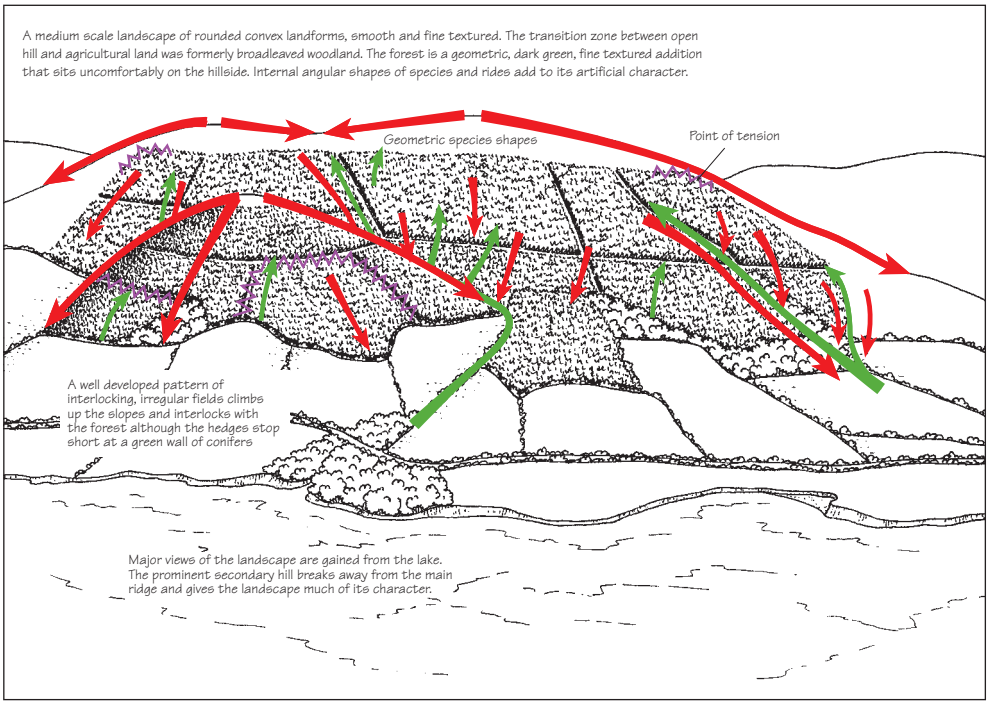
The constraints and opportunities analysis looks at the factors and resource values in terms of how they affect the designer's flexibility. Constraints restrict flexibility and opportunities increase it. Presentation of this analysis should include key factors sieved out of the survey maps annotated with appropriate comments, and a table listing all factors and the opportunities and constraints related to each. The mapped analysis should also be transferred onto the perspective views ready for the design phase. Also useful is a projection into perspective of the terminal heights or the economic felling ages for the felling design.



Constraints and opportunities analysis

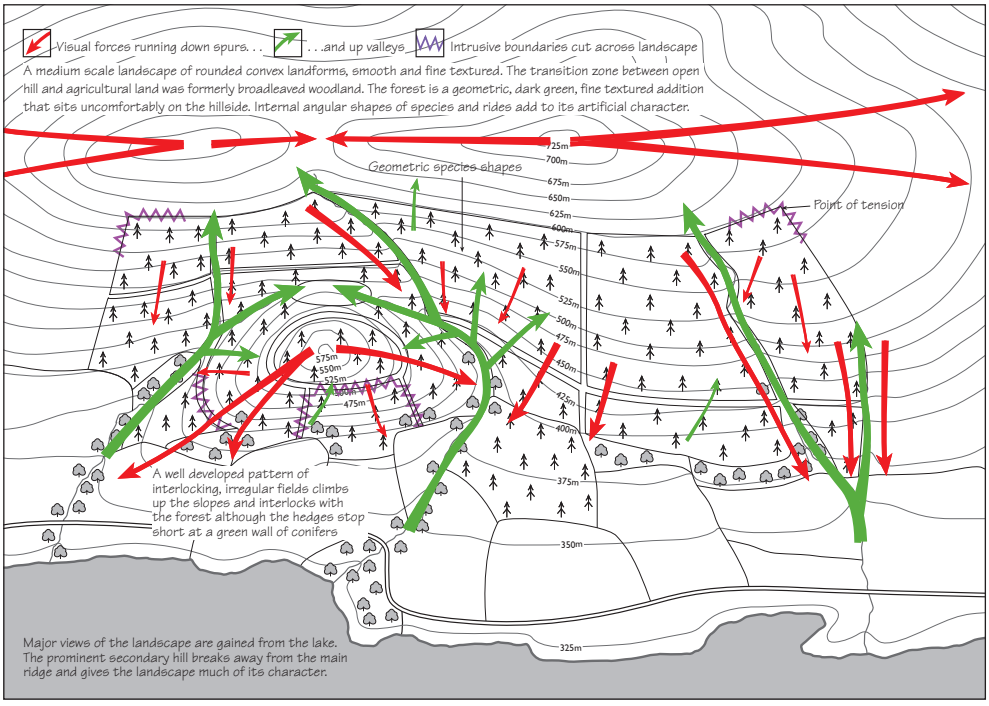


Constraints and opportunities analysis

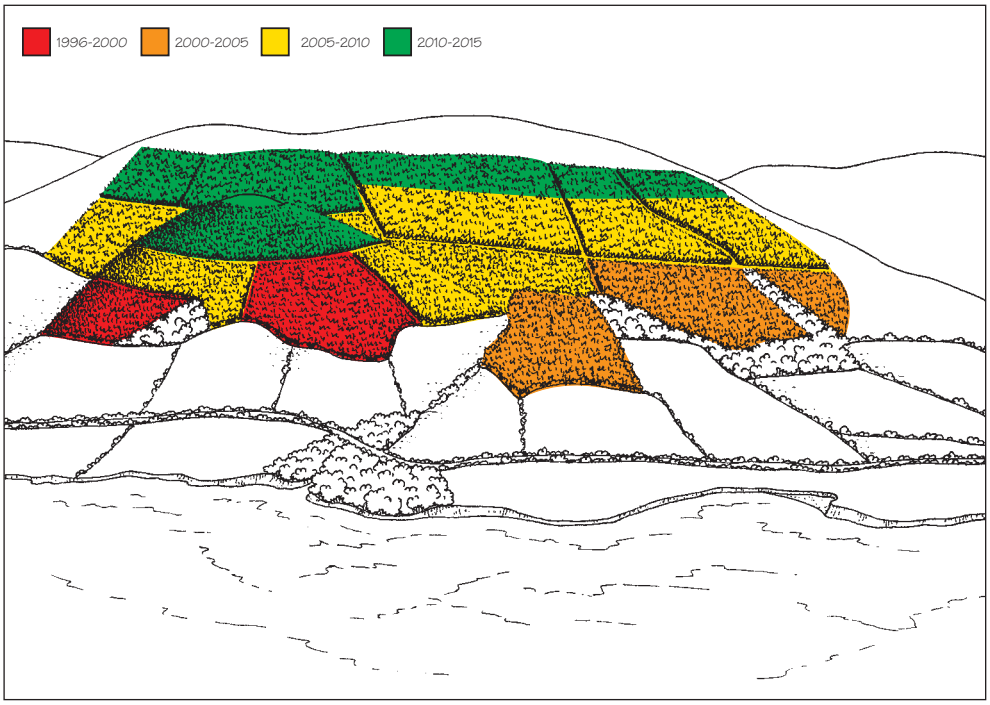


Landscape character analysis

The landscape character analysis includes the landform, expressed using the visual forces depicted in plan and perspective, a description of the landscape such as landform shape, scale, the degree of diversity, both actual and potential, and any visual problems in the landscape, such as angular or geometric external, internal or species margins.



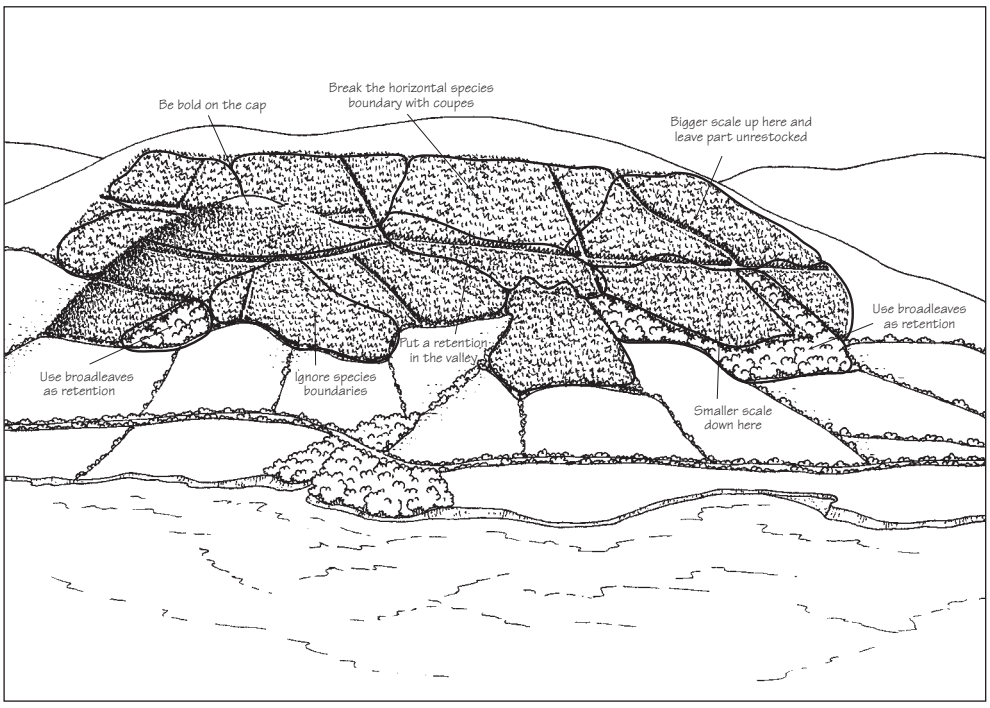
Landscape character analysis



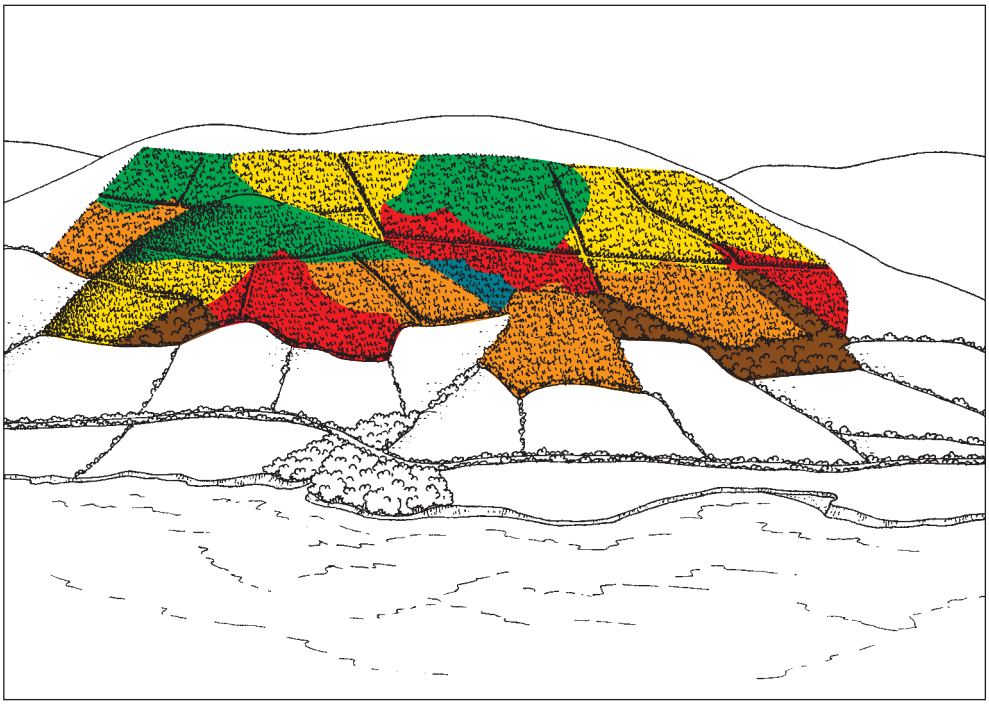
Economic felling ages

Concept

From the objectives and the analysis the concept emerges, based on the scale of the landscape, its breakdown into landform units, e.g. the cap of the secondary hill; the field pattern and presence of broadleaves lower down; the need to break up the geometry of the existing layout. Rough shapes are drawn onto the perspective (see Step 4 on page 14).



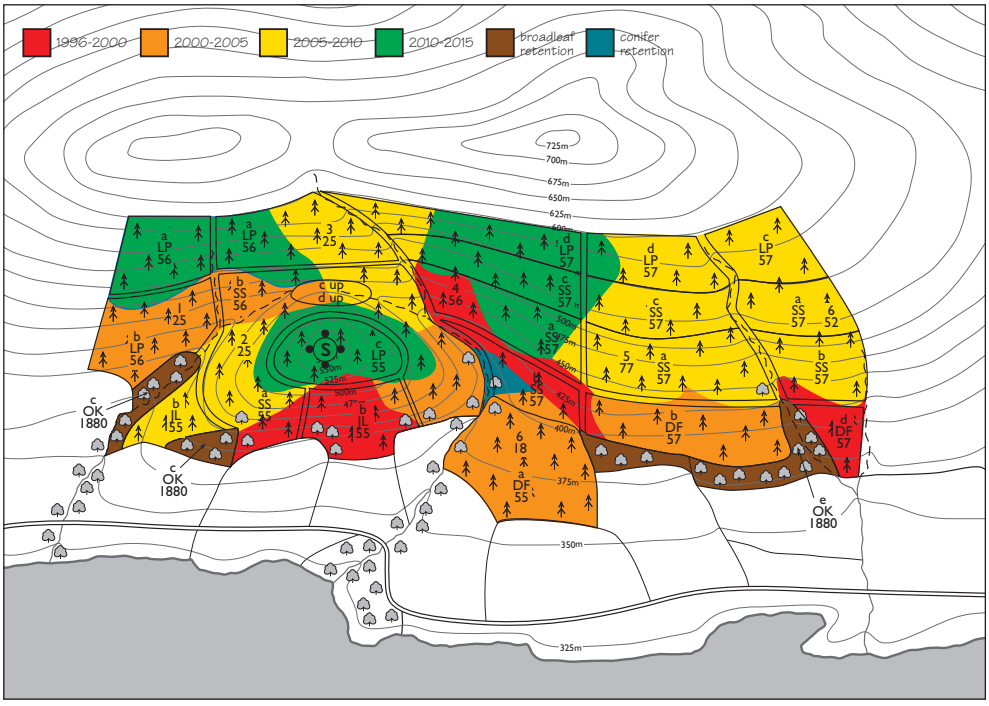
Concept



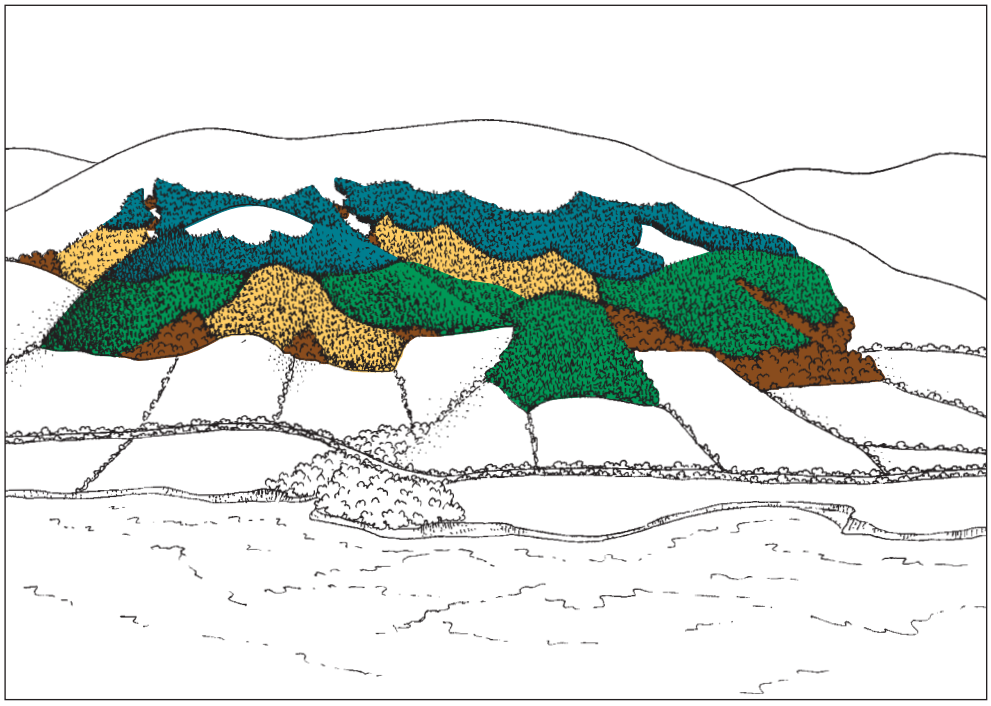
Felling plan

Sketch Design

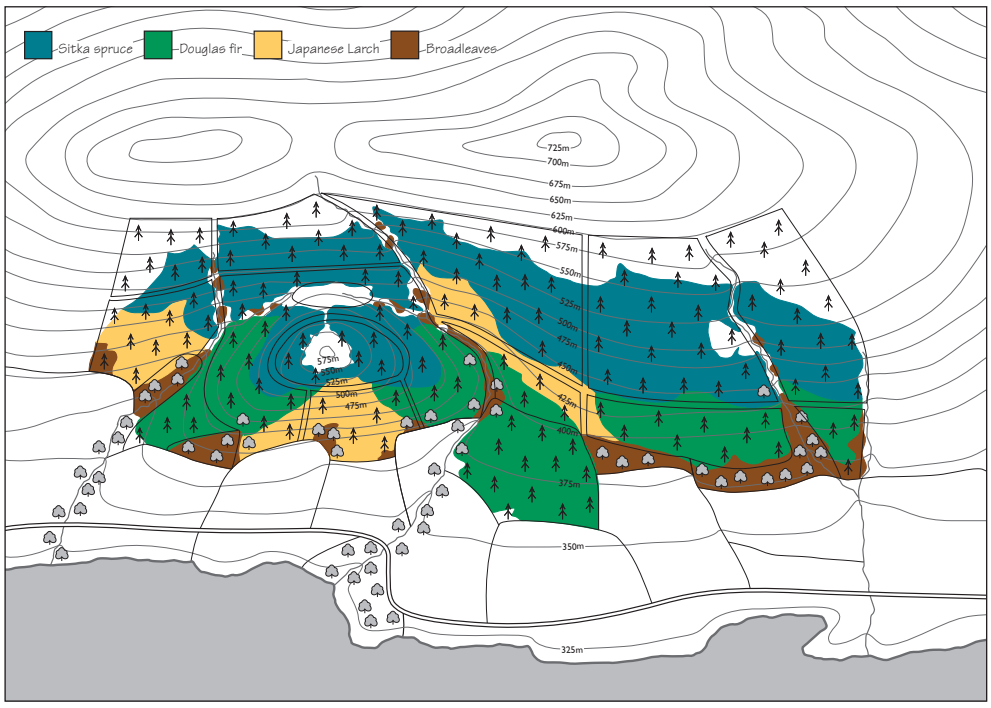
This develops the concept and is presented as a pattern of coupe shapes of varying shape and size with different phases colour coded by 5 year intervals. The coupe shapes are used to break up the compartment pattern and to allow for each to be replanted to take account of the constraints and opportunities. The map can be used to check that the felling coupes are all practical, while the timing can be evaluated for financial and wood yields. The restocking pattern alters the external boundary and introduces new native woodland to link with the ASNW and with the lower field pattern so as to tie the forest into the setting more effectively.



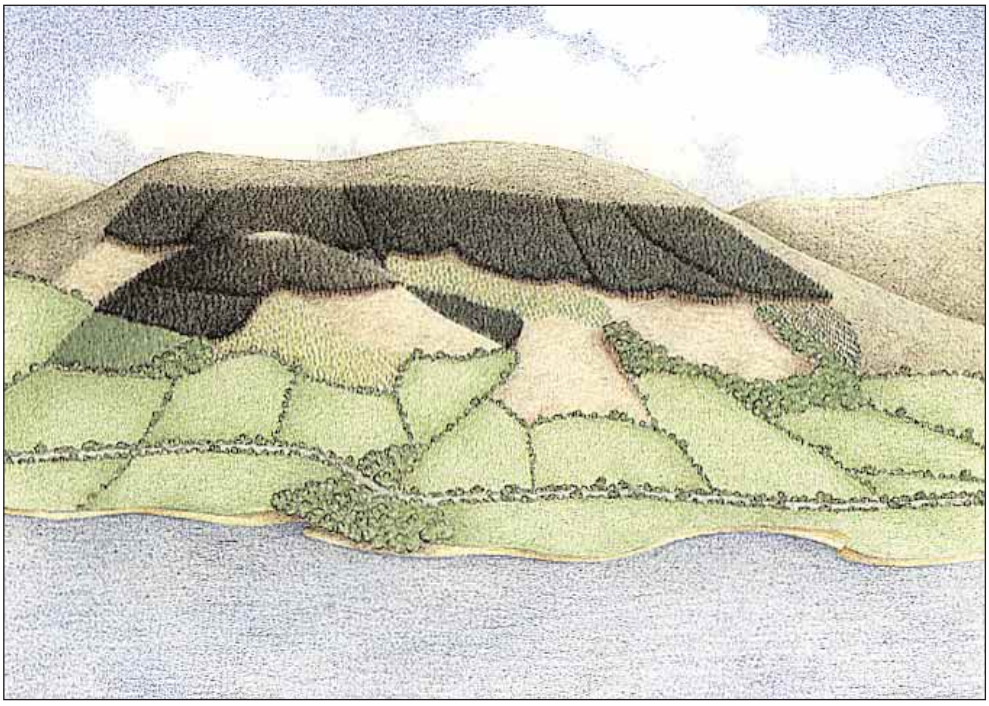
Felling plan



Restocking plan

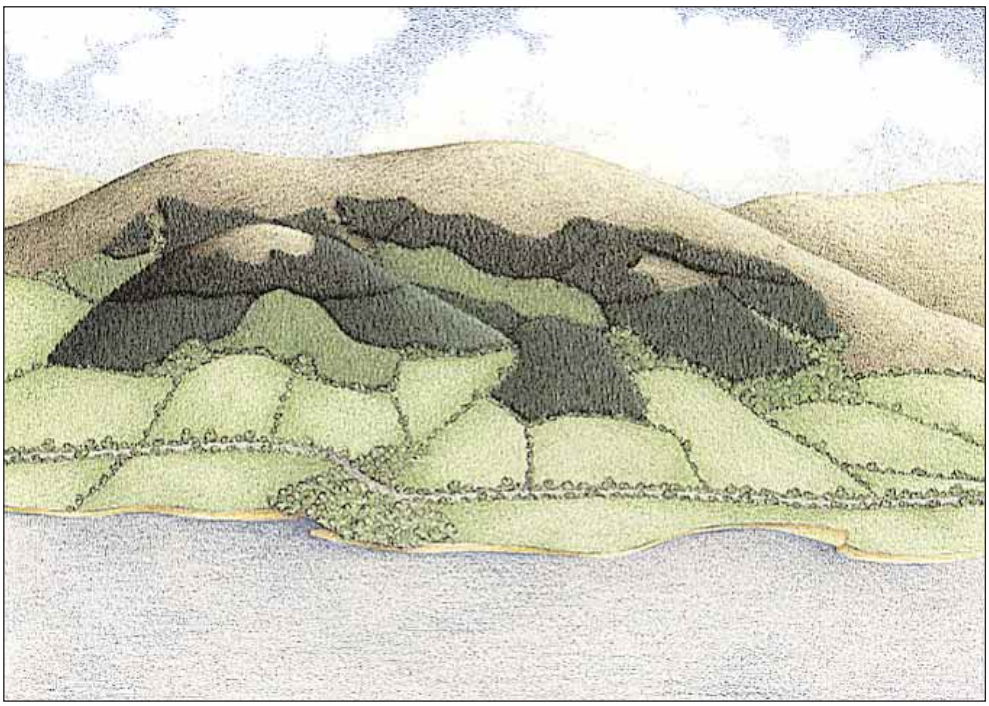


Restocking plan



Phase 2: the first phase felling has been replanted and the second phase felled. The remainder of the forest is intact.

It can be useful to show how the forest will look as it changes over time. These sketches show it part way through the process and at the end (see Presentation Graphics on page 27).



Replanting 10 years after the final coupe has been felled.

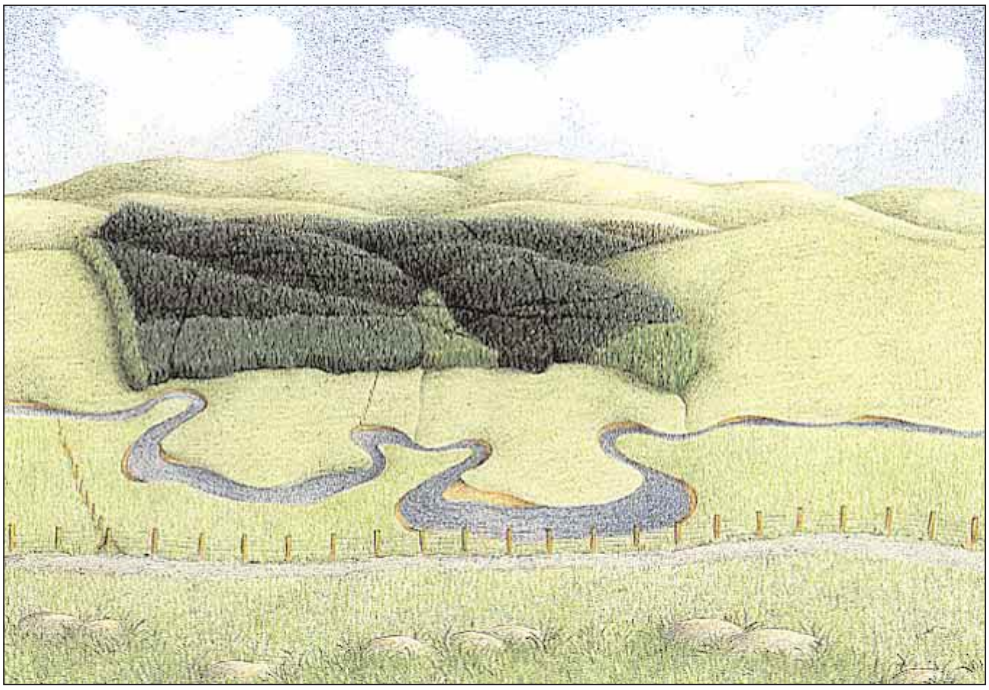
B. Upland - a large scale coniferous forest on a plateau area of high windthrow risk

This example is typical of many in parts of the West County, Wales, northern England, southern Scotland and elsewhere. The poor soils, high windthrow hazard class, early terminal heights, lack of any but geometric windfirm edges and limited views mean that a different approach has to be adopted from the previous example although the steps of design are essentially the same.

Objectives

In this instance the objectives vary quite considerably from those of the first example. This is because the forest is less sensitive visually and ecologically, and more important for timber. Recreation is of low value or potential.

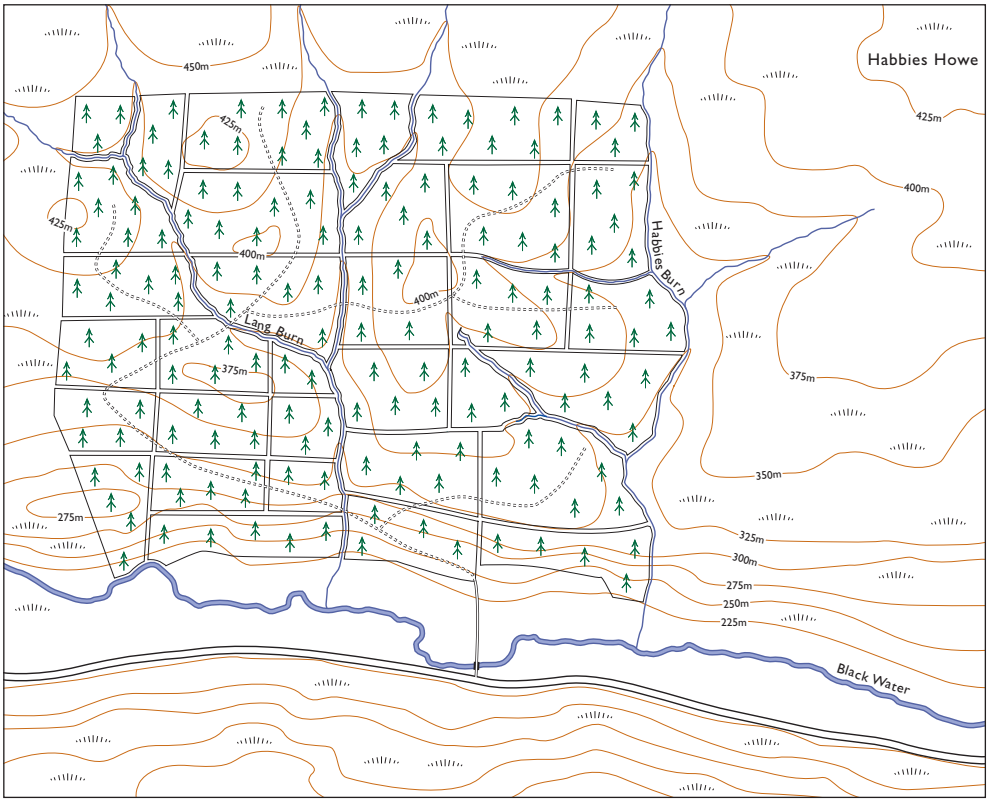
RESOURCE	OBJECTIVE	INDICATORS OF OBJECTIVE BEING MET
Timber	• To produce as much timber as possible economically	• Most productive species will occupy economically productive ground within limits imposed by the UK Forestry Standard
Financial	• To maximise net present value	• Forest is felled as close to max NPV as possible in context of standard • Minimal amounts of open space and other species are planted
Landscape	• To enhance the visually sensitive parts of the forest	• Species diversity is concentrated in visually sensitive part of forest • Intrusive boundaries are eradicated where they appear in views
Biological diversity	• To enhance the biodiversity value of the forest in the context of low sensitivity	• Open ground will be increased and connected to unplanted areas outside the forest • Broadleaves will be planted • Some age class variation will be introduced
Archaeology	• To protect sites of archaeological value	• Known sites will be kept open
Recreation	• To maintain the Right of Way	• Right of Way will be kept open
Water	• To maintain or enhance water quality	• Streams will be opened up • Wetlands will be restored



View of existing landscape

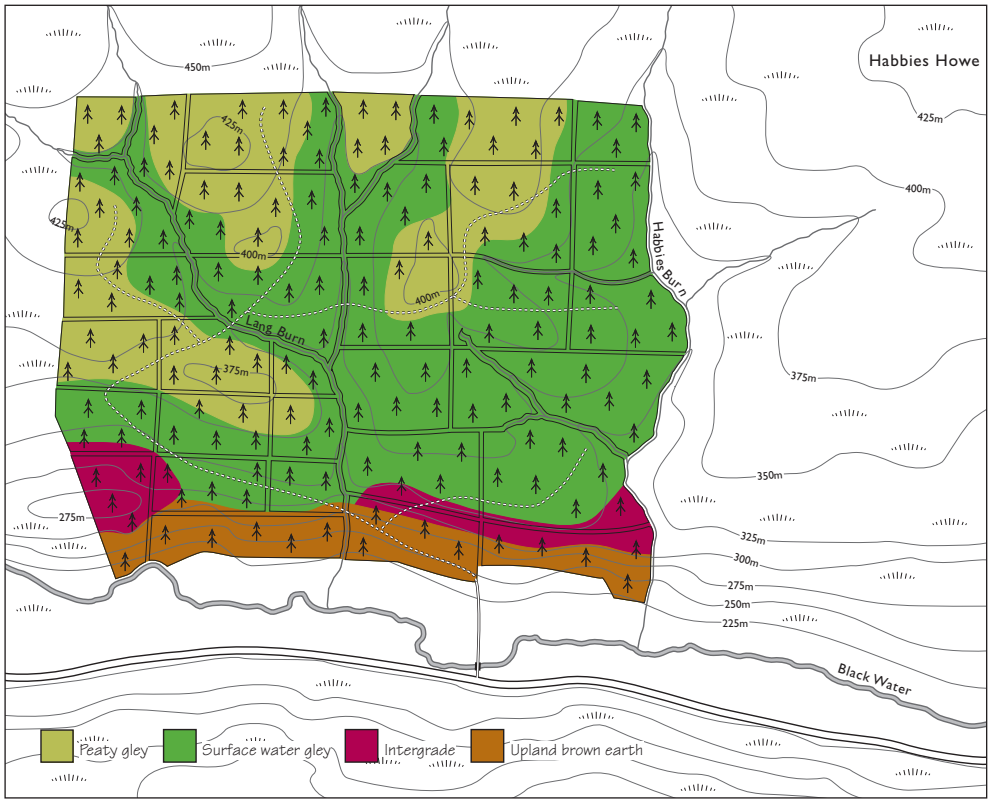
Survey

The survey was collected as before, using a set of overlays and site photographs. Because wind is a significant factor the map of terminal heights, that is the time at which stands might be expected to start to blow down, has been presented instead of the map of economic felling ages.



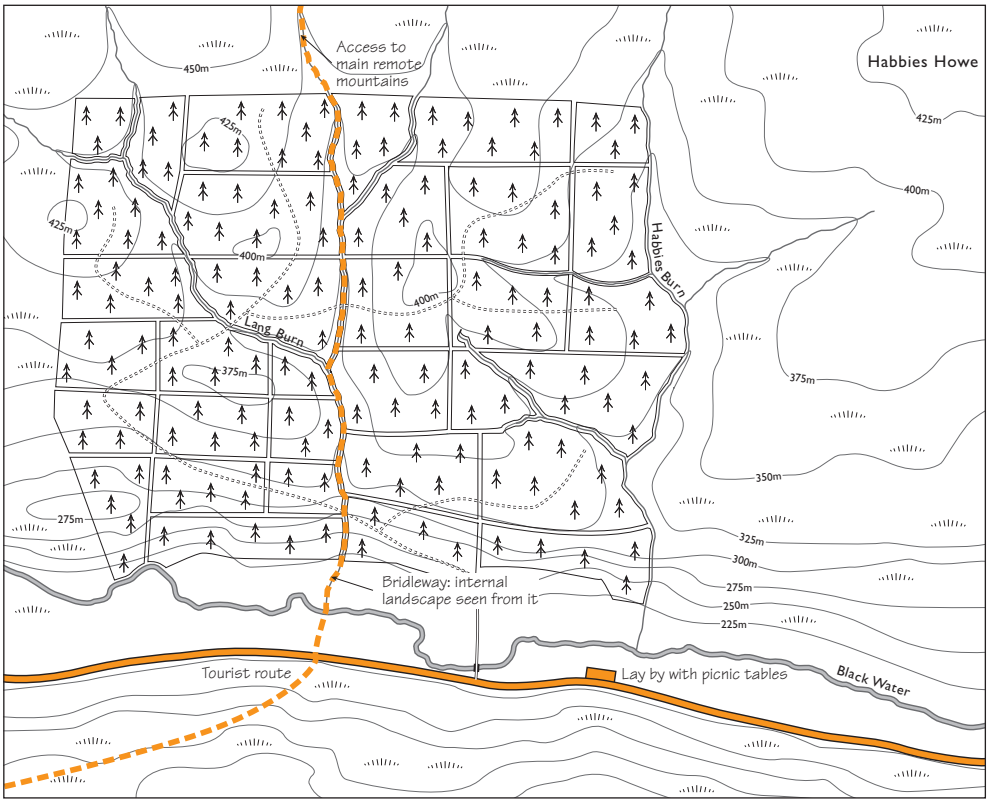
Plan of existing landscape

A base map of the area (such as Ordnance Survey) at 1:10 000 scale showing contours.

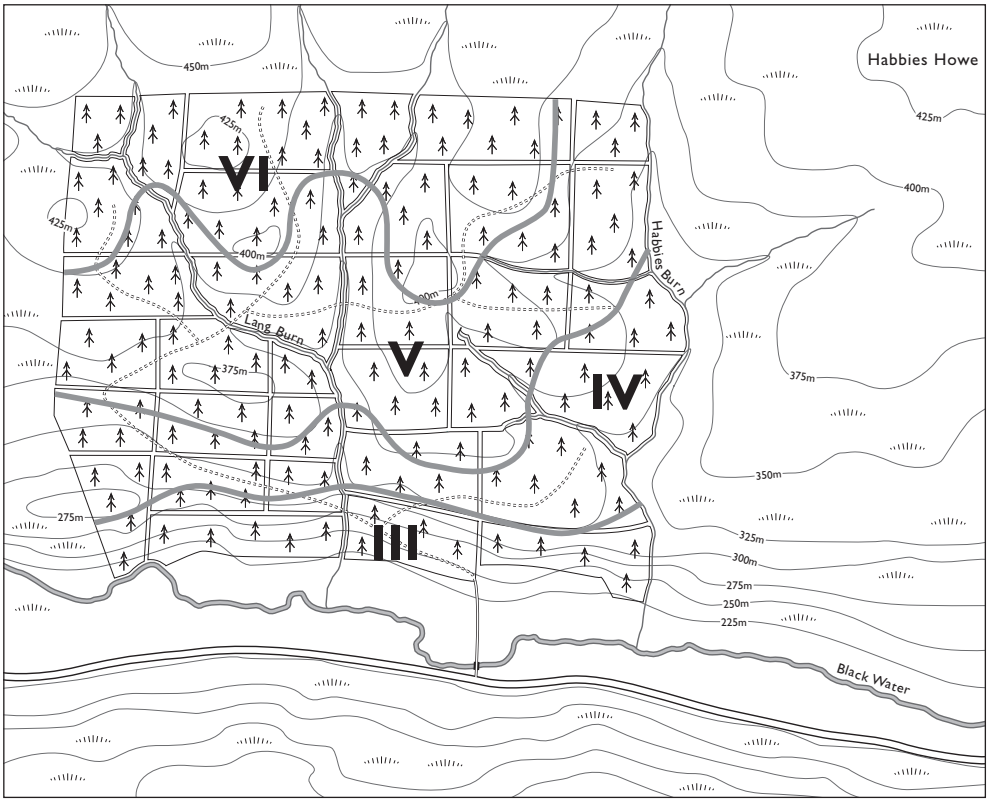


Soils

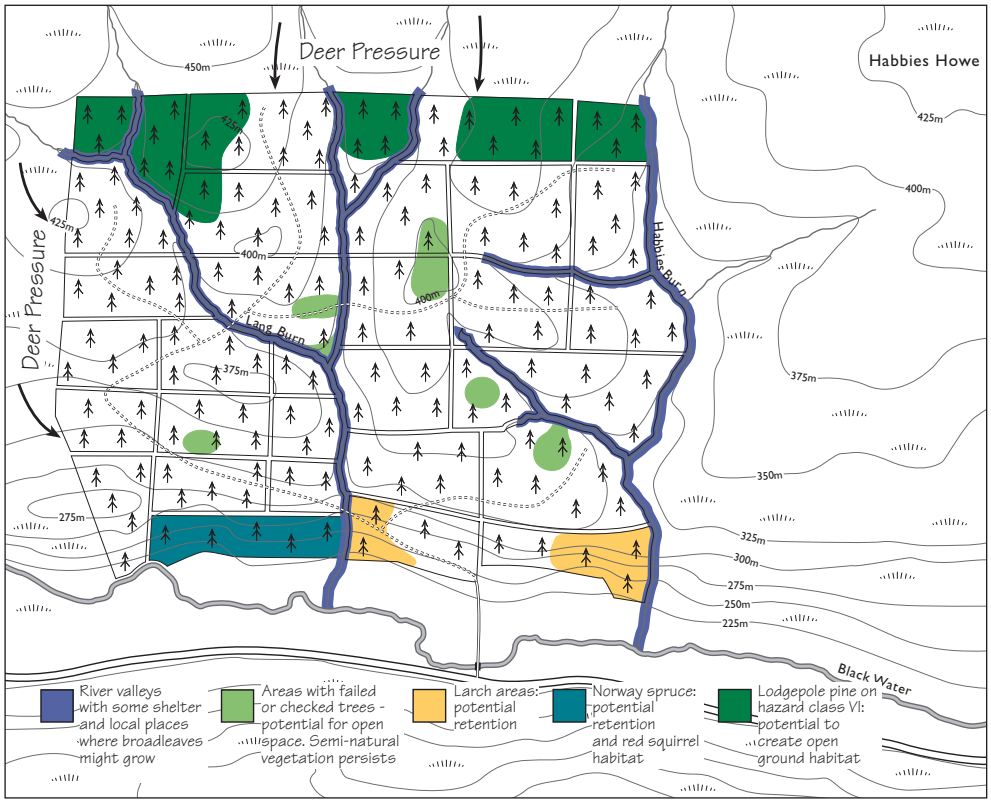
Archaeology



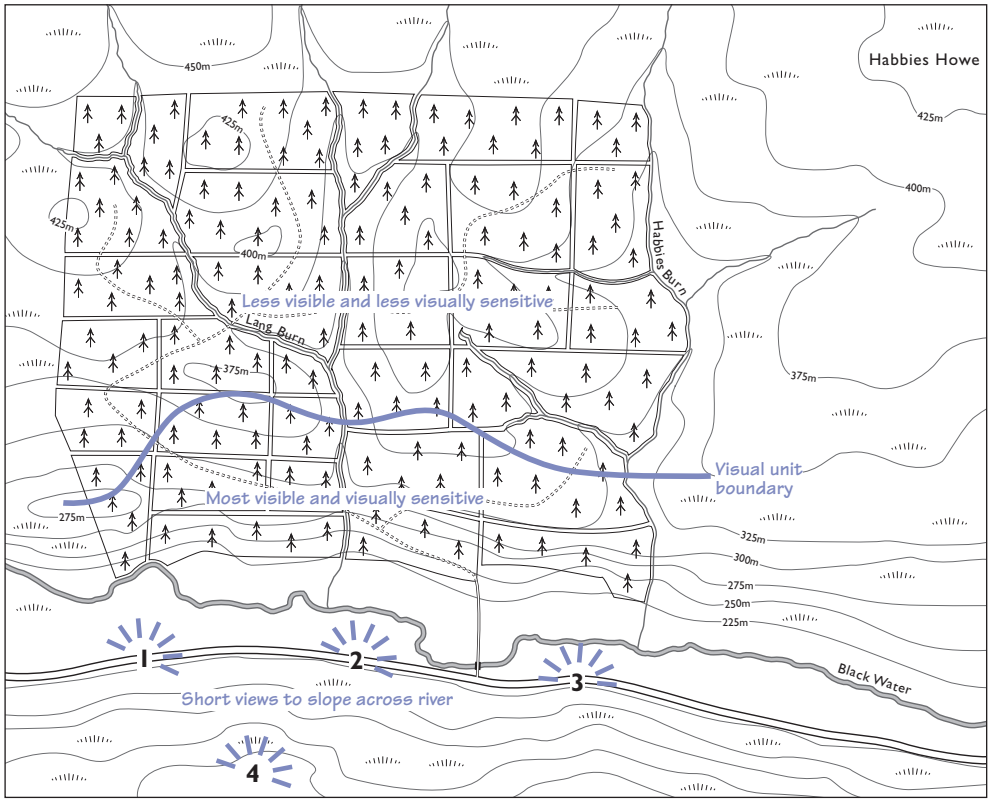
Recreation and access



Windthrow Hazard Classification

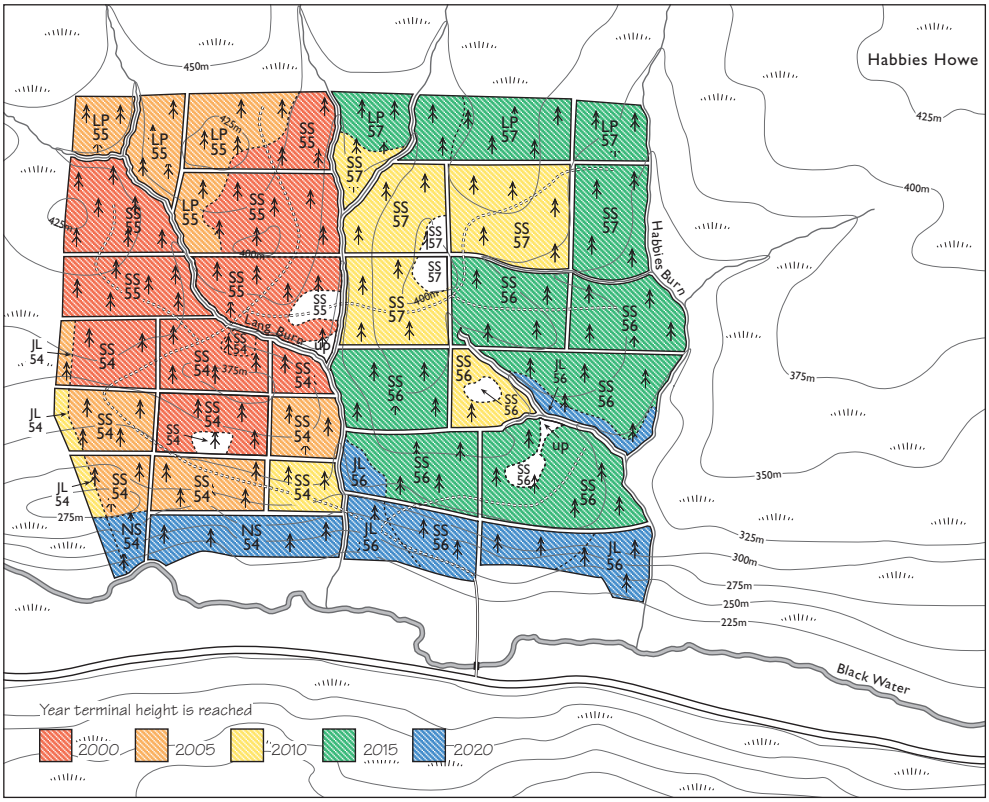


Water and nature conservation

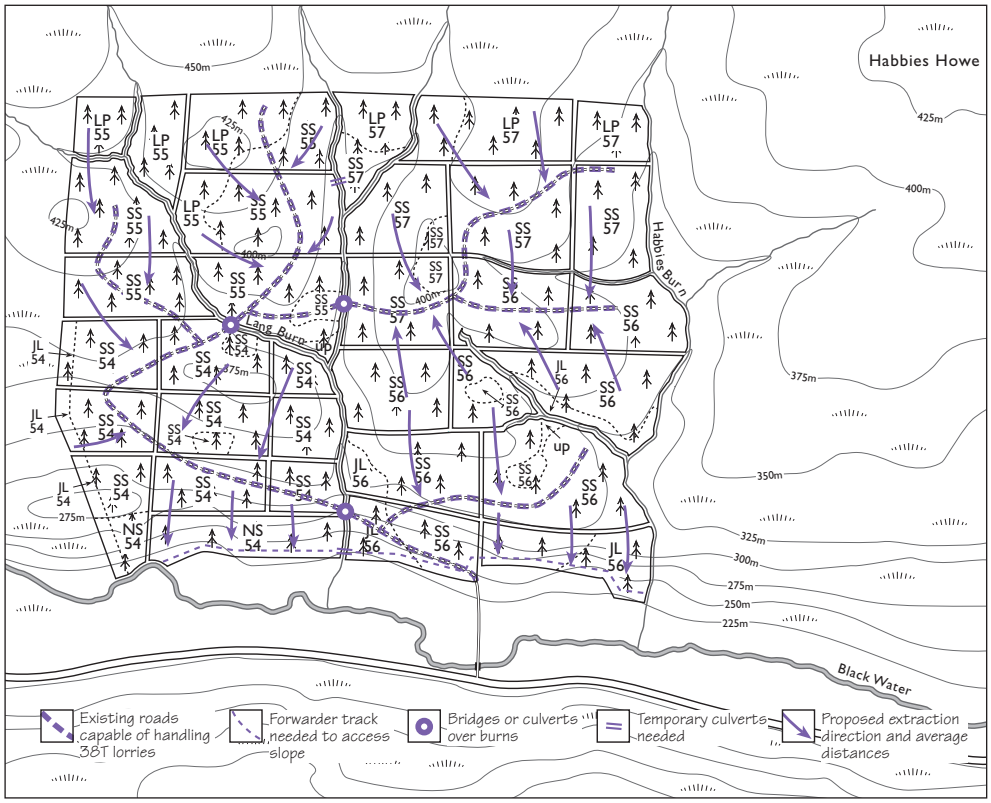


Landscape

Stock map



Terminal height

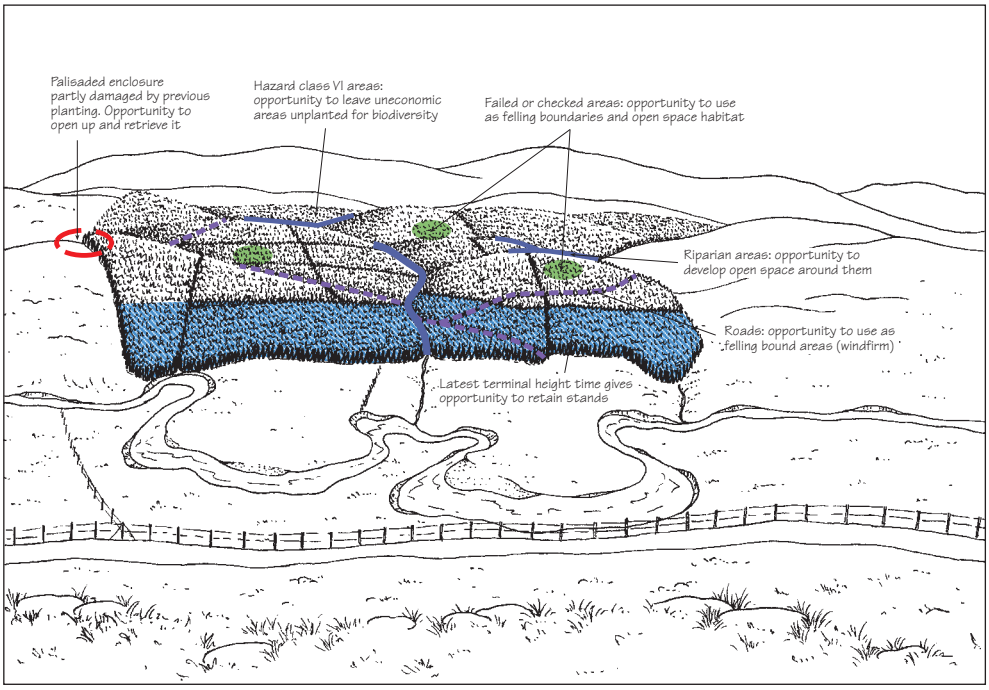


Roads and harvesting

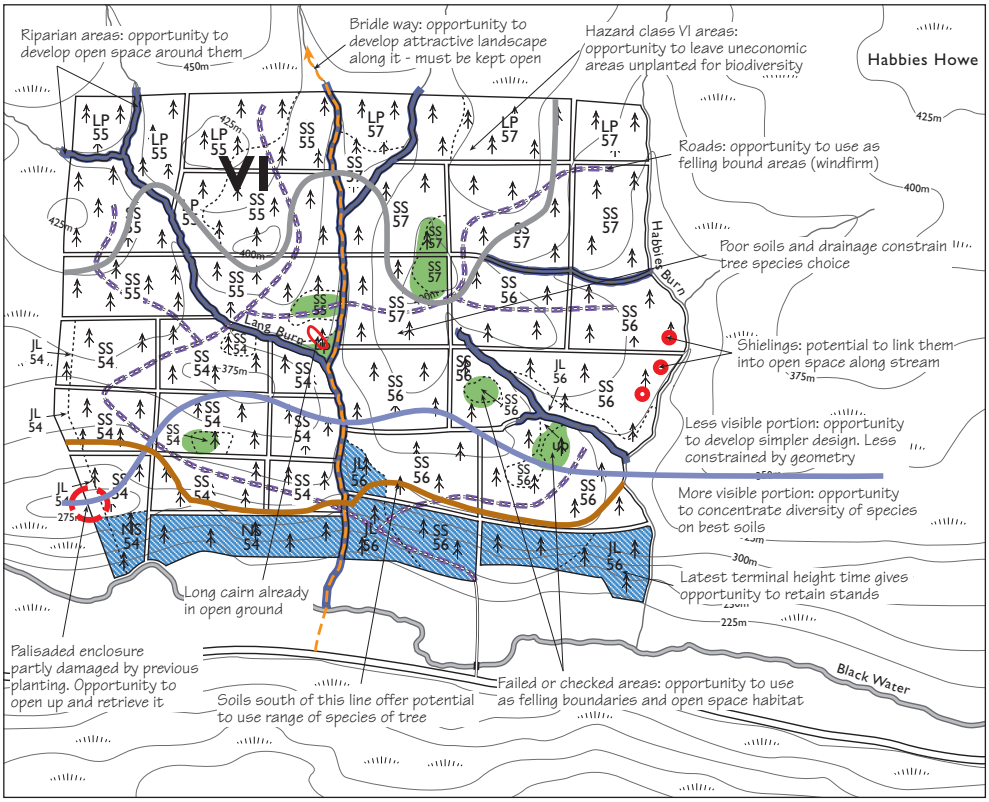
Analysis

The constraints and opportunities analysis is presented as in example a). In addition, a map showing the minimum harvestable units was prepared. This allows various shapes to be tested based on amalgamations of these units, while windfirmness is safeguarded.

FACTOR	CONSTRAINT	OPPORTUNITY
Windthrow risk	•Terminal heights are close to each other and occur very soon •Felling boundaries will have to follow windfirm edges which may be geometric •Age class separation cannot meet 2m difference in 1st rotation	•Some later terminal heights give a chance to hold on to some stands •New windfirm edges can be planned at restocking •To give as much age class separation as possible and prepare the ground for the next rotation
Age class	•The forest is all of a similar age	•To increase age variation somewhat at restocking
Species	•Very little species diversity •Poor soil limits ranges of species possible	•To introduce broadleaves and larch where sites and soils suit them
Archaeology	•Some sites are buried or partly covered by trees	•To open them up and manage them
Habitats	•Very poor habitats of value in the forest	•To create new open habitat in preference to species diversity

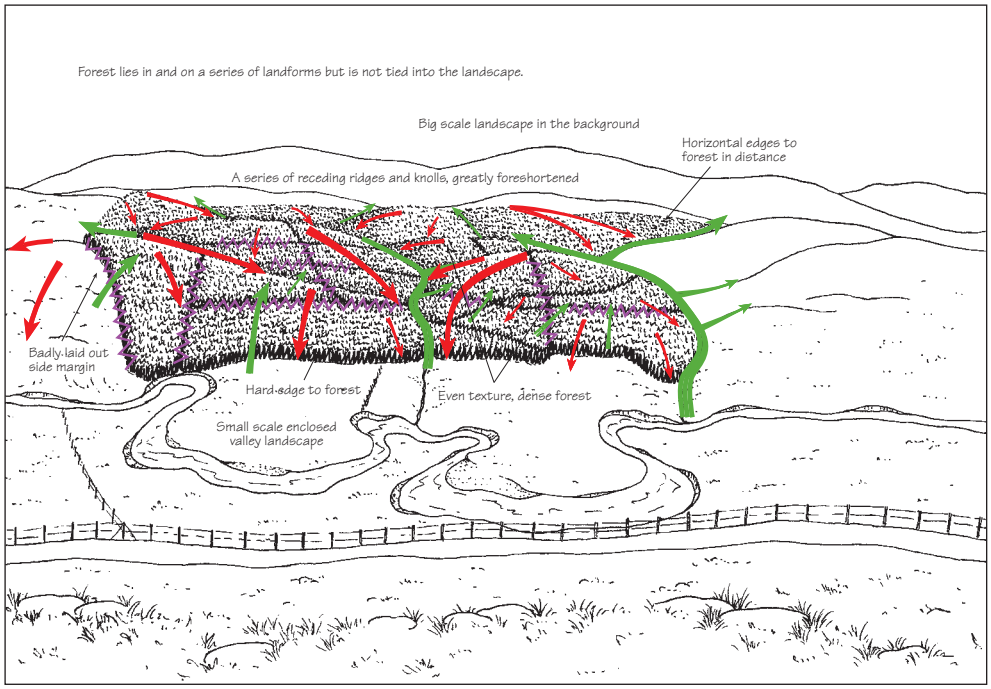


Constraints and opportunities analysis

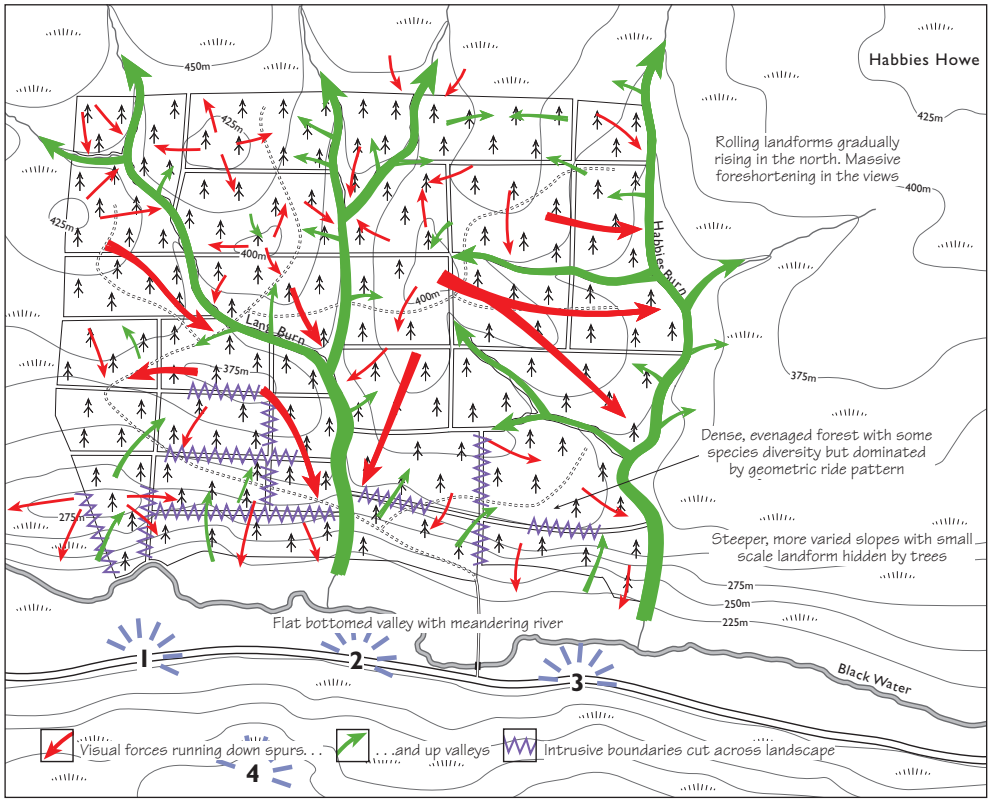


Constraints and opportunities analysis

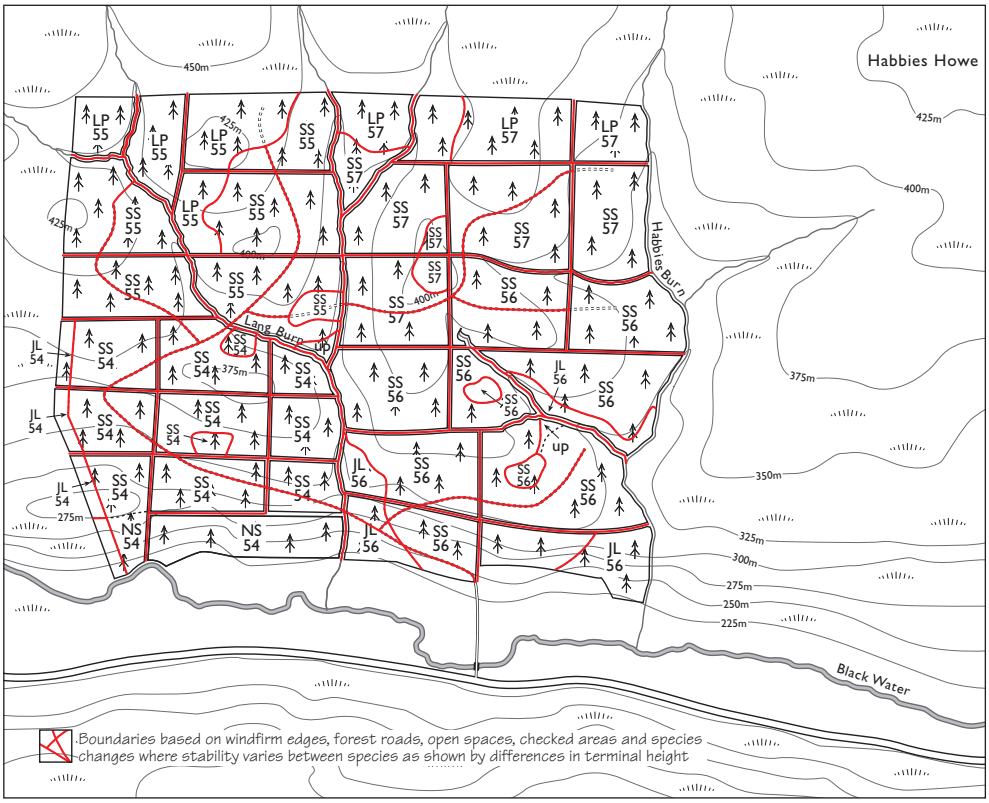
The landscape analysis deals with landform and the shorter views of part of the area where geometric rides dominate.



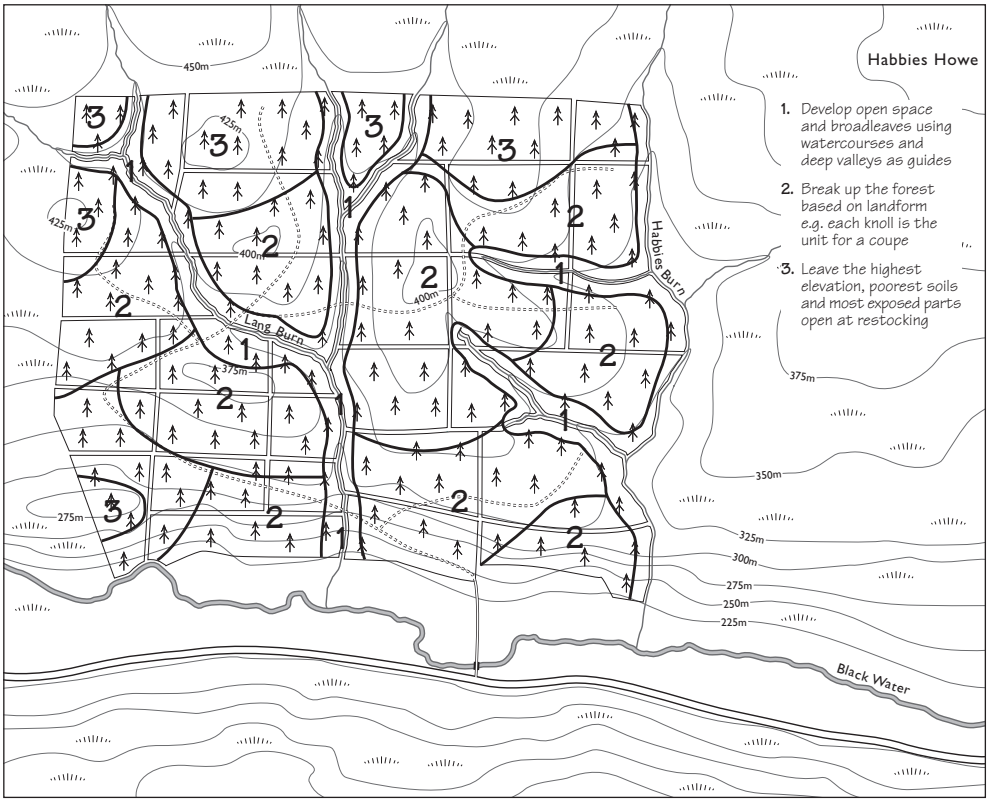
Landscape character analysis



Landscape character analysis



Minimum harvestable units



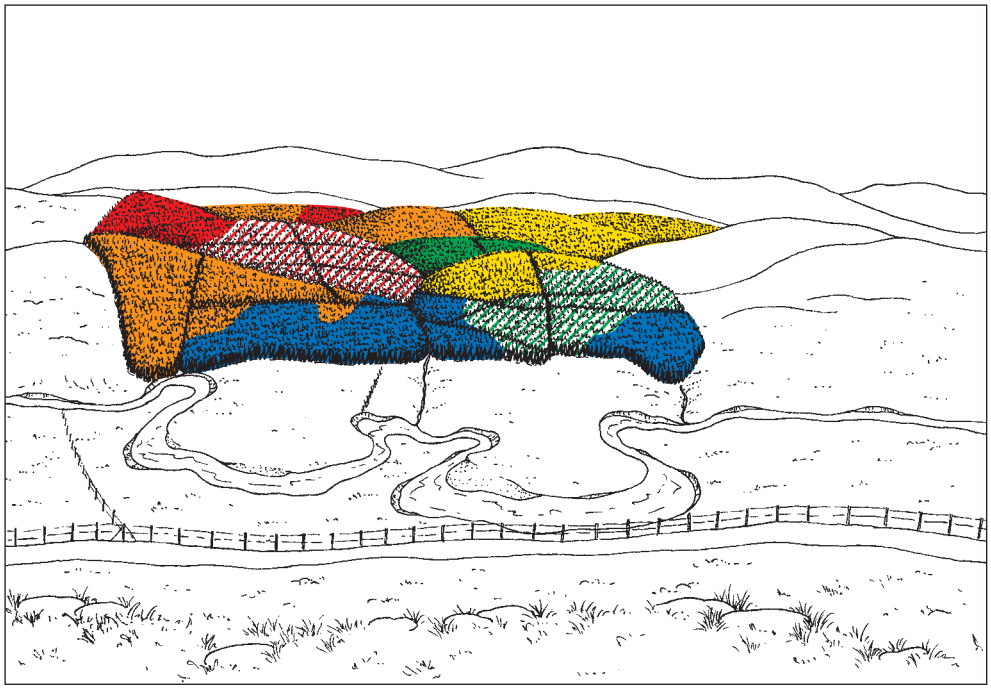
Concept

Concept

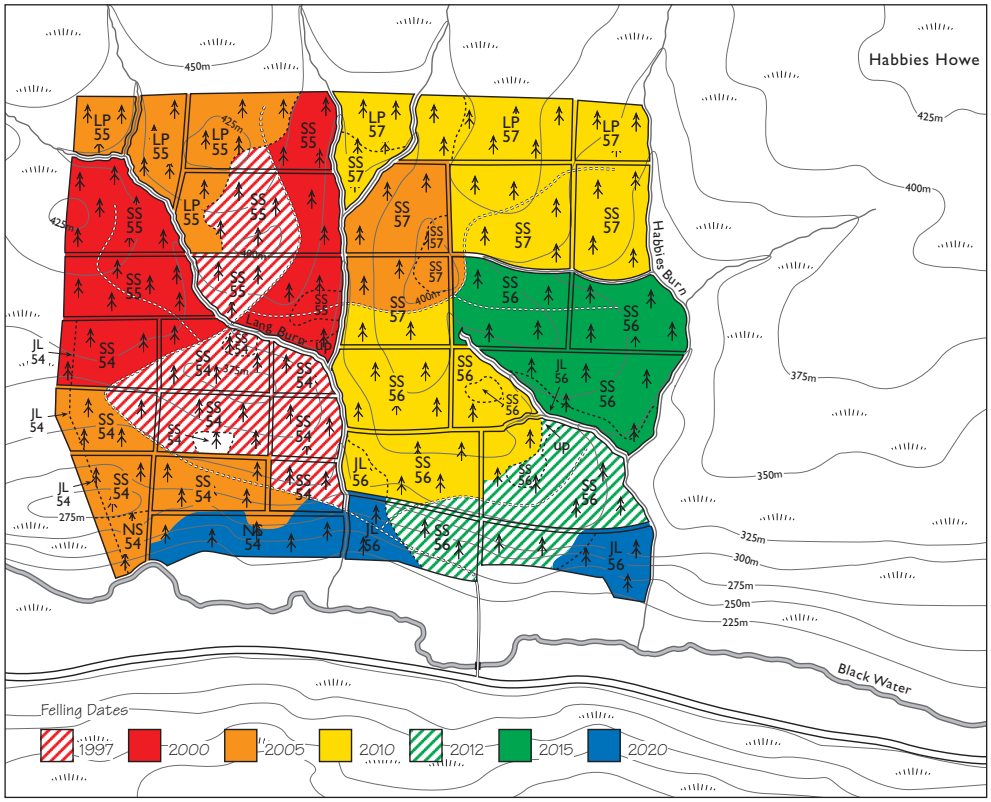
In such a constrained area there is limited scope for new ideas. The design needs to consider the future layout of the forest before fitting the felling to it, given the major constraint of felling to green edges. The concept envisages major use of open space, especially along the streams and also in the areas where high WHC and very poor soils suggest replanting is uneconomic. This framework maximises the productive spruce while other species such as broadleaves and larch are used in minimal quantities where they will have the best effect.

Sketch Design

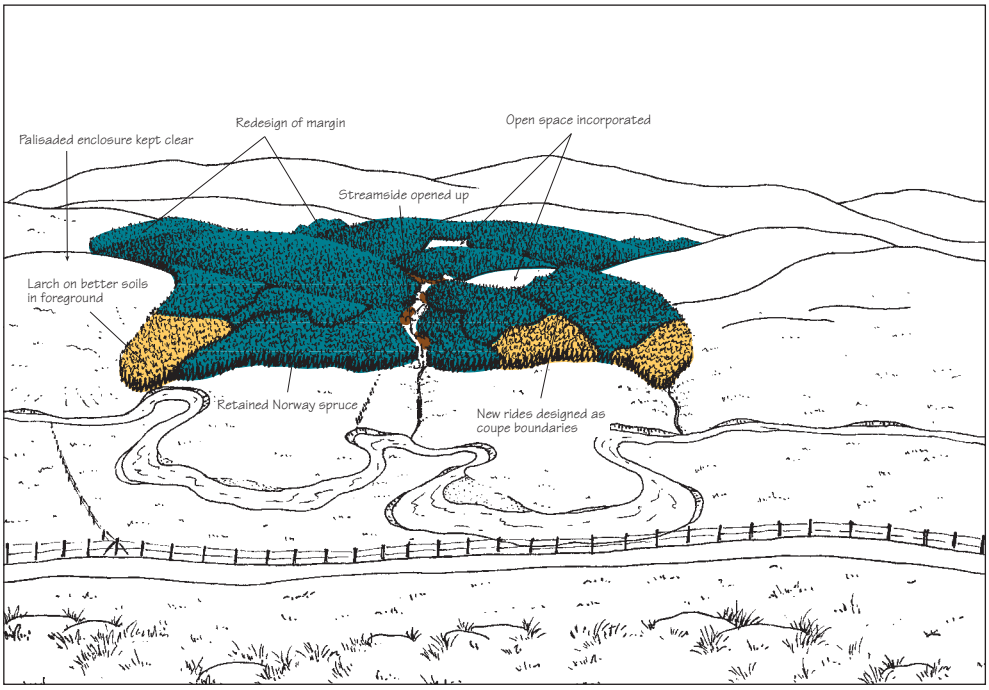
This presents the pattern of coupe shapes and the proposed restocking. The restocking uses the opportunity to include new rides that follow landform to be the green edges of the next rotation. This may entail some delayed restocking in order to break a geometric felling boundary. The design is worked in detail for the principal views and then left simpler for the plateau areas.



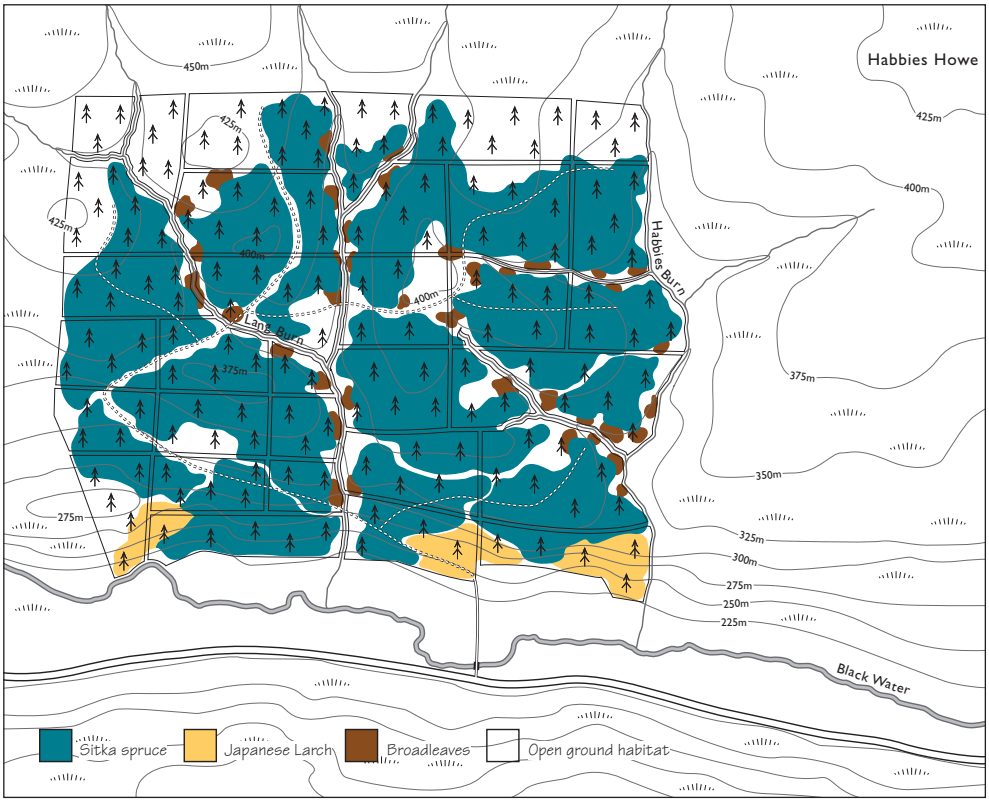
Felling plan



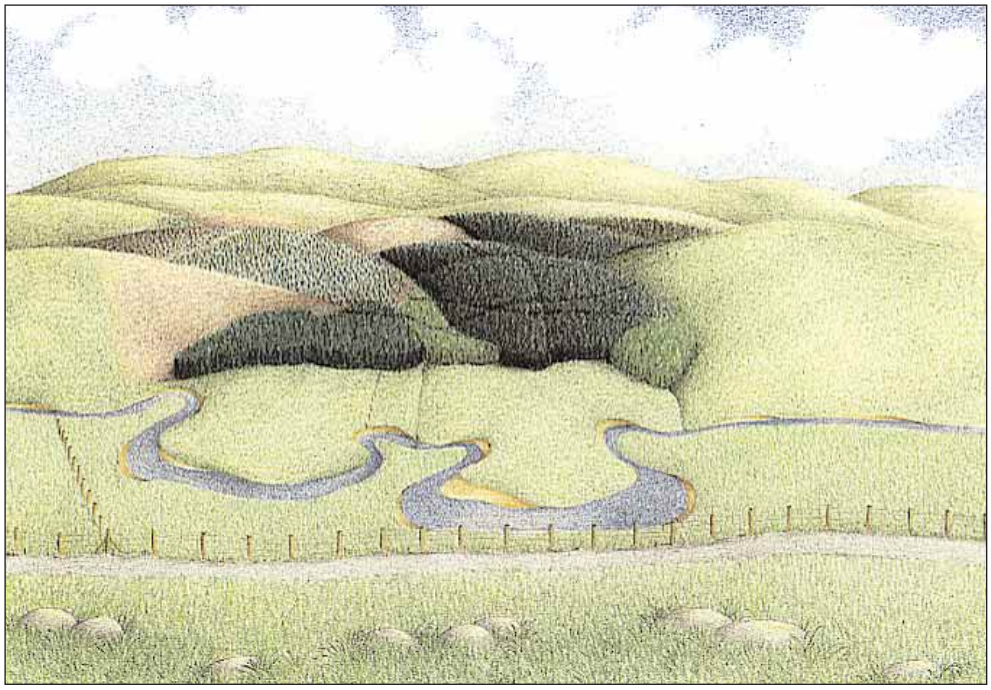
Felling plan



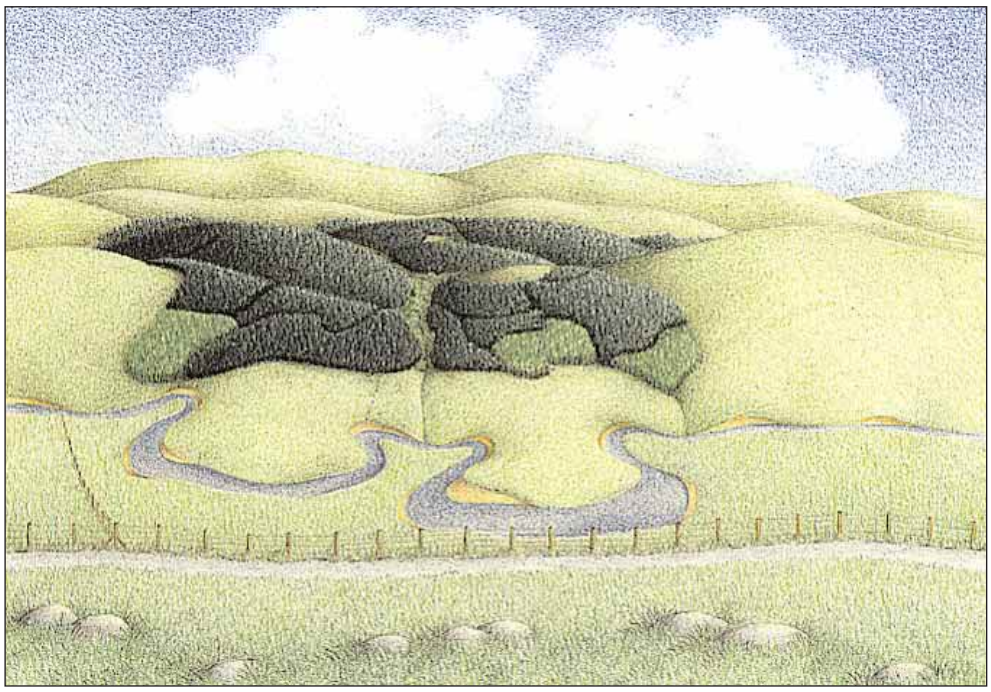
Restocking plan



Restocking plan



Phase 2: the first phase felling has been replanted and the second phase felled. The remainder of the forest is intact.



Replanting 10 years after the final coupe has been felled.

C. Lowland - a medium scale predominantly coniferous forest in a flat landscape

This example is in the flatter lowland heath areas where landform is slight, wind is not a serious problem, recreation access is high priority and views are limited to edges and internal landscapes. The main tree species are pines, particularly Corsican pine.

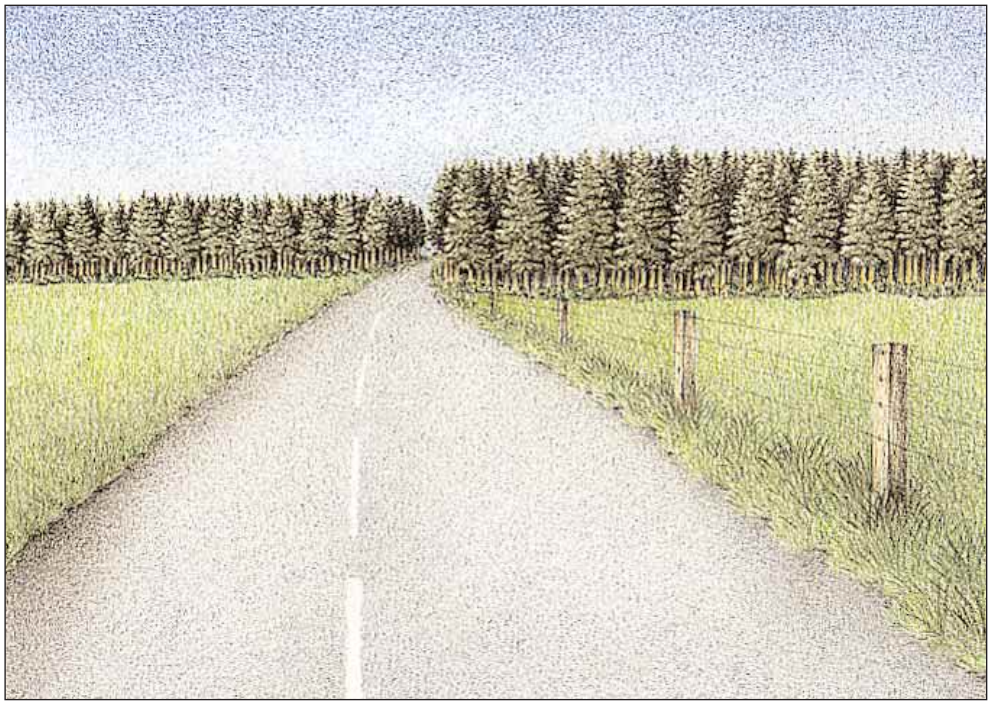
RESOURCE	OBJECTIVE	INDICATORS OF OBJECTIVE BEING MET
Timber	• To produce as much quality sawlogs as possible within framework of the environment	• Pine produces high proportion of sawn timber • As much ground as possible is planted
Financial	• To maintain a positive cash flow into the future	• Efficient silviculture methods are adopted • Fellings are fairly steady year on year • Thinning contributes to volume
Landscape	• To improve the views from inside and outside the forest	• External edges are enhanced • Internal shapes are organic • Views along paths and roads are interesting and appear natural
Nature conservation	• To enhance the value of semi-natural habitats in the forest, especially for rare species	• Heathland areas are developed, maintained and connected • Grassland habitats are developed • Sandy areas for lizards are developed • Sandy areas are introduced
Archaeology	• To enhance the protection of archaeological sites in the forest	• Sites will be kept open and protected from damage by operations or people
Recreation	• To maximise public benefit in terms of access and use	• Trail system for a range of users is established. • Rights of Way are maintained • Specialist users are able to gain access (paying if necessary).

Objectives

The objectives reflect the different priorities typical of such landscapes.

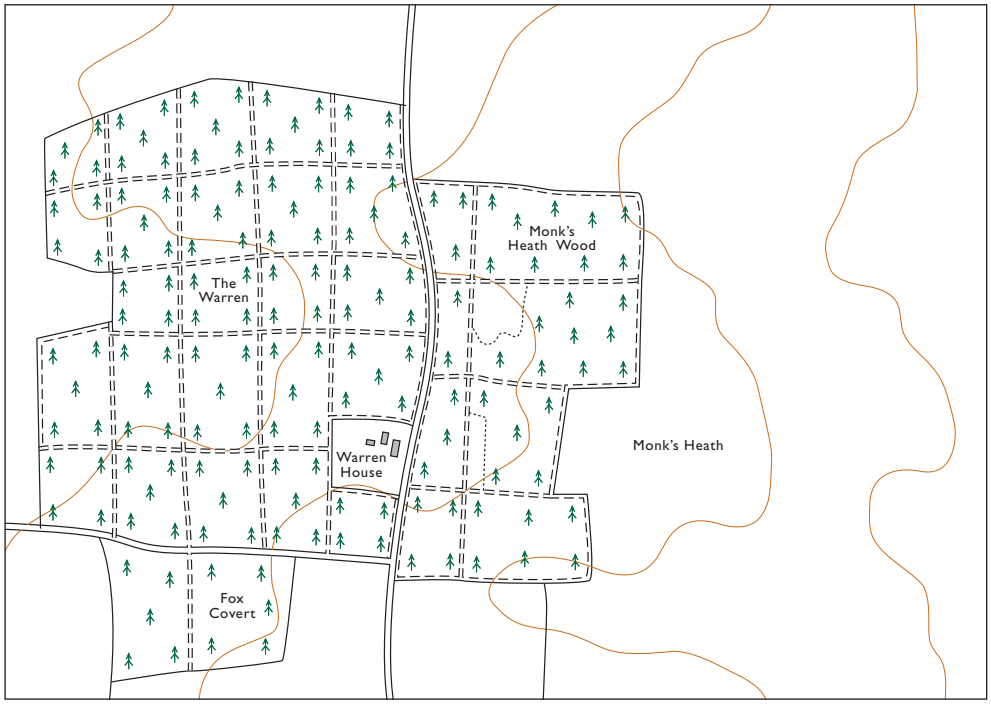
Survey

The same kinds of layers of information are collected as before.

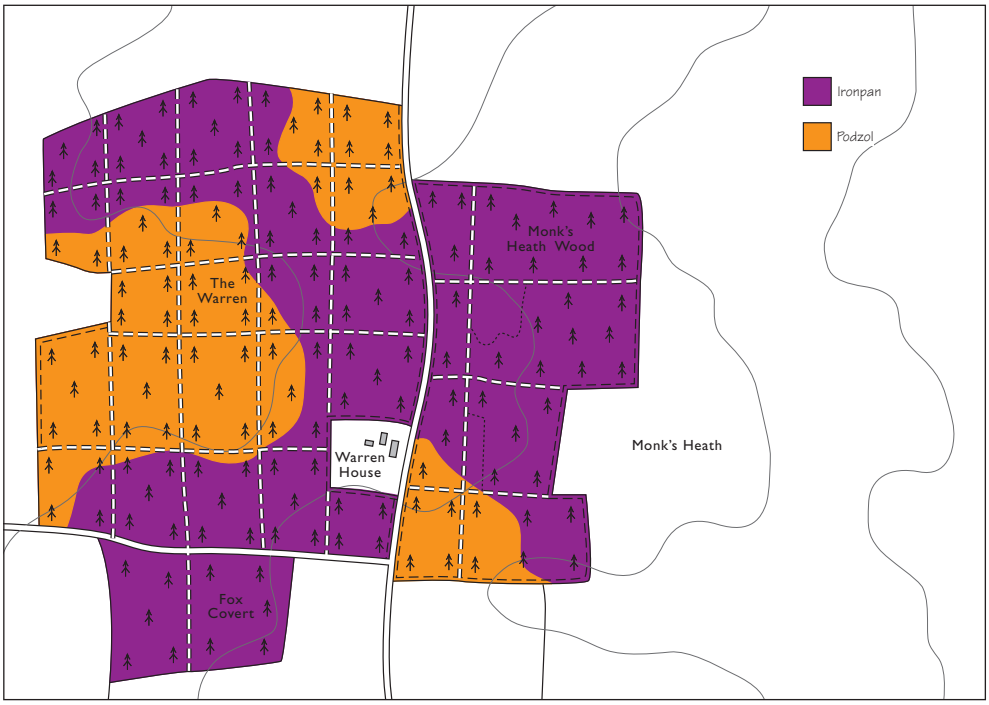


View of existing landscape

A base map of the area (such as Ordnance Survey) at 1:10 000 scale showing contours.



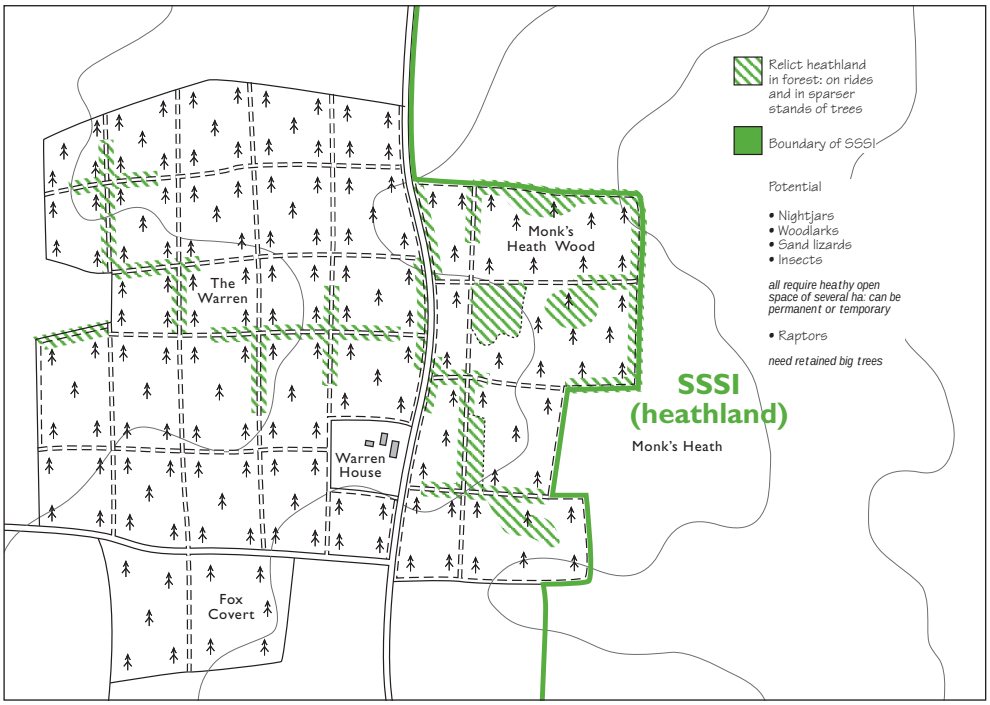
Plan of existing landscape



Soils

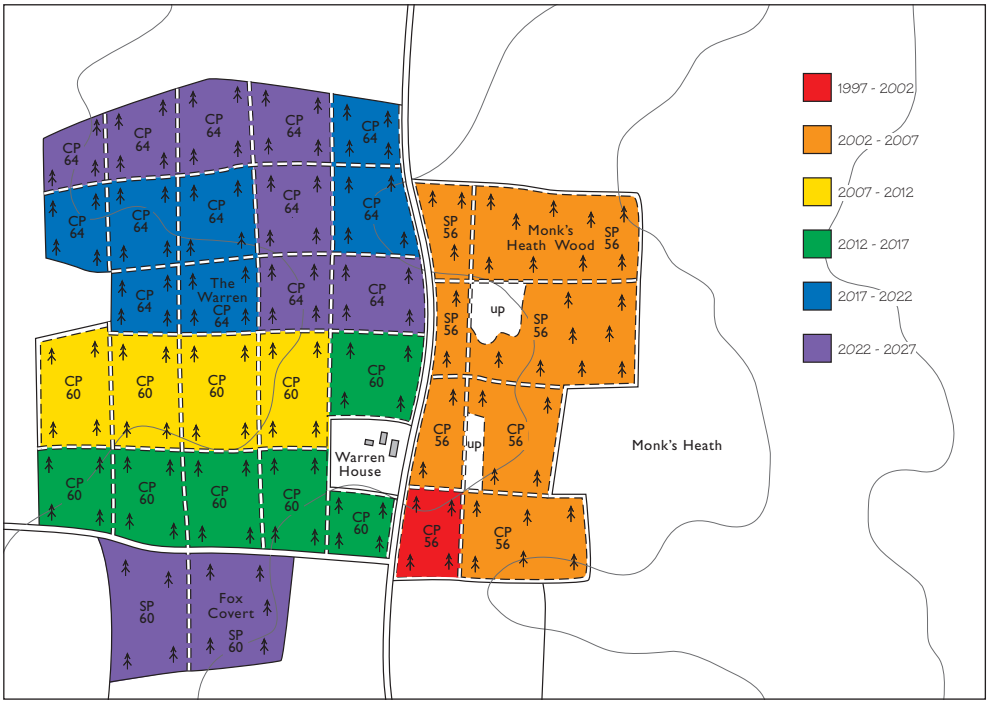
Archaeology

Recreation

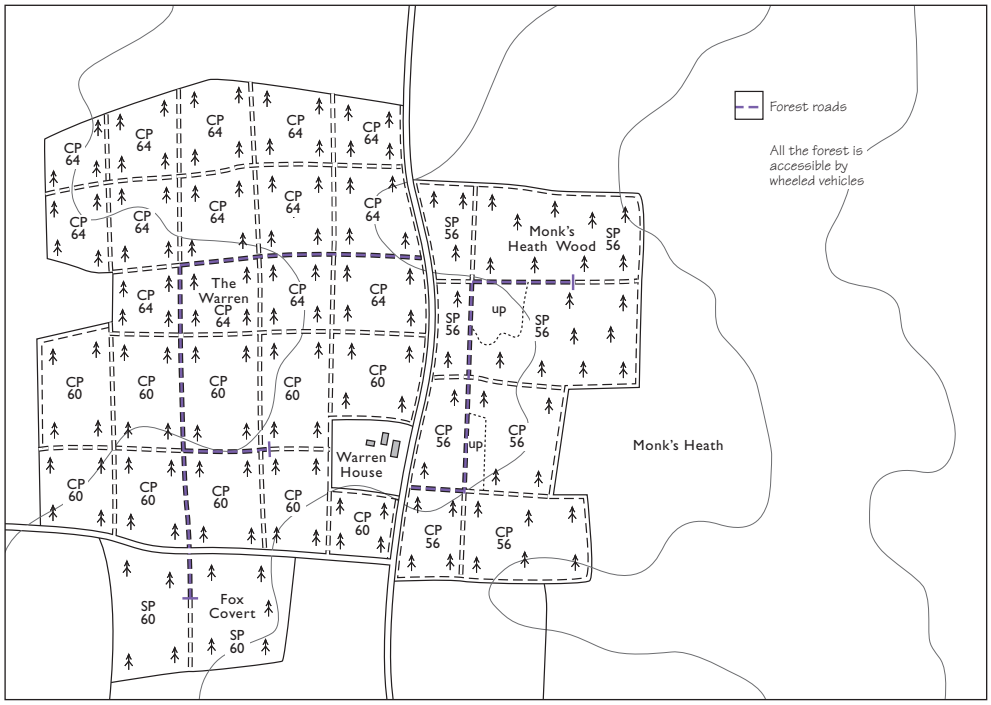


Nature Conservation

Stock map



Economic felling ages



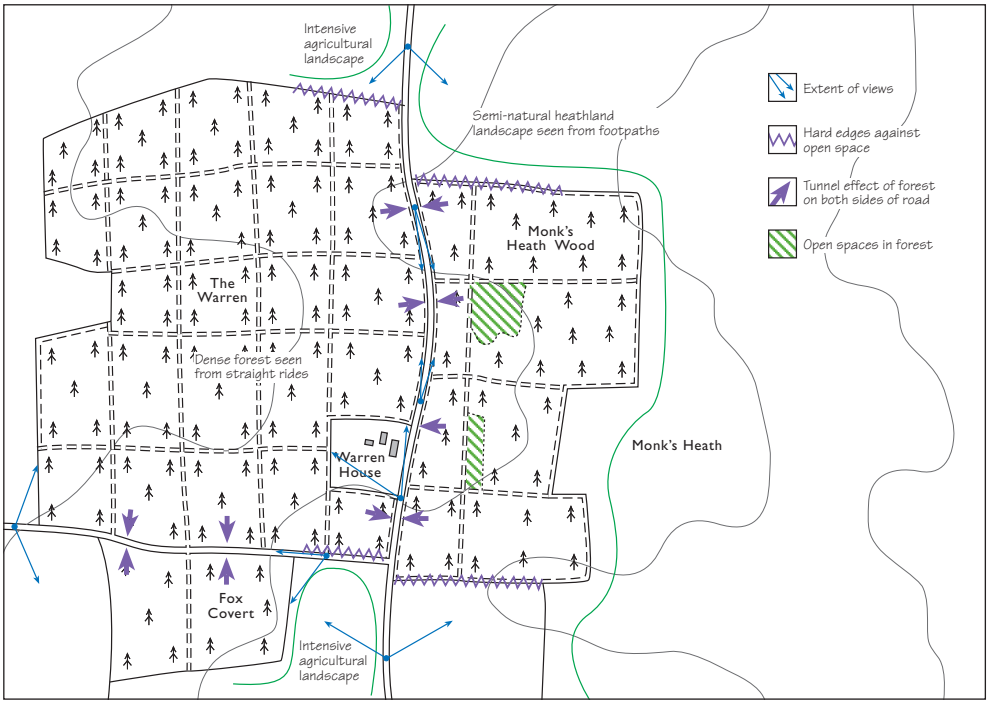
Roads and harvesting

Analysis

The constraints and opportunities analysis is compiled as before. The landscape character analysis places little importance on the landform and considers the internal views, especially moving views from car, cycle, horseback or on foot. It can be combined with the opportunities and constraints analysis if there is little overall information to record.

FACTOR	CONSTRAINT	OPPORTUNITY
Age of forest	•All the forest is close in age	•To diversify by felling over a period as all stands are windfirm
SSSI on border	•Risk of tree seeds colonising the SSSI	•To clear back the edge and link SSSI with the interior of the forest
Archaeology	•Sites under trees now mean loss of productivity when they cannot be replanted	•To clear them and link into heathland habitats
Trails and paths	•Existing use may conflict with forest operators	•To reroute and make them more interesting as work proceeds
Soil	•Poor soil good only for pines, some grow poorly on worst ironpan soils	•To maintain the low diversity of the forest to reflect the semi-natural habitats present •To use poor growth areas as open space
Old trees	•Keeping old trees takes volume out of production	•To keep sense of maturity in the forest •To provide important habitats

Constraints and opportunities analysis



Visual factors

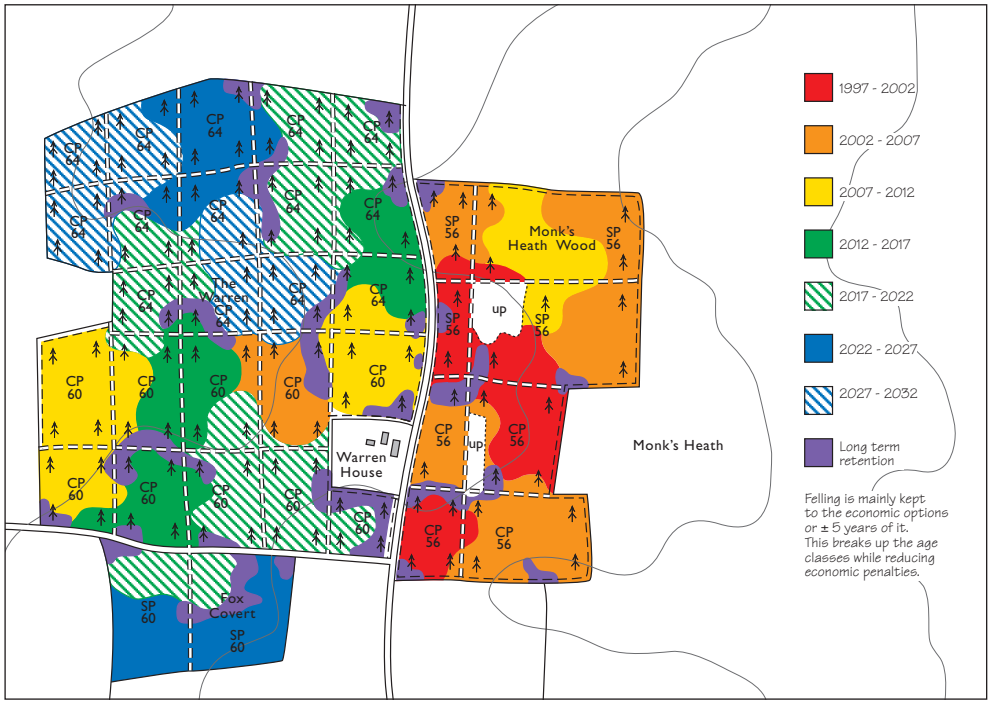
Concept

The concept here is to break up the forest with a pattern of clearfelling that permits new open ground habitat to be created and provides temporary habitat for many species.

The organic shapes break away from the gridiron compartments of the past and allow a more interesting landscape as seen from roads and paths. Edges are diversified, both internally and externally. The retention areas help control scale of felling and provide continuity of habitat over time.

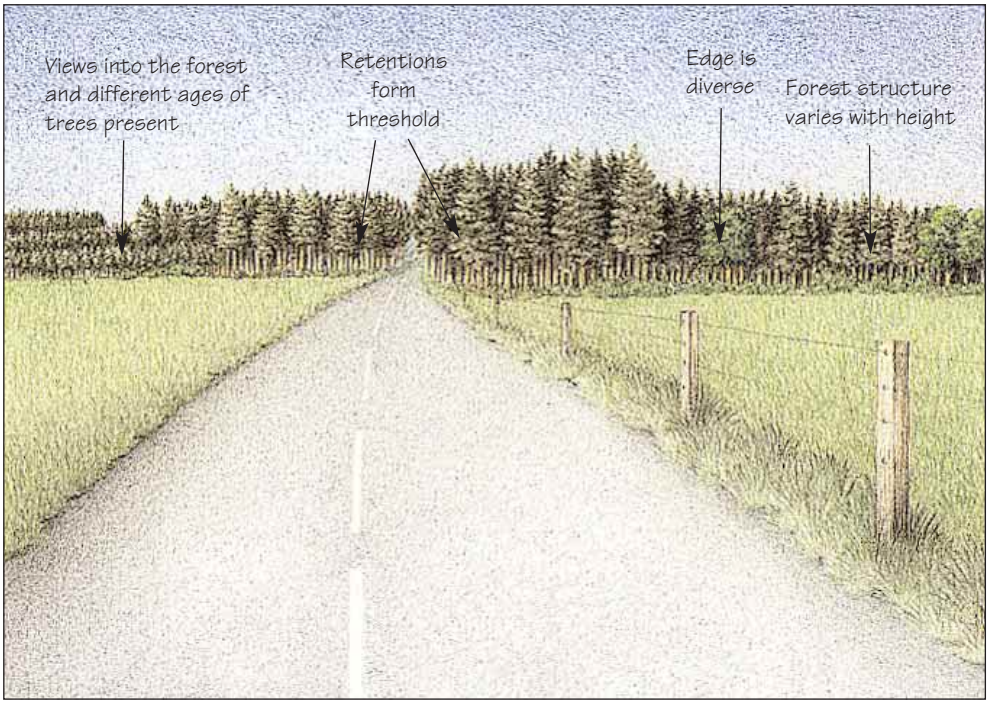
Sketch Design

The concept is developed into a felling pattern keyed to 5 year felling periods. Most felling is at or ± 5 year of economic optima. Each coupe is replanted leaving the necessary open spaces. Stability and growth rates mean that structural diversity can be achieved during one rotation. It is illustrated for sample external and internal views (one shown).



Felling plan

Restocking Plan



View at 2027

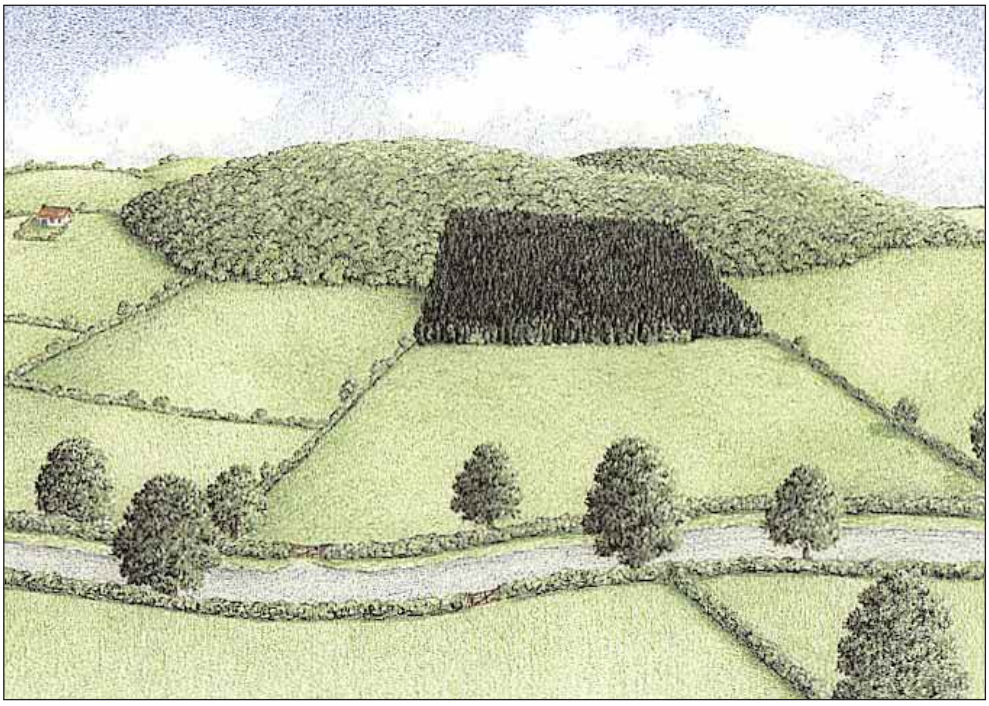
D. Lowland - a small to medium scale predominantly broadleaved woodland in a rolling, enclosed landscape

This is a different example from all the three previous ones because it is mainly broadleaved and also contains ancient semi-natural woodland. The design requires less in the way of restructuring and redesign of poor shapes (except in one notable place) and concentrates on the effect of some continuous cover and coppice management as well as clear felling.

Objectives

In this woodland the objectives are especially limited or directed by its existing character, composition and values compared with some of the other examples.

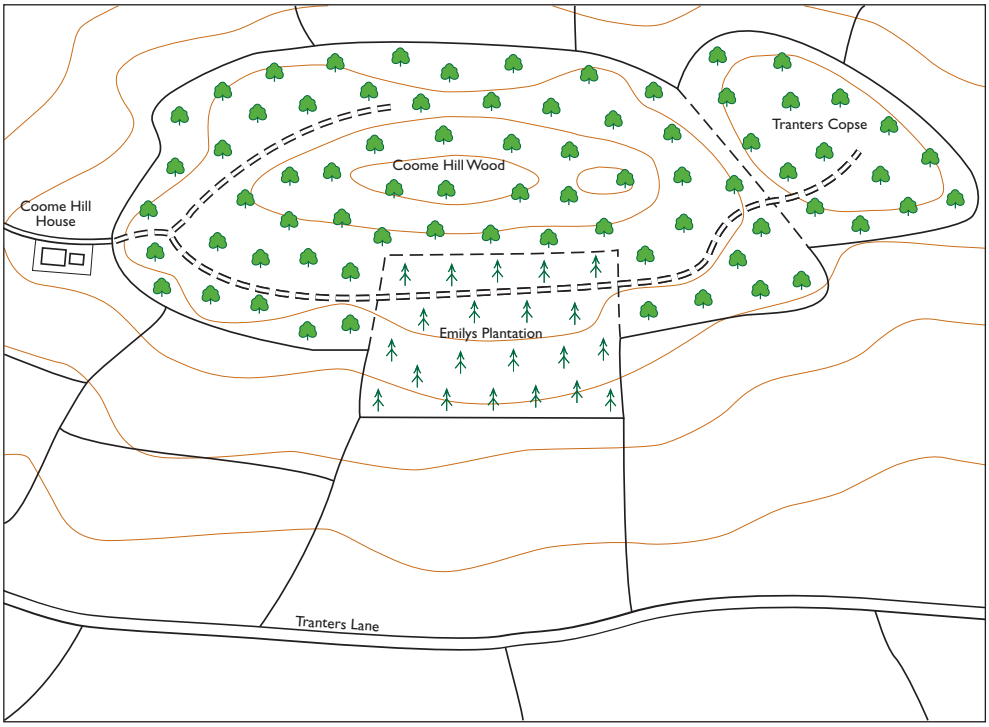
RESOURCE	OBJECTIVE	INDICATORS OF OBJECTIVE BEING MET
Timber	• As much wood production as can be sustained when other values are achieved	• Wood is produced all the time but not at the expense of meeting other objectives
Nature conservation	• To maintain and restore the semi-natural character of most of the wood • To maintain woodland habitats at the right level of diversity over the rest	• The coppice with standards area is brought back into production • Continuous cover is used to maintain the woodland atmosphere • Conifers are reduced in area
Archaeology	• To maintain and improve the management and protection of sites	• The wood banks are kept as part of the landscape • Other sites, that need to be kept open are open
Landscape	• The integrity of the woodland in the landscape is maintained	• The conifer area is improved in shape • The skyline is kept intact • Scale of coupe varies from top (big) to bottom (small)
Sporting	• The pheasant shoot continues to be valuable	• Pheasant rearing continues as before • Game bags continue at similar levels



View of existing landscape

Survey

The layers collected are similar to the other examples. The nature conservation layer is more comprehensive in terms of existing value as opposed to potential. The status of the ASNW and broadleaved management policy directs some action quite strongly.

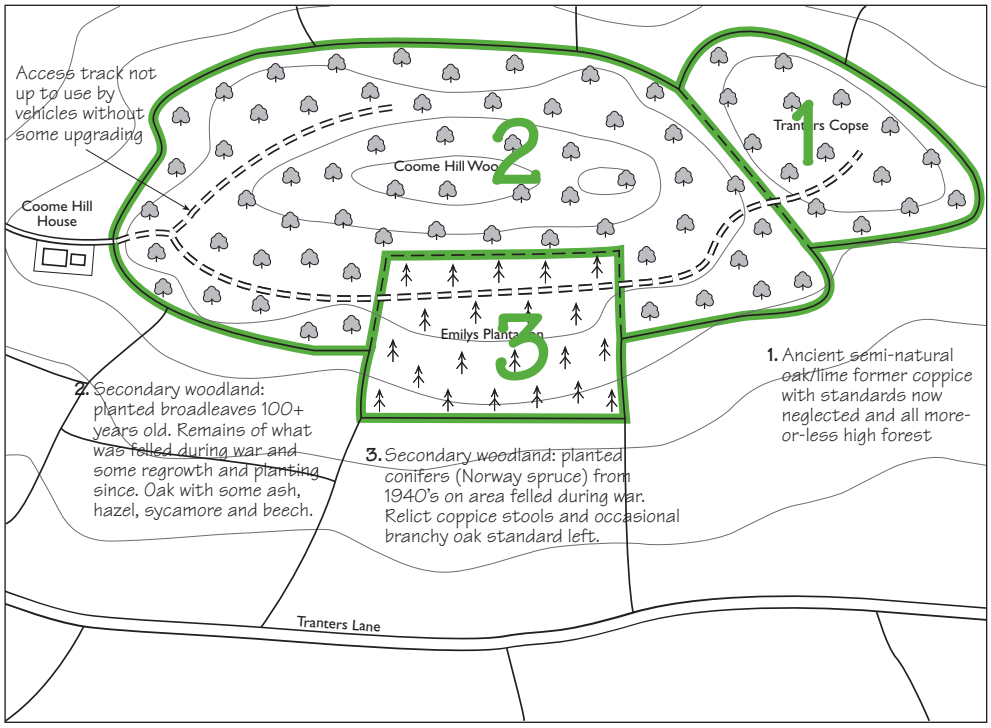


Plan of existing landscape

1. ASNW oak standard with lime and some hazel coppice. Small coppice cants or coupes, replanting if short of standards or viable coppice stools although natural regeneration is preferred. Part of the wood should be left as minimum intervention. There is potential to expand the woodland type by natural regeneration into the secondary woodland as it is felled. If dormice are present a link of hazel coppice canopy or hedgerows must be maintained with the rest of the wood.

2. Secondary broadleaved woodland of plantation origin. Conifer nurses could be considered as long as they are removed to produce a final broadleaved woodland. Coupe sizes should be similar or a little bigger than those required for ASNW.

3. Secondary coniferous woodland of plantation origin with some relict oak standards. If conifers are to be retained then a mixed zone between these and the broadleaves should be developed. If it is not viable as a red squirrel area because of the presence of greys nearby then it might be better to restore the area or most of it to broadleaves. Some should be managed as long term retention linked to the hedges or edges or broadleaved woodland.

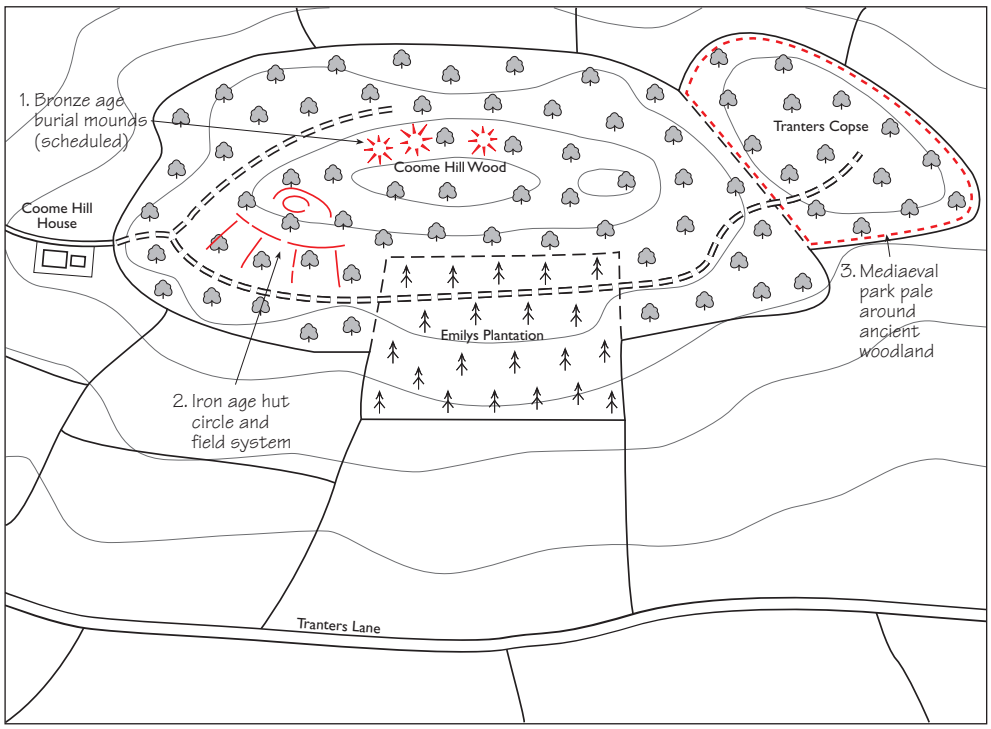


Basic woodland survey

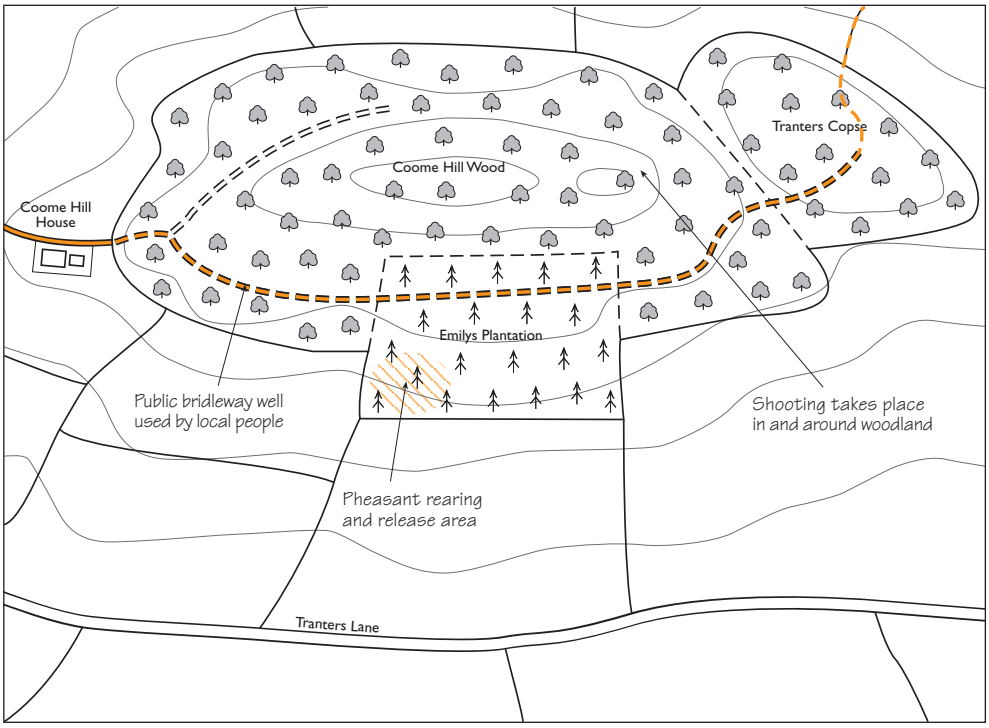
1. Bronze age burial mounds: remove any trees and keep replanting back to minimum distance.

2. Iron age hut circle and field system: this has been under secondary woodland for several centuries and may be left under trees. No disturbance by road building should be allowed.

3. Mediaeval park pale: the earth mound and ditch shows that it is intact and still wooded within. Woodland can come right up to the feature since that is its original purpose.



Archaeology



Recreation and access

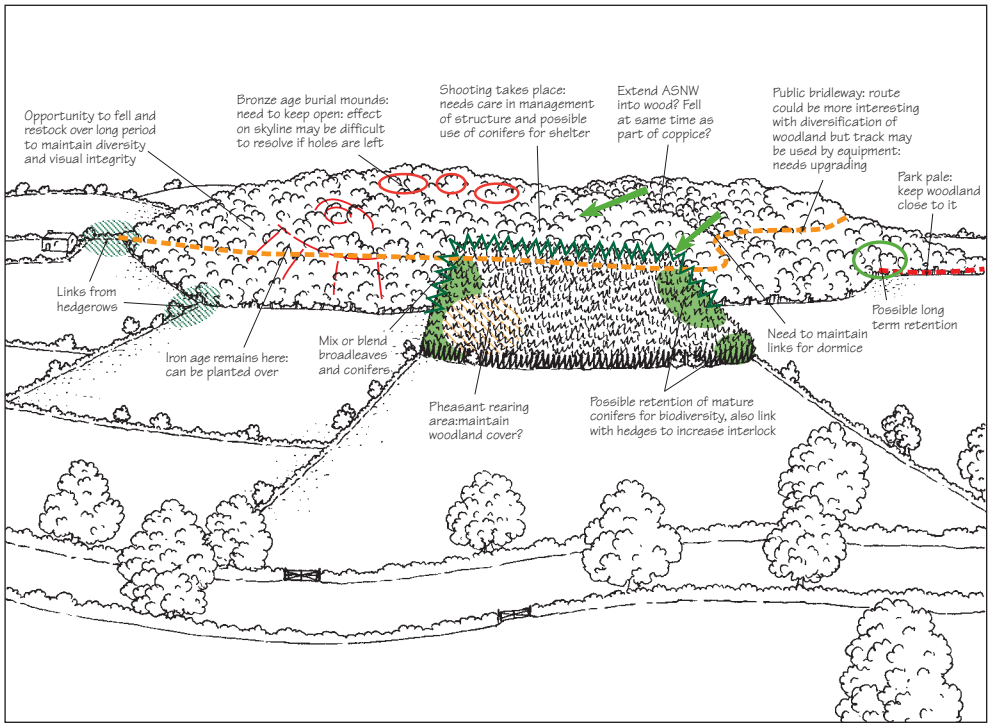
1. Shooting is the main recreational activity. The owner of the wood uses it together with the surrounding land for pheasant rearing and shooting. The wood is somewhat draughty around some of the edges. Coppice management in Tranters Copse would improve the pheasant capacity while more evergreens in the rest of the wood would help the shelter.

2. One right of way, a public bridleway, passes through the wood, mainly using the access track. It is well used all year round by local people including the local riding school. Shooting may conflict with use of the right of way unless guns are kept away from it (100 m minimum).

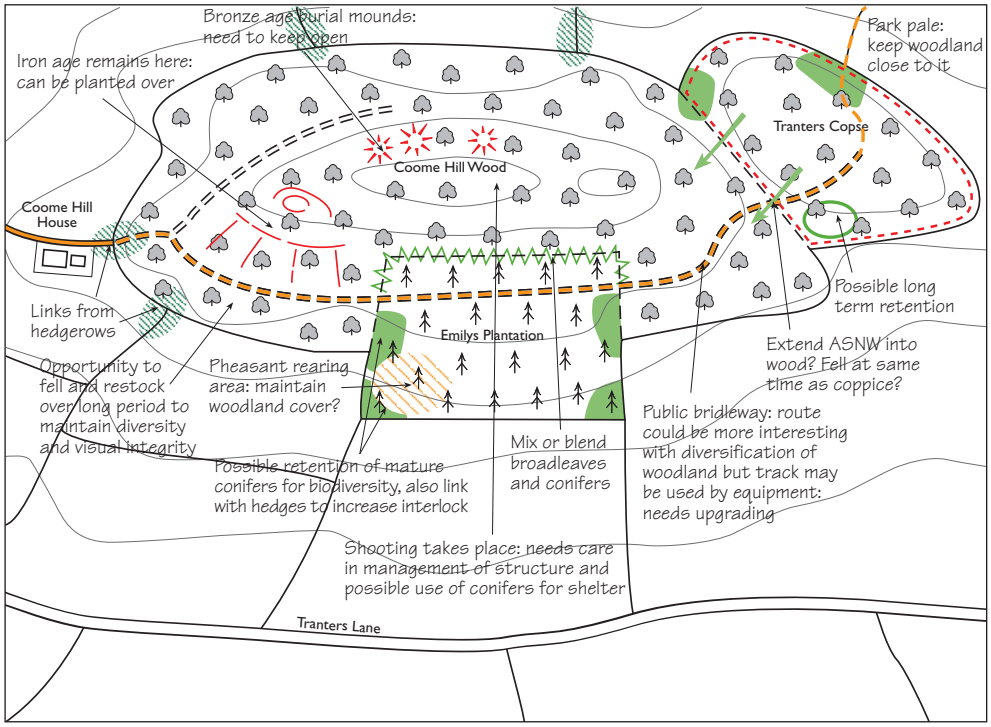
FACTOR	CONSTRAINT	OPPORTUNITY
ASNW	•Sensitive and traditional management may make it difficult to market products	•To increase nature conservation value
Conifers	•Out of place in the landscape but important for pheasant rearing	•To retain part and redesign to blend in better
Pheasant shoot	•Forestry operations may not mix with pheasant management	•To integrate work in the woods
Archaeology	•Currently wooded sites need to be opened up	•Some sites should be kept wooded

Analysis

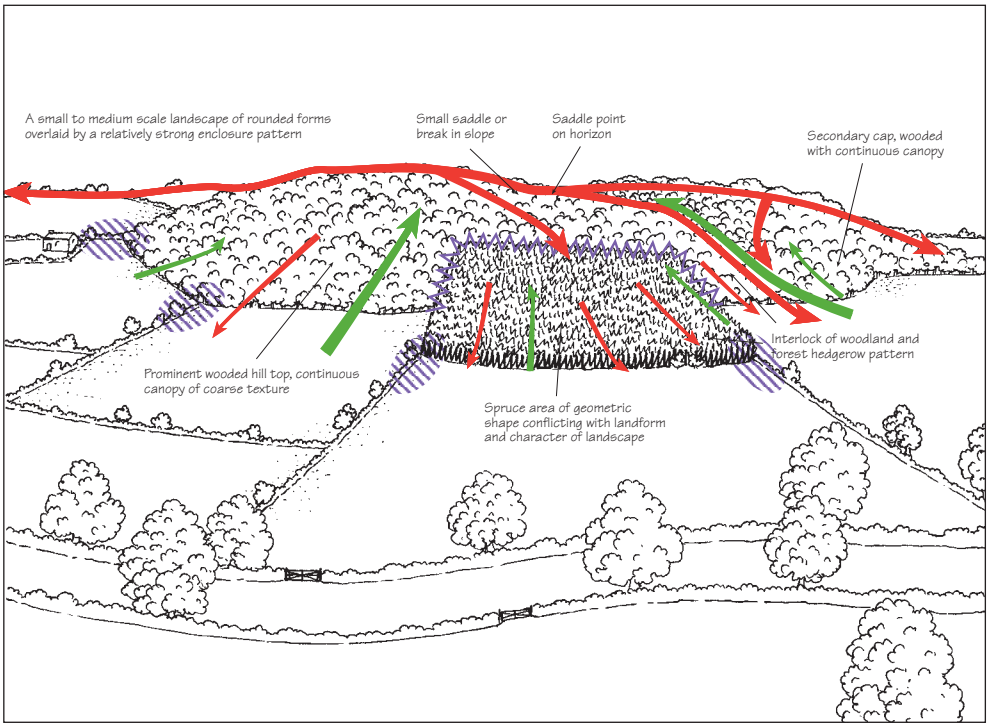
Opportunities and constraints and landscape character including landform are comprehensively completed in plan and perspective.



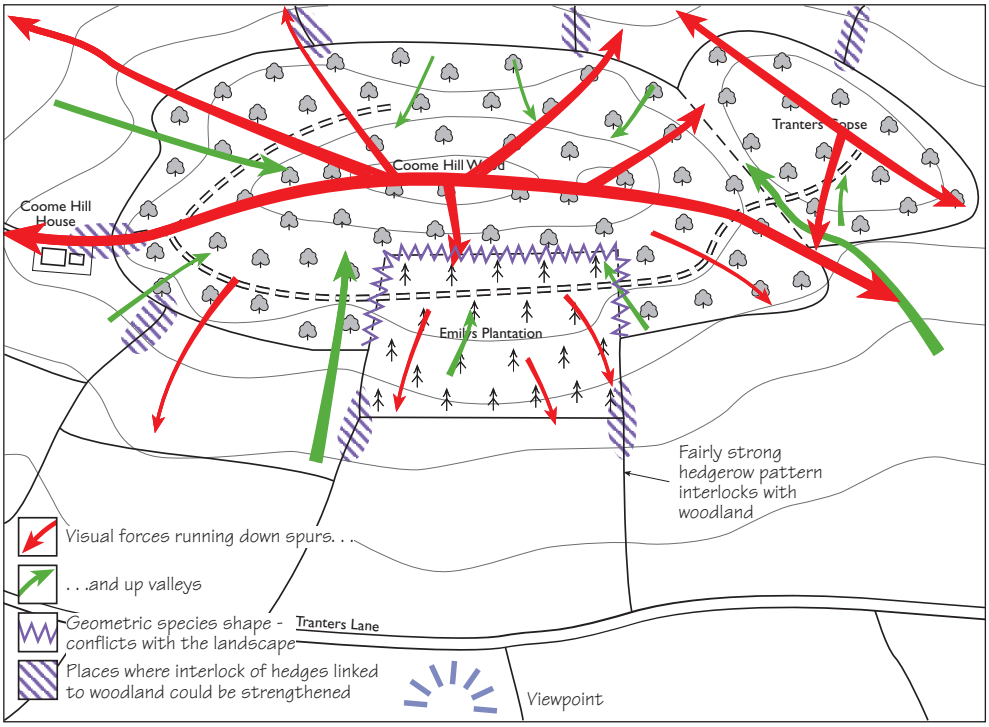
Constraints and opportunities analysis



Constraints and opportunities analysis



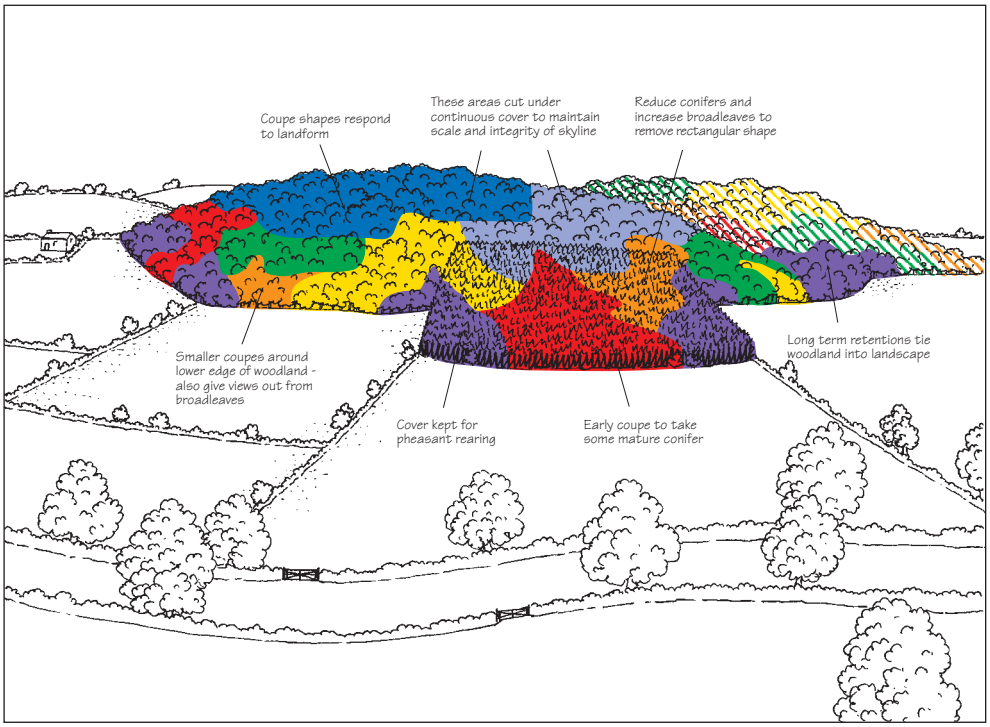
Landscape character analysis



Landscape character analysis

Concept

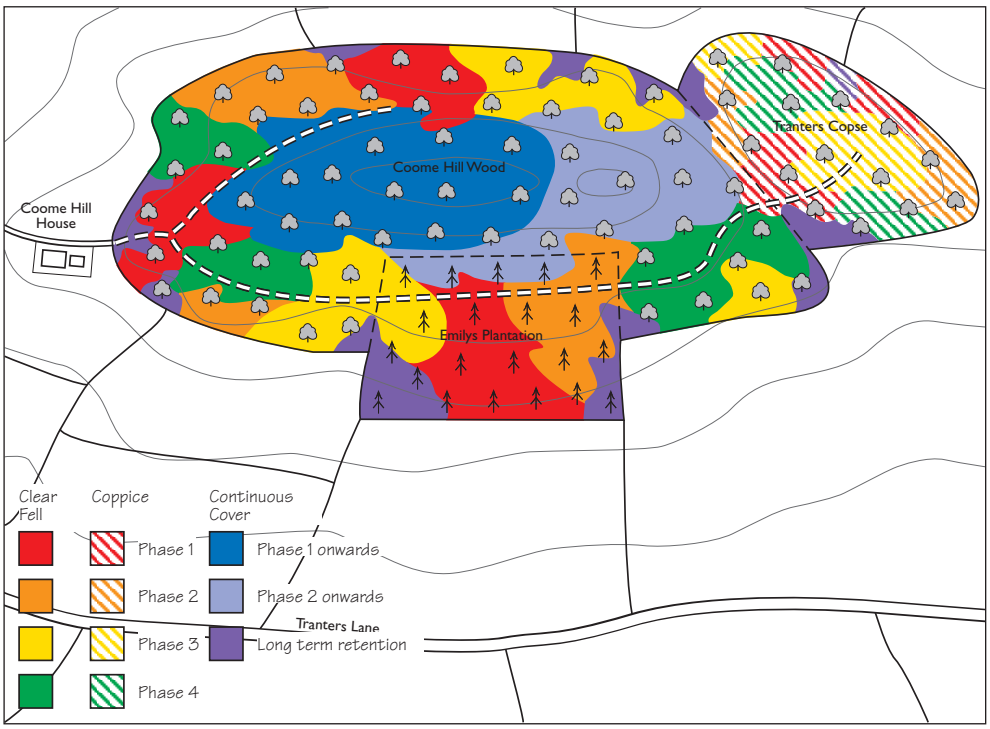
The concept places large, continuous cover coupes on the skyline cap of the larger section with smaller clearfell coupes around the flanks interspersed with retentions to link into the hedgerow pattern. The coppice area is likewise divided into coupes or 'cants' on the same principle except that areas are more similar in size. The conifer area is redesigned but retained as an element.



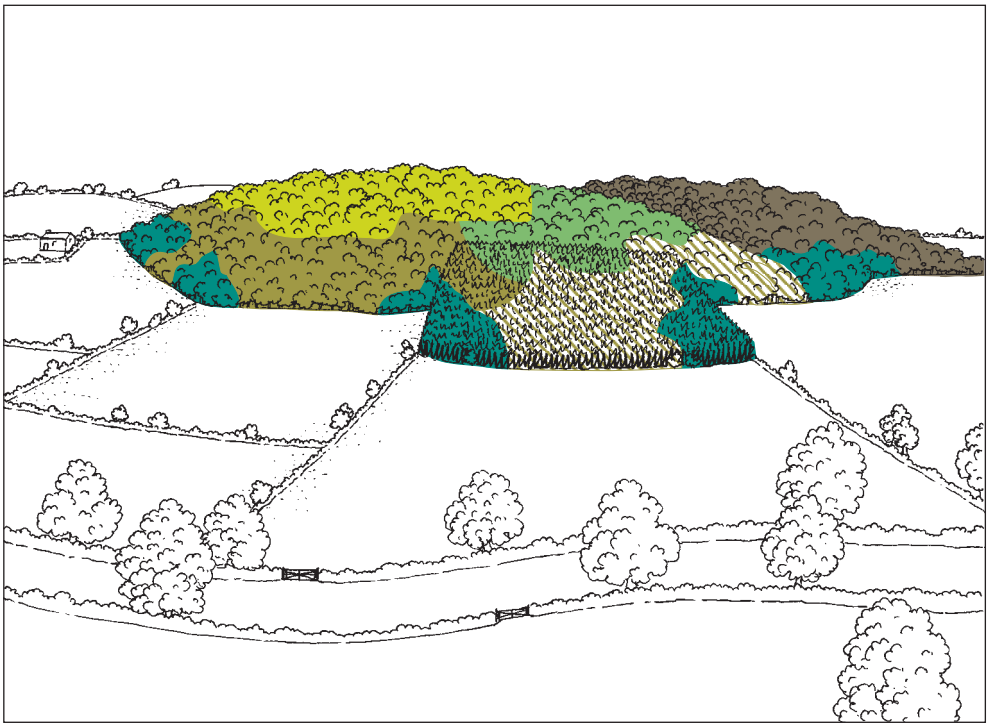
Felling plan

Sketch Design

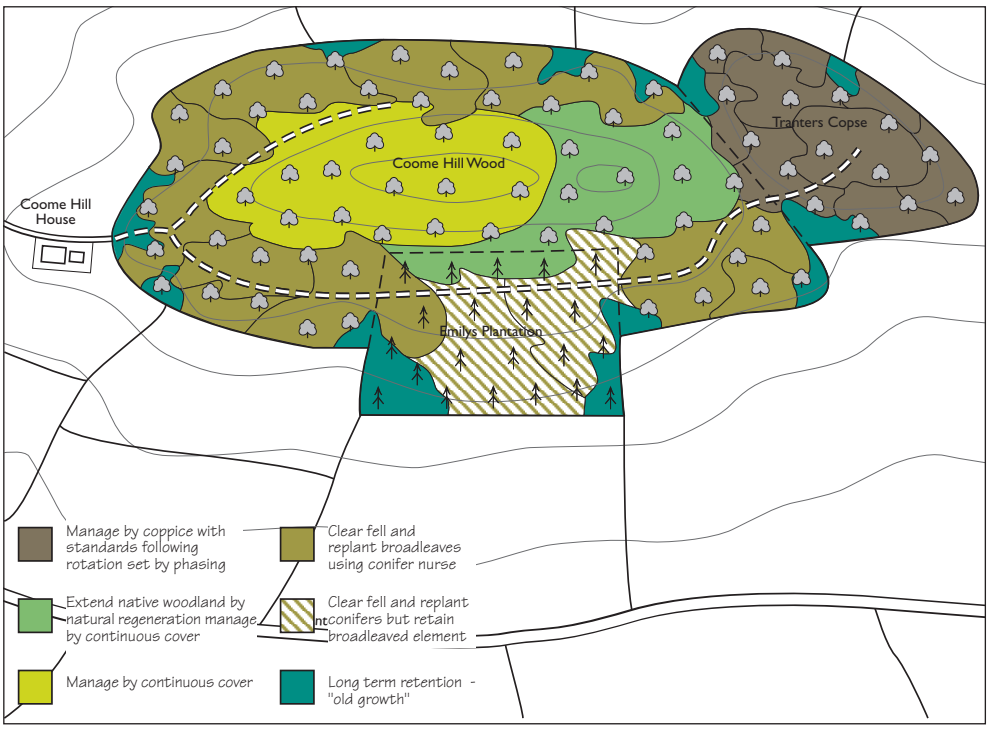
The perspective views are very important and are used to ensure that shape and scale of coupes is correct. Regeneration follows the felling pattern. No open space apart from the archaeological sites that need to be kept open is created so net areas of woodland remain virtually unchanged. Felling is timed over a long period but the economic penalties are not considered important.



Felling plan



Restocking plan

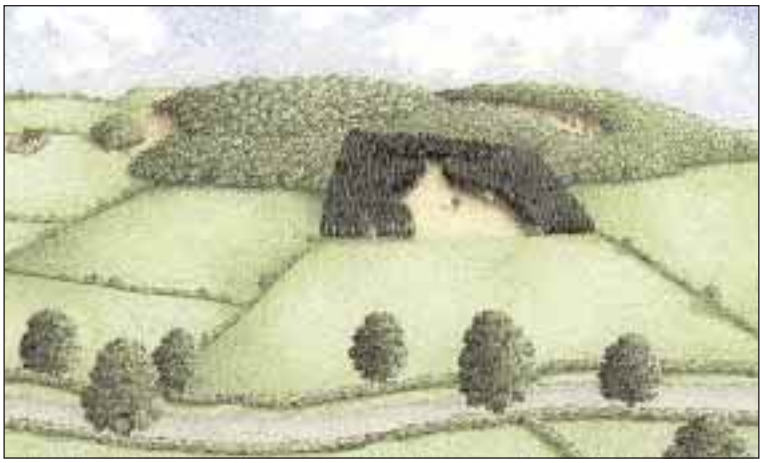


Restocking plan

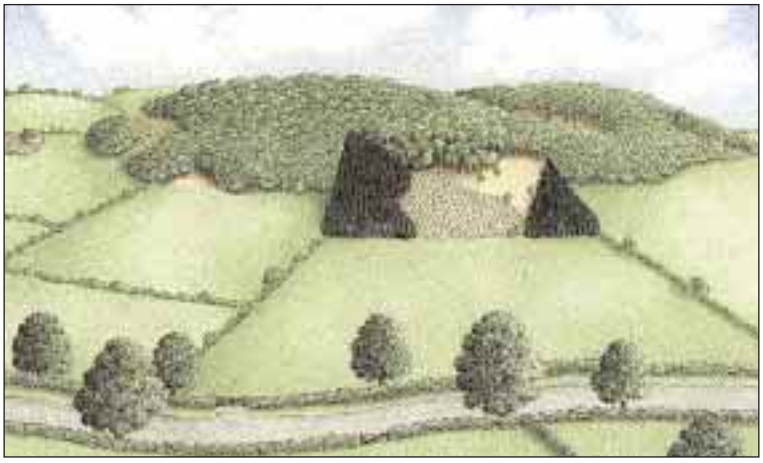
Time series

In such a sensitive landscape, the changes to the woodland over time are very important. Hence more phases are shown to demonstrate how the character and integrity of the landscape is maintained and enhanced over the period of the plan. The effects of continuous cover silviculture are shown as texture changes to the woodland canopy.

Phase 1

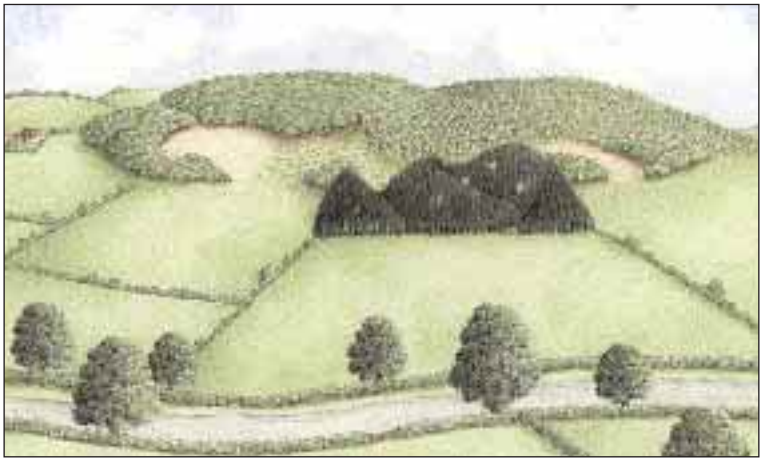


Phase 2



Phase 3

Phase 4



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