FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS IN SOUTH AFRICA

Mondi Ltd.

sappi

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS IN SOUTH AFRICA

(SECOND EDITION - AUGUST 2002)

Mondi Ltd.

In recognition of, and in the interests of promoting and encouraging all timber growers to practise Sustainable Forest Management, both Mondi Ltd. and Sappi have sponsored a significant proportion of the production costs of these Environmental Guidelines.

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INTRODUCTION

THE VISUAL LANDSCAPE

PLANNING SILVICULTURAL PRACTICES

IMPLEMENTATION SILVICULTURAL PRACTICES

OTHER FORMS OF LAND USE

ANNEXURES

CHECKLISTS

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IN SOUTH AFRICA

INTRODUCTION

1. FOREWORD

Sustainable development is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. If this is true, conserving the environment is fundamental to ensuring our continued existence on earth. Erosion of our natural resource base will result in disaster for all.

New forest policy and law provides the framework for the forestry sector to practise its activities and reforms policies and laws of the past by recognising the constitutional right of everyone to have the environment protected for the benefit of present and future generations. The need to conserve and develop natural resources according to principles of sustainable management is recognised and supported.

Plantation forestry is identified as a resource that provides benefits to many people in South Africa and has an important role to play in the local economy. The industry has also proven that it is a global player in the market place.

The publication of these Environmental Guidelines for Commercial Forestry Plantations in South Africa is a clear recognition by the industry of the impact of plantation forestry on the environment and attests to its commitment to mitigate these impacts with improved management practices.

The book is a practical guide to good sense in forestry, covering matters including destumping, residue disposal, observing sensible planting restrictions, weed control planning, fire protection, poaching control, litter, village management, hiking and so on.

I welcome the support provided to promote voluntary regulation and congratulate the initiative in reviewing the previous edition in line with new forestry policy and the National Forests Act, 1998 (Act 84 of 1998).

This publication is recommended to all involved in forestry: the private sector, managers of communal land, government and the wider public. The principles endorsed in this publication embody the concept of sustainable forest management, which will ensure a sustained contribution of the industry to the country, its people and our future.

RONNIE KASRILS MP
MINISTER OF WATER AFFAIR AND FORESTRY

2. PREFACE TO THE SECOND EDITION

Since the first edition of the "Guidelines for Environmental Conservation Management in Commercial Forests in South Africa" was published in February 1995, it has had to be reprinted several times. The popularity of, and the demand for, the first edition far exceeded the original expectations of the South African Forestry Industry.

The Guidelines have been used beyond the borders of South Africa, including in Southern African Development Community (SADC) countries, Europe, the United States of America, Australia and the East. This has been a source of great pride to the Industry and the Forestry Industry Environmental Committee in particular, confirming our conviction that the document would have a positive impact, wherever it has been used.

However, important developments have necessitated the production of a completely revised second edition of the Guidelines. These developments include changes in South African legislation, international developments regarding forest certification and the increased attention being given to Sustainable Forest Management (SFM). As with the first edition, this work has been undertaken by the Forestry Industry Environmental Committee, which is run under the auspices of Forestry South Africa, an Association representing the interests of all commercial timber growers in South Africa.

The Industry participated in the National Workshop on Sustainable Forest Management held in March 1997, at which the first steps were taken towards developing specific criteria and indicators for SFM in South Africa. The six initial Principles of SFM originally identified by this Workshop were eventually expanded and confirmed by the inclusion of nine Principles in the National Forests Act (Act No. 84 of 1998). In terms of this Act, a "Committee for Sustainable Forest Management" was established, under the auspices of the National Forests Advisory Council, on which the Forestry Industry is an active and important participant, and which is currently developing a set of criteria and indicators and standards for SFM, suited to local South African conditions. Once these are available they will form an important component of the Forestry Industry's environmental decision making processes at all levels. These Guidelines will be revised if and when necessary to provide for any new requirements.

What is important to note however is that SFM, which can be described as the management of the forest resource in such a manner that it produces a flow of products and services from the resource without depleting it through its over-exploitation, covers environmental sustainability in its broadest sense (i.e. the physical, economic, social and institutional aspects). However, these Guidelines essentially deal with only one of the aspects of SFM, namely the physical environment.

Comments and suggestions for improvements, received as a result of an extensive consultative process with various stakeholders, have been accommodated in this revised edition, and we anticipate ongoing feedback. The emphasis of this edition has moved from purely Industry-related issues and now accommodates the interests of other communities and stakeholder groupings. This has been done in the spirit of increasing transparency, dialogue, and adding value to our operations.

We recommend this second edition to all involved in the South African Forestry Industry as well as to those involved in other forms of land use, agricultural or otherwise, to enhance the cause of good land management, in Southern Africa and wherever the Guidelines are applied.

Finally, a word of thanks and appreciation must go to the many people who have given freely of their time and expertise to make this second edition of the Guidelines the document that it is and to the generous sponsorships received from both Mondi and Sappi for its publication.

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3. HOW TO USE THE GUIDELINES

3.1 Introduction

The objective of this publication is to provide the reader with concise and easily understandable information, including guidelines, on how to manage a forestry operation in such a manner that the physical environmental impacts of that operation are minimised and by so doing, to help promote the practising of Sustainable Forest Management (SFM). As such, this second edition of the Guidelines has been completely rewritten and reformatted so as to make it as "user friendly" as possible. In order for you, the reader, to gain as much from this publication as possible, a summary of the features of this second edition are covered below.

3.2 Overall Format & Layout

Unlike the first edition, this second edition is contained in a sturdy ring binder file. This has been done to enable new or amended Sections to be included, as legislation and best practice changes, without having to reprint the entire publication. Page numbering is thus split per Section. This format is also more hard wearing.

To make it easier and quicker for the reader to find the required information within the document, each Section has been placed in a logical sequential order and assigned its own colour coding which runs along the top and sides of each page. Section separators have also been provided to further assist in finding the required Section. The colour coding for the respective Sections is shown below.

SECTION		ABBREVIATION
INTRODUCTION		I
VISUAL LANDSCAPE		V
PLANNING	SILVICULTURAL PRACTICES	PS
IMPLEMENTATION	SILVICULTURAL PRACTICES	IS
PLANNING	HARVESTING	PH
IMPLEMENTATION	HARVESTING	IH
PLANNING	ROADS	PR
IMPLEMENTATION	ROADS	IR
OTHER FORMS OF LAND USE		OFLU
ANNEXURES		A
CHECKLISTS		C

3.3 Guidelines

For ease of identification, all guidelines contained in the publication appear in a bulleted format and are placed within shaded blocks. There are two types of "guidelines", namely; a recommended guideline and a statutory requirement. In the case of the latter, this is technically not a "guideline" but a statutory obligation which must be complied with. Examples of these two "guidelines" appear below. As is shown, statutory requirements appear in a red block.

Guideline : Recommended guideline (in cases where other guidelines should be consulted, these guidelines appear in a green block)

- Where possible, use firebreaks wide enough to permit burning each half in alternate rotations, where mowing cannot be practised.

Guideline : Statutory requirement

- Statutory restrictions on season of burning must be observed.

3.4 Statutory Requirements

As mentioned in 3.3 above, certain statutory requirements appear in a bulleted format within a red shaded block. In addition, other statutory requirements are contained in the document which are not guidelines as such (e.g. those related to the conducting of EIA's). These can be either actual references from Acts or in the form of an information note to alert the reader to the requirements of the law. An example of the latter appears below:

These sites are protected in terms of the National Heritage Resources Act (Act No. 25 of 1999). They may not be destroyed, damaged, disfigured, excavated, altered, removed from their original site or exported from the Republic without a permit from the South African Heritage Resources Agency (SAHRA).

3.5 Pictures

Photographs have been used extensively throughout the Guidelines. Some have been used purely for information / visual purposes (e.g. examples of SMZ's) but others have been purposely placed in the Guidelines to give the reader an indication of "good" and "bad" examples of certain practices. "Good" examples have green ticks within the photographs and "bad" examples, red crosses.

3.6 Cross Referencing / Additional Information

In most cases, a planned forestry activity will have an impact on one or more other activity. Guidelines for harvest planning for example, therefore need to be read in conjunction with those guidelines for other activities that will be impacted (such as certain planned silvicultural and road activities) as well as those contained in the Visual Landscape Section. To facilitate cross referencing, where this is required, the references appear in green blocks, an example being; (refer to Section PS 3.6). In this instance, this means Section 3.6 in the Planning : Silvicultural Practices Section. Green blocks have also been used for highlighting additional information, other than cross references. In cases where additional guidelines should be consulted, these guidelines appear in a bulleted format contained in a green block.

3.7 Annexures / Glossary

The Annexures at the back of the document provide additional information referred to in the body of the document as well as a glossary. With regards to the glossary, cognisance has been taken of the fact that English will not be the first language of a lot of the people reading this document and that not all the readers will have in-depth knowledge of the Industry and some of the terms used. As such, the glossary includes both technical forestry related terms (e.g. cable yarding) and rather more difficult "normal" English words which not all non-first language English speakers may be familiar with (e.g. contiguous). In order to make comprehension easier, certain words used in the definitions are in red letters. These highlighted words appear in the glossary themselves and can be looked up in their own right. An example of this appears below:

alien species	fauna or flora that do not naturally occur in a particular area, region or country (i.e. they are not indigenous species)

3.8 Checklists

Readers will find a series of "checklists" at the back of this document which cover the recommended environmental guidelines that need to be considered during both the planning and implementation phases of silvicultural, harvesting, road building or maintenance and multiple land use activities. It is suggested that these handy checklists be photocopied and waterproofed before use infield.

3.9 Additional Guidelines / More Detailed Information

In a publication such as this it has not been possible (nor the intention, for sake of repetition) to include all the detailed guidelines that should be followed in the forest engineering disciplines (i.e. harvesting, roads and transport). Only the most important guidelines are therefore covered. For those wanting far more detailed information it is recommended that they obtain copies of the following; Forest Engineering Southern Africa's (FESA's) publications; "Guidelines for Forest Engineering Practices in South Africa" and "Cable Yarding Safety and Operating Handbook".

4. ENVIRONMENTAL STATEMENT OF THE SOUTH AFRICAN FORESTRY INDUSTRY

4.1 Objectives

The South African Forestry Industry is committed to Integrated Environmental Management (IEM) to ensure that:

- Δ development takes place in the most economic and environmentally acceptable way;
- Δ resources are managed in a manner which will ensure the sustainability of the forestry enterprise; and
- Δ people on whom the Industry depends may work in safety and live under conditions of acceptable quality.

4.2 Principles

The South African Forestry Industry is committed to upholding the following Principles that are contained in the National Forests Act (Act No. 84 of 1998) and which are the driving force for Sustainable Forest Management (SFM) in South Africa. As quoted directly from the Act, these are as follows:

(3) The principles are that -

(a) natural forests must not be destroyed save in exceptional circumstances where, in the opinion of the Minister, a proposed new land use is preferable in terms of its economic, social or environmental benefits;

(b) a minimum area of each woodland type should be conserved; and

(c) forests must be developed and managed so as to -

(i) conserve biological diversity, ecosystems and habitats;

(ii) sustain the potential yield of their economic, social and environmental benefits;

(iii) promote the fair distribution of their economic, social, health and environmental benefits;

(iv) promote their health and vitality;

(v) conserve natural resources, especially soil and water;

(vi) conserve heritage resources and promote aesthetic, cultural and spiritual values; and

(vii) advance persons or categories of persons disadvantaged by unfair discrimination.

4.3 Values

Some of the values associated with the Principles of Sustainable Forest Management are:

Δ Soil	Soil quality, quantity and nutrient status
Δ Water	Water quality, quantity and wetland habitat
Δ Biodiversity	Species diversity, ecosystem function and important species
Δ Forest Health	Protection against pests, diseases and fire
Δ Economic	Optimal yield and value of timber and non-timber products and services
Δ Social	Occupational health and safety, training and human resource development, access to resources and opportunities and cultural values
Δ Research	Improved productivity and environmental management
Δ Legislation	Compliance

5. INTEGRATED ENVIRONMENTAL MANAGEMENT

5.1 What is Integrated Environmental Management?

Any planning process invariably leads to a decision that will ultimately have some impact (positive or negative) on the environment. The most important aspect is to recognise the fact that :-

FOR EVERY ACTION, THERE IS A REACTION

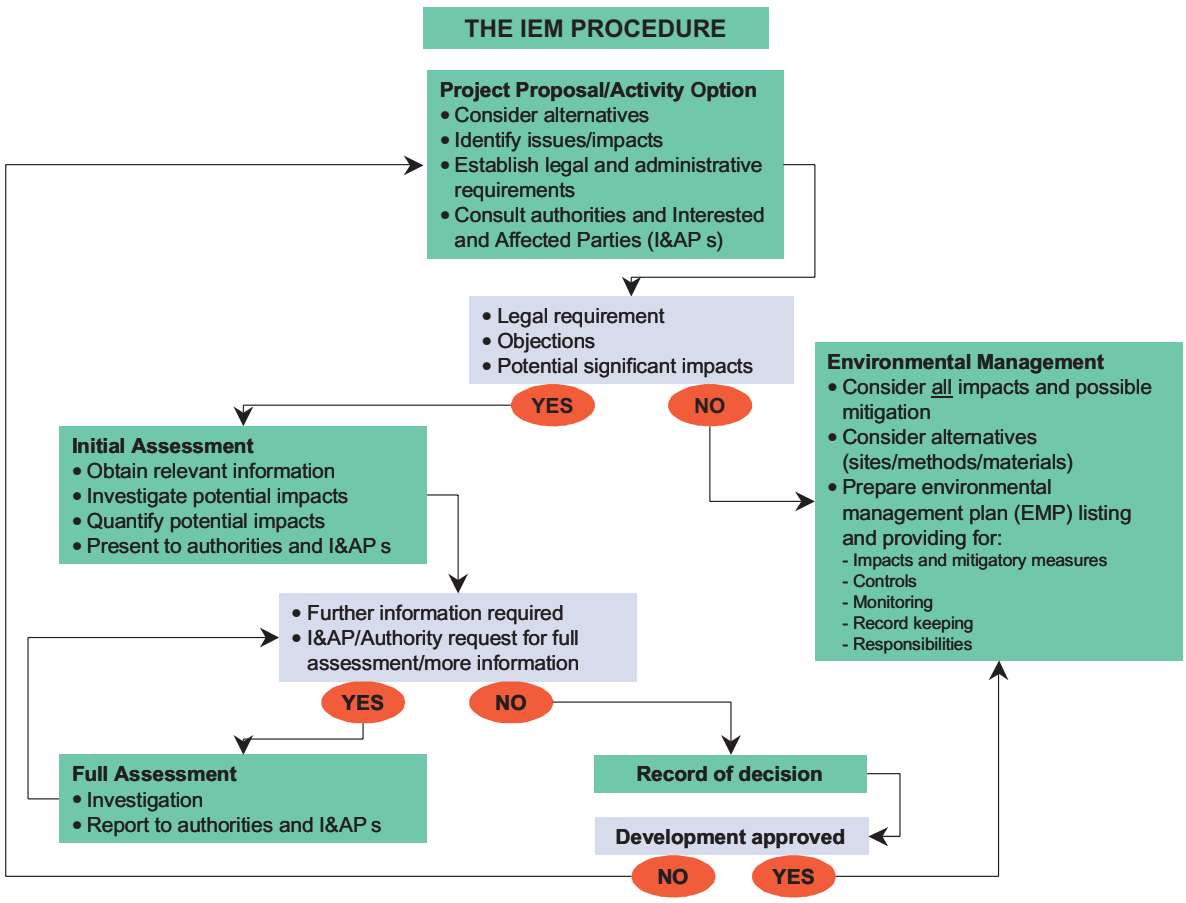
These decisions form part of everything we do in every aspect of our daily lives, be it the discarding of an empty bottle or the planning of a new plantation. The environment that is affected by an action will also "react" to it. This reaction may also result in a change in the human environment (social, political, economic, and cultural) and must be seen in the broadest sense. The basic objective of any proper planning in terms of the Integrated Environmental Management (IEM) process is to:

- Δ be properly informed on the reaction to an action - (i.e. what will happen?);
- Δ assess what can be done (mitigatory measures) to minimise or negate the negative and enhance the positive impacts of such an action; and
- Δ consider alternatives in terms of the options for the action or the place where the action will take place to minimise or negate the negative and enhance the positive impacts of such an action.

IEM is most effective when it becomes a way of doing things rather than merely a formal procedure to be followed as part of a specific project. Figure 1 1 below outlines the formal IEM procedure.

Figure 1 1

The Formal IEM Procedure



5.2 Environmental Impact Assessments (EIA's)

An EIA is the **formal** procedure that is followed to collect, organise, analyse, interpret and communicate data that are relevant to making a decision. The procedure can however be followed as an **informal** assessment for a project such as the planning of a harvesting operation.

Principles that a **formal** EIA should comply with are:

- **Informed Decision Making:** Decision making should be based on reliable information.
- **Accountability:** Responsibilities must be clearly defined.
- **Environment in the Broadest Sense:** The environment includes all aspects (i.e. physical, social, political, economic, visual).
- **Open Consultation:** Consultation with all interested and affected parties must be done in a transparent manner.
- **Specialist Input:** Specialists in the particular field must support impact assessments.
- **Alternatives:** Consider all possible alternatives in terms of location and activities.
- **Mitigatory Measures:** Assess mitigatory measures that will reduce or negate negative impacts and enhance the positive impacts of the planned activities.
- **Consider all Stages:** The assessment must consider all stages of the development, from the planning phase through to closure.

5.3 EIA in Terms of the Environment Conservation Act (Act No. 73 of 1989)

In terms of the regulations, published on 5 September 1997, under the Environment Conservation Act (Act No. 73 of 1989), it is a legal requirement that an EIA be undertaken before certain activities may commence. The National Environmental Management Act (Act No. 107 of 1998) also requires that an EIA be undertaken for any project that may potentially have significant environmental impacts. The following principles guide the implementation of the regulations:

The legislative process should be applied as early in the planning stages of the proposed activity as is practically possible and before irrevocable decisions are made, to ensure that environmental considerations are proactively incorporated into decision making.

Applicants are accountable for the potential impacts of activities being undertaken, for the management of these impacts and for supplying information on the process. Decision makers are accountable for decisions taken with regard to authorising identified activities.

Provision is made for the public to be involved in the process.

Although the full list is not provided here, activities that are most likely to be relevant to the Forestry Industry (especially those in **bold**) are:

(a) The construction or upgrading of:

- i) facilities for commercial electricity generation and supply;
- **ii) roads, railways, airfields and associated structures outside the borders of town planning schemes;**
- iii) cableways and associated structures;
- **iv) public and private resorts and associated infrastructure;**
- v) structures associated with communication networks, other than telecommunication lines and cables, as well as access roads leading to these structures;
- vi) canals and channels, including diversions of the normal flow of water in a riverbed and water transfer schemes between water catchments and impoundments;
- **vii) dams, levies or weirs affecting the flow of a river;**

viii) reservoirs for public water supply;
ix) schemes for the abstraction or utilisation of ground or surface water for bulk supply purposes; or
x) sewage treatment plants and associated infrastructure.

(b) The reclamation of land below the high water mark of the sea and inland water, including wetlands.

(c) The concentration of livestock in a confined structure for the purpose of mass commercial production.

(d) The intensive husbandry of, or importation of, any plant or animal that has been declared a weed or an invasive alien species.

(e) The release of any organism outside its natural area of distribution that is to be used for biological pest control.

(f) The genetic modification of any organism with the purpose of fundamentally changing the inherent characteristics of that organism (i.e. Genetically Modified Organisms or GMO's).

(g) The disposal of waste in terms of section 20 of the Environment Conservation Act (Act No. 73 of 1989).

(h) The change of land use from:
i) agricultural or undetermined use to any other land use;
ii) grazing to any other form of agricultural use; and / or
iii) nature conservation or open space to any other land use.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

VISUAL LANDSCAPE

1. INTRODUCTION

This particular Section is for information purposes only and does not represent any form of standard supported by Forestry South Africa.

87% of humans' perception is based on sight

Perception leads to awareness that can be either negative or positive. This awareness will affect the observer's attitude towards the land use.

Aesthetics can be defined as the branch of philosophy that deals with the nature and perception of beauty or the criticism of taste. Aesthetical appreciation is guided by objective perception (i.e. that which cannot be changed, such as light and a persons physical visual ability) and subjective perception (i.e. age, culture, past experience and motive). These two parallel processes lead to memory formation that ultimately presents cognisance, comprehension and thought.

Man, fauna, flora, water, land and **light** provide, through a combination of **mass** and **space**, a **perceived landscape,** a perception that can change over **time.**

Forestry activities in South Africa alter the visual quality and character of the natural landscape. These alterations usually reduce the variety with in, and visual penetration into, the landscape. Forestry also creates features with strong visual dominance.

Careful planning can reduce the negative effects of the alterations and provide a positive visual experience in the South African forestry landscape.

It is important to understand the important basic concepts of planning for the visual landscape.

Mosaic of species, age classes and habitats provide for enhancement and is aesthetically pleasing

2. BASIC CONCEPTS OF LANDSCAPE PLANNING

2.1 Character of the Landscape

Every landscape has a distinctive character (e.g. stony desert versus indigenous forest). The diversity within, and location of the landscape will determine the scale and character of any alteration that can be absorbed by the landscape. This is referred to as the landscape's **visual absorption capacity** (VAC). The VAC of a landscape is also determined by the relative location of the observer to the landscape (distance and tilt of landscape).

Landscape with a low VAC - small changes are immediately visible

Landscape with a high VAC - changes are not readily identifiable

Any change in the character of the landscape will be determined by the contrast that is created. **Contrast is created** through the characteristics of **form, line, colour, mass** and **texture** within the landscape. Any activity placed in that landscape will contrast or blend with the character of the landscape, and the aim is to manipulate these variables for effect.

Figure V 1

The Elements that Create Contrast

Form **Line** **Colour** **Mass** **Texture**

Contrast creates vision. This is achieved through the characteristics of form, line, colour, mass and texture within the landscape

2.2 Location of Observer in the Landscape

The longer an observer has to view a landscape, the more critical the observation will become. Landscapes viewed from a stationary position (e.g. a residential area) will be perceived with more criticism than those viewed from a moving vehicle, while a landscape viewed from a moving vehicle will generally have a higher VAC than one viewed from a stationary position.

The following need to be considered in the forestry landscape:

- Landscapes observed from public viewpoints have a low VAC and special precautions need to be taken in the planning of such landscapes and the placement of elements within that landscape.
- Harvesting operations should be scheduled from the farthest to the nearest point to such an observation site. This prevents expansive harvested areas being visible at any one time.
- Slash left after a harvesting operation contributes significantly to negative perceptions. In visually sensitive landscapes, screening can reduce this impact. Permanent screens would include belts of indigenous vegetation which would hide forestry operations, and temporary screens could be made by leaving a strip of trees standing until the compartments have been re-established.

2.3 Scale and Spatial Arrangement

Scale is the size of an element relative to either the whole landscape and or to the position of the observer. The relative scale and thus contrast of an element or activity within a given landscape will depend upon the scale of the landscape; its character (e.g. the diversity within the landscape) and the distance from which that landscape will generally be observed. Consider the following when determining the placement (or removal) of an activity or element in a landscape:

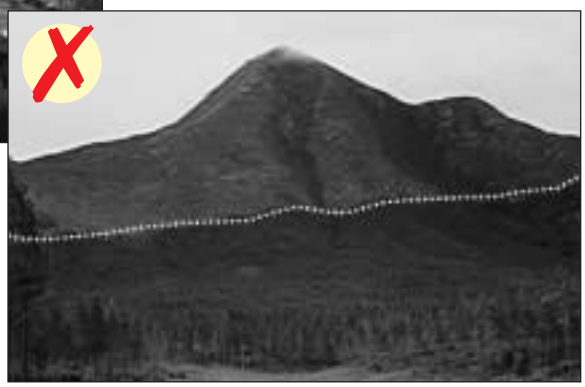
- A ratio of 1:3 normally provides visual balance. The activity or element may be either value in this ratio.

Figure V 2

Ratio of Elements Within a Landscape

DESIRABLE

Landscape broken into thirds creates better visual balance



UNDESIRABLE

Visual balance lacking due to landscape broken into two equal parts

- Variety can be provided by using species that are texturally different, e.g. different Pinus species.
- Variation and interest can be improved by introducing species with attractive autumn colours in selected areas of the landscape.
- In a flat landscape, elements or planes with varying heights can be used to break monotony and increase variety. Attentive clearfelling schedules next to public roads can assist in this.
- The visual dominance of ridge-tops requires that they be treated with special care.
- The impact of removing elements from a landscape can be dramatic. The spatial arrangement of such removals should prevent what is referred to as a "moth-eaten" landscape. Harvesting activities can have this impact and this should be considered when scheduling the clearfelling of areas.

2.4 Linear Arrangement

A tangent plane occurs between two starkly contrasting elements in the landscape (e.g. where sky and ridge meet, and at compartment boundaries). These planes often have strong visual dominance and a low VAC. Linear elements, such as roads, firebreaks, and powerlines, also have strong visual dominance in the landscape.

The following should be considered when they are designed and placed:

- Use natural features such as watercourses to define boundaries, as these are generally more pleasing to the eye than straight lines.

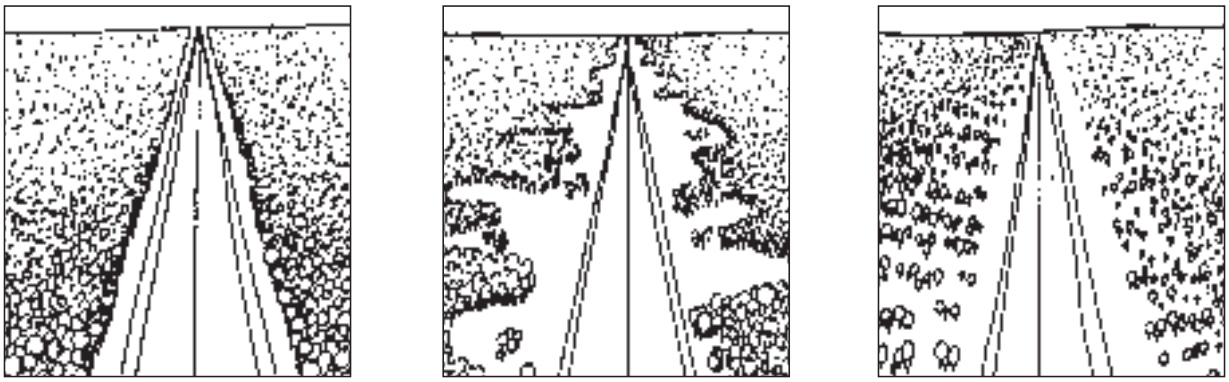
Land use fitted to the topography of an area is immediately more visually attractive and accepted. This can be achieved by using natural features to define boundaries

- Horizontal boundaries that follow the contour create a straight line when viewed from a distance.
- Where practical, the natural pattern of the land should be complemented when placing horizontal boundaries.
- Horizontal and vertical boundaries can be softened by using a gradual change in texture from one element to the next.
- To reduce the visual dominance of a feature crossing a ridge, the crossing should be at the lowest contour with a diagonal approach to the ridge.
- Elements with unrelieved gradients are observed as a straight line from a distance.
- Disturbances on southern aspects (in the Southern Hemisphere) are often less visible as they are observed under poorer light conditions, with the sun usually in the background.

- Continuous edges with little diversity and/or relative spatial change, such as plantations on road edges, create a monotonous experience. This tunnel effect can be broken up by alternating vertical edges or by creating openings in the "tunnel" to provide for the viewing of special landscape features and penetration to adjacent landscapes. Diversity can also be brought into the road edge by planting trees in groups to provide variation in colour, texture and form. Pockets of indigenous vegetation can serve the same purpose.
- Rock and soil exposed by activities such as road building create visually dominant features in the landscape. Where other treatment is not feasible, roughening of such surfaces provides for less directly reflected light and less visual dominance. In extreme cases, colouring of such surfaces can reduce contrast.

Figure V 3

Diversity Along Road Edges



UNDESIRABLE
Monotonous viewscape with little visual penetration

DESIRABLE
Variety with changing visual penetration

DESIRABLE
Textural variety with maximum visual penetration

2.5 Visual Penetration

The level of visual penetration into a landscape can have an effect on the observer's perception. Where the level is too low, the perception will be negative, and a landscape with high-density formal tree planting will leave the observer feeling "uncomfortable". To optimise this perception:

- an espacement of 300 **mature** tree stems per hectare provides good visual penetration and a "comfortable" spatial experience. This is especially important in plantings situated close to recreational sites, viewing sites and hiking trails.

Low stem density provides good visual penetration and thus a positive experience

High stem density provides poor visual penetration and thus a negative experience

2.6 Man-made Structures

Structures such as buildings, towers, reservoirs, and bridges often become visual focal points. Their design and location in the landscape should be carefully considered.

- The structure and design of a building is often more important than the material used to construct it. The use of natural materials (e.g. timber, stone and grass) does not necessarily create a building that is aesthetically acceptable. Where such structures are to be placed in a visually sensitive landscape, professional assistance should be used for the design.
- When locating service areas and villages, consider the visual impacts of these as well as the level of comfort they will provide to the inhabitants.
- Towers and lookouts often have to be placed in visually prominent locations, so their designs should complement the surrounding landscape. A specific choice between lattice and solid structures will have to be made and this will depend on the character of the landscape and the location of the structure. Green and grey colours normally blend best with the plantation environment. Structures with a rough texture will also have less contrast with the natural environment.
- Signage should be informative and clearly visible but should not dominate the landscape. Choice of location (a solid background), colours and size should be carefully considered. Signage that provides a lot of information should be carefully designed to prevent "visual pollution".

2.7 Unique Landscapes

Unique landscapes, or landscape features such as waterfalls and rock formations, contribute significantly to the positive experience of an observer. To protect these landscapes, the following should be considered:

- Aspects that contribute to the uniqueness of the landscape should be identified, conserved and not obscured.
- Any activity that would visually intrude on such a landscape or feature should be carefully planned and executed to minimise physical and/or visual negative impacts.
- Krantz edges and rocky outcrops are often more bio-diverse than the immediate surroundings, and generate interest in the landscape. They should not be obscured by commercial tree planting or weed encroachment.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

PLANNING:
SILVICULTURAL PRACTICES

1. MAPS

It is important to refer to maps at an appropriate scale (e.g. 1:10 000) which indicate various features of the area. The orthophoto maps available from the Surveyor General's office of the Department of Land Affairs are very useful in this respect. The maps should be consulted to identify:

- location of existing infrastructure, such as roads, firebreaks, and villages;
- existing plantations;
- contours; and
- site classification elements (e.g. soil, climate and topography).

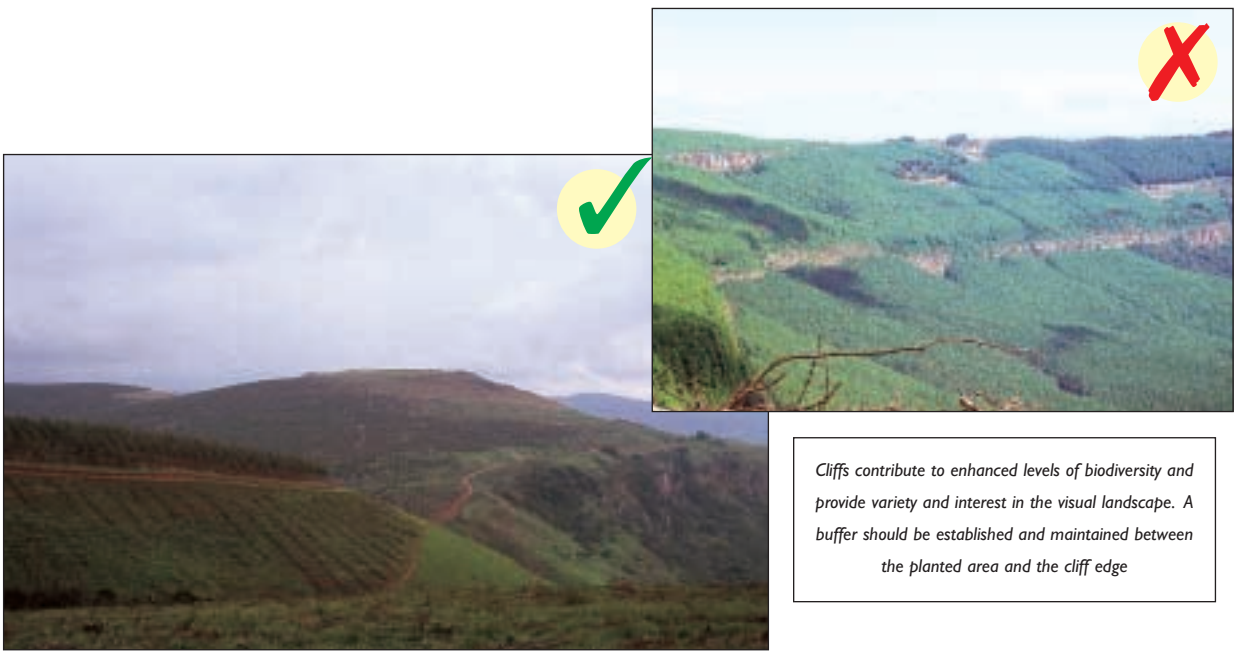
The maps will assist in deciding on:

- Δ areas that are suitable for afforestation;
- Δ site specific management requirements;
- Δ slope restrictions (to determine the site preparation method to be used);
- Δ the demarcation of Special Management Zones (SMZ's);
- Δ the choice of appropriate harvesting systems; and
- Δ the location of new infrastructure.

SPECIAL MANAGEMENT ZONES (SMZ'S)

Special Management Zones (SMZ's) are areas within the plantation which contain features that are natural or man-made, and which require particular management strategies due to their scientific, ecological, paleontological, archaeological, historical, traditional, aesthetic or recreational values.

To ensure the protection of these areas, particular management strategies and planting restrictions are associated with each SMZ. **An SMZ is considered a no-go area**. As such, no activity may be conducted in an SMZ other than for its maintenance or wise use. SMZ's also serve as sites of scientific importance, such as functional natural ecosystems, and should be conserved for demonstration and study.



Cliffs contribute to enhanced levels of biodiversity and provide variety and interest in the visual landscape. A buffer should be established and maintained between the planted area and the cliff edge

2. SMZ's : CLIFF EDGES AND ROCKY OUTCROPS

- These areas often have higher levels of biodiversity and are aesthetically important features. Planting should not be closer than 30 metres (approximately one tree length) from the edge of a cliff or **significant** rocky outcrop which is larger than 0.25 hectares. To facilitate practical management of SMZ's, they should be separated from the planted area by a road.

3. SMZ's : WETLAND AND RIPARIAN HABITATS

The guidelines given below are taken from the latest draft (June 2001) of the "Wetland/Riparian Habitats : A Practical Field Procedure for Identification and Delineation" document, as subsequently amended by DWAF's Wetland and Riparian Zone Policy Committee. Refer to Annexure J for an abridged version of the procedure. This provides the information needed and the procedure to use to be able to identify and delineate the outer edges of both wetland and riparian habitats. From this edge an appropriate buffer strip can be determined.

3.1 The Wetland and Riparian Buffer Strips

A buffer strip surrounding a wetland or riparian habitat is required to protect the habitat and the water resource. The buffer strip will depend largely on:

- Δ the type of land use;
- Δ the sensitivity of the wetland/riparian habitat; and
- Δ the scarcity/quality of the water resource.

It is thus recommended that the following guidelines be followed.

- For deep rooted crops such as commercial forestry species, a 20 metre buffer strip should be established from the outer edge of the temporary zone of a wetland or from the outer edge of a riparian zone.

The reasons for this are the following:

i) From a water resources point of view, the primary purpose of the buffer is to minimise the impact that water use by deep rooted crops would have on the dynamics of the saturated zone in the wetland/riparian area. The state of the saturated zone at any time plays an important role in determining the amount of run-off that would result from a particular rainfall event.
ii) The second purpose of the buffer from a water resources perspective, is to reduce access by crop roots to shallow low-tension water in the wetland/riparian soils which would result in evapotranspiration by the crop at the potential rate for most of the year.
iii) It is precautionary principle that is also practical to implement.
iv) It minimises the impact of the land use practice on hydrological processes in the wetland/riparian habitat.

- To ensure the effectiveness of field practice and to allow for biodiversity considerations (refer to Section PS 3.2), the buffer zone should be implemented on a "give and take basis" - there could be specific cases for widening or narrowing of the buffer strip.

- In the case of deep rooted crops, any deviation from the 20m width must be substantiated and documented in an auditable format that is available to the Responsible Authority, as defined in the National Water Act (Act No. 36 of 1998), or registered certification bodies such as the International Organization for Standardization (ISO) and Forest Stewardship Council (FSC).

- Wherever possible, the buffer should tie in with the layout of valley bottom roads (cut-offs) to provide a practical boundary for the maintenance and weeding of riparian habitats. This strip should not be used for land use practices other than for fire protection and carefully constructed roads (preferably grassed). Existing roads that cannot be relocated because of practical and economic reasons must be drained in a manner that is not detrimental to the wetland/riparian habitat.

- Refer to Annexure J for further details.

3.2 The Biodiversity Buffer Strip

In determining the biodiversity buffer, distinction must be made between existing land use and new land development, as there can be enormous socio-economic implications when changing the existing land use to accommodate biodiversity. Refer to Annexure J for further details.

a) Determination for new land development

- Permission to break new land or to significantly change land use is now governed by a number of Acts of which the Conservation of Agricultural Resources Act (Act No. 43 of 1983), Environment Conservation Act (Act No. 73 of 1989) and the National Environmental Management Act (Act No. 107 of 1998) are the most important. In terms of this legislation, any new land development, and specifically afforestation, must be permitted and such a permitting process may require a public Environmental Impact Assessment (EIA) to be undertaken.

- These EIA's, and where appropriate, the mitigatory measures, will determine restrictions on such permitted afforestation. These requirements will differ in terms of the biophysical attributes of the area in question and the conservation importance thereof.

b) Determination for existing land use

- Reducing existing areas of land use for buffer areas for either water resource or biodiversity purposes may have significant socio-economic impacts. This should be considered as part of the process of buffer delineation and it should be ensured that the net benefit for water and/or biodiversity is fully justified.
- By way of contrast, any land use that warrants a reduction in buffer area must meet the full social, economic and environmental criteria. It is therefore crucial that all cases for additional/reduced buffer areas within existing land use should be assessed on an individual (site-specific) basis. Where there is uncertainty about potentially important biodiversity aspects, the relevant regulators and environmental NGO's must be consulted.
- The removal of trees from wetland or riparian habitats should also endeavour to provide corridors for the linking of areas of conservation significance such as grasslands and indigenous forests.

4. SMZ's : ARCHAEOLOGICAL, CULTURAL AND TRADITIONAL SITES

A large buffer may enhance the quality of the site, as is the case with the buffer around these Afro-Indian ruins

These sites are protected in terms of the National Heritage Resources Act (Act No. 25 of 1999). They may not be destroyed, damaged, disfigured, excavated, altered, removed from their original site or exported from the Republic without a permit from the South African Heritage Resources Agency (SAHRA).

Such sites may also include grave sites, historical plantings, buildings older than 60 years, ruins, or any other signs of human habitation (e.g. rock paintings).

- A buffer of at least 5 metres should be maintained around these sites. If there is potential for damage during operational activities, this distance should be increased to exclude such impacts.

5. SMZ's : SPECIES OF SPECIAL CONSERVATION SIGNIFICANCE

These include those species identified in the Red Data species lists or by a particular Provincial Conservation Agency. For the effective conservation of these species, their presence should be identified and mapped, and appropriate management prescriptions and monitoring programmes initiated.

- Most raptors are legally protected species.

- Plantation trees with active nests of birds of prey should be left in a buffer of surrounding trees and recorded, mapped, marked infield, and should not be disturbed. Compartments with known nesting sites should not be harvested during the breeding season. However, if a new bird nesting site is identified before or during harvesting or road construction operations, it is important to :
  - alert competent and relevant authorities if the species is of conservation significance (e.g. protected species);
  - map and document the scientific and ecological values; and
  - protect the site from accidental damage by indicating it clearly on the ground. Care should be taken to prevent such indicators or signage compromising the protection of the site.

6. SMZ's : INDIGENOUS FORESTS

6.1 Legal Protection of Indigenous Forests

The National Forests Act (Act No. 84 of 1998) defines a "natural" or indigenous forest as being:

- a group of indigenous trees (i.e. two or more);
- whose crowns are contiguous (i.e. where a closed canopy exists); or
- a forest which has been declared as such by the Minister.

In terms of Section 7 of the Act it is illegal to cut, disturb, damage or destroy indigenous trees in or to remove or receive them from an indigenous forest unless:

- a licence to do so has been issued by the Minister; or
- the Minister has issued an exemption.

Given the above, and the fact that no general exemption is in force for commercial forestry operations, it is recommended that the following flow chart, shown in Table PS 9 below, be used as a guideline to determine under what circumstances an indigenous forest or tree can be removed.

Table PS 9

Flow Chart to Determine When an Indigenous Tree or Forest can be Removed

<table>
<tr><th colspan="2">Criteria 1</th><th colspan="2">Criteria 2</th><th>Outcome</th></tr>
<tr><td colspan="5">Apply criteria from left to right</td></tr>
<tr><td rowspan="3">Indigenous Forest (i.e. containing at least two indigenous trees whose crowns are largely contiguous)</td><td>Yes</td><td colspan="3">Protected Forest
Must apply for a licence to remove it</td></tr>
<tr><td rowspan="2">No
(i.e. single tree)</td><td rowspan="2">Tree is a protected species</td><td>Yes</td><td>Protected Tree
Must apply for a licence to remove it</td></tr>
<tr><td>No</td><td>Non-Protected Tree - Can be removed without obtaining a licence to do so</td></tr>
</table>

Note: i) An application for a licence must be made to one of DWAF's Regional offices.
ii) This only applies to indigenous trees.

6.2 Buffers

- At the time of establishment or re-establishment, a buffer of at least 5 metres should not be planted around the edge of any indigenous forest. This buffer must be kept free of weeds and the indigenous vegetation which exists or regenerates must be protected. Where the indigenous forest invades the buffer zone, it is important to maintain the plantation boundary as demarcated.
- Should there be potential for damage of the forest edge during operational activities, the boundary should be increased. The buffer zone thus established may be used for no other activities, and roads should not be built in them.

7. FIRE PROTECTION

Fire protection is not only a legal requirement of the National Veld and Forest Fire Act (Act No. 101 of 1998) but is also necessary for fire insurance purposes. It is strongly recommended that this Act and your local Fire Protection Association, if there is one, be consulted prior to any fire protection activity (especially the burning of firebreaks) being undertaken.

7.1 Fire Management Plan

Adequate and appropriate fire management strategies are imperative to ensure that the forest resource, together with its ecological and other associated values, is protected. A fuel management plan, which considers the management of plantation debris can be a useful tool. This technique is used to reduce the fuel load present under both immature and mature trees, thereby limiting the spread of fire. However, special precautions and expertise are needed to develop and implement this tool.

The following strategies should be included in a fire management plan.

- A well planned firebreak system.
- A fire protection system.
- A resources management system (including equipment, communications, and training of personnel).
- Fire fighting safety policies and procedures.

Fire protection systems should be designed to limit environmental and aesthetic impacts by:

- planning burning operations to comply with statutory restrictions as notified in the Government Gazette; and
- limiting firebreaks to the minimum number that can achieve the above objectives.

7.2 Firebreaks

7.2.1 Legal obligations and requirements

The National Veld and Forest Fire Act (Act No. 101 of 1998) places a legal obligation on landowners on whose land a veld fire may start or from whose land it may spread, to prepare and maintain firebreaks on the boundaries of their property. If the landowner intends to maintain the firebreak by burning, the **following legal requirements must be adhered to:**

- The landowner must agree a mutually acceptable date / dates to burn with all adjoining landowners and must inform the local Fire Protection Association (FPA), if any, of this / these dates.
- If no agreed date / dates can be reached then all adjoining landowners and the FPA, if any, must be given 14 days written notice of the intention to burn (fire danger rating permitting).
- All adjoining landowners who have either agreed to a date / dates or have been informed of the date / dates to burn:
  - must also burn their firebreaks on the boundaries concerned on the same date / dates; or
  - be present in person (or through an agent) and ensure that sufficient people are present on his or her side of the boundary to control the spread of the fire.
- If, for whatever reason, the burning could not be done on the stipulated date / dates, all adjoining landowners and the FPA, if any, must be notified of this fact (no new written notice is required for any additional dates needed to undertake the burning).

- If a landowner intends to be absent for a period of more than 14 days during the period in which burning normally takes place, he or she must supply all adjoining landowners with a contact address and telephone number (a landowner can however carry out burning if the adjoining landowner is not present or has not supplied any contact details)
- A landowner cannot carry out burning if:
  - the FPA objects to it;
  - a fire danger warning has been issued for that particular area; or
  - weather conditions are not conducive to burning.

In terms of the Act, the legal requirements for a firebreak are that:

- it must be wide enough and long enough to have a "reasonable" chance of preventing a veldfire from spreading to or from neighbouring land;
- it does not cause soil erosion; and
- it is "reasonably" free of inflammable material capable of carrying a veldfire across it.

7.2.2 Operational guidelines

The current system of external firebreaks on the plantation boundaries with an internal firebreak system is not always the most efficient and cost-effective system. A new system has been developed which, in most cases, is cheaper to maintain and much more effective. This new regional fire protection approach is referred to as "Dynamic Fire Protection". The system is based on fuel load management, and its purpose is to create a pattern of adjoining areas that have no fuel or a reduced fuel load that will stop a fire or reduce it to that of a moderate fire and serve as a buffer zone from where successful ground and aerial fire fighting can take place.

Points to consider when creating firebreaks are as follows.

- Where possible, use firebreaks wide enough to permit burning each half in alternate rotations, where mowing cannot be practised.
- Be aware that areas to be burnt, which are greater than 10 hectares in size, may require additional cut-off breaks.
- Establishment of firebreaks on steep slopes should be avoided. However, if there is no other viable alternative, the clearing methods to use, in order of priority are mowing, slashing, burning, desiccant chemicals, manual hoeing and, as a last resort, mechanical methods.
- Desiccant chemical treatment of tracer belts prior to burning should be applied on alternate strips.
- Ensure adequate water provision at the location of the fire.
- Avoid using firebreaks as landings and depots during periods when there is a high risk of fire.
- Remove or treat invasive plants before burning.

7.2.3 High fire risk areas

Villages, road verges, power lines, rubbish dumps, recreation sites and sawmills are high fire risk areas and are prone to uncontrolled burning.

- To decrease risks, fire protection of these areas must receive priority through:
  - having adequate fire fighting personnel on hand to protect these areas;
  - reducing the fuel load present; and
  - maintaining them during times of danger.
- Before the commencement of burning operations, take note of weather forecasts, and the Fire Danger Rating Index.

7.2.4 Use of natural features and roads for firebreaks

- By using roads and natural features in the landscape as the boundaries for firebreaks, both the physical and aesthetic impacts of firebreaks can be reduced or negated.

Using natural features for firebreak boundaries lessens their visual impacts

7.3 Provision of Adequate Access

Provision of adequate access reduces the risks of fire to human life and infrastructure, hence the importance of the following guidelines.

- Roads should be readily accessible during the fire season and provide permanent, well marked, easy access to the location of the fire.
- Signs should be used to assist those fighting the fires and to warn them of cul-de-sac (dead-end) roads.
- During the fire season, all roads should have a minimum fuel load to assist in stopping a fire or reduce it to that of a moderate fire from where successful ground fire fighting can take place.
- Should roads be closed during harvesting operations or for maintenance, signage to this effect must be erected and anyone who may be affected must be informed well in advance.

7.4 Veld Burning

Fire is an important ecological factor in the management of many vegetation communities. Burning programmes should thus adhere to the following guidelines.

- Statutory restrictions on season of burning must be observed.

- Generally, fynbos should be burnt in autumn and grassland in autumn, winter or early spring (when dormant) or according to prescriptions set out in a burning plan.
- Mosaic, irregular burning every one to three years is preferable. Alternatively, if fire is to be used to facilitate access to a heavily weeded area, it should be ensured that a silvicultural operation is conducted at an appropriate time after the burn, while access is still possible.
- Invader plant control operations should precede burning, but any chemical control measures should take place well in advance of the burn to ensure the efficacy of the active ingredient.
- Burning of wetlands should be on an irregular, partial, rotational basis and timed to avoid the peak breeding seasons of wildlife, particularly those of cranes which breed in winter.

8. SITE-SPECIES MATCHING

The requirements of the species should be matched to the characteristics of the site to ensure optimum yields, quality and economic benefits. The following should be considered:

8.1 Soils

The primary aspects of matching species to soil characteristics include:

- **Parent material:** The geology or lithology from which the soil has formed determines its direct characteristics, and indicates the characteristics of the deeper soil horizons.
- **Soil form:** This indicates the characteristics and arrangement of the horizons that make up the soil profile, for example Hutton, orthic A over red apedal B; Kroonstad, orthic A over E horizon over G horizon.
- **Soil depth:** This is often referred to as the "effective rooting depth" (ERD) and provides an indication of the volume of soil available to the tree.
- **Soil texture:** This refers to the relative proportions of sand, silt and clay and provides an indication of the moisture holding characteristics of the soil.
- **Soil wetness:** The soil wetness hazard (refer to Annexure E) provides an indication of the frequency that a soil is periodically saturated. Species differ in their ability to tolerate wetting and drying of the soil.

8.2 Climate

Climate plays a vital role in determining the suitability of a particular species to a site, in terms of:

- temperature (minimum, maximum and mean);
- rainfall (distribution, intensity and mean);
- altitude; and
- slope and aspect.

8.3 Monoculture Landscapes

Monoculture landscapes pose a risk in terms of disease and fire, which are heightened when single clones are utilised.

- If monocultures are unavoidable, a variety of age classes are suggested to reduce risk and improve the general aesthetics.

8.4 Weed Potential

Trees should not be planted or allowed to grow where they cannot be adequately managed and harvested. This applies particularly to steep and inaccessible areas. Trees should also not be planted on marginal sites, such as sites with shallow soils, or dry aspects. Where profitability is questionable and the impacts on the natural environment are potentially significant, plantings should be avoided.

- Where plantations have the potential to spread seeds into areas such as cliffs, species such as *P. elliottii* should preferably be used above or next to such features as they have relatively low "invasive" characteristics.

8.5 Water Use Efficiency

As water is a scarce resource, the water efficiency of the chosen species should be considered.

- Efficient species and clones should be favoured.
- As a general rule the order of preference in terms of water use efficiency is:
  - pine sawlog rotation;
  - gum sawlog rotation;
  - pine pulp rotation; then
  - gum pulp rotation.

9. HARVESTING SYSTEM

Prior to establishment, it is necessary to acquire a thorough understanding of the products that the plantation will produce. The selection of the most appropriate harvesting system to implement is influenced by the following:

9.1 Products

- Optimise the use of the site to ensure that all the timber grown on the site is used, thus eliminating waste. Consideration should be given to the types, volumes, and dimensions of the products that are to be harvested.

9.2 Harvesting System

The environment should determine the type of harvesting system to be used. When choosing the most appropriate system, consideration should be given to:

- terrain conditions;
- weather conditions;
- extraction routes;
- timetables; and
- yarding sites.

- Refer to Section PH 2.2 for guidelines regarding the selection of the most appropriate harvesting system for the site.

9.3 Terrain and Topography

- To minimise erosion and compaction of the site, terrain classification should include soil conditions (dry, moist or wet), ground roughness, slope, aspects and gradient.

10. ROADS

The exposed surfaces of roads are the main source of sedimentation in the plantation environment. By restricting this disturbance as much as possible, this impact and the loss of productive land can be reduced.

10.1 Road Density

- Transport systems, costs and maintenance requirements, and environmental impacts can be minimised by linking compartments and optimising road density according to the terrain and extraction routes.

10.2 Landings

To avoid unnecessary soil erosion, sedimentation, loss of productive land and negative visual impacts, landings should:

- be as small as practicably possible;
- be situated away from wetlands;
- not be situated in firebreaks (unless absolutely necessary);
- not be situated in power line servitudes where there is a danger of flash-back; and
- be situated on gentle slopes (3 to 6%) or have sediment traps to facilitate drainage.

10.3 Depots

To avoid unnecessary soil erosion, sedimentation, loss of productive land and negative visual impacts, in addition to the requirements for landings, depots should comply with the following:

- new depots should be situated at least 40 metres away from wetlands; and
- existing depots that are closer than 40 metres to a wetland should be closed and rehabilitated. If this is impractical then they should be managed in such a way as to prevent negative impacts.

10.4 Gravel Pits

Gravel pits can cause long-term visual impacts, soil erosion and water quality deterioration. Guidelines to avoid these problems are:

- plan properly to provide for optimum use (e.g. plan correct drainage);
- plan to facilitate successful eventual closure (e.g. store topsoil for rehabilitating pits);
- situate pits where they have the least visual impact (e.g. use trees as a screen or locate pits behind a natural barrier);
- locate pits away from areas where they could cause the deterioration of streams or watercourses; and
- rehabilitate and revegetate pits when they become redundant.

10.5 Redundant Roads

- When roads are no longer required, they should be rehabilitated, and revegetated if possible. This will limit erosion from road surfaces and optimise the land used for productive plantations.

11. LAND PREPARATION

Adequate soil preparation promotes rapid early root growth and produces even stands by facilitating optimum water and nutrient uptake. Adhere to the general rule of **"doing as little as possible to gain as much as possible"**. Information required for selecting the correct method of land preparation includes:

- Δ site factors, as indicated in Annexure C;
- Δ financial concerns in terms of the preparation cost and the long-term site productivity; and
- Δ future harvesting and extraction requirements (e.g. traversibility of mounds and ridges).

11.1 Stand Density

Stand density, or espacement, refers to the distance between planted trees. A closer espacement will promote earlier crown closure and, consequently, earlier weed suppression, but it also induces earlier competition between trees. Stand density is determined primarily by the following factors:

- Δ the desired product or species grown;
- Δ the length of the rotation of the stand;
- Δ the thinning regime employed; and
- Δ site potential.

11.2 Size of Clearfelling

The "size" refers to the area of plantation that is clearfelled, and can consist of one compartment or a number of adjacent compartments. The size and location of the original compartments usually determines the size of the eventual clearfelling. This factor has a pronounced effect on the visual landscape and should be considered in terms of the guidelines given under the Visual Landscape Section.

Clearfelled areas may have the following potential negative impacts which should be considered when planning the harvesting of a compartment.

- Δ Increased surface water run-off with increased erosion and subsequent sedimentation of watercourses.
- Δ Exposure of indigenous forest edges, previously protected by the plantation, to wind damage.
- Δ Destruction of habitat of faunal species that use plantations for cover, nesting and foraging.
- Δ Destruction of corridors used by faunal species.
- Δ Creation of localised areas with high dry fuel matter that increases the risk of fires with potentially devastating *in situ* impacts on soil quality. Facilitation of containing and combating such fires is determined by the size of the area that carries the fuel.

Size of clearfelling can have a pronounced impact on the visual landscape if too large. The effects on the catchment should be decided before deciding on the size of clearfelling

Planning tends to focus on the consolidation of harvesting compartments into larger units that lend themselves better to mechanised harvesting and more economical transport operations. However, the size of the clearfelling should also be considered. The total area clearfelled within a catchment, and its associated effects, is dependent on topography, soils and climate, which will differ greatly between regions and landscapes. The extent of this area and its effects on the catchment should thus also be taken into consideration when deciding on the size of clearfelling. Even if this information is not readily available, the size of the clearfelling should be decided on a case-by-case basis and, depending on the above variables, the following guidelines should be adhered to as far as possible.

- Clearfelling areas should be separated sufficiently to provide buffers serving as sedimentation traps and escape routes or havens for fauna.
- Within a catchment that feeds a permanent watercourse, no more than one third of the catchment should be clearfelled within a two-year period.

- Reference should also be made to the Visual Landscape Section for further details.

11.3 Steep Slopes

Forestry is very often concentrated in the steeper areas within catchments. Steep slopes are the least stable of all terrain types and, when coupled with a low soil-clay-content (less than 15%), disturbance in such areas carries potentially high environmental costs.

Physical disturbance can be caused by:

Δ silvicultural operations (pitting, fertilising, spraying);

Δ harvesting operations (thinnings and clearfelling); and

Δ road construction for access and transport, which poses the most serious potential environmental risk.

The **steeper** the area,
the **greater** the road construction costs (more earthmoving and more drainage necessary),
the **greater** the silvicultural and harvesting costs,
the **greater** the transport costs and
the **greater** the environmental costs (such as loss of catchment function, potential erosion and land sliding)

The negative aspects of the afforestation of steep and very steep slopes are:

Δ extremely high erosion risk areas. The velocity and erosive power of the surface run-off water increases with the degree of slope;

Δ mechanical site preparation (e.g. ripping) is not possible;

Δ harvesting costs are increased, since:

- mechanised felling is impossible and extraction by cable yarding is necessary;
- permanent landings will involve extreme earthmoving, and roadside landings limit the efficiency of the extraction process (space availability); and
- precision directional felling (e.g. the use of felling wedges and/or winching of trees) becomes vital.

Δ increased road building and maintenance costs;

Δ greater soil disturbance by road building. The volume of soil that needs to be moved increases **exponentially** with an increase in slope. The greater the soil disturbance, the greater the environmental impact;

Δ greater vehicle operating costs with regard to transport;

Δ increased safety hazard of operating in very steep areas;

Δ roads in steep areas have a greater negative aesthetic impact on the landscape due to the volume of earthmoving required. The scars from such roads are permanent and the rehabilitation of such roads is almost impossible; and

Δ fires spread rapidly uphill and fire fighting operations on steep slopes are difficult and extremely dangerous and can lead to injuries and loss of life to humans and animals.

The slope classes according to the National Terrain Classification System for Forestry (Erasmus, 1994) are provided in Annexure E and should be consulted.

In light of the increased environmental and operational costs of not only the logging operations, but also the **impact of road construction**, the financial viability of the afforestation of steep and very steep slopes (i.e. slopes of greater than 35%) must be critically assessed in terms of the following guidelines:

- Slopes of 35-60% may be considered for afforestation only if:
  - the soils are more than 60 cm deep (the greater the depth the more stable the slope);
  - the erodibility of the soil is low (refer to Annexure D). As a guideline, the soil should have a clay content of more than 15%;
  - ground conditions are very good to moderate under dry-moist conditions (1-3, in terms of the National Terrain Classification System for Forestry - Annexure E); and
  - access roads are constructed on flatter terrain (e.g. at the base of the slope). Any roads that need to be constructed in very steep areas (greater than 60%) should be constructed using the end hauling method to create a full bench (removal of all road debris) as opposed to cut and fill. The "fill" would be unstable, making the scar worse and difficult to vegetate. The topsoil must be kept to re-surface and revegetate the cut-bank and side-drains.
- Areas with slopes greater than 60% should only be afforested where:
  - specialist input has been acquired;
  - special road requirements and restrictions can be adhered to; and
  - special harvesting requirements and restrictions can be adhered to.

  - (Small patches of trees (less than 1 ha in size) occurring within the compartment to be planted can however be excluded from this rule.)

11.4 Ripping

The preparation of a site for the growing of commercial timber plantations may determine growth rates for the entire rotation and rotations to come. At the same time, operations must be cost effective as initial costs are compounded over an extended period. Mechanical site preparation methods that till the soil (e.g. discing, bedding, or ripping) are used to improve adverse conditions such as compaction, grass and weed competition and to enhance tree growth. This can alter the soil's physical and chemical properties by rearranging the upper soil horizons, rocks and organic matter. If properly applied, site preparation can positively affect plantation establishment and subsequent productivity. However, they can adversely affect long-term site productivity, with associated negative financial impacts, if the incorrect techniques are used with little regard for potential site-specific impacts. Natural processes are usually sufficient to improve the conditions of many soils without disturbing the soil layers. These processes include wetting and drying cycles, exudates from root and microbes and the creation of biopores.

Ripping should be done along the contour to prevent erosion

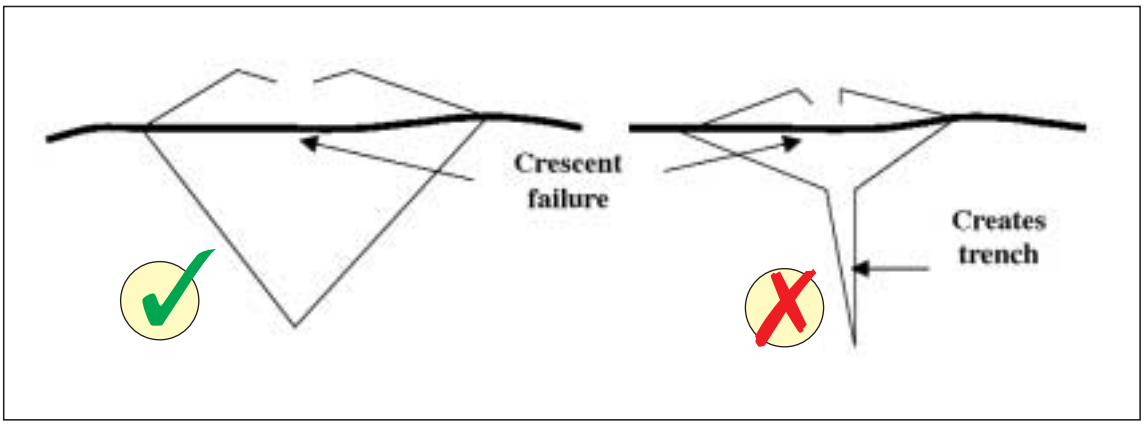
Biological tillage involves the creation of biopores by plant roots and soil fauna for use by subsequent crops. Intensive tillage disrupts this process, often resulting in unstable and less productive soils. The following guidelines are therefore recommended:

- Do as little as possible to achieve the desired effect; and therefore
- Minimal tillage and disturbance of the soil should be standard practice.
- The method of land preparation used should be determined by the site factors.

- The Tables contained in Annexures C and D can be used as guidelines for determining the correct method to use.

Figure PS 5

Ripping Using the Correct Tines



By using the correct ripping equipment, appropriate fracturing of the soil is achieved, as shown above in Figure PS 5.

11.5 Ridging

Although, as a general rule, waterlogged soils should not be planted, certain circumstances may necessitate this (i.e. Tsitsikama soils). Where this is the case, ridging can be done to raise the growing environment for the tree roots above the water table and to increase the volume of soil that the seedling root system can colonise. Ridging however has the disadvantages that root closure between planting rows may be impeded, and the uneven surface created between planting rows may hinder subsequent harvesting operations. Trees growing on soil forms listed in Group 8 of the **Soil Sensitivity Index** (refer to Annexure D) could benefit from ridging.

- Ridging should not be done if one or more of the following apply:
  - the soil has a low growth potential;
  - the soil is in a land type that could be classified as a wetland or riparian zone; and / or
  - the disturbance of the soil could lead to serious disruption of natural waterflow and erosion. These are commonly soils with E-horizons and/or plinthic sub-soils, which renders them very susceptible to erosion if disturbed.

- Soil preparation practices should be guided by the specifications set out in Annexure C. In addition, the Soil Sensitivity Index contained in Annexure D should also be taken into consideration.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

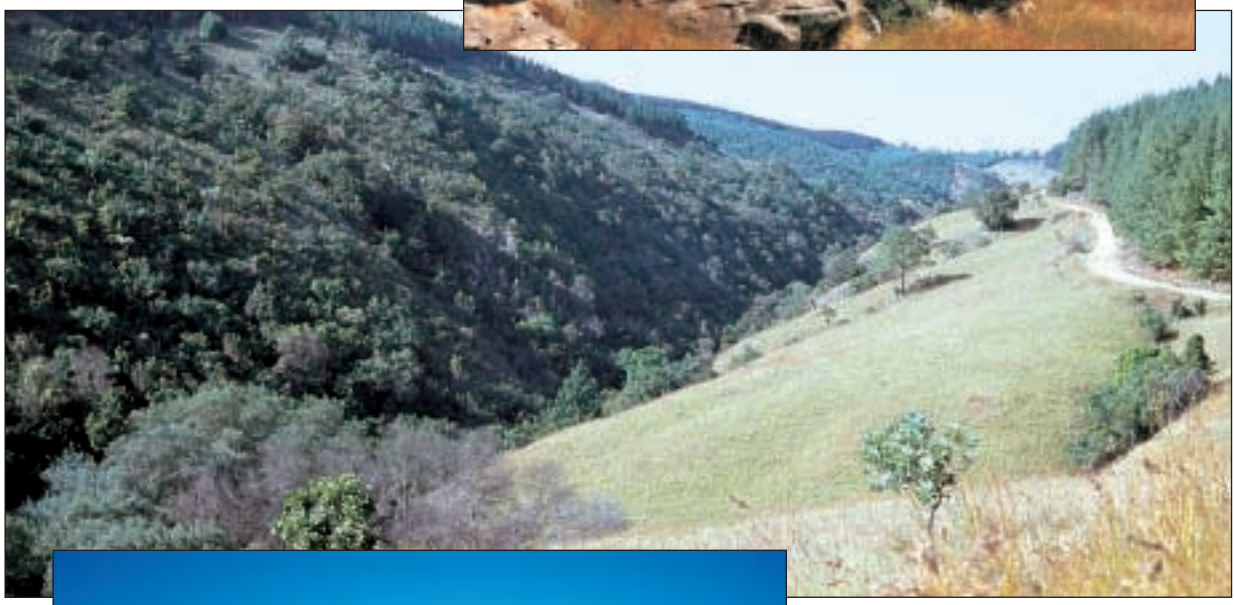
IMPLEMENTATION:
SILVICULTURAL PRACTICES

1. LAND PREPARATION

Appropriate land preparation is a silvicultural requirement that aims to avoid unnecessary environmental damage and successfully establish a plantation.

- The general rule of thumb should be to do as little as possible in terms of soil preparation whilst aiming to achieve maximum results.

The area to be planted should take into account SMZ's, such as these, that have been identified during the planning stage



1.1 Demarcating the Planting Area

- Before soil preparation and planting is carried out, the area should be clearly demarcated according to the compartment planning, taking into account the measures relating to SMZ's, as identified during the planning phase.
- Sites for special consideration include cliff edges and rocky outcrops, watercourses, wetlands, archaeological, cultural and traditional sites, aesthetic/scenic sites, sites of scientific importance, natural vegetation and other areas of special interest.

1.2 Chemical Application

Whenever chemicals are used, be sure to adhere to the following guidelines.

- Chemicals must only be applied by trained operators wearing the necessary protective clothing.
- Chemicals must only be used and applied according to their manufacturers' recommendations and in terms of their registered use. Mixing of chemicals into "cocktails" is illegal, unless registered in their own right.
- The application of chemicals must avoid the risk of contaminating ground or surface water.
- Chemicals must be applied at the correct rates.

- To avoid the danger of serious accidents and pollution occurring, chemicals should not be transported to field operations in bulk.
- Apply chemicals when the weather is cool and calm to prevent drift from the application point. This is particularly important when applying chemicals near SMZ's. In need, appropriate "no-spray" buffers can be established as a preventative measure.
- Chemicals should be mixed in suitable areas and away from open water.
- Equipment used to apply chemicals should not be cleaned infield.
- Chemical containers should be disposed of by first rinsing them thoroughly and then making them unusable (e.g. by punching holes in them). Alternatively, they should be returned to the suppliers from which they were purchased.

1.3 Destumping

Destumping is used primarily to facilitate access to the stand. From an environmental point of view, the order of preference for destumping is:

chemical - low soil disturbance;

grinding - low soil disturbance;

V-blading - low soil disturbance but potential for soil compaction; and lastly

uprooting - high soil disturbance.

The decision to destump should not be taken lightly as the environmental impacts can be considerable. The following should thus be considered before destumping a site:

- Destumping should only be considered when a ripping operation necessitates it.
- Only sites with high yield potential should be destumped.
- Destumping should be done directly after felling a compartment.
- Grinding is preferred to uprooting as it causes less disturbance and more roots are left in the ground to stabilise the soil.

When deciding between chemical or mechanical stump kills, consider the following:

- Chemical stump kill
  - Make sure that the guidelines listed in Section IS 1.2 (Chemical Application) are adhered to.
- Mechanical stump kill
  - Entire stumps should be ground to a minimum of 10 cm below ground level to allow effective cultivation and prevent re-growth.
  - Stumps should be shattered or sheared to a maximum of 5 cm above ground level. Less than 50 stumps should be uprooted per hectare, to reduce soil disturbance. Where this cannot be achieved, additional erosion protection measures must be implemented.
  - Obstructions should be removed to facilitate primary soil preparation.
  - No V-blade cutting or stump pulling should be carried out on slopes steeper than 20% (9 degrees) or on sensitive soils. Soil disturbance must be kept to a minimum.
  - Total stump removal is likely to cause excessive topsoil disturbance and should therefore not be undertaken.

2 SOIL PREPARATION

Appropriate soil preparation will ensure optimisation of the site as soil preparation, to a large extent, determines the success of the planting.

- In general, soil preparation should only be done when the moisture content of the soil is optimal. This is reached when a soil sample forms a stable clod when compressed by hand and breaks up when light pressure is applied. Sod formation will occur if the soil is too dry and glazing if it is too wet.
- Refer to Annexures C and D for more detailed guidelines.

2.1 Ripping

- Ideally, only soils with a clay content of over 35% should be ripped.
- Ripping should be done along the contour. If ripping is not done along the contour, then the ripline should be a maximum of 50 metres long with a 5 metre buffer zone between riplines.
- The depth of rip should be sufficient to overcome the limiting factor in the soil.
- At depths of more than 40 cm, the ripping tine must be provided with wings according to specifications.
- Ripping should preferably be done with tracked equipment to minimise soil compaction.

2.2 Ridging

- Ridging must be done along (i.e. parallel to) the contour to avoid erosion.

2.3 Ploughing

- Ploughing must be done along (i.e. parallel to) the contour to avoid erosion, and should not be take place on gradients steeper than 10%.

2.4 Mechanical Pitting

An advantage of mechanical pitting is that it prepares uniform pits. However, the following disadvantages should be considered:

- Δ rocks are brought to the surface;
- Δ air pockets can be formed;
- Δ soil compaction can occur, with subsequent potential for erosion; and
- Δ root impeding pit walls can be formed.

2.5 Manual Pitting

Sites which are unsuitable for mechanical cultivation should be pitted manually. Good plant establishment should occur if the following guidelines are followed:

- Pit depth should be 20-25 cm, and pit diameter should be 35-50 cm.
- Soil within the pitting area should be dug over and clods broken down. All rocks and other solid objects (e.g. roots) should be removed.
- Pit dimensions should be uniform.
- Pits should be in mineral soil and not just the litter layer.
- Pit walls should not be smeared or left vertical as this can inhibit root growth beyond the pit boundaries.

3. SLASH MANAGEMENT

Slash management plays an important role in the ultimate performance of the planted trees. Advantages of retaining slash on the site include:

- Δ the protection of soil against erosion;
- Δ the suppression of weeds;
- Δ the slow release of nutrients into the soil;
- Δ the provision of cover for many beneficial faunal species and;
- Δ the conservation of soil moisture.

Where practicable, slash rows should run along the contour and have "gates" in them to improve access

The disadvantages of substantial slash in a compartment are:

- Δ that access may become difficult;
- Δ slash provides cover for rodents which may damage trees; and
- Δ the fuel load increases the risk of fire and increases the difficulty of combating fires.

- In general, slash that has been broken down sufficiently and distributed evenly over the compartment, provides more benefits than disadvantages and must always be the first option to consider when planning for this operation.

3.1 Burning of Slash

The objective of burning slash is to reduce the fuel load, reduce and assist in controlling weeds and to leave the compartment more accessible without damaging the soil.

It is however important to remember that burning must only take place in the period specified by the relevant Government notice of that particular year, within Fire Control Areas specified by the National Veld and Forest Fire Act (Act No. 101 of 1998).

When burning slash the following guidelines should be followed:

- Wherever possible, slash should not be burnt during the period near the end of the rainy season.
- Slash rows should not be burned without particular care.
- Burning should only be done within 3 days after rain of at least 30 mm to prevent damage to the soil and humus layer.
- Steep slopes and difficult topography should be burned progressively downhill from the top of the slope to the bottom in the early morning when dew is present and wind speed is low to prevent damage to the soil and improve the safety factor.
- Burning should not take place if the expected relative humidity will be below 40% and/or the expected temperature will be above 23° Celsius.
- Do not burn when unstable or adverse weather conditions are expected.
- Burn only when sufficient well-trained personnel and sufficient fire fighting equipment are available.

3.2 Chopper Rolling and Mulching

Use of the chopper-roller is a cost-benefit decision, and should be applied according to the merits of every specific situation.

Advantages:

- Δ It facilitates the planting and tending process.
- Δ It reduces the fire hazard.
- Δ It enhances nutrient release through decomposition.
- Δ It conserves soil moisture.
- Δ It reduces the potential for erosion.

Disadvantages:

- Δ It has the potential to promote soil compaction.
- Δ The slash has to be dry enough for this activity to be effective and this may delay replanting of the area.

3.3 Reduction and Distribution of Slash

- This should ideally be done as part of the harvesting operation.
- Slash should be reduced to a size that can be handled manually and slash heaps or rows should be left as low as possible.
- Slash should be distributed evenly over the compartment and should not, if practicable, be stacked in rows, as the latter has the following disadvantages:

- Δ There is usually no financial benefit.

- Δ Fire risk and potential for soil damage are increased.
- Δ Control of rodents by raptors is complicated by the slash being stacked.
- Δ Erosion potential is enhanced.
- Δ Movement within the compartment is restricted to within the rows.

3.4 Removal of Slash for Secondary Use

- Informal wood collectors, for firewood and building purposes, should be discouraged from removing all branches from the compartment. This helps to maintain the nutrient cycle within the compartment at acceptable levels.

4. PLANTING

A correctly planted, good quality tree will help to ensure a healthy plantation that optimises the site.

Guidelines for planting are:

- use only quality, disease-free plants;
- ensure that the size of the planting hole is adequate and if not, rectify before planting the seedling/cutting; and
- firm the soil around the plant by hand, and do not trample it.

4.1 Fertiliser Application

Fertilising is an important practice in forestry and can ensure optimisation of the site if it is done properly and appropriately. Inappropriate practices can be detrimental to the plants and have negative environmental effects. It is also important to note that fertilisers are only of benefit in areas with proven positive responses. The following guidelines should be followed:

- Fertiliser should not be applied unless appropriate weed control has been exercised.
- Use only registered suppliers and products. The use of fertilisers is controlled in terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). In terms of Section 3 of this Act, any fertiliser, farm feed, agricultural remedy, stock remedy, sterilising plant used and any pest control operator has to be registered.
- The nutrient requirements of the site should be identified and fertilisers applied accordingly. **Do not over fertilise.**
- Seedlings should be fertilised immediately after planting to achieve the best growth response. If this is not possible, fertiliser should be applied no later than one month after planting.
- Fertiliser should not be stored in bulk infield.
- If the site has been ripped, then fertiliser should not be placed in the same plane as the ripline.
- Fertiliser should be covered lightly with soil.
- Full application of fertiliser should not occur during the dry season.

4.2 Plant Containers

Plant containers can be the source of environmental pollution, both aesthetically and otherwise.

- It is important to ensure that plant containers are removed from infield and disposed of in a properly managed disposal site that is permitted to receive such waste.

5. MAINTENANCE

5.1 Biological Control of Weeds and Pests

- Non-polluting and formally approved biological control methods should be implemented wherever possible.

The use of non-approved methods or foreign biological control agents can have devastating effects on fauna and flora and may result in prosecution. The importation of foreign biological control agents is strictly regulated and controlled by the National Department of Agriculture. Usually, only research bodies such as the Plant Protection Research Institute can import such agents.

It is illegal to import such agents without following the correct procedures.

Biological control measures should be encouraged to control weeds

5.2 Chemical Pest and Weed Control

Pesticides and herbicides are important tools for combating pests and weeds in plantations. However, as they are potentially harmful to both the environment and human life, it is essential that:

- contractors used are registered according to the statuary requirements;
- operators are well trained ; and
- appropriate precautions, as recommended in Section IS 1.2 (Chemical Application), should be taken to ensure safe application of chemicals.

Only properly trained and equipped workers should carry out chemical weed control

5.3 Manual Weed Control

- Care must be taken not to damage non-target plants, especially those in SMZ's.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

PLANNING:
HARVESTING

1. TACTICAL PLANNING (3 - 5 YEAR)

Consult Forest Engineering Southern Africa's (FESA's) publication entitled "Guidelines for Forest Engineering Practices in South Africa" for comprehensive details on harvest planning.

The tactical harvesting plan which, after field verification, outlines resource utilisation should incorporate the following:

- Reliable maps at a suitable scale showing:
  - compartment boundaries;
  - Special Management Zones (SMZ's);
  - terrain classification (if available);
  - haulage roads; and
  - depots.
- Sound system and equipment choices which should take into consideration the topography, soil and weather conditions of the area. This ensures that the system chosen will have minimal environmental impacts (e.g. in terms of compaction and erosion), whilst remaining economically viable.
- A readiness to change the plan for good reasons (contingency plan).
- An understanding of the influence of weather, markets and other external influencing factors.
- The maintenance of a sustainable supply of timber.
- A road plan which should:
  - identify the roads and transport systems required to remove the timber to be harvested during the tactical planning period;
  - indicate the year in which the roads have to be constructed, rehabilitated, upgraded or ripped and closed; and
  - include an appropriate maintenance plan for the road network.
- An equipment replacement plan which sets out the timely replacement of unsuitable, obsolete and depreciated equipment so as to ensure an optimum and efficient harvesting system.

2. ANNUAL PLAN OF OPERATIONS (APO)

The Annual Plan of Operations (APO) should balance compartments and harvesting systems over a year. It should ensure that:

- it is in line with, and complimentary to, the tactical harvesting plan;
- large continuous tracts of land are not harvested in a short period of time;
- there is a sustained timber supply;
- there is an optimal extraction of marketable timber; and
- there is an optimal allocation of resources (equipment and manpower).

2.1 Season (wet and dry)

- To avoid unnecessary damage to the environment, the annual plan of operations should take into account the season, thereby ensuring that compartments are only harvested during the appropriate season (i.e. wet versus dry).

2.2 Harvesting Systems

When selecting the most appropriate system the following should be considered:

- terrain, ground conditions, ground roughness and slope;
- aesthetics;
- delivery timetables;
- product;
- economic conditions;
- species harvested; and
- available equipment options.

- In order to determine terrain conditions (i.e. ground conditions, roughness and gradient) the National Terrain Classification System for Forestry should be used as a guide (refer to Annexure E). The recommended extraction methods that can be used for various terrain conditions should be used as a guide (refer to Annexure F).
- For more detailed specifications and guidelines on extraction methods, FESA's "Guidelines for Forest Engineering Practices in South Africa" and "Cable Yarding Safety and Operating Handbook" should be consulted.

2.3 Road Management

To minimise harvesting and transport costs, the APO should:

- optimise compartment access by means of the road and transport network;
- provide for the total area that is to be harvested during that particular year; and
- include prescriptions for road work required for the anticipated traffic load.

2.4 Contingency Plan

To ensure a continual timber supply, a contingency plan should be devised, in which alternative compartments are identified which could be harvested.

- The plan should allow for changes in weather conditions, changes in market conditions, and the breakdown of equipment or unplanned stoppages.
- Factors to be considered include:
  - wet/dry compartments;
  - irrigated depots; and
  - accessibility (all weather roads).

3. OPERATIONAL PLANNING

3.1 Scheduling Equipment and Labour

This is imperative to ensure timely, constant and sustainable delivery of the correct products to the customer. The greatest potential environmental damage in the plantation environment takes place during harvesting operations.

3.2 Physical Plan

The physical plan should encompass:

- Large scale contour map (e.g. 1: 2500) illustrating:
  - compartment boundaries;
  - Special Management Zones (SMZ's);
  - landing locations;
  - extraction routes;
  - direction of timber flow, loading and haulage;
  - streams and crossing locations;
  - vulnerable drainage structures; and
  - general felling direction near SMZ's, roads, firebreaks, telephone lines etc.
- Compartment data containing:
  - average tree size including volume, DBH and height; and
  - number of stems per hectare and volume per hectare.
- Market and product considerations:
  - markets and transport distances; and
  - product requirements and specifications.
- Harvesting activities for compartment:
  - harvesting systems (method of felling, conversion, extraction and transport) matched to the terrain;
  - extraction direction;
  - manpower and equipment requirements;
  - sequence of felling and extraction (flow of the operation); and
  - planned start and end times.
- Silvicultural requirements:
  - slash management;
  - stump heights and treatment; and
  - fire protection requirements (e.g. firebreaks and debris).
- Environmental requirements (SMZ's):
  - should be recognisable infield according to the harvesting plan and map;
  - the recommended management guidelines should be applied; and
  - should a new site be identified during harvesting operations, protect the site and alert relevant authorities and/or the Company Environmental Section.

NOTES:

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

IMPLEMENTATION:
HARVESTING

Consult Forest Engineering Southern Africa's (FESA's) publication entitled "Guidelines for Forest Engineering Practices in South Africa" for comprehensive details on harvesting guidelines.

1. HARVESTING PREPARATION

1.1 Pre-harvesting Checking

Prior to the commencement of any harvesting operation, the following documentation should be completed by the forest manager and person responsible for the harvesting, where applicable:

- A compartment hand-over checklist, completed by the forest manager, in consultation with the harvester, specifying conditions and requirements and identifying areas on a map where particular care should be taken.

2. HARVESTING ACTIVITY

2.1 Felling Direction

To ensure protection of life and the environment, the following guidelines should be observed:

- Use properly trained chainsaw / machine operators who are equipped with the necessary protective clothing.
- Trees should not be felled into SMZ's.
- If trees must be felled adjacent to SMZ's, felling aids such as winches, felling levers, felling wedges and tree jacks should be used.
- Do not fell trees in which there are active raptor nests.

Trees should not be felled into SMZ's

2.2 Extraction

When choosing a suitable extraction method, consider the following factors that influence productivity and product quality during extraction:

- timber size (piece volume);
- load size (total volume or weight);
- number of pieces per load;
- terrain (i.e. slope, roughness and condition);

- sensitivity of terrain (susceptibility to soil damage and erosion);
- size of area from which timber is to be extracted;
- extraction and felling directions (uphill, downhill or parallel (across) the slope);
- extraction distance;
- type and capability of extraction equipment;
- presentation (i.e. scattered, bunched or stacked; short lengths, long lengths or tree lengths; with branches or debranched);
- felling layout; and
- operator skills.

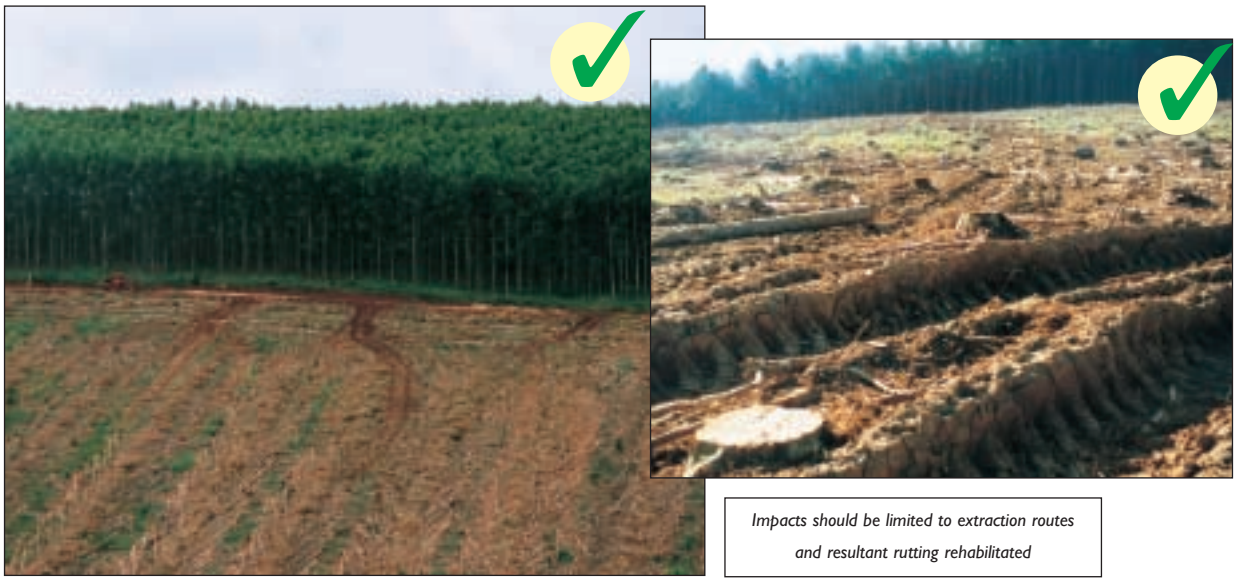
- Refer to Annexure F for the recommended extraction methods to use under various terrain conditions.

2.3 Extraction Routes and Landings

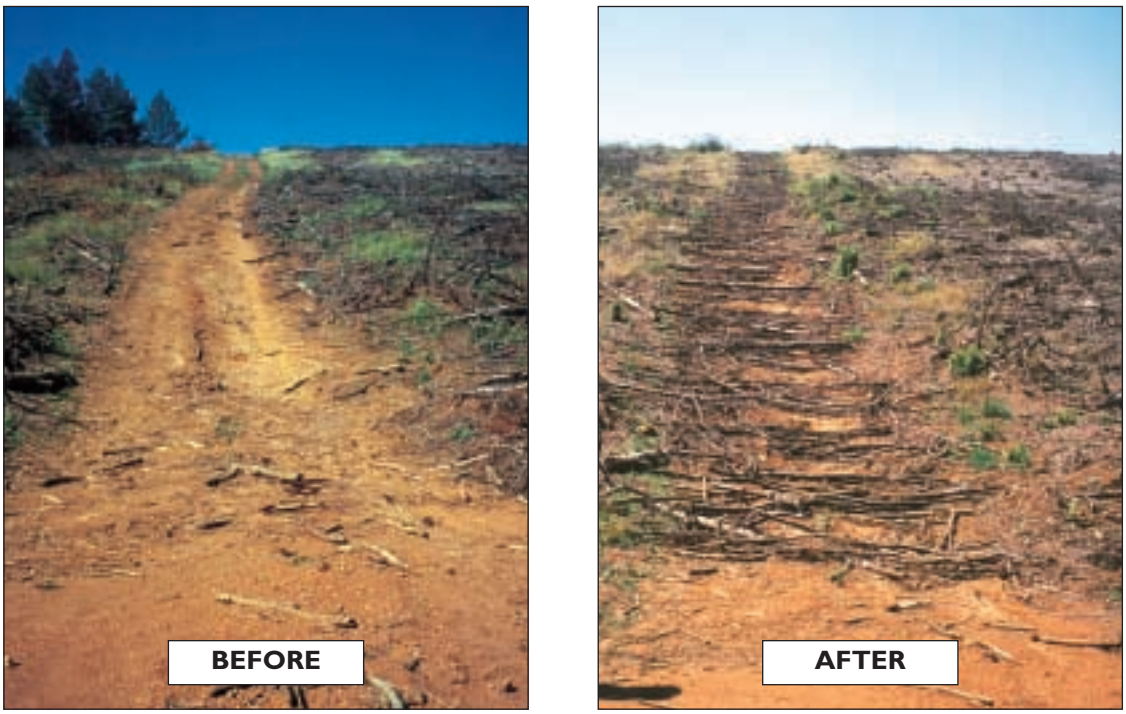
- Designated routes should be identified and used correctly.
- Landings should be identified, and equipment and work methods applied as planned.
- Special precautions should be taken when there is a particular risk of soil degradation.
- Extraction routes and landings must not be situated in riparian zones and/or watercourses.
- If planned extraction routes are unsuitable, make alternative recommendations.

- Permanent and temporary river crossings should be kept to a minimum, even during the dry season. Follow guidelines for permanent river crossings (refer to Sections IR 2.3 and IR 2.5).

Mules can be successfully used for extracting thinnings



Impacts should be limited to extraction routes and resultant rutting rehabilitated



Extraction routes should be protected against erosion after use

2.4 Depots

- Situate depots, where practicable, at least 40 metres away from riparian zones and well away from other sensitive areas.
- Situate depots on slopes with a gradient of less than 6%.
- Timber stacks should be neat and well presented for storage, checking, security and loading.
- Adequate drainage methods should keep the depot as dry as possible and should be kept free of debris to facilitate vehicle movement.
- Debris should be moved regularly and disposed of in a permitted waste site.

- Drains must direct water through an adequate strip of filtering vegetation or silt trap and not directly into a watercourse.
- Comply with the minimum safety and construction requirements for the anticipated traffic load.
- Where there is a danger of the depot, or stockpiles of bark or other debris creeping into riparian zones, the depot boundaries must be clearly demarcated with immovable markers.
- Consider safety factors near power lines.

Depots should not be located within 40 metres of a watercourse and should be well drained

2.5 Presentation

Presentation is important for site hygiene and optimisation of the site. To achieve this, the following guideline is recommended:

- During the wet season, log stacks should be sited to avoid blocking road drains.

2.6 Slash Management

Slash management is important for site hygiene and compartment presentation. Soil erosion and displacement are responsible for most post-harvesting damage to the site and the management of the remaining biomass has an important influence on:

- Δ the retention of nutrients;
- Δ the prevention of moisture loss; and
- Δ the retardation of water run-off that may cause erosion.

The following guidelines are therefore recommended:

- Scatter slash to allow decomposition as this will accelerate nutrient recycling and hence improve soil protection. If this is not possible, slash should be stacked in rows.
- Slash should be kept away from road edges, drains, SMZ's and adjoining compartments.
- Wetlands must be cleared of slash to prevent impeding water flow or blocking bridges and culverts. However, when clearing:
  - machines should not be allowed to enter wetlands to clear such debris;

  - debris should be removed manually, or winched out; and
  - if the debris poses no threat to water quality, streamflow or the inherent values of the SMZ, it should be left in place.
- Minimal extraction debris should be left outside the boundaries of a compartment and care must be taken not to damage plantings within adjacent compartments.
- Avoid burning after harvesting as the litter contains important nutrients that should be left to be recycled.
- Do not leave marketable timber in slash rows or piles.

2.7 Site Hygiene

Poor hygiene (e.g. littering and oil spillage) can lead to pollution, disease and degradation of the plantation in general. The following guidelines should therefore be followed:

- Remove all marketable timber as soon as possible.
- Impose appropriate fire prevention measures.
- Employ special care when servicing and repairing machines infield.
- Oil and diesel should be drained into containers and removed together with discarded spares and unusable containers.
- Remove unused or broken materials and equipment from the forest, (e.g. cables, old guide bars).
- Make provision for the collection and removal of refuse for subsequent disposal in a permitted waste site.
- All timber, including anchor trees / stumps should be felled and removed, leaving the site tidy and safe.

Good site hygiene limits the risk of pollution

2.8 Rehabilitation

To prevent, or at least restrict, environmental damage caused by harvesting operations, rehabilitation measures should be undertaken throughout the operation and checked before the site is handed over to those responsible for silvicultural operations. These rehabilitation measures should include:

- the restoration of redundant depots by installing appropriate drainage, ripping areas that are to be planted, and having stockpiled topsoil spread over the depots;

- the restoration of stream crossings (where applicable);
- the draining of skid trails (on slopes) and the placing of compartment debris in ruts to reduce soil erosion;
- the clearing of debris from roads;
- the rehabilitation, upgrading or restoring of roads as required; and
- the opening of all drainage channels.

Skid trails should be rehabilitated effectively. Slash used for this purpose should thus make contact with the ground

2.9 Post-harvesting Checking

On completion of the harvesting operation, the forest manager and person responsible for the harvesting, where applicable, should do the following:

- conduct a physical inspection of all work in the compartment, to ensure that the required standards have been met and that all marketable timber has been removed; and
- complete a hand-back acceptance checklist, similar to the pre-harvest checklist, once they are satisfied that the required standards have been met.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

PLANNING:
ROADS

Consult Forest Engineering Southern Africa's (FESA's) publication entitled "Guidelines for Forest Engineering Practices in South Africa" for comprehensive details on road planning, construction and maintenance.

1. TACTICAL PLANNING CONSIDERATIONS

By law, an Environmental Impact Assessment (EIA) is required before:

- the construction of any new road passing through an environmentally sensitive area (e.g. an SMZ); or
- the major upgrading of any existing road passing through an environmentally sensitive area (e.g. an SMZ).

The planning, construction and maintenance of the forest road network, depots, landings and extraction routes are referred to as access development. This is necessary to enable equipment and personnel to gain access to the standing tree to remove products from the forests.

Tactical planning is a necessary step in road planning and construction and should be a function of the time frame of the tactical harvesting plan. It aims to achieve an optimal balance between forest roads, extraction routes, depots and landings to maximise the profitability of the forest estate. Consider the following during the planning and construction of roads:

- competence of the planners;
- size of corridor to be cleared;
- soil properties, topography and terrain;
- prevailing climate;
- availability and type of harvesting methods to be used; and
- volume of timber to be transported.

Factors that should be considered in road planning and design are:

Poor planning results in high construction costs and damage to the environment. Alternatives should thus be fully investigated

1.1 Topography and Terrain

To minimise degrading environmental and aesthetic impacts:

- keep earthworks and exposed surfaces to a minimum;
- use natural topographical features such as saddles, ridge-tops, natural benches and flatter slopes; and
- SMZ's (as described in Planning : Silvicultural Practices Section), must be afforded appropriate protection. The total road width (including the reserve) and any side cast material should not fall within designated SMZ's. Where this cannot be avoided, appropriate mitigatory measures must be taken.

1.2 Visual Buffer Zones

- These should be present to minimise visual impacts. The buffer zone may be in the form of trees, a hill or other natural barrier.

- Refer to the Visual Landscape Section for more details.

Roads separating the planted area from riparian zones and other SMZ's reduce the potential for forestry activities to impact on them and make their management easier

1.3 Soil Volume to be Removed

- Negative aesthetic and environmental impacts can be minimised by balancing cuts and fills (i.e. use of excavated material for fills) and by minimising borrow pits and soil dumps.

1.4 Road Suitability

- To minimise user costs and environmental degradation, the road should match the functional requirements of the transport vehicles (e.g. to minimise gear changes and maximise average vehicle speeds), and match the volume of timber to be removed.

1.5 Flood Events

- To avoid unnecessary environmental damage and costs, roads should be designed to accommodate 1-in-50-year flood events.
- Bridges and culverts should be designed to prevent blockages.

2. OPERATIONAL PLANNING

2.1 Maps

In addition to the relevant details contained on silvicultural and orthophoto maps, the maps used for road design should include the following specific road details.

- The centre line, road width, positions of cuts and fills, bends, position of cross sections, engineering structures (e.g. culverts, bridges, etc.) and the drainage network.
- A longitudinal profile indicating the profile of the terrain, the planned grade-line, the centre-line, elevation of the road and cut and fill areas.
- Maps needed for the construction (or upgrade) of either major roads or those that will pass through a sensitive area, must show more detailed information.

2.2 Road Design

Road design should take the following into consideration:

- The planning and design of major road construction / upgrade should only be done with the assistance of experts.
- When deciding on the routing a new road, the following should be considered in order to reduce visual impacts and other negative environmental consequences:
  - Avoid routing the road on or in close proximity to "negative cardinal points" such as steep and unstable sites, sites prone to landslides, large rocks and cliffs and SMZ's.
  - Route a new road to take advantage of "positive cardinal points" such as saddles, ridge-tops, natural benches and the flatter sections of slopes as this will reduce earthmoving requirements.
  - Avoid routing a new road near designated scientific, ecological, paleontological, archaeological and historical site as well as tourist and recreational areas.
  - Keep road locations as low as possible across visible faces.
  - Specialist input is required when roads are to be located in or close to recreational areas or visually sensitive areas.

- Refer to the Visual Landscape Section for more details.

- Watercourses are particularly sensitive to the effects of sedimentation caused by run-off from roads. The following guidelines are thus important:

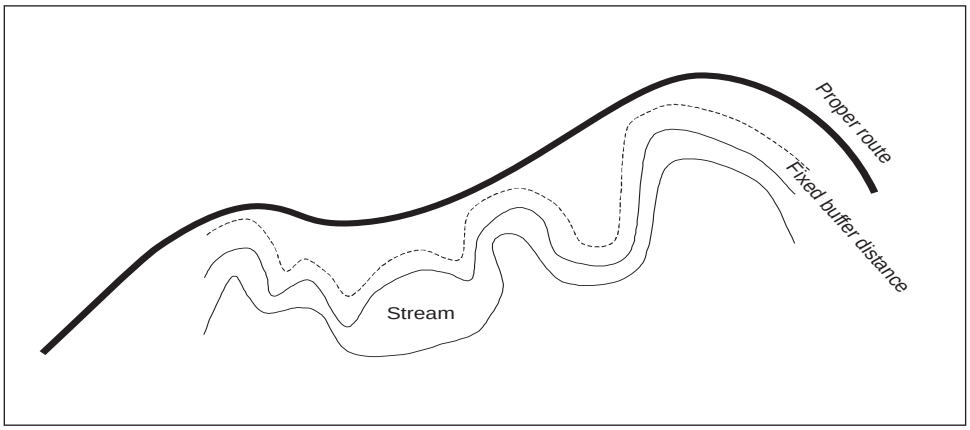
- A permit is needed from the Department of Water Affairs and Forestry if a road is to be construction in a riparian zone.
- Legally, roads may not be routed within 10 metres of a watercourse or wetland except where they cross. However, a 20 metre buffer is recommended.

- Where existing roads are routed within 10 metres of a watercourse they should, where practicable, be re-routed and/or decommissioned. Caution must be exercised to ensure that the impacts caused by decommissioning/re-routing are not greater than those caused by the road in the first place.
- Minimise the number of stream crossings.
- Roads should cross watercourses at right angles.

- Water should not be led off roads directly into watercourses but should preferably flow through at least 10 metres of vegetation before entering them. The least amount of water should be allowed to leave the road at the bottom of an approach to a watercourse.
- Minimise interference with natural drainage. On roads that carry heavy traffic loads over extended periods of time, bridges rather than drifts / fords should be used.
- All construction must be carried out in a manner that causes minimal damage to the streambed and banks.
- Movement of construction vehicles in natural areas and across waterways and streams should be limited to existing routes, the proposed roadway or other specified routes.
- Where possible, a route should not follow a parallel course to a river on flat terrain. This not only improves the safety of the route but also reduces construction and maintenance costs, drainage requirements and the ultimate sediment load.

Figure PR 1

Correct Routing of a Road Next to a Watercourse



- Cut and fill should be balanced as much as possible to reduce borrow pits and soil dumping. The distance for moving cut and fill should be minimised.

Well balanced cut and fill reduces the need for borrow pits and extensive earthmoving

- Drainage should be stabilised with suitable vegetation or other material to prevent erosion. Where practicable, roads should be grassed. Drains should be constructed to meet the slope requirements of the road.

If practicable, roads should be grassed. All roads should be well drained

2.3 Gradients

Steep road gradients can impact negatively on the environment and increase transport costs. The following guidelines are thus recommended:

- Full bench construction is recommended where the side slope on which the road is to be constructed exceeds 60%.
- The maximum allowable longitudinal gradient (usually 12%) should not be exceeded for a distance longer than 250 metres.
- Special surface protection may be necessary for particularly steep roads (exceeding 12%). Alternatively, the need for the road and the associated afforestation should be reconsidered.

2.4 Timing of Operation (season)

- To prevent contamination of streams or rivers, major construction and significant reconstruction of roads or stream crossings should not be carried out in the high rainfall months.

3. BORROW PITS

A permit from the Department of Minerals and Energy is required before a quarry is constructed. Exemptions may however be applied for but, if any mineral rights exist on the property, the owner of such rights must give permission for quarrying of the site.

Borrow pits can be responsible for many degrading environmental impacts, including long-term visual impacts, soil erosion and water quality degradation. The following guidelines should therefore be adhered to:

3.1 Visual Impacts

- Minimise degrading visual impacts of borrow pits by careful siting and use of buffer zones. Wherever practicable, leave a strip of trees to shield the pit or locate the pit behind a hill, ridge or other natural barrier.

3.2 Overburden Store

- For all new borrow pits, topsoil should be stored for subsequent rehabilitation of the site.

3.3 Drainage and Soil Loss

- Pits have the potential to cause erosion and reduce water quality and should be drained through a filter strip and not directly into the watercourse. Drains of a suitable design should carry run-off over the fill area and onto stable ground without eroding the fill area.

The negative visual impacts of borrow pits can be reduced by good planning

3.4 Reclamation

- When borrow pits are no longer required, they should be rehabilitated or turned into permanent water bodies within two years of becoming redundant. Failure to do this may lead to longer-term environmental impacts.
- If the use of a borrow-pit is temporarily ceased, measures must still be taken to ensure that any negative impacts are managed effectively during the periods it is not being used.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

IMPLEMENTATION:
ROADS

Consult Forest Engineering Southern Africa's (FESA's) publication entitled "Guidelines for Forest Engineering Practices in South Africa" for comprehensive details on road planning, construction and maintenance.

1. CORRIDOR PREPARATION

The corridor is the area that should be cleared before earthmoving operations can begin. All vegetation and topsoil should be cleared from this area and all marketable timber prepared for removal. The following guidelines should be followed:

- Recover all marketable timber and remove other vegetation, stumps and logs.
- Where possible, permanent drainage and bridges should be installed prior to the construction of the subgrade in order to keep the area as dry as is possible.
- The correct construction machinery should be used to limit environmental damage.

2. DRAINAGE AND RIVER CROSSINGS

Rivers and streams are particularly sensitive to sedimentation caused by roads. Adequate drainage should divert water away from the road and road surface and minimise discharge into watercourses.

Proper drainage protects infrastructure and prevents the sedimentation of watercourses

2.1 Road Surface

The road surface should:

- be as smooth as possible;
- have, where possible, a camber of 3-6% and a longitudinal gradient of at least 2% to 3% to facilitate run-off;
- not be out-sloped in steep or slippery terrain;
- be provided with adequate culverts and drains;
- have more frequent drainage on approaches to streams to ensure the least amount of water is discharged directly into the stream; and
- not allow discharge to enter streams directly without first moving through a filter of vegetation.

2.2 Drains

As water is the greatest cause of road degradation, drainage that diverts water away from the road and road surface is essential so as to reduce the potential for erosion. The type of drain constructed will be determined by the specific physical situation and the desired function.

Energy brakes in drains can reduce erosion considerably

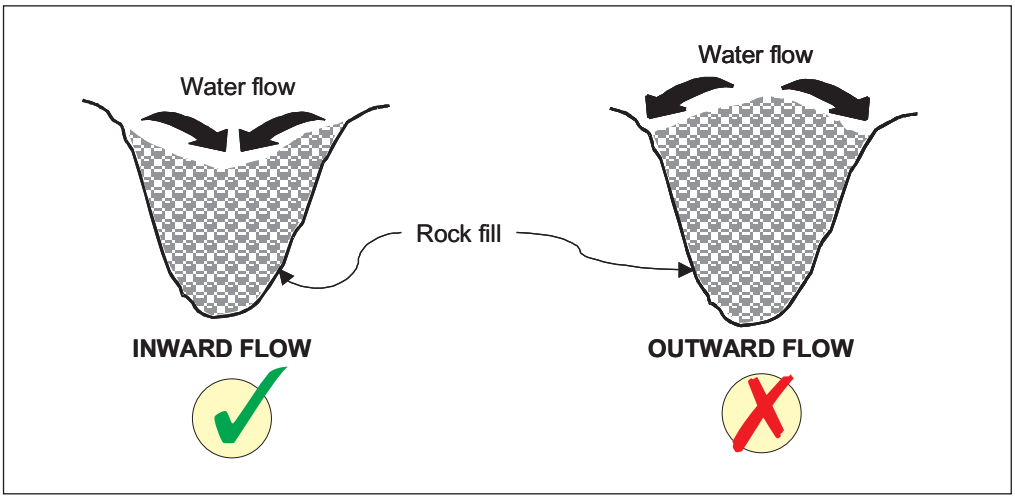
Examples of different types of energy brakes

2.2.1 Side/mitre/catch drains

- Ensure drains have a minimum gradient of 3% to facilitate drainage.
- Roadside drains (side- and mitre drains) are required to catch surface run-off and divert it to an area suitable for dispersing the water.
- Catch drains should be adequate and constructed on the top side of the cut to reduce erosion on the face of the cut.
- Mitre drains should be used for the dispersal of water where necessary.
- Special measures in high water flow velocity areas should be taken to reduce the erosion of drains (e.g. by lining with stones, concrete, grass or gabions).
- Drains should be routinely maintained, cleared after road grading and kept free of invading vegetation.

Figure IR 1

Correct Construction of a Drain



2.2.2 Water bars and surface cross-drains

- Where it is difficult to contain the velocity of water on road surfaces, water bars and cross-drains can be installed to assist in achieving this.
- High-velocity flow cross-drains are an alternative to culverts.

2.2.3 Culverts

A culvert is a drain that is required wherever a road crosses a natural watercourse. It removes water from a road and prevents sedimentation into the watercourse. The following guidelines are recommended:

- Space culverts according to road grade, soil erodibility and rainfall intensity.
- Build culverts on a well-prepared and compacted bed at a gradient of at least 2%.
- Minimum diameter of culverts will depend on the condition of the road, rainfall history and size of the drainage area.
- Do not push fill into running streams or into a position where it can be washed into streams.
- Protect the inlet and outlet of the culverts by limiting damage caused by the flow entering or discharging.
- Use sediment traps made of logs, rocks, tree tops and branches or concrete.
- Inspect, maintain and clean culverts regularly.

2.3 River / Stream Crossings

As river crossings can cause severe environmental degradation, the following guidelines are important:

- Wherever possible, the natural flow of the river should not be altered. If the flow of the river is to be altered (temporarily or permanently), a permit must be obtained from the Department of Water Affairs and Forestry.

- Construct crossings at right angles to the river/stream.
- Minimise impacts to river and streambeds by selecting natural crossings with easy approaches.

- Avoid steep approaches to river crossings.
- Construct crossing on firm stable soil, on a concrete base or on rock sub-strata and locate below a straight and stable section of the river.
- Coincide timing of construction with low water flows.
- Keep construction machines out of rivers or streams, wherever practicable.
- Protect inlet and outlet to prevent erosion of riverbed and sidewalls.
- Riverbeds and stream banks must be restored, as close as possible, to their original state once construction work has been completed.
- Prevent collapse of river beds and side walls by using gabions, concrete or hyson cells.
- Protect crossing embankments by using concrete, timber, gabions or vegetation.

Road approaches should not be steep and crossings must be constructed at right angles to watercourses using durable materials. Water should not be allowed to drain directly into watercourses

2.4 Drifts (fords)

The following guidelines are recommended when constructing a drift:

- Drifts are only suitable for seasonal access or for low usage roads.
- Drifts should be located below straight and stable sections of the river.
- Drifts should cross rivers at right angles.
- Minimise disturbance by using a firm and stable streambed and approach (preferably consisting of rock).
- Prevent sedimentation by using an excavator for construction.
- Consolidate entry and exit points to reduce scouring.
- Protect the crossing by using gabions, hyson cells and/or concrete.

2.5 Bridges

Bridges must be designed and constructed by qualified personnel to minimise significant impacts. The following guidelines are therefore recommended:

- Investigate alternatives before deciding on the necessity of a bridge.
- Do not disrupt fish passage.
- Only use rot resistant and/or treated timber for crossings constructed of timber.
- Use kerbs on the side of the bridge to stop fill material from sliding down the passage.
- Control abutment fill with wooden shutters or concrete abutments.
- Control run-off from the bridge surface.
- Regular inspection and maintenance is necessary.

3. EARTHMOVING

Road construction and associated earthmoving can be responsible for significant impacts including visual degradation, erosion and damage to riparian zones, indigenous forest and other SMZ's. It is important to minimise disturbances to streambeds and to carry out earthmoving operations during periods of low water flow.

3.1 Weather Conditions

- Extra care should be taken during wet conditions.

3.2 Balance Cut and Fill

- No fill or side cast should be allowed to encroach into SMZ's. Where this is unavoidable, authorisation from the relevant authorities must be sought.

- Refer to the Planning : Roads Section for more details.

3.3 Correct Machinery

- Use excavators rather than bulldozers in sensitive and steep areas.
- End hauling with excavators should be used in steep areas and on unstable soils to prevent loss of material downslope and to lessen the visual impact.
- Use bench compaction methods to stabilise fills on unstable soils on steep areas.

3.4 Blasting

- It is a legal requirement that blasting must only be undertaken by certified experts.

- Blasting should be controlled to minimise any potential environmental damage.

4. ROAD SURFACING

The structure of forest roads generally consists of the following:

- **Subgrade** - the foundation for the road surfacing (usually constructed using *in situ* material).
- **Base Course** - the layer that supports the weight of the traffic (can also be the running surface if it is the only layer on top of the subgrade).
- **Gravel Wearing Course** (or surface course) - the top layer which acts as the running surface for vehicles.

The anticipated traffic load and the subgrade characteristics will determine the number, quality, thickness and selection of these layers. The surfacing used will determine the efficacy of traffic and the maintenance of such surfaces and as such proper design is imperative to minimise possible road impacts.

Road surfacing refers to the layers of material placed on or above the subgrade. All roads have some form of surfacing and could consist of one or more layers. Crushed aggregate, stabilised, native or earth surfaces are the most common types of surfacing used on forestry roads. These can be defined as follows:

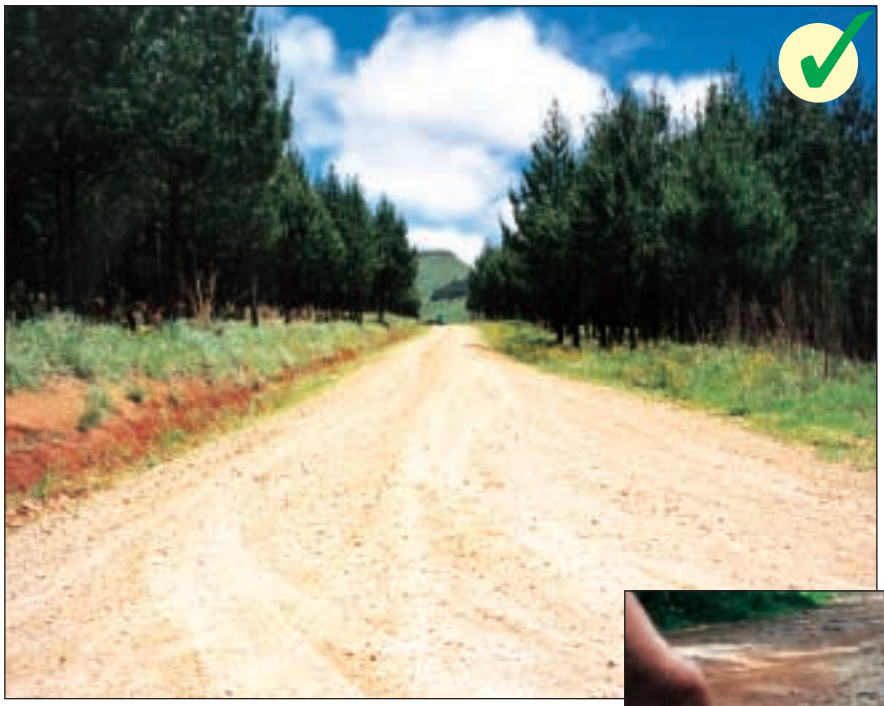
- **Crushed Aggregate** - sized material that has been crushed and blended to meet the required particle size specifications for the road.
- **Stabilised Surface** - made from material that has been modified by the addition of chemical stabilisers to increase strength and reduce dust and moisture penetration.
- **Native Surface** - made from naturally occurring surface material that has been imported and which may or may not have been modified.
- **Earth Surface** - made from soil found within the roadway and excluding any imported or manufactured material.

4.1 Subgrade, Base and Gravel Wearing Course Preparation

The subgrade provides the foundation for the base and gravel wearing courses of the road surface and the need for proper and adequate design is thus important. When preparing these courses the following guidelines are recommended:

- Test the subgrade material for compaction suitability before commencing.
- Shape the surface of subgrade to ensure drainage of water to prevent it from seeping upwards though the base course to the gravel wearing course.
- Install sub-surface drainage where needed (e.g. in wet areas or where water sensitive soils occur).
- Rip and mix the road bed and spray with water to optimise moisture content and then compact to recommended bulk density;
- Use *in situ* material for the subgrade where possible but if not suitable, excavate it and import suitable gravel from elsewhere.
- Ensure base course is of sufficient strength to carry traffic load by thickening layers and by using better quality or stabilised material.

- Ensure the material for the gravel wearing course is suited to the standard of the road, micro-climatic conditions and compaction requirements.
- Use *in situ* material for the gravel wearing course wherever possible to reduce transport costs and to facilitate easy road maintenance.
- Ensure the gravel wearing course is smooth and that the camber is sufficient to facilitate water run-off.
- Ensure that the road is built above the natural ground level.



The wearing surfaces of roads should be constructed with suitably sized material to ensure smoothness

5. SLOPE STABILISATION

Cuts, fills and all other exposed faces and slopes should be well drained, protected from erosion and stabilised by encouraging natural revegetation. Revegetate either by planting or seeding with grass or other suitable local vegetation. The following guidelines are recommended:

- Use stockpiled topsoil from the corridor preparation operation to cover exposed areas.
- Scarify the slope before replacing topsoil so as to enhance bonding.
- Constructed fills should be revegetated.
- Stabilise the topsoil along the outer edge of the road and down the fill to enable revegetation and stabilisation with the indigenous plant species of the area.

- Use devices such as mats, pegs and mesh together with suitable grass species (vetiver may be necessary in extreme cases) to improve the chances of successful revegetation and hence slope stabilisation, where this is required. Although Kikuyu grass is not ideal, it remains effective, easily available and if no other option is available, preferable to doing no vegetative control. However, it should not be used to stabilise exposed surfaces next to watercourses.
- Seed as soon as possible.
- Carry out suitable mulching on exposed areas.
- Prevent water running down slopes or at least reduce water velocity.
- On rocky slopes prone to erosion or rock-falls, apply wire mesh or a thin layer of shotcrete.

Effective embankment protection reduces road maintenance costs

6. ROAD MAINTENANCE

Adequate and proper road maintenance is required to ensure that erosion, sedimentation, protection of roadside vegetation and road degradation is kept to a minimum.

6.1 Drainage

Adequate and regular maintenance of road drainage is imperative (particularly just before and during the rainy season) for preserving the road infrastructure and limiting environmental damage. The following guidelines are thus recommended:

- Clear drains and culverts regularly to avoid blockages.
- Maintain culvert outlets and silt traps.
- Keep openings to culverts and bridges clear and always ensure that water can flow through without hindrance.
- Open side drains and mitre-drains with a grader, blade tractor, excavator or manually.
- Inspect and repair river / stream crossings, drifts, bridges and culverts regularly.
- Clean scour checks in side drains regularly.

6.2 Road Surface

- To prevent erosion, the road should be closed temporarily during and after excessive rain.
- Low usage roads should be vegetated and mown rather than graded.

6.3 Roadside

- Maintain, stabilise or replant cuts as soon as exposed areas reappear.
- Maintain buffer/vegetation to keep the road dry, improve visibility and for fire control purposes.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS
IN SOUTH AFRICA

OTHER FORMS OF LAND USE

NON - TIMBER FOREST PRODUCTS AND SERVICES

The forest estate is also a source of products and services other than timber. These are referred to as non-timber forest products and services. Their importance, which should not be underestimated in terms of their value and environmental impact, may either support the functioning of the estate (e.g. housing) or complement conventional timber products (e.g. water generation, biodiversity, hunting, and fishing etc.).

1. OPERATIONAL PLANNING AND IMPLEMENTATION

Multiple resource utilisation includes a host of activities that cannot all be covered in this publication. Activities such as hunting, mushroom collecting, wood collection (for carving and fuel), fishing and hiking are all types of forest products and should always take into account the issues below.

Planning for these should take into consideration the IEM procedure (refer to Section 1 3 in the Introduction for details on this procedure) and, where appropriate, make use of:

- proper maps;
- expert advice;
- consultation with interested and affected parties; and
- the best available information.

The planning, implementation and maintenance of other land uses should be fully integrated with timber activities and the following should be considered for all these activities:

1.1 Location and Scale

- Prevent or reduce conflicting interests as well as any negative environmental and core business impacts.
- Consider and compare alternative locations, to select a site where impacts are negated and/or minimised and mitigatory measures are most productive.
- Locate such land uses where the products and services, and subsequently the land use, can be optimised.

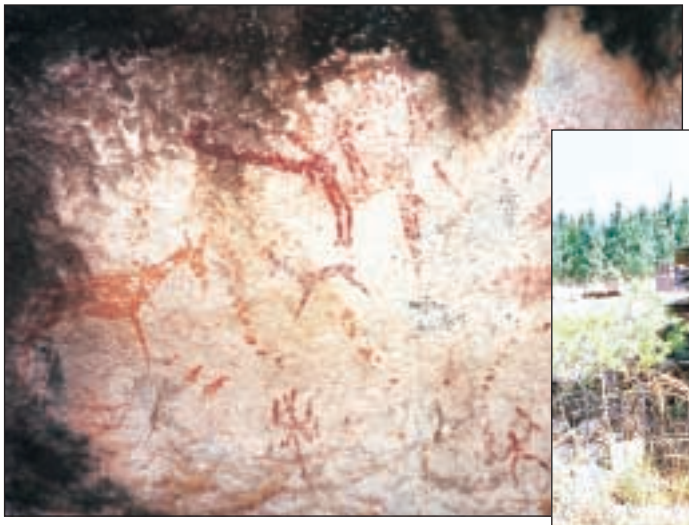
1.2 Legal Requirements

- Adhere to legal restrictions relating to the implementation and operating of other land uses on a forest estate.

1.3 Costs / Benefits

- Prevent duplication both in terms of facilities on own land and those on neighbouring properties.
- Obtain the optimum use for the particular location.
- Reduce maintenance and ultimate decommissioning costs.

2. NON -TIMBER PRODUCTS AND SERVICES



Rock paintings

Ancient Afro-Indian ruins

Petroglyph

Historical grave site

2.1 Responsible Use and Management of Non-timber Products and Services

All natural, cultural and recreational assets present on the forest estate should be used and managed responsibly. Provision should be made for the control of fire, invader plants and over exploitation. These assets may include:

2.1.1 Rivers, streams and wetlands

Rivers, streams and wetlands may be important as a water resource, for recreational or commercial fishing, as habitats for riverine vegetation, fish and other faunal species, for providing high quality water downstream, for biodiversity; and/or for providing corridors between habitats.

The following guidelines should thus be followed:

- A permit is required from the Department of Water Affairs and Forestry for the construction of weirs.

- Site weirs carefully to avoid siltation due to reduction of flow velocity.
- Use gabions and reinforce banks where there is a danger of side-cutting.
- Provide central overflow from a weir and discharge into a pool of reasonable depth from which fish will be able to move upstream.
- Indigenous species should be used in preference to exotic species such as trout, carp and bass, as exotic fish compete with indigenous species for habitat and food resources.

- If the introduction of exotic fish is being considered, permission from the relevant Provincial authority must first be sought. Where exotic fish are to be kept and feeding is necessitated, the impoundments should not be in the river course, but located away from it.

- All water released from a fish impoundment into a natural watercourse from this impoundment should be of a similar quality to that of the inflow.

2.1.2 Dams

Dams are important water resources for fire fighting, recreational use (e.g. fishing, picnics sites and aesthetics) and environmental uses (e.g. they may provide a habitat for fish, bird and plant species). However, dams can also interfere with the natural movement of water and organisms in a watercourse. They also increase the surface water area, which leads to an increase in water loss through evaporation. In terms of this, the following guidelines are important.

- A permit is required from the Department of Water Affairs and Forestry for the construction of dams.
- Dams with a wall in excess of 5 metres high or of a capacity exceeding 50,000 cubic metres of water require a safety permit from the Department of Water Affairs and Forestry.
- Dam sites should be carefully chosen and are, in terms of the requirements of the Environment Conservation Act, subject to the undertaking of an Environmental Impact Assessment (EIA) before construction commences.

- Dam spillways should allow for the frequency and intensity of flood events and be constructed to allow for the passage of organisms in the watercourse.
- Where possible, construct islands to encourage diversity and to provide safe nesting sites for waterfowl.
- Expert input should be obtained for the planning and construction of dams.

2.1.3 Hiking and mountain bike trails

Hiking and mountain bike trails are widely utilised recreational activities associated with the forest estate. To ensure their long-term viability and to minimise environmental degradation the following guidelines are recommended:

- They should be designed to provide a variety of landscapes and experiences in a comfortable but challenging manner, without compromising their value.
- The route should be selected to reduce the risk of erosion and environmental degradation. Where erosion cannot be avoided, preventative measures should be taken in the form of constructed steps and water drains.
- Where erosion or environmental degradation has been identified, the track should be resurfaced and rehabilitated.
- Consideration and provision should be made for toilet facilities, litter disposal, campfire sites and firewood.
- Toilets should be subjected to an Environmental Impact Assessment (EIA).
- Regular maintenance is a necessary and ongoing requirement.

Recreational activities should provide for a variety of landscapes and experiences without compromising their values. Such facilities should be well maintained

Stock grazing should be strictly controlled

2.1.4 Grazing

Grazing within the forest estate is used by traditional and commercial farmers. This has the potential to cause significant degradation if not controlled. Hence the following should be ensured:

- Restriction of stock movement in watercourses by having herdsmen present at all times and/or allowing grazing only in fenced camps.
- Carrying capacity should not be exceeded as this can lead to erosion, loss of trees and site quality.
- Access to wetlands, waterways and ecologically sensitive areas should be done in consultation with a competent expert.

2.1.5 Picnic and camping sites

Picnic and camping sites are important recreational and social amenities provided by the forest estate. Consider the following when providing these.

- Carrying capacity should be determined beforehand and not be exceeded as this can lead to unnecessary degradation and will impact on the enjoyment of visitors.
- Consideration and provision should be made for toilet facilities, litter disposal, campfire sites and firewood.
- Construction of toilets should be subjected to an Environmental Impact Assessment (EIA).
- Regular maintenance is a necessary and ongoing requirement.

Eco-tourism developments can enhance the values derived from the forest estate. The careful planning of such developments is, however, required so as to reduce their environmental impacts

2.1.6 Flora and fauna

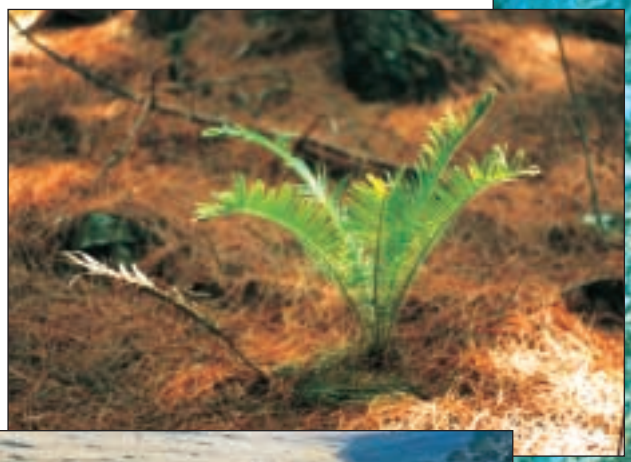
The forest estate provides important habitats for indigenous flora and fauna. Some species may be important for traditional and recreational uses including bird watching and the harvesting of products such as medicinal plants, honey, mushrooms and wood.

- These activities should only be undertaken on a sustainable basis.
- Permits are required for some of these activities and the relevant authority must be contacted before any such activity takes place.

Honey production

Medicinal plant

Indigenous flora



Community garden

2.1.7 Agricultural crops

- Land preparation for agricultural crops is controlled by regulations contained in the Conservation of Agricultural Resources Act (Act No. 43 of 1983). In terms of the Environment Conservation Act (Act No. 73 of 1989), an EIA is required for the conversion of agricultural land or conservation area to any other land use or grazing land to any other form of agricultural use.

3. AWARENESS AND EXTENSION

3.1 Access to Privately Owned Forests

In terms of Section 21 of the National Forests Act (Act No. 84 of 1998), the Minister may take steps to promote the voluntary granting of public access to privately owned forests by the registered owners of such forests. At the request of either the owner of the forest or a person seeking access to it, the Minister may set in motion negotiations between the interested and affected parties to determine whether or not the owner is willing to grant access and if so, on what conditions this access will be granted.

If an owner is willing to allow public access, he or she must provide the Minister with:

- Δ a map of the estate showing the areas designated for public access; and
- Δ a set a written rule setting out the conditions on which access will be allowed.

No person who is granted such access will be allowed to invade the privacy of the owner or cause damage to his or her property.

Where access has been granted by the owner, the Minister may provide funds or other forms of assistance from the National Forest Recreation and Access Trust to:

- Δ assist with the cost of developing the area of the forest which has been designated for public access; and / or
- Δ compensate the owner for any loss that may occur as a result of the public access being granted.

3.2 Promotion of Awareness of Environmental Values

The establishment of National Heritage Sites, Provincial Heritage Sites (as provided for under the provisions of the National Heritage Resources Act (Act No. 25 of 1999), Natural Heritage Sites and Sites of Conservation Significance contribute to the awareness of environmental issues. Visitors to forest estates should be made aware of these issues. Further education and awareness should be available about:

- The importance of the natural environment and its protection.
- The presence of particular natural assets on the forest estate such as rare flora and fauna species. **However, care should be taken in advertising these assets as it can lead to the illegal collection of such species.**
- The importance of the contributions that the forest estate makes to production forestry, environmental conservation, the economy, local communities and to society in general.
- Awareness may be increased by using notice boards, maps or handouts. These should be provided in various languages and forms (e.g. graphical) thereby allowing the message to be broadcast to as many users of the forest estate as possible.

4. VILLAGE MANAGEMENT

Formal plantation villages call for a variety of social and environmental considerations that should be taken into account. These include the following:

4.1 Accessibility and Convenience

- The availability and type of transport that is available to villagers needs to be considered to ensure adequate and convenient accessibility to the village.

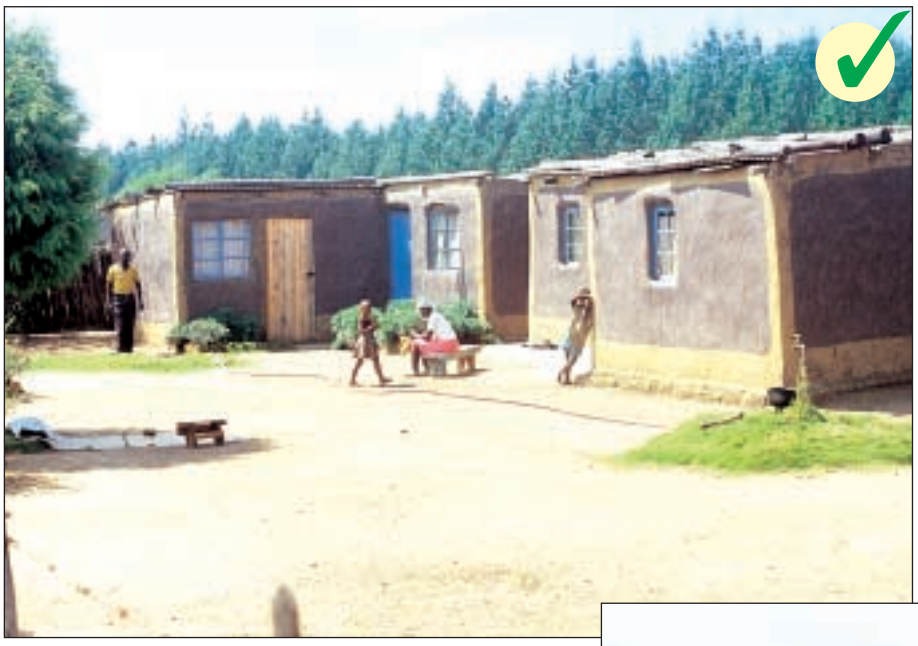
4.2 Water Supply

- The availability of potable and adequate water supply is very important for health reasons. Water supplied for domestic use must be potable (i.e. of a sufficient quality for human consumption).

4.3 Aesthetics

Consideration should be given to the aesthetics of the surrounding plantation environment and that within the village.

- It is important to consider cultural traditions in the design and the facilities provided.
- The village should be located, planned and designed to blend in with the general landscape.



Housing should be of an acceptable standard for the wellbeing of workers and their families and blend in with the general landscape

4.4 Site Hygiene and Waste Disposal

Maintenance of site hygiene is essential for the health of the villagers, prevention of pollution and the aesthetics of the village, so the following guidelines should be followed:

- In terms of the Environment Conservation Act (Act No. 73 of 1989), permits for waste sites have to be obtained from the Department of Water Affairs and Forestry prior to them being constructed or used. Exemptions can be applied for in case of smaller sites.
- The EIA process must be followed for the location, operations and eventual closure of a waste site.
- A permit from the Department of Water Affairs and Forestry is required for the installation and operation of sewerage waste treatment plants.
- Recycling should be encouraged and used where such facilities are available.

Recycling should be encouraged wherever possible

Domestic waste must only be disposed of in a site permitted by DWAF and should be properly managed and maintained

4.5 Availability of Education and Training

Education in environmental awareness will assist in establishing and maintaining the values that are being endorsed in this publication.

- Training and awareness education should be carried out in such a manner that it is understood by the villagers and should cover aspects such as literacy, hygiene, health, maintenance and protection of surrounding natural assets.

5. CONTROL

When utilising the forest estate for multiple uses, control measures should be put in place to ensure that resources are appropriately utilised and protected.

5.1 Security

For the security and protection of the forest estate's natural values, access must be controlled and can be integrated with recreation activities on the estate by:

- limiting access to certain times of the year;
- providing forest guards; and
- working through organisations that utilise the resource for recreation such as hiking, bird watching and youth clubs/groups and requiring them to assume part of the responsibility for controlling the activities undertaken by and behaviour of their members.

5.2 Protection of Species

To prevent the exploitation of species and thus maintain the environmental integrity of the forest estate, the following guidelines should be adhered to.

- Do not advertise the presence of rare species or communities as this may encourage their theft or destruction. Access to areas where such species occur should be supervised either by the estate owner or a recognised body.
- Registration of significant sites and the awarding of certificates and plaques can serve as motivation to continue with conservation efforts.
- Erect signboards focusing the attention on specific assets so that staff and visitors do not overlook their appropriate management.
- Keep accurate records of the species and numbers culled in hunting and fishing activities. This will not only provide control over the sustainable utilisation of these resources, but can also serve to support scientific research projects.
- Where rare species are being poached or collected illegally and where control over these activities is difficult, their relocation to places of safety should be considered.

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS IN SOUTH AFRICA

ANNEXURES

ANNEXURE A

ENVIRONMENTAL AUDITING

Environmental auditing is a management tool to check compliance of performance against a set of environmental standards. The audit itself can be compiled and conducted by the landowner (internal audit or self-assessment), or can be done in conjunction with other organisations (3rd party audit). The bottom line is that it should be compliant with all legal requirements but many landowners are setting goals which greatly exceed these minimum requirements. Examples of enhanced types of audits, which are obviously more worthwhile and credible, but also more time consuming to compile and conduct are:

- Δ auditing on a system accepted by a growers' organisation;
- Δ as above, but on a system compiled in conjunction with external interested and affected parties ;
- Δ as above but using external accredited auditors;
- Δ as above, for certification by some international body (e.g. FSC); and
- Δ any of the above, with public disclosure of audit results .

The objective of environmental auditing is to check compliance of performance against a set of standards and as such should be :

- Δ socially responsible;
- Δ environmentally sustainable;
- Δ economically viable; and
- Δ compliant with legal requirements.

There can be various added advantages to environmental auditing, including:

- Δ Good environmental performance invariably results positively on the bottom line of any organisation and helps ensure that a sustained yield of products is achieved at the least cost to the environment.
- Δ Preventing environmental damage and associated costs.
- Δ Market advantage (especially in some European markets for specialised products) and ensuring products are not blacklisted.

ANNEXURE B

FOREST CERTIFICATION

During the past decade, governments, environmental groups, Industry and the public have become increasingly aware that consumer demands and market forces have the potential to exert influence on the management and use of natural resources. As a result, there have been a number of international governmental and private sector initiatives to promote the concept of sustainable forest management (SFM). This concept is based on the management of the forest resource in such a manner that a sustainable flow of goods and services can be produced from it without the resource itself being depleted or over-exploited (i.e. it is managed in a sustainable manner). It is important to note however that sustainability in this context does not just include physical environmental considerations but also economic, social and institutional (e.g. legislation and policy) considerations (i.e. the "environment" in its broadest sense). The forest certification programmes that have been developed as a result of these initiatives fall into three broad categories. These are:

- Δ forest management certification;
- Δ forest product certification; and
- Δ forest management system certification.

In the South African context, SFM has become an increasingly important aspect of forest management and one which has been embraced by the local Forestry Industry. The first official recognition that SFM was a beneficial form of forest management came in March 1997 when a Workshop was held to discuss the principles, criteria and indicators for SFM. It was at this Workshop that six Principles of SFM were agreed upon and which were subsequently expanded to nine (these appear at the front of this publication). It was further agreed at the Workshop that there the need to develop a set of local criteria and indicators (C&I) for SFM which were specific to South African conditions. The National Forests Advisory Committee was tasked with developing these C&I for SFM and in this regard a "Committee for SFM" was established to undertake their development. Once completed, it is Government's policy to make compliance with these C&I a legal requirement.

A. Forest Management Certification

Forest management certification (e.g. FSC) usually takes place at the level of the forest management unit (FMU) and should have standards, independent inspection and monitoring, In particular, certification should take place by assessing the effect of forest operations against a set of standards that have been developed by stakeholders, and agreed by them to be significant and acceptable.

Prior to certification, a forest manager or organisation completes a process of **self-assessment**. Where inadequacies have been identified, modifications will be required which may be minor or major.

Following successful corrective action in the **preliminary analysis**, the forest owner can then proceed with the formal certification process. This usually entails a **pre-assessment** by an independent body, followed by the **main assessment** once any deficiencies identified in the pre-assessment report have been addressed.

The **main assessment** is a detailed evaluation of current forest management practices of the forest management unit (FMU) and includes on-site inspections, interviews with key personnel and external interested parties and the detailed examination of relevant documentation. At the end of the main assessment, it is confirmed whether or not the FMU will be recommended for certification or subject to corrective action, which will need to be addressed as a condition of certification.

Following certification, regular **surveillance visits** will be maintained by the independent body to ensure that the organisation is continuing to maintain the requirements and to address any problem areas that may have been identified during previous visits.

The best known FMU certification programme is that of the Forest Stewardship Council's (FSC's), an NGO based in Mexico. The FSC does not carry out certification itself but instead accredits certification organisations (e.g. SGS) to so on its behalf.

B. Forest Product Certification

Where the forest owner and/or buyers of wood from a certified forest wish to identify the wood as coming from a certified source, a **chain-of-custody assessment** is carried out. The chain-of-custody requirements are that the assessed organisation needs to ensure that:

- Δ all products from certified forests, or manufactured from products derived from such sources, are clearly marked;
- Δ documented procedures exist to control the marking of certified products;
- Δ all products from certified forests, or manufactured from products derived from such sources, are kept separate from other products;
- Δ all records are maintained relating to purchase, delivery, shipment, receipt, forwarding and invoicing for certified products; and
- Δ documented procedures exist to control the record keeping process.

The chain-of-custody provides the link between buyers and sellers from the forest to the point of sale and assures consumers that the products emanate from a certified forest. Such products are entitled to carry a so-called "ecolabel" such as the FSC's "Qualifor" logo so that consumers can easily identify them as coming from a certified forest. It does not however certify that the processing plant (e.g. sawmill) complies with any environmental standards other than the maintenance of the documented procedures outlined above.

Chain-of-custody certification can be readily applied to solid timber products such as sawn timber, charcoal, wooden furniture etc. but less so to pulp, paper and reconstituted board products. This is due to the complexity of complying with the **percentage-based-claims** criteria applied to the certification of these products.

C. Forest Management System Certification

The only management system certification applicable in South Africa is the ISO 14001 Environmental Management System.

ISO International Organization for Standardization

The mission of the International Organization for Standardization (ISO - derived from the Greek iso, which means equal), a federation of 119 national standards bodies, including the SABS, is to promote the development of standardisation and related activities in the world, with a view to facilitating the international exchange of goods and services and to develop co-operation in the spheres of intellectual, scientific, technological and economic activity.

The ISO 14001 standard specifies the requirements of an environmental management system. It is applicable to all types and sizes of organisation and accommodates diverse geographical, cultural and social conditions. The ISO standard does not establish absolute requirements for environmental performance beyond commitment to comply with applicable legislation and regulations and to continual improvement.

The environmental management system encourages organisations to consider implementation of the best available technology, where appropriate and economically viable. In general, the system should enable an organisation to:

- Δ establish an environmental policy;
- Δ identify the environmental aspects arising from the organisation's activities, products or services;
- Δ determine the environmental impacts of significance;
- Δ identify relevant legislative and regulatory requirements;
- Δ identify priorities and set objectives and targets;
- Δ establish a structure and programme(s) to implement the policy and achieve objectives and targets;
- Δ facilitate planning, control, monitoring, corrective action, auditing and review activities to ensure that the policy is complied with and that the environmental system remains appropriate; and
- Δ be capable of adapting to changing circumstances.

D. Markets for Certified Products

Certification is a useful marketing tool where (Upton and Bass, 1995):

- Δ there is a strong willingness among consumers to pay the extra costs associated with certification; or
- Δ any associated increase in cost as a result of certification is offset against other commercial gains, for example:
  - medium-term gains in efficiency and productivity;
  - access to and protection of market share and increased marketing opportunities through product differentiation;
  - reduction of environmental risk, resulting in better access to financial markets for loans, etc.;
  - better stock control; and / or
  - improved image in "green" conscious markets.

However, the real benefits from certification may not come from specific product benefits – such as higher prices, but from an improved business profile in the eyes of "green" conscious consumers, which can benefit overall commercial performance. However, these potential benefits can be low in markets in which there is no demand for such certified products or where the markets are underdeveloped.

ANNEXURE C

RECOMMENDED LAND PREPARATION METHODS FOR VARIOUS SITE CONDITIONS

Site condition	Guideline
Sites with deep apedal soils or sites that do not have a specific physical problem (e.g. root impeding layers)	a) Minimum tillage should be practised. This includes a shallow (not more than 500 mm) ripping or ploughing operation. b) Light tillage (single-pass operation using light equipment could be utilised to: • prepare planting positions; • incorporate plant residues into the topsoil to speed up mineralisation; or • to assist in weed competition control.
Non cohesive soils (Fernwood soils and soils with clay contents of less than 15%)	a) These sites will not benefit from tillage and this option should be excluded.
Sensitive unstable soils (i.e. soils that hardset and tend to erode)	a) Should receive no or very little tillage as disturbance could lead to physical problems. b) If tillage is deemed necessary then it should be conducted strictly along the contour with slash left on site. c) Slash should not be burned on these soils.
Water repellent soils resist wetting because of the formation of a coating of hydrophobic substances of organic origin on soil particles. The effect can result in reduced infiltration into soil and therefore increased overland flow. The topsoil of water repellent soils may remain dry even after a rainstorm and this leads to high mortalities of young seedlings and reduced productivity of successive rotations as repellence increases.	a) The most effective way to improve infiltration, but keep disturbance to a minimum, would be the use of ripping or sub-soiling tines. b) Such ripping must be along the contour using the correctly designed winged tines, thus resulting in furrows into which seedling are planted.

RECOMMENDED LAND PREPARATION METHODS FOR VARIOUS SITE CONDITIONS (continued)

Compacted soils, caused mostly by plantation operations, but also by the weight and movement of the tree crop will impede root development if bulk densities exceed the following: i) 1.55 g/sq. cm on clay-loams ii) 1.65 g/sq. cm on silt loams iii) 1.80 g/sq. cm on fine sandy loams iv) 1.85 g/sq. cm on loamy fine sands Severely compacted soils show increases in bulk densities down to depths of over 1 metre.	a) On the majority of sites suffering from compaction, tillage should be restricted to extraction rows. b) Disc-ploughs or chisel-ploughs can be used to loosen surface compaction, providing slash layers are light. c) Large winged sub-soilers can fracture soils to this depth if soil moisture levels are not too high and the tines have been designed to heave soil to this depth. Such tining must create crescent failure and not lateral failure (see Figure PS 5 : Section PS 11.4), the latter resulting in smearing of the profile and very little loosening occurring.
Soils containing root impeding layers (e.g. ouklip). These sites would include soils containing stonelines, waterlogged sub-soils, sub-soils with well weathered saprolite, a firm layer overlying a more friable horizon, or vice versa and possibly structured sub-soils.	a) Cultivation where root development is restricted by some impeding zone should result in increased tree growth.

ANNEXURE D

SOIL SENSITIVITY INDEX

Based on Soil Physical Properties of South African Forestry Soils

Soil Forms	A Horizon Characteristics and Soil Family	Clay Content in A Horizon (%)	Sensitivity Index			AWC	Permeability
			Compactability	Erosion Hazard	Hard-setting		
1. HUMIC SOILS							
Kranskop	thin humic A	< 35	low - moderate	low - moderate	-	high	very good
Inanda	(1100, 1200)	> 35	low	low	-	very high	good
Magwa	thick humic A	< 35	low	low	-	very high	rapid
Momanci	(2100, 2200)	> 35	very low	very low	-	very high	very good
Sweetwater	thin humic A	< 35	low - moderate	low - moderate	-	moderate	good
Lusiki	(1100 to 1220)	> 35	low	low	-	high	moderate
	thick humic A	< 35	low	low	-	high	very good
	(2110 to 2220)	> 35	very low	very low	-	very high	good
2. ORTHIC A / APEDAL B OR NEOCUTANIC B							
Hutton	less than 25 cm thick	< 15	very high	very high	H	very low	very good
Clovelly		15 - 35	moderate	moderate	pH	low - moderate	good
Griffin		> 35	low	low	-	moderate - high	moderate
Glencoe *	more than 25 cm thick	< 15	high	high	H	low	very good
Bainsvlei *		15 - 35	low - moderate	low - moderate	pH	moderate	good
Avalon		> 35	very low	very low	-	high	moderate
Pinedene *							
Bloemdal *							
Oakleaf							
Tukulu *							

For soils of these forms less than 60 cm in depth, the sensitivity index should be increased by 1 grade, e.g. "low" becomes "moderate"

*** These soils have a permeability 1 to 2 grades LESS than indicated**

SOIL SENSITIVITY INDEX (continued)

Soil Forms	A Horizon Characteristics and Soil Family	Clay Content in A Horizon (%)	Sensitivity Index			AWC	Permeability
			Compactability	Erosion Hazard	Hard-setting		
3. ORTHIC A / ROCK OR LITHOCUTANIC B OR HARD PLINTHIC B							
Mispah **Glenrosa** **Dresden**	non - bleached (1100 to 1222)	< 25	high	high	pH	very low	moderate
		> 25	moderate - high	moderate - high	-	low	moderate
	bleached (2000 to 2222)	< 25	very high	very high	H	very low	moderate
		> 25	high	high	pH	low	moderate
4. REGIC SAND AND STRATIFIED ALLUVIUM							
Namib			very high	very high	-	very low	rapid
Dundee	1110, 1120 2110, 2120		moderate	moderate	-	moderate	moderate
	1210, 1220 2210, 2220		moderate	moderate	-	moderate	poor
5. ORTHIC A / E HORIZONS							
Cartef **Longlands** **Wasbank** **Kroonstad** **Klapmuts** **Estcourt**		< 15	very high	very high	H	very low	poor
		> 15	high	high	H	low	very poor
Vilafontes **Constantia**		< 15	very high	very high	H	low	poor
		> 15	high	high	H	low - moderate	poor
Fernwood	light coloured A (1110 to 1220)		very high	very high	pH	very low	very good
	dark coloured A (2110 to 2220)		high	high	pH	low	very good

SOIL SENSITIVITY INDEX (continued)

Soil Forms	A Horizon Characteristics and Soil Family	Clay Content in A Horizon (%)	Sensitivity Index			AWC	Permeability
			Compactability	Erosion Hazard	Hard-setting		
6. ORTHIC A / PEDOCUTANIC B							
Swartland **Sepane**	non - bleached (1100 to 1222)	< 35	high	high	pH	low - moderate	moderate
		> 35	moderate	moderate	-	moderate	moderate
	bleached (2100 to 2222)	< 35	very high	very high	H	very low	moderate
		> 35	high	high	pH	low	poor - moderate
7. MELANIC SOILS AND ORTHIC A / RED STRUCTURED B							
Bonheim **Mayo** **Milkwood**			low	low - moderate	-	moderate	moderate
Willow-brook **Inhoek**			low	moderate	-	moderate	poor - moderate
Shortlands			low	low	-	moderate - high	good
8. ORTHIC A / GLEY OR SOFT PLINTHIC B OR PRISMACUTANIC B*							
Katspruit		< 35	very high	very high	-	low	very poor
Westleigh **Sterkspruit**		> 35	high	very high	-	low - moderate	very poor
*** NOTE These soils are normally not recommended for commercial afforestation**							

ADDENDUM TO TABLE

a) **Slope Factor Sensitivity Grade Alteration**

Compactability Erosion Hazard

Gently undulating / level 0 0

Moderate slope -1 +1

Steep slope -2 +2

b) **H = hardsetting**

pH = potentially hardsetting

c) **Available Water Capacity – mm / m**

Very high 180

High 150 - 180

Moderate 120 - 150

Low - moderate 100 - 120

Low 80 - 100

Very low <80

d) **Permeability (internal drainage) mm / day**

Rapid 60+

Very good 40 - 60

Good 25 - 40

Moderate 15 - 25

Poor 5 - 15

Very poor <5

Source : Institute for Commercial Forestry Research Bulletin 8/92 contents

ANNEXURE E

NATIONAL TERRAIN CLASSIFICATION SYSTEM FOR FORESTRY

Ground Conditions (trafficability within the stand)	
1	Very good
2	Good
3	Moderate
4	Poor
5	Very poor

Ground Roughness	
1	Smooth
2	Slightly uneven
3	Uneven
4	Rough
5	Very rough

Slope Class	Gradient	
	Percent	Designation
1	0 -11	Level
2	12 - 20	Gentle
3	21 - 30	Moderate
4	31 - 35	Steep 1
5	36 - 40	Steep 2
6	41 - 50	Steep 3
7	> 50	Very steep

Rating	Soil Wetness Hazard
0	No signs of wetness
1	Wet for short periods
2	Wet for long periods
3	Wet almost all year round

ANNEXURE F

RECOMMENDED EXTRACTION METHODS FOR VARIOUS TERRAIN CONDITIONS

Method	Slope (%)	Ground		Extraction Distance (Metres)
		Condition	Roughness	
Manual	0+	1 - 5	1 - 5	
Chute Extraction (half round pipe)	Traverse = 15 - 70 Straight Down = 15 - 35	1 - 5	1 - 2	50 - 120
Chute Extraction (round pipe)	Traverse = 20 - 90 Straight Down = 20 - 45	1 - 5	1 - 3	30 - 150
Animal (small logs)	Down = 0 - 35 Up = 0 - 15	1 - 5 1 - 3	1 - 2 1 - 2	30 - 100 15 - 50
Animal (large logs)	Down = 0 - 25 Up = 0 - 15	1 - 5 1 - 3	1 - 2 1 - 2	30 - 100 15 - 50
Wheeled Skidder (normal tyres)	Up = 0 - 20 Down = 0 - 35	1 - 3	1 - 3	50 - 500
Wheeled Skidder (flotation tyres)	Up = 0 - 20 Down = 0 - 40	1 - 4	1 - 3	5 - 500
Clambunk Skidder	Up = 0 - 25 Down = 0 - 40	1 - 3	1 - 3	50 - 1000
Tractor with A-frame	Up = 0 - 10 Down = 0 - 30	1 - 4	1 - 2	50 - 300
Tracked Skidder Crawler	Up = 0 - 30 Down = 0 - 45	1 - 4	1 - 2	50 - 350
Wheeled Forwarder (normal tyres)	Up = 0 - 30 Down = 0 - 35	1 - 3	1 - 3	50 - 1000
Wheeled Forwarder (high flotation tyres)	Up = 0 - 30 Down = 0 - 40	1 - 4	1 - 3	50 - 1000

RECOMMENDED EXTRACTION METHODS FOR VARIOUS TERRAIN CONDITIONS (continued)

Method	Slope (%)	Ground		Extraction Distance (Metres)
		Condition	Roughness	
Tracked Forwarder	Up = 0 - 25 Down = 0 - 45	1 - 4	1 - 2	50 - 1000
Tractor and Trailer	Up = 0 - 10 Down = 0 - 20	1 - 2	1 - 2	50 - 5000
Highlead - Buttrigging	20 - 40	1 - 3	Down 1 - 2 Up 1 - 3	50 - 200
Highlead - Riderblock	20 - 50	1 - 5	Down 1 - 3 Up 1 - 4	50 - 200
Skyline - downhill yarding	0 - 80	1 - 4	1 - 3	100 - 600
Skyline - uphill yarding (full suspension)	0 - 100	1 - 5	1 - 5	100 - 600
Skyline - uphill yarding (partial suspension)	0 - 100	1 - 5	1 - 4	100 - 600
Monocable	0 - 40	1 - 5	1 - 5	50 - 500
Groundlead (winching)	0 - 50	1 - 2	1	10 - 50

ANNEXURE G

SOME WOODY PLANT SPECIES INDICATING WETLAND CONDITIONS

Botanical Name	Common Name
Barringtonia racemosa	(Powderpuff tree)
Ficus sur	(Cape fig)
Ficus sycomorus	(Sycamore fig)
Ficus trichopoda	(Swamp fig)
Macaranga capensis	(Wild poplar)
Raphia australis	(Raphia palm)
Rhus gerrardii	(Drakensberg karee)
Salix mucronata	(River willow)
Syzigium cordatum	(Water pear)
Syzigium guineense	(Water berry)
Voacanga thouarsii	(Wild frangipani)

ANNEXURE H

GRASS SPECIES OCCURRING IN THE UPLAND AREAS OF THE EASTERN SEABOARD WHICH INDICATE WETLAND CONDITIONS

Agrostis eriantha	Fw
Agrostis lachnantha	Ow
Andropogon appendiculatus	Fw
Angropogon eucomis	Fw
Arundinella nepelensis	Fw
Brachiaria eruciformis	Fw
Diplachne fusca	Ow
Echinochloa crus-galli	Fw
Echinochloa jubata	Fw
Eragrotis lappula	Fw
Eragrotis plana	Fw (dry climate) f (wet climate)
Eragrotis planiculmis	Ow
Festuca caprina	Fw
Fingerhuthia sesleriiformis	Ow

GRASS SPECIES OCCURRING IN THE UPLAND AREAS OF THE EASTERN SEABOARD WHICH INDICATE WETLAND CONDITIONS (continued)

Helictotrichon turgidulum	Fw
Hemarthria altissima	Fw
Imperata cylindrica	w (dry climate) f (wet climate)
Ischaemum fasciculatum	Ow
Koeleria capensis	Fw
Leersia hexandra	Ow
Merxmuellera macowanii	Fw
Miscanthus capensis	Fw
Miscanthus junceus	Ow
Panicum coloratum	Fw
Panicum hymeniochilum	Ow
Panicum repens	Ow
Panicum schinzii	Fw
Paspalum dilatatum	Fw
Paspalum distichum	Ow
Paspalum scrobiculatum	Fw
Paspalum urvillei	Fw
Pennisetum macrourum	Ow
Pennisetum natelense	Ow
Pennisetum sphacelatum	Ow
Pennisetum unisetum	Fw
Phalarus arundinacea	Ow
Phragmites australis	Ow
Phragmites mauritianus	Fw
Setaria sphacelata	Fw
Stiburus alopecuroides	Fw

Notes :

1. **Ow** stands for obligate wetland species (i.e. plants which almost always grow in wetlands (>99% of occurrences)).
2. **Fw** stands for facultative wetland species (i.e. plants which usually grow in wetlands (67- 99% of occurrences), but occasionally are found in non-wetland areas).

ANNEXURE I

GLOSSARY OF TERMS

<	less than
>	greater than
abiotic	not a living organism (e.g. wind, fire, water etc.)
abutment	the part of a structure (e.g. bridge) that directly receives the pressure or load force of that structure
accountability	an obligation to be accountable or accept responsibility for ones actions
aesthetics	a branch of philosophy dealing with beauty and its creation and appreciation (e.g. if a view is beautiful then it could be described as being aesthetically pleasing)
age class	the categorisation of trees according to their age in years
alien species	fauna or flora that do not naturally occur in a particular area, region or country (i.e. they are not indigenous species)
alluvial deposit	Material (e.g. sand, gravel, silt) deposited by running water
anchor tree / stump	a tree or stump used to anchor a machine or other object by having cables attached to both the object and the tree or stump (particularly used during harvesting operations)
aeolian	wind blown
apedal soil	soil without peds, (i.e. without structure)
aquifer system	a water bearing stratum (layer) of permeable rock, sand or gravel
archaeological	relating to or based on the science of archaeology
archaeology	the branch of science dealing with the study of material remains of past human life and activities
areas of special interest (ASI)	examples include grave sites, waterfalls, picnic sites, bird nests, caves, sinkholes, old mining works
aspect	the direction that something faces (e.g. north, south, etc.)
audit	review of actions to ensure that they are or have been being carried out according to policy or procedure
auditable	actions that can be subjected to an audit
base course	the layer of road material above the subgrade that supports the weight of the traffic. on roads with only one layer on top of the subgrade, this layer also acts as the vehicle running surface
baseflow	longer-term flow in a river that continues after storm flow has passed
biodiversity / biological diversity	the number and variety of fauna and flora present in an area
biological	of or relating to biology or to life and living processes
biological control	the use of parasites or diseases to control the spread of unwanted plant or animal species (i.e. their control through biological as opposed to chemical or other means)

GLOSSARY OF TERMS (continued)

biology	a branch of science dealing with living organisms and vital processes
biophysical	a branch of science dealing with the application of physical principles and methods to biological problems
biotic	applied to the living component of the environment
borrow pit	a quarry from which material is extracted for use in road building activities
buffer zone	the natural or semi-natural area between the planted area and an environment component such as a stream, that requires protection
cable yarding	the extraction of timber using a stationary or semi-stationary machine using one of a number of cable systems
camber	the curvature of the road from its middle (centre line) to its outer edges
catch drain	a drain constructed on the top side of a cut to collect water that would otherwise cause erosion on the face of the cut
catchment	a defined geographic area from which run-off drains into a particular watercourse/s
chopper roller	a customised heavy roller incorporating blades that cuts and compresses slash
chromas	quality or colour of a soil combining hue and saturation
clearfelling	the felling of all the trees within a demarcated area (e.g. compartment)
clod	a lump of earth
clone	an individual grown from a single somatic cell and genetically identical to its parent
cognisance	to take into account or take recognition of
combustible	capable of being burnt
compaction	a process whereby the surface and sub-surface soil is pressed downward (i.e. it is compacted)
compartment	a demarcated area within a plantation that contains trees of the same species and age class and that is managed for a specific purpose (e.g. for the production of softwood pulpwood)
conservation areas	areas within a plantation that are left unplanted and which are managed for water conservation, biodiversity and other purposes
consultation	to confer with or discuss issues between parties
contiguous	touching or connected in an unbroken manner
contingency plan	an alternate (or back-up) plan of action that can be implemented should circumstances not permit the carrying out of the original plan
contour	points on the surface of the land that are of equal elevation (altitude)
contour lines	lines on a map linking points of equal elevation (altitude)
coupe size	area of trees to be felled or which have been felled
criteria (i.r.o. SFM)	a set of desired conditions, covering environmental, social, economic and institutional aspects, that meet the overarching principles of SFM

GLOSSARY OF TERMS (continued)

cross drain	drain constructed diagonally across the surface of a road
cul-de-sac	dead-end road
culvert	a drain required wherever a road crosses a natural watercourse and which crosses diagonally underneath the road. It acts to remove water off a road and prevent sedimentation build up in the watercourse.
cut and fill	a method used in road construction whereby soil removed from the cut side of the road is used as the fill on the other side of the road
cut slope	the up-slope side of a road (in-slope) that has been excavated to form an embankment
danger areas	areas which may enhance fire movement or intensity (e.g. villages, depots, power lines, waste sites etc.)
DBH	diameter breast height - used as a standard measure of tree growth
decommission	to shut or close down
decomposition	the process whereby animal or plant matter, through the action of bacteria and or fungi, rots or decays
degradation	the result of degrading something (i.e. the resultant lowering of something's physical properties)
degrade	to lower the physical properties of something
delineate	to mark the outline or border of something (e.g. a wetland)
delineator	a person who marks out the outline or border of an area
demarcate	to mark out the outline or border of something
depot	an area where large volumes of timber are stored and handled before being transported to a processing plant
destumping	the removal of tree stumps
directional felling	the felling of trees in a controlled manner in a particular direction (e.g. to avoid trees falling into SMZ's)
displacement	the removal of something to a new location
ecological	relating to or based on the science of ecology
ecology	a branch of science dealing with the interrelationship between organisms and their environments
end hauling	a method of road construction (normally used for full bench road profiles in steep areas) where an excavator (as opposed to a bulldozer) is used to excavate material which is then transported off-site. This leads to minimal material being lost down the slope thus causing a lower visual impact than side casting
endemic species	fauna or flora that only occur in one particular location and nowhere else
environmental auditing	a management tool to check compliance of performance against a set of environmental standards – can be either based on self assessment or third party assessment (e.g. FSC)
environmental conservation	the planned management and use of natural resources so as to ensure that they are sustainably used and not over-exploited or neglected

GLOSSARY OF TERMS (continued)

Environmental Impact Assessment (EIA)	a formal, or in certain cases, such as planning for harvesting operations, an informal assessment procedure that is followed to collect, organise, analyse, interpret and communicate data that are relevant to making an "informed" decision
ephemeral watercourse	a watercourse in which the water only flows for a short period of time, usually only after heavy rain, and which does not have a well defined channel
erosion	the removal of material from its original location through the action of the natural elements (i.e. wind, fire and water) or human and animal activity
espacement	the distance between planted trees (determines the stand density)
evaporation	the process whereby liquid is transformed into vapour
evapotranspiration	the loss of soil moisture both by evaporation and transpiration from the plants growing in it
exotic species	fauna or flora that do not naturally occur in a particular area, region or country (i.e. they are not indigenous species)
exponential	a result which is greater than by which the original variable was changed (i.e. it is characterised by a rapid increase)
extraction routes	routes within a felled compartment which allow access for equipment or animals (mules) to extract the harvested timber
exudate	a substance that oozes or spreads out in all directions
fault line	a fracture (as in rocks) caused by geological events beneath the earth's surface
fauna	animal life
field verification	to check the validity of information by physically visiting the area in question and verifying it's accuracy first hand on the ground
firebreak	a piece of land kept clear of vegetation designed to hinder the spread of fire
flash-back	an electrical discharge from a power source (e.g. powerline) to an object that is earthed (can happen if the object is too close to the power source)
flora	plant life
fluvial processes	processes relating to rivers and streams and their actions
focal point	a prominent feature to which one's attention is immediately drawn
Forest Management Unit (FMU)	an area of forest managed as a distinct and separate entity – usually consists of a single plantation
forwarder	a machine that carries the felled timber to the landing site by lifting the load completely off the ground
forwarding	operation whereby timber is extracted from a compartment by a machine that carries the felled timber to the landing site by lifting the load completely off the ground
friable	easily crumbled
fuel load	the amount of combustible material (e.g. slash) on a particular piece of land

GLOSSARY OF TERMS (continued)

full bench construction	a method of road construction (used in steep areas) whereby the entire width of the road is cut out of the slope
fynbos	herbaceous vegetation cover, largely restricted to the southern parts of South Africa
gabion	a basket or cage, filled with earth or rocks, used in building a support or abutment
gene	a specific sequence of compounds contained in DNA that determine a living organisms characteristics
genetic modification	the altering of a living organism's genes so as to change its inherent characteristics
geological	relating to or based on the science of geology
geology	branch of science dealing with the history of the earth and its life especially as recorded in rocks
gravel pit	a quarry from which gravel or rock is removed for use in road construction
gravel wearing course	the top layer of road material that acts as the running surface for vehicles
guidelines	a set of non-binding recommendations
habitat	the specific environment in which a plant or animal naturally occurs
harvesting system	the system used for the felling, conversion and extraction of trees
herbaceous plant	a plant which contains little or no woody tissue (usually only persists for one growing season)
herbicides	chemicals used to kill harmful or unwanted plants
highlead	a type of cable yarding system consisting of two drums (mainline and haul-back line) and a tower or spar – it has less lift than a skyline system and a maximum recommended yarding distance of 200m
hue	colour
humic soil	soil containing, or derived in part from, material resulting from the decomposition of plant or animal matter and forming the organic part of the soil
humus	brown or black material resulting from the partial decomposition of plant or animal matter and which forms the organic part of a soil
hybrid	the offspring of two animals or plants of different breeds, species, varieties or genera
hydric conditions	conditions resulting from an abundance of water in the soil
hydrological	relating to or based on the science of hydrology
hydrology	branch of science dealing with the properties, distribution and circulation of water on and below the earth's surface and in the atmosphere
hydromorphic soil	soil developed in the presence of excess moisture which leads to the suppression of aerobic (oxygen related) factors in soil building
hydrophytic plant species	any plant that grows in water or on a substratum that is at least periodically deficient in oxygen because of soil saturation or flooding; plant typically found in wet habitats

GLOSSARY OF TERMS (continued)

hygiene	conditions or practices conducive to health (e.g. cleanliness)
hyson cells	term for a "honey-comb" like material which, when filled with soil, aids in stabilising soils and assists in erosion prevention
impede	to obstruct or hinder
impermeable	not capable of being penetrated by liquids or gasses (e.g. granite)
in situ	in something's original location
indicators (i.r.o. SFM)	a set of measurable conditions, one of more for each criterion, that are used to judge (indicate) whether the criteria (and thus the principles) for SFM are being met
indigenous species	fauna or flora that occur naturally in a particular area, region or country (i.e. they are not alien or exotic species)
infield	the location where forestry operations are taking place
in-slope road	a road that drains water across the entire surface of the road towards the cut slope (for areas with steep slopes)
Integrated Environmental Management (IEM)	an integrated procedure upon which decisions can be meaningfully based which takes into account the likely reaction to any action, mitigatory measures that can be implemented and, in need, alternative actions that can further limit negative impacts or increase positive impacts
invasive tree species	tree species that have the extreme ability to spread and thrive outside their natural habitat or the controlled area in which they are grown (e.g. black wattle)
irrevocable	not capable of being rectified once done
krantz	a cliff
land preparation	the preparing of land for the planting of trees (e.g. by ploughing, ripping etc.)
landing	an open area, usually at roadside, where harvested timber is temporarily stored before being transported to a depot or processing plant
landscape	the natural features of the land surface (landforms) of an area taken as a whole
leaching	a process whereby mineral compounds are washed downwards through the soil
linear arrangement	the positioning of linear (long and narrow) elements within a landscape (e.g. roads, railway lines, powerlines etc.)
lithology	the characteristics of a rock formation or a rock formation exhibiting a particular set of characteristics
longitudinal gradient	the slope of the road when measured along its length
marginal site	a site that is not the most optimum for the crop that is to be grown (e.g. due to soil, climatic conditions etc.)
mean	a value equal to the sum of a set of figures divided by the number of sets
metamorphosed zone	an area which has been transformed by the forces of nature (e.g. by volcanic activity)
microbe	an organism of microscopic (extremely small) size

GLOSSARY OF TERMS (continued)

mitigatory measures	measures that will reduce the negative and increase the positive impacts that a planned activity will have on the environment
mitre drain	a drain that diverts water from the shoulder of the road by way of a curved channel that runs out from the road in the direction of the water flow and into an area where the run-off can be dispersed without causing erosion
monocable	a type of cable yarding system which is light-weight and semi-stationary and which consists of a capstan winch driving a continuous loop of cable. Only recommended for small pieces of timber and up to a maximum yarding distance of 500m
monoculture	the growing of a single crop or species on a tract of land
mosaic	a visual effect created in the forest landscape through the use and location of different tree species and age classes and unplanted conservation areas
mottles	spots or blotches of different colour or shades of colour interspersed with the dominant colour
mulching	the placing of a protective covering (e.g. compost, slash) on soil to reduce moisture loss, maintain soil temperature, prevent erosion, control weeds or to enrich the soil
Multiple Resource Utilisation (MUR)	the use of the forest estate for the production of timber and non-timber products and services (e.g. grazing, honey production, mushroom collection, hiking, fishing, mountain biking etc. etc.)
nutrient	a substance containing nutrive which enhances plant growth through providing nourishment
off-take	the marketable timber products removed from the area harvested
organism	a complex structure of interdependent elements whose relationships and properties are determined by their function as a whole
orthophoto maps	maps derived from aerial photographs which have been adjusted to remove distortion and which have contour lines marked on them
out-slope road	a road that drains water across the entire surface of the road away from the cut slope (only for areas with gentle slopes)
overburden store	a stockpile of material in excess of what was originally required that can be used for the subsequent rehabilitation of a road or other earthmoving needs
palaeontological	relating to or based on the science of palaeontology
palaeontology	the branch of science dealing with the life of past geological periods as known through fossil remains
pedological	relating to or based on the science of pedology
pedology	the branch of science dealing with the study of soils
perennial watercourse	a watercourse which has a well defined channel and in which water flows during all seasons of the year
permeable	capable of being penetrated by liquid or gasses (e.g. sandstone, limestone)
pesticides	chemicals used to kill harmful or unwanted insects

GLOSSARY OF TERMS (continued)

petroglyph	a carving or inscription on a rock
pitting	an operation whereby pits are dug into which seedlings are planted. Primarily used in steep areas where mechanical land preparation is not possible
plantation	a large man-made area of trees intensively managed for the production of fibre and usually consisting of a number of compartments
podzolization	a process of soil formation, principally through the leaching of upper layers with the resultant development of characteristic podzol horizons
potable water	water of a sufficiently high quality that humans can safely drink it
prescription	a directive or instruction that needs to be carried out
principles (i.r.o. SFM)	the overarching ideals or principles that set the overall framework for forestry activities to be sustainably managed
proactive	to act in anticipation of future developments before they occur
raptor	a bird of prey
recharge	to fill up again to capacity (e.g. the recharging of a wetland)
reclamation	the process whereby something is restored to its natural or former state
redundant	no longer in use or required
regime	the silvicultural practices employed for the growing of a particular crop
rehabilitation	the process whereby something is restored to its original or natural state
restoration	the process whereby something is restored to its original condition or state
retard	to slow down
ridging	an operation whereby earth is heaped into linear ridges into which seedlings are planted. Used in wet areas to prevent tree roots from being saturated for long periods of time
riparian zone	an area of land bordering a watercourse which exhibits particular and special characteristics (e.g. vegetation, soils etc.)
ripline	the line along which ripping has been carried out
ripping	an operation whereby a tined implement is pulled through the ground to loosen the soil so as to enhance tree growth through improved root development
riverine area	land bordering a watercourse
road corridor	an area that has to be cleared of all obstacles and vegetation prior to the start of earthmoving operations when constructing a new road
road density	the proportion of a particular area that is covered by roads
road reserve	the total area of land required for a road – includes the road width plus an area on each side of the road which is wide enough to include all side cast material, cuts (embankments) and fills
rocky outcrop	the part of a rock formation that protrudes through the surface of the ground

GLOSSARY OF TERMS (continued)

run-off	rainwater that eventually drains into streams (i.e. the proportion of rainfall that is not absorbed into the ground)
sapling	a young tree
saturation	a state whereby something (e.g. soil) cannot absorb more liquid
scale	the size of an object within an environment or landscape
scenic	a picturesque (attractive) view or landscape
scour checks	structures placed at intervals in drains that slow water velocity (and thus erosion potential) - usually constructed using rocks, pegs or branches
scouring	erosion caused by water borne particles of material passing over an object
scree fan	a fan shaped accumulation of loose stones or rock debris
seedling	a very young tree that has just been released from a nursery and which is ready for planting
sedimentation	the process whereby material (i.e. soil) is deposited
servitude	an area of land over which someone other than the owner has the right of use for a specified purpose (e.g. for powerlines, telephone lines, pipelines)
shotcrete	a form of liquid concrete which is sprayed, using compressed air, onto rock embankments to form a thin coating of concrete over the rocks to prevent erosion
side cast	material moved during road construction from the cut slope of a road to the other side of the road to form the fill
side drain	a drain running along the side of a road used to catch surface run-off
site hygiene	general appearance and conditions before, during and after harvesting and road construction
site species matching	the matching of specific tree species, clones or hybrids to a specific site so as to maximise their potential yield
skid trails	trails along which timber is extracted from the compartment using the skidding method of extraction
skidding	an operation whereby timber is attached to the extraction unit, lifted at one end, and dragged to the landing
skidder	a machine that, using either a cable, clambunk or grapple system, lifts one end of felled timber off the ground and drags the timber to the landing site
skyline	a type of cable yarding system consisting of a minimum of three drums for uphill yarding and two drums for downhill yarding and with the ability to use intermediate supports to increase lift height – it has more lift than a highlead system and a maximum recommended yarding distance of 600m
slash	debris left infield after harvesting (e.g. branches, unmarketable timber etc.)
sod	turf

GLOSSARY OF TERMS (continued)

soil classification	the classification of soils into "family levels"
soil horizon	a distinct horizontal layer of material within a soil profile
soil matrix	composition of the soil
soil profile	a vertical section of the soil through all its horizons and extending into the C horizon
spatial	relating to occupying or having the character of space
Special Management Zones (SMZ's)	areas that provide intrinsic and/or ecological values that require protection. They include scientific, ecological, paleontological, archaeological and historical sites
stand	a group of trees - normally a compartment of trees within a plantation
stand density	the number of stems per hectare in a stand (compartment)
standards (i.r.o. SFM)	a set of target levels or standards, one or more for each indicator of SFM, that help ensure that forestry management at the Forest Management Unit, local, Provincial and National levels is sustainable
stump grinding	the grinding down of stumps to just below ground level using mechanical means
subgrade	the lowest layer of material (*in situ* if available) used to form the foundation of a road
Sustainable Forest Management (SFM)	the management of the forest resource in such a manner that a sustainable flow of goods and services can be produced from it without the resource itself being depleted
tangent plane	the line between two distinct features in a landscape (e.g. between sky and ground)
terrain	the physical surface properties of a tract of land in terms of ground conditions (ease of trafficability within the stand), roughness and slope
Terrain Morphological Unit	terrain morphology is a term which describes land forms such as plains, hills, mountains, lowlands and escarpments. A terrain unit is defined according to its range in length, range in percentage slope, shape (concave, cortex, straight) and area
thinning	the process whereby selected immature trees are removed from a compartment during the growing cycle so as to improve the growth potential of those that remain
tillage	to work or cultivate land
topography	the configuration of the land surface, including its relief (altitude), and the relative position of natural and man-made structures in it
tracer belts	strips bordering a firebreak which prevent the fire from spreading beyond the intended boundary of the firebreak when burnt – can be created manually or by using chemical fire suppressants
traffic load	the amount of traffic that uses a particular road
trafficability	the condition of a terrain that permits travel across it
transparent process	an open process whereby nothing is hidden from view or scrutiny

GLOSSARY OF TERMS (continued)

transpiration	the process whereby watery vapour passes through the membrane (skin) or pores of a living plant or animal into the atmosphere
uprooting	an operation whereby tree stumps are physically removed from the ground complete with their root systems
V-blading	an operation whereby tree stumps are sheared off at ground level using a V shaped blade attached to the front of a bulldozer
veld	a grassland area usually with scattered shrubs or trees
velocity	speed
Visual Absorption Capacity (VAC)	the ability of a landscape to absorb elements within it (e.g. a salt pan has a very low VAC as any element within it will stand out immediately)
vlei	Afrikaans term for a wetland
water bar	elevated hump constructed diagonally across the surface of a road which directs run-off away from the road surface
water yield	the volume of water draining into the catchment
watercourse	that section of the landscape where surface flow of natural water will or may occur
weir	a structure build across a watercourse to raise the level of the water on one side of the wall and to regulate water flow within the watercourse
wetland	an area that is flooded for sufficiently long periods for water logging to become the dominant factor determining its characteristics (e.g. vegetation, soils etc.)
woody plant	a plant containing a predominance of woody tissue (persists for more than one growing season)
yarding	the extraction of timber from the compartment using a cable yarding system

ANNEXURE J

WETLAND AND RIPARIAN HABITAT IDENTIFICATION AND DELINEATION PROCEDURE

At the time of going to print, discussions were still ongoing between the Industry (who have developed the above identification and delineation procedure) and the Department of Water Affairs and Forestry's Wetland and Riparian Zone Policy Committee (W&RZPC) on a few outstanding issues related to riparian habitats and unfortunately no agreement had been reached on them.

As the publication of these Guidelines had already been put on hold, pending the outcome of these discussions, for many months, it was felt that it was not in the interests of the Industry to delay their publication further. As this is such an important issue, it was also felt that it would be irresponsible at this late stage to publish a set of identification and delineation procedures which had not been fully endorsed in its entirety by all parties.

The main guidelines flowing from the Industry's procedures document (which will not change) have however been included in the body of the Guidelines for the benefit of readers. Once the entire identification and delineation procedures have been officially sanctioned, a full summary, in the form of an Annexure, will be sent to all those who have purchased the Guidelines.

The Editors

NOTES:

FORESTRY SOUTH AFRICA

ENVIRONMENTAL GUIDELINES

FOR COMMERCIAL FORESTRY PLANTATIONS IN SOUTH AFRICA

CHECKLISTS

CHECKLIST 1: SILVICULTURAL PRACTICES

REF.	ACTIVITY	ASPECT	YES	NO	N/A
		A. PLANNING			
1.0	**Maps: Should include:**				
1.1		Existing infrastructure			
1.2		Existing plantations			
1.3		Contours			
1.4		Site classification elements (e.g. terrain, topography, soil)			
2.0	**SMZ's: Cliff Edges and Rocky Outcrops: Consider guidelines**				
3.0	**SMZ's: Wetland and Riparian Habitats: Consider guidelines for the following:**				
3.1		Identification of A,B and C Sections of stream channels			
3.2		Identification and management of preferential recharge areas			
3.3		Classification and delineation of wetland / riparian habitats			
3.3.1		Δ Wetland Indicators : consider the following 4 indicators			
3.3.1.1		• Terrain Morphological Unit			
3.3.1.2		• Vegetation			
3.3.1.3		• Soil form			
3.3.1.4		• Soil wetness factor			
3.3.2		Δ Specific cases			
3.3.2.1		• Recent alluvial deposits			
3.3.2.2		• Sandy coastal aquifers			
3.3.2.3		• Soils derived from quartzites and / or dolomites			
3.3.3		Δ Delineation Procedure : consider the following			
3.3.3.1		• Determination of wetland habitat			
3.3.3.2		• Determination of riparian habitat			
3.3.3.3		• Combined procedure for determining wetland / riparian habitats and minimum buffer strip			
3.3.3.4		• Determination of biodiversity buffer strip			
4.0	**SMZ's: Archaeological, Cultural and Traditional Sites: Consider guidelines for the following:**				
4.1		Legal requirements			
4.2		Operational requirements			
5.0	**SMZ's: Species of Special Conservation Significance: Consider guidelines for the following:**				
5.1		Legal requirements			
5.2		Operational requirements			
5.2.1		Δ Nesting sites			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
5.2.2		Δ Alert competent authorities			
5.2.3		Δ Record values			
5.2.4		Δ Protect sites			
6.0	**SMZ's: Indigenous Forests: Consider guidelines for the following:**				
6.1		Legal protection requirements			
6.2		Buffers			
7.0	**Fire Protection: Consider guidelines for the following:**				
7.1		Fire management plan encompassing:			
7.1.1		Δ Firebreak system			
7.1.2		Δ Fire protection system			
7.1.3		Δ Resources management system			
7.1.4		Δ Fire fighting safety policies and procedures			
7.2		Firebreaks			
7.2.1		Δ Legal requirements			
7.2.2		Δ Operational requirements			
7.2.3		Δ High fire risk areas			
7.2.4		Δ Use of natural features for firebreaks			
7.3		Provision of adequate access			
7.4		Veld burning			
7.4.1		Δ Legal requirements			
7.4.2		Δ Operational requirements			
8.0	**Site - Species Matching: Consider the following:**				
8.1		Soils			
8.2		Climate			
8.3		Monoculture landscapes			
8.4		Weed potential			
8.5		Water use efficiency			
9.0	**Harvesting System: Consider guidelines for the following:**				
9.1		Products			
9.2		Harvesting system : consider the following:			
9.2.1		Δ Terrain conditions			
9.2.2		Δ Weather conditions			
9.2.3		Δ Extraction routes			
9.2.4		Δ Timetables			
9.2.5		Δ Yarding sites			
9.3		Terrain and topography			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
10.0	**Roads: Consider guidelines for the following:**				
10.1		Road density			
10.2		Landings			
10.3		Depots			
10.4		Gravel pits			
10.5		Redundant roads			
11.0	**Land Preparation: Consider guidelines for the following:**				
11.0.1		To make right choice need to consider the following:			
11.0.1.1		Δ Site factors			
11.0.1.2		Δ Financial considerations (cost & site productivity)			
11.0.1.3		Δ Future harvesting and extraction requirements			
11.1		Stand density			
11.2		Size of clearfelling			
11.3		Steep slopes			
11.4		Ripping			
11.5		Ridging			
B. IMPLEMENTATION					
1.0	**Land Preparation : Consider guidelines for the following:**				
1.1		Demarcation of planted area			
1.1.1		Δ According to compartment planning			
1.1.2		Δ SMZ's & areas of special interest taken into account			
1.2		Chemical application			
1.2.1		Δ Legal requirements			
1.2.2		Δ Operational requirements			
1.3		Destumping			
1.3.1		Δ Chemical stump kill			
1.3.2		Δ Mechanical stump kill			
2.0	**Soil Preparation: Consider guidelines for the following:**				
2.1		Ripping			
2.2		Ridging			
2.3		Ploughing			
2.4		Mechanical pitting			
2.5		Manual pitting			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
3.0	**Slash Management: Consider guidelines for the following:**				
3.1		Burning of slash			
3.1.1		Δ Legal requirements			
3.1.2		Δ Operational requirements			
3.2		Chopper rolling and mulching			
3.3		Reduction and distribution of slash			
3.4		Control over removal of slash for secondary use			
4.0	**Planting: Consider guidelines for the following:**				
4.0.1		Consider the following:			
4.0.1.1		Δ Use disease-free plants			
4.0.1.2		Δ Adequate planting hole			
4.0.1.3		Δ Firm soil around plant by hand			
4.1		Fertiliser application			
4.1.1		Δ Legal requirements			
4.1.2		Δ Operational requirements			
4.2		Plant containers			
5.0	**Maintenance: Consider guidelines for the following:**				
5.1		Biological control of pests and weeds			
5.1.1		Δ Legal requirements			
5.1.2		Δ Operational requirements			
5.2		Chemical pest and weed control			
5.2.1		Δ Legal requirements			
5.2.2		Δ Operational requirements			
5.3		Manual weed control			

CHECKLIST 2: HARVESTING

REF.	ACTIVITY	ASPECT	YES	NO	N/A
		A. PLANNING			
1.0	**Tactical Plan: Should incorporate:**				
1.1		Reliable maps showing :			
1.1.1		Δ Compartment boundaries			
1.1.2		Δ SMZ's			
1.1.3		Δ Terrain classification			
1.1.4		Δ Haulage roads			
1.1.5		Δ Depots			
1.2		Equipment choices			
1.3		Contingency plan			
1.4		Understanding of external influences			
1.5		Maintenance of sustainable flow of timber			
1.6		Road plan : showing:			
1.6.1		Δ Roads & transport systems to be used			
1.6.2		Δ Road maintenance details			
1.7		Equipment replacement plan			
2.0	**Annual Plan of Operations: Consider guidelines for the following:**				
2.0.1		APO should:			
2.0.1.1		Δ Be complimentary to tactical harvesting plan			
2.0.1.2		Δ Ensure large areas are not harvested in a short time			
2.0.1.3		Δ Ensure a sustainable flow of timber			
2.0.1.4		Δ Ensure the optimal extraction of marketable timber			
2.0.1.5		Δ Ensure the optimal allocation of equipment & manpower			
2.1		Season (wet and dry)			
2.2		Harvesting systems choice: consider the following			
2.2.1		Δ Terrain conditions			
2.2.2		Δ Aesthetics			
2.2.3		Δ Market needs and economic conditions			
2.2.4		Δ Species to be harvested			
2.2.5		Δ Available equipment options			
2.3		Road management			
2.4		Contingency plan: consider			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
2.4.1		Δ Wet / dry compartments			
2.4.2		Δ Irrigated depots			
2.4.3		Δ Accessibility			
3.0	**Operational Planning: Consider guidelines for the following:**				
3.1		Scheduling of equipment and labour			
3.2		Physical plan : should incorporate:			
3.2.1		Δ Large scale contour map (1: 2500)			
3.2.1.1		• Compartment boundaries			
3.2.1.2		• SMZ's			
3.2.1.3		• Landing locations			
3.2.1.4		• Extraction routes			
3.2.1.5		• Timber flow, loading & haulage directions			
3.2.1.6		• Streams and crossing locations			
3.2.1.7		• Vulnerable drainage structures			
3.2.1.8		• General felling direction near sensitive areas			
3.2.2		Δ Compartment data			
3.2.2.1		• Average tree size (volume, DBH & height)			
3.2.2.2		• Stems per hectare & volume per hectare			
3.2.3		Δ Market and product requirements			
3.2.3.1		• Markets and transport distances			
3.2.3.2		• Product requirements & specifications			
3.2.4		Δ Harvesting activities for compartment			
3.2.4.1		• Harvesting systems matched to terrain			
3.2.4.2		• Extraction direction			
3.2.4.3		• Equipment and labour requirements			
3.2.4.4		• Sequence of felling and extraction (flow)			
3.2.4.5		• Planned start and end times			
3.2.5		Δ Silvicultural requirements			
3.2.5.1		• Slash management			
3.2.5.2		• Stump heights and treatment			
3.2.5.3		• Fire protection requirements			
3.2.6		Δ Environmental requirements for SMZ's			
3.2.6.1		• Recognisable infield			
3.2.6.2		• Management guidelines applied			
3.2.6.3		• Identification of new SMZ's during operations			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
B. IMPLEMENTATION					
1.0	**Harvesting Preparation: Consider guidelines for the following:**				
1.1		Pre-harvesting Checking			
2.0	**Harvesting Activity: Consider guidelines for the following:**				
2.1		Appropriate felling direction			
2.2		Extraction method to use : consider the following:			
2.2.1		Δ Timber size (piece volume)			
2.2.2		Δ Load size (total volume or weight)			
2.2.3		Δ Number of pieces per load			
2.2.4		Δ Terrain conditions			
2.2.5		Δ Terrain sensitivity			
2.2.6		Δ Size of area from which timber is to be extracted			
2.2.7		Δ Extraction and felling directions			
2.2.8		Δ Extraction distance			
2.2.9		Δ Type and capability of extraction equipment			
2.2.10		Δ Timber presentation			
2.2.11		Δ Felling layout			
2.2.12		Δ Operators' skills			
2.3		Extraction routes and landings			
2.4		Depots			
2.5		Timber presentation			
2.6		Slash management			
2.7		Site hygiene			
2.8		Rehabilitation			
2.9		Post-harvesting checking			

CHECKLIST 3: ROADS

REF.	ACTIVITY	ASPECT	YES	NO	N/A
		A. PLANNING			
1.0	**Tactical Planning Considerations: Consider guidelines for the following:**				
1.0.1		During the planning & construction of roads consider:			
1.0.1.1		Δ Competence of planners			
1.0.1.2		Δ Size of road corridor to be cleared			
1.0.1.3		Δ Soil properties, terrain and topography			
1.0.1.4		Δ Prevailing climate			
1.0.1.5		Δ Availability and type of harvesting methods to be used			
1.0.1.6		Δ Volume of timber to be transported			
1.1		Topography and terrain			
1.2		Visual buffer zones			
1.3		Soil volume to be removed			
1.4		Road suitability			
1.5		Flood events			
2.0	**Operational Planning: Consider guidelines for the following:**				
2.1		Maps : Should include:			
2.1.1		Δ Details contained on silvicultural maps			
2.1.2		Δ Specific road design information			
2.2		Road design : consider the following:			
2.2.1		Δ Assistance of experts			
2.2.2		Δ Reduction of visual / environmental impacts			
2.2.3		Δ Stream / river crossings			
2.2.3.1		• Legal requirements			
2.2.3.2		• Operational requirements			
2.2.4		Δ Balancing of cut and fill			
2.2.5		Δ Drainage requirements			
2.3		Gradients			
2.4		Timing of operation (season)			
3.0	**Borrow Pits: Consider guidelines for the following:**				
3.0.1		Δ Legal requirements (permit from Dept. Minerals & Energy)			
3.1		Visual impacts			
3.2		Overburden store			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
3.3		Drainage and soil loss			
3.4		Reclamation			
		B. IMPLEMENTATION			
1.0	**Corridor Preparation: Consider guidelines for the following:**				
1.1		Removal of marketable timber and debris			
1.2		Installation of permanent drainage and bridges			
1.3		Use of correct construction machinery			
2.0	**Drainage and River Crossings: Consider guidelines for the following:**				
2.1		Road surface			
2.2		Drains			
2.2.1		Δ Side / mitre & catch drains			
2.2.2		Δ Water bars and surface cross drains			
2.2.3		Δ Culverts			
2.3		River / stream crossings			
2.3.1		Δ Legal requirements			
2.3.2		Δ Operational requirements			
2.4		Drifts (fords)			
2.5		Bridges			
2.5.1		Δ Use of qualified personnel			
2.5.2		Δ Operational requirements			
3.0	**Earthmoving: Consider guidelines for the following:**				
3.1		Weather conditions			
3.2		Balancing of cut and fill			
3.3		Use of correct machinery			
3.4		Blasting			
3.4.1		Δ Legal requirements			
3.4.2		Δ Operational requirements			
4.0	**Road Surfacing: Consider guidelines for the following:**				
4.1		Correct preparation of subgrade, base and wearing courses			
5.0	**Slope Stabilisation: Consider guidelines for the following:**				
5.1		Drainage / erosion prevention requirements			
5.2		Revegetation			
6.0	**Road Maintenance: Consider guidelines for the following:**				
6.1		Drainage			
6.2		Road surface			
6.3		Roadside			

CHECKLIST 4: OTHER FORMS OF LAND USE

REF.	ACTIVITY	ASPECT	YES	NO	N/A
A. PLANNING & IMPLEMENTATION					
1.0	**Operational Planning and Implementation: Consider guidelines for the following:**				
1.0.1		Δ In general, make use of the following:			
1.0.1.1		• Proper maps showing the relevant details			
1.0.1.2		• Expert advice			
1.0.1.3		• Consultations with interested and affected parties			
1.0.1.4		• The best available information			
1.0.2		Δ In general, take into account the following:			
1.0.2.1		• Legal requirements (including IEM requirements)			
1.0.2.2		• Integration of non-timber activities with timber activities			
1.1		Location and scale			
1.2		Legal requirements			
1.3		Costs / benefits			
2.0	**Non -Timber Products and Services: Consider guidelines for the following:**				
2.1		Responsible use and management			
2.1.1		Δ Rivers, streams and wetlands			
2.1.1.1		• Legal requirements (for weirs & exotic fish)			
2.1.1.2		• Operational requirements			
2.1.2		Δ Dams			
2.1.2.1		• Legal requirements (for dams & EIA's)			
2.1.2.2		• Operational requirements			
2.1.3		Δ Hiking and mountain bike trails			
2.1.3.1		• Legal requirements (for EIA's)			
2.1.3.2		• Operational requirements			
2.1.4		Δ Grazing			
2.1.5		Δ Picnic and camping sites			
2.1.5.1		• Legal requirements (for EIA's)			
2.1.5.2		• Operational requirements			
2.1.6		Δ Flora and fauna			
2.1.6.1		• Legal requirements			
2.1.6.2		• Operational requirements			
2.1.7		Δ Agricultural crops			

REF.	ACTIVITY	ASPECT	YES	NO	N/A
3.0	**Awareness and Extension: Consider guidelines for the following:**				
3.1		Access to privately owned forests			
3.1.1		Δ Negotiations with interested parties			
3.1.2		Δ Provision of map of estate to Minister			
3.1.3		Δ Provision of rules of access to Minister			
3.1.4		Δ Provision of funding by Minister			
3.2		Promotion of awareness of environmental values			
3.2.1		Δ Promotion of forest values			
3.2.2		Δ Provision of promotional material (in various languages)			
3.2.3		Δ Careful advertising of assets to combat their theft			
4.0	**Village Management: Consider guidelines for the following:**				
4.1		Accessibility and convenience			
4.2		Water supply			
4.3		Aesthetics			
4.4		Site hygiene and waste disposal			
4.4.1		Δ Legal requirements			
4.4.2		Δ Promotion of recycling			
4.5		Availability of education and training			
5.0	**Control: Consider guidelines for the following:**				
5.1		Security			
5.1.1		Δ Timing of access (season)			
5.1.2		Δ Provision of forest guards			
5.1.3		Δ Working through clubs			
5.2		Protection of species			
5.2.1		Δ Advertising of rare species			
5.2.2		Δ Registration of sites			
5.2.3		Δ Signage			
5.2.4		Δ Keeping of accurate records			
5.2.5		Δ Relocation of threatened species			

NOTES: