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SUBTROPICAL
FARM FORESTRY
NEWSLETTER

ISSUE 51 July 2006

# OPEN DAY AT JAMES LANE: MIXED CABINET TIMBER AND RAINFOREST PLANTING AND PRUNING DEMONSTRATION

## AUGUST 26th 2006

*Alan on his property*

### Introduction

The SFFA invites members and others interested in growing native trees for cabinet timbers and/or for environmental restoration to visit 150 James Lane on **26 August between 10.00 am and 2.30 pm**. Diana and Alan Rowe have planted 25,000 trees over the past six years and this open day will provide an opportunity to look at progress to date and to learn from their experience. There will be guided walks around the plantings at 10.30 am and 1.30 pm and a pruning demonstration at 12 pm to show techniques for managing the growth of young cabinet timber plantations. In this article Diana and Alan reflect on their experiences. We hope that this may assist others with an interest in growing cabinet timbers.

### How To Get There

The property is located 12 km to the north west of Byron Bay. It is at the end of James Lane, which runs off Myocum Rd 5.8 kms from the Ewingsdale interchange on the Pacific Highway. There will be signs to the property from the corner of Myocum Rd and James Lane.

### Property Description

The property is 26.56 hectares (78 acres). It comprises a flat paddock of about 2 hectares in the northeast corner, most of which is enclosed and used for horses. The remainder of the property is mainly steep and comprises a series of ridges and gullies rising from 30 metres above sea level to 130 metres at the highest point. The soil varies widely from sedimentary loam in the swampy gullies to rich black and red soils and to dry rocky ridges. Springs are numerous, frequently half way down steep slopes. The property had been part of a larger cattle farm until the mid-nineties, after which it had degenerated rapidly, with extensive areas of noxious weeds, including Groundsel Bush, Lantana, Camphor Laurel and Crofton Weed.

### Rationale

When we purchased the property in November 2000, we had to choose between:

- Letting the property continue to deteriorate
- Agisting cattle, while attempting to address the noxious weed infestations

*(Continued on page 3)*

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Full sets are available for $55.00

**AIMS AND OBJECTIVES**

To foster and promote the commercially viable, socially and ecologically sustainable establishment and management of trees on private and public lands

To foster and promote all aspects of perennial tree crops through the establishment of special interests groups such as cabinet timbers, lobbying, plantation timbers, agroforestry, bush foods, polyculture and any other activity deemed of sufficient interest to members

To foster and facilitate co-operative marketing efforts and collective purchases of trees and materials for farm forestry purposes

To promote and engage in educational programs, relevant research and extension, and the flow of information to those planting trees on private land

In keeping with the above aims, to liaise with all other bodies, including community, government and industry.

# PRESIDENT'S REPORT

*Since we have been unable to produce the four Newsletters a year that members have been accustomed to in the past, the Newsletter committee has decided to produce a larger newsletter less often. We will attempt to provide members with nearly as much information as in the past at less cost in this way.*

*I urge members and others to consider becoming more active in the Association in whatever way they feel comfortable with. Letters to the editor describing your efforts in farm forestry is a good start. Please consider attending the AGM and dinner on the 30 August 6.30 p.m. at the Italo Club, Lismore. If you have friends and neighbours that may be interested in farm forestry please tell them about SFFA and refer them to our website at www.sffa.org.au to give them some idea of what it is that we do. Do not forget the field day at Alan and Diana Rowe's farm detailed in the lead article. They have done an absolutely wonderful job in the few years that they have owned their property.*

*We will be once again holding a Forest and Wood Expo at the Lismore Greenridge and Herb Festival on the 19th August. Please come and join us at this event. We will have renowned woodworkers and lots to do and see there. It should be bigger and better than last year's successful event.*

*We have just applied to do a project titled "Biodiversity Conservation in Productive Landscapes" with the Northern Rivers Catchment Management Authority. If our proposal is accepted then we will have some funds to help members and others undertake planning, planting and management for biodiversity values.*

*In the meantime keep enhancing and looking after your forests and enjoy yourselves.*

*Martin Novak*

## AGM

WEDNESDAY AUGUST 30TH 2006

*at*

ITALO CLUB LISMORE

Commencing 6.30 p.m. with dinner afterwards at 'Fire in the Belly' Restaurant, Lismore

- Growing native trees to help repair the environ mental damage and to develop a canopy to help with weed control

- **What we've achieved**

We decided to grow native trees, and to focus our efforts on growing cabinet timbers, in order to develop an eventual income stream and to get some tax relief from the quite heavy initial costs

- **Numbers planted**

Since May 2001 we have planted 25,000 native trees, of which around 14,000 have been cabinet timbers, with the remainder comprising a wide variety of rainforest species. In the first year we engaged an experienced local contractor to plant our seedlings and to design our layouts. Since then we have done all of the work ourselves: spraying, planting, slashing, fertilising and collecting and laying mulch

- **Our method of planting**

We have planted the cabinet timbers in the more accessible areas of the property. We measure a grid with spacings of 3 metres between rows across the slope and 2 metres down the rows. We then spot spray around the proposed planting spots about 6 weeks before our intended planting time and then we respray about one month later. We then plant after digging our holes with a mattock. We then lay mulch around the seedlings – we collect the mulch from slashing our own paddocks. In most of our cabinet timber plantings we can slash between the rows with our small tractor. In the remaining areas – mainly swampy gullies and steeper slopes – we have planted native rainforest species best suited to the conditions. We have planted these at spacings of about 1.5 metres by 1.5 metres. While this is very close, it enables a canopy to form earlier, which reduces the amount of spraying required. These rainforest plantings also include suitable cabinet timber species.

- **Species**

We have used 32 species in our cabinet timber plantings, most of which are indigenous to the area. However, most of our cabinet timbers are from 15 species. Over time we have gained a better understanding of which species are better suited to each site, depending on the moisture content of the soil and the exposure to wind. Our most successful species to date – in terms of growth and good form – have been Silky Oak, White Beech, Blue Quandong, Queensland Maple, Cudgerie, Yellowwood, Hoop Pine, White Booyong, Black Booyong and Black Bean. We have discontinued planting a few species because of poor form, high initial losses, damage from wallabies or very slow growth rates: these include Teak, Red Ash, Deep Yellowwood, Red Carabeen and Brush Ironbark (Acacia aulacocarpa). We have planted some 200 species of native trees in our rainforest plantings, ranging from melaleucas and other water-tolerant species in our swampy areas to dry tolerant species on the exposed slopes.

- **Maintenance**

Spraying with Glyphosate is necessary to prevent grasses and weeds from strangling the trees or competing for water and nutrients. In the early years we spray around the young trees about 4 times per year – gradually extending the radius of the area sprayed. Where we can slash between the rows we are able to reduce the frequency and volume of spraying. As the trees begin to form a canopy after about 4 years, we have progressively reduced our spraying to about twice a year.

- **Regeneration activities**

In addition to these plantings, we have continued to address to the problem of noxious weeds over the property as time permits, ie mainly outside the planting season. We have now eliminated most of the Groundsel Bush and Slash Pines and we have progressively poisoned some of the large Camphor Laurels. Our main challenge at present is with Yellow Guavas, which are widespread and are proving to be very difficult to kill.

- **Area**

In total, we estimate that we have now planted around 10 hectares.

- **Nursery**

In the first two years we purchased our seedlings from local nurseries. We received good advice as to which species to plant and where to begin planting.

Building on that experience, we decided to propagate our own seedlings. Since 2003 we have collected our own seed and raised all of our cabinet timber seedlings and most of our rainforest stock in our small nursery (in order to achieve greater diversity we swap some rainforest species with a local nursery). Growing our own stock has saved on costs, and has given us additional satisfaction, as we have developed skills in seed and tree identification, as well as in raising seedlings. It has also allowed us to experiment more in the species we have planted.

**Problems encountered**

- **Wallabies**

Wallabies have been our main problem. We have lost a lot of seedlings to grazing wallabies and had many more damaged by them. For the first two years we fenced all of our plantings with kangaroo mesh. This involved about 1.5 km of mesh and hundreds of star pickets. However, this method was quickly defeated by the wallabies, which simply pushed their way through the mesh even when we managed to close all of the gaps underneath the fences. Since then we have relied on plastic tree guards to protect young seedlings of the most regularly damaged species. However, plastic tree guards are not ideal, as the wallabies can still push these over to get at their preferred species or they can eat the tips as soon as these protrude from the guards. We have also found that seedlings tend to develop weak stems and fall over if they are left in the plastic guards for too long. Unfortunately, some species, such as Red Carabeen, Deep Yellowwood and Blue Quandong, are very sensitive to damage to their foliage when young and we have had limited success in raising them, even with plastic tree guards. We are now experimenting with more substantial wire guards, which can be left on the young trees for a longer time and which should enable us to grow species which are unsuited to plastic guards or which are most sensitive to wallaby damage. However, these guards are quite expensive at around $5 and we have already seen cases where these guards have been knocked over by wallabies.

- **Wind**

We have also found that some species are very sensitive to wind and tend to develop a hole around their base and then topple over, particularly if the soil remains wet for extended periods. As a result, we have had to do a lot of staking and a lot of refilling around the bases of trees. We now try to choose drier and more sheltered spots for these species: these include Cudgerie, Bennett's Ash, Tulipwood and Yellowwood.

- **Species unsuited to wet areas**

We are also learning which species are intolerant of areas which remain soggy for long periods and we are slowly finding a few species which will tolerate these conditions (to varying degrees). To date we have not planted any of the wet-tolerant eucalypts, but we suspect that we may have to in our most difficult areas. We are also learning which species will tolerate drier areas and which ones can be planted to fill gaps after a canopy has started to form. Fortunately we do not normally get frosts on our property.

- **Insects and Diseases**

We have experienced the same problems as many other growers with caterpillars defoliating White Cedars and Tip Moth ravaging Red Cedars. Together with one of our neighbours, we tried injecting Red Cedars with Confidor. Although this appeared to kill the grubs, this did not happen until after they had extensively damaged the tips of the young trees. We have also experienced extensive leaf damage and slowing of growth in some of our Rosewoods and White Beeches.

- **Assessment of our progress**

After six planting seasons and some five and one half years of intensive work, we can start to look at our progress as compared to our initial expectations. We were advised that the early years would involve a lot of work and we were prepared for that. However, the work has been harder and more extended than we had imagined. In the early years, the planting seasons were drier than average and this involved additional work in watering and even the use of water crystals. However, the two most recent planting seasons have been good and we are now seeing real progress in the growth of our cabinet timbers, with a good canopy beginning to form in many areas. Our rainforest plantings have been even more successful, except in those areas were we have suffered flood damage several times in the past eighteen months. We can look back and see the many things that we could have done better:

- we could have planted more appropriate species in several areas if we had known more about our property in different seasons and if we had known more about the characteristics of the different cabinet timber species
- we could have saved a lot of wallaby damage and a lot of replanting effort if we had used a smaller mesh in our wallaby fences
- we could have sited our nursery in a place which has better wet weather access, rather than locating it close to our dam

However, overall we have made a lot of progress and we are now beginning to enjoy the benefits of our work. Further, we are on the way to developing a viable cabinet timber plantation, with potential income benefits further down the track.

- **Environmental Impact**

On the downside, in a couple of small areas on steep slopes we have lost some topsoil after periods of heavy

*(Continued on page 5)*

rainfall and we experienced one small landslip. We have tried to counter this by planting Lomandra grasses (Lomandra longifolia and Lomandra hystrix) between the rows, by placing logs and prunings to impede the run-off and by less intensive spraying.

On the upside, we have seen and heard an increase in the number of bird species and, of course, we have seen a large increase in the number of wallabies. And we have replaced weeds and grasses with native trees over large areas of the property.

One potential longer-term benefit is that we have 3 close neighbours also planting cabinet timber trees and 2 others within a few hundreds metres, along with other neighbours who are regenerating parts of their land. This means that there is the potential in our part of the Myocum valley for quite an extensive corridor of native vegetation, with potential benefits for the spread of native vegetation and for bird and animal species.

**Where from here ?**

We have now substantially completed our cabinet timber plantings, as there are very few suitable planting areas left on the property. Most of the remaining areas are too steep, rocky, have poor access or are limited in size. We plan to continue with our rainforest plantings, but on a much smaller scale. We have a lot of regeneration still to do – particularly on the steeper and more difficult areas. And, of course, we will have a solid maintenance load: while the amount of spraying required should decrease as canopies form, we will need to turn our efforts to pruning and thinning. As part of our own learning experience we have arranged for a **pruning demonstration** during the open day. This will provide an opportunity for us, as well as our visitors, to learn more about the pruning of cabinet timbers and also to start considering thinning strategies to be used as the plantings mature.

**SFFA**

**AGM**

**WEDNESDAY AUGUST 30 2006**

at the Italo Club
commencing at 6.30 pm

With dinner afterwards at the
'Fire in the Belly Restaurant'

# GREENRIDGE HEALTH AND HERB FESTIVAL

*FAO publication extracts from Non-wood News April 2006 No. 13—copies available from NWFP home page at www.fao.org/forestry/site/6367/en*

This Festival is held in August each year in the northern New South Wales city of Lismore. The area is subtropical, with an annual rainfall of about 1400 mm and the volcanic soils are krasnozems. In pre-European times, the area supported the largest sub-tropical rainforest in Australia but most has been cleared for agricultural purposes. The Festival is a not-for-profit, signature event that showcases the use of herbs in complementary medicines and regional cuisine and promotes healthy lifestyles, a healthy natural environment and community participation. It provides a means to stimulate, network and learn new techniques and build expertise in the use of herbs and complementary medicine through a close link and involvement of the School of Natural and Complementary Medicine of the Southern Cross University. This year's Festival featured a herb garden area, a bush food cooking area, wood working demonstrations and quality cabinet work display, bush food farm tour and demonstrations on the use of herbs in natural medicine treatments.

Indigenous non-wood forest crops grown in this region to any extent are lemon myrtle (*Backhousia citriodora*), tea tree (*Melaleuca alternifolia*) and macadamia (*Macadamia integrifolia*). Lemon myrtle is in increasing use as a food additive and flavouring (in confectionery, teas, etc) and the citral-type oils are similar to those found in lemon grass. There is some evidence of insecticidal properties but there are indications of some skins being sensitive to its use. Tea tree is planted extensively on moister, lower-lying soil types and the trees harvested periodically and the oil extracted. The oils are used in creams and there are anti-fungal and anti-microbial properties. Plantations now are based on highly selected genotypes with very high yields of sought after oils. Macadamia is also planted extensively in this region mainly for the nuts for the food industry. However the oil is valuable and the chippings left from kernel extraction is used for production of macadamia oil used in cosmetics as well as in cooking. Work on these products as well as other potential products is being carried out by the Centre for Phytochemistry and Pharmacology at the Southern Cross University.

**FEES DUE**
**August 31st 2006**

# No wildlife amongst your trees?

## Perhaps you need some feral animal control measures.

Now that many of you have reasonably aged planted forests or better managed remnants or regrowth forests you expect to see much more wildlife. Unfortunately this is quite often not the case because of the impact of feral animals such as foxes, wild dogs and cats. So all that work that you have put into re-establishing forests aiming at wildlife values as well as production values has not yet met your expectations.

This is what the Whian Whian landcare members have noticed over the past few years and have decided to try to do something about.

*The Whian Whian Landcare group meet NPWS and RLPB officers to plan an attack on pest animals in the valley*

Nathan Kesteven organised a meeting to try and work out what could be done about to address the lack of wildlife and the increased number of feral animals in the valley. The meeting was held at Whian Whian Hall on the 15 July and experts from NPWS and Rural Lands Protection Board were invited to meet with the locals and work out what could be done to address this problem.

A number of Whian Whian landholders recounted sightings of foxes, wild dogs and cats on and around their properties. A number of their properties had active fox lairs and the landholders had noticed the dramatic disappearance of small mammals such as Bandicoots over the past 15 years.

Unfortunately, if we want wildlife, creating habitat by planting native forests is not enough, because of the high numbers of these feral animals. Neil Hing the Pest Animal Ranger from the Tweed Lismore Rural Lands Protection Board spoke to the group about what landholders need to know and what can be done. He suggested that it was important to get as many interested landholders together in the valley and he would help the group to develop a plan of control and eradication involving fumigation of lairs, baiting, and trapping.

*Elena Novak discovers an active fox lair on her property*

This would need to be carried out at least once a year and preferably more often. Landholders would need to help by mapping lairs and sightings. Neil, together with the landholders, would identify pest and wildlife animals generally by laying out sand beds. Then he would assess each property and determine the best way to commence the eradication.

Lisa Wellman, Pest Officer and Angela Seymour of NPWS reinforced what Neil had said and spoke to the group regarding NPWS strategies. They are working proactively with Park neighbours and have been trialing a number of strategies the results of which they will share once the data is properly analysed.

So if your wildlife population is low and you think it is the result of feral animals form a group of neighbours with adjoining properties and contact **Neil 6663 5250** or **0402 000 762** or **Lisa 6627 0200** for help and advice.

*Extracted from Growing rainforest timber trees: a farm forestry manual for north Queensland Bristow, M., Annandale, M and Bragg, A. 2005. Rural Industries Research and Development Corporation, RIRDC Publication No. 03/010, Canberra.*

*The introduction is available free and the full manual for purchase at the RIRDC website www.rirdc.gov.au/reports/AFT/03-010.pdf*

# Tree pruning for high quality rainforest timbers

Few trees in the natural forest are free of defects. Trees are generally crooked or have suffered from fungal and insect infestations, resulting in a significant loss of timber production and quality. The three most important factors that determine timber quantity and quality, and hence value, are the straightness and length of a single trunk and the amount of knot and defect free timber that the trunk can produce. An intensively managed plantation can significantly reduce this loss. Part of this good management is pruning.

Primary reason for pruning is to improve wood quality and quantity. Other reasons for pruning include:

- improving aesthetics
- improving access
- increasing light and air circulation into dense stands
- decreasing fire hazard
- stand certification

**The tree defence system**

Every injury and infection that a tree receives will be in the tree for the rest of its life. Trees cannot heal themselves, but instead put up barriers to contain infections and to stop further spread to other healthy parts of the tree.

After pruning, a process of permanent protection begins, a process that ultimately prevents the entry of fungi, bacteria, insects, etc, through the pruning scar. To seal off the pruning scar the tree produces cells called callus, which unite and form woundwood. The woundwood expands as ribs or rolls about the wound to ultimately seal and protect it. If branches are cut properly, a ring, or doughnut is formed completely around the wound (Fig 14).

Inside the tree at the base of the pruned branch, protection zones are formed to stop disease and organisms entering from the branch into the trunk. Once the woundwood has sealed the pruning scar and the protection zones within are formed, any existing or potential infection is completely sealed off.

Some trees, for example pines, provide natural protection to wounds by means of resin flow over the wound, although this is only temporary protection until the woundwood has sealed the injury. This natural protection has prompted the use of artificial wound dressings on pruning scars. Their use, however, is disputed and they may in fact encourage fungal infection by providing a favourable environment under the dressing or by preventing cut surfaces from sealing as quickly as they do under natural conditions.

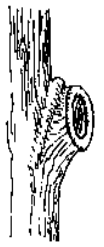


*Figure 14. The "doughnut ring" is an indication of wound healing over proper pruning (from, Bragg, A. unpublished report "Pruning for Quality Wood Production". Queensland DNR/ CRRP*

**Types of pruning**

Three types of pruning are discussed below: form, pre-emptive, and clearwood. All forms of pruning have a common aim, to produce the maximum amount of "clearwood" timber so as to increase the value of the final product.

Most pruning systems on a stand of trees consist of a number of form and pre-emptive pruning activities, followed by pruning for clearwood production (in multiple lifts) to produce a predetermined log length which is clear of branches, referred to as bole length.

**Form pruning**

The purpose of form pruning is to create good stem form and is simply the removal of any leader or branch that may inhibit the formation and growth of a single healthy stem. Form pruning is practised early in the life of the tree, ideally starting in the nursery, and is mostly concentrated in the first and second years after planting. Correcting defects early in the life of the trees is paramount to developing stronger, healthier trees. The process of form pruning is simple and requires only a little time to be spent on each tree.

Form pruning involves:

- The removal of multi-stems and multi-leaders. The aim is to create a single straight trunk.
- The removal of steeply angled branches. Such branches can break out in windy conditions thereby causing considerable damage to the main stem and this may allow the entry of pests and diseases. Branches that are less than 30° to the main stem usually have a weak attachment and can also compete with the main leader of the tree.

*(Continued on page 8)*

- The removal of damaged or diseased branches.
- The removal of crossing branches to avoid rubbing and breaking.

Remove only these branches in form pruning and do not remove more than 50% of the green crown in any one pruning operation. Occasionally, when less than desirable trees have to be selected for pruning to increase the proportion of trees for the final stand, pre-emptive pruning may remove in excess of 50% of the green crown. This may temporarily affect the growth rate of the tree.

Tools for form pruning include bypass type pruning shears and manual loppers for the larger branches. Safety in pruning is important. Wearing boots, safety glasses, safety helmets, and harnesses for off-ground work are necessary.

**Bud pruning**

The removal of branch buds from the axis of the leaf and main stem of some rainforest trees, notably *Flindersia* species, has proven to be a successful method in preventing branch development and subsequent pruning. Buds are simply pinched out (with fingers), broken or cut out of the axis before they develop hard, woody tissue. This is a cost saving procedure, as branches do not regrow at these points, reducing the need for later, more intensive pruning. Bud pruning is a useful technique in young stands of rainforest species that can develop heavy early branching when growing in exposed (high light) situations. It can also encourage apical dominance or height development (Fig 15).

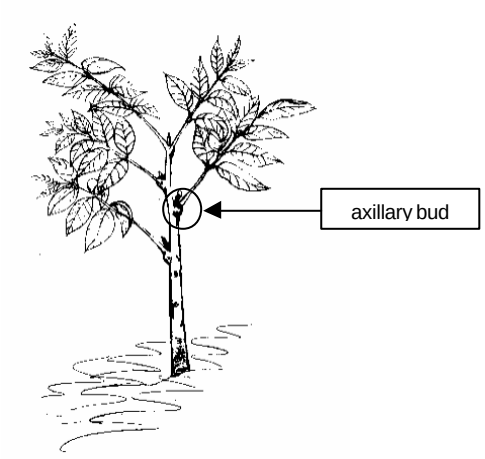



*Figure 15 Bud pruning. Early removal of the bud between the axis of leaf and stem can save intensive pruning activities later in the rotation (from, Bragg, A. unpublished report "Pruning for Quality Wood Production". Queensland DNR/CRRP)*

**Clearwood pruning**

One of the primary reasons for downgrade of timber value is the defect caused by knots or branch stubs. Knots interfere with the grain of the timber and reduce its strength and appearance qualities (Abel *et al.* 1997, Reid and Stephen 2001). Knot and defect free timber is called clearwood, and is commonly valued for appearance uses including furniture, flooring and joinery work (Reid and Stephen 2001). Clearwood production is the timely operation of pruning to a specified height on the bole of the tree. This process is generally done in stages, or lifts, over a period of years to realise a product that is knot free. After pruning, the wood subsequently produced outside the knotty core of the tree will be clearwood (Fig 16).

The knotty core is made up of the diameter measured over the pruned stubs plus the diameter involved in the healing over of the stubs. If, for example, the objective was to restrict the size of the knotty core to less than 13 cms diameter, and if the callus growing over the pruning stubs takes about 3 cms in diameter to seal it, then pruning would need to take place when the diameter was 10 cms or less. Figure 16 demonstrates the effect of pruning to achieve clearwood production and the importance of early pruning to minimise the size of the knotty core.

**When to prune**

Pruning is best timed to remove small living branches so that wound closure can be rapid. Pruning live branches when the tree is young also accelerates the transition from juvenile wood to mature wood below the live crown. If pruning lags behind the rise in green crown, as the stand of trees grow, it will result in the development of dead branches. When these are removed a proportion of the core can contain branch stubs, bark, and resin pockets, which cause substantial timber downgrade (Fig 16). Regular pruning can avoid this. Large limbs usually indicate that pruning has been delayed.

The risk of decay establishing after pruning increases with increasing branch diameter. As a guide, remove branches before they reach 3 cm in diameter. Once branch size exceeds 4 cm in diameter, consideration should be given to the need to prune, as there is a large risk of decay developing in branches beyond this size.

A light form pruning and the pruning of dead branches can be done throughout the year. Heavier pruning

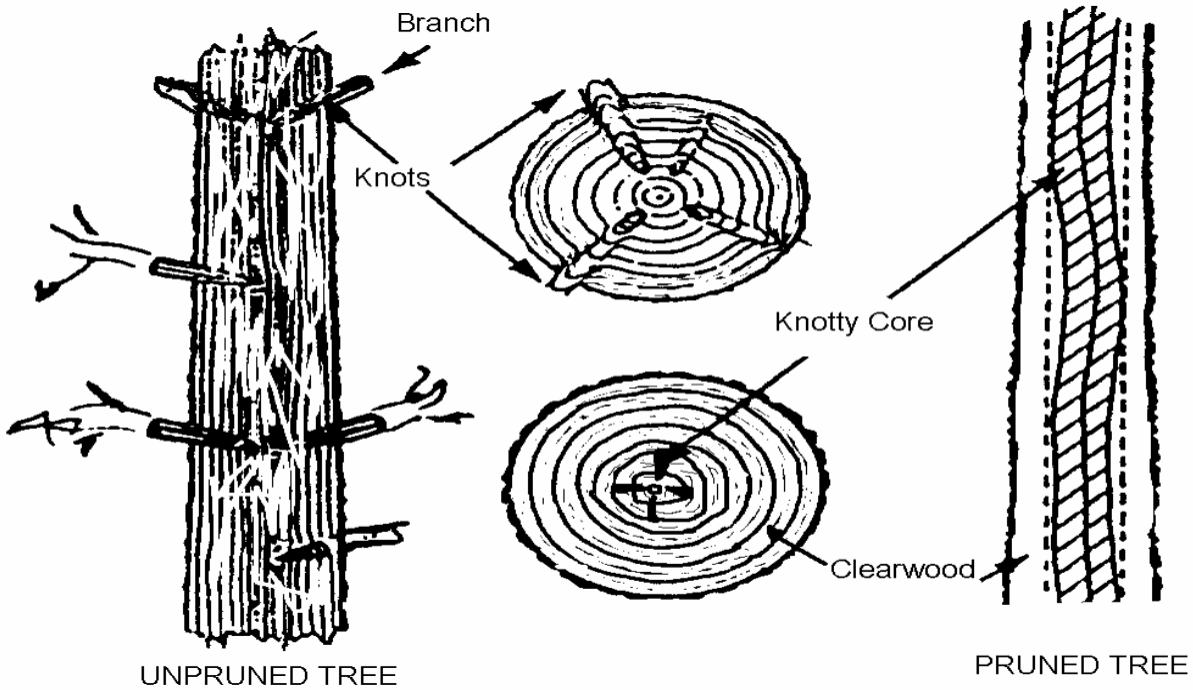



*Figure 16. Cross and longitudinal sections showing the effects of pruning and not pruning (from, "Pruning for Wood Production" Tree Facts No. T18: Department of Natural Resources).*

**Knowing the basics: how to cut the branch**

As a general guide, each branch should be pruned such that the cut is approximately at right angles to the branch and close to, but not into, the branch collar (Reid and Stephens 2001) (Fig 17). Branch collars are the rings of wood about the bases of branches where the bark and wood of the branch and trunk come together and overlap. They form a shoulder or bulge at the base of the branch. All woody plants have branch collars; in some trees these can be quite large, in others quite small and inconspicuous. Proper pruning cuts are based on the branch collar and care must be taken not to injure or remove the collar when pruning.

Cuts through the branch collar injure stem tissue and can result in decay. In most tree species, cutting flush with the main stem can injure stem tissue, delay or prevent woundwood formation, and provide entry to pests and diseases. Leaving branch stubs (sometimes called coat hangers) will also cause pest and disease problems in most species. An exception to this rule is Queensland kauri pine (*Agathis robusta*), whereby if live branches are cut, branch stubs are ejected; allowing for cuts to be made further back along the branch.

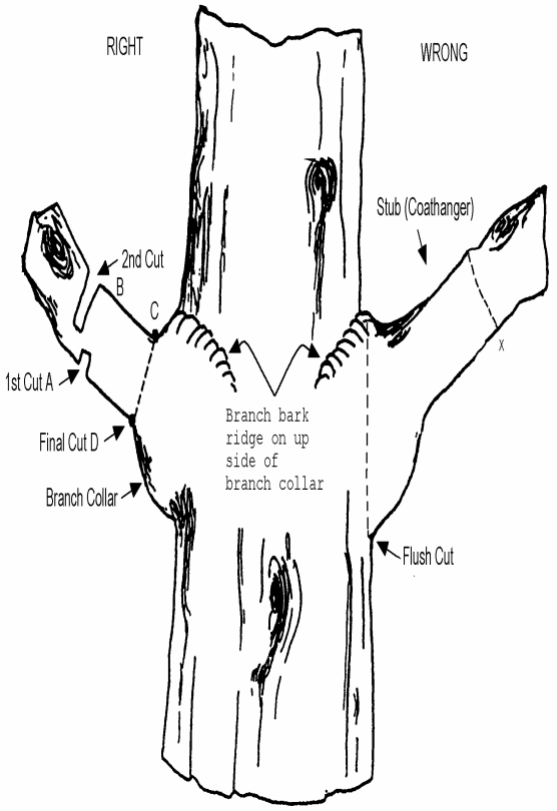



*Figure 17. Pruning cut: care should be taken to avoid injuring the branch collar (reproduced from Treeby, B. (1994). "Farm Forestry. The Open Polytechnic of New Zealand, NZ.)*

*(Continued on page 10)*

**Pruning steps**

**Step 1** Stub cut the large branch (up cut A, down cut B). B is located about half the branch thickness from A.

**Step 2** Locate points C and D where the branch meets the branch collar. Cut from C to D with care and as close as possible to the branch collar. The cut angle will depend on the species and size of the branch. For most species the cut should be approximately right angles to the main stem. Do not cut or injure the branch collar.

Small branches can be removed with one cut. Large branches need to be undercut before the final cut is made. Once the weight of the branch has been removed the remaining stub can be safely cut off without damaging the tree.

The branch bark ridge is the raised bark that forms within the branch crotch. It indicates the angle of the branch core in the tree. It can be a useful guide in determining the angle of cut for branch removal. Do not prune behind the branch bark ridge.

Pruning co-dominant stems can be the most difficult of the pruning operations as it frequently requires the stem to be cut from below because there is insufficient room to operate a saw from above.

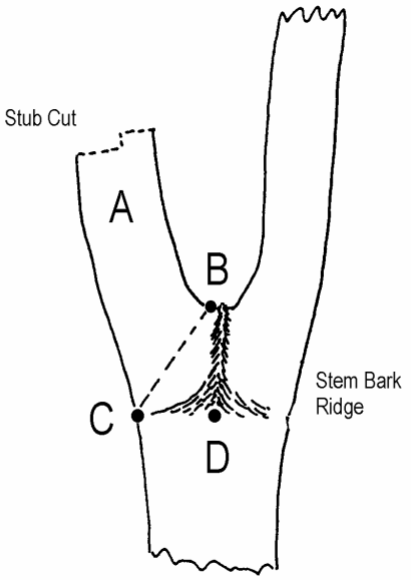



*Figure 18. Pruning co-dominant stems (from, "Pruning for Wood Production" Tree Facts T18: Tree Management Series, Queensland Department of Natural Resources)*

Stem A has been selected for removal.

?? To remove stem A cut from B to C or from C to B with care. B is located just to the left of the stem bark ridge.

?? Always stub-cut the stem to be removed and then make the final cut.

?? Points C and D are approximately opposite. This can be a useful guide for the cutting angle if you cannot determine the position of C.

**How many trees to prune and to what height**

While it will be necessary to form prune many trees in the initial planting, it will only be necessary to clear-wood prune a select number of trees for a final crop. As all trees do not grow at the same rate, it is necessary to take into account the height of each individual tree. This is known as variable height pruning, where each tree is treated individually with regard to its pruning requirements.

Pruning should be done to a height required to produce a high value log (Reid and Stephen 2001). A common recommendation with rainforest timbers is to prune the final target trees to 6 m bole height. Some veneer mills only require a 2.5 or 3 m log, whereas many sawmills prefer log lengths of 5 m to 6 m. Without knowing the final market of the growing stand, it has been suggested that taking into account a stump of about 0.5 m, pruning to 6.5 or 7 m would allow for two veneer logs or one long sawlog (Reid and Stephen 2001).

Recommendations for pruning for quality timber:

- **Bud prune** - from 6 months to age 3 year as required
- **Pre-emptive prune - at age 1 year, or when trees reach 2m in height**
- **Select** and mark trees for retention and therefore long-term pruning
- **Clearwood prune** - at age 2 years and onwards, or once trees reach 6m in height, at periodic intervals

**References**

Abel, N., J. Baxter, A. Campbell, H. Cleugh, J. Fargher, R. Lambeck, R. Prinsley, M. Prosser, R. Reid, G. Revell, C. Schmidt, R. Stirzaker and P. Thorburn 1997. Design Principles for Farm Forestry: A Guide to Assist Farmers to Decide Where to Plant Trees and Farm Plantations on Farms. Rural Industries Research and Development Corporation, Canberra. 102 p

Reid, R. and P. Stephen 2001. The Farmer's Forest - Multipurpose Forestry for Australian Farmers. Rural Industries Research and Development Corporation, Canberra. 167 p.

# Jeff Kelly, Mila Bristow, Alan Rowe and ecophysiology of some Australian subtropical rainforest tree species

**J. Doland Nichols**

Last year Jeff Kelly visited SCU to collect data for his Master's degree at the University of Florida. His supervisor is Associate Professor Shibu Jose, a forest scientist with broad interests in ecology and agroforestry. Shibu has visited our area on several occasions, including August 2005 when he attended our meeting on mixed-species plantations in Ballina and gave a talk on belowground interactions in mixed plantings.

Jeff brought with him one of the most important tools – if they can afford one – used by ecophysiologists, an IRGA, an infrared gas analyzer. This machine, which we found is not especially easy to get through Customs in Brisbane Airport, can measure actual $CO_2$ being fixed through the process of photosynthesis at given light levels. Newer models like Jeff's make it possible artificially to control the light level, so one can measure photosynthesis at varying levels up to maximum irradiation. It's not an easy machine to keep up and running. For this we had the kind assistance of Mila Bristow, an SCU postgraduate who lives in far north Queensland and came down to help Jeff with his IRGA work.

A key question concerns which species continue to fix more and more carbon as light intensity increases and what species reach a lower level of fixation at moderate light intensities. Generally, we expect "pioneer" or sun-preferring rainforest species to tolerate some shade but to fix more carbon and grow more as light levels increase. We also expect those species to be more flexible – "plastic" – in their response, than the "climax" species which are more shade tolerant and whose photosynthesis tends to flatten out at lower light levels. These were the kinds of questions Jeff wanted to answer.

Surprisingly, we found that photosynthetic response curves and relative growth rates – how much weight a plant puts on in relation to its current weight – have not been recorded for most Australian rainforest species. Jeff did two sets of studies: one in the shadehouse at SCU and another at Alan Rowe's farm near Byron Bay.

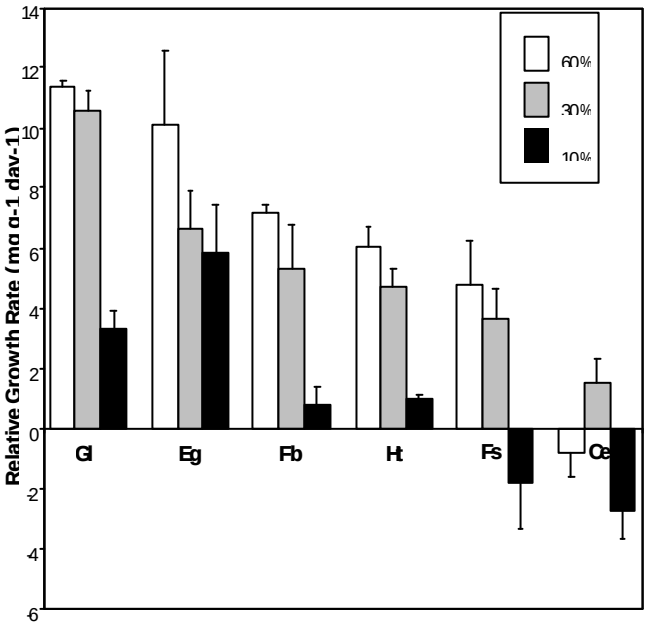
Shadehouse studies

We purchased, at great expense (cost being a familiar problem to rainforest tree planters) seedlings of six species for the shadehouse trials. They were (with two-letter codes):

*Cryptocarya erythroxylon CE*
*Elaeocarpus grandis EG*
*Flindersia brayleyana FB*
*Flindersia schottiana FS*
*Gmelina leichhardtii GL*
*Heritiera trifoliolatum HT*

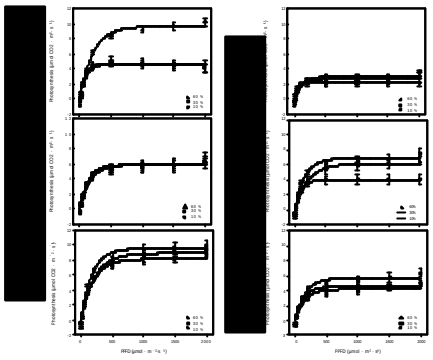
Jeff grew these seedlings at light levels of 10%, 30%, and 60% of full sunlight and then recorded their Relative Growth Rates. Most of the species grew fairly well at 30% full irradiance. Not surprisingly *Elaeocarpus grandis* grew best at 60% sunlight and may grow better at higher light levels. It was also the most plastic of the species, growing fairly well even at 10% light. The least plastic species was *Cryptocarya erythroxylon*, a more mature stage species, which actually lost biomass at 10% and 60% and only put on positive growth at the 30% of full sunlight treatment.

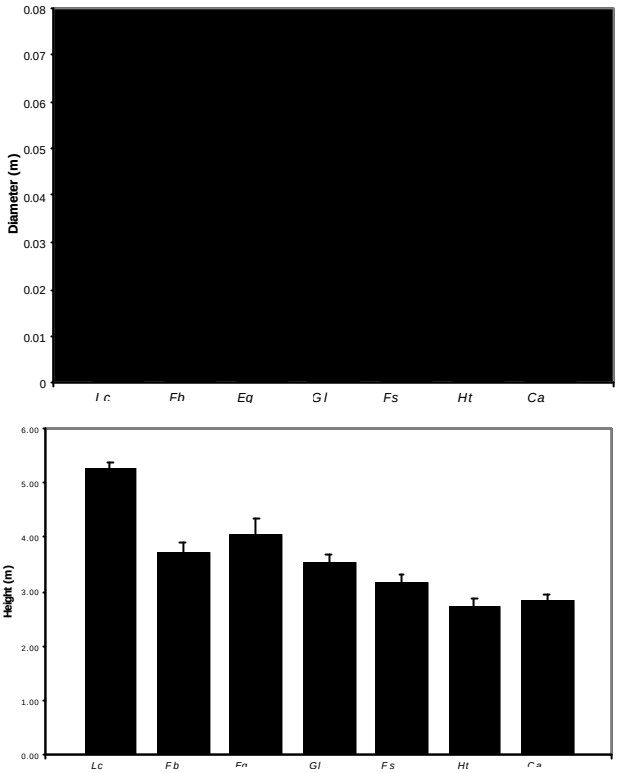
In photosynthetic responses, early secondary species (*E. grandis & F. brayleyana*) achieved peak photosynthesis in 60% full sunlight. *E. grandis* displayed light-demanding physiology and also an ability to down regulate photosynthesis in lower light conditions.




*Relative growth rate (mean (SE)) of seedlings of six Australian subtropical rainforest trees, grown at 60%, 30%, and 10% of full sunlight.*

## Light Response Curves






*Diameter growth (m) (top) and height growth (m) (bottom) (mean (+/- SE)) of seedlings of seven Australian subtropical rainforest trees at 3 years of age.*

Experiment Two: Alan Rowe planting.

Jeff also worked at a "real-world" plantation at Alan Rowe's farm near Byron Bay. Here he measured the growth of a 3-year old stand of rainforest trees in a mixed planting. He also used the IRGA to record rates of photosynthesis. The species in the stand were:

*Castanospermum australe* Ca
*Elaeocarpus grandis* Eg
*Flindersia brayleyana* Fb
*Flindersia schottiana* Fs
*Gmelina leichhardtii* Gl
*Heritiera trifoliolatum* Ht
*Lophostemon confertus* Lc

Jeff's results would not be surprising to most of us. Brushbox seemed to do the best, having characteristics intermediate between those of a rainforest tree and a moisture and sun-preferring eucalypt species like flooded gum or Sydney blue gum. As we can see from height and diameter data, *Lophostemon confertus*, *Elaeocarpus grandis* and *Flindersia brayleyana* grew faster and the other three species were somewhat slower.

Value of research for management?
So we have used a very expensive and sophisticated tool to measure response to different light levels in several subtropical rainforest species. And? These results support the often-made statement that rainforest tree species exist along a continuum of responses to increasing light. The shadehouse seedlings were not tested at 100% full irradiance - perhaps *Elaeocarpus grandis* would have grown better at full light than

at 60%. We also don't know how seedlings of these species would survive and grow at 2-5% of full irradiance – the level found on the floor of mature rainforest.

We can say that these results confirm that most rainforest species do their best growth at moderate levels of light – not at the highest levels that are found in open field situations. All other things being equal – which of course they usually are not – 30-60% of full sunlight would be best. Open paddocks often present other problems – heavy competition from pasture grasses for nutrients and water, exposure to wind and fire, and to browsing mammals. One implication of this research is that perhaps rainforest plantings should take place not all at once, but over a few years' time, with high-sunlight preferring species being planted first and then other "mature phase" species being planted in their shade.


**Jeff Kelly's thesis is 82 pages long. I can share more details – the actual thesis and a PowerPoint slide show Jeff gave with his Master's defense - with anyone who is interested.**

# High-Density Eucalyptus Plantations – Good for Wood, Good for Biomass

**Felicity Harris**
**PhD Candidate, Southern Cross University**

The vast majority of eucalyptus plantations in Australia are fast-growing, higher-density plantations that are managed for pulpwood production (Turner *et al.* 2004), however pressure has been building to increase plantation production of solid hardwood products. Current eucalyptus pulpwood plantations have the potential to produce solid hardwood, and high-density eucalyptus plantations could prove attractive to private investors by providing an early return cash crop in biomass (bio-energy) on top of the normal solid hardwood product. These options are often discounted, however, as high-density plantations are considered unlikely to produce quality solid hardwood (Turner *et al.* 2004) with wood properties including high wood density for strength and durability, low variability to prevent warping of sawn wood, and low knot content. In this study, the accuracy of the above perception has been investigated by examining the effect of planting density on stand, tree and wood structure, particularly of the largest trees representing the likeliest source of solid hardwood products.

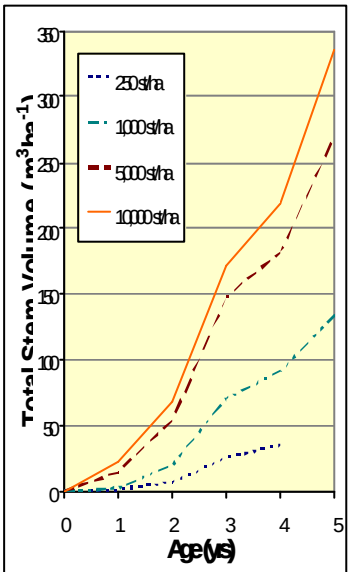


Figure 1: Stand Productivity

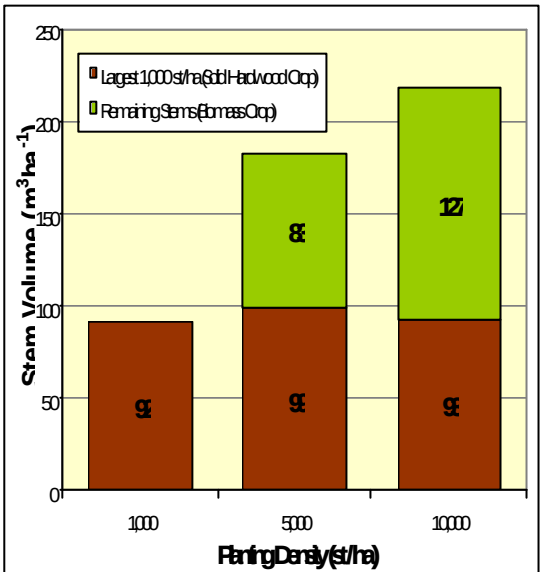


Figure 2: Stem volume of solid hardwood and biomass crops at 4 yrs

The study was based on a 4-year-old *Eucalyptus grandis* trial planted in south-eastern Queensland in March 1999 by Greenfield Resource Options P/L. Planting densities of 250 st/ha, 1,000 st/ha, 5,000 st/ha and 10,000 st/ha allowed a comparison from very low density in 250 st/ha to very high density in 10,000 st/ha. The spacing trial was located on a river-flat consisting of very deep, highly fertile loam soils to stimulate the fastest possible growth. The long term mean annual rainfall of the site is 1050 mm, however since establishment annual rainfall generally fell below the long term mean and in 2003 only 600 mm annual rainfall fell.

The study found that total productivity increased with planting density, as trees in the high planting densities (5,000-10,000 st/ha) accumulated more total stem volume than in the low planting densities (250-1,000 st/ha) (Figure 1). The largest stems in high planting densities were smaller than those in low planting densities, but high planting densities had more of them and they were more uniform in size. In consequence, the stem volume of the largest 1,000 st/ha (solid hardwood crop) was similar for all planting densities, and the stem volume of the remaining stems (biomass crop) increased with planting density (Figure 2).

The use of high planting density to provide a biomass crop is worth pursuing only if not detrimental to the solid hardwood crop. Examination of the wood structure of the stems revealed that the largest 1,000 trees in high planting densities exhibited better wood properties with consistent wood density, less variability in wood properties, and better branch-shed (hence low knot content) than the largest trees in the low planting densities. This suggests that high-density plantations could be of better value for timber production than low-density plantations, especially if the biomass crop revenue offset extra planting costs and increased value from improved wood quality outweighed decreased value from lost growth.

The above findings are based on a young plantation, however they indicate that a high-density plantation could be used to provide an early cash return biomass crop with, on balance, no detrimental effect on a retained solid hardwood crop of the largest 1,000 st/ha. The perception that high-density plantations do not produce quality solid hardwood is therefore inaccurate, however substantial further research is required before a high-density plantation could be grown commercially.

**Reference**

*Turner, J., Wareing, K., Flinn, D. and Lambert, M. (2004). Forestry in the agricultural landscape: a review of the science of plantation forestry in Victoria. Melbourne, The State of Victoria, Department of Primary Industries. 53pp.*

# The Sale of Barry Walker's Property at Nimbin

The SFFA is very concerned that the values of this property are conserved.

Many of you may recall Barry Walker's passing in 2003. We wrote about him in one of that year's Newsletters.

Barry was one of a rare breed of Timber Millers that loved forests and plants for their own sake not just for their timber value. He was planting trees in the 1950's up on Mount Nardi and the Night Cap Range.

The SFFA committee was given a tour by Barbara Riordon, his daughter, to evaluate how best to preserve the property for its social, environmental and educational values.

Sandra, Barbara (Daughters) Bruce Hungerford (Dipnr) and Envite have been maintaining the property since Barry's death.

The Arboretum dates back to 1976 and now includes over 800 native species from this region with an additional selection of notable species from Queensland and Victoria.

There are 2 healthy specimens of Elaeocarpus minyon, which Barry managed to germinate after quite some effort. He worked with Robert Kooyman in finding and identifying these incredibly rare local species.

**Enjoying Barry's legacy Barbara and grandson, young and old Kestevens, John Grant, Alex Heathwood and Alan Rowe**

As well as a number of other rare and endangered species including Notelaea llodydii. Bruce Hungerford purchased 2 Woolimii Pines last year which have been added to the arboretum.

Barry was born in Nimbin in the1920's. The Butcher

*(Continued on page 15)*

shop that his father owned is still going well.

SFFA is keen to help Barry's family and friends to ensure that the Arboretum is valued and used to its full potential and that Barry's legacy lives and grows on. If any of you can help with ideas of how this can be achieved please get in contact with Martin Novak on 02 66895027

**A 7 year old Elaeocarpus minyon fruiting thanks to Barry's germination technique.**

**Below is a comprehensive description of the property prepared by Rob Kooyman.**

Rob, Barry and Barbara have also prepared a number of data bases of all the over 1200 specimens on the property.

**Barry Walker Property, Nimbin Arboretum**
**Location:**

Lot 17, High Street,
Nimbin, NSW

**Topography:**

The property is dominated by a broad ridge running south-east to north-west, and has mostly gentle to moderate slopes that become steeper in the west and south above the small creek flats and flood benches.

**Soils:**

Soils are clay loams derived from deeply weathered meta-sediment parent materials.

**Native Vegetation and Ecosystem Types**:

The native vegetation on the property is dominated by mixed dry hardwood forest on the ridge and upper slopes, and moist hardwood forest types on the mid to lower slopes. Brush Box dominates the lower slope transitions with the 'gully' rainforest.

**Vegetation (general)**

Species lists detailing the floristics of both the planted (arboretum) and native vegetation components of the vegetation have been compiled and are stored digitally as spreadsheets (in Excel). Fields include species name with botanical authority, family name, life-form category, and general location (Kooyman and Walker, 2003). Over 800 significant vascular plant species from 138 families were recorded on the property, while herbs and other plants (including introduced species) increased overall plant diversity to well over 900 species. Virtually all of the rainforest species of New South Wales are represented in this unique arboretum collection. All species in the arboretum plantings are represented by at least two planted specimens, and one individual of each species is labelled with a metal name plate (botanical name) fixed to a large wooden post.

Arboretum planting: description and significance. The rainforest arboretum plantings occupy the western and northern areas closer to the creeks, but extend to the lower and mid slopes in several areas. Walking trails traverse the whole of the arboretum planting area and provide ready access to all the specimens in the rainforest collection. As far as I am aware this is the only (virtually) complete collection of the rainforest flora of NSW, and is certainly the only such collection fully labelled and with replicate plantings. As such it represents a unique (and professional) botanical planting in close proximity to the Nimbin village centre, with enormous potential in terms of educational, economic, and social values.

Prepared by:

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# WHY PEOPLE PLANT TREES

by Dr Nigel Strauss

Fellow of the Royal Australian and New Zealand College of Psychiatrists and tree grower on his property in the Otway Ranges

As our community becomes wealthier, and the discipline of psychology more sophisticated, researchers are turning increasingly to the study of happiness and well-being. More and more studies are showing that happiness is far less dependent upon hedonistic pleasures than it is on the pursuit of meaning, and intense involvement in regular engaging activities.

The concept of "The Well Being" involves a number of separate factors, all of which contribute to the happiness of people. What are these factors? Studies have shown that the most important factors include sound personal relationships, occupation which allows for a decent level of autonomy, physical health, a healthy environment, a moral life, a sense of something greater than self, and self-awareness.

If we look at these factors and ask ourselves why people want to plant trees apart from any mercenary reasons, we are led to the conclusion that there must be something in the desire to plant trees and to watch them grow that is very attractive to the human mind. Of course, there are the aesthetic benefits. Trees both individual and grouped, can be beautiful and putting together a treed landscape can be a very rewarding activity. But my guess is that there is a lot more to it than that. If we look at the factors that encourage happiness, the concept of a healthy environment and a sense of something greater than self need to be looked at in more detail.

I believe that mental and spiritual health are intimately related to what nature can provide us and what we as humans can provide it. Here, I think is one clue to the idea of personal happiness and regeneration and how one source of it can be provided by nature. If we look after nature, it will look after us.

Most people are aware of the mind-body relationship. That is, how our mental state affects our physical state, and vice versa. Beyond that dualistic relationship, we should be aware of the importance of other interrelationships throughout the physical world, the idea of community and responsibility, not just for ourselves as individuals, but for each other and our total environment. These are ideas about healthy living that are too infrequently spoken about, or encouraged, as are the tools for healthy living such as optimism, mindfulness (being aware of each moment) and compassion.

These are not isolated intellectual constructs but rather human roles to live out and manifest.
As part of this, there is the argument that the world's flora and fauna should be respected, not just because of their usefulness to humanity (a usefulness estimated variously in terms of environmental, aesthetic, spiritual, psychological, scientific or economic needs), but also for their inherent value.

In other words, they have a right to exist, and it is humanity's task to bring its consciousness into a rapport with that of the world's other species.

Instead of an I-IT relationship to the world, there is a desire for one that is more I-THOU: all flora and fauna are assumed to occupy a unique place in the ecological totality.

It seems that western society has to a large extent, lost touch with that latter relationship and perhaps that is one source of so much collective depression and alienation that we now see around us. It is here that perhaps we should turn to the wisdom of the indigenous people of the new world for guidance. Let me quote the words of Chief Seattle replying to the US government's forceful request to purchase large areas of Indian land in 1854:

*"Teach your children what we have taught our children, that the earth is our mother. Whatever befalls*

*(Continued on page 17)*

*the earth befalls the sons of the earth. If men spit on the ground, they spit upon themselves. This we know, the earth does not belong to man, man belongs to the earth. This we know, all things are connected like the blood which unites one family. All things are connected. Whatever befalls the earth, befalls the sons of the earth. Man did not weave the web of life, he is merely a strand in it. Whatever he does to the web he does to himself".*

In our contemporary godless culture, more and more people are jumping on the environmental bandwagon not only to stop the obvious mindless destruction and wastage but possibly also because they sense in such a quest there is meaning, purpose and ultimately a deeper understanding of what life and existence are all about.

I want to take this argument a little further to try and understand why forests and trees in particular, have a special place in the minds of human beings. Of course, we as humans like to see ourselves at the top of the food chain in the animal world and perhaps in a similar way, we see trees as the ' leaders' or monarchs of the plant world. But this is a somewhat simplistic explanation.

To extend the concept of our special interrelationship with trees we need to look at the symbolic nature of trees. In particular, how we as human beings have related to trees since the beginning of time.

Myths are our stories, our human attempt to come to grips with the essential realities of the world and the origin of things. One of the most common images we find in many myths concerned with the creation of the world, is the Tree of Life. It belongs to a coherent body of myths, rites, images and symbols, which together make up what the historian Marcia Eliade has called the ' symbolism of the Centre '. All symbolic images of the tree participate to some degree in this symbolism.

The tree can reveal the face of the sacred, primarily by virtue of what is in itself, through the power of its physical presence, and through its seasonal transformations.

Universally, the earth is regarded as ' the mother of all things ' and it is into the hidden and mysterious depths of this great earth mother that the roots of the tree descend. Through these penetrating roots, the tree participates in the regenerative life of the waters and the soil. From germination to death, the tree remains bound to its mother, the earth, the permanent source of its renewal. Standing at the centre of all that surrounds it the Tree of Life, like the Fountain of Life, is an image of the endless renewal of the cosmos from a single centre or source.

The psychologist C.G. Jung understood the dream image of the tree to be a symbol for the transpersonal self, which embraces the totality of conscious and unconscious processes, reflecting the potential fullness of man's being in his total environment. So when we ' feel ' for trees, or relate to trees, or just need to get amongst them, I believe that this is more than just a vague urge to be satisfied. It is rather a profound need to get back (if you'll excuse the expression) to our roots and most importantly, it is healing.

Planting and watching trees grow, can be a special way of being or relating to this home we call earth. It is about the geography of hope. To deny nature is to dice with death. Although generally it is arrogantly dismissive of the sacredness of nature, and the ancient myths, Western culture is racked by the negative effects of the destruction and misuse of plants: tobacco, sugar, chocolate, coffee, alcohol, heroin, and petrol. Torn from their complex, mythological roots, such plants and plant derivatives have wrought their revenge on a culture that has relocated them in a fast living, rootless, consumer orientated world. For example, secular smoking of commercial tobacco for pleasure was totally unknown in the pre Columbian Americas. This is despite tobacco rivaling maize in its distribution, and being used for a greater variety of sacred purposes than any other plant in the New World.

So those who are drawn to tree planting for greater than mercenary reasons may well be attempting to do what comes naturally and rewardingly: to intertwine our bodies, minds and habitations in a way that allows us to respect the complexity, divinity and power of vegetal life. To do this, I think is an attempt to live life well, to refocus and to take responsibility not only for ourselves but for all that is around us.

Please understand that I do not expect everyone to feel that forests and trees are necessarily places of spiritual regeneration. But many do believe this and more importantly, many more would if they could better experience the great benefits that forests and trees can bestow on the mental and spiritual health of humankind. Therefore, attempts to grow trees are not just physical or cognitive acts. Rather growing trees is a way of attempting to live, what I would consider to be a meaningful and connected life.

# Looking at Soils - Part 3: Drainage - A Vital Site Descriptor

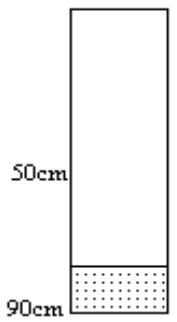
**John Grant**

When assessing whether a soil is suitable for growth of a certain species an assessment of drainage is probably one of the most important characteristics. When reading through the preferred sites requirements of most species you will find some reference to drainage. Usually it will be 'prefers a well drained soil with…..'. If your site has any drainage limitation you tend not place too much emphasis on what a species **prefers** but what it will **tolerate**.

Soil moisture is essential to provide water and nutrients to growing plants, however, excess wetness reduces air movement into the soil and robs roots of the oxygen they need to survive. Extended periods of waterlogging create conditions unsuitable for many species and anaerobic (low oxygen) conditions also can lead to conversion of mineral nitrogen to a gas which denies that nutrient to plants.

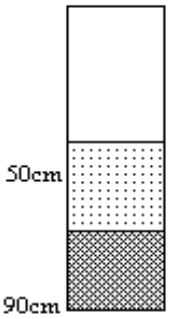
We need some definitions of drainage so that we are all talking about the same thing when we talk about well drained soils or poorly drained soils. When we discuss drainage we are really talking about two things, site drainage and soil drainage. Site drainage is how water moves onto and off a site and therefore depends to some extent on what the catchment characteristics of the site. Soil drainage is how water moves through the soil and eventually off that site. So we could have a soil with good drainage characteristics such as high permeability (ie it might be open and porous and let water move through it like a sand does) but if it occurs in the base of a valley that has continuous water input the overall effect may be permanent wetness and poor drainage. On the other hand, a clay dominated soil with low permeability and poor drainage characteristics will not be wet for extended periods if on a hill crest.

Soil drainage classes tend to be defined on the duration of saturation that the soil experiences over the year.



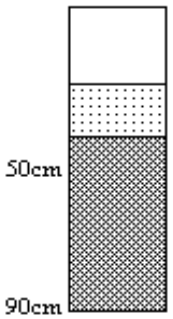

Well Drained

Soils may be wet for some days but are rarely saturated for extended periods. Mottling is absent except sometimes at depth. Water drains from profile readily (either through vertical or lateral movement). Generally loamy soils or well structured clayey soils



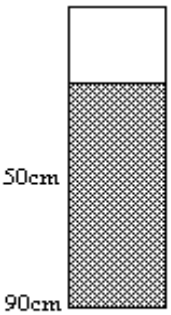

Moderately Well Drained

Water drains from the soil slower than supply so that some soil horizons may be wet for up to a week following rain. Some mottling or dull colours occur below 50 cm And some gley mottling at depth.



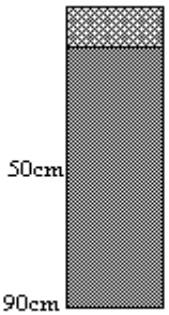

Imperfectly Drained

Water drains from the profile slowly in relation to supply. Some horizons in the top 50cm are saturated for several weeks. Commonly mottling occurs in the top 50cm of soil and distinct gley colours occur at depth.




Poorly Drained

Water drains from the soil very slowly in relation to supply. Significant ponding often occurs. All soil horizons remain wet for several months. Significant gley mottling is often present and many horizons have root channels with rusty oorange linings




Very Poorly Drained

Water drains from the soil so slowly in relation to supply that the water table remains near the soil surface for most of the year. Strong gleying to near the soil surface and surface peaty layers are common.

This is fine if you have the luxury to know that soil over a few seasons to observe those changes. If, however, you need a measure of drainage with only one observation to go on, you will need to rely on soil characteristics indicative of drainage. Colour is a good indicator. Consistent, uniform red to reddish brown colours generally indicate well drained soils (the iron in the soil is oxidised by consistent exposure to air). Yellow colours indicate slightly less well drained conditions and bluish grey colours (called 'gley' colours) are indicative of per-

sistent conditions of low oxygen where the iron is reduced and even flushed out of the soil. Often mottling (a mix of colours) occurs in soil horizons that are subject to periodic saturation (periods of anaerobic conditions alternating with periods of aerobic conditions). The higher in the soil profile that indications of impeded drainage occur, the poorer the drainage.

The diagrams can be used as an indicator of drainage class but they are a rough guide only as other factors can sometimes mask colour indicators of drainage. For instance, high organic levels can make a poorly drained profile appear black throughout. Other indications of impeded drainage you may use include iron-manganese deposits (laterite or buckshot gravels) in the profile, accumulation of organic matter on the soil surface and mottling that follows root channels.

But, as mentioned before, the best measure is observation over time. Monitor your soils following persistent or heavy rain to see how quickly they lose their saturated status. If there is a water table how does that change and where does it fall in the soil profile? (Sometimes a water table will exist in the middle of the profile only; where a relatively permeable soil horizon overlies a relatively impermeable horizon producing a 'perched water table'). When you are classifying your site according to drainage remember that topography is commonly a major determinant, so examine upper slopes, lower slopes, etc and be prepared to find anomalies that may be due to a change in bedrock material.

Drainage characteristics are important in species selection with many species sensitive to even relatively short periods of waterlogging. If you have soils that are imperfectly drained or worse a large a number of common cabinet species are likely to be unsuitable for your site. There are a number of species that appear to do well and there is interest in identifying a complete list of such species, so if you have had success with particular species we would be interested to hear. In the mean time SFFA will discuss this issue on one of the field trips later in the year.

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# Looking at Soils - Part 4: Some common soils across NE NSW


**John Grant**


**Soil Classification**

Every soil is unique. This may become frustratingly apparent if you ever attempt to map out soil types in any particular area. From metre to metre, changes can occur in the total depth of the soil as well as depths, colours, textures and structures of different horizons (see Looking at Soil - Part 1, where these soil descriptive terms were discussed). However after observing soils across an area you may find that the different soils often have enough in common for them to be lumped together as a 'soil type' and differentiated from other 'soil types'. The degree of lumping and splitting of these soils into groups generally depends on the particular requirement driving the soil description in the first case. For example, if you know the soil requirements of two plantation species you might simply map the target soils into four classes: Class 1 - suitable for both species; Class 2 - suitable for species A only; Class 3; suitable for species B only or Class 4 - unsuitable for either species A or species B.

But to compare soils outside of our own property we need a more universal language of soil description and nomenclature. And this brings us to one of the most difficult and sometimes confusing aspects of Soil Science. That is soil classification. It is difficult because soils are unique (as we have discussed) and they are also generally specific to an area or at a broader scale to a country. Thus we have different soil classification systems that have developed between countries and even different systems that have developed within countries. Within Australia older classification systems have been replaced as more soils are described and our knowledge of soil expands. Some of the newly defined soil classes coincide broadly with old classifications but most of them do not completely overlap. The universally accepted soil classification system now used across Australia is The Australian Soil Classification (Isbell, 2002).

Classification of soils is important as it allows us to draw on research and experience of a particular soil type and apply across the range of its occurrence.

So let's look at some common and well known soils around North-Eastern NSW.

**4a Acidic, Red Ferrosol Soils**

(As classified by The Australian Classification, Isbell, 2002)

**Description**

These are red (obviously) well drained, well structured soils. (I guess I should, at the outset, cover myself and say that the general use of adjectives such as 'well' or 'good' or 'poorly' are used from a purely anthropocentric point of view. The soil itself is quite content with its drainage or structural status and does not feel it needs to strive towards artificial goals of desirability set by any irritating bipedal mammal that it supports. More specifically, we tend to define the soil from a limited phytocentric point of view in that the majority of our planted crops prefer soils that are not wet for long periods and that have fine, open structure allowing rapid and extensive root growth. Of course for some crops such as tea-tree or rice, good or desirable drainage may in fact be what we class as 'poor'. But I am diverging from the topic and for simplicity will maintain the anthropocentric/phytocentric perspective and expect that soils will be far above being insulted by this bias.)

Back to The Ferrosol Soils, in our area they are generally formed on basalt under higher rainfall and constitute much of the area that would have been covered by the Big Scrub. They have been classified (under older schemes) as Krasnozem Soils, Acid Red Loams, Red Basaltic Soils or sometimes Scrub Soils. The Ferrosols are very distinctive soils and in this region are associated with the Alstonville Plateau to Wollongbar, Rosebank areas etc etc. They are much sought after for horticulture due to their desirable physical characteristics and they are the basis of many local horticultural industries including macadamias and coffee. They have a high clay content but the clay particles are aggregated together by organic matter and high levels of iron and aluminium oxides (the iron oxides give the soils their distinctive red colour) to produce small peds thereby combining the best characteristics of coarse sand (good drainage, good aeration and loose structure) with the best characteristics of clays (capacity to hold onto water and nutrients). They often show little obvious differentiation in colour, texture or structure down their profile.

These soils are formed in this region under rainforest and the health of the ecosystem was dependent on the high input and turnover of organic matter that those rainforest environments provided. The organic matter helped maintain the good structure of the soil as well as playing a vital role in holding and recycling nutrients. This is particularly important under high rainfall where nutrients in solution are quickly leached from the system and where the main clay (kaolinite) present in the Ferrosols is relatively poor at holding nutrients (compared to other clay types). In general the Ferrosol soils are relatively poor suppliers of nutrients and it is only their good structure in combination with high rainfall and fertilizing that leads to their high agricultural productivity. Phosphorus supply can be a particular problem on these soils due to their ability to 'lock up' any added phosphorus and make it unavailable to plants. To ensure that phosphorus uptake is maximised it is important to target application at times of plant need and to place the fertilizer in a concentrated patch close to the root zone.

**Degradation**

The deep uniform nature of Ferrosol profile can be their downfall. When someone claims that they have metres of topsoil on their property they are really looking at the full depth of a Ferrosol soil. The real topsoil (which is differentiated by being slightly darker in colour than the subsoil), if it still exists, is usually only the top 10-20cm. Sheet erosion is a major problem on these soils. Sheet erosion in itself tends to be the most insidious form of erosion as it removes the top layer of soil, bit by bit, in an even fashion and does not produce the obvious rills and gullies generally associated with eroding landscapes and that alert us to a problem. It is only if distinctly different subsurface soil horizons are exposed by sheet erosion that it becomes obvious for an observer to recognise (as usually occurs in soils other than Ferrosols). Sheet erosion of a relatively uniform soil profile such as a Ferrosol can continue unnoticed.

Ferrosols can be particularly prone to sheet erosion if not protected by vegetation as they tend to become 'hydrophobic' (resistance to water absorption) when completely dry. They only 'wet up' slowly as they gradually absorb water. This initial resistance to water uptake can mean that in the early stages of a rain event the surface peds can float and be easily carried away in any surface water movement. In Ferrosol soils the only obvious signs of sheet erosion are the rocks that 'float' to the surface (the soil is actually moving down to reveal the rocks) or tree roots that appear as the soil around them is removed. Or rivers and creeks that are the recipients of the eroded material and suffer from degradation, silting and eutrophication.

Soil compaction is also a potential problem on these soils. Compaction leads to loss of the valuable, distinctive friable structure of Ferrosols and it can occur when the soils carry traffic (such as machinery or cattle), particularly when they are saturated. The friable structure of the Ferrosols can also be at risk from over cultiva-

*(Continued on page 21)*

tion, leading to a structural break down in a relatively short time to a fine powdery (or 'snuffy') structure which reduces water infiltration and soil porosity.

Other degradation risks include acidification associated with prolonged fertilizer use and establishment of leguminous crops; and mass movement, associated with steep slopes.

**Care**

There are a range of management procedures that can help maintain the qualities of these remarkable soils into the future. It lies beyond the scope of an article such as this to detail those procedures except to emphasise the importance already highlighted of maintaining organic matter levels and nutrient holding capacity and to institute measures to prohibit soil erosion and maintain soil structure.

However, as part of a whole farm plan a cabinet timber plantation can play an important role, particularly on steeper slopes where erosion risk is highest and where other horticultural pursuits are less suited. A cabinet timber plantation has the potential to provide organic matter input into the soil as well as helping reduce erosion through physical protection of the soil from rain drop impact (via canopy and ground litter) and binding the soil with root growth. At the same time they can add diversity to a farm's income stream as well as to a farm's biology and landscape.

**Cabinet Timber Species for these Soils**

Many species will do well on these soils and analysis of growth from a number of plantings on these soils have been presented in previous newsletters (eg Allison Specht's article in the SFFA newsletter Issue 49, July 2005 and Kevin Glencross' article in SFFA newsletter Issue 45, July 2003). One thing to remember on these soils is that they can be prone to drying out due to their rapid drainage so planting should occur at a time and in a manner as to try to minimise that problem.

But the best way to get a feel for the cabinet timber potential of these soils and to do yourself a favour is to have a picnic at Rocky Creek Dam. While there, wander across and visit the plantation established and maintained by Ralph Woodford and see for yourself the possibilities that await.

**Further Reading:**


Grains Research and Development Corporation web site with a section on soil types at

http://www.grdc.com.au/growers/oft/soiltype.htm

The Australian Soil Classification (Isbell 2002) on line at:

http://www.clw.csiro.au/aclep/asc_re_on_line/soilhome.htm.

National Land and Water Resources Audit Site with soil descriptions:

http://audit.ea.gov.au/ANRA/agriculture/docs/national/Agriculture_ferrosols.html

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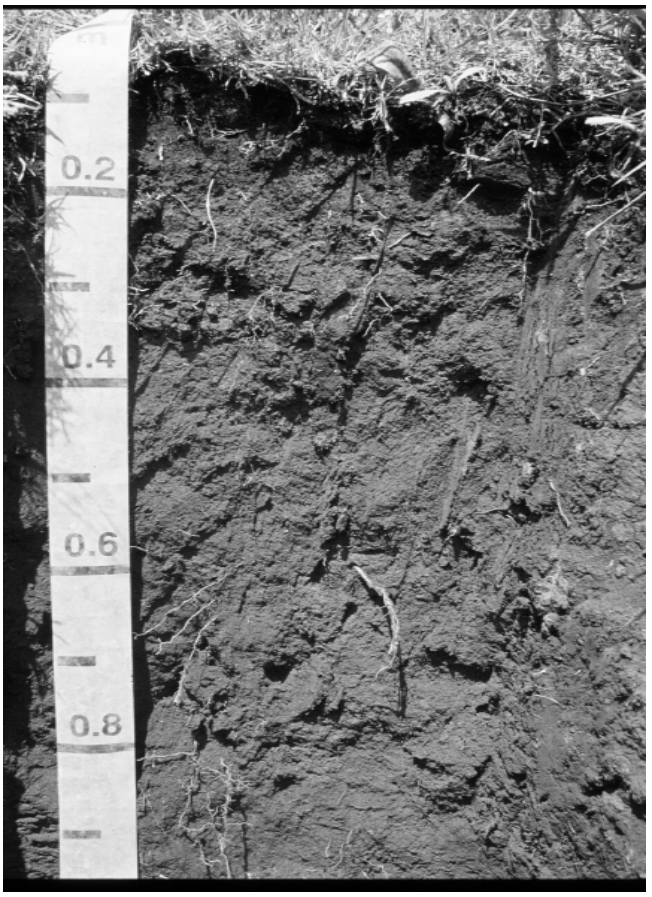



***Ferrosol Soil. Fine structure is observable and roots are penetrating with little impedance.***

# Some personal views on teak

(*Tectona grandis)*

David Cameron

*FAO publication extracts from Non-wood News April 2006 No. 13—copies available from NWFP home page at www.fao.org/forestry/site/6367/en*

In a rash moment some time ago I promised Martin that I would try to dig out something on teak for the Newsletter. I found several articles that could be suitable but then thought why not put in my personal walk through tropical/sub-tropical forestry and pass on some of my feelings about this superb tree and the timber it provides.

I had my first real contact with teak when I was given the task of finding suitable timber species for growing in the Northern Territory and helping to supply the increasing demand for timber associated with the growth of Government services in Darwin and the Northern Territory. This was as the Officer-in-Charge of the Northern Regional Station of the Forest Research Institute of the Forestry and Timber Bureau and within the Department of National Development. (So here was a federal organization doing what the states were doing in their own territories.) Teak had been imported some years prior to my arrival in Darwin in mid-1967 and there were trials at the Radio Block near Darwin and on Melville Island. As we were rather desperate to find timber species that could survive and grow relatively quickly in this dry monsoonal climate, teak was included in the broad range of species tested in trials at Howard Springs and Gunn Point. Another hazard for tree growth in the region was the voracious appetite and skilful selection of food sources by the Giant Darwin Termite *Mastotermes darwiniensis.* I recall the look of absolute horror on the face of the Director of the Indian Forest Research Institute when he inspected some of our trials with teak. The usual mode of attack by *Mastotermes* on teak was to move upwards through the stem totally removing all woody material leaving the bark to progressively fold over and drop all leaves and branches. Red soil would show in places along the 'stem' where the termite had ensured the gallery system was fully enclosed and secure. It was well known in India that teak was not susceptible to termite attack!

Humpty Doo about 40km south-east of Darwin had been opened up and promoted as a potential rice growing area and an American venture capitalist apparently advised by Bill Gunn (a cattle man who had little or no experience with rice growing) had cleared quite a large area for rice growing. After about 10 years, it was decided that the problems of rice growing were large and the operation closed down but on the very day that the last of the employees left, a CSIRO rice breeder and agronomist (Butch Langfield) arrived to help study the problems. CSIRO had been at Humpty Doo for a number of years at this stage and Butch agreed to allow our group to have a small area to test our range of tree species. The site was attractive as it was on a lower slope just above the swampy soils supporting paper bark (*Melaleuca*) forest. So it had good water relations and relatively good nutrient content. The one problem would be *Mastotermes*. At this stage we had a large group working on termite biology and control (three professionals and three technicians) and they had succeeded in locating colonies in the field and were testing control techniques with Mirex. So they carried out a survey of the area, found several *Mastotermes* sites and eliminated them. It was also considered that a lower slope position would not be a preferred habitat for termites.

The first year's trial saw about 15 species tested on the site and it was indeed very pleasing to find one species way ahead of the others in height growth and that was teak. Some of the others showed promise but teak was the outstanding species for the site. I had heard of an International Teak Provenance Trial being organised by the Danes (DANIDA) and this seemed a good opportunity to access valuable genetic material as well as participate in an international trial. So we acquired seed of 8 provenances. At this stage I requested approval from Canberra to install the trial but this was denied by the Director and reinforced by the Director General of the Forestry and Timber Bureau, even after they visited the site and saw the good performance of the teak. Their reason for refusal was that teak did not perform well anywhere in the world and it would be a waste of time and resources! Contrary to this, Butch Langfield based on his Asian experience was of the opinion that teak would certainly grow in the Humpty Doo area and we decided to go ahead with the trial but in a more remote part of the CSIRO farm. From memory the provenances selected spanned the range of climatic and edaphic conditions of a large collection through much of India and Thailand and included the provenances from the wettest and the driest areas, as well as some from sites with conditions similar to those of Darwin. We also included the local 'land race' in the experiment. Mean diameter increment of

the better provenances after 9.6 years was 1.5 cm per year and the best basal area increment was about 2.5 $m^2ha^{-1}a^{-1}$.

A few years later and after our group had moved into CSIRO as the Division of Forest Research and the Darwin Station had been closed, I was given the task of reviewing for ACIAR the performance of high value rainforest species in Australia. This gave me the opportunity of including teak in the list and reporting on the trials in Queensland and the NT. A range of studies in various parts of the tropics is referred to in the report with height increments of up to 4 m per year for the early part of the rotation and down to less that 1m per year in the latter years. Volume production ranged up to 15 $m^3ha^{-1}a^{-1}$ on better sites with good silviculture.

My next contact with teak came when I was working with a SIDA-funded Interforest project in Vietnam in 1991-93. At that stage I can only remember one planting with teak in the country. It was a rather large trial and I think on the road from Ho Chi Minh City to Da Lat. There were some good stems in the plantation and it was used as a seed source for other plantings in the country. I think that teak was one of a range of species the Vietnam Forest Science Institute considered useful for trial on the best sites available. Unfortunately most of the sites handled were severely degraded and the most appropriate species to handle those were eucalypts, acacias and casuarinas.

When I worked on an FAO Regional Project for Vietnam, Myanmar, Laos and Bhutan (STRAP) from 1993-1996, I was then very much exposed to teak and given a much better appreciation of its potential. Early visits to each of Laos, Myanmar and Bhutan raised the point that each of these countries considered teak as a major species for their plantation programs.

Perhaps I should digress here a little to cover something of the natural distribution of teak and how it has been managed over the years. Teak is considered as originally covering about 28Mha distributed as follows – India 8.9Mha, Myanmar 16.5Mha, Thailand 2.5Mha and 16,000 ha in Laos. In India it was found in a region below $24^oN$ in a dis-continuous band covering very moist forest receiving from 900 mm to over 2,500 mm per year. In Myanmar, teak occurs between 10 and $25^0 30'N$ and up to elevations of about 900m. It is found in the semi-evergreen, lower mixed deciduous, moist upper mixed deciduous, dry upper mixed deciduous and in deciduous dipterocarp forest types. In Thailand it occurred between 16 to $20^0N$ in mixed deciduous forest. Its occurrence in Laos was in the north-west of the country in mixed forest types. Logging in native forests appeared to have halted in India, Thailand and Laos at the time of the 1995 Seminar but was continuing in Myanmar. In the region, plantations have been established since the 14th century in Java and more recently in China, Malaysia, Papua New Guinea and Vietnam. This is in addition to plantations in the four countries in which it originated.

It is interesting to follow the development of teak management in Myanmar. Teak was important in Myanmar before European interest and teak boats were exported locally from the 17th century. Systematic forest management was initiated in 1856 with the arrival of Dr Dietrich Brandis to take charge of the Bago forest. He drew up the first Working Plan based on ring counting and observation of trees of known age. He calculated that it took 24 years for teak trees of 44 cm dbh to reach 58 cm dbh and prescribed that 1/24th of the number of trees should be cut annually. This system was applied until 1920 when it was revised into what is now known as the Myanmar Selection System. The System was applied progressively over 60 years and about 3Mha of the country was managed in this manner.

The standard practice is to divide the area to be logged into 30 blocks of potentially the same yield volume. One of the blocks is logged each year. All marketable trees reaching a fixed exploitable diameter are selected for cutting. The process is to search the compartment to be logged progressively along contours and all trees over 39 cm dbh are measured and recorded while trees attaining the prescribed girth limits are selected and scrutinized as to whether they will yield marketable logs or not. If they can yield marketable logs, they are girdled for exploitation. Some undersized defective trees, which will not last another 30 years but will yield marketable logs will also be selected.

The exploitable diameter varies with the type of forest. In good moist teak forest the limit is 73 cm dbh and in poor dry forest it is 63 cm dbh. Unhealthy trees that are not up to this size are selected for cutting as they are unlikely to survive through to the next felling cycle. If seed bearers are scarce, some high quality stems are retained as seed trees. Mature teak trees are normally girdled about 3 years before being felled and extracted. The girdling is to season the timber and ensure logs will float as transport is commonly in streams and rivers. The girdling process is to make a cut about 10-15 cm wide around the stem as close to the ground as possible through bark and sapwood right into the dark brown heartwood. Records are kept of all girdled trees. For instance in the period 1992-93, 84,000 trees were girdled, 118,000 trees were marked and 260,000 trees were felled. The excess of felled trees over the number

girdled is likely to be due to a larger number of carry over girdled trees from the previous years. In accessible areas, teak is extracted green. Improvement fellings are carried out concurrently with girdling. In this operation, inferior tree species that are competing or suppressing teak trees are felled in favour of teak. Thinnings are also carried out in crowded young teak stands.

In the native forest, teak is relatively fire hardy, light demanding and fast growing. In the early seedling stage, surface fire may destroy above ground shoots, but the root portion will send up a new shoot at the commencement of the rainy season. This process goes on for a number of years until conditions are favourable and the root is developed enough to send up vigorous shoots that can escape from ground fire damage. Another factor that influences natural regeneration is when the bamboo, which is abundant in a lot of teak forests, flowers. This occurs in a cycle of 30-60 years, after which the bamboo dies. This creates large openings, allowing more light and space to the existing advance growth and consequently natural regeneration has a great opportunity to become established. Growth in native forests has been the subject of study for many years by Myanmar foresters but also with assistance in modelling of yields by Prof Jerry Vanclay in 1992. A general figure for a lot of teak forests is an annual increment of about 0.3 $m^3$ $ha^{-1}$ $a^{-1}$.

The annual allowable cut of natural teak in Myanmar was set in the early 1970's at just over 604,000 $m^3$ or 180,000 trees. In the period 1946-94, the allowable cut was 8.7M trees while the number actually logged was 7.1M. It appears from this that the allowable cut is not being exceeded and the only problem foreseen is that if the felling series is covered in less than 30 years or the yield drops. Inventories are regularly undertaken to ensure management demands are followed. Besides this, plantations have been established at the rate of about 11,000 ha per year since 1980. It has been noted that a teak plantation is incorporated into the natural forest stand when the plantation reaches an age of 40 years.

During the Second Regional Seminar on Teak, it was decided to establish a permanent network of people and organizations interested in teak. TEAKNET (Asia-Pacific Region) was established. The objectives were stated as follows:

- ?? Exchange of technology and information on sustainable management, silviculture, processing and promotion of teak
- ?? Exchange of genetic materials, plants, soils and timber samples together with standardisation of trials to facilitate international comparison.
- ?? Collaborative studies on critical areas that are of common interest to member countries.

Myanmar was unanimously nominated as the home for TEAKNET and the Ministry of Forestry selected to provide the secretariat and the Coordinator. The first Coordinator was U Mehm Ko Ko Gyi.

## SOME PERSONAL VIEWS ON TEAK

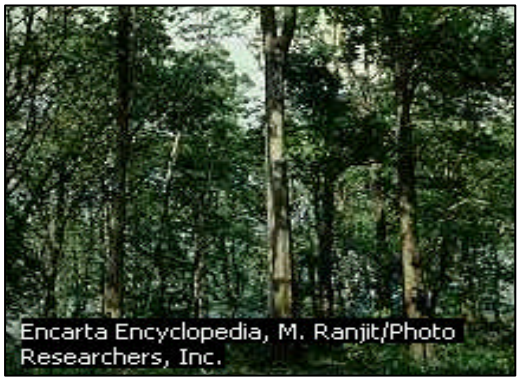
To conclude, I have been very impressed with what I have seen of teak growing in Myanmar, Thailand, Laos and Vietnam. It is certainly a magnificent species from the viewpoints of growing the tree and in the superb timber it yields. I wonder if the Queensland Department of Forestry had persisted with some of the teak trials from early days, whether teak may have developed as a major species in that state. Officers of that organization were aware of the International Provenance material organised by the Danes but did not access the collection. It is likely that at that stage the Department considered there were enough plantation species on their list and they would have presumed that the rainforest would continue to produce quality cabinet timbers for many years to come. If it had been realised that access to rainforest would be stopped, then maybe teak would have been tested more thoroughly. From the small amount of work in the NT, I have no doubt that teak can grow at a respectable rate if planted on those lower slope sites where moisture and nutrient levels are adequate and *Mastotermes* is not likely to be a major problem.

Now is it possible to grow teak in this Northern Rivers region? I believe a trial of a small number of likely provenances should be tested on good quality soils and preferably on ex-rainforest sites. The trials should be given quality establishment and maintenance conditions. It would be good to have someone who has actually raised and grown teak to supervise the trial and it is likely that there are probably a few people who have that experience. Besides the need to test such a valuable species under our conditions, there is also a real need to grow some valuable timbers of international repute. In Australia we have relied mainly on indigenous high value species and neglected the quality timbers of international trade. Perhaps as well as teak, we should also test out several other quality

*(Continued on page 25)*

timbers at the same time and look at providing a range of timber colours – white, pink/red, yellow/brown – to cater for fashion changes in demand for timber.

If there is interest in this article, another could concentrate on the silvicultural requirements of the species. Material could be sourced from TEAKNET and from various mainly FAO publications on teak.

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## NOTES FROM THE GREENING AUSTRALIA SUMMER 2006 NEWSLETTER - QUEENSLAND EDITION

(Comments from north of the border)

1 A new project has been attracting the interest of landholders in south-east Queensland. Following 40 workshops in shires and cities in the south-east during the immediate pre-Christmas period, over 450 calls for information on becoming VIPs (Vegetation Incentive Program) have been received on the Greening Australia free hotline. The Program is designed to help landholders regenerate native vegetation and protect land from clearing in perpetuity. The GA project officers advise that 'callers come from right across the region and have demonstrated a wide range of values, existing land uses and community interest, so the message is reaching a wide audience'. Some callers sign up immediately while others require more information on the Program.

The program is a $ 12 million segment of the Queensland Government's $ 150 million financial package to help landholders adjust to new vegetation management laws. Involvement in VIP is voluntary and landholders can apply for funds for activities such as fencing areas from grazing, controlling weeds and rehabilitation of areas with soil erosion problems.

2 A new Guinness record was established in Lara, near Balliang, Victoria when 400 volunteers planted 13,125 trees in one hour! Ten planting teams demolished the earlier record of 4,100 trees. The planting was organised by the Geelong Landcare Network Coordinator Bronte Payne with assistance from the Corangamite CMA, DPI, Department of Sustainability and Environment and Greening Australia Victoria. The activity was captured on TV and was to be shown on Channel 7's Guinness World Records program. The planting was one of 11 funded by the Melbourne 2006 Commonwealth Games project.

3 There is an interesting note in the Newsletter about a device about the size of a microwave oven that extracts hydrogen from water. It was developed by the CSIRO Manufacturing and Infrastructure Technology team. The Project Leader Dr Sukhvinder Badwal said that hydrogen economy was a real possibility and full-scale commercialisation was 3-4 years away. Comments are that the family car could be powered for up to 150 km daily with the hydrogen unit presently running on mains power.

# $10,000 TO CONSERVE NATIVE VEGETATION

The Northern Rivers Catchment Management Authority (CMA) is offering up to $10,000 to assist landholders conserve and manage native vegetation.

"The intention of this program is to provide landholders with funds through a Conservation Contract for a specified range of native vegetation conservation and management activities" said Judy Henderson, Chair of the Northern Rivers CMA.

To be eligible for the Northern Rivers CMA Conservation Contract, a landholder must submit an Expression of Interest for a proposal that:

- ?? is on private land within the Northern Rivers CMA area;
- ?? addresses the conservation and management of priority ecosystems in good condition;
- ?? involves eligible conservation and management activities;
- ?? involves an agreement of at least 10 years; and
- ?? meets the funding and cost sharing rules.

Fund will be provided for activities that protect existing native vegetation and biodiversity values from threats through:

- ?? fencing for stock exclusion;
- ?? weed control using mechanical and/or chemical methods;
- ?? bush regeneration (for environmental weed management and minor supplementary planting); and
- ?? off-stream stock water points that is essential for protection of priority ecosystems.

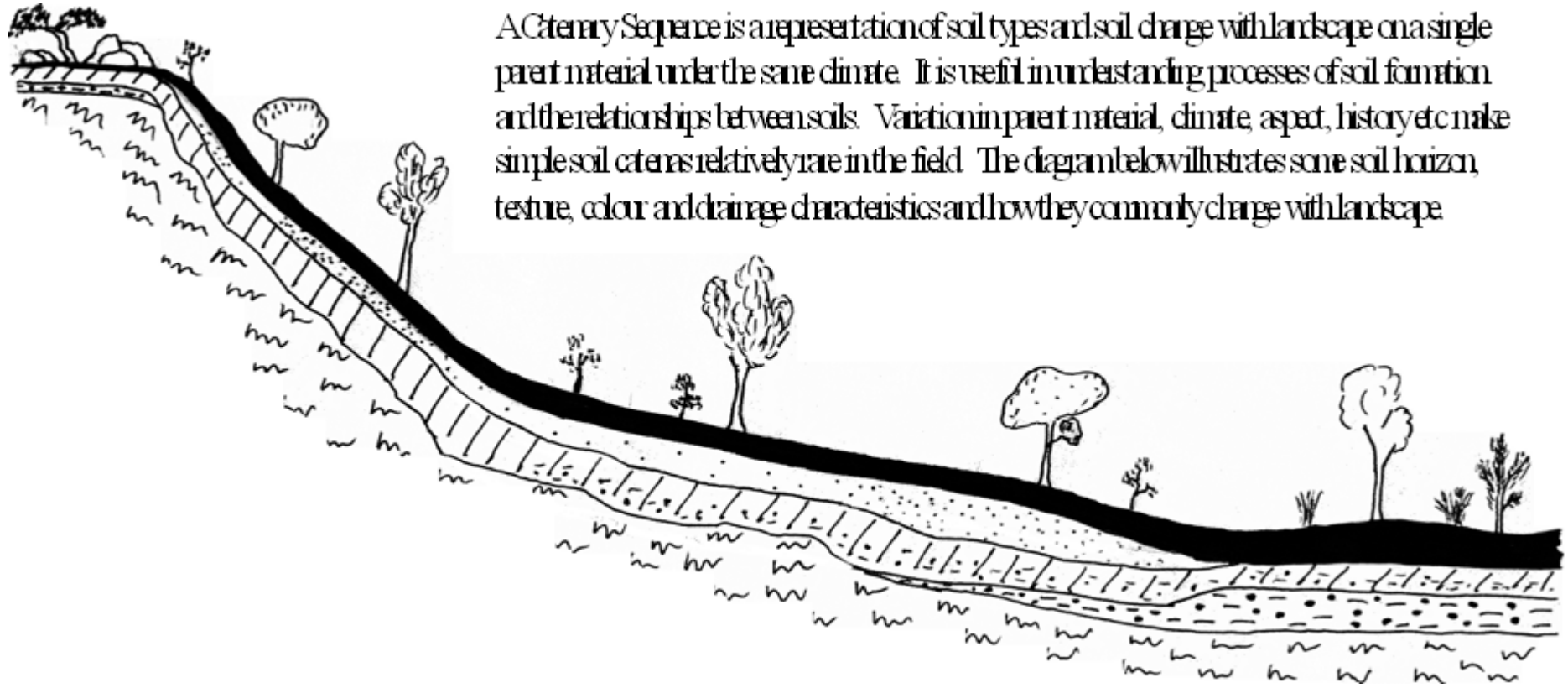
Although not limited to, priority will be given to expressions of interest involving rainforest; wetlands; riparian ecosystems; coastal dune ecosystems, heath lands; mangrove & salt marsh communities; old growth forest, and endangered ecological communities on privately owned land.

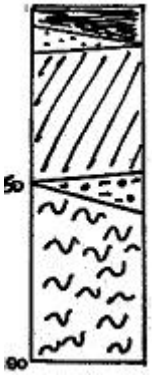
For further information, please visit the Northern Rivers CMA website at www.northern.cma.nsw.gov.au or contact Jamie Morton on 6627 0119.

## NOTICEBOARD

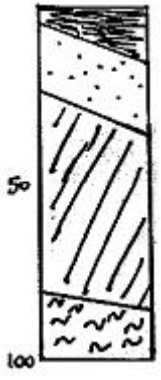
| | |
|---|---|
| **HEALTH & HERBFEST**<br>**Including SFFA Forest & Wood Expo** | **AUGUST 19th and 20th**<br>**Spinks Park Lismore** |
| **SFFA FIELD DAY** | **AUGUST 26th**<br>**150 James Lane Myocum 10 am—2.30 pm** |
| **SFFA A.G..M.** | **AUGUST 30th**<br>**Italo Club Lismore 6.30 pm with dinner at 'Fire in the Belly' Restaurant** |
| **FEES DUE** | **AUGUST 31st** |
| **BIG SCRUB FIELD DAY** | **SEPTEMBER 10th**<br>**Rocky Creek Dam from 9 am**<br>**Farm forestry tours start from 10 am** |

A Catenary Sequence is a representation of soil types and soil change with landscape on a single parent material under the same climate. It is useful in understanding processes of soil formation and the relationships between soils. Variation in parent material, climate, aspect, history etc make simple soil catenas relatively rare in the field. The diagram below illustrates some soil horizon, texture, colour and drainage characteristics and how they commonly change with landscape.

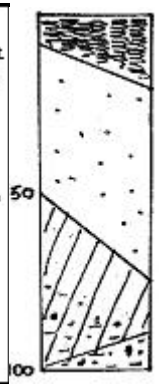




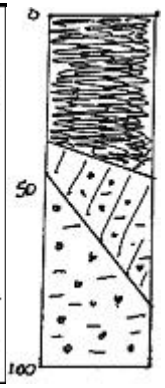

Ridge Crest Soils
Sites with soil and nutrient loss due to leaching and erosion. Generally the soils are the youngest, shallowest and stoniest and they are often drier, being exposed, shallow and having no input of water from upslope.
eg. Well to moderately well drained shallow soil (50 to 60cm to rock) with 10 to 15cm dark topsoils over clay. Sometimes a thin, bleached A2 occurs and occasionally the clayey B is mottled or gleyed at depth.




Upper Slope Soils
Sites with erosion and leaching but also with deposition from upslope sites. Often they have good drainage due to slope and only a moderate input of water from upslope.
eg. Well drained, moderately deep soils with 10 to 20cm of dark topsoil over bleached A2 (due to leaching with lateral and vertical water movement) on uniformly coloured clayey B horizon on bedrock at 70 to 80cm.




Lower Slope Soils
Sites with clay and solute deposition from upslope as well as some loss. Input of soil and water from upslope leads to deeper, more clayey soils and poorer drainage. Increased water throughput has led to greater development of the A2.
eg. Imperfectly drained soil with dark surface over bleached subsuface to between 50 and 70cm over mottled clay (indicating impeded drainage) with bedrock at 90cm to below 100cm




Soils on the Flats
Depositional soil. Inputs of water and soil from upslope leads to poorly drained clayey soils (water, clay and solute deposition). Slow decomposition of organic matter due to waterlogging creates deep organic topsoils.
eg. Poorly drained soils with deep, dark coloured A1 over mottled clayey subsoils on gleyed subsoils to a depth of over 100cm.

This is the diagram that was omitted from the last Newsletter "Looking at Soils 2"

# Subtropical Farm Forestry Commercial Services Listing

| ACTIVITIES | BUSINESS NAME | CONTACT PERSON | CONTACT |
|---|---|---|---|
| **Education & Research** | Southern Cross University | Forestry Department | 02 66 203 000 www.scu.edu.au |
| **Consultancy** | Wombat Soil & Environmental Surveys Pty Ltd | John Grant | 66 895 596 |
| **Nursery** | RJ & JJ Hibbens | Manager | 66 333 252 |
| **Timber** | Solar Slabs | Don Metcalfe | 66 293 226 |
| **Consultancy** | Bioenergy Australia Ltd | Cliff Peiffer | 08 9225 7888 cliff@bioenergyaustralia.com.au |
| **Seed Supply** | Forest Futures | Peter Page | 02 9342 6415 |

## SFFA MEMBERSHIP APPLICATION FORM

Name: _____

Address: _____

email: _____ phone: _____

Cheques should be made payable to SFFA and posted to PO Box 1320 LISMORE NSW 2480

**FULL TIME STUDENTS $16.50 - INDIVIDUAL $33 - BUSINESS $66 - CORPORATE $132**
**Inc gst**
**Membership renewals due 31st August each year**