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BAMBRA Agroforestry Farm

writing a history on the landscape
WELCOME

Welcome to Bambra Agroforestry Farm, our outdoor classroom for those keen to explore, discuss and debate the growing of trees on farms – for both conservation and profit. What you'll see are not demonstrations of how I think others should grow trees on their land. This is just a place where people can come together and share their knowledge and experience. We hope this will help us all realise the great potential for trees and forests to enhance, rather than replace, our farming landscapes and the communities that depend on them.

I'm a forest scientist by profession, a tree grower by passion, a farmer by inheritance and a woodworker by ambition. This farm and the farmers I work with have provided me with much of the knowledge and experience that now underpins my work as a lecturer, researcher, consultant and extension agent. There is only so much you can learn from books - I learn best from experience and conversation.

To borrow from Aldo Leopold, growing trees is like writing a history on the landscape. Please, take the time to reflect on how growing trees might change your landscapes for you, your children and your communities.

Thank you for visiting.

Rowan Reid

let’s go!

Since 1987, we have established more than 50 commercial tree species over 25% of the farm. They include trees for timber, nuts, seed, foliage, fodder and food. Shying away from conventional plantation designs we prefer to integrate the commercial trees into mixed species forests, belts, corridors and parklands that provide conservation, biodiversity and aesthetic values.

With most visitors I follow a circuit that takes us through a number of ‘outdoor classrooms’. Each provides an opportunity to display various tree species, planting designs and management options. Many other plantings are spread across the farm and new ones are added every year. You are welcome to explore.
1987 the creek was seriously degraded. The bare banks were being undermined by stream flow and collapsing due to uncontrolled cattle access and waterlogging. In our first year we fenced the creek and started planting. I was hoping to develop a productive forest that would control soil erosion, shelter stock in adjacent paddocks, provide habitat for native wildlife, and enhance the landscape values—especially the view from the house.

The first planting included Mountain Ash and Blackwood for timber with a native understorey. In 1988, we added Shining Gum and Blue Gum. Fencing out stock allowed for some natural regeneration and the development of reed beds which held back the sediments and allowed for the development of deep pools. The reeds have since been shaded out, although the woody debris created by active management is now doing the same job.

Every winter I thin and prune to enhance the timber values and continue enrichment plantings of shade-tolerant species. When thinning or to control Willows I prefer to ringbark or stem inject so as to provide standing dead wood for wildlife. Tree creepers scour the peeling bark for insects and we’ve seen a perfectly camouflaged Tawny Frogmouth roosting in a dead Willow.

We have begun harvesting high quality timber. The plan is to selectively remove the eucalypts whilst enriching the riparian forest with native temperate and sub-tropical cabinet timbers that will ultimately create a dense rainforest canopy. This will provide a cooler environment and present less of a fire hazard.

Waterways are an obvious place to start revegetating farms as there is a clear need for trees and revegetation is unlikely to reduce agricultural production. Unless salty, waterways also often have the best soils and water availability. Although what I am doing is currently illegal in some states I hope to show that, with care, it is possible to manage riparian forests for both conservation and profit.

SAFETY  Emergency – Ring 000
You are touring a working farm. You should have appropriate footwear and clothing for the season. Please take note of the following risks and heed the safety advice given at the beginning of the tour.

Electric fencing – you will be advised if the fencing is turned off
Snakes – Tiger Snakes and Copperheads are common and may be seen between August and April. Wear appropriate footwear and watch where you walk!
Insects – Bees and European Wasps are commonly seen.
Falling trees and limbs - During very windy weather you will be offered a hard-hat and asked not to enter into plantations that are considered risky. The old native trees often drop large branches during still weather in later summer.
Machinery - Occasionally we hold demonstrations involving chainsaws, tractors and sawmills. We ask that you heed all advice about safe-viewing distances.
Fire – Please do not smoke in the paddocks at any time of year.
First Aid – A First Aid kit is available if required.
**ROOM 2: EUCALYPT SAW LOG SILVICULTURE: FAT, CLEAN AND FAST!**

*Shining Gum (1995)*

There are hundreds of eucalypt species to choose from. They vary in their growth rates, disease and insect resistance, drought tolerance, wood properties and soil preferences. We were initially attracted to the fast growing Shining Gum because of its good form and light branching. Although the timber is not durable and lacks colour, it is useful for internal joinery and furniture. However, Shining Gum is susceptible to wood boring insects if stressed and fungal attack when growing on our heavy wet soils.

In less than 20 years we have been able to grow and mill Shining Gum for furniture and building. The key to success is in the silviculture. This planting design, known as a Nelder Wheel, illustrates the impact of spacing on tree growth. At high stocking rates the trees compete for light resulting in slow diameter growth and self thinning. Interestingly, height growth is unaffected by the intense competition. At wider spacings the trees must be pruned to control branch development but the diameter growth is tremendous. But, if planted too far apart both height and diameter growth is affected by exposure, particularly to drying winds. See silvicultural notes for more information.

![Nelder Wheel](image)

Fig: Diameter growth of the Shining Gum at different stocking rates

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**ROOM 3: OTWAY BLACK GOLD – AUSTRALIAN BLACKWOOD**


Australian Blackwood is one of the most well-known and highly regarded native timbers in Victoria. In our native forest there is a tree standing more than 20m tall with a clean bole of 50cm rising almost 8m to the first branch. This gives me some confidence that I can grow good logs on this slope. However, managing Blackwood for good form and fast diameter growth is a little tricky.

Blackwood needs shelter from dry winds and form pruning is critical in order to develop a strong, straight central leader. When pruning I try to maintain a deep canopy by removing only the large branches (over 2cm) and retaining the small live ones on the lower stem for a little longer than I would for other species. To promote diameter growth I suggest thinning to a Diameter:Basal Area ratio of more than 3. That is, if the trees were 30cm in diameter the stocking would be less than 140 st/ha - a basal area of less than 10m²/ha. 150 st/ha seems a reasonable target spacing for high-pruned trees. On an exposed site I'd start with at least four times that number.

Blackwood coppices freely from the cut stump, suckers from exposed roots and can be easily cloned from root cuttings. On this site there are three rows of genetically identical trees that were cloned from the roots of native trees growing further up the slope. Autumn is the best time to take root cuttings (10cm long and 10mm in diameter). We anticipate that clonal propagation will reduce the pruning costs and increase timber value. It may also be the key to replicating interesting grain patterns like fiddle-back and birdseye.

Another long lived Acacia that produces beautiful timber has the ominous common name of Hickory Wattle. It appears more drought tolerant than Blackwood so is worth considering for more exposed sites. We have also planted Australian Sandalwood which, like its relative the local Cherry Ballart, is a root parasite of other trees including Wattles. The value of sandalwood lies with both the edible seed (which are about the size of macadamias) and the heartwood which contains the valuable oils.
**Room 4: Autumn Colour and a Gift to the Next Generation**

*Hybrid Poplars (1987), Black Walnut (1987), Australian Red Cedar (2005-).*

Deciduous trees offer farmers something our natives cannot: summer shade and winter sun. In this paddock we’ve planted the slow-growing Black Walnut as a succession between fast-growing Hybrid Poplars. The Poplars are a hybrid of the North American Cottonwood and the European Black Poplar. Some also include the genes of a semi-evergreen form of Lombardy Poplar originating in Chile. The trees are planted as clones using rooted stem cuttings.

Poplar timber is pale, light weight and soft. It is strong for its weight, does not splinter, has no tannins, resins or oils that might taint food and can be stained to look like any timber, even Ebony. It is often used as icy pole sticks and food utensils. Other possible markets include picture frames, wooden toys and craft timber.

Black Walnut is a slow-growing native of North America that produces one of the world’s most valuable dark coloured timbers. I planted the seed directly into the ground so that taproot could go straight down into the deep alluvial soils. Diameter growth rates have been less than 1cm per year suggesting it may take more than 60 years to produce a high-quality sawlog! Any economist will tell you that it’s not worth growing timber if it means waiting more than 40 years till the final harvest. Of course, time is money, but time also provides an opportunity. Trees are unique in that they both increase in value over time and cannot be moved. So, while I’m growing other species that I will harvest myself I’m also using the time I have to grow something for my children that money can’t buy: a living forest of mature Black Walnut trees on their land! It’s like giving them a gift of time.

When the time is right I will remove the Poplars to allow the Black Walnut trees to flourish. I have also begun adding some Australian Red Cedar to this forest. Although not deciduous, it has a similar leaf to Black Walnut and a similar reputation as a superior furniture timber. If successful I will add it to my rainforest mix for the creekline.

**Our Wallaby Guard**

Unlike Kangaroos, wallabies are browsers and prefer young trees to grass. We’ve tried a range of techniques and have settled on a 1.2m length of vine tube (13cm open diameter) supported by a 2m length of 20mm electrical conduit pushed into the ground. Including 3 cable ties to attach the vine tube to the conduit brings the total cost to about $2.50/tree. In most cases the pole can be reused.

Unlike a solid steel or wooden post, the conduit allows the tree to move in the wind as it grows out of the tube resulting in thickening of the stem (a process known as thigmomorphogenesis). Although regular inspections are required, particularly on windy sites, I have found the guard to be effective for many species except those susceptible to fungal attack. Shining Gum and Sugar Gum failed whereas Sydney Blue Gum and Yellow Stringybark seem to thrive. All the deciduous hardwoods seem to grow better in the tubes, as do the Redwoods.
ROOM 5: THE MONTEREY PENINSULA TRIO


The Otway Ranges has a very similar climate to the Monterey Peninsula in California so it’s not surprising the Radiata Pine and Monterey Cypress grow so well on our farmland. A third species from the Monterey Peninsula that does well here is Californian Redwood - currently the tallest tree in the world.

Radiata Pine is an adaptable species that grows on a wide range of soil types and produces useful timber within a reasonable time frame. But, as a species for small growers it has its limitations. The pine industry is big. It deals in large volumes of relatively low value. The timber is non-durable and relatively unattractive.

As a farm timber Cypress is much superior. The orange-coloured heartwood is durable above ground and can be used for a wide range of purposes. Unfortunately, a canker disease has been introduced that damages the cambium resulting in fluting, dieback and death. An alternative is the more resistant Mexican Cypress or some of the many cypress hybrids.

Not as adaptable as pine, Redwood is tolerant of heavy wet clays and resists toppling making it an ideal species for tunnel erosion control. Although slow to start – it may take 8 years before you start stem pruning – once they get their roots down they can grow fast. The many small horizontal branches are easy to prune, so much so that I take them up 8 metres! Redwood timber is very light and easy to work. The heartwood is dark red and durable making it an alternative to imported W estem Red Cedar. I’m planning to grow the trees out to about 1m diameter and expect that might take about 40 years.

ROOM 6: NATIVE FOREST - FARMING CONSERVATION AND BIODIVERSITY FOR PROFIT

Fenced in 2006

Our native forest has been burnt, logged and grazed for over 100 years. The best area is in this gully that runs from the creek up to the ridge and provides a valuable wildlife link to areas of intact native forest. In 2007 we fenced it out at our own expense and are looking to manage the forest for conservation, biodiversity, aesthetics and timber.

The gully has a nice stand of Blackwood and there has been some good natural regeneration which we will manage. We’ll also have to manage the weeds. ‘Saving’ a patch of remnant native forest requires more than just excluding stock. Rather than grants for fencing and the exclusion of harvesting, I’d prefer to see farmers paid for the environmental services their forest offers on an ongoing basis. If a farmer can find a cheaper or more effective way of promoting natural regeneration or enhancing biodiversity they should be able to profit from it.

Handouts and subsidies can discourage investment, innovation and initiative, and disadvantage those who can find ways to marry conservation and production.
**ROOM 7: THE VINEYARD – OAKS, FRUITWOODS AND FUNGI**


This room has a complex planting of red and white varietals of Oak with aromas of Cherry, European Walnut and Pear that display earthy characters with a subtle fungal finish! Welcome to our ‘vineyard’.

The deciduous Oaks are divided into two groups: White and Red. The large pores in the heartwood of the White Oacks, including English Oak, are completely sealed. As a result, it is virtually impervious to water making it ideal for ships and barrels. In the Red Oacks the pores are open: you can actually blow air through the wood making it easy to dry.

All the Oacks are ring porous so the faster they grow the greater is the wood density! Ask me and I’ll explain. They also have the prominent medullary rays which give the striking pattern on quartersawn boards. It is that characteristic that led to many species in the ‘new world’ to be given oak names like Silky Oak and Sheoak.

I’m interested in Oacks for another reason: fungi. Shiitake literally means ‘Oak Mushroom’. We’ve grown Shiitake on both Oak and Eucalypt with good success. The other fungi that always comes to mind is the Truffle. We’ve recently planted our first inoculated trees (2 English Oak, 2 Holm Oak and 2 Hazelnuts). We’ll keep you informed – or maybe not!

Pear and Cherry are fruitwoods. Both can grow to a medium sized tree and produce timber that is highly valued for wood turning, crafts and small furniture pieces. Cherry requires well drained soils whereas Pear can tolerate heavy clays. Also in this paddock is a large grafted Walnut tree (1988) which produces well. We did have Chestnuts but they died after the ‘big flood’ of 1995. Both species produce valued timber and nuts and can easily be grown for both at once.

**ROOM 8: GONDWANA WOODS – REMINDERS OF A CHANGING CLIMATE**


We’ve planted four of our native Australian softwoods that link us back to the wet forests of Gondwana. These species remind us our indigenous forests are dynamic: species have had to adapt or move to survive drought, frost and fire. Human-induced climate change is more rapid and fragmentation due to clearing has disrupted the flow of species through the landscape. We need to make decisions about species suitability: you might have noticed that many of the native species I am now planting originate from New South Wales.

Depending on wood density, a cubic metre of wood stores about one tonne of CO₂. But, trees only lock up CO₂ if the rate of wood formation is greater than the rate of respiration and decay. Hence, whilst a mature forest is a carbon store, it is not a carbon sink. The real potential of trees to reduce carbon dioxide levels in the long term lies in the establishment of new forests on land with a low carbon status and the harvesting of trees for wood (stored carbon) or fuel (green energy). Selling the carbon in your standing forest is not risk free – I’d prefer to see taxes on fossil fuels that encourage the use of timber as building material and a fuel.
THE LIVING ROOM

As we return to the shed we’ll be passing by the home we built. The house is designed as a passive solar fire bunker that mimics the rolling landscape. The construction involves two overlapping concrete slabs, load bearing compressed mud brick walls (made on-site with road gravel and cement), Red Ironbark poles and a sprayed concrete roof. All the timbers in the windows, lining and the kitchen floor are recycled NSW eucalypt species including Sydney Blue Gum and Spotted Gum.

The shed was originally built for shearing but has been recently renovated as a venue for our tours, workshops and displays. Many of the species we are growing, and some of the timbers we have actually produced, have been used in the building.

THE FARM

Area: 42 hectares (113 acres)

Rainfall: Long term average: approximately 800mm.

Lowest since 1987: 500mm (2006)

Highest since 1987: 1100mm (1995 & 2001)

SOILS AND NATIVE VEGETATION

The north facing slopes (with the house and shed) have heavy clay loam soils derived from Tertiary mud stones. The top soil is naturally high in organic matter, highly acidic (less than pH 5) and prone to waterlogging. Subsoils are mottled clays that erode freely if exposed. Although there are patches of deep, well drained alluvial loams along the creek many of the flat areas are actually heavy clays and prone to waterlogging. On the south facing slope there are areas of reasonably well drained clay loams but also infertile sands that cannot sustain pasture. The clays have dispersible subsoils making them prone to tunnel erosion in the drainage lines.

NATIVE VEGETATION

Manna Gum (Eucalyptus viminalis) and Blackwood (Acacia melanoxylon) would have dominated the creek and more fertile, better drained clays. Swamp Gum (E. ovata), Tea Tree (Leptospermum lanigerum and L. juniperinum) prefer the waterlogged areas. Narrow-Leaf Peppermint (E. radiata) is only present on the most infertile sandy soils. Bracken indicates well drained soils. Other native tree and shrub species include the Cherry Ballart (Exocarpus cupressiformis), Black Wattle (Acacia mearnsii), Bursaria (Bursaria spinosa), Prickly Mosses (Acacia verticillata) and the occasional naturally regenerating Pomdarris (Pomaderris aspera) along the creek now that it is shaded.

WEEDS

Crack Willow, Blackberry, Ragwort and Thistle are the most significant weed species. We stem inject the willows along the creek allowing them to die standing and contribute to deadwood in the stream. The Blackberry is sprayed and is being progressively pushed back, and cleaned out, of the forest areas. Ragwort is controlled through grazing, spraying and pulling. On the heavy soils, Thistles will emerge following any form of soil disturbance and are chipped or mown. The best control is the maintenance of ground cover.

Trees too can become weeds. We’ve removed some species having become concerned about their weed potential. Those that can be spread by farm stock, birds, floods or wind are of greatest concern.

AGRICULTURE

For the first 10 years we ran up to 400 Drysdale Carpet Wool wethers. Since then we have agisted around 200 breeding ewes and a couple of Alpaca that are run with the flock to protect the lambs from foxes. The pastures have a reasonable perennial component on the more fertile soils but are admittedly poor in other areas. Fertilisers have been applied on an occasional basis as has lime.
<table>
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<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>First Planted</th>
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<tr>
<td>Messmate</td>
<td>Eucalyptus obliqua</td>
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<td>Manna Gum</td>
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<td>Swamp Gum</td>
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<td>Black Wattle</td>
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<td>River Sheoak</td>
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To produce a high value sawn board sawmillers require a long, straight, large diameter log. Branches result in knots in the timber. Pruning when the tree in young confines the knots to the central core of the log. Whilst every species is different the fundamentals of tree growth and management for quality is similar. This discussion uses our experience with Eucalypts to illustrate the principles and practice of silviculture.

We aim to grow our Eucalypt sawlogs about six metres long with an underbark diameter of over 65cm and a knotty core of about 15cm. This log would have a volume approaching two cubic metres and can produce about 1 cubic metre of sawn timber of which half should be select grade. Accounting for bark thickness and log taper the target tree will need to have a diameter at breast height of around 75cm. On our best sites we can achieve this within 25 years - if we thin and prune!

THINNING TO PROMOTE DIAMETER GROWTH

Measurements of the Nelder wheel trial at Site 3 show the impact of competition on diameter growth. At higher stocking the trees begin to self-prune and self thin but only after the competition has slowed diameter growth. At wider spacings the trees have more leaf and therefore generate more sugars which flow down the cambium feeding greater diameter growth. At very open spacings exposure to the wind can affect canopy performance reducing both height and diameter growth.

I use forest basal area (cross sectional area of the trees at 1.3m) as a thinning guide. To promote diameter growth whilst retaining sufficient mutual shelter I like to thin a eucalypt forest so that the basal area remains between one third and a half of the tree diameter. For example, if the best trees have a diameter of 30cm then the forest should be thinned down to a basal area of 10m²/ha before it reaches 15m²/ha. When the best trees reach 50cm thinning down to a stocking of about 75 stems per hectare (my target for most eucalypts) will produce some small sawlogs and leave the best trees to grow on to a basal area of 25m²/ha. Species, such as Pine, that are more tolerant of competition can be managed such that the ratio of the diameter to basal area is 1.

Target stocking rates based on maintaining a Diameter:Basal Area Ratio of greater than 2 for eucalypts and 1 for the more tolerant Pines. In practice, the stand would be thinned in stages depending on opportunities for generating income from the thinnings.

PRUNING FOR HIGH QUALITY TIMBER

My aim in pruning is to first of all improve the form of the tree by removing large branches or double leaders. Then, as the tree develops, I follow with stem pruning to increase the proportion of clearwood. Although I adapt my techniques to the peculiarities of particular species the following outlines my standard approach:

1. Visit every tree, every year.
2. Make a judgement as to whether it is to be pruned or culled.
3. Remove all branches on the stem up to a point where the diameter is 8cm.
4. Remove any other branches from the remaining canopy that are over 2cm in diameter.

The simplest way to follow these guidelines is to make up a pair of callipers with openings that are 8cm and 2cm wide. These are placed over the stem or branch to determine what must be pruned. Of course, if the tree is very young there will be no stem pruning but you should still visit every tree to remove any large branches.

The pruning cut should remove the branch whilst not damaging the stem wood. Cut the branch at a point just out from where the base of the branch swells. Avoid leaving a stub that you could hang a hat on. I use a vertical ladder, harness, pruning shears and a folding saw.

Where to prune. A cut from A to B will minimise the area exposed and avoid damage to the stem wood that will overgrow the wound.
thanking you . . .

We hope you’ve found it interesting and look forward to your return visit to our little tree farm. If you would like any more information please refer to the contact details below.

Regards,
Rowan and family.

ACKNOWLEDGEMENTS

The Australian Master TreeGrower Program
The MTG is a project of the Department of Forest and Ecosystem Science at the University of Melbourne. The program provides regional courses and extension support for farmers and community groups with an interest in the establishment and management of forests on farmland. Since 1996, more than 1600 landholders have completed the 8-day program and around 50 have undertaken training as Peer Group Mentors.

In 2000 we were awarded the Eureka Prize for Environmental Education. The prize money has helped us run conferences and develop extension material. Initially supported by the Myer Foundation the program has been since funded by the Federal Government's Joint Venture Agroforestry Program and, more recently, Land and Water Australia.

The Otway Agroforestry Network
Incorporated through the Victorian Farmers Federation, the Otway Agroforestry Network (OAN) is a non-profit community group with around 150 financial members. The OAN began in 1993 as a federal government supported farm forestry project managed by a small group of landholders from two large Landcare groups in the region. Unlike many other government sponsored farm forestry projects the OAN didn’t focus on the establishment of demonstration sites and trials. The emphasis was always on community development. If farm forestry was going to work for farmers it would be the landholder themselves who would be the demonstration of its potential - not a patch of trees and roadside sign! Since its inception the OAN has raised more than $1 million from federal and state government farm forestry and Landcare programs.

The network has been instrumental in the development of the Australian Master TreeGrower Program and the Peer Group Mentoring concept.

And finally

Thanks to Courtney Bertram and Marianne Stewart for their contributions to the production of this booklet and to my family for their support.

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ROWAN REID (BACHELOR FOREST SCIENCE (HONS), MASTERS FOREST SCIENCE)

In 1985, Rowan co-authored the book Agroforestry in Australia and New Zealand which sold more than 5000 copies and is widely acknowledged as the first of its kind in Australia. At the time he was researching his Masters, working in agroforestry research, helping out on his brother’s dairy farm and travelling the country to learn more about trees on farms.

Rowan has since become a leader in the development of agroforestry education and extension in Australia having developed the first undergraduate and post graduate subjects in agroforestry and the Eureka Award winning Australian Master TreeGrower Program. In 2007 he extended the MTG program to include the training for Peer Group Mentors, a concept first introduced by the Otway Agroforestry Network of which he is a founding member.

Rowan has worked in many countries including New Zealand, Thailand, Vietnam, India, Kenya and Fiji and has travelled to many more to learn from their experience. He has shared his knowledge in hundreds of articles in newspapers and magazines, in his presentations at numerous conferences and field days, and through hosting thousands of visitors on a tour of this farm.

For more details about Rowan’s work see www.mtg.unimelb.edu.au

Thank you...