

ANALOGUE FORESTRY

Integrating conservation and production in farm forestry

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Integrating conservation and production in forestry is a common refrain in our forestry community – it was the theme of the Ballarat AFG national conference in 2004 – but we have largely only paid it lip service. Instead, the siren song most of us have chosen to follow has promised commercial returns and income diversification. Farm forestry as a source of environmental services and as a means of reviving rural communities continues to play second fiddle – for a variety of reasons extending from the local to the global.

This paper argues that our private forestry community needs to abandon old forestry paradigms. We think that the time is ripe for a new form of farm forestry – one that creates a strong ‘sense of place’ for participants and brings environmental stewardship to the fore, while tackling the commercial imperative imposed on us by higher order economic pressures.

In discussing why and how this might occur, the paper will move from the local to the global and present the main issues, as we see them, in the context of a national/international perspective.

The BRT's 'farm forestry' model

Most Ballarat Region Treegrowers (BRT) members have a farm forestry emphasis, ranging from woodlots in paddock corners to thinning native forests for native habitat, firewood and aesthetics. The common theme is “the use of trees to give rural properties additional environmental benefits” [1]. Consequently, underlying the activities of BRT is a philosophy grounded in localism; in a bottom up approach where farm forestry design is seen as having a foundation based on a sense of place and the need to integrate conservation and production.

The BRT 'Boosting Biodiversity' workshop in 2007 had Landcare nurseryman Stephen Murphy present his 10 revegetation design principles for restoring habitat for native fauna and flora across bare farmland. Stephen's 'blueprint' is based on his 25 years of practical observation and research in revegetation, so there is a far greater scale and complexity involved than simply plonking in skinny rows of shelterbelts or the odd multi species plantation of canopy trees. His blueprint did not, however, address commercial timber production.

We decided to work with Stephen to produce a guide that integrated best practice farm forestry designs with Landcare-style environmental revegetation principles. Out of this collaboration came the 148 page book *Recreating the Country* [2] published by AFG, and the concept of the 'biorich plantation': our 'missing link' – a model of revegetation that created high quality habitat suited to the site integrated with forestry trees for wood supply and income.

And a year after the book was published, we put the 'biorich' concept to the test on a swampy, bare degraded site near Lal Lal, south-west of Ballarat.



Figure 1: Aerial view of the ImLal biorich demonstration model site: ImLal South ripped and mounded in foreground.

The ImLal Biorich Demonstration Project

In 2010, BRT President and geologist Phil Kinghorn presented the multinational kaolin clay miner Imerys with the idea for a 10ha biorich demonstration project in one of their mine's buffer zones. Imerys Environmental Manager Brad Haywood was keen to work with the local community to improve the site's biodiversity, and the company gave the go-ahead.

BRT commissioned Stephen Murphy to design the environmental plantings, with Phil Kinghorn deciding on the forestry trees. In the first 5ha site to be planted (ImLal South), the forestry trees were arranged in clumps around the perimeter, easily accessible for later harvesting without damaging the biodiverse core. Here, the ratio of environmental to forestry plantings is 80:20.



Figure 2: ImLal South site design.

The second 5ha site, ImLal North, has the forestry trees arranged in rows on either side of a central access track. For ease of silvicultural treatment and harvesting, the forestry trees – whether clumped or in rows – have been established as pure single species stands. Both sites were planted by BRT members and locals.

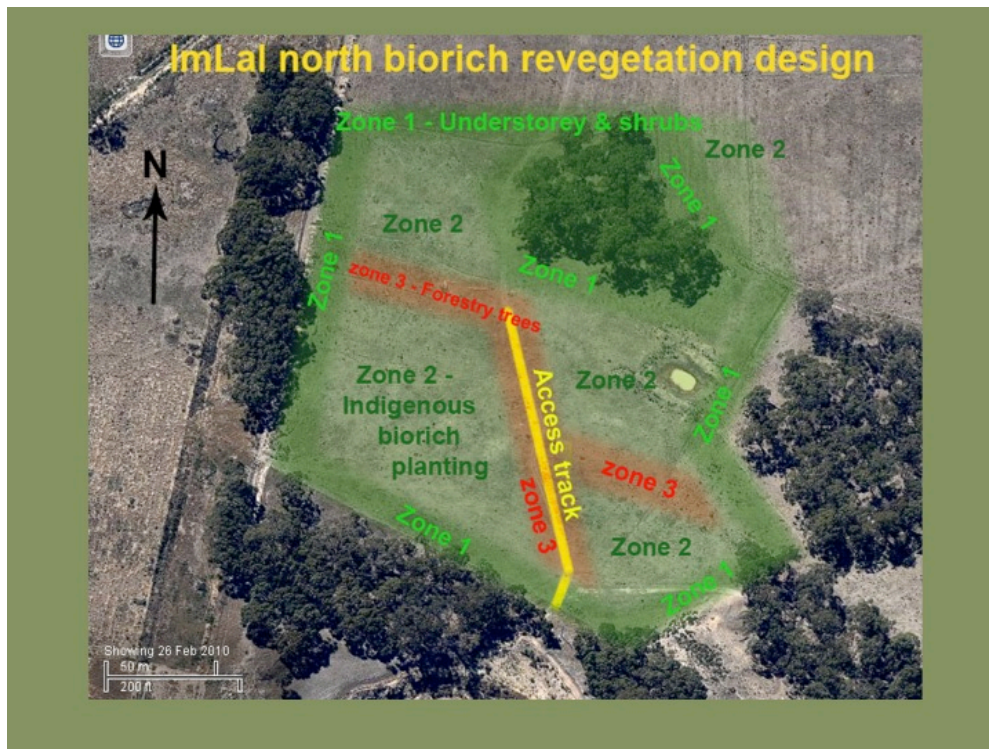


Figure 3: ImLal North site design.

The biodiverse component illustrates the difference between a biorich plantation and other polycultures or Landcare plantings. In particular, the biorich planting is not tree-dominated. All the plant layers are present, so we hope that a splendid biodiversity will return to this swamp woodland.

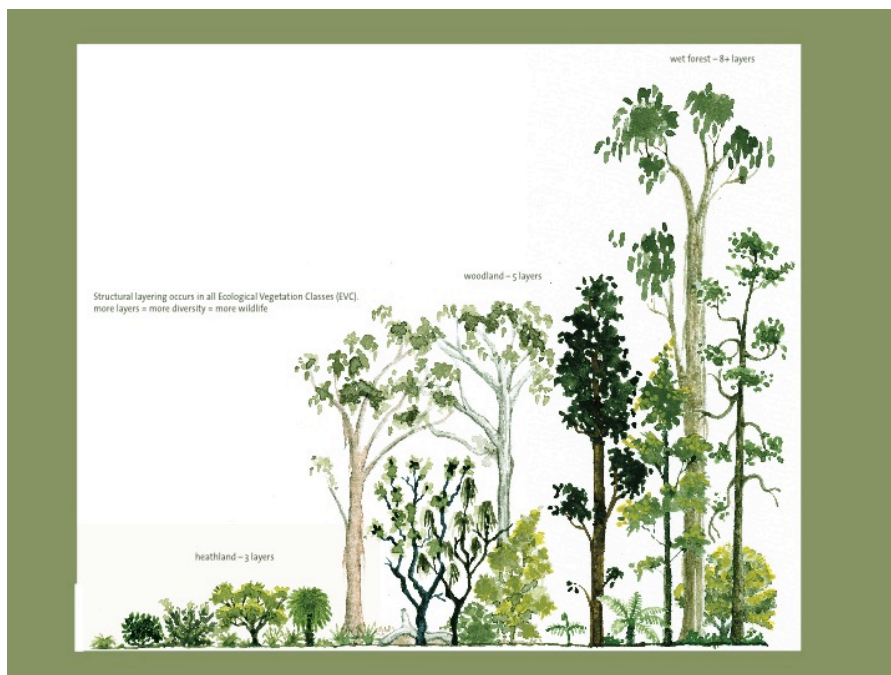


Figure 4: Bringing back the structural layering that occurs in natural forests.
SOURCE: *Recreating the Country* [2]

The first planting in spring 2010 established four vegetation layers – grasses and shrubs through to larger understorey and canopy trees. A total of 33 mostly endemic species from 16 plant families and 21 genera were planted in a clumped but somewhat random pattern. This diversity and complexity was designed to mirror what happens in a natural forest setting – in this case a swamp woodland – thereby recreating a wildlife-friendly and self-perpetuating native habitat for 200 years or more. We plan to top up diversity this spring by undertaking direct seeding.



Figure 5: ImLal South 20 months after planting: Phil Kinghorn among forestry trees on bottom right. Redwood seedling on ImLal North (bottom left).

The other major element is scale. Studies of remnant vegetation on farms have found that 10ha is a critical minimum size for supporting a variety of forest and woodland birds. Recent research by ecologists found that associating farm forestry with native forest remnants can have significant benefits for fauna. “Thick young plantations can, for instance, substitute for protective understorey. Linkages between plantations and native forest patches can act as ‘stepping stones’, particularly for highly mobile species” [3]. By placing ImLal North and South either side of a remnant patch of woodland and wetland, we are turning over 15ha into diverse wildlife habitat.

Almost two years after planting, the forestry trees on ImLal South are growing particularly vigorously. Plant monitoring by Ballarat University students recorded an overall plant survival rate of 88%. ImLal North was not as successful. Spraying in 2011 failed to adequately kill the heavy grass cover, which overwhelmed many of the seedlings. We resprayed the grasses and will replant this spring. Despite this setback, the Californian redwoods on this site are surviving well [4].

Custodianship

Besides the obvious benefits of appropriate site-specific land protection, habitat for native flora and fauna, shelter for livestock, renewable farm materials, aesthetics, carbon sequestration and alternative sources of income, a biorich plantation has one other incredibly important advantage – both to landholders and in the maintenance of sustainable landscapes. The biorich model does not seek to exclude humans. Where parks and reserves rightly have no place for resource extraction, the biorich model instead places human ‘interference’ (i.e. management) in a central role. Landholders are acknowledged as custodians, charged with maintaining biodiverse abundance both for people and the other species with which we share this planet.

We would like to think that this is a step closer to how Aboriginal people managed what Bill Gammage [5] describes as “the biggest estate on earth” prior to the newcomers’ landing at Botany Bay in 1788. Aboriginal people, he maintains, used purposeful fine grained application of fire to manipulate landscapes across the continent to achieve biodiverse abundance. Their management was integral to the park-like nature of the Australian continent so lyrically described by explorers and early settlers.

Look at Cooktown in 1770 compared to today [5, p.35-36]. Here, Captain Cook climbed Grassy Hill and recorded in his journal: “I had an extensive view of the inland country which consisted of hills and vallies and large plains agreeably diversified with woods and lawns.” Grassy Hill is now tree covered and the bald hills and the mosaic of clearings and forests he described have become uniformly forested.

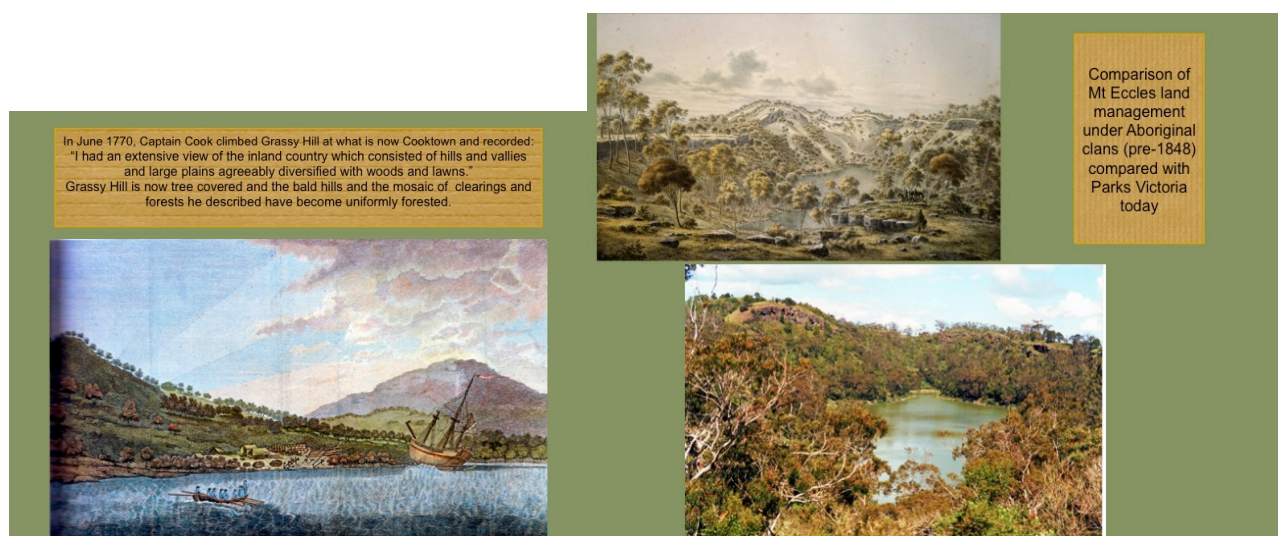


Figure 6: Images showing impact of Aboriginal land management on landscapes.

The scientifically trained Eugene Von Guerard meticulously recorded Mt Eccles (top right) a few years after the ending of Aboriginal land management. It was not only a lot more open 160 years ago than today under Parks Victoria management, but it has some peculiar artificial features – such as belts of trees running up slopes. These, claims Gammage, were for running kangaroos into traps or ambushes [5, p.46-47].

The Aboriginal people acted as Australia’s first custodians. We need to learn to follow in their footsteps.

PART 2: The practice of Analogue Forestry in the Asia-Pacific

It is this very same biodiverse abundance model that our Asia-Pacific small landholder neighbours are deploying under the title of analogue forestry for combating the ravages of deforestation, corporate monoculture models of agriculture and forestry, extreme climate events and endemic rural poverty.

Perhaps not surprisingly, we found that our biorich plantation concept was a 'reinvention of the wheel.' Really, it is a sub-set of the 'analogue forest' (AF) model. An AF is basically a human-created, tree-dominated ecosystem that is analogous in structure and function to a site's original climax or sub-climax forests. An analogue forest might be planted with species expected to be found in the forests of that area, or grown through 'seral stages' to reach a climax/sub-climax equivalent [6]. Crucially, an AF is also created to provide short and long term commercial and environmental value, so may use species exotic to the site or even nation.

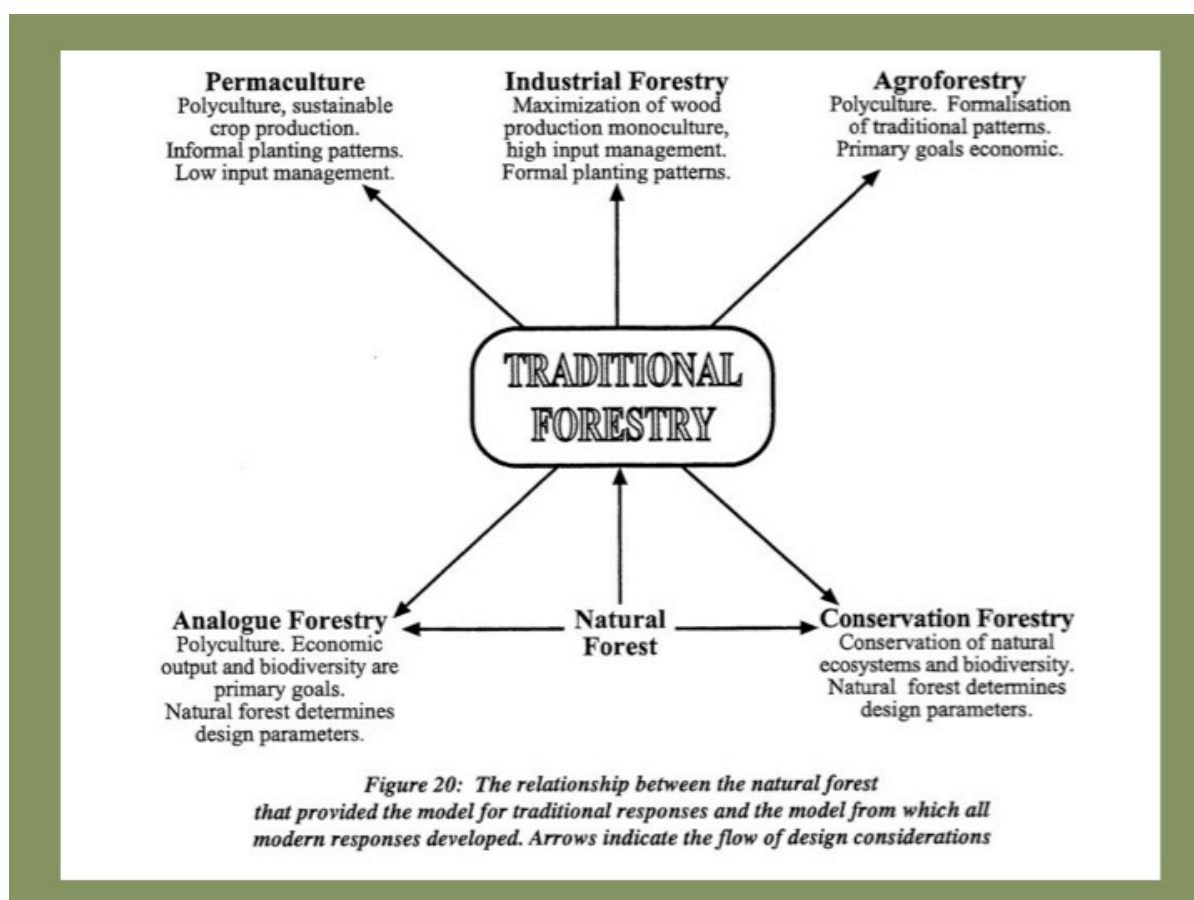


Figure 7: Comparison of analogue forestry with other forms of forestry.

SOURCE: Senanayake, R. and J. Jack [7]

As Figure 7 shows, an analogue forest is different from agroforestry, permaculture, and monocultures in that the original forest once on site acts as the starting point for revegetation design, thereby optimising biodiversity.

After our biorich model was accepted as a type of analogue forest by the International Analog Forestry Network, BRT became the first Australian organisation to join.

Over our horizon – Sri Lankan analogue forestry

In an extraordinary coincidence, it was the local shire environmental planner, Victoria Mack, who pointed out that analogue forestry was flourishing within our region. As a director of the Secretariat for International Landcare [8], she had been supporting analogue forestry at its source in Sri Lanka. No need to look to Scandinavia for inspiration. Analogue forestry practitioners among our Asia-Pacific neighbours have much broader economic and social agendas than we envisaged.

Ravil Senanayake first developed the concept in Sri Lanka by modifying traditional village gardens. He explains that, “Analogue forestry is a response that seeks to address both the genetic and cultural issues of biological loss” [7].

A century ago, Sri Lanka’s mountainous areas were largely stripped of their protective, moisture-absorbing forest cover and converted to monocultures of tea, coffee, rubber and more recently pine, eucalypt and acacia plantations. Less than 8% of natural forests remain. The consequences have been devastating, with severe erosion when the heavy 2,500mm monsoon rains arrive, while in the dry season, springs and stream gullies dry up. Consequently, traditional farming practices were lost, replaced by those that further stripped the declining forest cover and contributed to accelerating rural impoverishment.

The Sri Lankan analogue foresters recognise the value of those lost ecosystems, and seek to restore productive capacity to the land, bring in genetic diversity, establish protective vegetation layers, and give local people more control over their way of life and natural resources – especially food and building materials.

Kamal Melvani of the Neo Synthesis Research Centre (NSRC) is utilising analogue forestry’s silvicultural techniques to “empower rural communities both socially and economically through the use of species that provide marketable products”[9]. The ‘sense of place’ inherent in seeking to mimic site-specific natural forest structures is carried through to consulting with landholders about their dreams and desires.

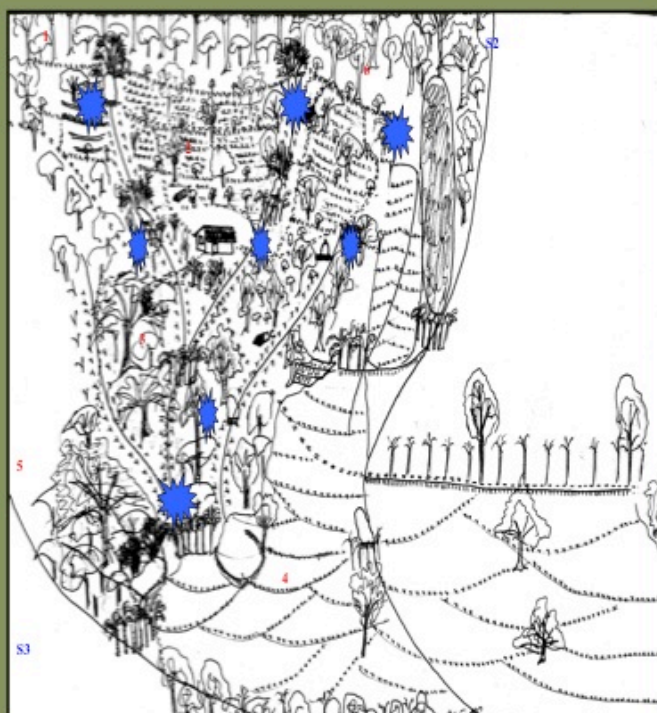
One of the NSRC’s first broad scale applications of analogue forestry was to help farmers living on the mountain of Maragalakanda to reverse forest cover decline while increasing their incomes.

The NSRC established a demonstration model on the treeless 8ha plot of a poor farmer, Jane Nona, who was growing just one crop. The plot was high up the mountain and as a preliminary step, the closest natural forest in the area was visited and the architectural structure, species composition and ecological functions of those species were studied.

Figure 8 shows key features of the design, which led to 5,000 trees, shrubs and plants being established. Native species sourced from nearby forest ringed the perimeter of Jane Nona’s plot and all gullies were renovated. Around the homestead, water was diverted from a marsh area for a vast array of tropical tree crops. Rice paddies were established using traditional rice varieties and applying traditional low impact methods of management. Ornamental trees flanked a walking trail.

Design of Jane Nona's garden by Kamal Melvani

– divided into six sections based on contours, physical features and drainage pattern



Key features:-

- (1) Endemic species planted adjoining the forest [sourced from forest itself];
- (2) Fruit and vegetable garden around house;
- (3) Biodiverse plantings in degraded gullies;
- (4) Traditional rice varieties and methods applied in paddy fields;
- (5) Walking trail with indig ornamental trees [*Delonix*, *Tabebuia*, *Cassia*];
- (6) Very rocky area planted with fast growing trees, vines and succulents to establish cover.



Holding pond

Figure 8: Design of Jane Nona's garden in Sri Lanka.

SOURCE: *The Water Towers Project* by K. Melvani


After two years, 25% shade over her land allowed Jane Nona to change her cropping pattern from annual to shade loving crops. Using forestry as nurse trees is ideally suited to the tropics, where many valuable food crops grow best under a canopy.

After four years, Jane Nona's income had risen fourfold. Revegetation had built up leaf litter and moisture retention in her soil, even during the dry season. Frogs and skinks, birds and butterflies returned to her plot.

This success allowed the NSRC to recruit 51 farmers at Maragalakanda to implement analogue forestry. After intensive mapping of land features and extensive consultation, the NSRC drafted individually specific AF farm plans. Over 2003 and 2004, 155,000 trees and shrubs from 205 species were planted on 4,350 acres, with analogue forestry filling the gaps, linking mature natural forest.

The farmers then formed the Maragalakanda Watershed Restoration Organisation, introduced thrift and savings schemes and are now exploring Forest Garden Product Certification for their 'organic' farm produce. This model was replicated in four adjoining catchments.

NSRC has since led three other major AF projects [10]:

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THE WATER TOWERS PROJECT
The community based restoration of the Kalkanna Oya watershed in the Lipton Valley, in Sri Lanka

Work has already started on the 'small' tea gardens - 'water towers' of the region. The tea is being sold separately as a 'tea for water' and the gardens are being planted with a mix of useful trees and other crops such as cinnamon, cloves and avocado. The 'water towers' are being planted with a mix of useful trees and other crops such as cinnamon, cloves and avocado.

Across 23 tea plantations in Lipton Valley

 - restoring gullies with natural rainforest
 - replanting mountain ridges with useful trees
 - shading tea plants and diversifying with other valuable crops such as cinnamon, cloves and avocado.

(On right) Kamy Melvani, Neosynthesis Research Centre

Going global

A recent study by the United Nations Food and Agriculture Organisation (FAO) [12] examined wood production and scenarios of future wood supply from the world's 'planted forests' (plantations and planted semi-natural forests). Fuelwood production exceeds the production of industrial wood, but the amount of fuelwood likely to become

available from 'planted forests' through to 2030 is a fraction of the likely 'planted forest' industrial wood supply (see Figure 10). In the absence of investment in creating new sources of fuelwood for the world's poor, native forests in places like Asia-Pacific will continue as the overwhelming source of fuelwood, placing even more pressure on their long term health.

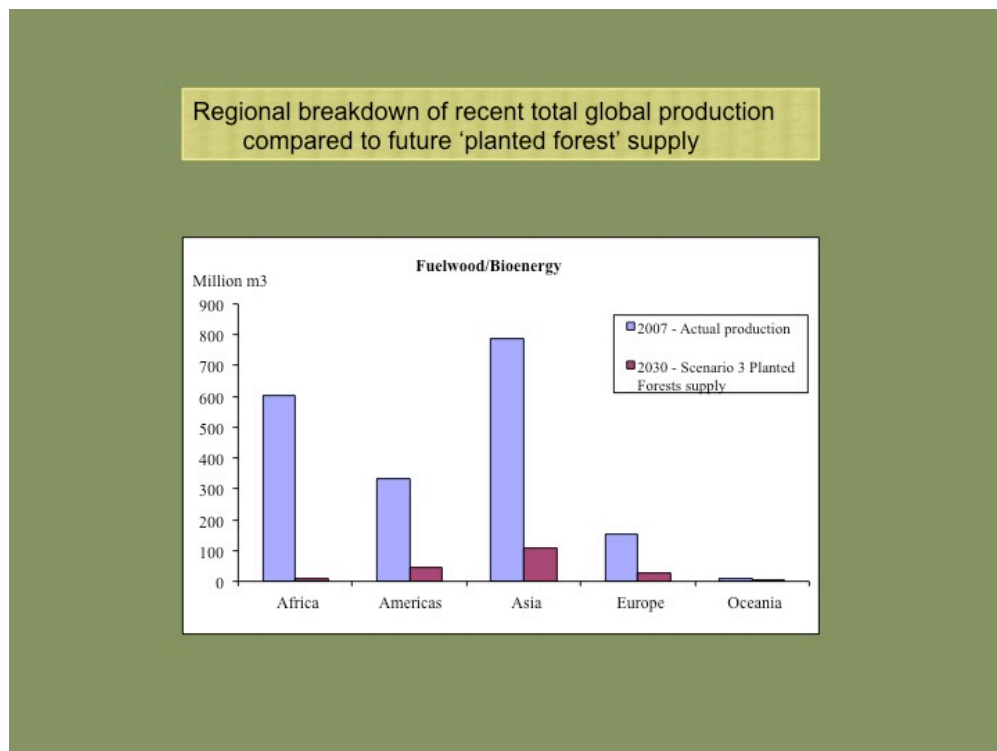


Figure 10: Projections to 2030 shows that under current projections fuelwood supply from natural forests will greatly outstrip that from planted forests.

SOURCE: FAO data in Penna [13]

Across SE Asia, smallholders have collectively established plantation cover over an area three and a half times greater than have corporate growers (2.303 million ha cf 0.636 million ha [14]). These millions of small scale farm foresters in the Asia-Pacific are our neighbours. Like International Landcare, we ought to see it as in our interest, as well as theirs, to support efforts aimed at increasing their food security, improving their access to a prime source of energy and building material (i.e. wood) and lifting them from poverty.

Tropical forester and author of *Regreening the Bare Hills*, David Lamb argues for new plantation paradigms in the Asia-Pacific region. Forestry methods that have served in the past "will no longer prove sufficient," he says, in meeting the region's mounting challenges. As well as population pressure, climate change and the ravages resulting from land clearing, the region's rising middle classes are increasingly concerned about biodiversity conservation and protection of water quality. He concludes [15]:

"Simple monocultures of fast growing species may serve pulpwood production, but may be quite unsuitable for forests supposed to protect watersheds, conserve biodiversity or sequester carbon over long periods... What this means is that Australian forest growers should be willing to explore and innovate, testing new methods of reforestation and remaining open to the new opportunities that are likely to emerge."

AFG has the potential to reach out and engage with Asia-Pacific's smallholders. AFG's CE Warwick Ragg is a member of the International Family Forestry Alliance, which partners the G3 group of organisations, representing locally controlled forestry worldwide [16]. He has begun the process, but there is a long way to go. Agroforestry is supposedly the cornerstone of many overseas rural aid programs. Why aren't we part of the delivery process? Moreover, AF in our region does NOT seem to have a commercial forestry component. AFG could work in partnership with International Landcare or Oxfam, for instance, to inject commercial forestry into AF designs.

The biorich and analogue forestry models seem ideally placed for bridging the gap between rural communities and foresters, here and overseas.

Meeting the triple bottom line

We need a circuit breaker between the old model of monoculture forestry and new more participatory, bottom up models that deliver the triple whammy of environmental, social and economic services. AF has the potential of meeting the triple bottom line of fulfilling environmental, economic and social functions for farmers who are more than foresters.

- **Environmentally**, an AF design enhances **biodiversity** by mimicking the structural composition of the local natural forest.
- **Economically**, an AF design incorporates **productive resources** either for **sale** or **use** by the landholder.
- **Socially**, the 'sense of place' of an AF design requires **consultation** with and **collaboration** between landholders.

So long as the original natural forest determines design parameters, and the integrity of the species composition and structural layering is retained, opportunities exist for a whole range of AF models and ratios across a wide continuum. AF founder Ranil Senanayake is working with designs that reverse the ratio of our ImLal biorich plantation. While remaining structurally analagous to the original nearby Sri Lankan native forest, Figure 11 shows a once bare site now transformed with five layers of 80% tropical crop trees and shrubs to 20% biodiverse plantings.

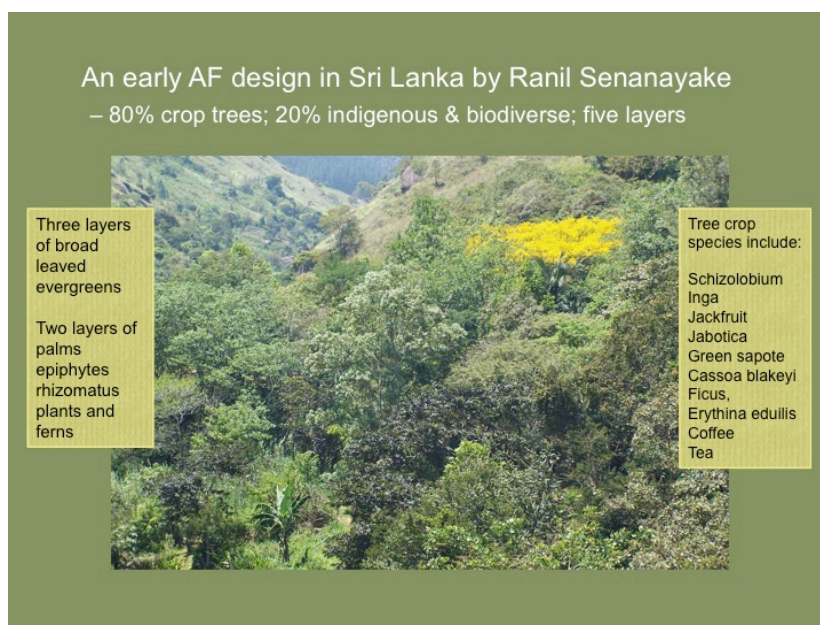


Figure 11: An early Analogue Forestry area in Sri Lanka. Source: Ranil Senanayake

Three AF design ideas for Australian conditions

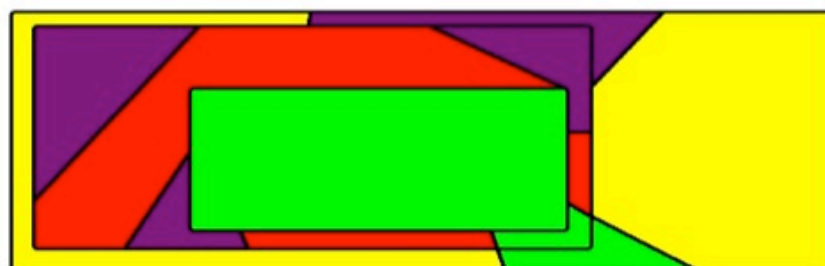
Finally, we would like to present three ideas for introducing analogue forestry into Australian rural enterprises. Analogue forestry is founded on respecting the wishes and desires of local landholders, rather than seeking to displace them. Australian farmers no doubt wish that corporates like McCains, Woolworths and Coles started from the same 'localism' premise.

AF Design 1

The simplest model is based on the standard paddock. In the centre of AF Design 1 is the biodiverse core with forestry adding bulk and acting as a further buffer. The forestry is represented in the illustration as a mix of fuelwood (yellow) and short and long term sawlog production (purple and red).

This model echoes the design parameters of United States national parks policy, where there is a pure biodiverse core at the heart with rings of commercial exploitation increasing in concentration the further the distance from the centre [17]. Ideally, square or circular designs best reduce negative edge effects and protect native flora and fauna from predation by feral animals and invasion by weed species [18] – see further AF Design 3.

AF Design 1: Biodiverse core in paddock with forestry adding bulk and acting as a buffer



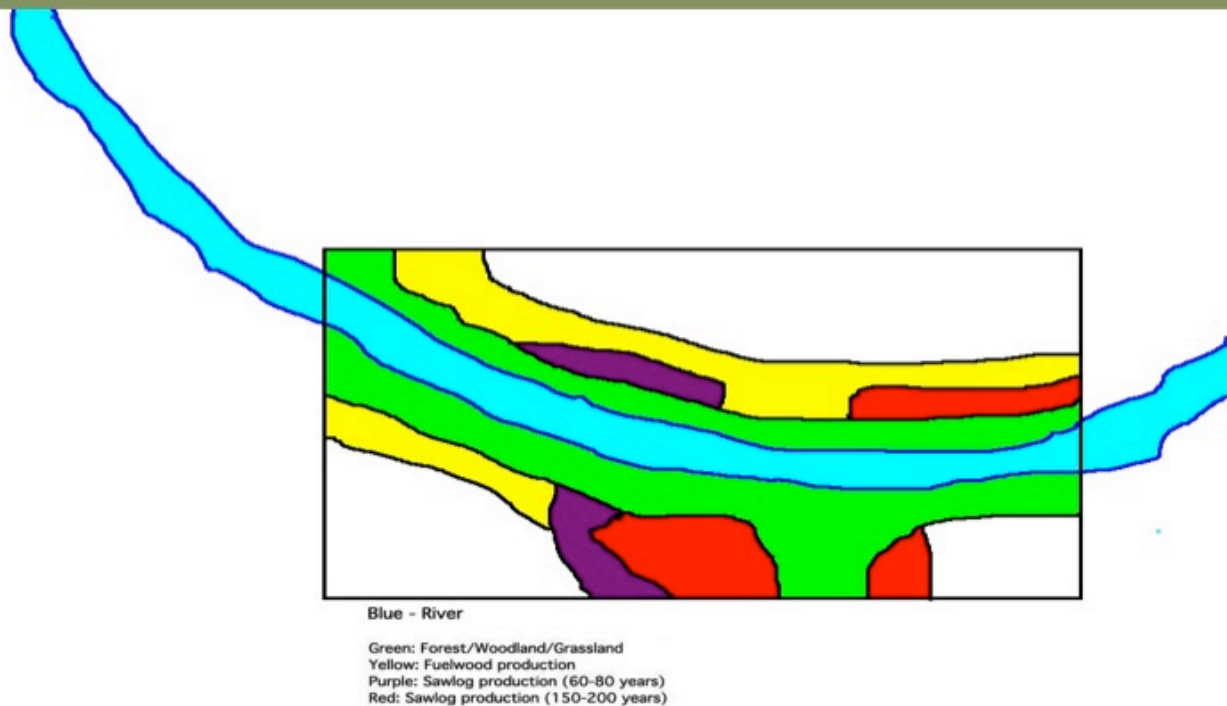
Green: Forest/Woodland/Grassland
Yellow: Fuelwood production
Purple: Sawlog production (60-80 years)
Red: Sawlog production (150-200 years)

AF Design 2

It is generally acknowledged that riparian zones form the richest sources of biodiversity and act as corridors for wildlife. Corridors allow wildlife to move from one habitat to another. North-south corridors will prove crucial to aiding species to adapt to climate change.

The AF Design 2 model would involve bulking out riparian biodiversity with farm forestry and ensuring that any adjacent productive rural enterprises did not compromise the perpetual regenerative role of the recreated analogue forest. Once again, the forestry is represented in the illustration as a mix of fuelwood (yellow) and short and long term sawlog production (purple and red).

AF Design 2: Biolink in a riparian zone bulked out by farm forestry



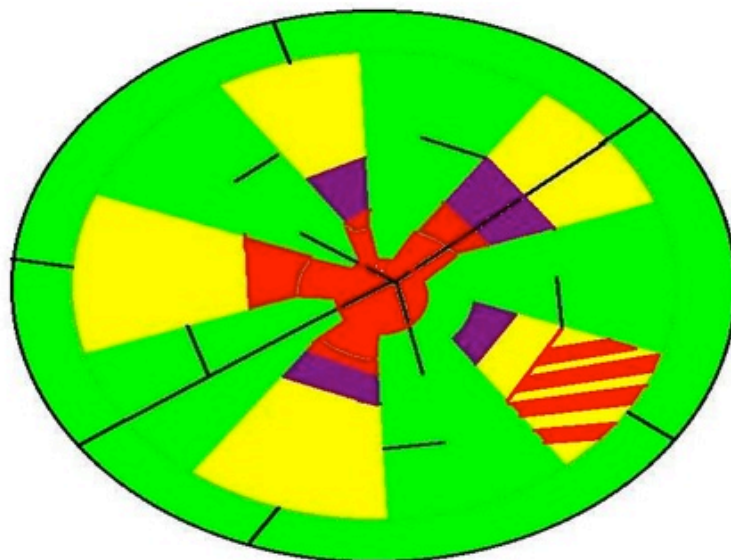
AF Design 3

While other models shown here are for relatively small areas, this design could be applied to both small areas (tens of hectares) and large areas (hundreds of hectares). It illustrates that the design approach should not be limited by narrow or static visions of what might be suitable for an area, and to show that the issue of 'time' needs to be considered in designs. It also demonstrates that the commitment to the forest's perpetuation and its environmental and economic values needs to cover several human generations.

A circle is used here for convenience, but the general concept and forest shape could be adapted to the landscape in which the analogue forest is to be located. In contrast to other designs, the wood production areas are enclosed by the environmental plantings, with shorter rotation production areas as 'spokes' around the longest rotation area at the core. One of the shorter rotation areas is shown as striped yellow and red to indicate that after 50 to 100 years part of the fuelwood area could be converted to a long rotation sawlog production area that would mature after the core area is logged out completely. However, if the area covered some hundreds of hectares, then each production area could be logged over a period of time, and not in one year, depending on demand for the wood products.

AF Design 3: Taking the long view with rotations planned over generations

Green: Forest/Woodland/Grassland
 Yellow: Fuelwood production
 Purple: Sawlog production (60-80 years)
 Red: Sawlog production (150-200 years)
 Black: Tracks



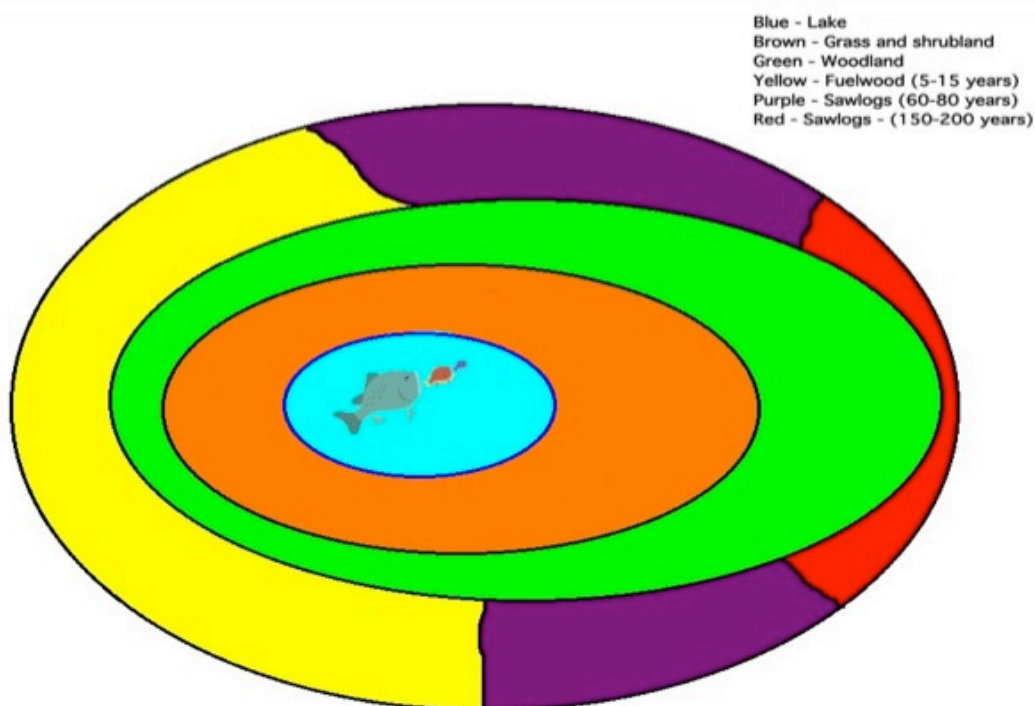
AF Design 4

This design adapts what Bill Gammage [5, p. 59-63, 187-195] described as a classic Aboriginal pre-1788 land management template. Around wetlands or lakes, Aboriginal people would frequently create a clearing so that the water was surrounded not by trees, but by grassland, which attracted happily grazing Aboriginal stock – kangaroos. The grassland – in brown in this illustration – would in turn be surrounded by sheltering woodland, which not only modified wind speeds and added to the pleasing park-like aspect so beloved of explorers and pioneering settlers, but provided an ideal ambush site for hunters.

We are not suggesting we go back to a hunter/gathering existence, but what we have here is what Professor Mike Archer would call an analogue ecology – which is yet another step up from analogue forestry [19]. Under this scenario, indigenous sources are optimised for both environmental and productive purposes. An obvious example is reintroducing kangaroos as livestock along with their favoured pasture of kangaroo grass. Or paying farmers to breed or care for endangered native species as the Southern Cross Group of Scientists has suggested [20]. Less controversially, analogue ecology models might incorporate indigenous flora like thryptomene or banksias; or indigenous food crops or medicinal plants.

We might even stop being strangers in a strange land, and look for our culture and affirmation of identity in this place, rather than far away to the north in another hemisphere.

AF Design 4: First two rings mimic a classic '1788' Aboriginal land management template, consisting of grassland around a wetland, fringed by woodland



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