FORESTRY EXPLAINED

A FASCINATING INSIGHT INTO FORESTRY IN SOUTH AFRICA
INTRODUCTION

Forestry is more than simply the science of planting, managing and caring for timber plantations. It’s about the landscape that our timber plantations are a part of, the animal and plant species that call the forestry-owned land home and the people and communities that the industry touches.

It’s about developing best practices that are efficient and effective with the lowest environmental and social impact possible, while producing an array of sustainable and versatile end-products.

The forestry industry’s legacy in South Africa is far reaching and we, as Forestry South Africa, are proud to be part of it.

ABOUT THIS BOOKLET

In this booklet, we have included a selection of infographics from www.forestryexplained.co.za.

This one-stop resource offers in-depth but easy-to-read content supported by well-illustrated infographics and additional links for those who want to explore the industry further. It is ideal for learners and teachers.

We encourage you to visit the website as it offers itself as ‘a beginner’s guide to forestry in South Africa’ and caters for users of all ages. It covers the basics of forestry and forest products, and everything from water-use to recreation, pest control, ownership and end-uses.
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Trees are the PLANET’S LUNGS!

0.9 TONNES of carbon for every 1m³ of wood.

1 KG of carbon removed from the atmosphere.

1.47 KG of oxygen released.

CONSERVATION FACTOR

Plantations provide an alternative source of wood, thereby conserving natural forests.

Global bodies like the Forest Stewardship Council® FSC® are ensuring forestry is being managed SUSTAINABLY.

Over 80% of SA plantations are FSC® certified.
The forest industry supports well over 1/2 a million South Africans.

**Carbon Neutral Fuel Substitute**

Wood only releases CO₂ it had previously removed from the atmosphere.

To other energy intensive building materials like concrete, steel and aluminium. These require large amounts of energy and fossil fuels in their production process.

Wood has best thermal insulation value of all building material.

Wood is a humidity regulator. It absorbs moisture in wet conditions and releases moisture in dry conditions.

The carbon stored in trees offsets the amount released during:

- Harvesting
- Processing
- Manufacturing
- Transporting

200 homes = 100 tonnes carbon
GETTING TO KNOW SOUTH AFRICA’S FORESTS

FORESTS have a CRUCIAL role to play in:

- The Diversity of South Africa’s Flora and Fauna
- Soil Protection and Conservation
- Ecotourism
- The Water Cycle
- CO₂ → O₂

Globally, there are over 800 definitions of a forest!

In South Africa, a forest is considered to be:

An area of land DOMINATED by TREE SPECIES with OVERLAPPING CANOPIES, covering at least 75% of the area and very LITTLE grass or herbaceous GROUND COVER.

Although, South Africa by nature is not a forest rich country, it does have some natural (or indigenous) forests, as well as timber plantations.
Getting to know us

**NATURAL FORESTS**

Areas of naturally growing indigenous tree species.

**0.5 MILLION** hectares. 
**0.4%** of South Africa’s land cover.

![Natural forests symbol]

**TIMBER PLANTATIONS**

Established through afforestation, (planted on what were previously non-forest ecosystems). They comprise almost exclusively non-indigenous, (exotic), commercially profitable tree species.

**1.2 MILLION** hectares. 
**1%** of South Africa’s land cover.

= Plantation

- Western Cape **4%**
- Eastern Cape **11%**
- KwaZulu-Natal **40%**
- Mpumalanga **41%**
- Limpopo **4%**

South Africa’s natural forests are home to some **649** woody and **636** herbaceous natural plant species.

Some are completely unique to South Africa.

South Africa grows **3** major genera: Pine, Eucalyptus and Wattle.

The other **1%** is made up from a mix of other commercially grown indigenous species.

Around **25%** of South Africa’s natural forests are conserved within timber plantations.
TIMBER PLANTATIONS
GETTING TO KNOW THE TREES

1.2 MILLION
hectares of timber plantations in
SOUTH AFRICA.

Less than 1% is other commercially grown species:
yellowwood, blackwood, jacaranda, oak and cypress.

99.7% is made up of 3 MAIN GENERA

PINES (softwood)
EUCALYPTUS (hardwood)
WATTLE (hardwood)

51% 42% 7%
619,311 ha 512,226 ha 88,319 ha

PINE
3 MAIN SPECIES

P. patula  P. elliottii  P. radiata

Plus various other species and hybrids selected and specifically bred to combat tree threats and improve production.

WHERE ARE THE PLANTATIONS?

8% Western Cape (47,312 ha)
4% Limpopo (26,919 ha)
19% Eastern Cape (118,326 ha)
20% KwaZulu-Natal (120,920 ha)
49% Mpumalanga (305,835 ha)

END PRODUCTS

Structural Timber  Constructions  Mining Piles  Veneer  Pulp and Paper  Timber  Wood Chips  Furniture  Pallets  Cellulose  Cable Drums
WHERE ARE THE PLANTATIONS?

<table>
<thead>
<tr>
<th>Province</th>
<th>Ha</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mpumalanga</td>
<td>175,032</td>
<td>34%</td>
</tr>
<tr>
<td>Limpopo</td>
<td>21,300</td>
<td>4%</td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>20,868</td>
<td>4%</td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>293,404</td>
<td>57%</td>
</tr>
</tbody>
</table>

**Plus various other species and hybrids selected and specifically bred to combat tree threats and improve production.**

**END PRODUCTS**

**EUCALYPTUS**

**5 MAIN SPECIES**

- E. grandis
- E. nitens
- E. macarthurii
- E. smithii
- E. dunnii

**WHERE ARE THE PLANTATIONS?**

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<tr>
<td>Eastern Cape</td>
<td>20,868</td>
<td>4%</td>
</tr>
<tr>
<td>Western Cape</td>
<td>1,622</td>
<td>1%</td>
</tr>
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</table>

**WATTLE**

**1 MAIN SPECIES**

- Eucalyptus species

**WHERE ARE THE PLANTATIONS?**

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<thead>
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<th>Province</th>
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<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>KwaZulu-Natal</td>
<td>73,118</td>
<td>83%</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>12,965</td>
<td>15%</td>
</tr>
<tr>
<td>Limpopo</td>
<td>72</td>
<td>0.1%</td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>2,144</td>
<td>2%</td>
</tr>
</tbody>
</table>

**END PRODUCTS**

- Pulp and Paper
- Wood Chips
- Tannin
- Adhesives
- Charcoal
- Tannin Extract
- Telephone Poles

**Getting to know us**
FORESTRY AND CLIMATE CHANGE

DEFORESTATION
VS
SUSTAINABLE TIMBER PLANTATION MANAGEMENT

While both involve cutting down trees, when it comes to climate change they couldn’t be more different.

DEFORESTATION

Is the transformation of a forest into cleared land, when trees are cleared but not replanted. Deforestation is one of the biggest contributors to greenhouse gasses adding 1.6 gigatonnes of \( \text{CO}_2 \) every year, making it a major driver of climate change.

Gigatonne = 1 billion tonnes

What is CARBON NEUTRAL?

It is when the carbon released is equal or less than the carbon taken up.
SUSTAINABLE TIMBER PLANTATION MANAGEMENT

Sustainable timber plantation management ensures that rate of harvesting (felling) and planting are synchronised such that the area under timber remains the same.

Globally forests absorb 2.6 GIGATONNES of CO₂ every year.

CO₂ released during transpiration.

CO₂ released during harvest, manufacturing and transport.

GROWTH

HARVEST

CONTINUAL UPTAKE & STORAGE

Sustainable harvesting can help fight climate change by absorbing CO₂ from the atmosphere and storing it in a variety of carbon sinks. It also provides a renewable, carbon neutral alternative to fossil fuels.
Trees are nature’s biggest carbon sinks, removing CO₂ from the atmosphere and storing it.

FACT: One mature tree can produce enough O₂ to sustain 2 people for a year.

FACT: By the time a tree has reached 40 years old it could have taken up 1 tonne of CO₂.

Some carbon gets stored in soil.

Small amount released during transpiration.

Photosynthesis: CO₂ + H₂O + ENERGY → O₂ + C₆H₁₂O₆ (glucose)

Tree (wood) becomes a carbon sink.

OXYGEN (O₂) released.

FACT: Trees, forests and timber plantations all have an important role in influencing climate change.
GREEN DESERTS?

The irony of this myth is that if critics really understood deserts, they’d know that they are actually teeming with life. You just need to know where to look! The same is true for timber plantations.

At the scale of a timber compartment or stand, plantations are monocultures. **BUT** At a landscape level they actually contribute to conserving biodiversity.

**WHAT’S CONSERVED?**

Conserved riparian areas*, grasslands and indigenous forests provide important habitats for flora and fauna and increase water production.

*A riparian area is the interface where the land meets a river or stream.

As a result, there is a network of wildlife corridors running through plantations. **AERIAL VIEW**

**CREATED, MANAGED AND PROTECTED**

by timber plantation owners in South Africa.
TUMBER PLANTATIONS ARE NOT IRRIGATED.

However, forestry does use around 3% of the country’s available water. The trees use soil water to produce energy through photosynthesis and release it through their leaves during transpiration. They also prevent a percentage of the rainwater reaching the ground, as a result of interception. This alters an area’s water catchment. It is for this reason that the commercial forestry sector pays a stream flow reduction tax.

This alters the water balance in the catchment. As a result, timber plantations need to be CAREFULLY MANAGED.
WHY WATER IS REGULATED IN FORESTRY?

This sounds like a lot and it is! It’s enough to fill 171,200 Olympic swimming pools.

But when you place it in the context of the total water used each year in South Africa by all sectors and users, 12,871 million cubic metres.

Forestry is a small player: Accounting for around 3% of South Africa’s WATER USAGE.

ANY WATER SAVING IS IMPORTANT

Of the available water we already use 98%.

450mm rainfall annually

SOUTH AFRICA = 30th driest country in the world

350mm LESS than global average.
THREATS TO TIMBER PLANTATION HEALTH

There are numerous threats to tree health, which can leave the tree weakened, damaged or dead! These can be grouped into two categories, **ABIOTIC** (non-living) factors and **BIOTIC** (living) factors.

Many organisms interact with trees. It is only when they affect the timber plantation in a detrimental or harmful way, that they become a pest.

**KEY SIGNS TO TELL THE DIFFERENCE**

<table>
<thead>
<tr>
<th><strong>Abiotic</strong></th>
<th><strong>Biotic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not host specific (numerous different tree genus affected)</td>
<td>Mainly host specific (usually one genus affected)</td>
</tr>
<tr>
<td>Non-infectious</td>
<td>Can spread infectious</td>
</tr>
<tr>
<td>Visible damage gradient from source spreading outward</td>
<td>Random damage pattern</td>
</tr>
<tr>
<td>Damage occurs at the <strong>SAME</strong> age / development stage</td>
<td>Damage occurs at <strong>DIFFERENT</strong> ages / development stages</td>
</tr>
</tbody>
</table>
WHAT IS A DISEASE?
A condition caused by a living organism or environmental change that impairs the normal functions of the tree.

THE MAJOR PLANTATION DISEASES
Below are the major plantation diseases and the tree species they affect.

KEY: Pine:        Wattle:      Eucalyptus:

TRUNK AND STEM DISEASES

LEAVES AND NEEDLE DISEASES

ROOT DISEASES

Dr Irene Barnes TPCP / CTHB: Dothistroma Needle Disease Izette Greyling TPCP / CTHB: All others
**FORESTRY** is a balancing act!
Getting the **BEST** output for the **LOWEST** input costs.

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**TIMBER’S VALUE**

3 factors influence timber’s end use and therefore its **VALUE**.

1. Straightness/taper
2. Knots and damage
3. Thickness

---

**HOW TO IMPROVE RATIOS**

**THINNING**
Going from over **1,000** seedlings to **200** harvested logs plays an important role in ensuring that trees grow optimally.

**PRUNING**
Remove side branches that cause knots and force competition for light which increases growth.

However, both **PRUNING** and **THINNING** increase **INPUT COSTS**.

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**VALUE OF A SAWLOG TREE**

**PULP**
Least valuable tree section:
Top section of the trunk where the wood is thinner and tapered.

END PRODUCT = Pulp

**Lowest Quality**
Straight not tapered but too thin to make planks.

END PRODUCTS = Pulp, Fibre Board

**High Quality**
Thick enough for the outer bark to be stripped and planks made, but too many knots for furniture quality.

END PRODUCTS = Structural and Building Timber

**Highest Quality**
No knots thanks to pruning:
Thick enough for planks to be cut but not for veneer.

END PRODUCT = Furniture Grade Timber.

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The best quality wood:
No knots and thick enough for veneer peeling.

END PRODUCT = Veneer

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**FORESTRY’s 3 factors**

- Straightness/taper
- Knots and damage
- Thickness

---
VALUE OF A PULP LOG

When it comes to pulp logs, some can be worth a lot more than others. Value depends on on a number of factors, including:
1) the species of tree; 2) whether it is a soft or hardwood; 3) the pulping process involved; and 4) what it will finally be used for.

<table>
<thead>
<tr>
<th>SOFTWOOD (Pines)</th>
<th>VS</th>
<th>HARDWOOD (Eucalyptus &amp; Wattle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produce long coarse fibres suited for packaging and newsprint.</td>
<td></td>
<td>Produce short fine fibres suited for fine paper, textiles and nanocellulose applications.</td>
</tr>
</tbody>
</table>

**BONDING AGENTS**

These are used in:
- cement,
- paint,
- fertilizer,
- dust retardant,
- energy production,
- etc...

**SUGARS AND ORGANIC ACIDS**

These are used in the making of many chemicals:
- Xylitol - a wood sugar alcohol used as a sweetener.
- Sorbitol - a glucitol, sugar alcohol that the human body metabolises slowly.

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**Amount Produced**

<table>
<thead>
<tr>
<th>FOOD INGREDIENTS &amp; COSMETICS</th>
<th>CHEMICALS</th>
<th>TEXTILES</th>
<th>NON-WOVEN MATERIALS</th>
<th>PAPER AND PACKAGING</th>
<th>BIOENERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMALL QUANTITIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HIGH</td>
</tr>
<tr>
<td>LARGE QUANTITIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LOW</td>
</tr>
</tbody>
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**Breaking Down Cellulose into Its Smaller Components**

1. **Cellulose Fibre**
2. **Fibre**
3. **Microfibril Matrix**
4. **Microfibrils**
5. **Nanofibrils**
6. **Nanocrystals**

USES:
- Paper, packaging, bags, boxes, cartons, etc...
- Textiles, materials, viscose, etc...
- Food, cement, medicine, batteries, LED screens, touch screens etc...

That holds the individual microfibrils together in larger groupings.
Turning a solid tree into a versatile liquid that makes far more than just paper.

- Paper
- Textiles
- Filters
- Medical consumables
- Packaging
- Diaperstock
- Insulation
- Composites

The list goes on with more uses being added as science discovers new ways to harness the potential of wood and fibre products.
Selective felling

Removing the largest trees for markets with higher returns per tonne can provide a profitable secondary revenue stream.

The Wonder of Wood

One of the amazing aspects of wood is how many end products can be made from farmed trees. From printer paper to underwear, timber to tar oil, our wood is turned into hundreds, if not thousands, of products. Some you will instantly recognise, others you would never believe were originally made from wood.

As a versatile, sustainable, carbon neutral alternative, wood not only has multiple uses it also has multiple reasons to be chosen over the alternatives. This often makes wood the most environmentally and socially responsible, cost-efficient and desirable choice.

We are proud of the jobs it creates and its contribution to South Africa’s economy. We are also proud of the basic needs it fulfils and even the convenience our products bring to people.

Fact:

Removing the largest trees for markets with higher returns per tonne can provide a profitable secondary revenue stream.

Wood chips

Exported for pulp production.

Sawn timber
(Lumber)

Making a square plank from a round log is the real challenge as sawmillers need to optimise the process and get the most from each log.

Poles + Posts
FROM SAW TO SAWDUST

SAWLOGS

ROUND LOGS

Thickest and best quality bottom section

VENEER

1. TOP QUALITY FACE VENEER
Furniture, windows, inlays panelling, fixtures, etc...

2. LESSER QUALITY PACKAGE VENEER
(Once-off use)
Baskets, crates, hampers, boxes, etc...

PLYWOOD

1. CONSTRUCTION
Door panels, crates, roofing, prefabricated homes, etc...

2. MARINE (Waterproof)
Canoes, naval boats, sail boats, speed boats, etc...

3. COMPREGNATED (Resin Soaked)
Aeroplane propellers, table tops, bearings, etc...

TIMBER (Biggest Logs)

1. CONSTRUCTION
Building foundations, bridges, mine timber, lapas, log cabins, timber frame homes, etc...

SAWLOGS

LUMBER

1. CONSTRUCTION
Beams, flooring, joists planks, posts, rafters, sills, walls, boat hulls, boards, shuttering, panels, etc...

2. FINISHED LUMBER
Base boards, pannelling, casing, steps, moulding, ceilings, flooring, decking, etc...

OFF CUTS

1. CONSTRUCTION
Building foundations, bridges, mine timber, lapas, log cabins, timber frame homes, etc...

2. REMANUFACTURED LUMBER (Additional Process)
Children's toys, cable drums, tool handles, sports equipment, gunstocks, cabinets, moulding aeroplane parts, instruments, shoes, pallets, ships, bowling alleys, etc...

Smaller mills will spend more time on turning their off-cuts into usable timber.
**End Products**

- **Chips & Flakes**
  1. **Particle Board**
     - Worktops, flat pack furniture, moulded furniture, panels, etc...
  2. **Other**
     - Animal bedding, wood flour, pulp bricks, dowel, lathes, fuel logs, chicken litter, furniture squares, mop handles, sawdust products, mulch, flooring, etc...
  3. **Remnants**

- **Burnt**

- **Sawdust**

**Wood Distillation**

- **Hardwood**
  1. **Acetic Acid**
     - Latex, photo film, lacquers, plastics, perfume, dyes, etc...
  2. **Acetone**
     - Explosives & solvents
  3. **Charcoal**
  4. **Pitch**
     - Rubber filler
  5. **Tar Oil**

- **Softwood**
  1. **Creosote Oil**
     - Disinfectant, animal dips, etc...
  2. **Lacquer Solvents**
     - Paints & varnish, pine oil disinfectant, fabric dye, etc...
  3. **Resin**
     - Soap, linoleum, varnish, etc...

**Wood Hydrolysis**

- Acetic acid, baking yeast, glycerin, furfural (nylon), butadiene (rubber), ethyl alcohol (alcoholic drinks), animal feed (glycose), etc...

**Electricity**

- Used to power sawmills and kilns.
FROM FOREST TO PULP

WATTLE, EUCALYPTUS + PINE

Round logs + By-products
Damaged logs
Branches
Edge pieces
Bolts

DEBARKING

1. DISSOLVING PULP
Makes plastic-type products:
Cellophane, explosives, rayon, film, lacquers, etc...

2. MECHANICAL PULPING
Made into tiny particles:
All forms of paper, newsprint, telephone directories, magazine paper, etc...

PULPING

WOOD CHIPS + WOOD PELLETS
**PROCESS**

3. **SULPHITE or SULPHATE or SODA**  
   Paper, paper-based products & packaging, etc...

4. **SEMI CHEMICAL**  
   A mild chemical treatment:  
   Egg cartons, insulation, boards corrugated paper, wallboards, etc...

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**PULP + LIQUOR**

Glues, dyes, paint,  
varnish, fertilizer,  
fuel bricks, plastic,  
fatty acids, soap,  
road binder,  
artificial flavours,  
pharmaceuticals,  
turpentine, acetone,  
plastic compounds, etc...

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**COGENERATION OF STEAM + ELECTRICITY**

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**WOOD CHIPS EXPORTED FOR PAPER PRODUCTION**
Major contributor to our country’s economy

Endless career options

CAREERS IN FORESTRY

Alternative energy source

CONTRACTOR ARTISAN MILLER SCIENTIST EQUIPMENT SUPPLIER FORESTER ENVIRONMENTALIST COMMUNITY OFFICER ACCOUNTANT PRODUCT DEVELOPMENT ENGINEER BUSINESS DEVELOPER
Be part of the solution.

Mitigating climate change

Worldwide career opportunities

5 REASONS TO CHOOSE A CAREER IN FORESTRY

Work in some of the most beautiful parts of the country.