

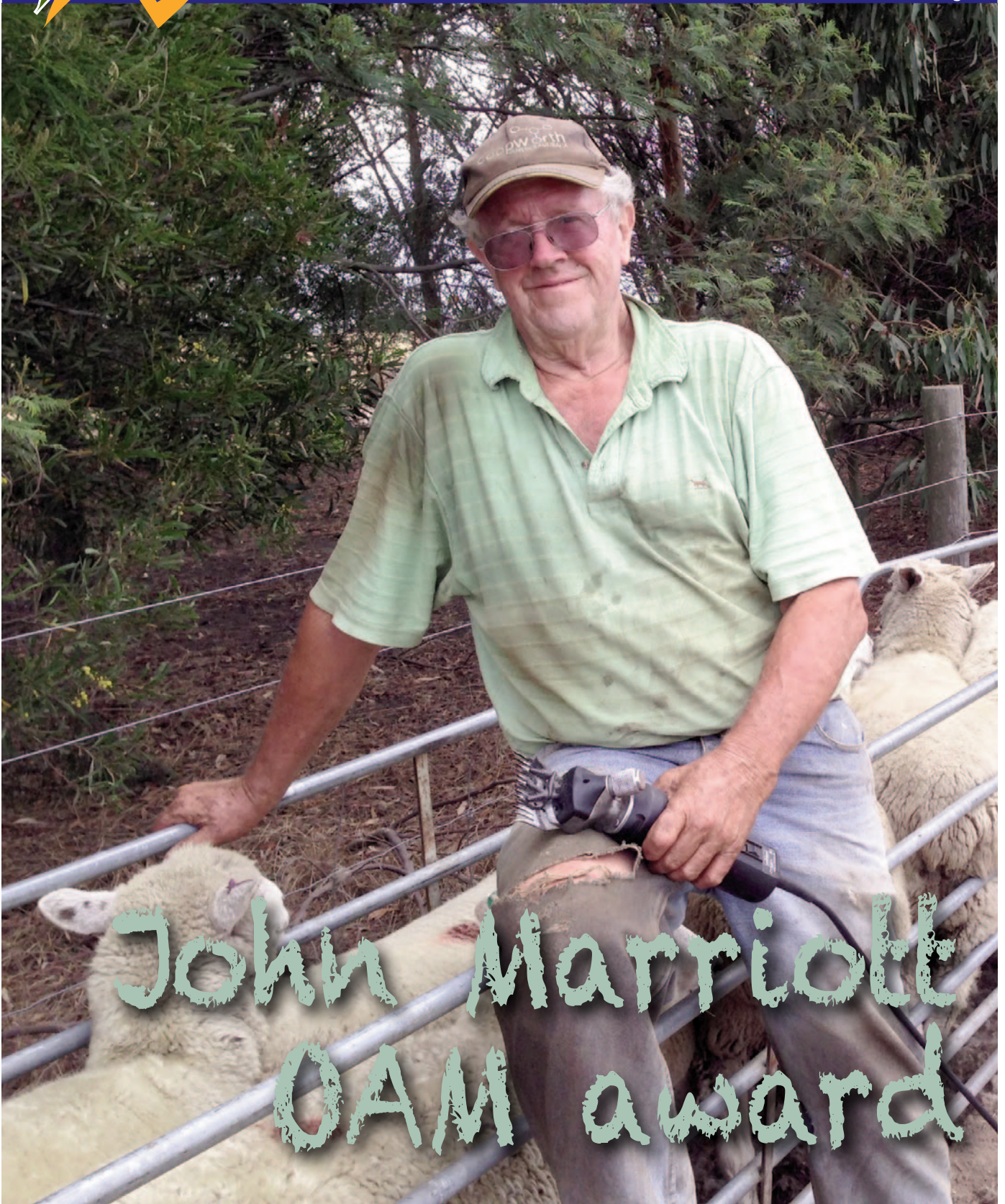


July 2023

Newsletter

C/- PO Deans Marsh 3235

www.oan.org.au



Around the Network

by Andrew Stewart

I am continually amazed by the breadth of talent and ideas that circulate around the Otway Agroforestry Network. The following short articles exemplify this. If you have made something or you have seen or read something that you think would be of interest to our members then email the details to : andrew.stewart@oan.org.au

John and Sue Marriott



In 2022, long term Otway Agroforestry Network (OAN) member, **John Marriott**, was recognised with a Medal of the Order of Australia (OAM) in the Queen's Birthday Honours List for his significant service to the sheep breeding industry.

John has had a very busy and productive life. Not only has he made a significant contribution to the sheep industry but he has made a significant contribution to the habitat that sheep live in with a focus on revegetating farming landscapes using the Whole Farm Planning approach.

John was very involved in the Potter Farm Plan in western Victoria in the 1980's, which led to many farmers adopting Whole Farm Planning.

He has been involved in various farm planning, land use management and land care organisations as a group facilitator and project officer including the Farm Management 500 program, which was the precursor to the current and very successful sheep extension program, Best Wool Best Lamb.

Sue Marriott AM, (John's wife) has also had a very high profile in rural industries as a passionate advocate and practitioner of Landcare since its inception in Victoria in 1986. Sue has worked in a range of specific Landcare extension projects and education enterprises, developing networks across Australia and internationally.



Sue was made a Member of the Order of Australia (AM) in the Australia Day Honours in January 2012 for her service to International Landcare.

In their busy lives Sue and John raised a family and have owned and run farms. Congratulations John and Sue on your wonderful contribution to society.

COVER PHOTO: John Marriott OAM



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National
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Program



Central Otway Master TreeGrower

Over the past couple of months, the Central Otway Master TreeGrower group has been moving around the network to a variety of OAN member's properties.

OAN has been working with the Central Otway Landcare Network (COLN) to deliver a locally run Australian Master TreeGrower Program (MTG) on behalf of the Australian Agroforestry Foundation. The award-winning MTG is more than just a short course on tree growing for farmers. Each course is run within a community of landholders and reflects their interests and aspirations for trees on their farms.

More than 2200 farmers across Australia have completed the course which was developed by Rowan Reid when he was working at the University of Melbourne. Thanks to Andy Gray and his team from COLN for coordinating a very successful program.

The following photos show some of the activities experienced by the twenty-seven participants. There will be a full report in the next edition of OAN's newsletter.



Ian Campbell (centre) on his property, Langibanoon, near Deans Marsh talks to participants about the community revegetation of the Yan Yan Gurt creek where nearly the entire length of the 20 km creek forms a wildlife corridor, connecting the Boonah bushland to the Barwon River. *Photo: Andrew Stewart*



Jimmy Musiime talking to participants about agroforestry and landcare in Uganda. Jimmy reflected on the MTG program in his home town of Kabale which was run by the Australian Agroforestry Foundation and members of the Otway Agroforestry Network in 2013. Jimmy then announced as a 10 year celebration there would be another MTG course run this year.



Day 1 MTG: field tour at Liz Hamilton's property near Gellibrand where she talks about the silviculture of her well grown Spotted Gum (*Corymbia maculata*). *Photo: Deb McSephney*



Day 6 MTG: Mike Robinson- Koss presenting on the principles of establishing seedlings at Kate Lidgerwood's and Peter Cuthbertson's property, Barongarook. *Photo: James Kidman*

Cont'd over

Stewart Mathison - DROP DOWN FENCE



When attending a field day some years ago at Stewart Mathison's property south of Winchelsea, I noticed he had used a fence design, which allows the fence to be dropped to ground level then quite easily returned to its original configuration.

Look carefully in the above photo at the cyclone wire attached to the post and you will notice a wire pin has been dropped through the staples to hold the cyclone against the post. Now observe the photo on the right.

Note that the wire pin has been removed allowing the cyclone to lay flat. The two top plain wires can easily be detached from the insulators by removing the black plastic pins. In order to lay a section of the fence down, remove the wire pins and black plastic pins from several posts then lay a couple of



weights such as old posts on the wires, which will flatten the fence for motorbike access or removing rogue livestock. The drop-down fence will be handy for access when thinning for firewood or harvesting saw logs. Wire pins can be applied to each post and is a cheap solution requiring very little time and providing access anywhere along the plantation.

The background in the photos shows a multi-purpose plantation on 'Yan Yan Gurt West Farm', which is on the boundary of a landclass subdivision and consisting of a variety of understorey and managed Spotted Gum (*Corymbia maculata*) along the fence line. It is considered that the Spotted Gums could be harvested as saw logs at about age 25 – 30 years. The plantation also acts as a bio link from one plantation to another.

Deb McSephney

OAN board member Deb McSephney spotted this segment on ABC TV Gardening Australia on how to make smoke water for propagation and thought this would be of interest to some of our members. Youtube link <https://www.abc.net.au/gardening/how-to/up-in-smoke/13860738>

Deb McSephney says... *"When learning about a new plant, I love to pick up the paint brush and create an artist's impression. I'm definitely not a botanical illustrator, but there's something about the process of looking, drawing, looking again, choosing the colours and the angle - the whole process of putting an image down on paper - that helps me get to know the plant. 'Hello Prickly Geebung, there you are.' "*



Agroforestry and small business development

By David Curry



Bringing portable mills to farms is an efficient way to saw timber. Nick Theodore (right) assisted Will Butler (left) with farm machinery to mill a Cypress pine log (*Cupressus macrocarpa*) into beautiful boards. Photo Andrew Stewart

The potential for small business development and even a small rural “industry,” oriented around agroforestry, has always been part of the mindset of OAN with a particular emphasis on farm product diversification. Agroforestry services such as tree planting, tree management, education, tourism, harvest and milling have also been at front of mind particularly for land managers with limited equipment or time.

What has happened?

Product diversification has included:

- **High quality timber.** Several OAN members have harvested and milled wood on their own properties using it for farm infrastructure such as shedding, carports, animal housing, cottages, house building and house renovation/upgrade. The farm grown timber has offered significant saving and access to resources when they are in short supply from external providers. Some timber has been sold externally and several members have consulted CERES Fair Wood in Preston as a potential outlet. CERES Fairwood specialise as an outlet for sustainable and recycled timber. (www.ceresfairwood.org.au). Some members are/have made and sold furniture and craft wood products such as spoons, bowls and bread boards from their farm grown timber. OAN has several “furniture makers” as members who are selling furniture indicating the potential high end market for farm grown wood.

- **Firewood.** Many members supply their own firewood from their agroforestry projects, some are selling firewood through local markets or direct to the many cottage tourism operations in the region. Savings are significant for both individual members and their customers and local convenience is a huge time/fuel saver. Farm grown firewood is a 100% renewable resource.
- **Cut flowers.** Several OAN growers are providing cut flowers and foliage to local and Melbourne based florists and functions. Direct access to outlets has been the key; removing the “middle people” and enabling cost reductions for everyone. A boost to this enterprise has been possible since the reduction of imported flowers due to COVID. Several members have included plants in their projects that have the potential for cut flowers in the future.
- **Native Food Products.** Some members are growing native food plants for local sale to restaurants and even interstate when the demand is there. The challenge is consistency of supply which could be enhanced with a cooperative approach between a range of growers. Mountain Pepper and River Mint have had some success.
- **Plant seed.** A small amount of seed has been sold/exchanged over the years to assist others in their tree growing endeavours.
- **Biochar.** Several members are producing Biochar to enhance their soil productivity and to sell to urban

growers for the same purpose. Biochar has the capacity to improve soil by retaining nutrients and water if activated with manure.

A commercial Biochar production facility has been proposed, utilising wood waste and tree thinning as a wood source. A potential small business.

- **Mushrooms.** Attempts have been made to establish significant production of log grown Shiitake Mushrooms on 2 occasions. Unfortunately the vagaries of growing fungus and an unknown market have provided too much of a challenge for ongoing success. Small growers are still supplying some local restaurants and small inoculated logs have been sold to interested participants. There is still significant potential for this product using thinnings from agroforestry planting as a growing medium.


Services

- **Seedlings.** Several local nurseries have been supplying seedlings for agroforestry and landcare plantings for many years. Some have also diversified their production to include selected forestry trees, native food plants and plants that have the potential to produce cut flowers in the long term. Agroforestry projects have provided significant business.
- **Planting services.** Again local nurseries and other "landcare" operators have been supplying this service since inception. It also has the potential to expand.
- **Fencing.** Significant fencing has been provided by contractors specifically for Agroforestry plantings adding to those fencing businesses.
- **Tree management.** Silvicultural services are offered by some members to assist those with limited time/capacity. With an expanding membership this could provide work on a semi regular basis.

A NEW BUSINESS

A new business which could boost the above is a milling /furniture making enterprise to be run from the old Deans Marsh CFA shed on the Deans Marsh - Lorne Road. The proprietor is Will Butler, an Industrial Designer, furniture maker and experienced dealer in all things wood. Will is offering a range of services including milling trees on site, timber machining and slab servicing with 3-phase power at the old CFA shed.

ESTIMATE COST TO SAW A LOG INTO DIMENSIONAL LUMBER



- 20 minutes for setup
- 30 minutes breaking down flitches
- 40 minutes resawing boards
- 20 minutes stacking, sealing and strapping

TWO MINUTES*

\$173.35 for 0.35 cubic meters* or average \$500 a cubic meter

Green (freshly fallen) logs have better recovery to due to even moisture content and ease of resawing.

*Based on a 450mm Diameter x 3m long log
sawn at a 75% recovery rate

- **Educational/agricultural tourism** programs are running on a private basis with the potential for expansion. Some schools and tourism operators are showing interest.

All the above are in their early stages of development and have the potential to be refined and expanded to become more established, consistent and stable.

Contribution to local economy

Using a guess at the above business turnover and including money brought in through grants it is estimated (very roughly) that \$500k is turned over/annum. This indicates that the current contribution to the local economy is around \$2million dollars a year. A multiplier of 4 has been used. A multiplier reflects money circulated in the economy and spent on numerous different occasions generating more business as it circulates. A multiplier can vary depending on circumstances, 4 is a common standard.

Funding from Government and Philanthropic trusts on their own have had a significant contribution employing people on a casual contract basis including catering businesses for field days etc. A conservative total of \$1.7million dollars brought into the community over 20 or so years has contributed \$6.8 million when a multiplier of 4 is used.

The potential is there for a more significant contribution to the economy. It would be interesting to conduct a detailed analysis in a few years to accurately estimate/predict that contribution.

BANDSAW MILLING SERVICE



Billies Blackwood
Premium Otway Timbers
EST. 2018





SLAB SAWN



DIMENSIONAL LUMBER

LET US COME TO YOU AND SAW YOUR LOGS INTO VALUABLE TIMBER

\$50 per hour setup fee
\$120 per hour for sawmill operation
End grain sealing and stacking available

Based in Deans Marsh & operating in the Surfcoast / Otway Area

0458344303 

WILLBUTLERID@GMAIL.COM 

WOOD.AND.WEDGE 



Will Butler's Norwood portable mill. Photo: Will Butler



Portable mills are capable of precision sawing as Will Butler has demonstrated here Photo: Will Butler

The challenges of contractual frameworks for forestry

By *Graham Holdaway and James Kidman*

Forestry, even short rotation forestry, presents challenges to anyone seeking to understand a couple of age-old but essential questions:

- is this a 'good idea' in terms of how it will / might impact my operations and options? and
- what sort of return might I expect on a particular investment of resources and time?

This is because forestry is one of the longest cycle enterprises anyone can enter. From as little as 10 to 12 years - to 30 or 40 years – to much longer than that. Weighing up the potential income generated from different activities on your farm is an important step in deciding if growing trees as commercial crops is viable.

Another important consideration from an Agroforestry perspective is - how could my farm benefit from the complementary benefits of tree growing? It is important to consider that in the farming environment the benefits of trees are not simply measured by the commercial value of the timber. For instance, irrespective of the commercial value of the sale of timber or tree products, do I still need shelter and shade for the sheep? Will erosion get better if I do nothing? Will I be encouraging biodiversity values by not planting trees? If looking at a commercial crop, you may need to compare the return of other enterprise options and consider the different agreement types and options that might be best suited for your site.

Evaluation techniques that have dominated private and public sector decision making over the last 40 years often end up being ill-suited to forestry – without significant adaptation. Graham has said to people on many occasions - "When most costs are near and certain and most revenues are distant and uncertain – you can have any IRR (internal rate of return) you want!"

It is not that we should not consider future costs and revenues. Rather we should be extremely careful in imagining that forecasts prepared now will end up being accurate.

The short version of what different and additional analyses might be considered goes something like:

- how are initial (and ongoing) costs to be incurred and how does one try to keep them 'efficient'; and
- how are revenues to be earned and, in particular, what arrangements are to be put in place to make sure that a grower gets access to a 'fair share' of the future market price.

Both these issues inevitably take a grower to the contractual arrangements that frame these costs and revenues. Such

things are commonly developed by counterparties whose every-day business is forestry - rather than by tree growers for whom tree growing is an irregular activity. Such a situation cries out ... beware!

When Midway Limited presented to OAN in 2019 they identified three main contractual options for intending tree growers and placed them on a graph which mapped risk and expected return. The graph and two slides on the following page explain the advantages, disadvantages and other considerations of new investment in forestry.

This is good material for anyone thinking about tree farming as a 'green-fields' exercise – whether for established commercial crops like *Pinus radiata* or *Eucalyptus globulus* – or for other less established options.

It may be less relevant to other OAN members who are not dealing with a 'green-fields' situation, but have planted trees at some time in the past. In industry terms, such growers are now 'mid-rotation'. For such growers, many choices have already been made – and expenses incurred. The main issue is now how to realise value for the investment. In Midway terms, such growers may be at the back end of an 'offtake' project. Others may have had a contractual counterparty from the outset.

But whether a prospective or existing tree grower – all tree growers face the ongoing challenge of trying to optimise returns. Which, as noted above, has two elements:

- ensuring costs are reasonably efficient; and
- trying to make sure that the grower gets a fair share of revenues.

In seeking to do this a tree grower will most often find themselves up against what economists call an 'information asymmetry'. That is - the counter parties will tend to know much more about what efficient costs and revenues are than the average tree grower.

Almost inevitably there will also be a resource asymmetry. That is – the counterparties will almost always have greater access to expert advice and market information than the average tree grower.

And, if one looks at what has happened in forestry over the last 30 years, it is hard to be positive about how tree-grower counterparties have operated. The reasons for this may be complex, but it is demonstrably not the case that suppliers of forestry services and offtakers of forest products have acted consistently in ways that lead to good outcomes for tree growers.

The consequences of this inadvertently affect processors in the long run by reducing investment by growers, resource security for processors and increase resource costs, which would have otherwise been lower due to a larger resource pool.

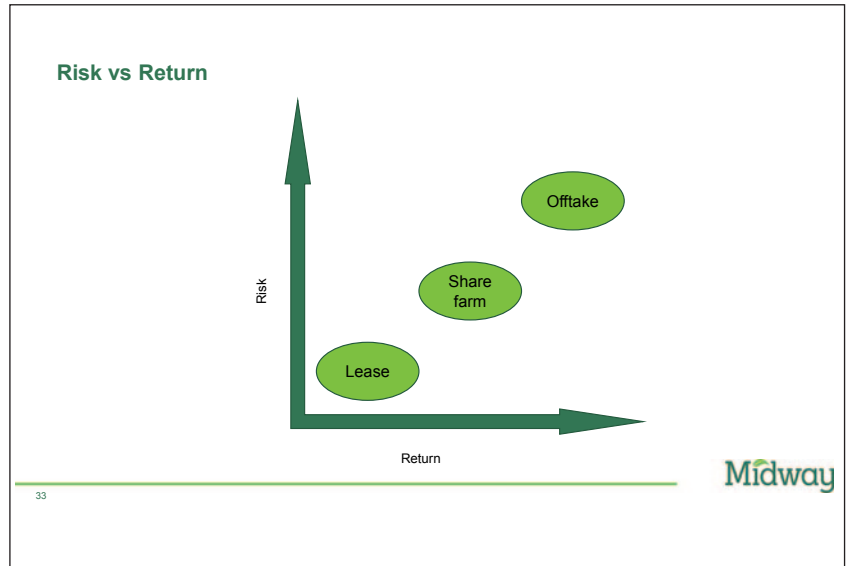
Another deterrent for growers is the lack of transparency and availability of current market prices for logs and timber products. How can growers determine the market value of their timber - just like they can for lamb or grain? There are a few data platforms which do provide some information on pricing, such as the Australian Pine Log Price Index (APLPI), the Timber Market Survey (TMS) and the Forests and Wood Products Association (FWPA) statistics. However, limitations in their timeliness and coverage of various products reduce the relevance as a guide for any particular harvest. The APLPI has good data on stumpage rates but is usually over one year behind and solely focuses on pine. Market information on native forest logs, hardwood plantation sawlogs and pulplogs is limited. Carbon credit spot pricing can be found on the Jarden website.

There is also a range of considerations when dealing with harvesting contracts that can leave you out of pocket. You might get good prices for good logs but small logs will be left if you haven't specified small log or pulp classes. This can leave you to do the clean-up which can also be an unexpected cost if it has not been specified. Clarifying exit clauses is also important – which some operators may do if markets change quickly due to the variability in the commodity markets of pine and pulp.

So – rather than having an easy answer to the challenge of contractual arrangements that work for tree growers – we could consider how farmers (and other groups) have dealt with similar problems in the past.

Up until the 1980s / 1990s and the 'economic reforms' of that time (in which one of the authors participated), such disparities in access to information and resources were often addressed by some form of cooperative organisation. By cooperating, groups of farmers got access to information and resources that 'balanced up' the market places in which they operated.

Mike Edwards from the Otway Agroforestry Network was active in facilitating the procurement, processing and sales of logs from farms with the Sustainably Managed Australian Regional Timbers (SMARTimbers) co-operative. This was a member-based co-operative based



Partnership Opportunities

Type	Description	Advantages	Things to consider
Lease	<ul style="list-style-type: none"> Midway pays an annual rent to the landowner Midway has exclusive right to the leased land to plant, grow and harvest trees Trees are owned and insured by Midway 	<ul style="list-style-type: none"> Secure annual income Lease rates equal with agricultural gross margins Flexible terms No capital costs No commodity risk No seasonality risk No production risk 	<ul style="list-style-type: none"> Comparison of potential lease income to current farm practices and income Identifying which parts of the farm would be suitable for leasing Determining how leasing may impact on remaining farm practices
Sharefarm	<ul style="list-style-type: none"> The landowner contributes the land Midway is responsible for: <ul style="list-style-type: none"> plantation establishment and annual management costs (including insurance) plantation expertise harvest, haulage, processing and marketing of product Midway and the landowner share in the total proceeds from the crop at harvest 	<ul style="list-style-type: none"> Higher returns compared to leasing Exposure to woodchip market prices Alignment of interests of landowner and Midway No capital costs No seasonality risk 	<ul style="list-style-type: none"> No income from the land until crop harvested (usually 10-14 years) Some commodity risk Some exposure to production risk i.e. drought affected plantation

31

Midway

Partnership Opportunities

Type	Description	Advantages	Things to consider
Offtake	<ul style="list-style-type: none"> The landowner contributes and is responsible for: <ul style="list-style-type: none"> the land plantation establishment and annual management costs (including insurance) Prior to establishment Midway signs an Offtake Agreement agreeing to purchase the trees in the future by either: <ul style="list-style-type: none"> Purchasing the timber at the Mill (Mill Gate Price) whereby the landowner coordinates and pays for harvest, haulage, delivery to the Mill OR <ul style="list-style-type: none"> Purchasing the timber at the stump (Stumpage Price) whereby Midway coordinates harvest, haulage and delivery to the Mill 	<ul style="list-style-type: none"> Higher returns than leasing and sharefarming Full exposure to woodchip market prices Trees pre-purchased by Midway in advance No seasonality risk Alignment of interests of landowner and Midway 	<ul style="list-style-type: none"> High capital cost in establishment years No income until crop harvested (usually 10-14 years) Commodity risk Production risk i.e. drought affected plantation

32

Midway

Note: (An offtake agreement is an arrangement between a producer and a buyer to purchase or sell portions of the producer's upcoming goods)



In Ballarat from 2002 to 2012 that oversaw timber processing and marketing for its members. It did not own any resources but facilitated the entire process alongside the member and received a commission from the sale of the end product.

The SMARTtimbers co-op dealt mostly with the many Sugar Gum plantings in the western district and were making profits up until its closure in 2012. This method removed competing interests and made the entire process a member driven joint interest that took control of its own returns by processing and marketing the product.

Otway Agroforestry Network members have had some joint harvesting activities to minimise harvesting costs and maximise returns over the years. However, besides providing general knowledge tailored to individual members and their needs, there has been no combined strategy to assist with contracts, harvesting, processing or marketing.

There may be opportunities for the OAN to assist in this space – keeping in mind the diversity of individual circumstances. For example, the OAN could create a basic contract template so that growers have a checklist so they don't get caught-out with harvesting costs.

There are also a range of existing local operators that can undertake services from harvesting and milling to retail sales that the OAN could bring together to meet members' needs. These include felling and loading, harvesting and haulage, mobile sawmills, fixed sawmills, timber grading, drying, treating, resawing, dressing, machining and both wholesale and retail sales.

There are increasing opportunities for connections to larger niche markets such as Ceres fair-wood, who support the marketing and sale of farm-grown timbers and have access to large markets in the Melbourne area.

Opportunities for group harvest operations to meet some demand for larger mills in Gippsland, such as ASH, could also be an option. However, given their timber supply requires FSC certification, meeting this demand would require the establishment of a group FSC certification scheme for local growers. The OAN is actively advocating for government assistance in reducing the costs of certification schemes.

More locally, Forrest Timber Products Australia, locally known as the Birre Mill, has services to resaw, dry and machine timber. This could be for a personal project or something to value-add and on-sell.

If you have some feedback on how the OAN could assist with contracts, market information and group harvesting/tree activities please let us know. If you provide any of these services or know of people that do, we would love to hear from you. Also if you are interested to know more about your harvesting options feel free to get in touch with your mentor.

Graham Holdaway: Tree farmer and OAN member; Analyst with long experience of discounted cash flow (DCF) and other investment analysis techniques; Experience with conducting business operations in low trust / high risk business environments (Indonesia and elsewhere)
James Kidman: Ecologist; manager of Otway Tonewoods; and OAN board member.

Amazing Otway proteaceae

By Mike Robinson-Koss

One of my earliest and fondest Australian memories after emigrating here was of experiencing my first banksia and thinking "how unusual this plant is" and so "southern". I thought I knew plants, but my knowledge was limited to the conifers and deciduous trees of the north. I literally felt out of my comfortable botanical knowledge zone! I'm still intrigued by this southern Gondwanan genus with its prehistoric flowers and sclerophyllous (drought tolerant) characteristics and just because they are just so beautiful! But I'm also intrigued by the whole Australian Proteaceae family and especially those species that live here in our Otways: The Grevilleas, Hakeas, Isopogons, Proteas and Lomatias as well as our one Banksia representative. So let's check them out.

Australia has over 80 species of Banksia, with the majority endemic to WA. These WA species are arguably some of the most spectacular flowering plants on the continent, if not the world! But many of these have evolved to live in very specific soils and are hard to transplant to our gardens over here in the eastern states. Mike and Mandy Edwards of Special Effects Nursery at Barongarook grow and sell the WA banksia species most suited to thriving in our Otway climate. Their knowledge is vital if you're interested in growing Banksias from the west.

Some people say the Silver Banksia (*B. marginata*), the one Otway representative of the genus, is a bit of a poor cousin to its WA relatives with its straggly habit and comparatively small, and nowhere near as intricate flowers. However, if I was a feathertail glider, yellow-tailed black cockatoo, ring tail possum or one of the dozens of honeyeaters that thrive on Silver Banksia for tucker, I'd say these shrubs are pretty important for keeping me alive and the ecology of the woodlands finely balanced. But, of course, I'm a mere human who enjoys nature and to me there is nothing more glorious than experiencing the golden glow of the silver banksia flowers on a cool April morning. It's one of the few autumn blossoms in our bush so it keeps the honeyeaters HERE!

The third largest plant genus in Australia is the 340 species strong Grevilleas. The Otways are represented by 2 species, both rare and confined to two tiny remnants. And both beautiful! The Anglesea Grevillea (*G. infecunda*) is apparently sterile producing no viable pollen so it can only spread by root suckers and can only be grown from cuttings. The other is the lesser known, but equally rare, Holly Grevillea (*G. aquifolium*), which is found from a small population near Forrest. These plants in their native habitat can be very sparse and shabby looking until, finally, come springtime when they light up the drab messmate and peppermint woodland with their deep red tooth brush flowers. A sight to behold!

The region certainly isn't a Protea hotbed in comparison with other places, but it does boast 11 beautiful, unusual and, for at least some, quite rare species. All but one Protea species in

the Otways enjoy free draining, impoverished, heathy soils. All of them have evolved specialised proteoid roots that secrete enzymes transforming normally unusable phosphorus into a useable form to assist these species survive the otherwise difficult growing conditions. These plants are survivors and if you try to propagate them, you'll need to grow them using a low phosphorus fertiliser and a free draining potting mix.

The Hakeas are the tough nuts of the Proteaceae family. You play with them at your peril! Gloves are an essential item when collecting seed from these shrubs which sport dagger sharp leaves protecting their hard woody seed capsules. Their spring flowers are white to pink gloriously twisted masses of anthers and styles hidden in a foliar jail! I remember years ago one (sadistic) customer purchased a few bushy needlewoods (*Hakea decurrens* var *physocarpa*) to plant at his back fence to deter the neighbouring school kids from jumping the fence into his garden. I wonder how that worked out for him! Beautiful but deadly!

The Victorian Smoke Bush (*Conospermum mitchellii*), the Prickly Geebung (*Persoonia juniperina*) and the Horny Cone Bush (*Isopogon ceratophyllus*) all are underrated Proteaceae members. They hardly get a mention when it comes to discussing the local proteas and I really believe it's because they're so difficult to grow AND keep alive if you do get some to strike or germinate! There is still so much we don't know about germinating some plant species. I believe timing of sowing and specific mycorrhizal and bacterial relationships all play a part in unlocking these plant's secrets. And Mother Nature grows them with ease...

Now, if I may, I'd like finish with one of my favourite Otway Proteaceae species and again, one you may not have heard of before. It's the tree Lomatia (*Lomatia fraseri*). And it's the odd one out. It doesn't grow in the poor impoverished heath country, it laps up life in the cool temperate rainforest and wet forest gullies across the high rainfall zone of the region. You'll see it hugging the edge of the Aire, the Gellibrand, the Cumberland, the Ford and the Barwon. It loves the shadows and the rainfall but just like it's cousins, it doesn't like wet feet. It may grow on the edge but its roots are above the flood zone. And this is a definite tree where it reaches upwards of 10m and sometimes more. It has a dense canopy which I'm sure is a prime perch for concealing powerful owls during their daytime siestas. Creamy yellow toothbrush blossoms literally fill the nearby spaces with a sweet perfume attracting those fleet-winged honeyeaters and their nectar cops, the red wattle birds.

Enjoy our Proteaceae family members, the ancient Gondwanan family we share with South Africa and South America, but don't forget your gloves, and eye protection and...

Mandy Edward's Banksias page 16 



Mycorrhizal fungi for plants

By Dr. Charline Henry and Andrew Stewart

Andrew Stewart visited Graham and Kristina Holdaway at their property "Carmyllie Farm and Forest" near Grenville for a Peer Group Mentor visit.

On this occasion, Andrew was fortunate to meet Dr. Charline Henry who was staying and working with the Holdaways. Charline, who is from France, told Andrew she completed her PhD in the tropical rain forest of Madagascar to study ways of restoring open cast mining sites. The goal of her study was to accelerate ecological restoration by stimulating soil microbial activity through the development of ectomycorrhizal trees. Her study showed that *Asteropeia mcphersonii*, a native tree naturally present in the mining area, can grow in disturbed areas and shares much of its mycorrhizal fungal partners with other ectomycorrhizal species in the area."

Andrew invited Charline to stay at "Yan Yan Gurt West Farm",

which she did so for several weeks. The Stewart family had a fascinating time working with Charline on the farm and learning much about mycorrhizal fungi for plants.

With Charline's agreement it was decided to share this knowledge with Otway Agroforestry Network members and other interested people by way of a field day on the farm. With only two weeks of advertising, forty-eight people turned up for a fascinating day of learning with Charline in charge. In preparation, Charline prepared a comprehensive power point about The Importance of Mycorrhizal Fungi for Plants.

The following is an article Charline wrote for this newsletter based on her presentation to field day.

Above: Dr. Charline Henry teaching Hannah Stewart (left) and Kristy Stewart (centre) how to identify ectomycorrhizae in a Shining Gum (*Eucalyptus nitens*) plantation. Photo Andrew Stewart

The importance of mycorrhizal fungi for plants

By Dr. Charline Henry



Participants divided into small groups to examine ectomycorrhizal fungi in a pine plantation

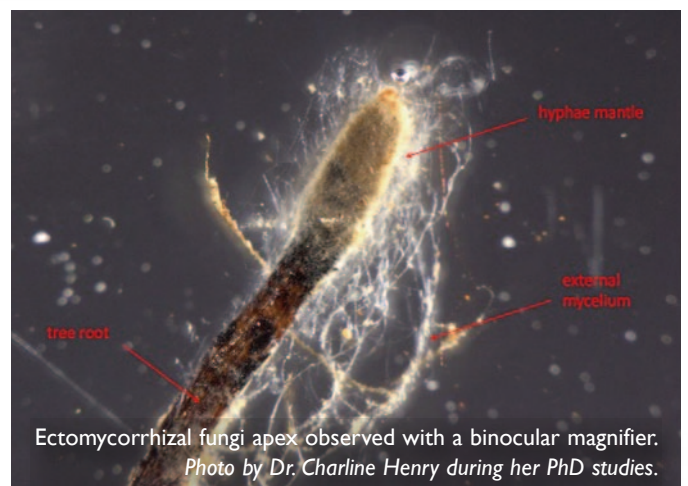
The word mycorrhiza comes from the ancient greek fungi (Myco) and root (Rhiza).

Mycorrhizae are symbiotic associations essential for one or both partners, between a fungus (specialised for life in soil and plants) and a root (or other substrate-contacting organ) of a living plant, that is primarily responsible for nutrient transfer. Mycorrhizas occur in a specialised plant organ where intimate contact results from synchronised plant-fungus development (Brundrett 2004).

During this session, we presented the two most common types of mycorrhizae: endomycorrhizae and ectomycorrhizae.

Endomycorrhizae, also called Arbuscular-Mycorrhizae or Vesicular-Arbuscular Mycorrhizae are characterized by the fact that the hyphae of the fungus penetrates inside the cells of the root. In the root, endomycorrhiza usually forms arbuscules, which is the main interface with the plant for nutrient exchange, and vesicles to store the nutrients. When stressed, endomycorrhizas relocate nutrients from the root into spores in the soil.

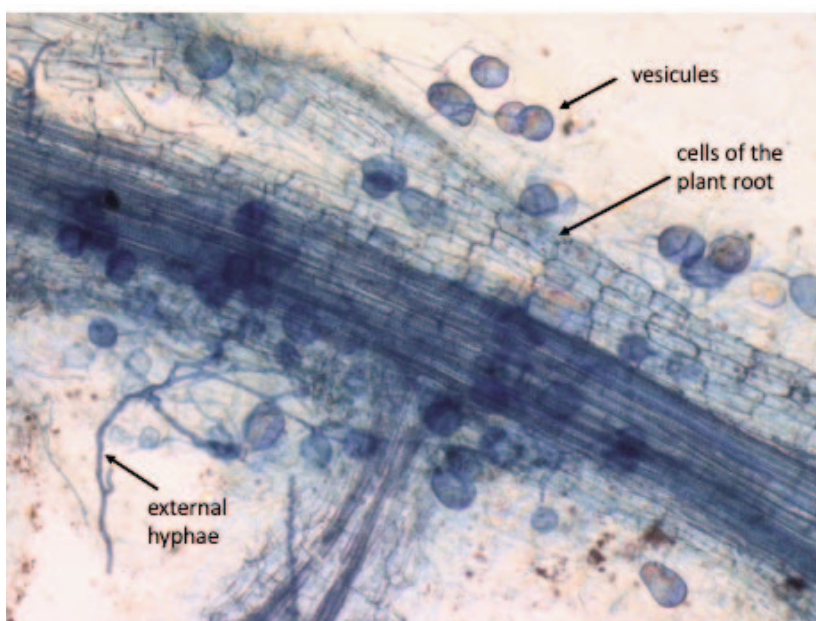
Endomycorrhizas can spread from different kinds of propagules: spores, mycelium from the soil or root fragments containing vesicles or hyphae. There are only a few hundred endomycorrhizal fungi species but they are generalists. It means they can be attached to every plant species able to form endomycorrhizas. But you need a microscope to observe them.



On the contrary, you can easily observe the second big type of mycorrhizae: the ectomycorrhizae. We call them ectomycorrhizae, because contrary to endomycorrhizae, the hyphae in the root stay between the roots cells, forming what we call the Hartig net. We can easily observe ectomycorrhizae without a microscope because the mycelium surrounds the short lateral roots, forming a thick hyphae mantle. Ectomycorrhizae usually form an above ground fruit body: a mushroom. There are more than six thousand species ectomycorrhizal fungi, but contrary to the endomycorrhizas which are generalists, they can be specific to a plant species, a plant gender or a plant family.



Hannah Stewart (left) and Jill Stewart (right) preparing microscope slides under instruction from Dr. Charline Henry to examine the presence of endomycorrhizal fungi in rye grass



Endomycorrhizal root observed with a microscope.
Photo by Dr. Charline Henry during her PhD studies.

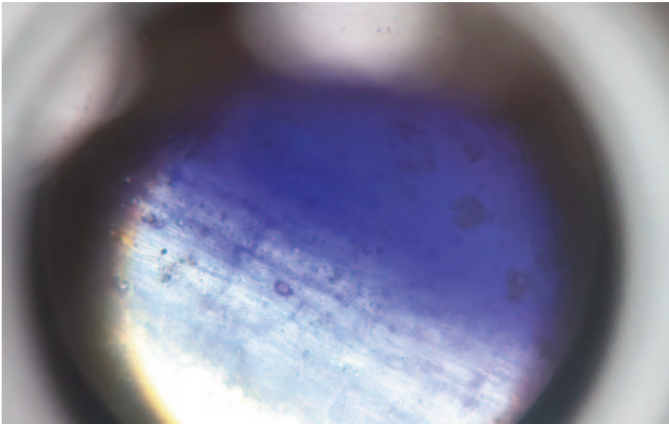
Between 80 and 90% of plant species form mycorrhizae. Most of them form endomycorrhizae, whereas trees of temperate forest usually form ectomycorrhizae. Some noteworthy families don't form mycorrhizae, as for example the Brassicaceae family and the Proteaceae family, including genera *Banksia*, *Grevillea* and *Hakea*.

Then, we presented the function and ecology of mycorrhizae. They are very important for plant nutrition.

Plants obtain carbohydrates from CO₂ in the air through photosynthetic activity. But nutrients such as nitrogen, phosphorus or potassium are dispersed in the soil. To obtain enough nutrients, plants must explore a large volume of soil. Producing a lot of roots to do this costs a lot of energy.

Mycorrhizal fungi can do this in a more efficient way, producing very long and very thin hyphae, allowing the fungi to explore a large volume of soil and very small cavities. Moreover, mycorrhizal fungi can absorb insoluble (and then non available for the plant) nutrients and transfer them to the plant. So, in poor soils, mycorrhizal plants obtain a big part of their nutrients from mycorrhizal fungi in exchange for carbohydrates. When soils are very rich in nutrients, plants can obtain them via roots and don't need the fungi. As giving carbohydrates to the fungi has a cost, the symbiosis can be broken and then the fungi die. But mycorrhizal fungi present other interests for plants. They protect them from pathogenic fungi, from some soil microbes, from toxic compounds and heavy metals. Moreover, a given mycelium is usually attached to several plants, creating a plant-mycelium-plant network. Carbohydrates can move through this network from one plant to another one, allowing for example plants growing in heavy shade to receive carbohydrates from a better-placed plant. This can be particularly useful for young trees. Finally, during the presentation we analysed the results of scientific articles, we realized that the effect of trees on mycorrhizal rates of surrounding crops is not clear.

We went into a pine plantation (*Pinus radiata*) as *Pinus radiata* are known to form ectomycorrhiza and as there was no understorey, we just had to dig a hole and we were sure that all the roots we found were from the pine trees. We divided the forty-eight participants into small groups of five people, and we saw a lot of ectomycorrhizae. There were a lot of fluffy white ectomycorrhizae, and some brown ones. Almost all the observed short lateral roots formed mycorrhizae. This gives an idea of the importance of ectomycorrhizae for the pine trees. This was the easiest part, because ectomycorrhizae are visible with the naked eye.



The photo above by Josh Rigg was taken down the microscope after the slide preparation in our make-shift lab. Dr. Charline Henry said the dark purple circle close to the centre of this slide is a vesicle in the rye grass root.



Dr. Charline Henry (far left) instructing field day participants on how to produce a homemade inoculum to improve the quantity of endomycorrhizae in the soil

But what about the endomycorrhizae, present in the roots of pasture grass?

We set up a make-shift laboratory in the "Yan Yan Gurt West" barn. Luckily, the Stewart family has three microscopes, and a participant brought a professional one (thanks Jaqui Kirkland). We had KOH (potassium hydroxide) from the local soap maker, white vinegar, ink and globes. We had everything to be able to observe the endomycorrhiza. Before commencing any investigation, it is important to address safety issues keeping in mind that potassium hydroxide is very corrosive. Thus, when handling the KOH, it is important to wear protective glasses, gloves, lab coat and a very well-ventilated area.

We took some thin roots from a rye grass plant from one of the Stewart's pastures, cleaned them in water, put them in a 10% KOH solution, warmed them at 90 degrees Celsius for 15 minutes (being very careful as KOH is very corrosive), then put them in white vinegar for 5 minutes to neutralise the KOH. This dissolved and cleared the contents of the root cells but the cell walls and fungi stayed intact.

The second step was to make the fungi visible. This was made by putting the roots in a 5% ink solution diluted in white vinegar (1 ml of ink for 19 ml of white vinegar) and warm them at 90 degrees Celsius for 5 minutes. We rinsed the roots in water and put them on a slide. We had the chance to observe a clear vesicle attached to a hyphae.

Finally, we saw how to produce a home-made inoculum to improve the quantity of endomycorrhizae in the soil.

The idea is to multiply the mycorrhizal fungi already present in a soil rich in mycorrhizae, by diluting it in an inert substrate and planting mycotrophic plants. As the soil will be poor because of the dilution, the mycotrophic plants will really need the mycorrhizae to develop and will boost them.

In a big pot, dilute 1 volume of soil, rich in mycorrhizal propagules (taken in a good pasture for example, 10-25 cm deep) in 3 volumes of inert substrate such as vermiculite. Use a volume which allow the roots to explore the entire volume. Sow mycotrophic plants (from *alliaceae*, *poacea* or *fabaceae* for exemple). Water for 2 or 3 months. 10 days before

harvesting, stop the watering and cut the aerial part. This will stress the fungi and lead to a mass production of spores in the soil. 10 days later, cut the roots in 1 cm length fragments (they contain hyphae and vesicles which are also propagules) and mix them in the soil. Your home-made inoculum is ready. In the field, spread 1 volume of your home-made inoculum for 10 volumes of soil explored by roots.

It is much easier for ectomycorrhizae. You can just take some soil in a forest containing trees which form ectomycorrhizae. Your inoculum is ready! But don't forget that ectomycorrhiza can be specific to a tree species. So, choose well the forest where you take the soil.

OAN board member, Mike Robinson-Koss, presented to us two other kinds of symbiosis that allow plants to access nutrients. Mike spoke about root clusters (proteoid roots) on banksias and other Proteaceae genera that can extract a useable form of phosphorus from the poorly depleted soils in which they commonly inhabit. The plants release an enzyme called phosphatase from the cluster roots to break the bonds in ferric phosphate, calcium phosphate and aluminium phosphate, which makes the phosphate available to plants. It is important when growing protea plants, be it in the nursery or in the field, to limit their access to phosphate fertiliser so they will produce the cluster roots to do the job for themselves.

Mike also explained how he adds mycorrhizal fungi spores and helpful bacteria in the potting mix he uses at Otway Greening. These beneficial additives help plants establish more quickly and easier once planted in the field.

To learn more about mycorrhizal fungi and see more photos google: mycorrhizal associations: the web resource.

Bibliography:

Brundrett MC. 2004. Diversity and classification of mycorrhizal associations. *Biological Reviews* 79: 473-495



Mandy Edward's banksias. 🐣 to page 11 for Mike Robinsons-Koss's article about our Otway proteaceae family