TREE FARMING GUIDELINES
for private growers

part 1
forest management

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credits

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Cover photograph courtesy of Craig Ford.

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foreword

More than a decade has passed since the first edition of the “Tree Farmers Manual” was published in 1997. Important developments in legislation as well as advancing research and technology, and the increasing importance of sustainable forest management made it necessary to publish the second edition in 2004 titled “Tree Farming Guidelines for Sappi Outgrowers”.

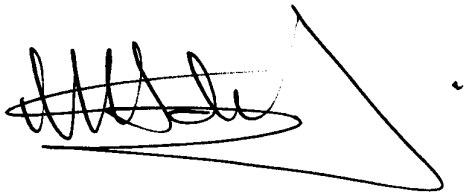
We are pleased to introduce this third edition of the Guidelines. It presents a step forward in our aim to provide a practical guide to the timber industry. We once again cover topics such as species selection and planting through to harvesting and extraction, but now also provide much needed information on fundamental issues such as safety and proper planning and scheduling processes.

The importance of sourcing timber in a responsible manner is also covered in this edition. A large portion of timber supplied by Sappi Forests is FSC (Forestry Stewardship Council) certified, and Sappi only sources timber that comes from sources that:

- are legally registered with the Department of Water Affairs and Forestry;
- do not clearly violate the customary, traditional or civil rights of any people;
- do not consist of genetically modified trees; and
- are legally harvested.

Our objective remains to provide consistent and clear guidelines and assistance to Sappi’s contracted growers, to ensure the sustainable development and protection of our forests for future generations.

The new edition is also in keeping with Sappi’s commitment to continuous improvement, and also to its vision of creating value and growth in a sustained manner for their shareholders, employees, customers, suppliers and the communities in which we operate.



Hendrik de Jongh
Managing Director
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acknowledgements

Several Sappi employees have been instrumental in the collation and publication of this third edition of the Guidelines. Their hard work, passion and professionalism are a great asset to Sappi, and this work would not have been possible without their expertise.

We also extend our acknowledgements to the many external resources visited and used in this publication, as well as to all the people who contributed to previous editions. A complete list of references can be found in the References section of the Forestry Guidelines package.

Rob Pallett
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chapter 1
investing in forestry

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Investing in forestry

The decision to invest in forestry either by planting virgin land or buying an existing tree farm should, like any investment opportunity, be carefully researched and the risks and returns quantified as best possible.

Forestry is a long-term investment. Compared with various other agricultural products, timber has been a very stable and financially worthwhile investment. Over the past twenty years, new expansions were done by the small and medium forestry enterprises and they have become major role players in the timber industry.

From the above it should be clear that the decision to invest in forestry is complex. In addition, the length of the investment period in forestry requires careful financial planning. Substantial investments have been made by individual plantation owners representing 14% of the current forest landholdings in South Africa.[1]

The forest industry developed financial models to determine the financial viability of any forestry project. The models will indicate the risk and returns on the investment as well as interim valuations of the growing stock for insurance purposes. The diverse products that can be produced from plantation forestry are ever increasing. The 'natural product range' offered to the public will increase the demand for timber.

The forest industry has been placed in the centre of the 'Bio energy' drive throughout the world. South Africa will become part of this new product and the non-utilizable biomass (harvesting debris) will become an important product in the industry.

Timber is one of the few renewable raw products in the world and, if managed in a sustainable manner in future, will always be a sought after product.

[1] Forestry South Africa – Annual Report 2006.

chapter 2
long-term planning

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Long-term planning

Forestry is a long-term business. Depending on the species, trees take between 8 - 25 years to reach maturity. Long-term planning is the process through which current plantation information is used to predict future expected yields. The length of the prediction period is normally 10 - 20 years.

The value of long-term planning

The value of having this information formally documented is the following:

- provides input information for financial analysis eg cash flow analysis;
- provides information on current and future tons that should become available from a plantation over the planning period;
- provides information on areas that must be replanted or coppiced, weeded over the longer term and the potential impact on resources;
- can be used as driver of the budget process;
- assist with identifying risk for fire protection;
- Forest Stewardship Council (FSC) requirement;
- formal reference source used by all parties within a wider planning framework eg a region.

Variables affecting the long-term plan

During the long-term planning process, variables that impact on volume prediction are discussed and include:

- management objective (maximise volume, maximise income);
- growth rates (based on rainfall soil types, management regimes etc);
- market supply and demand;
- cash flow;
- sustainability (smoothed similar annual supply vs irregular supply);
- rotation length;
- stocking (live stems at the end of the rotation).

Chapter 4, "Planning and scheduling of timber yields" will provide more detailed information on long term planning and timber scheduling with sustainability as priority.

chapter 3
annual plan of operations (APO)

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Annual plan of operations (APO)

The Annual Plan of Operations (APO) is a document describing the different operations taking place during the course of a specific year. The year in which these operations take place is selected by the owner and can be a financial year or the normal calendar year. Most owners use their financial year to prepare the APO.

THE APO

The APO describes the processes that take place on a plantation, from land preparation to the timber harvesting process. The plan provides, on a compartment basis, an indication of work required to ensure optimum growth in that specific compartment. The APO is a good basis for the development of a Resource Requirement Plan (RRP).

OPERATIONS

Typical operations taking place on a plantation in normal practical sequence are as follows:

Harvesting	Silviculture	General Management	Environmental Activities
Harvesting	Land preparation	Roads	Non timber area maintenance
Extraction	Planting	Fire protection	Safety
Shorthaul	Weeding	Security	Fauna and flora
Delivery	Maintenance	Infrastructure maintenance	New developments
	Pruning	Human resources	Forestry Stewardship Council (FSC)
		Vehicle management	

(Various other operations exist to achieve the required results)

The compartment data should be correct at any time to ensure correct planning results. *(This information includes the non- timber areas as well*).

COMPILING AN APO

To compile the APO the Grower will refer to his long-term plan and determine which compartments must be harvested in that specific year. If a compartment is harvested, it must be re-established and maintained.[1]

To explain the process of planning the year's operations, we will use an example as noted in Annexure "A" – Example of an APO (Annual Plan of Operations).

[1] South African Forestry Handbook.

chapter 4
planning and scheduling of timber yields

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4.1 Introduction

Proper planning and scheduling processes should be in place for analysis of possible timber deliveries, and the development of an optimal harvesting strategy.

With new land acquisition or with the planning of what species is to be re-established on clear felled areas, it is crucial to decide beforehand where the most profitable markets are, and what product should be produced.

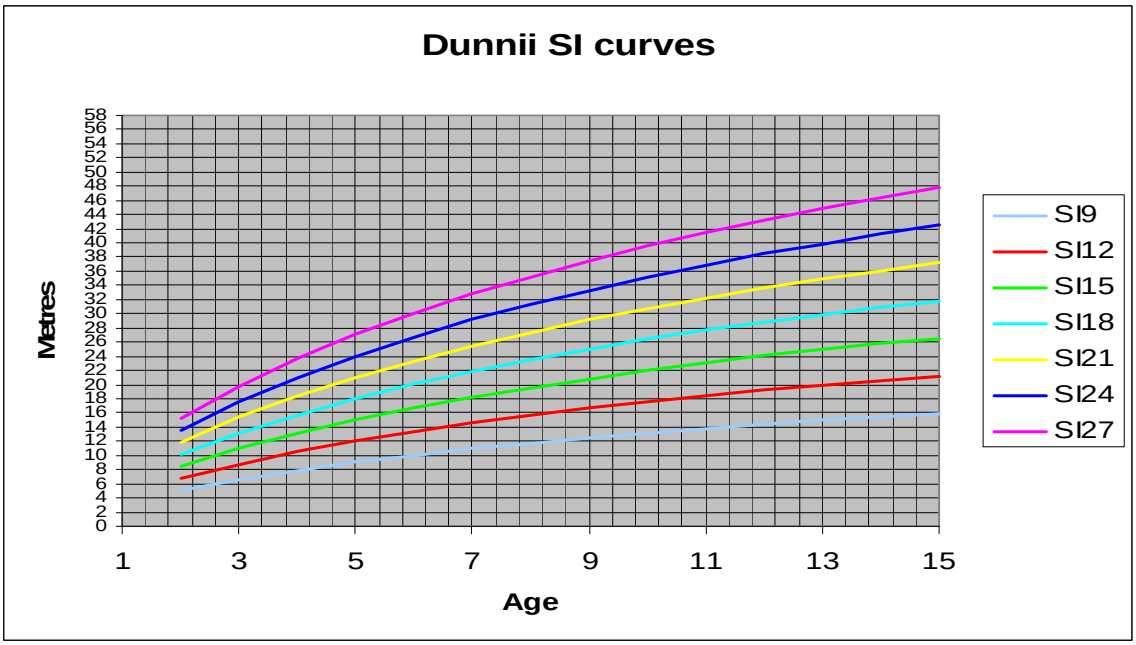
4.2 Measuring growth and yield

4.2.1 Site Index (SI)

Site Index is defined as the dominant stand height for a specific species attained at a set reference age.

The reference ages applied to Sappi Forests are 5 years for all hardwood species, and 15 years for all softwood species.

Site Index is one of the main drivers used in the growth and yield model database, to determine volume projections. See Figure 4.1 and 4.2 on the following page.



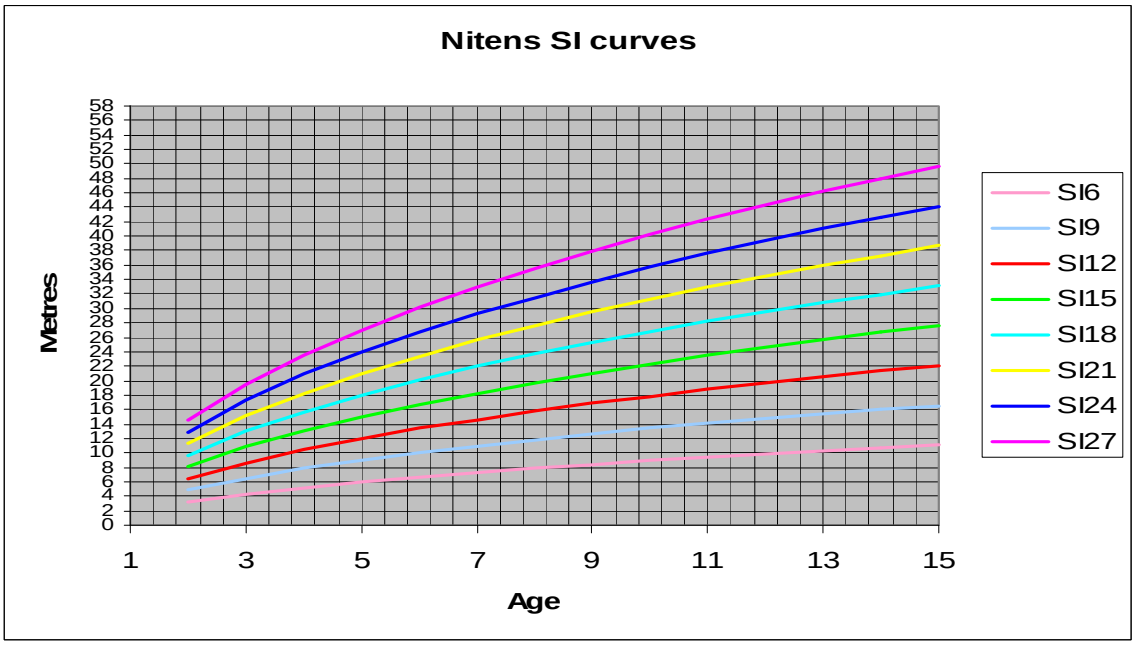


Figure 4.1 (top): Example of site index curve for *E. dunnii.*
Figure 4.2 (bottom): Example of site index curve for *E. nitens.*

4.2.2 Site Quality (SQ)

It can be defined as the yield potential for specific tree species on a given growing site. Site quality can be directly assessed by using available tree measurements, or indirectly either from lesser vegetation characteristics, or from topographic, edaphic or climatic factors.[1] See Table 4.1 below.[2]

2004	SQI	SQII	SQIII	SQIV	SQV
E. grandis Lowveld	24.1-27.0	21.1-24.0	18.1-21.0	15.1-18.0	12.1-15.0
E. grandis Midlands	21.1-24.0	18.1-21.0	15.1-18.0	12.1-15.0	9.1-12.0
E. grandis Natal	23.1-26.0	20.1-23.0	17.1-20.0	14.1-17.0	11.1-14.0
E. nitens	20.1-23.0	17.1-20.0	14.1-17.0	11.1-14.0	8.1-11.0
P. patula	25.1-28.0	22.1-25.0	19.1-22.0	16.1-19.0	13.1-16.0
P. elliottii	21.1-23.0	19.1-21.0	17.1-19.0	15.1-17.0	13.1-15.0

Table 4.1 Relationship between Site Quality and Site Index.[2]

4.2.3 Mean Annual Increment (MAI)

MAI is expressed as tons/hectare/year. An estimated MAI can be used to determine production potential that could be harvested from an area by using a given index age. See Table 4.2, 4.3 and 4.4.[3]

eg Planned tons: *Total Volume = ha x tree age x MAI*

MAI will differ from one species to another. Site quality and climatic factors will also influence the MAI.

UTILIZABLE MAI (TONS) BY SI AND SPECIES : KZN-Midlands								
SITE	Utilizable MAI (tons) with felling							
INDEX	Amea	Egra	Edun	Enit	Emac	Esmi	Ppat	Pell
10	3	5	6	7	6	6	4	5
11	4	6	8	9	7	7	5	6
12	5	7	9	10	8	9	6	7
13	6	8	10	12	10	10	6	8
14	7	10	12	14	12	12	8	9
15	9	11	14	16	14	13	9	11
16	10	13	15	19	16	15	10	12
17	12	15	17	21	18	17	11	14
18	13	17	19	24	20	20	12	16
19	15	19	21	27	22	22	14	17
20	17	21	23	30	25	24	15	19
21	19	24	26	33	28	27	17	21
22	21	26	28	37	30	29	18	24
23	23	29	30	40	33	32	20	26
24	25	32	33	44	37	35	22	28
25	28	35	35	48	40	38	24	31
26	30	38	38	52	43	41	25	33
27	33	42	41	57	47	44	27	36
28	36	45	44	61	51	48	29	39
29	39	49	47	66	54	51	32	42
30	42	53	50	71	58	55	34	45
Reference age for SI: Pines = 15yrs, Eucs&Amea = 5years								
Data source: Sappi PSP and Enumeration data								

Table 4.2 Utilisable MAI tons (KZN Midlands).

UTILIZABLE MAI (TONS) BY SI AND SPECIES : MIDLANDS (Highveld)					
SITE		Utilizable MAI (tons) with felling			
INDEX	Egra	Enit	Emac	Ppat(pulp	Pell(pulp)
10	5	7	5	5	4
11	6	9	6	5	6
12	7	11	8	6	7
13	8	13	10	7	8
14	9	15	11	8	10
15	10	17	13	9	11
16	11	20	16	11	13
17	13	22	18	12	15
18	14	25	20	13	17
19	15	28	23	14	19
20	17	32	26	16	21
21	18	35	29	17	24
22	20	39	33	19	26
23	22	43	36	20	29
24	23	46	40	22	32
25	25	51	44	24	35
26	27	55	48	25	38
27	28	60	53	27	41
28	30	64	57	29	45
29	32	69	62	31	49
30	34	74	67	33	52
Reference age for SI: Pines = 15yrs, Eucs = 5years					
Data source: Sappi Enumeration data					

Table 4.3 Utilisable MAI tons (Highveld).

UTILIZABLE MAI (TONS) BY SI AND SPECIES : LOWVELD					
SITE	Utilizable MAI (tons) with felling				
INDEX	Egra	Enit	Ppat(pulp)	Pell(pulp)	Ptae(pulp)
10	5		7	7	5
11	6		8	8	6
12	7	10	9	9	7
13	8	12	10	10	8
14	9	14	11	11	10
15	11	16	12	12	11
16	12	19	13	13	13
17	14	21	14	15	14
18	16	24	15	16	16
19	17	27	16	17	18
20	19	30	17	19	20
21	21	33	18	20	22
22	23	37	20	22	24
23	25	40	21	23	27
24	28		22	25	29
25	30		23	27	32
26	32		25	28	34
27	35		26	30	37
28	38		27	32	40
29	40		29	33	43
30	43		30	35	46
Reference age for SI: Pines = 15yrs, Eucs = 5years					
Data source: Sappi PSP and Enumeration data					

Table 4.4 Utilisable MAI tons (Lowveld).

4.2.4 Basal Area (BA)

It indicates the total area per hectare (in m²) of all trees measured at 1.3m breast height. The diameter of the tree of mean basal area is referred to as the quadratic mean Diameter at Breast Height (DBH). Figure 4.3 and 4.4 display the relationship between basal area and dominant tree height.

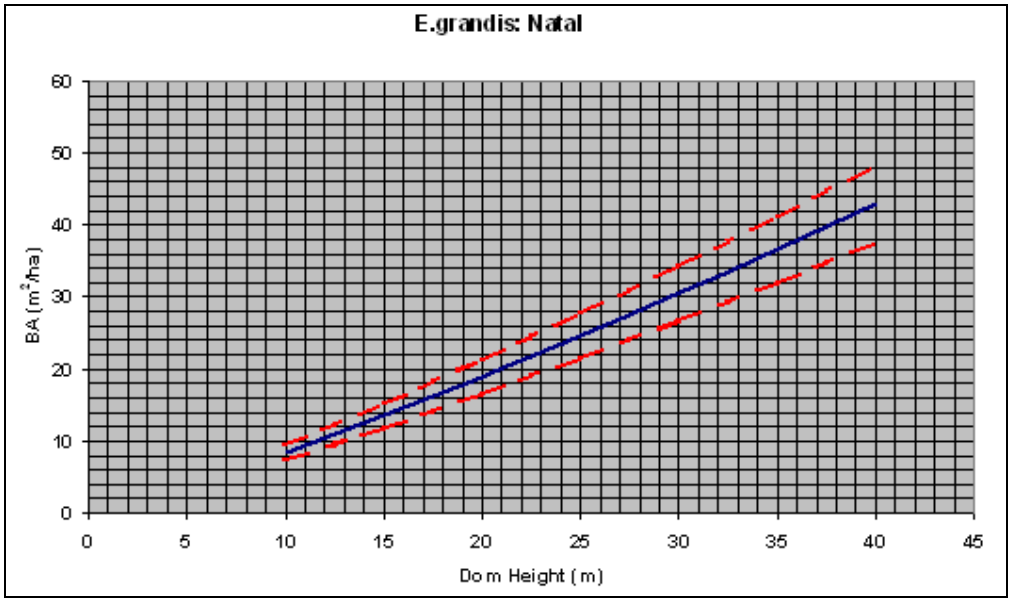


Figure 4.3 BA/Dominant height graph (*E. grandis*).

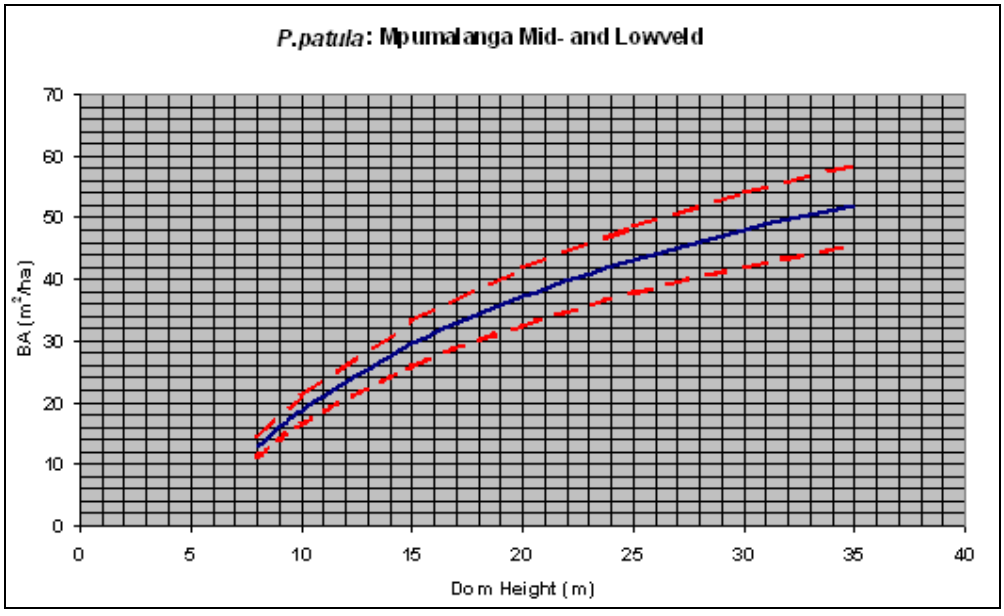


Figure 4.4 BA/Dominant height graph (*P. patula*).

4.2.5 Conversion factor

At Sappi Forests, volume is determined at the weighbridge. The unit of sale is wwt (white wet tons) and timber is delivered after a period of about four weeks after clear fell. A standardised conversion table is used to determine the relationship between wwt/m^3 and m^3/wwt (see Table 4.5).

Spp	wwt/m^3	m^3/wwt
A. mearnsii	0.87222	1.14650
E. dunnii	0.87719	1.14000
E. grandis	0.71429	1.40000
E. gxc	0.71429	1.40000
E. gxu	0.71429	1.40000
E. macarthurii	0.87719	1.14000
E. nitens	0.87719	1.14000
E. smithii	0.87719	1.14000
P. elliottii	0.92336	1.08300
P. greggii	0.85712	1.16670
P. patula	0.87108	1.14800
P. taeda	0.85712	1.16670

Table 4.5 Conversion factors.[3]

4.3 Maintaining sustainable yields

Continuity and stability of timber supply should be the main aim of any tree farmer. This does not only refer to the harvesting aspect, but also a balanced focus on the re-generation activity. The planting program should be synchronised with the clear fell program to ensure sustained yields.

There are various principles in forestry today on how to achieve this. In the end it will be determined by the goal of the tree farmer himself, whether it is a constant supply of timber, or looking at the highest profitability. Timing, market and product play a major role in this decision making period.

Quick Formulas:

1. Calculating annual felling area = Total forest area / Fell age

2. Calculating felling annual volumes = Total forest area x MAI

This will be the area or volumes felled annually to ensure a sustained forest. The method is more popular where growing conditions are more uniform, but has limited use in harvest planning.

Knowledge of the genera and age class distribution allows for a more refined method of harvest planning.

Bucket fill method of scheduling harvest volumes:

Sappi Forests uses this method extensively for long-term harvesting plans. It is also easy to simulate in a spreadsheet. The planned fell year represents a bucket, and each 'bucket' is filled with volumes from available stands. The availability of the stands will depend on product, age and market demand.

This simulation involves timber harvesting followed by immediate planting.

The procedure (Table 4.6 below):

a) Specify the annual harvest volume per fell year.(Refer to Bucket row B)

b) Do the following in each age class:

i) Calculate the total available growing volume for each fell year column.
= Area x MAI x Fell age

ii) If Harvest volume (A) > growing volume for an age class, harvest whole age class. Otherwise add the shortfall from next age class.

iii) If only a portion of growing volume was used for a fell year, calculate the balance of hectares available for the next fell year.
= Balance of growing volume / (Total age class area x fell age)

Age class	Area	Fell year 1	Fell year 2	Fell year 3	Fell year 4	Total Volume
>6	200	15 000				15 000
6	150	5 000	20 000	10 000		35 000
5	180			10 000	15 000	25 000
4	120				5 000	5 000
3	160					
2	230					
1	260					
Bucket (B)		20 000 **(A)**	20 000	20 000	20 000	

Table 4.6 Bucket fill method of harvest scheduling.

[1] K. von Gadow, B. Bredenkamp (1992)
[2] H. Kassier - 2003
[3] R. Pallett - 2004

chapter 5
certification of plantations

CONTENTS

Forestry Stewardship Council (FSC)

The global markets trading in timber products have been scrutinized by several environmental groups, customers and clients since the late 1970s to verify that their products are sustainable, environmentally, socially and financially managed. In order to verify these timber products and the process of distributing, an independent certifying body was required for verification.

Several certifying bodies were established worldwide of which FSC (a European acceptable standard) is the most well known brand.

The Forestry Stewardship Council (FSC) has set up ten main principles (also called code of conduct). The ten principles form the foundation of good management and consist of social, financial and environmental sectors. These three sectors are interdependent and must be equally weighted and managed.

The ten principles are broken down into criteria which describe the required action in more detail. The verifier is an indicator of the specific action, document or management format required to adhere to the specific criteria. An example of the principle layout can be seen in Figure 5.1.

The individual plantation owner can certify his plantation under the FSC certification body or can participate within a group scheme under a joint certificate. Certification must include both Plantation Management and Chain of Custody (CoC) for any plantation owner.

The ten FSC principles are:

#1: COMPLIANCE WITH LAWS AND FSC PRINCIPLES
Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

#2: TENURE AND USE RIGHTS AND RESPONSIBILITIES
Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established

#3: INDIGENOUS PEOPLES' RIGHTS
The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognised and respected.

#4: COMMUNITY RELATIONS AND WORKER'S RIGHTS
Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

 # 5: BENEFITS FROM THE FOREST
Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

#6: ENVIRONMENTAL IMPACT
Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

#7: MANAGEMENT PLAN
A management plan - appropriate to the scale and intensity of the operations - shall be written, implemented, and kept up to date. The long term objectives of management, and the means of achieving them, shall be clearly stated.

#8: MONITORING AND ASSESSMENT
Monitoring shall be conducted - appropriate to the scale and intensity of forest management - to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

#9 : MAINTENANCE OF HIGH CONSERVATION VALUE FORESTS
Management activities in high conservation value forests shall maintain or enhance the attributes that define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

In South Africa all High forest should be considered as High Conservation Value Forests (HCVF). In addition, since afforestation in South Africa has largely been at the expense of afromontane grassland habitats and these habitats now occupy only a small proportion of their former extent, it is appropriate to consider these as being HCVF. This is using the term Forest in the sense of its original Latin meaning (Foris = a wild place).

High Conservation Value Forests are those that possess one or more of the following attributes:

a) forest areas containing globally, regionally or nationally significant :
   - concentrations of biodiversity values (eg endemism, endangered species, refugia); and/or
   - large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance;

b) forest areas that are in or contain rare, threatened or endangered ecosystems;

c) forest areas that provide basic services of nature in critical situations (eg watershed protection, erosion control), forest areas fundamental to meeting basic needs of local communities

(eg subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

#10: PLANTATIONS

Plantations shall be planned and managed in accordance with Principles and Criteria 1 - 9, and Principle 10 and its criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

Example of Inspector's completed checklist

FSC principle

Score for criterion 5.1

FSC criterion

SOIL ASSOCIATION WOODMARK NORMS	VERIFIER(S)	COMMENTS and REGIONAL GUIDANCE	SCORE
FSC Principle #5: BENEFITS FROM THE FOREST Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.			
FSC Criterion 5.1 Forest management should strive toward economic viability, while taking into account the full environmental, social and operational costs of production, and ensuring the investments necessary to maintain the ecological productivity of the forest.		Overall score for certification	**3**
1. There is a work plan and budget for the forest management enterprise showing expected costs and revenues for at least the current financial year.	Annual budget	Budget clearly set out, expected costs and revenues shown for two years.	√
2. The income predicted in the annual budget is consistent with the expected rate of harvest of forest products (see 5.6).	Product yields stated in the annual budget		√
3. The income predicted in the annual budget is consistent with product values comparable to regional or national norms.	Product values stated in annual budget	Product values appear to be somewhat overestimated.	**?**
4. The annual budget incorporates stumpage, royalties or rents as required.	Annual budget	Regional guidance: royalties must be paid to the local forest department administration on annual basis (see regulation FD 4.511a 1989).	√
FSC Criterion 5.2 Forest management and marketing operations should encourage the optimal use and local processing of the forest's diversity of products.		Overall score for certification	**4**
1. Forest managers make a proportion of their production available to local enterprises, such as small-scale industries and processing operations, unless there is an over-riding reason preventing this. (see 5.4 below for related norms)	Sales information. Discussion with local community.	Clear management commitment for encouraging local processors with written strategy, several local companies already supplied with timber.	√
FSC Criterion 5.3 Forest management should minimise waste associated with harvesting and on-site processing operations and avoid damage to other forest resources.		Overall score for certification	**2**

Regional guidance

Soil Association Woodmark norm.

Inspector's mark for norm 5.2.1

Figure 5.1 Example of an inspector's completed checklist.

chapter 6
safety

CONTENTS

6.1 Introduction

Effective, pro-active safety management is good business practice. A safe operation is associated with an efficient operation not only because it reduces the potential for loss, but because it increases production, improves the working environment and adds to an overall improvement in worker attitude and morale.

The Constitution of South Africa allows every person the right to a safe and healthy environment. In terms of section 24 of the Constitution, every person has the right to an environment that is safe and not harmful to their well-being. At common law, every employer is obliged to take reasonable care for the health and safety of its employees at work. Also, the Occupational Health and Safety Act 85 of 1993 states that every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.[i]

6.2 Safety management

A risk free working environment is best achieved by implementing a safety management system. Figure 6.1 illustrates the basic concept of a safety management system and will be discussed in detail.

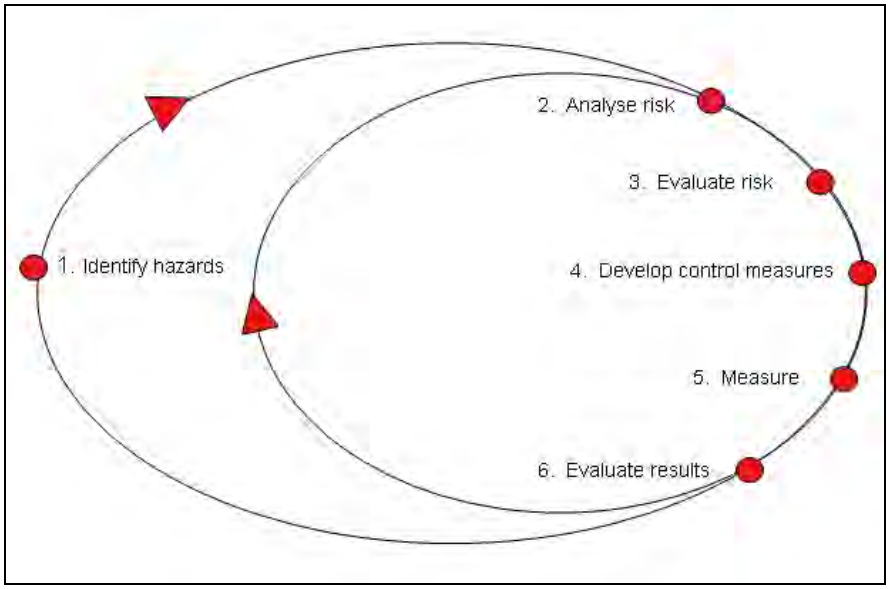


Figure 6.1 Safety management model.

A process of managing safety risks needs to be in place and should include the following steps:

- identification of hazards;
- risk analysis;
- risk evaluation;
- risk reduction by developing control measures;
- implementing and monitoring the control measures;
- measurement / audit; and
- evaluation of the measurement results.

Identification of hazards:

The first step in managing the risk is identifying the hazard. A hazard is something with the potential to cause harm.

Risk analysis:

Once the hazards have been identified, the risk that it poses to the organization has to be determined. A risk is the likelihood of a hazard actually causing harm.

Risk evaluation:

Once the extent of the risk is known, a decision has to be made whether or not the risk is acceptable. Should the level of risk be unacceptable, risk control measures should be developed and implemented.

Risk reduction:

This is where risk control techniques apply to risks that cannot be tolerated and should be aimed at achieving the following:

- terminating the risk;
- transferring the risk;
- treating the risk;

in order to reduce the level of risk.

Implementation and monitoring the system:

Once the work has been identified and the standards set, the control measures are implemented.

Measurement / audit:

In order to ensure that control measures are effective, they need to be monitored and measured.

Evaluation of the measurement results:

Once the audit or measurement is completed, the results should be analyzed. Analysis of the information may reveal the following information:

- everything is on target;
- deviations from the set standards occur and should be corrected; and
- control measures are totally ineffective and should be redesigned.

6.3 Risk control

Risk control is part of the risk management process that deals with the control of specific risk. Risk control can be considered in terms of four options. Figure 6.2 shows the four Ts of risk control.

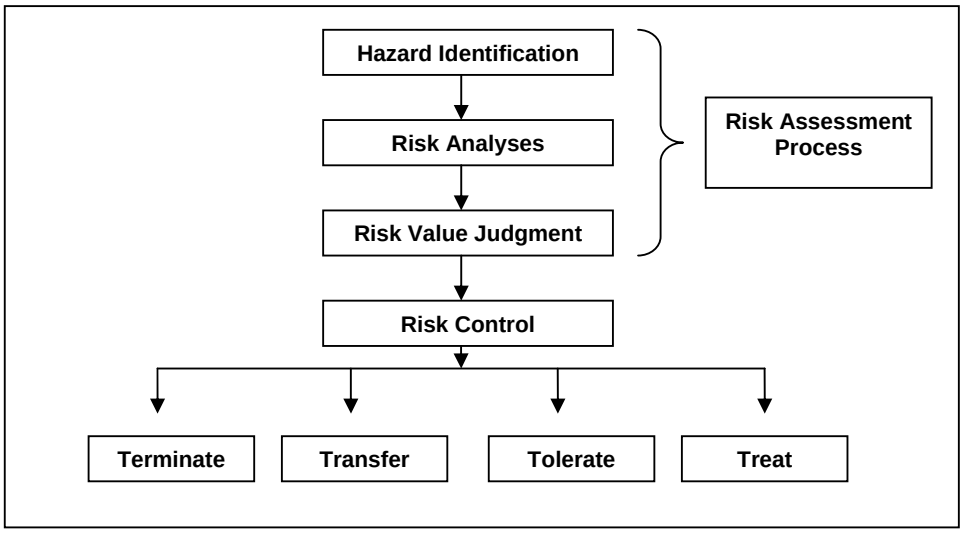


Figure 6.2 The four Ts of Risk Control.

Terminate:

Terminating a risk exposure is the first step following the risk assessment process and the managers should attempt to terminate risk exposures where possible. This option however, is not always possible but should be applied to hazards that bear unacceptable levels of risk. To terminate a risk means to avoid the risk completely. For example, should the risk exposure of asbestos be too high, you may decide to remove all asbestos sources thus avoiding the exposure completely.

Transfer:

After doing what's possible and practical to terminate the risks, the remaining risks could then be transferred. Risk can be transferred to a third party by:

- contracting;
- leasing;
- insuring.

Certain risk can be transferred by contracting it out. This means that the organization transfers the risk responsibility, via a contractual agreement to a third party. The disadvantage of transferring the risk is that the person contracted to accept responsibility for the risk may suffer the losses.

Tolerate:

Some risk exposures are so low that you may decide to tolerate such exposures. Often, putting additional control measures in place for such low risk exposures will cost more than the actual loss should the event occur.

It is important however to remember that risk exposures change. A low risk exposure today may not be a low risk exposure tomorrow and should be evaluated regularly.

Treat:

The majority of risks cannot be tolerated, transferred or totally terminated. In such cases, risks are treated in order to reduce the exposure to an acceptable level. There are a number of options available to treat risks and include the following:

- planning and leadership;
- training and communication;
- planned inspections;
- critical task analysis;
- incident investigation and analysis;
- task observations.

Treating risks can be done in three stages:

- before the event occurs – pre-contact;
- during the event – contact;
- after the event occurred – post-contact.

Pre-contact stage:

This is the only pro-active stage of treating risk exposures and is aimed at preventing the event from occurring. Examples of such systems are training, work procedures and rules, and increased supervision.

Contact stage:

This is a reactive stage of treating risk as some form of contact between two sources of energy took place resulting in an accident. The purpose of systems implemented during this stage is aimed at reducing the amount of loss. This is often achieved through design engineering and Personal Protection Equipment (PPE).

Post-contact stage:

This is also a reactive stage of treating risks and is aimed at recovering from the event as soon as possible. Examples of post contact treatment of risks include emergency plans, rescue operations, incident investigations and clean up.

6.4 Conclusion

To conclude, once a hazard has been identified, and the resulting risk analyzed, an organization should attempt, as far as is reasonably practical, to avoid or terminate a risk. If this is not possible, the organization should then do everything possible to treat the risk to reduce the likelihood of the risk resulting in injury, damage or loss.

[i] Section 8 of the Occupational Health and Safety Act 85 of 1993.

annexure “A”
example of an APO

EXAMPLE OF AN APO (ANNUAL PLAN OF OPERATIONS)

Mr X owns a 100 hectare plantation. The plantation information is as follows:

APO - 2008

Compartment No.	Area	Species	Plant date	Espacement
1	22.4	*E. grandis*	1/10/1997	3 x 2m
2	27.9	*P. patula*	1/11/2001	3 x 2m
3	28.9	*A. mearnsii*	1/02/2006	3 x 1.5m
4	20.8	*E. smithii*	1/01/2001	3 x 2m

Based on accepted forestry standards and practices the long term plan indicates the following:

- Compartment 1 can be harvested;
- *Pinus patula* should be pruned at age 6 (2 meters);
- Weeding should be done in compartments of 0-2 years of age;
- Wattle should get a final thinning at age 2;
- It is recommended that the harvested compartments be replanted;
- The compartment data should be checked and must be accurate.

Mr X requests:

1. A plan of operations for the next 12 months.
2. Predicted volumes for the next 12 months.
3. Predicted income from the timber to be harvested.
4. Predicted silvicultural costs for the next twelve months.

RESULTS OF MR X’S REQUESTS

1. Annual plan of operations - Year 2008

Annual plan of operations (APO)														
				Operation type										
				ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	
Compt	Area	Spp	Planted	Harvesting	Land prep	Plant	Fertilize	Weed 1	Weed 2	Weed 3	Watt space	Prune 3m	Prune 5m	Pre-harv clear
1	22.4	E.gra	1997	22.4	22.4	22.4	22.4	22.4						22.4
2	27.9	P.pat	2001									27.9		
3	28.9	A.mea	2006						28.9	28.9	28.9			
4	20.8	E.smi	2005						20.8					
Total area of operation				22.4	22.4	22.4	22.4	22.4	49.7	28.9	28.9	27.9	0	22.4

2. Predicted volumes for the next twelve months

The long-term plan predicts a volume of	**2514**	**TIMBER VOLUMES**		
The volume can also be calculated as follows:	Area	22.4	A	Compartment to be felled
	MAI	13	B	Mean annual increment
	Age	8	C	Age
	Volume	**2329.6**	(AxBxC)	

NOTE: The volumes as planned in the long-term plan are the more accurate volumes.
The calculated volume (example) can be used when doing rough estimations

3. Predicted income for the next twelve months - Year 2008

PREDICTED INCOME							
Area to be felled		22.4					
Total tons to be sold	A	2514	(long-term plan)				
Cost calculations for timber delivery:				**Income calculation for timber delivered**			
		R/Ton					
Cost of harvesting		R 68		Mill delivered price		R 340	
Cost of shorthaul (Extended primary)		R 18					
Cost of loading		R 9					
Cost of Delivery (Rail or Road costs) (secondary)		R 84					
Total cost of delivered timber		**R 179**	B			**R 340**	C
Income per ton of timber delivered		R 161	per ton	(C-B)			
Total income for timber delivered for the year					**A * (C-B)**		**R 404,754**

4. Predicted silvicultural costs for the next twelve months – Year 2008

Annual plan of operations (APO)													
				Operation type									
				ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
Compt	Area	Spp	Planted	Harvesting	Land prep	Plant	Fertilize	Weed 1	Weed 2	Weed 3	Watt space	Prune 3m	Prune 5m	Pre-harv clear
1	22.4	*E.gra*	1995	22.4	22.4	22.4	22.4	22.4						22.4
2	27.9	*P.pat*	1997									27.9		
3	28.9	*A.mea*	2002						28.9	28.9	28.9			
4	20.8	*E.smi*	2001						20.8					
Total area of operation				22.4	22.4	22.4	22.4	22.4	49.7	28.9	28.9	27.9	0	22.4

SILVIC											
		Land prep	Plant	Fertilize	Weed 1	Weed 2	Weed 3	Watt space	Prune 3m	Prune 5m	Pre-harv clear
Silviculture operation costs/ha	R/ha	800	580	780	395	280	145	543	512	385	156
Total operational costs for the y	Tot/operation	17,920	12992	17472	8848	13916	4191	15692	14285		3472
TOTAL predicted Silvicultural costs for the year											**108788**