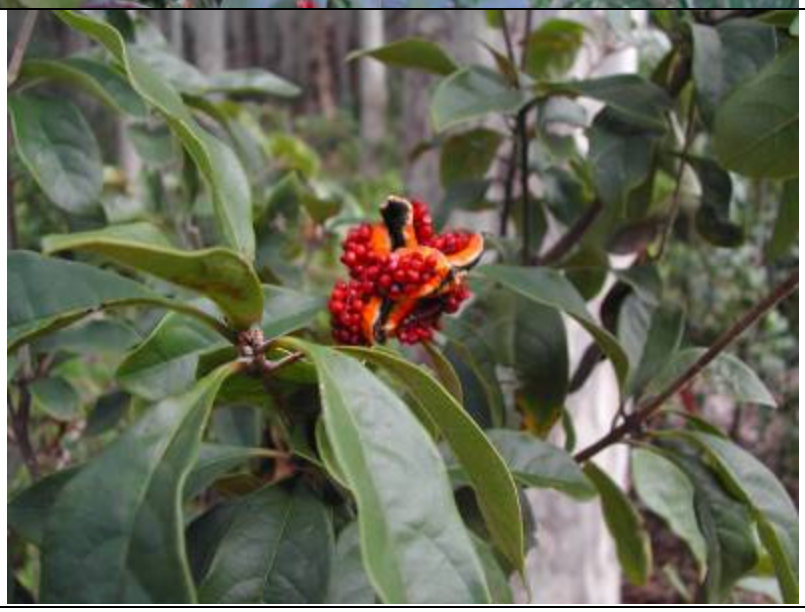
CONSERVING AND REPAIRING RAINFOREST DOES MORE THAN PRESERVE RAINFORESTS



The illustrated plant species support a range of animals: Jungle Grape *Cissus hypoglauca*: Superb Fruit-Dove, Satin Bowerbird, Grey-headed Flying Fox, Humans; Red Olive Plum *Elaeodendron australe*: Pied Currawong, and Rough-fruit Pittosporum *P. revolutum*: Silvereye. Four are seasonal migrants (Superb Fruit-dove, Silvereye, Satin Bowerbird and Pied Currawong, one is a resource migrant (Grey-headed Flying-fox) that need many patches; the latter is a ***keystone species*** in adjacent eucalypt forests out-crossing many species and thereby maintaining their genetic vigour. Repairing rainforest does so much more than just conserving these animals!

Legal status

The restoration of rainforest is well underway, but only across a limited area: with 20 sites and more than 165ha of rainforest being restored in East Gippsland (Table S1), with 10 sites comprised of about 200ha of rainforest and associated vegetation in southern New South Wales (Table S2). In the last 5 years, in East Gippsland alone, over $1,000,000 has been spent on rainforest restoration. That represents an investment average of $6,060 $ha^{-1,}$ with $200,000 coming into the region each year. In 2006, the Victorian Government announced a further investment in riparian vegetation restoration on the lower Snowy River of $7,000,000, 58% of which (~$2,618,000) will be for rainforest restoration. On average over the 6 year life of the riparian restoration project, this represents a doubling in annual funding.

This prompts the question: why are governments (and by extension the community: you and me), bothering to restore rainforests by investing such large amounts of money? Such large and sustained investments are the result of many factors, including community and political support for rivers in general and rainforests in particular. The successful promulgation of knowledge in your community – to funding agencies, bureaucrats and politicians – are all important components in this process. But surely there are deeper more basic reasons for wanting to restore rainforests. Let us explore some of them.

Legislation

A number of rainforest communities have been listed under the Victorian *Flora and Fauna Guarantee Act* (FFG) *1988,* the New South Wales *Threatened Species Conservation Act* (TSC) *1995* with one: Littoral Rainforest being listed as Critically Endangered under the Federal *Environmental Protection and Biodiversity Conservation Act 1999* (Appendix S1: worksheet: Nomination status or potential). It is expected that some of these, and some additional coastal types (Littoral Rainforests) described for the first time in this publication, could also be listed under Victoria's *FFG Act*. The listing process commits the government (and the community at large) to give priority to the allocation of natural resource management effort and funding to conserving these rainforest communities.

Conservation status

In south-eastern Australia, rainforests provide habitat to a staggering array of biodiversity. Although it is beyond the scope of this publication to list all of these, some values have been compiled and are summarised in this section to give you a bit of a glimpse (Appendix S1 and Appendix S2). The rainforests of south-eastern Australia (to a lesser or greater degree) provide habitat and support the life-cycles of the following number of taxa:

Plants and animals:

- 70 fauna taxa are rare or threatened or Federally listed as migratory: 20 mammals, 21 birds, 4 reptiles, 2 frogs, 7 fish, 11 *invertebrates* and 5 insects (only butterflies and dragonflies/damselflies were examined)
- 135 flora taxa are rare or threatened 57 (42%) are restricted to or largely only found in rainforest, 26 (19%) are usual in rainforest but found elsewhere, while 52 (39%) are widespread in the landscape.
- Following a partial examination of the Victorian rainforest flora by the author and David Cameron (*DSE*) using *IUCN* criteria it has been determined that of the 134 taxa randomly assessed to date: 32 (23%) are critically endangered, 31 (23%) are endangered; 25 (19%) are vulnerable, 19 (14%) are near threatened; and 27 (20%) are of least concern (Appendix S1: worksheet: IUCN flora determination status). Major factors contributing to this worrying trend are threats associated with past land clearing and ongoing population losses that are related to one or a combination of factors including: climate change, disease, forestry operations, megafires, Sambar Deer and weeds
- 173 fauna taxa are at their *geographic edge of range*: 12 mammals, 23 birds, 10 reptiles, 4 frogs, 27 fish, 5 invertebrates and 92 insects [only two groups were examined: butterflies (24 species and subspecies) and dragonflies/damselflies(68 species)]
- 432 of the 735 plant taxa (59%) recorded for rainforest are at their geographic edge of their range: which are comprised of: 9 % at their northern limit, 47% at their southern limit, 10% at their eastern limit and 17% at their western limit; with another 11% that occur more widely as taxa that are found in a rainforest edge of range (note that one species may mark several cardinal points of its edge of range)
- Biogeographically these plant taxa can be described as: 84% occurring in the South East Corner Bioregion (primarily plants of Subtropical, Warm Temperate, Gallery, Dry and Littoral Rainforests at the edge of their range), 12% occurring in the South Eastern Highlands (primarily plants of Cool Temperate Rainforest and Warm Temperate Rainforest at their edge of range), 3% occurring in the Australian Alps (only plants of Cool Temperate Rainforests at their edge of range), and 2% occurring in the Flinders Bioregion (some plants of Cool Temperate and others Warm Temperate Rainforest at the edge of their range)
- 38 (5%) of the plant taxa are regionally endemic to south-eastern Australia.

Rainforests (Appendix S2: worksheet: Rainforest edge of range):

- Have high *endemism*: 49 of the 57 rainforest types (86%) being restricted to south-eastern Australia
- 36 of the 57 rainforest types found in the south-east (or 63%) are restricted to one or other state (Victoria with 25; New South Wales with 19).

A comprehensive study of the rainforests of Victoria by Peel (1999) found that a significant proportion of the rainforest flora is restricted to rainforest and of these 30% of their number are either rare or threatened; some of which are Victorian Rare or Threatened Species (*VROTs*) and others are Australian Rare or Threatened Species (*AROTs*). Of the 23 rainforest floristic communities described for Victoria by Peel (1999), 14 were, at the time, listed under the *Flora and Fauna Guarantee Act 1988* as threatened. These are:

- Cool Temperate Rainforest listed as Cool Temperate Rainforest community includes the following floristic communities:
    - *Otways* Cool Temperate Rainforest
    - *Otways Redwater* Cool Temperate Rainforest
    - *Central Highlands* Cool Temperate Rainforest (Peel 1999)
    - *Central Highlands Montane Riparian* Cool Temperate Rainforest (Peel 1999)
    - *Central Highlands Montane Scrub* Cool Temperate Rainforest (Peel 1999)
    - *East Gippsland* Cool Temperate Rainforest (Peel 1999)
    - *East Gippsland Montane Riparian* Cool Temperate Rainforest (Peel 1999)
    - *East Gippsland Montane Scrub* Cool Temperate Rainforest (Peel 1999)
    - *East Gippsland Overlap* Cool Temperate Rainforest (Peel 1999).
- Warm Temperate Rainforest includes the following communities:
    - *East Gippsland Coastal* Warm Temperate Rainforest (Peel 1999) listed as Warm Temperate Rainforest (Coastal East Gippsland) community
    - *Alluvial Terraces* Warm Temperate Rainforest (Peel 1999) listed as Warm Temperate Rainforest (East Gippsland Alluvial Terraces) community
    - *Hinterland* Warm Temperate Rainforest (Peel 1999) listed as Warm Temperate Rainforest (Far East Gippsland) community
    - *Coastal Ranges Overlap* Warm Temperate Rainforest (Peel 1999) listed as Warm Temperate Rainforest (Cool Temperate Overlap, Howe Ranges) community.
- Dry Rainforest includes the following communities:
    - *East Gippsland Karst* Dry Rainforest (Peel 1999) listed as Dry Rainforest (Limestone) community.

Nationally, Littoral Rainforests of the South East Corner Bioregion have been included in a nomination under the Environmental *Protection and Biodiversity Conservation Act 1999* collectively known as: Littoral Rainforests and Coastal Vine Thickets of Eastern Australia Ecological Community. The nomination was approved and it became legally protected on 9 October 2008. The listed ecological community covers the area from Cape York Peninsula southwards from Princes Charlotte Bay (north of Cooktown) in Queensland to the Gippsland Lakes in Victoria. For details of the bioregional species lists and its distribution, see Definitions and Synonymy: *EPBC Act* Condition Thresholds for the Littoral Rainforests and Coastal Vine Thickets of eastern Australia.

In New South Wales, several rainforest *ecological communities* (the equivalent of Victoria's ecological vegetation class of the same name) have been listed under that state's *Threatened Species Conservation Act 1995*. These include:

- Subtropical Rainforests (on floodplains) listed as: Lowland Rainforest on Floodplain
- Dry Rainforest of the south-east New South Wales listed as: Dry Rainforest of the South East Forests in the South East Corner Bioregion
- Littoral Rainforest in the whole of New South Wales listed as: Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

The level of threat to rainforests is also highlighted by the fact that many of the plant communities that surround them are also under threat in the same regions and have also been listed including (for New South Wales): Swamp Oak Floodplain Forest and Lowland Grassy Woodlands of the South East Corner Bioregion. In Victoria, Littoral Rainforest would be eligible for listing under the *Flora and Fauna Guarantee Act 1988*, should anyone take the time to nominate it – as are many other rainforest types across the region *(*Appendix S1: worksheet: Nomination status or potential).

Rainforest values

Introduction

The values of rainforest presented in this section are discussed from many perspectives. Their considerable intrinsic values, role in biodiversity and their *conservation significance* are dealt with in more detail elsewhere. The perceived value of rainforests to people are as diverse as there are people, but their inherent rarity in the landscape and their starkly different composition, appearance and ecology to that of the rest of the vegetated landscape means that most people have a view about them. The following sections canvass some of those views.

Landscape values

- Improve urban and rural amenity both at the site of the rainforest stand and downstream
- Often present along streams, they play an important role in preventing erosion and maintaining water quality
- Rainforests are some of the most effective vegetative fire breaks available (Additional Reading: Ignition times)
- Provision of migratory species habitat..

Traditional cultural uses

Culturally, rainforests have a special place in the psyche of Australians. The importance of rainforests to individuals much idiosyncratic but the cultural value is not only people-specific, but also cross-cultural. These sites are still culturally significant for Koori people (Figure S50) because they provided food, shelter, medicines, materials (Figure S51) and spirituality (Additional Reading: Koori cultural use of Littoral Rainforest in south-eastern Australia De Souza-Daw *et. al*. 2000; AAV (2007).

For the rest of us more recent arrivals, it is more likely to be because rainforests have been represented as synonymous with the tropics (holidays, relaxation and a good time). In a hot dry climate, this strikes a chord with the heat-stressed populous: the rainforests' leafy shaded and cool depths are indeed an oasis. From a conservation perspective, their value lies in their conservation status: the rarity of many of their plants and animals, some of which have a high ***fidelity*** to rainforests and consequently rely on them for their survival and evolution.

There has been a significant loss of indigenous people's cultural information in our region (Stuart Cameron pers. comm.). Even so, we have been able to document seven major categories (across 84 sub-categories) with 250 odd species or groups uses by local Koori groups for Littoral Rainforest alone in the South East Corner Bioregion. The full compilation is listed in Additional Reading: Koori cultural uses of rainforest of Littoral Rainforest in south-eastern Australia, while the following is a summary:

- Five site-based uses including: totems, birthing, religion and burial (6 species and several rainforest types)
- Provision of water: (3 species)
- Beverages: (10 species)
- Plant foods: (across 12 categories) including: cones (1 species), fruits (30 species), grains (8 species), *pods* (2 species), green leafy vegetables (13 species), gums (4 species), *manna* (4 species), flowers (1 species), nectar (1 species), shoots (4 species), roots and tubers (13 species), vegetable hearts (3 species), fungi (4 species)
- Animal foods: (across 4 categories) including: birds (7 species); insects (6 species); mammals (10 species); reptiles (2 groups)
- Medicines: (across 28 categories) including: mouth ulcers (1 species); asthma, coughs, colds and sinusitis (4 species); bandages (1 species); burn or wound dressings (1 species); general dressings (2 species); bites and stings (1 species); contraception (1 species); decoctions (5 species); diabetes (1 species); dysentery remedy (1 species); extracts for sore eyes (1 species); headache treatment (2 species); indigestion (1 species); ligatures (4 groups); local anaesthetic (1 species); poultices (2 species); rheumatic treatments (5 species); skin infections (2 species); promotion of sleep (1 species); snakebite (1 species); splints (3 species); stomach disorders (1 species); stingray stings (1 species); toothache treatments (1 species); tonics (2 species)
- Materials: (across 34 categories) including: animal skinning knives (1 species); baby basket lining (1 species); basketry (4 species); blankets (1 species); boomerangs (1 species); breathing straws to catch waterfowl (1 species); bullroarers (1 species); bush soap (1 species); canoes (3 species); carrying bowls (3 species); cement (3 species); clubs (3 species); digging sticks (1 species); dyes (1 species); firesticks (4 species); floats for fishing nets (1 species); mats (1 species); necklaces (1 species); rafts (1 species); resin (1 species); sandpaper (1 species); shields (7 species); spears (1 species); tinder to conserve fire between camps (1 species); throwing sticks (3 species); string (11 species); thatching (1 species); 'tie-wire' (1 species); tree-climbing belts (1 species); wallets (1 species); water-carrying bowls (2 species); weaving (4 species); and weaving needles (1 species).

When we fully understand these uses, and those that have been lost to us, we will be the ones who have been 'restored to Country' as well as the sites that we seek to reinstate: both are a healing process that we should all aim to achieve.

THE MAJESTY OF RAINFOREST

Figure S50. Nachanuka, New South Wales. This site is culturally significant to the local Koori people. This massive Rusty Fig, *Ficus rubiginosa*, occurs in Subtropical Rainforest and Dry Rainforest at this site. It produces huge crops of fruit over an extended fruiting season (10 months out of 12) and they are delicious to eat. Many other resources, both physical and spiritual, are provided by rainforests.

RAINFORESTS WERE SHOPPING CENTRES FOR KOORI PEOPLE

Figure S51. Maringa Creek, Nyerimilang Heritage Park, Victoria. Two beautifully crafted and decorated weapons from East Gippsland's *Gunai/Kurnai* made from Blackwood *Acacia melanoxylon*, [the tree on which they sit (Yanun to the people who made these implements)]. The wood is prized for firesticks and shields; the bark used to make fishing lines; the bark and twigs used as a fish poison and an inner bark decoction used to treat rheumatic pain (Additional Reading: Koori cultural uses of Littoral Rainforest in south-eastern Australia).

General values

- Rainforest make really good windbreaks because they maintain dense foliage from the ground up
- They provide better fire protection than eucalypt forests or grasslands because they are much less flammable (but remember anything will burn on a bad fire-weather day) (Additional Reading: Ignition times)
- They contain a large number of visually attractive plants including ferns, flowering and fruiting trees, shrubs and vines
- Their low profile makes them useful in areas where views are important
- People from all cultures are very strongly attracted to rainforests for camping and picnicking and this is one of the main reasons for the loss of Littoral Rainforests through ***incremental development***.

Rainforests as nutrient traps and waterway health

Rainforests make excellent ***nutrient traps*** and processors in catchments (especially in third-order streams or smaller Jodie Hallowell pers. comm.) and so provide:

- ***Sinks*** for nutrients such as phosphorus and nitrogen, especially where associated with streams and wetland systems – as many rainforests are (Figures S52 and S53). These nutrients pollute waterways and lakes, but reductions of 70% in surface water phosphorus and 88% in groundwater phosphorus have been recorded as the result of rainforest (Figure S54) and associated wetland restoration (Figures S55, S56)
- Help to reduce the nutrient pollution that support algal blooms (especially in estuaries and lagoon systems) when drains are blocked and floodplains and wetlands are re-hydrated (Figures S52, S53 and S57).

LANDHOLDER GENEROSITY SEES RAINFORESTS RESTORED AND NUTRIENTS STRIPPED FROM STORMWATER

Figure S52. Frenchman's Gully, Lakes Entrance Victoria. This site is the famous Infill Gullies project. Many of its drains, such as this one at Frenchman's Gully, are straight and are designed to get water from the catchment to the lake as quickly as possible and to deprive the alluvial flat of its floodwater. This leaves little time (or space) for water to slow down and drop its sediment (and phosphorus load) (compare the velocity in this figure with that of Figure S53. As urbanisation increases in the catchment, water flow rates and erosion increase and remedial action is needed. Fortunately for this site, the landholders are very aware of this issue and have offered every assistance in getting this restoration project going.

Figure S53. Frenchman's Gully, Lakes Entrance Victoria. The drain (Figure S52) is being progressively blocked and re-directed to meander across the floodplain and re-form its original course as a creek while the gully floor is having its original Warm Temperate Rainforest and Swamp Scrub restored. The water is slowed, spends more time on land and drops more of its sediment load. Immediately downstream (Figures S55, S56), the creek enters a lakeshore swamp before disgorging into the North Arm. The swamp purifies low flows (of nitrogen and dissolved phosphorus), while the rainforest restored to the alluvial flats will treat higher flow events for phosphorus. Over a distance of just 400m (and after only 2 years of growth), these rainforest plantings have stripped 88% of the phosphorus from the groundwater entering the site, before it could go into the North Arm estuary! The red arrow marks the photographic point and the red circle that is shown in Figure S54.

RAINFOREST TO WETLANDS: THE FINAL NUTRIENT FILTER

Figure S54. Frenchman's Gully, Lakes Entrance Victoria. Piezometers (made of agi-pipe) at this site have not only helped us to plan the plantings on the valley floor by mapping soils and water table depth, they have also assisted in assessing the amount of processing by the rainforest planting of phosphorus in the water table (which ultimately ends up in the Gippsland Lakes). The red arrow marks the point and the circle in Figure S53 two years later.

Figure S55. Frenchman's Gully, Lakes Entrance Victoria. Colquhoun-North Arm Landcare Group members planting wetlands associated with rainforest restoration at Frenchman's Gully north of Lakes Entrance to trap and process phosphorus and nitrogen before it enters the Gippsland Lakes (August 2005). Craig *et. al*. (2008) recommends that to capture a stream's nitrogen well, restorers should: increase the in-stream carbon availability, the water's surface area through contact with bed (shallow is better) and reconnect it to its floodplains (remove levees).

Figure S56. Frenchman's Gully, Lakes Entrance Victoria. This lakeshore swamp is the final water processing point for the catchment. Because of Leigh and Judy Davies' generosity, this too is being restored, and so the water quality is being significantly improved even though the restoration was only 1 year old, it had already reduced the surface water's phosphorus load by 21%. It should eventually achieve similar results to those recorded for Maringa Creek (Figure S57). The left water flow has lower turbidity (and phosphorous) due to its more circuitous route through the wetlands. Figure M65 shows the big-picture view of this process.

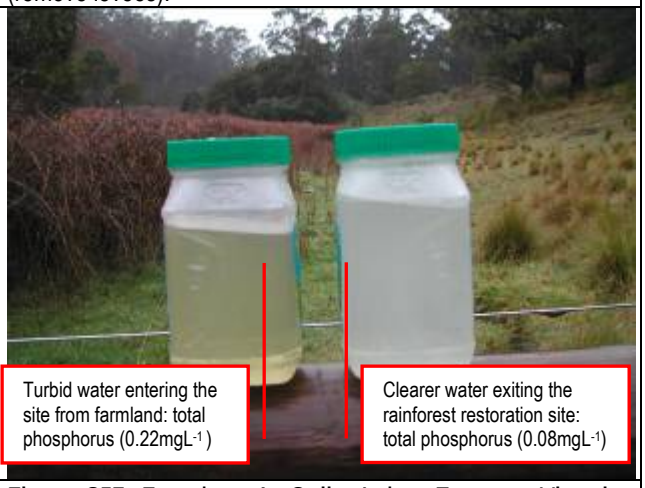


Figure S57. Frenchman's Gully, Lakes Entrance Victoria. The water shown in these two jars graphically illustrates a 70% stripping of phosphorus from the floodwaters of Maringa Creek: a 4-year-old rainforest restoration site. See the cover figure to Chapter S3 to understand the usefulness of these results in changing social attitudes towards rainforest restoration and the wider environment.

Biodiversity

Rainforests contain a disproportionate amount of species diversity per unit area and many of these species are restricted to, or dependent, on the rainforests for their survival. For example, even though Victoria's rainforest estate occupies no more than 0.14% of its land area, it supports 4% of its vascular plant flora (Peel 1999). Consequently,

rainforests provide habitat for conserving regionally and nationally threatened plants and animals (Figure S58) (Appendix S1).

COMMUNITY INVOLVEMENT WITH RAINFOREST CONSERVATION AND THREATENED SPECIES RECOVERY

Figure S58. Cann River, upstream of Princes Highway bridge Victoria. Integrated rainforest restoration: the community through Envirofund grew Slender Lignum e *Muehlenbeckia gracillima* (now growing over the sign), recovered its degraded habitat (*FFG Act*-listed Warm Temperate Rainforest) while the locals (Cann River P12 School and Cann Valley Landcare Group) gained pride and ownership of their popular local swimming hole by planting it out and weeding the site. Four years later, this critically endangered plant has thrived so well at this site that it is now naturally regenerating in another rainforest remnant being restored on the opposite bank of the river, as a result of the plantings pictured here.

Rainforest biodiversity in south-eastern Australia

There are three acts of parliament that require us as a community to help conserve biodiversity: the *Threatened Species Conservation Act 1995* in New South Wales; the *Flora and Fauna Guarantee Act 1988* in Victoria; and the federal *Environment Protection and Biodiversity Conservation Act 1999*. Rainforest restoration provides an opportunity to link conservation with community education and participation (Figure S58).

Rainforests in south-eastern Australia are also wellsprings for speciation (Figures S59, S60, S61, S62, S63 and S64), where the special conditions provided by this vegetation often in association with steep environmental gradients, including moisture, salinity and light conditions, are leading to the evolution of new species. In addition to these species, the rainforests of this region represent the edge of range for 432 plants and 167 animals (Appendix S2).

These represent some of the major reasons for the conservation of rainforests in south-eastern Australia. Figures S65-S70 and Figures S71-S78 show some of the other reasons why rainforests are places of special beauty, which are worth conserving for their intrinsic values alone. Rainforests do, however, have significant threats ranged against them (Appendix S1: worksheet: Threatening processes) including habitat loss, transforming weeds (Appendix S3), feral animals and climate change.

Migratory species

There are a wide range of migratory species that use rainforests over the period of a year. These migrants can be divided into four categories (which are summarised in Table S3, with the full list in Table AR 9 of Additional Reading). Those that are listed for their migratory habitat requirements under the EPBC Act are presented in Appendix S1: worksheet: Fauna..

Some species appear to have different migration patterns depending on the climatic zone in which they occur, but end up in the same rainforest type. For example Rufous Fantails *Riphidura rufifrons* are summer breeding migrants in the Warm Temperate Rainforests of Victoria, but move north in late summer. However, in the subtropical climate zone (in the lowlands of the area covered by the Manual), they are a winter species that locally becomes an altitudinal migrant: leaving the lowlands' Subtropical Rainforests along the coast to move into the Warm Temperate Rainforests of the foothills during summer. Two possibilities are apparent. Their migration into the warm temperate climate zone can take two paths: birds in the subtropical climate zone can either become altitudinal migrants by moving into the foothills; or they can move south into the warm temperate climate zone south of Bunga Head. Either way, they end up in Warm Temperate Rainforests over summer.

Landscape context

Rainforests have a significance and influence in the landscape context that goes way beyond their aerial extent. There are numerous reasons for this, including:

- Rainforests in general have a high proportion of plants (30% of the species recorded in them for the region) that have a high fidelity (are restricted to them or are mostly found in them): that are not usual in the wider landscape
- 66% of the plant species of mature rainforest have a high fidelity
- They provide resources (particularly fruits) that are not found outside them
- As a consequence of these two factors there are a lot of fauna species dependent on them (particularly migrants)
- Rainforests occur in, enhance or create ***fire refuges*** as a result of their disposition in the landscape, their ecology and the low flammability of many of their component species (Additional Reading: Ignition times)
- Many rainforests occur in ***drought refuges***
- Several (Subtropical, Warm Temperate, Cool Temperate Rainforest and Gallery Rainforest) provide refugia during periods of climate change
- These factors combine to offer both refugia and migration routes during climate change.

Rainforests as refugia and migratory routes during climate change

Refugia are places that offer protection from specified threats. When it comes to climate change (which represents a significant cluster of threats to the rainforests of south-eastern Australia), these include (among others):

- Fire – increased frequency, intensity and extent (mega-fires)
- Increased rainfall variability
- Increased temperatures
- Increased evaporation
- Increased frequency, duration and intensity of drought.

Rainforests have always been very important as migration routes (and destinations) to seasonal migrants (Additional Reading: Table AR9). Increasingly, and perhaps more importantly, in the context of climate change, they are acting as migratory routes for species that are forced to chase their core climate envelopes across the landscape as climate change marches on. Clearly therefore, rainforests have an important role to a range of plant and animal species as resting and refugial sites as well as migratory routes. Interestingly, at least two altitudinal migrants (Pied Currawong and Crescent Honeyeater) breed in late winter-early spring in the lowland rainforests of the region and rear their young there before moving up into the mountains over summer. Another species (Satin Bowerbird) is suspected of doing the same, but this has yet to be confirmed.

Rainforest in the urban environment

In urban areas, rainforests provide dense vegetation along linear reserves that screen residences from one another (Figure S79). Over recent years in Lakes Entrance, the presence of rainforest on the property, or adjacent to it in a reserve or neighbouring property, has become a major selling point: helping to command premium prices. Increasingly the urban amenity value of rainforest is being realised by property developers. As such, the presence of rainforest is proving to be a financial advantage when designing housing developments. One recent example includes the restoration of a rainforest gully at Kings Cove at Metung. At this site, a rainforest-housing precinct has been specifically delineated: a clearly beneficial result for residents and the restoration of rainforest in a gully previously cleared for farming.

The additional benefit to the urban environment during high-fire risk periods is that rainforests represent a lower fire risk than ***sclerophyll*** vegetation or unkempt grass. This was one of the major motivators for residents who participated in the restoration project at Lakes Entrance pictured in Figure S79. A recent inspection by the author found that there were now significant breaks in the ***fuel ladders*** on the site where rainforest was maturing, that plantings of fire suppressant species (rainforest species notwithstanding) that included: Common Boobialla *Myoporum insulare* and Seaberry Saltbush *Rhagodia candolleana* had established and significantly reduced the fire risk to both the mouth of the gully (the fire weather direction) and the boundary between residents and the reserve (compared with the starting condition for the site. In addition, the Council was providing much more maintenance (of lawns and ***ecological maintenance*** in the rainforest itself) than was ever previously the case: the reason being that there was now a rainforest asset, as well residential assets, worth protecting.

RAINFORESTS ACT AS CRUCIBLES FOR THE EVOLUTION OF NEW SPECIES

Figure S59. Lochend Jungle, lower Snowy River Victoria. This is a Snowy River endemic taxon Slender Burgan *Kunzea phylicoides,* which regularly occurs in Riparian Shrublands and more rarely in Warm Temperate Rainforest gaps along the river.

Figure S60. Site 70b Marlo Road, lower Snowy River Victoria. Forest Burgan *Kunzea* sp. (Upright form) grows with the taxon (Figure S59), but is different: its leaves are very broad, it is usually single-stemmed and is often a rainforest tree that can grow to 20m or more (see the white-flowered tree centre-background in Figures S30, S32). This species is a Warm Temperate and Gallery Rainforest plant in Victoria but not in New South Wales (Floyd 1989).

RAINFORESTS PROVIDE NOVEL NICHES WHERE NEW SPECIES CAN EVOLVE

Figure S61. Lake Bunga, Victoria. Scented Groundsel *Senecio odoratus* reaches its eastern limit in East Gippsland at this site where it is disjunct from the rest of its range. It is also found in South Australia, Tasmania and Queensland (Walsh and Entwisle 1999)..This is the only site in Victoria, and possibly Australia, where this species is found in Littoral Rainforest where it is abundant in gaps and plays a major role in rainforest regeneration. Such isolated populations growing in novel environments are the ingredients of speciation and evolution of new taxa.

Figure S62. Martins Creek Scenic Reserve, Victoria. Here, Gristle-fern *Blechnum cartilagineum* is common in Warm Temperate Rainforest where it grows beneath the closed canopy in ***deep shade*** as well as in gaps (as pictured here). The fact that it is more common in Damp Forest in ***partial sun*** where the overstorey is eucalypt dominated, but can function very well in deep shade in Warm Temperate Rainforest, suggests at least two ecotypes and the possible beginnings speciation that would see the emergence of two entities based on shade-tolerance and habitat.

Figure S63. Lower Snowy River, Victoria. Broad-leaved Panax *Polyscias sambucifolia* ssp. 1 is already considered a separate taxon and it grows as a tree in Littoral and Cool Temperate Rainforest only in this catchment.

Figure S64. Lochend Jungle, lower Snowy River Victoria. Hybrid Bramble *Rubus* X *novus* is a stable hybrid between Queensland Bramble *R. moluccanus* and Small-leaved Bramble *R. parviflorus*.

SOME OF THE SMALL RAINFOREST FAUNA OF SOUTH-EASTERN AUSTRALIA

Figure S65. Snowy River, Victoria. Cotton Harlequin Bugs *Tectocoris diophthalmus*.

Figure S66. Kalimna, Victoria. Mimicking Longicorn *Eroschema* sp. on Sticky Daisy Bush r *Olearia viscosa*.

Figure S67. Snowy River, Victoria. ♂ Black-faced Percher *Diplacodes melanopsis* in rainforest.

Figure S68. Snowy River, Victoria. Common Blue-tongue Lizard *Teliqua scincoides*.

Figure S69. Nyerimylang, Victoria. Green and Gold Nomia Bees *Nomia* sp. showing clumping behaviour typical of dull moist spring days in south-eastern Australia.

Figure S70. Snowy River Victoria. Emperor Gum Moth *Opodiphthera eucalypti* larva on Southern Mahogany *Eucalyptus botryoides*.

SOME OF THE BEAUTIFUL RAINFOREST PLANTS OF SOUTH-EASTERN AUSTRALIA

Figure S71. Snowy River, Victoria. Yellow Elderberry *Sambucus australasica*.

Figure S72. Snowy River, Victoria. Rose-leaf Bramble *Rubus rosifolius*.

Figure S73. Snowy River, Victoria. Red Passion-flower *Passiflora cinnabarina*.

Figure S74. Bunga Head New South Wales.. Trailing Guinea-flower *Hibbertia dentata*.

Figure S75. Murrah River, New South Wales. Koda *Ehretia acuminata*.

Figure S76. Lakes Entrance, Victoria. Kanooka *Tristaniopsis laurina*.

Figure S77. Mystery Bay, New South Wales. Scurvy-weed *Commelina diffusa*.

Figure S78. Ben Boyd National Park, New South Wales. Coast Banksia *B. integrifolia*.

Table S3. Some of the migratory birds reliant on the rainforests of south-eastern Australia (see also Table AR 9).

Migrant type	Species	Rainforest breeding	Rainforest resources used
Altitudinal (winter migrants)	Pied Currawong	Yes	Fruits
	Satin Bowerbird	Facultative	Fruits
	Superb Fruit Dove	No	Fruits
	Spangled Drongo	No	Insects
	Crescent Honeyeater	Yes	Nectar: Coast Banksia *B. integrifolia*, Sweet Pittosporum *P. undulatum*
	Rufous Fantail (sub-tropics)	Yes	Vaulted canopies for foraging
Summer migrant	Rufous Fantail (warm temp.)	Yes	Vaulted canopies for foraging
	Shining Bronze Cuckoo	Yes	Host nests to parasitise and breed
	Fan-tail Cuckoo	Yes	Host nests to parasitise and breed
	Channel-billed Cuckoo	Yes	Fruits and host nests to breed
	Common Koel	Yes/No	Fruits and host nests to breed
	Scarlet Honeyeater	Yes	Nectar
	Black-faced Monarch	Yes	Insects, nest camouflage
	Dollarbird	Yes	Insects
	Cicadabird	Facultative	Insects and fruit
	Restless Flycatcher	Yes	Insects
Passage migrants	Swift Parrot	No	Nectar and *lerp*
A-seasonal migrants	Grey-headed Flying Fox	Yes	Nectar and fruits
	Topknot Pigeon	Yes	Fruits
	Fig Bird	Yes	Fruits
	White-headed Pigeons	Yes	Seeds

RAINFOREST RESTORATION CAN EXPAND INTO BACKYARDS INCREASING THE REMNANT AREA

Figure S79. John Street, Lakes Entrance Victoria. Four enthusiastic residents planted rainforest in their back yards during this restoration of a former rainforest gully that gave the adjacent street its name: “Ferndale”.

Rainforests also perform less obvious 'urban services'. They help maintain water quality and prevent erosion along drainage reserves (Figure S80), reduce fire risk and have minimal maintenance costs compared with a comparable area of grass planted with trees that must be continually mowed, trimmed and upon which every branch that falls has to be collected for removal and disposal before mowing. At the same time, habitat is provided for communities of rare and threatened plants and animals, and rainforests provide refugia and migration routes for rainforest-dependent animals and others that use rainforest on a regular basis, or rely on it during drought.

Rainforests are a relatively benign way of bringing urban residents into contact with the bush. They are not threatening, (you can see the snakes) and, if well designed, they are a low fire risk and provide an abundance of wildlife that are both beautiful to see and hear.

Rainforest restoration and recreation can have some surprising synergies. The Lakes Entrance Golf Club Inc. (through the energetic efforts of Terry Polwarth and his band of volunteers) has implemented a World Wide Fund for Nature habitat restoration project for Swift Parrots *Lathamus discolor*. The aim is to manage their existing remnants better, connect remnants where they can and provide amenity plantings that are also habitat for this nationally endangered bird that is listed under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act* (EPBC) *1999*. The educative value of such collaborative efforts is incalculable.

The Golf Club project (Figure S81) is a classic example of looking for, and finding, opportunities in the landscape and within your community for rainforest restoration. Finding such synergies means that good work can be done in the most surprising places, which at the same time puts people in touch with nature and the need for preservation and conservation.

Rainforest in the rural environment (farms)
Rainforests on farms provide a range of free environmental services to farms that include:

- Cleaner water for domestic, live-stock and irrigation use
- Stabilisation of low flow channels by Gallery Rainforest (compared with willows) that will reduce irrigation pump fouling
- Maximising habitat (shelter/food resources/breeding sites) for animals, including domestic stock but as importantly for native birds, mammals, reptiles, amphibians and insects – many of which are useful to farms:
    - *Carrion* feeders: Australian Ravens and Whistling Kite
    - *Insectivores*: Cattle Egret, Nankeen Night Heron, White-faced Heron, Straw-necked Ibis, Sacred Ibis, Magpies, Mudlarks, Willy Wagtails, Silvereyes, Australian Falcon, Boobook Owl, Clamorous Reed Warblers, Superb Blue-wren, small forest bats, sugar gliders, frogs, reptiles and insects (wasps, scorpion flies and ants)
    - *Pollinators*: Honeyeaters, mammals (particularly flying foxes) and insects
    - *Predators* of rodents (rabbits, rats, mice): Boobook Owl, Sooty Owl, Nankeen Night Heron, Black-shouldered Kite, Grey Goshawk, Whistling Kite and White-bellied Sea Eagle.
- Provide effective sound insulation for dwellings from the traffic moving along roads
- Maximise above-ground nutrient uptake of phosphorus (in riparian vegetation) before it pollutes the river
- Maximise below-ground nutrient uptake of phosphorus (trees) and nitrogen at seepage interfaces in Subtropical, Warm Temperate, Cool Temperate and Gallery Rainforests before it before it enters the river
- Minimising sand transport onto farms and maximise silt deposition through rainforests that trap sand
- Maximising crop and stock shelter (a role that willows fail to supply during autumn-winter)
- Reducing woody debris loads that make it out of the river's channel and on to paddocks during floods.

Table S4 lists some of the animal species that rely on rainforest and expands on some of the *environmental services* that they provide to adjacent farms and the wider region. One species that uses *riverine* rainforests for roosting is Cattle Egret *Ardea ibis*. These birds follow stock around in paddocks, eating insects flushed by the movement of cattle. They are particularly fond of rainforest trees that reach out over the river for preening and roosting. Another synergy on the Snowy River involves the hollows in Southern Mahoganies *Eucalyptus botryoides*, which provide roosting sites for a range of insect-eating bats that shelter there during the day and emerge at night to feed over the adjacent pastures and crops. In a bizarre native species adaptation to an exotic species, Clamorous Reed Warblers *Acrocephalus stentoreus* that nest in Common Reeds *Phragmites australis* in rainforest gaps and along river margins cross roads to forage in nearby Corn **Zea mays* crops for grubs that attack the crops. They then return to the reeds to feed their young. This valuable (and free) environmental service is provided to farmers because the birds apparently do not distinguish between corn and reeds!

Studying rainforest animals, such as Powerful Owls *Ninox strenua* and Sooty Owls *Tyto tenebricosa* (Figure S82), can shed light on the role of a wide range of native vegetation on the farm. Figure S83 provides information collected by Bilney (in prep.) for his PhD that contains a wealth of information about the importance of a range of native vegetation and how it should be managed to sustain a much wider suite of rainforest animals. Greater Gliders *Petauroides volans*, Sugar Gliders *Petaurus breviceps*, Yellow-bellied Gliders *Petaurus australis*, and Mountain Brushtail Possums *Trichosurus cunninghami* (*sensu* Lindenmayer *et. al.* 2002)/ Common Brushtail Possum *Trichosurus vulpicurus* all require the presence of large hollows (as do the owls that hunt them). Sugar Gliders (the main prey items of both owl species) are entirely dependent over winter on the presence of mature Black Wattles *Acacia mearnsii*. This is because of the gum, which is essential sustenance to the gliders over the colder months, is only produced by older trees. Because Black Wattles have a short life (~23 years), they has to be regenerated by burning the fringing vegetation every 15-20 years to induce wattle regeneration (it also reduces the fuel load there as well as rejuvenating the ecotone's fire-suppressant plant species, thereby lessening the likelihood of wildfire burning the rainforest. Feathertail Gliders *Acrobates pygmaeus* require proteaceous species, such as banksias, to be maintained in the landscape (for their nectar) and require soft material that includes tree-fern fibre to line their nests (Woodside 2002). They are most often found in structurally complex habitats and require an abundance of nesting hollows for successful breeding (Woodside 2002). Ensuring that grazing is minimised will allow dense tussocky ground covers to be maintained for Long-nosed Bandicoots *Perameles nasuta*. Powerful Owls prey on a wide variety of birds (Figure S82). The maintenance of a complex habitat in and around your rainforest is the best insurance for the retention of a diverse bird fauna as prey items for this large forest owl species. Note the segregation of roosting habitat between these two large forest owls as described by Rohan Bilney (pers. comm.) (Figure S82).

URBAN RAINFORESTS: IMPROVED AMENITY	AMENITY AND SWIFT PARROT HABITAT
	
Figure S80. John Street, Lakes Entrance Victoria. This rainforest restoration project was planted by residents and Council and was designed to be an amenity planting that also treats stormwater, brings in the birds and screens out neighbours across the reserve. Close liaison between project planners and the residents ensured that the plantings matched residents' needs: with the remnant in the background ensuring privacy from the mown walking path (left), but allowing long views into the rainforest. Residents donated the tree ferns to the project from plants coming up in their back yards (and are still doing so 4 years later)! Over the last 5 years, rainforests have become a significant selling point for properties in south-eastern Australia, and although no one landholder owns this one, all residents share in its value.	Figure S81. Lakes Entrance Golf Club, Victoria. Although to golf club patrons this is an amenity planting between the practice green and the Club's wedding reception area, it uses local Littoral Rainforest species, some of which are food trees (Coast Banksia *B. integrifolia* and Sweet Pittosporum *P. undulatum*) for the nationally endangered Swift Parrot *Lathamus discolor* that is still regularly recorded on the course. The banksias provide autumn and winter nectar for the parrots on their first landfall after flying across Bass Strait from their summer breeding grounds in Tasmania. The pittosporums provide the nectar that 'fuels them up' for their return flight in October as they leave the mainland to return to their breeding grounds across the sea.

RAINFOREST OWLS OF SOUTH-EASTERN AUSTRALIA

Figure S82. East Gippsland, Victoria. In the 'bright shade' of a mature Sweet Pittosporum *P. undulatum* in Gallery Rainforest a parent Powerful Owl with a 4 week-old fledgling (top) finds refuge because its 'broken-shade' plumage is better suited to this roosting choice. It is holding the remains of Brushtail Possum *Trichosurus* sp. that was fed to the chick later that night (Rohan Bilney pers. comm.). In contrast, a Sooty Owl in its cave roost (below left) and another in the gloom of a Lilly Pilly *Syzygium smithii* roost where the deep shade of this dense-canopied tree is a better camouflage match for its dark 'sooty' plumage. The bird on the right had a radio transmitter fitted at this time by Rohan and his studies revealed that this individual ranged over 3,100ha of forested land around Nowa Nowa and Lake Tyers, but that rainforest was critical in its home range, not only for food, but also rest and refuge. Photos: Rohan Bilney.

Rainforest in the riverine environment

Rainforests protect land (Figure S84) improve the quality of the riparian environment – both aquatic and terrestrial – as well as providing significant habitat for a range of wildlife and plants. They are (or were once) an important component of the vegetation that lined most of the region's lowland waterways and many of its foothill streams. Rainforest restoration can help protect the land and its agriculture Figure S85. Their restoration brings many benefits (Figures S86, S87).

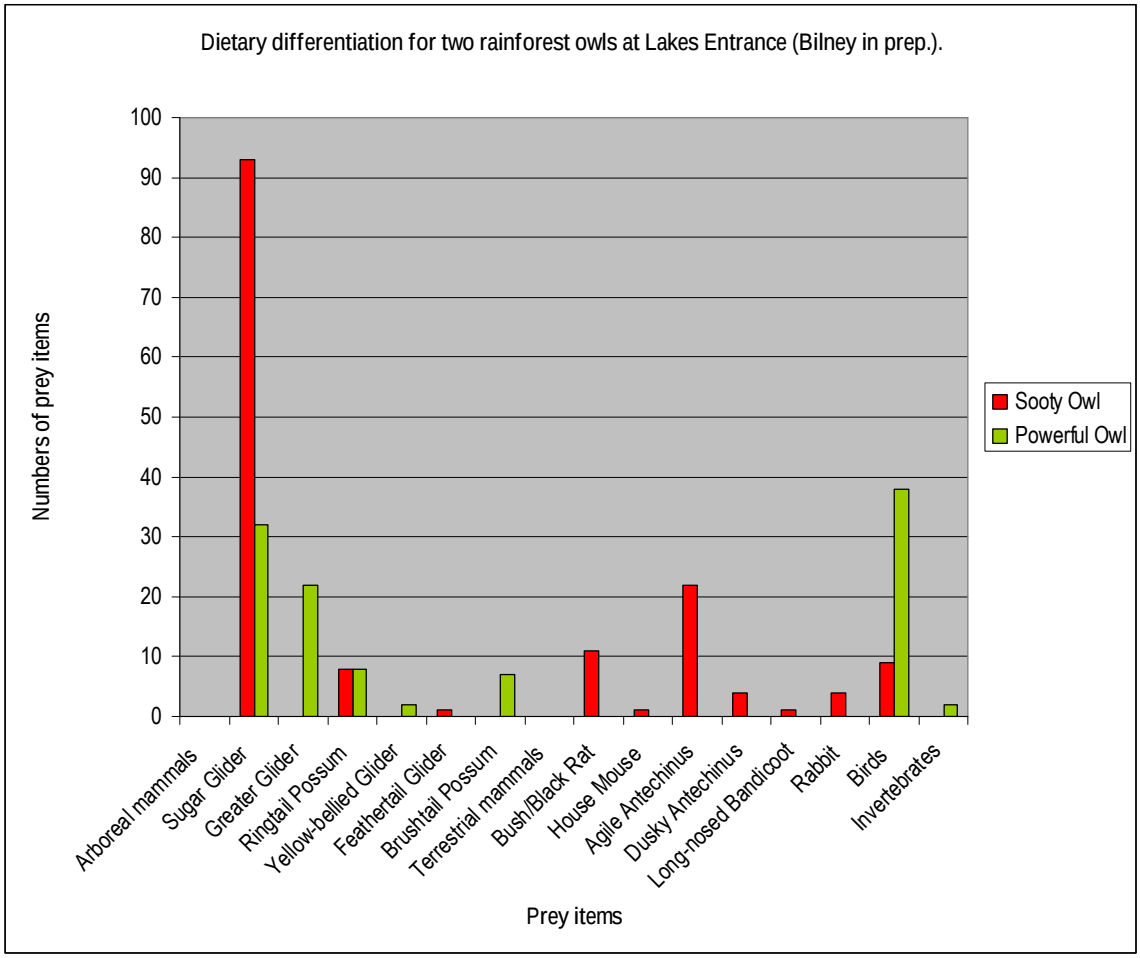


Figure S83. Dietary items and their proportions for two rainforest owls at Lakes Entrance (data and permission to use it kindly supplied by Rohan Bilney).

The functional and river health benefits associated with intact or restored rainforest along streams include:

River bed stability and durability during periods of stress (fire and flood)

- Maintenance of channel form through:
  - Bed stabilisation via instream debris incorporated into the stream sediments where they act like reinforcing in concrete to reduce lateral bank movement. Brooks (1999) found that on the Thurra River (an intact rainforest stream; and formerly the Cann River) that the lateral movement is as little as 0.7cm per year where Gallery and Warm Temperate Rainforests clothed their banks (compare the palaeochannels of the Cann in Figure S88 with that of the current-day Thurra in Figure S89). In contrast, on the Cann River (an equivalent floodplain 10 kilometres away) that has been cleared of its Gallery and Warm Temperate Rainforest and de-snagged, the lateral movement was 4.5m per year! (Figure S90). This damage extends to the habitat of many riverine species such as River Blackfish *Gadopsis mamoratus*, which are reliant on snags and slow-moving waters (Allen *et. al*. 2002). Because of the importance of this issue in south-eastern Australia it is treated separately as Case Study S1: A verdant rainforest valley lost and its redemption through a *social contract*.

Water quality:

- Cleaner water through:
  - Reduction in bank erosion
  - Protection of alluviums during major flood events
  - Stabilisation of channel sediments
  - Detoxification of floodplain poisons and pathogens.
- Decrease in water and air temperature through:
  - Deepening of low flow channel
  - Shading of the water (Figure S29).

Refugia

- Over geological time periods for the evolution and conservation of both primitive and *Gondwanan* species including plants (Peel 1999) and animals
- During droughts
- During and following fire
- During periods of climate change.

Biodiversity

- Habitat for a wide range of generalist species that use rainforest
- Habitat for a wide range of *rainforest-dependent species* restricted to rainforests
- Habitat for migratory species (e.g. birds: Additional Reading: Table AR9);
- Corridors for migration
- Provision of regionally restricted or rare resources for terrestrial species (fruits, nectar, *lichens* for nesting)
- Increased invertebrate diversity and abundance due to the 'organic rain' from rainforests that are the building blocks of the food web in our streams (compare Figure S86 with S87; S89 with S90)
- The large woody debris substrates within the stream that are derived from rainforests and grow biofilms that feed many of these species (Figure S89)
- Large woody debris, slowing water and provide refuge and breeding opportunities for biodiversity (Figure S89)
- Large woody debris causing scour holes and deepening of low flow channels
- Diversity and abundance of fish populations increase through greater oxygenation, food resources and places to avoid predators and rest.

RAINFOREST PROTECT AGRICULTURAL LANDS: REMOVE THEM AT YOUR PERIL	RAINFOREST RESTORATION REHABILITATES THE LAND: PROTECTS AND BUFFERS AGRICULTURE
	
Figure S84. Tonghi Creek, Victoria. Valuable agricultural land is slipping into this rainforest stream because of past over-zealous clearing of the Warm Temperate Rainforest and Gallery Rainforest (background). The bank slump is at least 10m high. Photograph Rob Allen.	Figure S85. Maringa Creek, Nyerimilang Heritage Park, Victoria. Richard Vuat of Wildseed Nursery looking proud of his rainforest restoration efforts: erosion is reduced and phosphorus loads have declined by 70%!

Table S4. Environmental services to agriculture and the wider landscape from animals that occur in or rely on the rainforests of south-eastern Australia.

Species or component	Environmental service as predator*	Rainforest dependence**
Nankeen Night Heron	Crickets, beetles and mice during plagues	Roost in rainforest trees along lower reaches of rivers, numbers drastically reduced by land clearing of roost sites and draining of wetlands
Cattle Egret	Grasshoppers, ticks, beetles	Roost in rainforest trees around wetlands and along rivers
Pied Currawong	Snails, beetles, grasshoppers, consumes soil invertebrates in paddocks after ploughing[1]	Fruits of lowland rainforests
Clamorous Reed Warbler	Grubs and other insects from maize/corn crops[1]	Birds cross open ground (roads to feed in crops) from reed beds in rainforest gaps or along the river margins of rainforest
Superb Blue Wren	Grubs and other insects from maize/corn crops[1]	Birds cross open ground (roads to feed in crops) from reed beds in rainforest gaps or along the river margins of rainforest
Sacred Ibis	Prey on pasture-pests: caterpillars, cock chafer beetle larvae, grasshoppers and sheep fly larvae	Birds roost in emergent eucalypts over rainforest along rivers
Straw-necked Ibis	Over 60 different animals, many that are pests in farming: pasture-consuming caterpillars, cock chafer beetle larvae and grasshoppers. Probe cow pats and eat fly larvae.	Birds roost in emergent eucalypts over rainforests on rivers (due in part to the seclusion offered by the rainforest canopy).
White-faced Heron**	Insect larvae, crickets, earwigs, grasshoppers, cock chafers beetles, fly larvae, moths, caterpillars, House Mice***.	Breed (sometimes in colonies) in eucalypts over rainforest
Boobook Owl	Adult Scarab Beetles[1], grasshoppers, crickets and beetles, rats and mice***	Roost in rainforest on rivers, as elsewhere in the lowlands (Rohan Bilney pers. com.)
Kookaburra	Snails, army worms, grasshoppers, crickets, beetles, weevils, rats and mice***	Nest in eucalypts over rainforest, forage in rainforest
Mudlark	Pasture insects	Nest in eucalypts and wattles in rainforest
Magpie	Scarab Beetles	Nest and roost in eucalypts and wattles in rainforest
White-breasted Sea Eagle	Rabbits[1]	Nest and roost in eucalypts in rainforest
Whistling Kite	Grasshoppers, crickets, weevils, carrion, House Mice, caterpillars, Brown Rats, rabbits***, Cats[1]	Nest and roost in eucalypts and wattles in rainforest
Hollow-dwelling bats: the Lesser Long-eared Bat	Forages above pasture for insects	Roost and breed in hollows
Grey-headed Flying Fox	Through pollination maintains genetic diversity in eucalypts across the landscape	Depend on flowering and fruiting of rainforest species for sustenance and maintenance of migratory pathways
Sugar Glider	Each den contains up to 8 animals, that each individually consume up to 25 Cock Chafer beetles a day, a total of 200kg a year per colony (Lindenmayer 2007)!	Regularly found in lowland rainforests (including those of the Snowy River)[1]
Silvereye	Generalist species, these birds are major insectivores	Rely on rainforests for fruits, nectar, shelter and they also breed there
Australian Raven	Eat carrion, and insects in with cow pats[2]	Nest in emergent eucalypts and Banksias in rainforest, feed on rainforest fruits
Tree Martin	Ants, beetles, flies, bugs and wasps*	Nest in emergent eucalypts over rainforest and roost in reed beds of rainforest gaps.
Bluetongue Lizard	Snails[1]	Occur in rainforest[1]
Forest Bats	Insects	Roost in tree hollows in rainforest
Rainforest stand	Wind shelter	Not applicable

*Referenced from HANZAB and Vesjens (undated); **Referenced from HANZAB and observations from the region; ***Vesjens (undated) Volume 1;
[1]=observations of the author; [2]=Tops Chester a landholder of the Snowy River.

RAINFOREST IS PLANTED AND A DRAIN BECOMES A CREEK: WEEDS ARE CONTROLLED, FIRE RISK IS REDUCED=HAPPY RESIDENTS AND COUNCIL	
	
Figure S86. John Street, Lakes Entrance Victoria. The Council's weed choked drain (as the adjoining residents referred to it) before planting and weed control at the John Street rainforest restoration site.	Figure S87. John Street, Lakes Entrance Victoria. The same site two years later with a successful Blackwood *Acacia melanoxylon* planting as a nursery crop for Gallery Rainforest. Additional plantings will follow once the weeds are controlled. The adjoining residents who helped do the planting and weed control now refer to it as their creek instead of the Council's drain. There is now a clear channel, lots of leaf litter and increased fish populations.

CASE STUDY S1: A VERDANT RAINFOREST VALLEY LOST AND IT'S RESSURECTION THROUGH A SOCIAL CONTRACT
CASE STUDY SITE: CANN RIVER VALLEY, VICTORIA

The Cann Valley before 1919: A 20m wide, narrow shaded lush rainforest stream meandering across a verdant well-watered floodplain (*palaeochannels* in Figures S88 and what they looked like as seen in today's Thurra River: Figure S89 when it over-topped its banks on average 1.25 times a year.

Past floodplain management:

- Large woody debris cleared from the stream
- The floodplain cleared of its rainforest
- The stream banks denuded of its native vegetation.

Consequences:

- Massive erosion of the cleared banks and floodplain (Figure S90)
- River bed-base erodes deeper (Figures S88 and S90)
- River widens (Figures S88 and S90)
- Water table recedes and the floodplain dries and loses its once highly valued drought proof qualities for agistment

Early response 1919-1980s:

- Plant willows

Later response 1980-1990s:

- Study changes
- Identify threats
- Recommend action.

River feature	Changes from 1935 to 1995	Impact/significance
Width	Increases 325%	Water velocity increases, more erosion, more sediment
River channel depth	Increases 39%	Water table drops Previously permanent water holes dry up Previously drought-proof pastures (sustained by the water-table) die in drought
River volume	Increases by 48%	Overbank floods decline All of the power (and ability to move sediment stays in the river channel) The river chews up more of the productive farmland on the floodplain
River discharge	2720mL day to 37,300	More water lost more quickly Velocity increases More fertile flats eroded More sediment transported downstream More sediment clogs Tamboon Inlet
Water slope	Increases by 31%	More water speed More erosion More sediment transported downstream
Overbank floods	1 every 1.57 years to: 1 every 7.1 years	Water lost from floodplain more quickly Water table drops Productive farmland swamped by sand in floods instead of the silt of the past

Community contract between the Cann Valley community and the East Gippsland Catchment Management Authority:

- Prevent river channel dropping further
- Encourage low growing instream native vegetation
- Restore river bank *indigenous* vegetation
- Remove willows
- Fence stream off from cattle
- Narrow river width to reduce water power instream and diffuse its power across floodplain
- Review in ten years time.

Problems:

- River Health Strategy concentrates on current condition and river health and so is a low priority (diverts dollars to other sites).

Options:

- Attract state funds through FFG-listed vegetation restoration and threatened plants and animals
- Nominate *Alluvial Terraces* Warm Temperate Rainforest under the *EPBC Act* which will attract Commonwealth funds
- Recognise role as a refuge and migration path during climate change and seek funding for restoration works
- Review social contract and update actions.

THE DEATH OF A FLOODPLAIN WRIT LARGE

Figure S88. Cann River, Cann River Township Victoria. This aerial photograph shows the impact of early floodplain management that saw the Cann River once a narrow meandering rainforest stream (the palaeochannels of the ancient stream course: green arrow on left) morphing into a rapidly eroding, out of control and dying stream (3.25 times as wide: red arrows), on a drying floodplain (browning pastures). The blue circle marks the location for the photograph in Figure S90. Photograph East Gippsland Catchment Management Authority. Proportional change in river channel:

→ Original river channel width; and

→ Current river channel width.

Figure S89. Thurra River Rainforest Walk, Princes Highway Victoria. Rainforests intact: large woody debris knit the stream bed together (30% by volume) and are regularly renewed: erosion is minimal, stream life is abundant and the floodplain well-watered.

Figure S90. Upstream of the Princes Highway Bridge, Cann River, Victoria. Rainforest gone: large woody *de-snagged*: a stream out of control, minimal stream life and a major threat to valuable agricultural lands and the township itself.

SUMMARY	
COMPREHENSION: **STOP**	Rainforests have cultural value. Rainforests have substantial biodiversity and landscape value. Rainforests have community value and so have been allocated legislated protection.
KNOWLEDGE: **THINK**	Rainforest values and functions vary according to their landscape context. Because of their value, rainforest merit conservation attention: resources and action.
WHAT TO DO?: **ACTION**	Start thinking about the context of rainforest in your local community: you may value rainforests, but do others? If rainforests are not locally valued, how can you alter that?
WHAT NEXT?	We need a framework. We need collective action. BUT FIRST WE NEED A THEORETICAL AND PHILOSOPHICAL BASIS FROM WHICH TO START.