Growing trees in riparian areas to improve water quality, shelter, biodiversity and timber production
- a field day for farmers, foresters and land-use managers

Saturday 8th December, 2012
Willow Bend Farm
292 Sunday Hill Road
Wattle Grove

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ACKNOWLEDGEMENTS

The contribution made by our host landowners on their property, Giuliana and Chris White, is gratefully acknowledged.

This field day has been organised by Private Forests Tasmania in conjunction with the landowners Giuliana and Chris White and Dr Philip Smethurst, CSIRO.

Support and contribution by the following and their input on the day is appreciated: Dr Neil Davidson, Greening Australia Tasmania.

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CSIRO Ecosystem Sciences
Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national science agency and one of the largest in the world.

CSIRO research delivers solutions for agribusiness, energy and transport, environment and natural resources, health, information technology, telecommunications, manufacturing and mineral resources.

www.csiro.au

Greening Australia Tasmania
Greening Australia is an environmental organisation, founded in 1982 to engage the community in vegetation management to protect and restore the health, diversity and productivity of Australia's landscapes.

www.greeningaustralia.org.au
Field day program
Growing trees in riparian areas to improve water quality, shelter, biodiversity and timber production
Sat. 8th December 2012 – Willow Bend Farm, 292 Sunday Hill Road, Wattle Grove

9:00am Registration / tea, coffee & scones

9:30am Housekeeping and introductions

9:35am Arthur Lyons, Private Forests Tasmania
- Brief on PFT

9:45am Chris White, landowner
- Property information
- Project background information
- Trees on farm: why plant trees?, summary of plantings

10:00am Briefings on tour stops
To Stop 1

10:15am Stop 1 – Base of Stream D
Rob Smith & Henry Chan (PFT), Chris White and Malcolm Larner:
- Site and project history
- Planting trees in riparian areas: objectives, planning, establishment and maintenance

11:00am To Stop 2

11:05am Stop 2 - Top of Stream D
Arthur Lyons & Rob Smith:
- The contribution of trees to biodiversity and conservation

11:30am To Stop 3

11:35am Stop 3 - Stream E
Rob Smith (PFT) / Chris White:
- Growth and potential markets
- Trees and shelter
- Lessons learnt
Henry Chan (PFT):
- Growing blackwood on farms

11:55am To Stop 4
12:00pm  **Stop 4 – Base of Stream B**  
Dr Philip Smethurst, CSIRO Ecosystem Sciences:  
- Plantations in Streamside Management Zones: Water Quality, Stream Flow

12:25pm  Back to barn

12:30pm  **Barn**  
Light lunch & tea, coffee served

1:30pm  **Barn**  
Dr Neil Davidson, Greening Australia Tas.:  
- Biodiverse plantings for carbon

2:00pm  **Q&A (5 mins)**

2:05pm  **Summation**

2:15pm  **Close and Thanks**  
Tea, coffee & biscuits

2:30ish  Safe drive home
Stop 1 - Site and project history

**Landowners** - Giuliana & Chris White, Willow Bend Farm, 292 Sunday Hill Road, Wattle Grove, Tasmania 7109.

The White family moved to the property in 2000 and carried on the intensive dairying activities of the farm until approximately 2006. In 2006 Chris White contacted Private Forests Tasmania for advice on how to manage the riparian areas, this resulted in a property forest management plan to primarily protect the riparian areas from livestock and revegetate the streamsides within Willow Bend Farm.

**Site details**
- **Property area:** 61 hectares
- **Project area:** Approximately 3 hectares
- **Management zone:** Watercourse revegetation

**Project objectives**
The purpose of the project is to protect the riparian areas from livestock and revegetate the streamsides within Willow Bend Farm. The aim is to improve the water quality in the streams, increase habitats for native fauna and flora and provide a potential timber resource.

The CSIRO objectives are to conduct a research program aimed at providing guidelines to regulators and farmers for managing commercial forest plantations in riparian zones of cleared farmland that will remain predominantly agricultural. The emphasis is on monitoring water yield and quality impacts and communicating results to farmers and regulators.

This project will act as a blueprint for other Australian land managers who may wish to revegetate riparian areas on their farms.

**Physical descriptions**
The North-facing, mid-slopes of the property are dominated by deep (1 – 1.5 m), duplex soils with sandy loam surface over very pale brown to light grey clays, with occasional small stones throughout the profile, derived from Permian mudstone deposits:

- **Erodibility:** Moderate to high
- **Compaction:** High
- **Nutrient depletion:** Moderate
- **Landslides:** Slight – severe (dependant on slope)
- **Flooding:** Negligible
- **Geology:** Permian fine sandstones and mudstones
- **Root depth:** 1 – 1.5 m
- **Fertility:** High
- **Stoniness:** Moderate
- **Drainage:** Low
- **Slope:** 5 – 15°
- **Aspect:** North
- **Average max. & min. temperature:** 21.3°C & 2.5°C
- **Rainfall & frequency:** 1 050 mm/yr 190 days/yr
- **Frosts:** Frequent seasonal
Site index: 25.5m height growth at 15 years old
Site productivity: Medium to high productivity
Soil management: Surface horizons, with higher organic and nutrient levels, should be left intact as far as possible.

Typical soil profiles at Stream A (left) and Stream D (right) deep (1 – 1.5m), showing a sandy loam surface over very pale brown to light grey clays, with occasional stones through the profile

Suitability for plantations: Highly suitable
Cultivation: Ripping to break up clayey subsoils is necessary. Mounding is desirable to produce a good planting medium and to aid drainage.
Fertilizer treatment: Soils are low in nutrients and site preparation may lead to low initial availability. Fertilizing planted seedlings is required. Low levels of nutrients indicate that fertilizer may be required during the rotation.
Predicted growth rate: Peak Mean Annual Increment 22m³/ha/yr at 24 years (E.globulus – blue gum) Farm Forestry Toolbox V4
Streams C (left) and E (right) in 2007 before establishment, showing typically denuded streamsides, erosion and an abundance of rushes.

Original proposed operational prescriptions 2007
NB – the changes to these proposals are listed in ‘Changes to the proposed operational prescriptions’ (see next page)

Stream A
Establish *E.globulus* revegetation plantings – 5 rows wide along stream.

Ground preparation: Excavator mounding (50 x 50 x 20cm mounds) 3 x 3m spacing.
Pre-plant herbicide spray: Contact translocated (glyphosate) and residual (atrazine).
Initial stocking: 1 100 trees/ha
Fertilizer: 100g di-ammonium phosphate (DAP) per tree
Pruning: 3 lift pruning (age 5, 6, 7 years)
Thinning: Age 10 years: selective to retain better formed, healthy trees (remove 40%)
Clearfall: Not applicable, a non-clearfall regime is proposed

Stream B
Establish blackwood revegetation plantings. Blackwood to form 4 rows along the streamsides, avoid planting in obviously wet or waterlogged areas.

Ground preparation: Blackwoods: excavator mounding (50 x 50 x 20cm mounds (3 x 3m spacing)
Pre-plant herbicide spray: Contact translocated (glyphosate) and residual (atrazine – eucalypts only).
Initial stocking: 1 100 trees/ha
Fertilizer: 100g di-ammonium phosphate (DAP) per eucalypt tree
Weeding: Translocated contact herbicide (glyphosate) during first 3 years to reduce competition
Pruning: Form pruning – age 1, 2, 3, 4 years
Thinning: Blackwoods: upon canopy closure (approx. age 15 years) select best formed trees to retain, remove 40% of total crop
Clearfall: Not applicable. Continue thinning as necessary to create an uneven age semi-natural streamside.

Streams C, D, E
Establish *E. globulus* and blackwood revegetation plantings. Blackwood to form a core of 4 rows along the stream-sides, avoid planting in obviously wet or waterlogged areas, plus 2 rows of *E.globulus* on either side of the blackwoods.

Ground preparation: Blackwoods: excavator mounding (50 x 50 x 20cm mounds), blue gums: mound plough (3 x 3m spacing)
Pre-plant herbicide spray: Contact translocated (glyphosate) and residual (atrazine – eucalypts only).
Initial stocking: 1 100 trees/ha
Fertilizer: 100g di-ammonium phosphate (DAP) per eucalypt tree
Weeding: Translocated contact herbicide (glyphosate) during first 3 years to reduce competition
Pruning: Blackwood: form pruning – age 1, 2, 3, 4 years; *E.globulus* - 3 lift prunes (age 5, 6, 7 years)
Thinning: Blackwoods: upon canopy closure (approx. age 15 years) select best formed trees to retain, remove 40% of total crop; *E.globulus*: age 10 years: selective to retain better formed, healthy trees and remove *E.globulus* suppressing the blackwoods (remove approximately 40%)
Clearfall: Not applicable. Continue thinning as necessary to create an uneven age semi-natural streamside.

See also Private Forests Tasmania’s publications:
- ‘Farm Forestry Series – Eucalypts’;
- ‘Farm Forestry Series – Blackwoods’;
- ‘Farm Forestry Technical Information Sheets’; and
- ‘Plantation Information Series’.

Proposed total tree numbers per stream:

<table>
<thead>
<tr>
<th>Stream</th>
<th>Length</th>
<th>Blackwood</th>
<th>Blue Gum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100m</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>200m</td>
<td>280</td>
<td>170</td>
</tr>
<tr>
<td>C</td>
<td>230m</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>D</td>
<td>195m</td>
<td>260</td>
<td>260</td>
</tr>
<tr>
<td>E</td>
<td>160m</td>
<td>210</td>
<td>210</td>
</tr>
</tbody>
</table>
Generic prescriptions
- Fencing was erected to exclude livestock from the streamsides;
- The revegetation of riparian areas has helped provide natural stock havens for cattle, thus improving stock protection, health and farm productivity;
- Natural regeneration of native trees and shrubs was encouraged;
- Fixed photo points were installed as a record of the development of the farm site. Scheduled monitoring and reworks will ensure successful establishment of the plantings.

Changes to the proposed operational prescriptions
During the evolution of the project a few changes, initiated by Giuliana and Chris, were made to the proposed operational prescriptions; these included:
- The fertiliser regime was removed, due to a perceived high cost:benefit ratio;
- The residual herbicide was changed to Eucmix, due to its granular composition the application was far simpler;
- A proportion of *E. nitens* (Shining gum) were included in Streams D & E;
- Stream B was left unplanted as a control for CSIRO’s research project;
- Stream C was established for CSIRO and used a standard plantation forestry regime and combination gum:blackwood mix;
- All the selected blackwoods have received their form pruning and their first lift prune to 2.4m;
- All the selected eucalypts have prematurely received their first, second and third lift prune; and
- As yet, Stream A has not received any pruning.

Innovation
The main innovation of the project has been the development of the ground preparation technique of individual spot cultivation using Chris’ own mini-excavator. The technique was developed from a recognised ‘inverse humus’ mounding technique that involves the scraping of top soil layer and vegetation into a mound; the ‘White mound’ involves digging a deeper hole and lifting the bucket high in the air to release the mound with the vegetation upside down, resulting in:
- A raised planting site;
- Fracturing of the clay soil and exposure to the elements;
- A weed-free site;
- A reservoir of water to irrigate the transplant in summer; and
- Improved growth rates.
Stream A (left) in 2007 before establishment, showing typical scraped mound and Stream D (right) in 2012 showing the improved mounding technique.

Costs

Mainly due to the largely linear nature and necessity for fencing, the costs of establishing riparian plantings can appear to be high, for example:

<table>
<thead>
<tr>
<th></th>
<th>2007 – Streams A &amp; D</th>
<th>2008 – Stream E</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fencing</td>
<td>$5 820</td>
<td>$3 100</td>
<td>$8 920</td>
</tr>
<tr>
<td>Equipment hire</td>
<td>$3 720</td>
<td>$2 200</td>
<td>$5 920</td>
</tr>
<tr>
<td>Planting &amp; maintenance</td>
<td>$1 865</td>
<td>$1 410</td>
<td>$3 275</td>
</tr>
</tbody>
</table>

$18 115

Actual total plant numbers:

<table>
<thead>
<tr>
<th>Blackwood</th>
<th>Blue gum (<em>E.globulus</em>)</th>
<th>Shining gum (<em>E.nitens</em>)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 220</td>
<td>340</td>
<td>820</td>
<td>2 380</td>
</tr>
</tbody>
</table>

However, it should be borne in mind that the majority of the fencing was in need of upgrade and renewing and therefore the fencing cost has been omitted from the following calculations:

Cost per hectare = $3 065
Cost per tree = $3.86
Outcomes
The most significant initial outcome from the project has been the rapid site capture within the first 4-5 year establishment phase.

Stream E (left) in 2007 before establishment, showing typically denuded streamsides, erosion and an abundance of rushes and in November, 2012 (right) showing rapid site capture by the gums and blackwoods with improved herb and shrub layers, plus reduced erosion.
Stop 2 - The contribution of trees to biodiversity and conservation

Habitats for native fauna and flora
One of the aims of the project was to ‘increase habitats for native fauna and flora’ to be achieved by the establishment of semi-natural streamside tree-planting and the encouragement of natural regeneration of native herbs, shrubs and trees species.

In particular, Stream A was designed to extend the existing blue gum (*E. globulus*) remnant with the intention of providing potential foraging habitat for the swift parrot. The swift parrot is an endangered species that has important breeding areas within the Huon Valley and Channel, the site provides potential nesting habitat in the nearby native forest and potential foraging habitat within the blue gum remnant and plantations.

Significantly, the blue gums are only 4 years old and are already flowering, thereby providing a potential foraging resource for the swift parrots. The intended management prescription to continually thin and encourage natural regeneration will ensure the longevity, quality and quantity of the potential foraging habitat; whilst supplying a valuable timber resource.

Stream A (left) in 2007 before establishment, showing the existing blue gum remnant and in November, 2012 (right) showing the planted extension to increase potential habitat for swift parrots

The White family has noticed a significant increase in the amount of fauna across their property, in particular the number of bird species has improved with sightings of species recently that have not been seen since the family's arrival in 2000.
NOTES
Stop 3 - Growth and potential markets

Growth rates
A quick visual inspection can indicate that the planted trees have grown exceptionally well during the first 4-5 years. However, we can also calculate the growth using the latest version of the Australia-wide tree growing software program Farm Forestry Toolbox V5 (see ‘Farm Forestry Toolbox – NEW Version’) to plan, make decisions and manage plantations, shelterbelts, agroforests and carbon.

The Farm Forestry Toolbox is a collection of programs (tools) to assist forest owners and managers plan, monitor and manage shelterbelts, plantations or native forests, available from Private Forests Tasmania through its web page http://www.privateforests.tas.gov.au/products/farm_forestry_toolbox.

The *E. nitens* were measured in November, 2012 and entered in to the Farm Forestry Toolbox, a summary is as follows:

- **Age:** 4.4 years
- **Mean dominant height (MDH):** 11m
- **Mean diameter breast height (MDBH):** 14cm
- **Basal area (BAob):** 20m²/ha
- **Volume:** 71m³/ha
- **Periodic annual increment (PAI):** 16m³/yr
- **Predicted peak mean annual increment (PeakMAI):** 32m³/yr at 20-25 years

(see FFT v 5.2 Scenario: Whites Cygnet)

These figures indicate a highly productive plantation, this was predicted from the site conditions. Plus, the majority of the trees have been planted as two rows around the outside of the blackwood core, they are therefore afforded the additional benefit of being edge trees that have reduced competition for water, nutrients, space, light and soil.

The growth of the blackwood component has been equally impressive but due to the inherent characteristics and probable unimproved planting stock it is naturally variable across, and within, the...
streams. Although the growth cannot compare with the eucalypts it has still performed well, and would appear to be benefitting from the shelter afforded by the adjacent eucalypts. The blackwoods are not able to be modelled at this early growth stage in the Farm Forestry Toolbox, due to the highly variable growth typical of young blackwood plantations and their small size that would make the calculations highly unreliable and of little value.

**Potential timber markets**
There is an element of crystal-ball gazing involved in predicting the potential timber markets, combining: an untested plantation resource, a small local specialty timber processing sector and a rapidly changing timber processing industry. However, predictions can be made based on trends and local experience.

**The eucalypt components** are being managed for a veneer/sawlog regime due to the assumptions that: higher grade timber products are easier to market and their potential higher value will increase the returns and improve the economies of scale.

The Farm Forestry Toolbox calculations make assumptions for the predicted value of the eucalypt products:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>25 years</td>
</tr>
<tr>
<td>Mean dominant height (MDH)</td>
<td>39 m</td>
</tr>
<tr>
<td>Mean diameter breast height (MDBH)</td>
<td>38 cm</td>
</tr>
<tr>
<td>Basal area (BAob)</td>
<td>47 m²/ha</td>
</tr>
<tr>
<td>Volume</td>
<td>588 m³/ha</td>
</tr>
<tr>
<td>Periodic annual increment (PAI)</td>
<td>30 m³/yr</td>
</tr>
<tr>
<td>Internal rate of return (IRR)</td>
<td>10%</td>
</tr>
<tr>
<td>Net present value (NPV)</td>
<td>$3,950/ha</td>
</tr>
<tr>
<td>Total product value</td>
<td>$16,500/ha</td>
</tr>
</tbody>
</table>

(see FFT v 5.2 Scenario: Whites Cygnet(a))

These figures assume a standard regime with a Clearfall event at age 25. However, it is unlikely that this event will not happen as the areas are planned to be continually thinned to promote a semi-natural streamside management zone.

It should also be noted the Farm Forestry Toolbox calculations do not include any high value veneer products at age 25 as the mean diameter (MDob) is too small (39cm), but the options in a non-clearfall management regime allow the harvest operations to be market and product-based to maximise returns for the grower ie. trees can be removed or retained as the markets and products dictate.

For example:

- In year 25 a proportion of the trees are over 50cm DBH and can be harvested for veneer at a premium price of $100/m³. The remaining trees, lower quality sawlog, can be retained to grow on to become veneer.
- Conversely:
  - In year 25 a small proportion of the trees are over 50cm DBH and can be retained for veneer at a premium price of $100/m³. The remaining trees, lower quality sawlog, can be harvested to provide an intermediate income.
The following Farm Forestry Toolbox calculations, using a 40 year rotation and multiple thinning operations, make assumptions for the predicted value of the eucalypt products that more reflect the proposed continual thinning to promote a semi-natural streamside management zone:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>40 years</td>
</tr>
<tr>
<td>Mean dominant height (MDH)</td>
<td>48m</td>
</tr>
<tr>
<td>Mean diameter breast height (MDBH)</td>
<td>46cm</td>
</tr>
<tr>
<td>Basal area (BAob)</td>
<td>44m²/ha</td>
</tr>
<tr>
<td>Volume</td>
<td>690m³/ha</td>
</tr>
<tr>
<td>Periodic annual increment (PAI)</td>
<td>24m³/yr</td>
</tr>
<tr>
<td>Internal rate of return (IRR)</td>
<td>10%</td>
</tr>
<tr>
<td>Net present value (NPV)</td>
<td>$6 880/ha</td>
</tr>
<tr>
<td>Total product value</td>
<td>$46 400/ha</td>
</tr>
</tbody>
</table>

(see FFT v 5.2 Scenario: Whites Cygnet(b))

It can therefore be seen that the flexibility of management within a non-clearfall regime can have the potential to take advantage of market and product opportunities as they present themselves to a landowner.

**The blackwood components** are also being managed for a veneer/sawlog regime using continual thinning to create an uneven age semi-natural streamside.

It has already been mentioned that accurate modelling of the young blackwoods is not possible, but experience from similar blackwood plantations at Abbotsham (see ‘Blackwood growth and returns’) indicate:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>45 years</td>
</tr>
<tr>
<td>Mean dominant height (MDH)</td>
<td>25m</td>
</tr>
<tr>
<td>Mean diameter breast height (MDBH)</td>
<td>50cm</td>
</tr>
<tr>
<td>Basal area (BAob)</td>
<td>45m²/ha</td>
</tr>
<tr>
<td>Volume</td>
<td>400m³/ha</td>
</tr>
<tr>
<td>Mean annual increment (MAI)</td>
<td>9m³/yr</td>
</tr>
<tr>
<td>Total product value</td>
<td>$21 - 26 000/ha</td>
</tr>
</tbody>
</table>

Currently, in northern Tasmania log prices paid to farmers are $80-100/m³ for higher grade logs and $15-20/m³ for lower grade logs. Locally, corresponding prices paid are about $50-60/m³ for higher grade logs (Cat4) and $20/m³ for lower grade (Utility & Out-of-spec) logs. Thus, locally the corresponding estimated total product value would be approximately $15 000/ha.

NB – the stumpage price difference between north and south Tasmania are mainly due to a lack of speciality timber processors in the south and the cost of carting timber to the northern timber processors.

**Firewood**
The value of firewood resource should not underestimated, within the local area delivered seasoned firewood is approximately $110/m³ and firewood stumpage is often quoted at $30/m³, thereby providing a valuable source of fuel.
Growing blackwood on farms
(Henry Chan, Private Forests Tasmania)

Since the early European settlement in Australia, Blackwood has been widely used and recognised as one of the world’s premium decorative timbers for a wide range of end products: musical instruments, furniture, cabinets, bedroom suite, kitchen bench, panels, flooring, etc. With the diminishing supply of native forest blackwood plantation grown blackwood is becoming an important future niche market opportunity for farmers and tree growers, as a potential medium/long term income. To capture and maximise this niche supply potential, it is best to produce premium quality clearwood via dedicated and timely pruning and thinning.

Planting blackwood with or without nurse crop
Blackwood has poor apical dominance, and the use of a nurse crop (E. nitens, P. radiata, etc) interplanted with blackwood has been successfully trialled to train and encourage the blackwood to produce a straighter trunk and better form. Also, pure blackwood establishment has been successful (especially in New Zealand), but requires higher initial planting stocking of 1000-1200 stems per hectare. Both these regimes require proper silviculture treatments – form pruning, clearwood pruning and thinning (see ‘Farm Forestry Series – Blackwoods’).

Some pros and cons of blackwoods with or without nurse crops:

<table>
<thead>
<tr>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure blackwood regime produces twice as many good form trees available for selection*</td>
<td>Pure blackwood regime requires more timely form pruning with twice as many blackwood planted</td>
</tr>
<tr>
<td>Nurse crops train the blackwood trees to produce straighter trunks for pruning</td>
<td>Nurse crop regimes produce fewer blackwood trees to select for the final crop</td>
</tr>
<tr>
<td>Both nurse crop trees and blackwood thinning can provide a potential firewood resource</td>
<td>Nurse crops must be removed before they suppress the blackwoods</td>
</tr>
</tbody>
</table>

* currently important as available blackwood seedlings are not from improved seedstock.

Silviculture
It is important that the blackwoods on your property get as much attention as your stock. Without proper care and maintenance, your animals will suffer in health and weight loss and return less income. This is exactly the same logic for your planted blackwoods. In order to produce the ideal timber for high premium quality decorative end products, you must judiciously prune and thin on schedule.

Key message - Unless the grower is able and prepared to carry out regular form pruning, clearwood pruning and on-time thinning, it is a waste of time to plant blackwoods for production of higher quality timber.

Form pruning
Due to poor apical dominance blackwood is known to suffer abortion of shoot tip (caused by insect or fungus or frost) and causes the retained branches to compete for dominance, resulting in the development of double or multiple leaders. By retaining only one branch with best form near the aborted tip, this branch will take over as the main leader shoot. Other large branches, with diameter of 30mm and over, need to be removed to eliminate stem kinks and maintaining a smaller defect core of the pruned trunk.
Annual form pruning should start from the early age of 2 or 3 years. The common practice is to form prune about 70-75% of your blackwoods in the pure blackwood regime, and you will need to form prune virtually all the blackwood trees in the nurse crop regime (to ensure you can get enough pruned final crop trees). Work becomes easier with the aid of a simple 30mm plywood gauge, calliper or thumb. Remember during subsequent years, as the trees grow higher than 6m, only remove these big branches on the 5 to 6 meter pruned butt log length. In situations when the some trees do not warrant further pruning due to some stem defect below 6m, a shorter log length is perfectly acceptable by millers.

Remember - if any large branches are not removed, by next spring they would have grown to a diameter of 40mm or more, resulting in: harder work, larger defect core, less clearwood volume, a larger wound and longer final rotation to achieve the preferred target tree diameter at breast height of 60cm.

Chris carries out some blackwood form pruning in 2008

Clearwood pruning
The following table is a typical pruning schedule which has been successfully trialled by New Zealand growers. As for the nurse crop regime, depending on the planting ratio of the nurse trees, you will virtually need to prune all the blackwoods if the blackwood stocking is less than 600 stems per hectare (to ensure you can have enough harvestable final pruned logs at the end of the rotation).
Table 1 - Typical silviculture regime of a pure blackwood stand

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Tree height: (m)</th>
<th>Stocking (stems/ha)</th>
<th>Pruning operation</th>
<th>Thin to: (stems/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>1111 (3x3m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>Form prune 75% of stems.</td>
<td>Remove malformed stems</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>600</td>
<td>Form prune</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>600</td>
<td>Form prune</td>
<td></td>
</tr>
<tr>
<td>5-6</td>
<td>6-7</td>
<td>600</td>
<td>Prune to 2.5 m (or up to half height-leave minimum 3m green crown)</td>
<td>600</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>400</td>
<td>Form prune</td>
<td></td>
</tr>
<tr>
<td>7-8</td>
<td>9</td>
<td>400</td>
<td>Prune to 4.0m (leave minimum 3m green crown)</td>
<td>400</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>250</td>
<td>Form prune</td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>11-12</td>
<td>250</td>
<td>Prune to 6.0m</td>
<td>250</td>
</tr>
</tbody>
</table>

Note: During normal clearwood pruning visit, remember to form prune off large branches above the pruned height, to at least the potential 6m trunk height, to keep uniform defect core for the whole pruned buttlogs.

Form and first lift (2.4m) pruning of blackwoods completed in Stream D in 2012, note the eucalypt in the foreground pruned to approximately 4.5m
Pruning techniques and tools
Just like the important stock maintenance, correct and effective tools and equipment are paramount to get the best outcome. Proper secateurs (able to cut branches more than 30mm in diameter) and prune loppers are ideal for form pruning. Pole pruners are extremely useful for the few metres above your reach. It is advisable to use a ladder to prune above 4 or 5m, because it is very difficult to keep still and prune flush with the branch collar.

It is important that branches are cut as close as possible to the branch collar. Avoid cutting the branch collar as the live cambium wound will take a longer time to heal, as well as the risk of fungal infection.

Thinning
Trees start to compete with each other when their crowns start to close up. For the nurse crop regime, the nurse trees may need to be removed at an earlier age and should be progressively thinned out in stages, to minimise excessive growth loss to the pruned blackwoods. The nurse trees should be considered expendable, and need to be thinned out and left on the ground, for nutrient recycling. An alternative to felling nurse trees (e.g. E. nitens) may be to inject the tree cambium layer with glyphosate to kill the trees standing. For small woodlots, commercial production for the final thin may be economical, but it is usually not economical due to the small logs and low volumes, which more than likely end up in negative stumpage to the growers. Also the likelihood of damage by machines and falling trees, will downgrade these premium pruned butts, which in most cases the monetary loss will outweigh any pulplog returns.

A 30 year old blackwood at Abbotsham, the largest tree in the trial at 57cm DBHob
Market Information – what is the return for your pruned logs?
Several Tasmanian processors and retailers have provided log price and timber sale information. The important message is that big pruned logs with high clearwood volume will fetch top dollars. The miller’s preferred target log size seems to point towards standing trees with 60cm diameter at breast height. All processors agreed well pruned planted blackwood logs are worth far higher premium prices due to much higher clearwood recovery.

Farm-gate log prices
Most log buyers, although currently getting only native forest or paddock grown logs, are offering $100-$150 per cubic meter for logs of 35cm diameter. Paddock trees with high figured featured grain quality are worth up to $500 to $1,000 per cubic metre.

Forestry Tasmania’s Island Specialty Timbers sells from their yard to millers and processors:

- Out-Spec knotty logs (for lining boards): $120/m³
- Utility Grade sawlog (inc.furniture grade, standard boards): $165/m³
- Cat 4 top grade: $220-300/m³
- Bird-eye quality: $300-500/m³
- Premium fiddle back (figured): $500-1,000/m³
- Green sawn timber (various dimensions): $1-3 000/m³ (top quality)
- Air-dried/ machined timber: $2-7 000/m³ (sold to tourists), up to $10 000 for figured quality

NB - one buyer believes top figured quality logs can be up to $2,000/m3.

Several craftsmen in the north buy their seasoned timber for $8 or $9 per super foot i.e. 1 inch thick and one square foot ($3 400 – 3 800/m³). Craftsmen in the south can pay a wood permit from Forestry Tasmania to collect odd ends from logging landings.

There are few processors who process and supply special fiddle-back and figured quality timber for musical instrument manufacturers interstate and overseas. This niche market is very lucrative and the market values this special quality timber/veneer can fetch several times more than the above mentioned general high quality furniture/dining table/kitchen bench prices.
The finished product, a guitar with blackwood back, sides and neck (left) and a laminated blackwood benchtop (right).

Further information:


Stop 4 - Plantations in Streamside Management Zones: Water Quality, Stream Flow

Philip Smethurst, CSIRO Ecosystem Sciences

Background

• Many water quality problems in the Australian landscape are related to livestock access to steams.
• It therefore makes sense to fence off these areas, but this is expensive, removes the area from agricultural production, and the area within these streamside management zones (SMZ) still needs managing, e.g. for weeds and vermin.
• One idea is to use this zone for forest plantations. Such use has many potential benefits, but there are also risks and most codes of practice for plantations discourage or prohibit this practice.

Aims of the Research

• Quantify the positive and negative effects on water quality of plantation establishment and harvesting in streamside management zones.
• Stream flow impacts

Research Strategy

Establishment Phase

• Near Cygnet, Tasmania
• Paired-catchment, before and after, control and intervention (BACI) experiment for water quality and stream flow
• Small catchments 4-10 ha, steep, mostly grazed pasture, with both catchments in the same paddock
• Monitoring commenced 2006, with planting in Sept 2008
• Water quality monitoring until 2010, and stream flow monitoring will continue until June 2012
• The plantation: *E. nitens*, *E. globulus*, and *Acacia melanoxylon*; initial severe browsing, but then rapid canopy development and height growth of the eucalypts.

Harvesting Phase

• Near Burnie
• 20-year-old commercial *E. nitens* plantation
• Stream reach design: control and harvested, before and after turbidity monitoring for two years
• Literature review

Results

*Water Quality*

Establishment Phase

• Phosphate concentration decrease
• *Escherichia coli* (E.coli) decrease
• Minor turbidity increase first major storm after cultivation – careful management required of cultivation (small spot mounds OK on steep erodible soils)
• Major turbidity decrease in wet winters during storm and grazing events
• No effects for other parameters – also important result – no detrimental SMZ effects

**Harvesting Phase**

• No harvesting concerns for turbidity if code followed
• Cattle access and road were the main sediment sources
• International experience of harvesting next top streams indicates it is not a concern if well-managed (major result for the 2011-12)

**Steam Flow**

• Up to 3 years of age: minor decrease in stream flow – only detectable during periods of very low flows

**Conclusions**

• Plantations should be considered as an option, or encouraged, if improved water quality is a major objective.
• Further data and modelling will refine implications for stream flows, but so far no effect on total flows.
• If maintenance of low-flows is a major concern, minimise SMZ width or don’t use forest plantations.

**Further Information**


Radio Interview, ABC Northern Tasmania, Rural Report 7th Nov. 2012: http://www.abc.net.au/rural/regions/content/201211/3627332.htm (starting at 7:10 minutes remaining point).
The CSIRO flume installed in the control stream (Stream B)

The CSIRO flume and monitoring equipment installed in Stream C
The CSIRO monitoring station
The Barn – Biodiverse plantings for carbon

Dr Neil Davidson, Greening Australia Tasmania
Private Forests Tasmania – Equipment for hire

Savannah mound plough
- Supplied on a self-contained trailer
- A large 4wd is necessary to tow the trailer
- Greater than 75hp tractor necessary to plough
  Minimum fee = $120
  $60 per hectare

Mound smudger
- Supplied on a self-contained trailer

Three point linkage winged ripper
- Supplied on a self-contained trailer

Quikspray unit with retractable hose
- Ute tray suitable for cartage
- Chemical certificate required by operator
  Minimum fee = $125
  $75 per day

Direct seeder and operator
  $30 per km
  $340 per kg

Cleaning fee
  $35

Travel
  75c per km

Private Timber Reserve Part B
  $110 per hour

General consultancy services
  $110 per hour

For other fees and services please contact Private Forests Tasmania: see over page
Contact Private Forests Tasmania
www.privateforests.tas.gov.au

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Email: admin@privateforests.tas.gov.au
The latest version of the Australia-wide tree growing software program, Farm Forestry Toolbox, is now available. Its key use is to assist farmers, forest managers and consultants to plan, make decisions and manage plantations, shelterbelts, agroforests and carbon.

The new 2012 version includes growth models for tropical forestry, a ‘break even’ calculator and a tool to estimate and model carbon management in plantations.

The Farm Forestry Toolbox is a collection of programs (tools) to assist forest owners and managers plan, monitor and manage shelterbelts, plantations or native forests. These tools are user-friendly and among other things help users with:

- surveying and mapping;
- forest inventory;
- estimating plantation growth for a wide range of species;
- managing plantations for different scenarios;
- financial analysis;
- diagnosis of forest pests and diseases; and
- carbon accounting.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversions</td>
<td>Convert common standard units of measurement including area, length, volume, weight and slope.</td>
</tr>
<tr>
<td>Log Stack Volume</td>
<td>Estimate volume and weight of logs.</td>
</tr>
<tr>
<td>Slope</td>
<td>Convert slope distance into horizontal and vertical components.</td>
</tr>
<tr>
<td>Survey</td>
<td>Map, plot and calculate areas, using either a compass or GPS traverse, or by directly digitising a map.</td>
</tr>
<tr>
<td>Stocking</td>
<td>Calculate the number of trees per hectare using the distance between trees and between rows.</td>
</tr>
<tr>
<td>Site Productivity</td>
<td>Estimate site quality and plantation growth over time.</td>
</tr>
<tr>
<td>Inven-tree</td>
<td>Find out the volume and value of products in a single tree, a plot of trees or your whole forest.</td>
</tr>
<tr>
<td>Stand Manager</td>
<td>Grow your forest and track income and expenditure. Calculate Net Present Value (NPV), Internal Rate of Return (IRR), and the break even value for items such as land, carbon or sawlog price. Test many different management scenarios and model wood products and carbon.</td>
</tr>
<tr>
<td>Health</td>
<td>Identify health problems in plantation-grown eucalypts, plantation pines and native forest.</td>
</tr>
</tbody>
</table>
More information and downloads

Information about the Toolbox and a download version of the new Farm Forestry Toolbox V5.2.11 is available from Private Forests Tasmania through its web page http://www.privateforests.tas.gov.au/products/farm_forestry_toolbox.

The download version contains a detailed user manual, worked examples and short video clips, to show how each tool is used.

Enquiries:
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Manager Services, Private Forests Tasmania,
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Phone 03 6336 5305

This project is supported by funding from the Australian Government through the Department of Agriculture, Fisheries and Forestry under its Forest Industries Climate Change Research Fund.
Blackwood Growth and Returns

A Blackwood plantation was planted at Abbotsham (South of Ulverstone) in 1982. This site has red brown Basalt soil, receives 1200mm annual rainfall and is 100-130m above sea level. Tree growth has been monitored since 1996.

When to harvest?
Here, tree growth trends estimate optimum harvest is when the trees are about 45 years old.
Let’s look at an average tree in this plantation. At harvest, its diameter, (DBHob) is 49.6 centimetres and its height is 24.8 metres. The merchantable wood volume is 1.7 cubic metres consisting of 1.0 cubic metre veneer log (SED 35 cm and 7.25m length) and two pulp logs. The following table describes one hectare of plantation at harvest age.

<table>
<thead>
<tr>
<th>Trees per hectare</th>
<th>Average tree volume (cubic metres)</th>
<th>Total merchantable volume (cu.m.)</th>
<th>Veneer/Cat 4 volume (cu.m.)</th>
<th>Utility/Out-spec volume(cu.m.)</th>
<th>Products / Log price</th>
</tr>
</thead>
<tbody>
<tr>
<td>233</td>
<td>1.7</td>
<td>396</td>
<td>233</td>
<td>163</td>
<td>$80-100/cu.m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$15-20/cu.m</td>
</tr>
</tbody>
</table>

Thus the estimated income for one hectare of this Blackwood plantation, when harvested at 45 years at 2012 on-farm log prices, is $21,100 to $26,600.

Tree Growth Trends
Estimated tree growth trends estimates derived using the Farm Forestry Toolbox are shown below. Forest science shows an optimum silvicultural time to harvest trees is when the mean annual increment (MAI) and period annual increment (PAI) are the same. Here this is at about 45 years.

Mean Annual Increment versus Periodic Annual Increment

Definitions
- **DBHob**: Diameter at Breast Height over bark. The tree diameter is measured at 1.3 metres above the ground.
- **MAI**: Mean Annual Increment. The average annual rate of growth over the long term (often the life of the forest), expressed as cubic metres per hectare.
- **PAI**: Periodic Annual Increment. The average annual rate of growth for a defined short period, such as two years, expressed as cubic metres per hectare.

Private Forests Tasmania November 2012
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal area</td>
<td>The cross-sectional area of a tree at breast height (1.3m), measured in m². Usually expressed per hectare (m²/ha) as the sum of the basal areas of all the trees.</td>
</tr>
<tr>
<td>Bark</td>
<td>The tissue covering the stems, branches and roots of a plant, extending from the cambium layer to the outer surface.</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>The variety of all plants, animals and micro-organisms, the genes they contain and the ecosystems of which they are a part.</td>
</tr>
<tr>
<td>Blackwood</td>
<td>A species of acacia or wattle (<em>Acacia melanoxylon</em>), that is widespread in eastern Australia, southern South Australia and Tasmania and produces a high-quality hardwood timber.</td>
</tr>
<tr>
<td>Blue gum</td>
<td>Generally refers to the forest tree, Tasmanian blue gum (<em>Eucalyptus globulus</em>), which is grown widely for wood and hardwood chip production.</td>
</tr>
<tr>
<td>Cambium</td>
<td>The layer of cells between the wood and the bark of a tree which divide and add growth to both the wood and the bark.</td>
</tr>
<tr>
<td>Canopy</td>
<td>The top part, or crown of a tree, consisting of branches and foliage (leaves/needles).</td>
</tr>
<tr>
<td>Catchment</td>
<td>An area of land drained by a major river and its tributaries.</td>
</tr>
<tr>
<td>Chipping</td>
<td>Debarked logs, often of lower quality, are chipped or flaked into small pieces for use in particle board, paper manufacture or fuel wood (also see woodchips).</td>
</tr>
<tr>
<td>Clear fell</td>
<td>The complete removal of a crop of trees from a site in a single operation.</td>
</tr>
<tr>
<td>Clearwood</td>
<td>Wood which is free of knots; also known as cleartimber.</td>
</tr>
<tr>
<td>Cloning</td>
<td>A process of producing plants, which all have the same genes as the original plant from which the clone was made.</td>
</tr>
<tr>
<td>Crown</td>
<td>The branches and foliage at the top of a tree (also see canopy).</td>
</tr>
<tr>
<td>Current annual increment</td>
<td>The current annual rate of growth, expressed as cubic metres per hectare (m³/ha).</td>
</tr>
<tr>
<td>(CAI)</td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Degradation</td>
<td>Any damage to the natural resources that living things need to survive.</td>
</tr>
<tr>
<td>Dieback</td>
<td>A term used to describe the gradual death of trees. Dieback can be caused by a complex interaction of factors including fungal infection, insect attack, waterlogging and soil salinity.</td>
</tr>
<tr>
<td>Ecological Sustainability</td>
<td>Allowing ecosystems to function healthily by balancing the needs of nature with the needs of humans and not using resources faster than they can be replaced.</td>
</tr>
<tr>
<td>Ecologically Sustainable Development</td>
<td>Ecologically Sustainable Development meets the needs of the present generation without compromising the needs of future generations.</td>
</tr>
<tr>
<td>Endemic</td>
<td>An endemic species is one that is confined to a specific country, region or location.</td>
</tr>
<tr>
<td>Eucalypt</td>
<td>Evergreen hardwood trees belonging to the genus Eucalyptus. The genus has about 700 species.</td>
</tr>
<tr>
<td>Exotic species</td>
<td>A plant or animal species introduced from another country.</td>
</tr>
<tr>
<td>Farm forestry</td>
<td>The integration of growing trees within an agricultural enterprise.</td>
</tr>
<tr>
<td>Felling</td>
<td>The cutting down or harvesting of trees.</td>
</tr>
<tr>
<td>Forest</td>
<td>An area of land covered by trees. Forests can be native or planted.</td>
</tr>
<tr>
<td>Forester</td>
<td>A person trained in forest management.</td>
</tr>
<tr>
<td>Forestry</td>
<td>The managing and protecting of forested land.</td>
</tr>
<tr>
<td>Growth rings</td>
<td>The rings formed in the trunk of a tree as wood of different densities is produced at different times during the growing season.</td>
</tr>
<tr>
<td>Habitat</td>
<td>The environment in which a plant or animal lives. Each living organism has its preferred habitat. Some organisms are much more sensitive than others to changes in the environment, and are therefore more vulnerable.</td>
</tr>
<tr>
<td>Hardwoods</td>
<td>Wood produced by species of trees that bear flowers and have broad leaves (also see softwood).</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Harvesting</td>
<td>The cutting down of a crop of forest trees for wood.</td>
</tr>
<tr>
<td>Heartwood</td>
<td>The central core of dark hard wood in tree trunks, consisting of old cells blocked with resins, tannins and oils.</td>
</tr>
<tr>
<td>Indigenous</td>
<td>A species which occurs naturally in an area and has not been introduced from elsewhere.</td>
</tr>
<tr>
<td>Kiln drying</td>
<td>Heat seasoning of timber to reduce the moisture in the wood and give it increased stability.</td>
</tr>
<tr>
<td>Mean annual increment (MAI)</td>
<td>The average annual rate of growth over the long term (often the life of the forest), expressed as cubic metres per hectare (m³/ha).</td>
</tr>
<tr>
<td>Mean diameter breast height (MDBH)</td>
<td>The mean diameter of the trees, measured at 1.3m above ground.</td>
</tr>
<tr>
<td>Mean dominant height (MDH)</td>
<td>The mean height of the 50 largest diameter trees per hectare.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>The routine counting, testing or measuring.</td>
</tr>
<tr>
<td>Multi-function forest</td>
<td>A forest area with a range of different uses, such as wood production, recreation, water catchment protection and conservation of native fauna and flora.</td>
</tr>
<tr>
<td>Mycorrhiza</td>
<td>An association between a fungus and the roots of a forest tree that usually benefits them both.</td>
</tr>
<tr>
<td>Native forest</td>
<td>Trees and vegetation that naturally grow in an area and are not introduced from elsewhere.</td>
</tr>
<tr>
<td>Natural regeneration</td>
<td>Regrowth of forest as seeds fall naturally onto the ground or shoots sprout from the roots and stumps of fallen trees.</td>
</tr>
<tr>
<td>Old-growth forest</td>
<td>A natural forest, many of the trees will be extremely old and/or large.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Open forests</td>
<td>Forests in which the leaves shade 30 to 70% of the forest floor. As well as trees, they have a lower layer of shrubs and a ground layer covered in grasses.</td>
</tr>
<tr>
<td>Parasite</td>
<td>An organism which lives on or in and obtains its food from other living organisms (also see saprophyte).</td>
</tr>
<tr>
<td>Peak mean annual increment</td>
<td>The maximum average annual rate of growth over the long term (often the life of the forest), expressed as cubic metres per hectare (m³/ha).</td>
</tr>
<tr>
<td>Pest</td>
<td>An animal or plant species that occurs where it is not wanted (also see weed).</td>
</tr>
<tr>
<td>Pesticide residue</td>
<td>Chemicals that remain in food, soil and water after weed killers and other sprays have been used.</td>
</tr>
<tr>
<td>Photosynthesis</td>
<td>The biochemical process by which green plants make food from carbon dioxide and water using light energy from the sun.</td>
</tr>
<tr>
<td>Pine</td>
<td>Pines are conifers and produce softwood. The main species is Radiata pine.</td>
</tr>
<tr>
<td>Plantation</td>
<td>Trees planted for the production of timber or other values.</td>
</tr>
<tr>
<td>Potable water</td>
<td>Water that is fit for drinking.</td>
</tr>
<tr>
<td>Preservation</td>
<td>Impregnating logs or sawn timber with chemical preservatives.</td>
</tr>
<tr>
<td>Pruning</td>
<td>Cutting branches from the trunk or crown of trees, often to promote the production of clearwood.</td>
</tr>
<tr>
<td>Pulp mill</td>
<td>Processing plant where debarked logs are mechanically or chemically reduced to paper pulp by separating the wood fibres.</td>
</tr>
<tr>
<td>Recharge area</td>
<td>The area within a catchment in which surface water (from rainfall, irrigation or streams) soaks into the soil and increases groundwater levels.</td>
</tr>
<tr>
<td>Recycling</td>
<td>Reusing materials that would otherwise be disposed of as waste.</td>
</tr>
<tr>
<td>Regeneration</td>
<td>Regrowth of plants and trees, either naturally or resulting from management practices such as sowing seeds or planting tubestock.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
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</tr>
<tr>
<td>Respiration</td>
<td>The process by which living organisms take in oxygen from the atmosphere and give out carbon dioxide.</td>
</tr>
<tr>
<td>Rotation length</td>
<td>The number of years between planting and harvesting a forest. The time varies with species, site conditions, objectives and growth rates.</td>
</tr>
<tr>
<td>Salinisation</td>
<td>The accumulation of salts in the soil, waterways or the water table to a level that causes damage to plants.</td>
</tr>
<tr>
<td>Saprophytes</td>
<td>Plants that live and feed on dead organic material (also see parasite).</td>
</tr>
<tr>
<td>Sapwood</td>
<td>The pale outer part of the wood of a tree which contains living cells.</td>
</tr>
<tr>
<td>Sclerophyll</td>
<td>Sclerophyll means 'hard-leaved' and refers to plant species that have developed drought-resistant leaves with thick cell walls and a heavy cuticle.</td>
</tr>
<tr>
<td>Seedling</td>
<td>A young plant grown from seed.</td>
</tr>
<tr>
<td>Silviculture</td>
<td>The study, cultivation and management of forest trees.</td>
</tr>
<tr>
<td>Slash</td>
<td>The leaves and branches left on the ground after harvesting operations.</td>
</tr>
<tr>
<td>Softwood</td>
<td>The wood of conifer species such as pines, firs and cedars.</td>
</tr>
<tr>
<td>Soil conservation</td>
<td>Prevention and control of soil erosion and degradation by careful land management.</td>
</tr>
<tr>
<td>Species</td>
<td>A population or group of individual plants or animals which are able to interbreed to produce fertile offspring and/or have common characteristics derived from a common gene pool.</td>
</tr>
<tr>
<td>Species diversity</td>
<td>The total number of different species and their relative abundance within a given area.</td>
</tr>
<tr>
<td>Stand</td>
<td>A crop of trees in a particular area, such as a forest.</td>
</tr>
<tr>
<td>Stomata</td>
<td>The pores on the surface of leaves that control the movement of gases into and out of plants.</td>
</tr>
<tr>
<td>Sustained yield</td>
<td>The quantity of wood that can be harvested per year over an indefinite period equal to the rate of growth.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
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<td>--------------</td>
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</tr>
<tr>
<td>Thinning</td>
<td>The removal of some trees (usually of poorer quality) from a forest to reduce the competition for available resources.</td>
</tr>
<tr>
<td>Timber</td>
<td>Wood after it has been processed.</td>
</tr>
<tr>
<td>Turbidity</td>
<td>Cloudiness caused by suspended solids or soil sediment in water.</td>
</tr>
<tr>
<td>Understorey</td>
<td>The small trees, shrubs, herbs and grasses that make up the lower layers of vegetation in a forest, woodland or other habitat.</td>
</tr>
<tr>
<td>Watercourse</td>
<td>A stream, river or canal along which water runoff flows towards the ocean.</td>
</tr>
<tr>
<td>Watertable</td>
<td>The level of the water-saturated underground areas below the surface of the soil.</td>
</tr>
<tr>
<td>Weed</td>
<td>A plant species growing where it is not wanted (also see pest).</td>
</tr>
<tr>
<td>Weed control</td>
<td>Reducing competition with forest trees for water and nutrients. This can be done by physical methods (such as cultivation) or by using chemicals called herbicides.</td>
</tr>
<tr>
<td>Wetland</td>
<td>Any area of land that is regularly or occasionally inundated by water, including swamps, billabongs, mudflats, salt marshes and lakes.</td>
</tr>
<tr>
<td>Woodchips</td>
<td>Chips produced from either soft or hardwood logs and turned into paper and other paper products (also see chipping).</td>
</tr>
<tr>
<td>Woodland</td>
<td>A native plant community dominated by relatively openly-spaced trees (covering up to 30% of the land surface), often with a dense understorey.</td>
</tr>
<tr>
<td>Woodlots</td>
<td>Forest plantings for wood production.</td>
</tr>
</tbody>
</table>

The best forests come out of the Toolbox

The latest version of the Australia-wide tree growing software, Farm Forestry Toolbox V5.2.11 is now available. It assists farmers, forest managers and consultants to plan, manage and make decisions about plantations, shelterbelts, agroforests and carbon.

The new 2012 version includes growth models for tropical forestry, a ‘break even’ calculator and a tool to estimate and model carbon management in plantations.

The various tools are user-friendly and among other things help users with:

- Surveying and mapping
- Forest inventory
- Estimating plantation growth for a wide range of species
- Managing plantations for different scenarios
- Financial analysis
- Diagnosis of forest pests and diseases
- Carbon accounting

Information about the Toolbox and a download version is available at: http://www.privateforests.tas.gov.au/products/farm_forestry_toolbox

The new version contains a detailed user manual, worked examples and tutorial video clips.

This project is supported by funding from the Australian Government through the Department of Agriculture, Fisheries and Forestry under its Forest Industries Climate Change Research Fund.

Tasmania
Private Forests Tasmania