GLOSSARY

KNOWLEDGE IS THE STARTING POINT: WHAT YOU DO WITH IT IS THE JOURNEY!

Opener: Murrah River, New South Wales. Spreading the word: South Coast Rainforest Restoration Workshop participants: Ali Rodway (left) of Far South Coast LandCare who is involved in restoring a billabong on the Bega River as a member of Bega River Landcare and Wetlands (BRAWL) and Melissa Mass a Far South Coast ranger with National Parks and Wildlife Service's Narooma office (right). They are being introduced to the newly described *'Sand Rivers'* Warm Temperate Rainforest; and are thinking about whether this is a model for rainforest restoration along the other ***sand rivers*** of the region. At this moment in time, the participants looked euphoric, so in awe were they that this beautiful site could possibly represent the past vegetation of the riparian environment of today's ecologically devastated Bega River valley (see Figures S14 and S15). Clearly a gargantuan whole of community effort would be required to restore the Bega River sand pit to this level of beauty.

GLOSSARY (including symbols, acronyms and abbreviations)

*	Symbol: an asterisks before a *Latin* name indicates that the species is an ***exotic*** or ***non-indigenous*** plant. E.g.: Blackberry **Rubus anglocandicans*, which is a weed, as apposed to Rose-leaf Bramble *Rubus rosifolius*: a native species of rainforests in the region but from the same genus. This convention is not used for fauna. Note: an asterisk before an animal name in some Appendices references a footnote.
~	Symbol: approximately, about that much.
>	Symbol: greater than (the figure that follows the symbol).
<	Symbol: less than (the figure that follows the symbol).
<>	Bracketing: to indicate a web site address e.g.: <www.bom.gov.au> which is the web address for the Bureau of Meteorology.
^{o}C	Abbreviation: degrees Celsius.
m^2	Abbreviation: square metres: e.g. 100 m^2= an area 10 m x 10 m.
m^{-2}	Abbreviation: per square metre (used say for a measure of ***abundance***): e.g. 10 plants m^{-2}.
n=	Abbreviation: number equals. Usually used to indicate the number of samples or replicates in a ***trial***, so as to give the reader a broad grasp of the reliability of a data set or a piece of information. Low numbers generally indicate lower reliability (replicates of a particular observation), whereas higher numbers are the converse. So, for example, a floristic entity based on one observation is just an indication of what might be going on: it could represent the average (i.e. usual) state of that vegetation or it may represent a 'one-off'' or an extreme. Consequently, the information based on a lower number of observations should be treated with caution, but with more confidence when 'n' is higher.
®	Symbol: to indicate that the name, concept or article before the symbol is a registered trade mark. E.g. Roundup Biactive® is the trade-mark registered name for one of the chemical preparations containing the compound glyphosate that is used as a herbicide. Glyphosate can be used as a generic reference to a range of trade-marked herbicides using this compound.
X	Symbol: when written thus: Hybrid Bramble *Rubus* X *novus* the 'x' indicates a plant hybrid, in this case between Queensland Bramble *R. moluccanus* and Small-leaved Bramble *R. parviflorus*.
abiotic	Any element of an ecosystem that is not living. Cf. ***biotic***.
abundance	The numbers of a particular species. Cf. ***diversity***.
ADA	Acronym: Australian Deer Association.
adaptive management	The process whereby a problem is examined by developing an ***hypothesis***, which then leads to a ***theory*** that you use to try to explain the observed facts (often, but not always a problem), which then results in a series of actions (***experiments***) are undertaken to test the hypothesis behind your theory. For example, the plant won't grow where you put it. Your hypothesis is that it was the site's conditions that caused the plant's death (it was too wet, too dry, too shady or too sunny) rather than the plant dying from a disease such collar rot. By observing the conditions under which the plant failed to grow, you develop your theory that this particular species requires shade for establishment (because all plants died that were planted out in full sun). What is not yet obvious is whether the plant can tolerate full sun for part of the day or no sun at all. The next time you plant the same species out you do so by conducting a ***trial***. The trial involves careful and deliberate placement of the same species in a range of ***light niches*** where all other conditions are kept the same (day and time of planting, soil moisture, soil type, aspect, landform, etc.) except the one that you are testing in your trial: the shadiness of the spot in which you plant. Some of your new season's plant stock is placed in each of these ***niches***

	(we recommend a minimum of ten plants for each niche in these trials) and you monitor and record the results. The number of replicated observations is important. Using ten or more plants helps to reduce the risk of other variables (for which you cannot account or control) such as genetic variability of the stock you are planting out, random events such as disease or browsing clouding the results of your trial. You then evaluate the results of your trial being very careful to look for other factors (that you might have expected could influence the result, or anything else that has cropped up), that might confuse the results (see the cautionary note below). The answer is then deduced from the result, and if the experiment provided you with an answer, then this is added to the tool-kit of ***restoration*** actions for the management of the site and that particular problem because it is now more completely understood. Your management of the site is therefore improved by adapting your actions the next time you plant that species since you now better understand its light niche. This is adaptive management, it is essentially the process of life: you question, try, learn, adapt, apply what you know and then move on to the next question (for a worked example see Appendix S14.). A useful way to set this out logically is to develop a ***logic train.***. A note of caution: just because it worked the next time you tried it, this does not always mean that your conclusion as 'to cause and effect' is necessarily proven (i.e. you may never know with absolute certainty that you understand what are the underlying processes that are at work). This uncertainty may seem a bit scary, but it is a necessary part of restoration because we will never have the resources to completely know why things work before we look at a situation and take an intelligent guess at the process behind the observation and start out along the restoration road. This is the 'art' part of the art and science of ***rainforest restoration***. So always keep a weather-eye out for another explanation, and always keep re-jigging your hypotheses, by observing what is going on. Where you can, set up experiments to monitor your actions so that the results can be continually updated and thereby advise everything you do. Everything you do in restoration should be a trial. That way you are most likely to succeed (in the face of ongoing uncertainty), even if you never know absolutely that your hypothesis is proven. This process (called the ***precautionary principle***) allows you to move forward in the absence of complete scientific knowledge. See also: ***hypothesis, logic train*** and ***trial***.
adventive	A taxon that has by chance established in a ***habitat*** to which it is not suited; its presence in this atypical habitat is usually therefore transient. For example, eucalypt saplings establishing in Riparian Shrubland whose habitat is characterised by frequent and violent flood events, to which these trees are not adapted. Consequently, these adventive eucalypts are usually removed by the flood before they mature.
aeolian	Acted on by the wind: in the context of this work, usually sands deposited or reworked by wind. Cf. ***lacustrine***.
after-ripening period	Literally as it reads: a period of time that is required after the 'apparent ripening' of a fruit or seed, before the seed is mature and will germinate. It may take 3-12 months and may require a number of subsidiary treatments including smoke or chemical processes that have been found to be more effective towards the end of the after-ripening period (Ralph 2003). V***ernalisation*** is another such treatment. The after-ripening process is common in a range of native grasses and in the family Asteraceae (daisies) (Ralph 2003). Locally, after-ripening has been discovered for Southern Brush Kurrajong *Commersonia rossii* in south-eastern Australia (Rainforest Plant Propagation Manual for south-eastern Australia). See also: ***chemical dormancy***, ***physiological dormancy***, ***stratification*** and ***vernalisation***.
algae	Non-vascular plants that are usually aquatic, though some single-celled species are involved in ***symbiosis*** in ***lichens*** or are free living. See also: ***blue-green algae***.
altered trajectory	Describes a change in the expected progress or end point of restoration or a natural process with regard to vegetation, from that expected for the site. For example, the trajectory of recovery for a rainforest stand after a disturbance event can be deflected by another disturbance episode before ***succession*** has had a chance to take it back to the mature pre-disturbance state. The recovering rainforest stand is experiencing an altered trajectory to that predicted for the site, before the disturbance and at the time of the disturbance. Similarly, site factors may have been so fundamentally changed on a restoration site (from the historic condition) such that the pre-1750s EVC can no longer be sustained on that site. This site is said to have an altered site trajectory, which means that you must restore a different (but local EVC) that matches the site's contemporary environment. See also: ***ecosystem recovery***, ***replacement***, ***trajectory, transformation*** and ***restoration goals***.

anastomose	Describes a pattern of veins or roots that come together or open into each other, as in: the veins of a leaf, of your own vascular system, or when a ***strangler*** fig's roots cross each other on the outside of the host tree's trunk. These roots anastomose, welding together to form a lattice work straight-jacket around the host. Because the host trunk expands just a little each year with the production of its trunk's annual rings, this straight-jacket begins to constrict the sap flow of the host, eventually strangling it to death. By the time that the host tree has died and rotted away the strangler fig's roots have become so completely anastomosed, that they form a lattice work or cylinder that is sufficiently strong to hold the crown of the fig erect on its own without the need for the structural support of the host's trunk. Anastomosing stems are also known in English Ivy **Hedera helix*, which, like figs, can strangle their hosts to death.
Anthropocene Epoch	The newly described geological epoch that has been proposed to account for anthropogenically derived ***climate change*** (Flannery 2005) that is separated from the former ***Holocene*** Epoch (formerly 11,500 years *BP* to present). Settling on a starting point (8,000 or 200 years *BP*) for the Anthropocene Epoch is still being debated and will be settled on the basis of the first measurable and sustained ***climate change*** indicators that can be attributed to humans alone (Flannery 2005).
anthropogenic	Derived from the action of people.
aril	A membranous or fleshy appendage that is often brightly coloured (CRCfAW 2007a), which is formed by the expansion of the ***funicle*** that partly or wholly obscures the seed (Walsh and Entwisle 1996). Examples include bird-dispersed ***rainforest wattles*** (Maidens Wattle *Acacia maidenii*, Blackwood *A. melanoxylon,* etc.). Cf. ***funicle***. See also: ***non-rainforest wattles*** and ***rainforest wattles,*** Chapter S4: *Wattles*.
AROTs	Acronym: Australian Rare or Threatened species. See also: *VROTs*.
artificial mulches	Artificial mulches are derived from materials other than living mulches, litter fall, or herbicide applications to pre-existing groundcover plants. They are usually made in mat form. Some are manufactured specifically for this purpose using both synthetic and natural materials while many use recycled fabrics. Artificial mulches are very useful because of their very effective at weed control (Figure 8.19). The choice of material, however, is critical. Those illustrated in Figure 8.19 are made of recycled natural and synthetic fibre. Therein lies their Achilles Heel: wherever the material is synthetic, they have yet to break down and are completely unchanged in 5 years. This is a potentially a huge problem for the restoration site. It is therefore strongly recommended that only natural materials such as choir, jute etc. are used if you wish to employ artificial mulches on your restoration sites. Cf. ***living mulches***.
arthropods	Animals with jointed external skeletons, such as insects and crustaceans in your rainforests (including many small soil invertebrates and larger animals such as yabbies).
ASL	Acronym: above sea level (in metres).
assisted regeneration	In essence ***restoration***: what we do (how we assist) the ***ecosystem*** to restore itself; the regeneration can be of plants, animals or ***systems***.
atmospheric accession	The process whereby nutrients are transferred from water bodies to the atmosphere. This phenomenon is important when ***salt hazes*** settle on coastal vegetation, thereby transferring nutrients from the sea to the terrestrial ***ecosystem***; and coincidentally reducing fine fuel flammability (Additional reading: Ignition times).
auger	A device for drilling holes in soil. See also: ***Hamilton Treeplanters, mechanical auger*** and ***Potaputkis*** and Chapter 6: Table S2 for a comparison of their relative merits.
Australia's Virtual Herbarium (AVH)	An online service composed of all of Australia's herbarium data bases that provide a mapping service and other data sets to the public that plots the distribution of plant taxa across Australia (for an example see the maps presented in the Glossary under ***vernalisation***). See also: ***PlantNet***.
avulsion	The (usually rapid) process of a river changing its course from one channel to another.

background weeds	These weeds generally represent little ***threat*** to particular ***vegetation types*** and the species in them (compare with ***transforming weeds***). They are generally characterised by being small in stature, rarely abundant or fleeting in appearance (annuals or biennials). Although often widespread in distribution, even in remote areas of natural bushland, they appear unable to take over (transform) the vegetation in which they are found (through displacement of native species), either as a result of poor competitive abilities or an absence of the required disturbance regimes needed for their proliferation in that vegetation type. As a consequence, the definition of a background weed is ***ecological vegetation class***-specific Examples of background weeds in ***rainforest*** include: Spear Thistle **Cirsium vulgare*, Flatweed **Hypochaeris radicata*, Cape Gooseberry **Physalis peruviana*, Madeira Winter-cherry **Solanum pseudocapsicum* and Common Mouse-ear Chickweed **Cerastium glomeratum*. The vegetation-specificity of such a definition is emphasised again, in that Cat's Ear is a significant weed of Coast Dune ***Scrub*** where this species can out-compete most small-stature native ground orchids. See also ***transforming weeds***.
backing fires	See *Fire types*.
back swamp	A swamp formed on the margins of the floodplain near the valley's sides where the stream's alluvial deposits are at their lowest elevation and water accumulates between the river levee and the surrounding hills.
bacteria	Single-celled organisms without nuclear membranes. These taxa are important for decomposition of organic material in the soil and leaf litter, pathogenicity (causing disease and, in some cases, killing plants and animals), as well as participating in the succession of organisms that leads to hollow formation in trees, etc.
banyan forms	Forms of Small-leaved Fig *Ficus obliqua* and Rusty Fig *F. rubiginosa* that have an abundance of aerial roots that facilitate strangulation of a host tree (Supplement Preamble Figure P1). This feature needs to be selected for when using these species as ***stranglers*** that can kill weedy trees, since those seedling figs without these aerial roots may not establish and certainly will not strangle the host (see ***endophytes***). This distinction is important if you want to use this species as a control measure for woody weeds like Camphor Laurel **Cinnamomum camphora*.
barrier dunes	Dunes that form between the ocean and an estuary (e.g. Ninety Mile Beach in Victoria), which can be important for ***Littoral Rainforest***.
beach rotation	The process whereby sediments rotate along the length of a beach, causing accession (build-up) or recession (loss) of material at different localities along its length at different times. This cyclic change alters according to the pattern of tides, currents, prevailing winds and storm events. These movements can be altered by changes to any of these sediment transport mechanisms. There is some evidence that a small shift in the prevailing wind direction and/or sea level rise and/or prevalence and severity of storm events (all of which are changing as a result of ***climate change***) are now taking place (SMEC 2008). Together, these can dramatically affect this pattern of beach rotation, an example of which is now occurring along the Lighthouse Beach (Port Macquarie) to Middle Rock Beach section of the Mid North Coast of New South Wales (SMEC 2008). If it is occurring locally, this phenomenon can add to or remove Littoral Rainforest habitat.
BGT	Acronym: Botanic Gardens Trust. The BGT must be consulted when accessing or supplying the NSW Seedbank plant propagation material from threatened communities or threatened species. <www.environment.nsw.gov.au/threatenedspecies/>.
benchmark	The individual elements of a ***reference site*** that comprise the goals of your ***restoration*** works for your particular restoration site. Although individual benchmark elements represent the aims of restoration, many of them may not be directly reinstated by your restoration tasks, but are instead set in train through ***ecosystem processes.*** These underpin the restored ***ecosystem*** and these are the drivers that will ultimately ensure that the benchmarks that comprise your reference site are finally reinstated.
berm	A low narrow shoreline deposit usually in the form of a small sandy flat (occasionally composed of cobbles with some sand), typically less than 1.0 m high. This ***landform*** is derived from wave action along a lakeshore that may occasionally be reworked by wind. Typically the texture of berms differs to that of ***aeolian***-derived dunes in that the particle size is highly variable and in sandy types can contains water-worn pebbles and even cobbles deposited by the wave action. If well protected from fire, these landforms are ***habitat*** for ***Littoral Rainforests*** within the study area. Those berms associated with ***deltaic deposits*** are called ***cheniers***.
berry	A fleshy or pulpy ***indehiscent*** fruit with one or more seeds embedded in fleshy tissue (CRCfAW 2007a).
billabong	An old (non-flowing) section of a river that has been cut off from the flow of the stream, which has moved to a new course. Billabongs are found on mature floodplains. Billabongs are generally only rehydrated by flooding and over time are infilled with sediment. This reduction in open water decreases their ability to provide fire protection to the rainforest remnants associated with them compared to the main channel of a perennial stream.

biodiversity	The diversity of ***taxa***, ***communities***, vegetation patterns and the genetic material contained within them.
biogeographical region	See ***bioregion***.
biological control *biological controls*	Species that kill or weaken other species, and thereby help to keep the populations of the prey species under control. It can apply to any combination of ***predator*** or prey: animal to animal interactions, plant to animal, plant to plant, ***fungi*** to plant, fungi to animal, ***bacteria*** to plant, and so on. These relationships are often exploited by biologists seeking 'natural' solutions to the invasion and damage caused by ***exotic*** organisms that are introduced to places that are outside their natural range. Many of these pest species become a problem themselves because their normal biological controls are left behind in their native habitat: as illustrated by the introduction of Cane Toads to control Cane Beetles. These days, the introduction of biological controls has a strict protocol attached to their release: should their pest species prey run out, the new biological controls would die rather than switch to a related or unrelated native species. The aim of biological controls is to reduce the pest species population to low levels, because full eradication using such methods is often impossible. Nonetheless, with integrated pest management, the biological control may reduce numbers to such a degree that other control methods may succeed in eliminating the pest altogether. See also: Chapter S6: Biological control and ***integrated weed management***.
biome	A collection of like vegetation (***ecological communities***) that constitutes a definable grouping with the same structure delineated by ***climate*** (Lindenmayer and Burgman 2005). For example, there are two ***rainforest*** biomes in south-eastern Australia: one is the lowland rainforest biome that is constituted of: ***Subtropical***, ***Warm Temperate***, ***Gallery***, ***Dry***, ***Dry Gully*** and ***Littoral Rainforest EVCs***. The other is the ***montane*** rainforest biome that is comprised of: ***Cool Temperate Rainforest***, ***Cool Temperate Mixed Forest*** and ***Cloud Forest***.
bioregion	A geographic region defined on the basis of its biological attributes, ***climate*** and ***landforms***.
biotic	Any part of an ecosystem that is living. Cf. ***abiotic***.
blossom-nomads	A species whose nomadism is dictated by the mass-flowering events of the species that provide them with nectar. Blossom-nomads include birds and mammals and the ***blossom-nomad chains*** that sustain them reach from southern Queensland to Tasmania. Blossom-nomad species that use rainforest in south-eastern Australia include: the honeyeaters (Little Friarbird, Noisy Friarbird, Red Wattlebird, Little Wattlebird, Yellow-faced Honeyeater, Regent Honeyeater, Crescent Honeyeater and Scarlet Honeyeater), parrots (Rainbow Lorikeet, Musk Lorikeet and Swift Parrot), Silvereyes, and Grey-headed Flying Foxes and Little Red Flying Foxes. In south-eastern Australia, mass-flowering rainforest associated genera include: *Amyema* (frequently in any type where they grow on eucalypts, angophoras or wattles), *Angophora* (rarely), *Banksia* (usual in Littoral Rainforests), *Corymbia* (rarely), *Eucalyptus* (some species only in most types), *Muellerina* (in any types with eucalypts, angophoras, wattles or banksias) and *Pittosporum (*all lowland types). See also: ***Blossom-nomad chains.***
blossom-nomad chains	The interconnected and/or overlapping synchronised mass-flowering genera and/or species that form a sequential temporal and geographic chain that supports the migration of ***blossom-nomads*** up and down the eastern seaboard of Australia. See also: ***blossom-nomads***.
blue-green algae	A group that closely resembles bacteria (to which their cell structure is related), but which can photosynthesise. Some species (particularly *Nostoc* spp.) are symbiotic with plants and fix nitrogen for their host. *Nostoc commune* forms crusts on bare soils and when they become wet they change to a gelatinous state. During these active phases of growth this species fixes nitrogen and in its gelatinous state it catches wind-blown seeds that may provide beneficial germination sites. This species may be important in the succession and recovery of degraded areas of Dry Rainforest (particularly areas that were previously grazed) that have lost topsoil and organic matter, because this species assists in soil formation. See also: ***bacteria***, ***lichens*** and ***liverworts***.
bole	The base of a tree's trunk, below the first (usually substantial) branches.
bonfire trees	This phenomenon was drawn to the author's attention by Rohan Bilney who was researching two large forest owls (Sooty Owls *Tyto tenebricosa* and Powerful Owls *Ninox strenua*) in the rainforests in south-eastern Australia for his Doctorate thesis. Following the 2007 Great Divide Alpine Complex Megafire, Rohan 'lost count of the number of Owl roost trees (usually large Sweet Pittosporum *P. undulatum*) around the base of gum-barked eucalypts, that were immolated' due to this 'bonfire tree' phenomenon. Buried deep within many rainforests in south-eastern Australia are gum-barked eucalypt trees that are centuries old that develop enormous bark piles and fallen limbs at their bases during inter-fire periods. During wildfires, because rainforests occupy '***fire shadows***' and often have sufficient moisture differentials and fuel discontinuities to ensure that fire only trickles through the leaf litter as a cool burn as the result of ***backing*** or ***flanking fire***s some time after the ***heading fire*** has passed (Greg McCarthy pers. comm.). These 'gentle fires', however, can find these large fuel piles at the bases of these gum barked-trees. If they are sufficiently dry at the time, these bark piles ignite with tremendous vigour and they can cause a bonfire effect whose radiant heat can reach 40–50 m into the crown of the

	eucalypt setting its crown ablaze. The ignition of the fuel pile at the base of the tree has the effect of producing a sustained and high-intensity fire deep within the ***rainforest***. This can kill the thin-barked rainforest trees for a radius of tens of metres [because bark thickness is the principle factor governing temperature rise at the cambium during a fire which leads to thermal damage and scarring (Gould *et al.* 2007)], and sterilise the soil for many metres around the burnt eucalypt (Appendix S18 worksheet: Figures fire AS18-1, AS18-2, AS18-4 and AS18-5). These observations of fire behaviour, causes and effects were independently and forensically confirmed by Greg McCarthy (pers. comm.). Note: the bark piles that are associated with these tree species take a long while to develop. Their accumulation is related to both very old trees and long-unburnt ***habitats***. Regrowth trees of these gum-barked species following the 1983 wildfires in East Gippsland (have 26 years further on), failed to even begin the process of a bark pile accumulation at the base of these young regrowth trees.
boulder berms	A ***tsunami landform***, created by the surge of the wave collecting near-shore marine boulders and depositing them on the adjacent shore.   Bittangabee Bay NSW. Boulder berm believed to be derived from a tsunami event that supports a small stand of Littoral Rainforest. Bittangabee Bay NSW. The Littoral Rainforest on the boulder berm pictured to the left.
BP	Acronym: Used to describe geological time periods. Literally years 'Before Present'.

Bradley Weeding	Bradley Weeding is a technique developed by two sisters of that surname who lived in Mossman on the north shore in Sydney. They undertook to reverse the weed invasion in a park at Bradley Head that was killing their local bit of bush. In the process, they developed a revolutionary technique that has been widely adopted by community groups and natural resource management agencies alike and has spawned an international movement. It has wide application across most ***habitats*** and in most plant communities (including ***rainforest*** in the temperate regions of Australia). The technique is well covered in the book: 'Bringing Back the Bush' (Bradley 2002), which is now in its fifth edition and second revision. The technique involves a number of important components: • Always work from the most intact part of the remnant outwards into the more degraded areas (this has the beneficial result of keeping healthy areas intact, while allowing these to reinforce the areas that you work on next); • Keep your weeding disturbance to a minimum (so as not to further damage already struggling native species); • Don't bare the soil: it just creates more sites for weed germination, establishment and reproduction; • Where there is no public risk, kill large woody weeds and leave them in place; and • Remove any fragment or seed (called bagging) from the site for appropriate disposal: deny the weed the opportunity to reproduce in your ***restoration*** site.
Bradley Weeding principles	The Bradley Weeding technique employs the following ecological principles: • ***Ecosystem resilience*** (the power of plant communities to self-repair) will help extend the remnant and repair it if the right bit of management happens at the right moment. It helps to ensure that relatively unsophisticated acts of ***restoration***, lead to recovery (Harden *et al*. (2004) through the development of greater levels of ecological complexity and integrity and the restoration of ***ecological processes*** (this publication); • Concentrate your efforts where you will have the best result, not necessarily the biggest visual impact: a lot of Bradley Weeding leads to major ***ecosystem*** repair but has minimal visual impact; • Begin your work in the least disturbed areas that are in the best condition. While this is not always possible at the outset on a restoration site, once restoration is underway, weeds are under control and ***natural regeneration*** is occurring, it becomes really important to prioritise areas that should be Bradley Weeded as opposed to those where herbicide or other techniques are still needed (***Wingham Weeding***); • Know your weeds (including ***germinants***): how they reproduce, how they persist and what kills them quickest with the least disturbance. • Work carefully so that you don't create new weed invasions or populations; • Don't over-reach yourself or your group's resources; and • Be persistent and very patient.
browse	Shrub or tree material that is eaten by a ***herbivore***. Cf. ***grazing***.
browsing	The act of browsing. See: ***browse***.

browsing refuge	Any situation, structure or circumstance that provides relief from browsing impacts. These are many and varied: their effectiveness may change according to season, availability of other suitable browse for the animals doing the chewing, the number of browsers and their ***diversity***. It all sounds complicated, but once you get your eye in, you will discover where the ***natural regeneration*** is establishing: and that is your browsing refuge. A refuge may be a ***landform*** (cliff, steep undercut river bank (Figure: below right), a structure (ranging from a grass tussock to a fallen tree head (Chapter 4 Opener) a mesh fence, or another plant species. The latter are particularly important as these can be propagated or helped along by your site management to manipulate your browsers (Figure 4.1 and 4.2; Chapter S6, S245). Such species are grouped (according to the mechanisms that enable them to protect your precious plants) such as: ***unpalatable***, ***camouflage*** or ***deterrent species*** (see Chapter S6: Browsing management using companion planting). Almost always browsing refuges are browsing-animal specific: that is to say, what works for one species may not work for another. If you get this one area right, you may well never have to put in stakes or a tree guard ever again! In fact, a lot of rainforest restoration planting in East Gippsland no longer uses conventional guards. Some novel suggestions for assessing your browsing problems are presented in Case study 3 in Chapter 4 and Figure 4.11.

Lake Wat Wat, Victoria. A seasonal browsing refuge of Scrub Nettle *Urtica incisa* which is a perennial geophyte (dying down during dry periods such as summer and drought). This species provides a browsing refuge from Swamp Wallabies, which is illustrated by the browsing to the lower branches of Muttonwood *Myrsine howittiana* (red ellipse). Contrast this to the photo below where the same refuge is enhanced by a fallen tree.

Lake Wat Wat, Victoria. Part of the same browsing refuge pictured above, but with the addition of a fallen tree. The level of browsing from Swamp Wallabies is much less, because when the nettles die down, the fallen tree still provides browsing protection. This more durable browsing refuge's effectiveness is illustrated by the lack of browsing on the lower branches (red ellipse). Note: the specificity of the browsing refuge; none of these impediments would stop Sambar which are periodically present on this site.

Maringa Creek, Nyerimilang, Victoria. This Yellowwood *Acronychia oblongifolia* is highly palatable but it is protected by a 1.5m steep creek bank (}) and a 1.0 m deep water hole (even during drought). It has protected it from browsing by cattle, Hog Deer and Swamp Wallabies. We have used this browsing refuge just upstream to establish this species, when at the same time on the adjacent flat ~1,000 wattles were eaten in a month by the deer and wallabies. Note water siphoning from the water hole vertically up the bank. In estuarine situations this process can convey salt into soils of Littoral Rainforests (see Chapter 3 Case study 1).

brush	A New South Wales term for an extensive and more-or-less continuous area of rainforest. For example, Yarawa Brush at Robinson in the Southern Highlands of New South Wales. See also: '***scrub'*** and '***jungle***'
bryophytes	***Non-vascular*** plants (mosses and liverworts).
bulk density (of soils)	This is one way of calculating the proportion of soil carbon. See: Chapter S5: Figures S205–S209 and you can find the recipe provided for its calculation in Chapter 7: Coasts (beaches dunes, headlands and estuaries).
bush regeneration	The general term for ***ecological restoration*** across any landscape, where the principles of ***restoration ecology*** are applied in an integrated manner using specific approaches (targeted ***restoration methods***, ***integrated weed management***, ***Bradley*** and ***Wingham Weeding***) that are strategically applied in concert with other ***ecological management*** at the landscape-scale (such as the ***knockdown weeding***). Bush regeneration should be employed either when there is a small but high weed cover infestation in or near good quality bush (the control program should ensure ***natural regeneration*** repairs the damage) or where there are lower levels of infestations or small stature weeds over much larger areas (the earlier phases of weed invasion). Bush regeneration is particularly important as a follow-up technique to ***knockdown weed control*** programs and pre-treatment before aerial spraying (that reduces the risk of ***weed succession***). In contrast, knockdown weed control is appropriate where the first stage of ***landscape-scale weed control*** is required and weed infestations are either large and/or dense. Each site should be assessed on its merits and in its ***landscape context*** and the appropriate combinations of techniques applied.

bush regenerators	People who undertake ***bush regeneration***.
canopy	Uppermost layer of vegetation: canopy vines, ***canopy trees***, etc.
C3 plants *C3 pathway* *C3 weeds*	Abbreviation for a physiological pathway for fixing CO_2. Plants adapted to cooler moist ***climates*** (temperate zones) or ***niches*** (southern aspects: e.g. ***Warm Temperate Rainforests***), shady situations (***rainforest understoreys***) because the C3 pathway is less efficient than the C4 pathway, which leads to greater losses of water when photosynthesis takes in CO_2 to make sugars. The advantage to the plant is that it can fix the same amount of CO_2 with less light in moister environments than C4 plants. Such plants will be at an advantage under ***climate change*** due to increasing levels of CO_2 in the atmosphere. This gives the advantage to C3 plants, but only where conditions remain moist and water stress is not a limiting factor. C3 weeds are often common in the light to moderate shade found beneath pioneer and secondary canopy species (Chapter S4: Table S8).
C4 plants *C4 pathway* *C4 weeds*	Abbreviation for a physiological pathway for fixing CO_2. Plants adapted to hot sunny ***climates*** (tropics or subtropics) or warm sunny ***niches*** (northern aspects: e.g. ***Dry Rainforests***), sunny non-shaded vegetation (grasslands) because the C4 is more efficient than the *C3* pathway. The advantage to the plant is that it can fix the same amount of CO_2 into sugars over a shorter period of time (losing less water through their stomata) during photosynthesis, hence the advantage it has in hot or dry conditions over ***C3 plants***. Such plants will be at an advantage from climate drying under ***climate change***, but not by increasing levels of CO_2 in the atmosphere that advantages C3 plants (provided moist conditions still prevail in those plant's ***habitat***). C4 weeds are most likely to be found in full sun niches.
ca	Abbreviation: from the *Latin*: *circa*: about. Usually applied in reference to a date: ca 1990.
CAMBA	Acronym: Chinese-Australia Migratory Bird Agreement providing legal protection to both these migratory species and their habitat in each of the countries that are parties to the agreement. See also: *JAMBA* and *ROKAMBA*.
camouflage species	Species that provide a ***refuge*** from ***browsing*** by obscuring the palatable species. For example: Bracken *Pteridium esculentum*, Seaberry Saltbush *Rhagodia candolleana*, etc. These species may be ***unpalatable***: low in nutrients or food value, or just old and woody.

canopy attrition	Canopy attrition occurs wherever a ***Littoral Rainforest*** stand is exposed to prevailing salt-laden winds (Additional Reading Figure AR15). The prevalence of salt and its destructive impacts on vegetation are a major determinant of the composition of Littoral Rainforests compared with other ***rainforest types*** (Floyd 1989). There are no other known disturbance types for rainforest that will remove mature canopy over substantial areas as slowly or as relentlessly as the attrition of mature trees by prevailing winds once the seaward protective ***storm shutter's*** canopy begins to break down. The unique nature of this disturbance type was not realised until it was discussed with David Cameron. Its features include: • Slow but inexorable loss over time (Additional Reading Figure AR15), that only ceases with the emergence of a new windward protective canopy often from root ***coppicing*** or basal coppicing (Additional Reading Figure AR16) ; • Loss of canopy from mature trees in their prime (Additional Reading Figure AR17); • Depending on species, the loss can be the whole tree (Coast Banksia *B. integrifolia*, Sweet Pittosporum *P. undulatum*) (Additional Reading: Figure AR15 and AR17) or only the aerial portion as with *Syzygium smithii* where coppicing regeneration from the rootstock begins immediately (Additional Reading Figure AR16); and • ***Gap phase regeneration*** by Lilly Pilly *Syzygium smithii* in these situations is relatively short as rootstock regeneration allows for rapid gap closure to form a dense shrubland, even in highly exposed sites that constitutes the new ***storm shutter*** (Additional Reading Figure AR16). • Gap phase regeneration involving other species (particularly seedling Coast Banksia *B. integrifolia*, and coppicing of Rusty Fig *Ficus rubiginosa* and Sweet Pittosporum *P. undulatum)* has been recorded at several sites. The process of canopy attrition is very intriguing. Structurally these mature Littoral Rainforest stands have a bare ***understorey*** and are primarily composed of trees with long leafless ***boles*** topped by a dense leafy canopy. In the intact state, such stands start at ground level on the windward margin of the stand and proceed from there in a wedge-shaped configuration to attain mature height on the leeward side of the stand: creating an effective *storm shutter* (Figure AR18). Within the study area, the ***usual species*** in these situations are Sweet Pittosporum and Lilly Pilly *Syzygium smithii*, but may also include other species such as Rusty Fig *Ficus rubiginosa* (Additional Reading Figure AR19). When the mature stems at the windward edge of the Littoral Rainforest stand are exposed to the prevailing winds, the leading edge of one or a few stems dies back and this results in the death of that stem (Additional Reading Figure AR15). Regeneration of the wind-proof front line canopy occurs through a variety of mechanisms that are species-specific. These include: • from basal coppicing in the case of Lilly Pilly (Additional Reading Figure AR16), Blue Oliveberry *Elaeocarpus reticulatus* and others; • root coppicing as is the case with Red Olive Plum *Elaeodendron australe* and Muttonwood *Myrsine howittiana* (Appendix S6 worksheet: Coppicers and collapsers)*;* • from decumbent trunks lying on the ground in the case of Rusty Fig (Additional Reading Figure AR19); or • as seedlings in the case of Brittlewood *Claoxylon australe*, Sweet Pittosporum and others (Additional Reading: Figure AR16 and AR18).

canopy decapitation	There are three mechanisms that can lead to mature canopy decapitation: 1. Drought 2. *Wind attrition* 3. Loss of *frontline* vegetation. Each process leads to the same result: the mature canopy is lost and leads to a nick in the ***storm shutter***. During this period of storm shutter failure, the *rainforest* interior is opened up to the damaging *edge effects* of salt-laden winds and a *tunnel gap* develops, which may be more than 100 m long. Unlike the usual *gap* regeneration scenario of most other rainforests of the region, the process of *wind tunnel gap* repair can occur through the regrowth of the original *canopy tree* from basal shoots, which is a regenerative capability of many of the dominant canopy species. At the beginning of the process, the rainforest canopy at its seaward edge may be only centimetres high and tightly interlocking and can often involve a graminoid component (Blady Grass *Imperata cylindrica* (Figure S268), Spiny-headed Mat-rush *Lomandra longifolia* (Figure: *Storm shutter*), Prickly Couch *Zoysia macrantha*, etc. or rocks (Additional Reading Figures: AR18 and AR19). These features help to protect the stand from further wind attrition as it grows in stature. See also: *storm shutter* and *wind tunnel gap*.
canopy tree	Primary or secondary *rainforest* species (e.g. Lilly Pilly *Syzygium smithii*) that form the closed canopy of the rainforest stand (as apposed to an *emergent tree* that grows beyond the canopy such as a eucalypt, banksias or fig.
capsule	A dry *indehiscent* fruit (CRCfAW 2007a).
carbon highway	This is the highway between the atmosphere and the soils along which carbon is transported and stored in the soil, improving its fertility and the soil's health. It describes the route through which atmospheric CO_2 is sequestered by plants during *photosynthesis* manufactured into sugars and other organic molecules. These *photosynthates* are then transported down into the roots and excreted by the plant into the soil in the root zone (*rhizosphere*) where it feeds a multitude of mycorrhizal *fungi* that help sustain the plant and other soil micro-organisms and soil processes.
carnivore	An animal that eats meat. Cf. *frugivore*, *granivore*, *herbivore*, *insectivore* and *nectivore* .
carrion	Dead flesh.
CARS	Acronym: Comprehensive and Adequate Reserve System, defined by Lindemayer (2007) as: • 'Comprehensiveness': requiring the need to include all biodiversity; • 'Adequate': relating to the need to support populations with long-term viability; • 'Representativeness': requiring that a reserve system should support samples of species, *vegetation types* and communities from throughout their ranges; and • 'System': necessitating a range of sizes, uses and areas available to achieve the above aims. This is where your *rainforest restoration* works are so important because they ensures that there is a good (and improving) geographic spread of rainforest (not only in the extant rainforest estate), but also reinstating the extinct rainforest estate.
catabatic winds	Winds that flow down slope. This is of relevance to *rainforest restoration* where cold air moves down slope as a wind or breeze that can cause cold air to pool resulting in frosts of much greater severity than on the surrounding slopes. Such cold air pooling is exacerbated by clearing forest cover and may be more frequent at higher elevations (provided cloud cover is less).
catchment hardening	The process whereby land clearing and urbanisation increases the volume and rate of water discharge to a waterway by up to 40% from the original catchment's discharge (Chapter 3: Setting your *restoration trajectory* and goals: what type of rainforest was it and should this be the one to be put back?). This process has important implications for *rainforest restoration* as it may change your site's *restoration trajectory* from the historic state.
cf.	Abbreviation: compared with.
CFA	Abbreviation: Country Fire Authority (Vic).
CFS	Abbreviation: Country Fire Service (NSW).
Characteristic Species	Species that occur in more than 27% of sampled sites (*sensu* Peel 1999).

chemical dormancy	The presence of chemical compounds that can inhibit germination in some species such as saltbushes *Atriplex* spp., appleberries *Billardiera* spp. and correas *Correa* spp. The effects of these chemicals must be broken before the seed can germinate. See also: ***physical dormancy***, ***physiological dormancy***, ***stratification*** and ***vernalisation***.
chenier	A ridge formed by the lateral transport and reworking of ***deltaic*** sediment deposits often (but not always) containing shell material. Higher chenier deposits are found in the study area (Tambo Bay) and can be up to 5 m ***ASL***. In the context of this work, one of the ***habitats*** colonised by ***Littoral Rainforest*** in south-eastern Australia. See also: ***berm***.
chlorosis	The loss of green pigment from the leaves of plants. Most commonly caused by a lack of specific plant nutrients that are important in the development of chlorophyll: the green pigment in plant leaves. This leads to a yellowing of leaves, and death of new shoots in serious examples (see photo below). It is caused by one or a combination of the following: poor drainage, soil pH causing some minerals (used in the manufacture of chlorophyll or its precursors) to be unavailable, a mineral lacking from the soil (iron, magnesium or nitrogen) or herbicides.
	Merrangbaur Gully, Lakes Entrance Victoria. This illustrates the importance of knowing about the risks of chlorosis in some soil types and being strict about plant ***provenance*** when collecting seed both for propagation, but most especially for ***direct seeding***. The site is at Lakes Entrance on a ***rainforest restoration*** site that has a limestone soil, with high pH that is likely to lead to chlorosis in some species and in ***ecotypes*** not suited to these soils. In anticipation of this problem, the seed mix included Limestone Blue Wattle *Acacia caerulescens* (which as the name suggests is adapted to limestone). It is the plant on the right of the photo. It also included Golden Wattle *A. pycnantha* (the plant on the left of the photo: named for the colour of the flowers, not the colour of its leaves!). Golden Wattle has some ecotypes in the district that are well adapted to limestone soils. Clearly the seed collection used for this direct seeding plot was from plants that are from the ecotype adapted to acid soils, but not the alkaline limestone soil into which it was sown. The Golden Wattle is sick and will die, but only metres away on acid sandy soils this ***ecotype*** is flourishing. 

climate	The thirty-year average of a range of meteorological measures that are experienced every day for a specific site or region. The weather is what you experience on the day at a particular spot, whereas climate is the average of these daily phenomena. Long-term measurements of these indices help to predict climate in terms of what you might expect next year or the year after in that month rather than on that particular day.
climate change	The contemporary change in *climate* during the *Anthropocene*, as the result of human activity. *Climate change bump-along-tables* help conceptualise the likely and observed changes at the *EVC* level.
climate change bump-along-tables	These tables have been produced to help *restoration* ecologists and land managers to conceptualise the likely impacts of a range of climate change elements that are beginning to impact on *rainforest ecology* and the distribution of rainforests in south-eastern Australia. Some examples of climate EVC bump-along tables follow.

Reduced frost days (leading to longer growing seasons where moisture levels are not limiting):

- Based on expected latitudinal and altitudinal migration of climate zones; and
- Based on expected longitudinal migration of climate zones (as seas warm and the influence of the Circum-Antarctic Western Current declines).

Postulated changes to riparian rainforest EVCs in south-eastern Australia from reduced frost frequency and severity

CURRENT AND FUTURE RIPARIAN RAINFOREST EVCs UNDER REDUCED FROST REGIME AND WARMING CLIMATE					
Winter rainfall and very wet+coolest		Even rainfall wet+warm	Damp+warmer	Drier+warmer	Summer rainfall+warmest
Cool Temperate Rainforest		Warm Temperate Rainforest	Gallery Rainforest		Subtropical Rainforest
Sub-alpine/montane	Montane	Foothill and lowlands		Coastal lowlands	
Cool Temperate		Warm temperate		Subtropical climate zone	

Postulated changes in riparian rainforest EVCs by Victorian Rainforest Region (*sensu* Peel 1999) as a result of reduced frost frequency and severity

CURRENT AND FUTURE RIPARIAN RAINFOREST EVCs UNDER REDUCED FROST REGIME AND WARMING CLIMATE						
Very wet+cool			Wet+warm	Damp+warmer	Drier+warmer	Summer rain+warmest
Cool	Temperate Rainforest		Warm Temperate Rainforest	Gallery Rainforest		Subtropical Rainforest (currently NSW only)
Otways	Strzleckis	Central Highlands	East Gippsland			
WTRf migration barrier of Western Basalt Plains	Overall: *CTRf* in retreat Entry of *WTRf* in Central Highlands Expansion of *WTRf* in Strzeleckis		*CTRf* in retreat up the altitudinal profile *WTRf* and *GRf*, move up the altitudinal profile *STRf* enters from southern NSW			
Lose some *CTRf*	Lose *CTRf*	Reduced *CTRf*	Reduced *CTRf*	Maintain *WTRf*	Maintain *GRf*	Gain *STRf*
Migration barrier *WTRf* can't enter	All *WTRf* Expanding warm climate envelope	More *WTRf*	Losing cool climate envelope	Altitudinal migration of warm climate envelope		Latitudinal migration of subtropical climate envelope

Glossary

Postulated extreme temperature impacts (leading to loss of keystone or structurally important species) for south-eastern Australia:

- Based on temperatures over 30ºC for cold temperate climate envelope: substitute the next most temperature-tolerant/decreasing moisture dependent EVC;
- Based on temperatures over 35ºC for cool temperate climate envelope: substitute the next most temperature-tolerant/decreasing moisture dependent EVC;
- Based on temperatures over 40ºC for warm temperate climate envelope: substitute the next most temperature-tolerant/decreasing moisture dependent EVC; and
- Based on increasing duration of extreme temperatures.

Postulated changes to riparian EVCs on major streams in south-eastern Australia as the result of extreme temperatures

CURRENT RIPARIAN EVCs AND CONDITIONS IN THE SEQUENCE					
Very wet+coldest	Very wet+milder	Wet+warmer	Damp+warmer	Drier+warmer	Driest and warmest
Riparian Thicket	Cool Temperate Rainforest	Warm Temperate Rainforest	Riparian Forest	Dry Valley Forest	Valley Grassy Forest
Sub-alpine	Montane	Foothill			
Cold temperate	Cool temperate	Warm temperate			
Days exceeding 30ºC	Days exceeding 35ºC	Days exceeding 40ºC			

Reduced rainfall (up to 50% reduction in flows on the Mitchell, Tambo and Snowy by 2070 (Victorian Government 2008) reduction in moisture levels, increased fire):

- Based on moisture levels on the floodplain: substitute the next driest EVC from downstream; and
- Based on increased fire risk: substitute the next most pyrophyllic (fire-tolerant) EVC from downstream.

Postulated changes to riparian EVCs for major streams in *Regular Riparian Response Regions* resulting from reduced rainfall

CURRENT RIPARIAN EVCs AND CONDITIONS IN THE MOISTURE SEQUENCE					
Very wet+cold	Very wet+milder	Wet+warmer	Damp+warmer	Drier+warmer	Driest and warmest
Riparian Thicket	Cool Temperate Rainforest	Warm Temperate Rainforest	Riparian Forest	Dry Valley Forest	Valley Grassy Forest
Sub-alpine/montane	Montane	Foothill			
Cold temperate	Cool temperate	Warm temperate			

Postulated changes to riparian EVCs on minor streams in south-eastern Australia from reduced rainfall and increased temperature:

- Based on moisture levels on the floodplain: substitute the next driest EVC from downstream; and temperature.

CURRENT RIPARIAN EVCs AND CONDITIONS IN THE MOISTURE SEQUENCE				
Very wet+coldest	Very wet+colder	Wet+variable temp.	Damp+warmer	Driest+warmest
Sub-alpine Wet Heathland	Riparian Thicket	Riparian Shrubland	Riverine Escarpment Scrub	Non-riparian EVC of adjacent slope
Sub-alpine	Sub-alpine/montane	Foothill		
Cold temperate	Cool temperate	Warm temperate		

Reduced estuary opening, frequency and (as a result of reduced rainfall) for south-eastern Australia:

- Based on inundation leading to increased estuary stand level: substitute the next wettest EVC from downstream/downslope; and
- Based on salinity substitute the next most saline-tolerant EVC from downstream.

Observed changes as the result of increased stand levels and durations on freshwater and estuarine reaches of rivers in East Gippsland.

Warm Temperate Rainforest	Swamp Scrub	Riverine Wetland	Littoral Rainforest	Estuarine Swamp Scrub	Estuarine Wetland	Seagrass Meadow
FRESHWATER biome			ESTURARINE/SALINE biome			
Dry+freshwater (soils)	Wet+freshwater	Wettest+freshwater	Dry+saline(soils)	Wet+saline	Wetter+saline	Aquatic+saline

Changing fire frequency, intensity and extent (as a result of reduced rainfall+increased temperature); their actual and postulated impacts on rainforests in south-eastern Australia:

- Based on frequency, intensity, and extent: substitute the next most pyrophyllic (fire-tolerant) EVC for the climate zone; and
- Based on past observed response to fire: successional re-occupation of the site by rainforest (at lower pre-climate change fire frequencies).

Cool Temperate Rainforest	Warm Temperate Rainforest	Wet Forest	Riparian Forest
FIRE-SENSITIVE biome		PYROPHYLLIC biome	
Cool temperate climate zone	Warm temperate climate zone	Cool temperate climate zone	Warm temperate climate zone

climate change canaries	Species (plants and animals that are the earliest harbingers of ***climate change***): the ‘canaries in the climate change coal mine’. For plants, this includes species that are moving into previously cooler climatic envelopes from lower altitudes or latitudes and thriving, as well as those left behind that are showing poor health or are dying out. For animals, the best examples are the subtropical bird species that are beginning to show up (and breed) in the previously ***warm temperate climate zones*** of East Gippsland. Potential climate change canaries for plants are listed in Chapter 3: The altitudinal and latitudinal shift in climate zones: facilitating climate change migration of rainforests; birds are discussed in Additional Reading: Rainforest birds as harbingers of climate change.
climate change coloniser	In the context of this publication: a ***rainforest*** or other plant species that has ***naturalised*** beyond its old ***climate zone*** (pre-climate change), which is postulated to be the result of either an altitudinal or latitudinal migration of its preferred ***climate envelope***. The coloniser can establish either through natural migration or via the assisted migration of a species across a ***migration barrier*** (usually because of its horticultural use: see Chapter 4: Rainforest conservation during climate change: landscape and local action).
climate change freeways	The terminology of freeway alludes to the water-marked routes that planners place across landscapes to alert map users (and society at large), that certain sections of the landscape will be dedicated for a particular purpose as funds become available. Such proposed climate change freeways for biodiversity would be used by ***taxa*** that need to escape or adapt to the new conditions wrought by ***climate change***. This encompasses existing migration routes that need to be preserved (coasts, riparian zones, etc.) as well as new routes that will be needed by plants and animals which face barriers created by land clearing and urbanisation (see Additional Reading: Rules for climate change intercession across climate change barriers and Table AR22). It is likely that many of these climate change freeways will need to be reconstructed, strengthened and protected in the coming decades if species and systems are not to disappear and we are to maintain the evolutionary potential for species that are threatened by climate change in south-eastern Australia.
climate change immigrant	Species that have moved from their usual pre-climate change range into new areas (and are now resident) in a way that is consistent with the change expected and modelled for a range of elements of climate change. A good local example is that of the Figbird, which is now resident as far south as Bermagui where it is considered to be a climate change immigrant. Its original range was restricted to northern Australia, with a past southerly range limit on the Far North Coast of New South Wales. It is moving both south and up the altitudinal profile (Birds Australia 2007d; Birds Australia 2007e). This species is regularly recorded at Eden. In 2007, it was recorded at Mallacoota (both a single birds and a pair), Bemm River (two birds) (EGBOC 2007), and in 2008 one was recorded in Bairnsdale, Victoria. Cf. ***climate change migrants***.
climate change migrants	Seasonal migrants that are moving further afield than their usual migration destinations into new areas in a way that is consistent with the changes expected and modelled for a range of elements of climate change. Thus, for East Gippsland, some bird species noted to be moving further south and breeding are the summer migrants: Channel-billed Cuckoos *Scythrops novaehollandiae* and Common Koels *Eudynamys scolopacea.*. The latter species has been recorded for the first time in a 22-year-old Framework Restoration site at Kinkuna, Lakes Entrance in 2009: 5-7 years after its first visit to the town. Cf. ***climate change immigrants***.
climate change refuge *climate change refugia*	Localities and ***habitat refugia*** for ***taxa*** and plant communities that will support them until climate change is brought under control; this will allow for their recolonisation of the wider environment once these adverse conditions have ameliorated and cease to threaten their current or near-term survival and evolution. The type and character of the refuge will depend on the element of climate change and its affect, as well as the landscape context of the areas affected. An example is the ***marginal bluffs*** around the northern margins of the Gippsland Lakes, which currently host Littoral Rainforest, but which will be re-activated by coastal erosion that will destroy their habitat through erosion. The climate change refugia for these at-risk marginal bluff stands are the valley slopes of nearby flooded valleys (North Arm and Lake Bunga) because these areas will not lose their Littoral Rainforest habitat to increased oceanic wave action. For a contemporary regional example, see ***extreme temperature refuge***.
climate envelope	A small-scale area of the landscape with a uniform climate that is a subset of that experienced and circumscribed for the larger scale ***climate zone*** in which it occurs. For example, the climate envelope for the habitat of *East Gippsland Montane Scrub* Cool Temperate Rainforest may be defined as occurring in the ***cool temperate climate zone*** between 1100 and 1180 m *ASL*. A climate envelope’s boundary is thought to be one of the factors that constrain the distribution of a plant, animal or ***ecosystem***. Cf. ***climate zone***.
climate zone	A broad-scale area of the landscape whose ***climate*** is defined within south-eastern Australia by the broad categories: ***cool temperate***, ***warm temperate***, ***maritime*** or ***subtropical***. For more details, see Additional Reading: Climate systems you should know more about: impacts on rainforest. Cf. ***climate envelope***.

close weed control	The application of minimal amounts of herbicide at close quarters using a variety of techniques (in New South Wales: sometimes called secondary weeding). If spraying: use low pressure, large droplet size and small foot-print of spray effect applied at no more than 20 cm above the ground. ***Wick-wiping***, cut and paint, drill and fill are other examples of close weed control. See also: ***knockdown weed control*** and ***landscape-scale weed control***.
Cloud Forest	A fire-sensitive ***rainforest type*** dominated by rainforest ***taxa*** (usually of small stature) where the omnipresent cloud cover produces a heavy cover of mosses and other ***bryophytes*** (as well as ***lichens***) both on trees and rocks. Very rare in the region, the only example known to the author is dominated by Hill Kanooka *Tristaniopsis collina* and occupies rock a scree upslope of ***Cool Temperate Rainforest*** at the head of an escarpment in the Clyde River catchment (see Chapter S1: Figure S24).
Clumped Mixed Canopy Method	A ***rainforest restoration method*** that is applied where there is a diverse native species ground-layer that would be destroyed if ***Framework*** or ***Maximum Diversity Rainforest Restoration Methods*** were to involve extensive herbicide use. This method involves planting a mixture of canopy species in clumps across the site to establish a broader shady canopy over time, which conserves the herbaceous or ferny ground-layer without the need for its chemical removal to establish a more complete canopy cover in one hit. See Chapter 5: Clumped Mixed Canopy Method for a complete description and how and when to apply this approach. Cf. ***Framework, Maximum Diversity*** and ***Natural Regeneration*** rainforest restoration methods.
CMA	Acronym: Catchment Management Authority.
CMN	Abbreviation: Conservation Management Network.
C-NALC	Acronym: Colquhoun-North Arm Landcare Group.
cohort	Population of individuals of the same age. In ***restoration***, a group of plants that have arisen from the same ***regeneration event***. See: ***regeneration event***, ***seed dormancy***, ***continuous recruitment***, ***episodic recruitment*** and ***soil seed bank***.
cold feet species	***Rainforest*** species (usually, but not always, secondary and primary plants) that require cool soil for establishment after their germination. Even though many secondary species can grow in ***full sun***, there has to be a soil mulch for them to establish which keeps the soil cool. In contrast, with ***primary species***, the soil is kept cool by a canopy. The author is indebted to Richard Vuat of Wildseed Nursery for alerting him to the apparent contradiction of these species that could be grown in full sun in the nursery, but which failed to establish in full sun on restoration sites. In the nursery, the cold feet conditions were provided by densely packed forestry tubes with the cold-feet seedling's foliage providing the shade that was missing once they were planted at wide spacings in the field. Such species were always fully grown before the heat of summer could reach the soil around their 'feet'. *Cf.* ***hot feet species***. See Appendix S6 worksheet: Hot feet–cold feet species.
collar burn	These burns ringbark and kill plants. They arise when mulch and shade are absent and the sun heats the soil–air boundary layer to temperatures that can exceed 70^{o}C. The danger period in the ***warm temperate climate zone*** is in early spring. The effect is exacerbated in spots that are sheltered from cooling breezes. The burn is usually located at the base of a plant stem where the stem emerges from the soil. The collar denotation arises from the short width of the burn (usually only a centimetre or so) and its complete encirclement of the plant's stem (like the collar around your neck), thus killing the sap-conducting cells which in turn leads to the plant's death. It is easily detected in plants that die suddenly (leaves still intact but wilted), by stripping the bark away from the base of the plant and looking for a brown discoloration. If this discoloration in fresh material also has fungal hyphae associated with this zone, then consider collar-rot (a fungal disease) as the culprit.

community succession	See *plant community succession*.
compost	The second stage of soil carbon formation following the deposition of mulch, compost is dead plant material in and on the soil surface that is derived from the deposition of coarse litter and results from preliminary breakdown of mulch by fungi, microbes and soil invertebrates into a finer form, which then has a number of further stages of decomposition. Compare to other forms of soil carbon: ***humus***, ***labile carbon*** and ***mulch*** (the whole process being defined under ***humus***).
Composting	The process of seed treatment (especially those with significant dormancy periods) whereby the seed or the fruit containing the seed is added to mulch to compost until germination inhibition is broken or germination occurs. The process does not result in the breakdown of the whole seed and leaves it viable so that germination is still possible. For some seeds, germination is initiated when the sown seed is placed into full sun (following composting) while shade-tolerant species, germination will occur in partial shade. A good example of the former is Cherry Ballart *Exocarpos cupressiformis* and of the latter: Blue Oliveberry *Elaeocarpus reticulatus*. See the Propagation Manual for rainforest species that require this technique for germination.
connate salts	Salts present in the soil as the result of past geological processes: this is relevant to the distribution of *Limestone* ***Littoral Rainforest***, which occurs on marine-derived limestones that are often well away from the usual coastal sources of salt (the presence of which) in part, defines Littoral Rainforest ***habitat***.
conservation significance	The National, State, Regional or Local significance applied to vegetation or species based on a clearly defined and agreed process of comparison of qualities, ***threats*** and features of the taxon that is the subject of the assessment of conservation significance. Very Rare or Threatened species (*VROTs*) in Victoria and Rare or Threatened Australian Plants (*ROTAP*) are two examples, as is the IUCN Redbook classification system (Appendix S1: Rare and Threatened Species, Communities and Threatening Processes worksheet: IUCN flora determination status). See Appendix 8 of Peel (1999) for an example of the assessment of ***rainforest*** conservation significance in Victoria.

context dependent	The likelihood of an event or outcome occurring being dependent on the site's context. For example, the amount and ***diversity*** of ***natural regeneration*** from species that are not present on your site will depend on many factors associated with the site's context. For example: • whether a species is present in a nearby remnant; • whether a species is present and seeding; • whether the seed set is viable; • whether there is a ***dispersal*** agent that can bring the species' seed onto your restoration site; • whether the intervening country is suited to the dispersal process: o If the dispersal agent is an animal, can it cross the intervening country between the seeding plant and your site before dropping the seed? o When the dispersal agent is water (is your site downstream of the seed source) or inundated by the waters of a flood (not necessarily a downstream direction of dispersal) o If the dispersal agent is wind (is your site downwind of the breeze that dislodges the ripened seed) o Does the wind characteristically blow long and hard enough to bring the plant's seed to your site? o If your site is too far away for a single-step dispersal event (from remnant to your site), are there sufficient stepping stones between your site and the seeding plant's location for it to colonise the stepping stone, mature and produce viable seed so that it can ultimately reach your site in subsequent dispersal events?
contiguity	The level of connectedness between your ***restoration*** site and other areas of natural bush. Other things being equal, the more connections and the wider the connections, the better the contiguity and the larger the number of plant and animal species that will reach your remnant.
continental	'Of the continent', as in winds and the weather that they produce. Cf. ***maritime***.
Continental Drift	That part of the Theory of *Plate Tectonics* (often referred to in common parlance as 'Continental Drift' *sensu* Alfred Wegener), whereby continents move across the globe in a process thought to be powered by convection currents in the Earth's mantle. The movement is possible because along continental margins the crust is subducted and returned to the mantle, which is then roughly balanced by the creation of new oceanic crust along mid-oceanic ridges. The process is of significance to the evolution of Australian rainforests and their component rainforest species, because many rainforest species are derived from the forests of an earlier continental aggregation: the great southern continent of Gondwana. This landmass included Africa,

	Antarctica, Australia, India, Madagascar and South America. This explains the species relationships of species now separated by thousands of kilometres of ocean. In contrast, inter-island dispersal of rainforest plants between oceanic islands is usually limited by the dispersal mode (with birds migrating or blown off course: they are apparently only able to retain gut contents for distances in the order of 200–300 km, as deduced by some of the rainforest species found on Lord Howe Island that are shared with south-eastern Australia). The apparently impossible bird-dispersal distance of 700 odd kilometres (Chapter S5 Figure S191) was originally relieved by two intervening (currently submerged) island masses one 417 km off Newcastle, and the other 310 km off Port Macquarie. These stop-over points provide a more plausible two-step dispersal route (see Google Earth ®) than a journey of 700 km in one flight. However, species such as Jointed Mistletoe *Korthalsella rubra,* which are believed to hitch rides on bird feathers, may even succeed over longer distances (see CASE STUDY AR3).
continuous recruitment	Ongoing, more-or-less regular coppicing, germination and establishment: recruitment that does not require major disturbance or any other trigger. See: *episodic recruitment*.
collapsers	Species whose habit (or through structural weakness during wind) collapse onto the ground and provide browsing refuges. See Appendix S6 worksheet: Coppicers and collapsers. See also: *coppicing* and *coppicers*.
cool temperate climate zone	A region characterised by cold wet winters (sometimes with frost and snow) and cool humid, and often moist, summers. In south-eastern Australia, this includes the highlands above 600 m south of Bunga Head, just south of Bermagui on the Far South Coast of New South Wales to the Central Highlands, Strzelecki Ranges and the Otway Ranges in Victoria. North of Bermagui, this zone occurs above 700 m as the *warm temperate climate zone* begins to edge upwards as you move further north. See also: *subtropical climate zone*, *warm temperate climate zone* and *Mediterranean climate*. For a more detailed treatment, see Additional Reading: Local climate.

Cool Temperate Mixed Forest	Wet forests that exhibit features and a stable floristic composition of both *rainforest* and *sclerophyll* species (Peel 1999) whose structure and composition are maintained by long inter-fire periods. See: Figure *Ignition times*.

Cool Temperate Rainforest	A *rainforest EVC* that occurs in the highlands in the *subtropical climate zone*, in the *montane* zone (above 700 m) in the *warm temperate climate zone* and from near sea level in the *cool temperate climate zone*. It develops in deep south or east-facing gullies in lower rainfall areas, but may extend into gullies of any aspect, onto ridges or montane plateaux in higher rainfall areas. It has excellent *landscape-scale fire protection* and is composed of *characteristic species* and **life-forms** that are adapted to cool to cold conditions; it experiences low *insolation* and is never exposed to severe drought. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Cool Temperate Rainforest.

coppice *coppicing*	Coppicing occurs at two scales. The first is the activation of dormant buds *en masse* to regenerate a plant's foliage that has been destroyed by any number of catastrophic processes such as canopy decapitation, wildfire, bank collapse (leaving behind only the roots), inundation by water or by mud. This scale of coppicing occurs in a wide range of life-forms including: ***trees***, ***shrubs***, ***vines***, ***graminoids***, ***herbs*** and ***ferns***. The process is possible because there are dormant buds that have a substantial food store associated with them that can power the rejuvenation event until food can once more be generated by the foliage of the recovering plant. It is especially important for a range of rainforest plants as the photographs below illustrate. The second scale is much smaller and often forms the basis of ***continuous recruitment***, which appears especially important for some tree species. ***Ecosystem engineers*** such as wombats can initiate coppicing on much smaller scales and can assist in the development of copses of trees that rely on this method of vegetative reproduction (including species such as: Yellowwood *Acronychia oblongifolia* and Muttonwood *Myrsine howittiana*).	
		
	Reefton Spur, Yarra Ranges National Park Victoria. Myrtle Beech *Nothofagus cunninghamii* that grew in Cool Temperate Mixed Forest burnt in the Black Saturday fires showing past coppicing recovery due to an unknown cause. The central trunk had died and has been superseded by coppicing, illustrated by the smaller trunks arising from the bud mass associated with the base of the original trunk.	Reefton Spur, Yarra Ranges National Park Victoria. The same process is repeated for Myrtle Beech (but this time from a known cause: the Black Saturday wildfire). Six months following the 7th of February fires, the first coppicing shoots of the new tree emerge from the seared base of the parent. Silver Wattle *Acacia dealbata* is also regenerating but from seed only (red circle): it is an ***obligate seed regenerator***.

coppicers	Plants that coppice. Because of their usefulness as browsing refuges and for erosion control (along rivers and steep sites), these species are listed in Appendix S6 worksheet: Coppicers and collapsers. See also: *collapsers*.
core	See: *rainforest core*, *edge effects*.

correlation versus cause and effect (general example)	This is a classic caution in science not to: 'jump to conclusions', firstly without evidence and secondly without evidence of effect. The following examples include a simple medical one followed by two topical rainforest-related ones for south-eastern Australia. Sneezing has been shown to **cause transmission** of disease to uninfected people through the inhalation of small water droplets that contain these viruses. Sneezing is a symptom of these infections and is therefore **correlated** with colds and flu, **but it is not the cause of the diseases.**. On the other hand, sneezing is also **correlated with hay fever**, but does not transmit the allergen. So, in this case, **sneezing is correlated with hay fever but does not cause it to be transmitted**. This concept is so important that we have provided two additional rainforest examples of the correlation versus cause and effect scenario. They are causing a lot of fuzzy thinking both for scientists and the people on the ground that are expected to 'manage the problems' that these correlations describe. Pity the poor landholder who is trying to sort out the mixed management messages that these apparent conundrums appear to warrant.
correlation versus cause and effect (first rainforest example)	MISTLETOES AND THE DEATH OF FARM TREES. Mistletoes are widely seen as the cause of farm tree death in cleared and fragmented farming land and because Mistletoebirds spread the seed, they must be the culprit. But is this actually so? Mistletoebirds favour edges when foraging. Our clearing of the landscape has fragmented the bush and increased the number of edges while at the same time it has decimated the number of available mistletoe host trees. It is therefore not surprising that the number of mistletoes growing on some farm trees is very high. Because Mistletoebirds have not changed their behaviour, and the **correlation** between increased mistletoe numbers in fragmented landscapes seems to be correlated with the increased numbers of edges, could the **effect** be the result of our land clearing? There are of course many other factors at play, including a significant reduction in the number natural control agents and frequency of events that mediate mistletoe numbers in the landscape. These include: reductions in hollow-bearing trees that support possums that forage on mistletoes and can prevent them establishing; a lack of connection between trees that increases the loss of possums to *predators* when they are forced to traverse open ground; the tidying obsession that sees the removal of wattles from farmed landscapes that are essential to these *herbivores*; an ageing of pre-clearing remnant trees; the lack of more resilient younger trees that can host mistletoes with lesser impacts; and higher nutrient loads as a result of stock camps and application of fertilisers. The lack of regular fire in fragmented landscapes is the other major mistletoe control that is lacking nowadays. All of these (and several other) conditions in fragmented landscapes are contributing to the death of paddock trees. So although there are **some correlations between mistletoes and tree decline in rural landscapes** and the **causes and effects are many and varied**: without tree *recruitment*, reconnection and an acknowledgement of fire in the *ecology* of these trees and their mistletoes, the decline of paddock trees is inevitable, whether mistletoe are present or not. Mistletoes are therefore **correlated** with the **effect** (rural tree decline). but are only a symptom of our defective landscape management (which is ultimately the cause). This example (and what you can do to alleviate 'the problem' while retaining mistletoes as *keystone species* in your landscape) is discussed in Additional Reading: Restoration mistletoe planting and mistletoe colonisation.

correlation versus cause and effect *(second rainforest example)*	BELLBIRDS (BELL MINERS) AND EUCALYPT DIEBACK. This 'problem' has become so severe that 'Bell Miner Associated Dieback' (BMAD) received a Preliminary Determination as a key *Threatening Process* under the *Threatened Species Conservation Act* (1995) in November 2007 (BMAD Working Group Newsletter 2008). At the time of publication, it had yet to receive a final listing. What follows may explain why. There is no doubt that there is an association between the presence of Bellbirds and some eucalypt dieback, but many landholders and land managers see the Bellbird as the cause. But what if Bellbirds just happen to like to be around dying eucalypts because there is an abundance of lerp (their favoured food) and that the dying eucalypts provide ideal ***habitat*** for the colonisation of their ***understorey*** by a dense ***shrub*** layer that provides perfect nesting, roosting and foraging conditions for the Bellbird colony? With regard to this issue, eminent retired Forester Dr Ross Florence sees the wider picture and lists other contributory (and possibly causal factors) for eucalypt dieback where Bellbirds are often present. In the following list from the BMAD Working Group Newsletter 2008, our notes are in *italics,* Ross suggests that the origins of Bell Miner Associated Dieback may lie in the disturbance of forested (eucalypt) ***ecosystem***s associated with: • severity of post-settlement fires and the weakening of site control exerted by old-growth trees, resulting in the initial colonisation of the shrub understorey (*ideal habitat for Bellbirds*); • selective harvesting which further weakened stand control of the site, particularly where the stand components with low inherent vigour were retained; • failure to ensure that ***rainforest*** with emergent eucalypt ***overstoreys*** (Wet ***Sclerophyll*** Forest *in NSW parlance*), were maintained at near full site use through post-harvest regeneration and other treatments; • a declining frequency of low intensity fires (initially as a result of complete fire exclusion) and then later as a result of the difficulty of burning Wet Forests with a shrubby understorey; • an increase in soil wetness with a reduction of transpiring eucalypt canopy particularly on water accumulating sites (*a classic description of many **rainforest** habitats*) and/or soils with restricted drainage (*an acknowledgement that this process also occurs in swampy areas*); • increases in available soil and foliar nutrients associated with the loss of site control by the over-wood (*eucalypts*); • *a runaway feedback loop* that increases the density of the shrubby understorey as the result of the preceding factors (*improving the habitat for Bellbirds*) in response to the increases in available soil water and nutrients (*possibly disadvantaging the eucalypts);* • possible decline in the fine feeder roots of the eucalypts (*and perhaps an alteration in the mycorrhizal fungal associations that had previously sustained them in good health*); and • the association of alternating periods of heavy rainfall events and droughts being concomitant with BMAD. Once again, you will notice the hand of humankind in these perturbations where Bellbirds show up, eucalypts die but the bird becomes the perceived villains without much evidence of 'cause'. A part of the demonising process includes assertions or allusions to Bellbirds being the cause: they drive away small birds and that they kill trees. No wonder there are trials to kill Bellbirds to see if this improves the lot of the dying eucalypts. Given Ross Florence's insights, this seems highly unlikely and shows the risks of making ill-advised jumps between correlations and cause and effect. In support of this strong caution, our research indicated that small forest bird ***diversity*** is absolutely unaffected by Bellbirds in natural Warm Temperate Rainforest and on ***rainforest restoration*** sites (Chapter 9; Appendix 1.1 worksheet: Two way table), a finding replicated by Amanda Dare (BMAD Working Group Newsletter 2008) who found that Bellbirds alone do not lead to an increase in psyllid abundance, nor do they affect bird diversity and ***abundance***. Much of the science to date on this issue fails to acknowledge the natural role and association of Bellbirds with rainforests, emergent eucalypts and their 'natural decline' following the initial colonisation of eucalypts in rainforest habitat after fire in south-eastern Australia. These aspects of Bellbird and rainforest ***ecology*** are dealt with in more detail in Chapter S4: *Bellbirds: rainforest-protectors?* So, what is the solution? By all means look for correlations, but once you have found them, try to identify the causes of the effects that you see.

cover crops	***Exotic species*** that are planted (or are already present), which act as mulch (as shade), improve soil condition (nitrogen fixation and organic material) and provide cover (from ***browsing*** or ***grazing***), or protect and foster the growth of desired (in this case, rainforest) species. Cover crops prevent sun-dependent species from germinating, but facilitate the germination or establishment of shade-dependent species (see below). In south-eastern Australian ***rainforest restoration,*** existing pasture cover crops have been effectively used and Perennial Rye-grass has also been specifically planted for this purpose as have a range of other species including exotic trees. See: ***nursery crops***.
cover crops (to combat disturbance)	USING A COVER CROP FOLLOWING FIRE WHERE NATURAL REGENERATION WAS WEED DOMINATED  Bete Bolong, lower Snowy River Victoria. A fire on this narrow remnant on a fertile floodplain in a long-established agricultural area saw a poor native species regeneration response, while stimulating substantial weed regeneration (see right).  Bete Bolong, lower Snowy River Victoria. The remnants of the Kikuyu sward (dead grass), the raging broad-leaf weed response and the cover crop of rye grass planted to stymie the continued germination of weeds until the site can be planted.

cover crop (inhibition of sun-dependent species)	COVER CROP REMOVED TO FACILITATE NATURAL REGENERATION OF SUN-DEPENDENT NATIVE SPECIES
	
	Marlo Road, lower Snowy River Victoria. Four years after the removal of the willow cover crop on this restoration site. At the time of the willow's removal, sun-dependent semi-aquatics and terrestrial plants immediately proliferated, where once the willow's shade prevented their germination and establishment. This regeneration response has resulted in the banks being built up and the advance of these semi-aquatic species into the river which until this treatment, had been widening since European settlement and de-snagging.

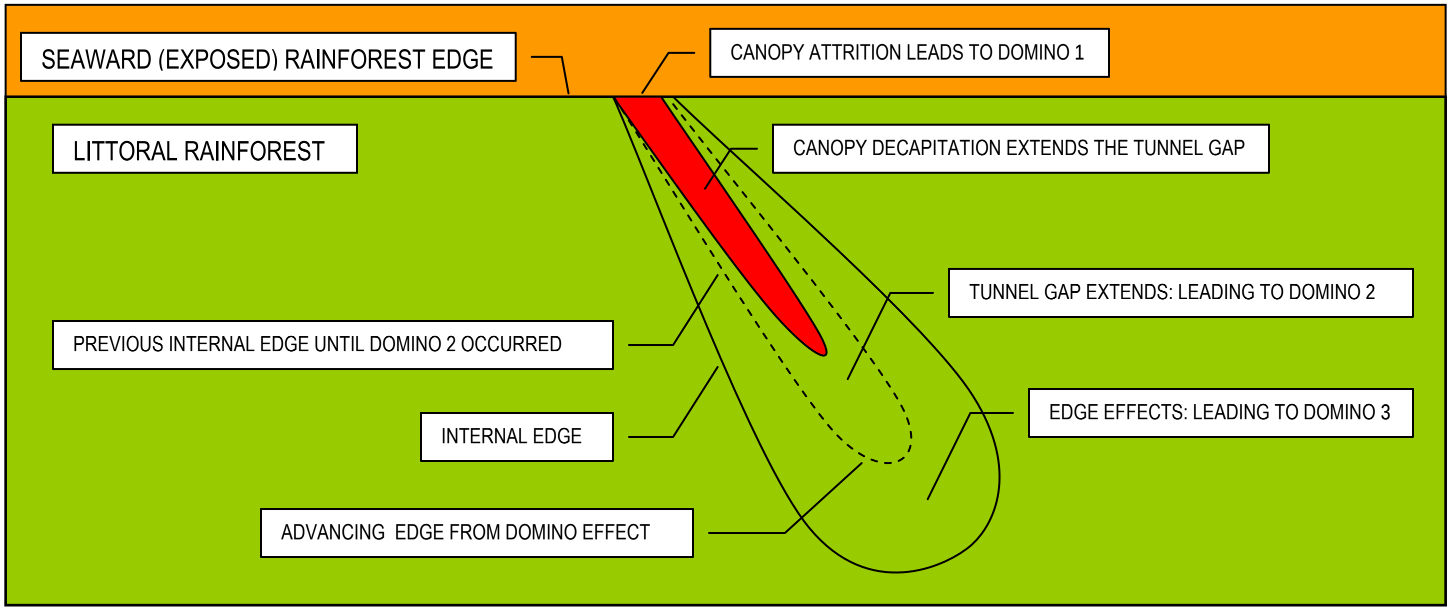
Cover crop (end stage)	COVER CROP REMOVED (NATURAL REGENERATION ONLY)	COVER CROP REMOVED AFTER UNDER PLANTING
		
	Wibenduc Creek, lower Snowy River Victoria. Here the mature willow cover crop was removed to reveal the presence of natural regeneration of shade-dependent rainforest primary species including several trees (Muttonwood *Myrsine howittiana,* Sweet Pittosporum *P. undulatum* and Lilly Pilly *Syzygium smithii)* and ferns (e.g. Rough Tree-fern *Cyathea australis* and Tender Brake *Pteris tremula*).	Bete Bolong, lower Snowy River Victoria. Extensive planting beneath the original willow cover crop (shown here: recently culled), demonstrates the success of the under planting that has ensured that the bank will not erode now that the willows have been killed. This site forms part of the 'Willows to Natives' Trial, earlier pictures of which include: Figure S266 and Figure 5.11 of the Manual.
crowning fire	See *Fire types*.	

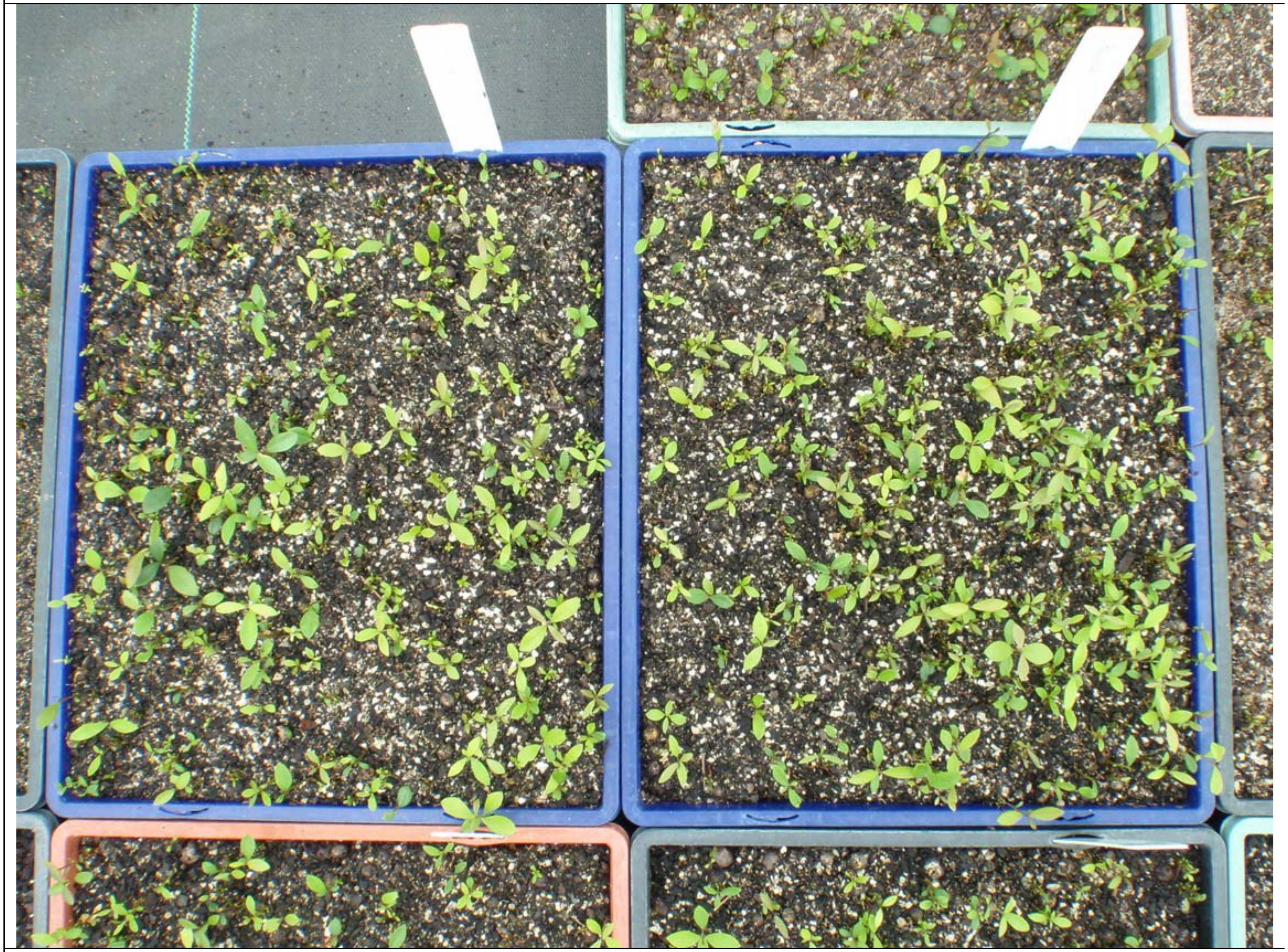
crustose	One of three groups in a broad *lichen* structural classification. Crustose lichens appear as thin paint-like patterns on their substrate, with very little vertical development or thickness. Cf. *foliose* and *fruiticose*. See: Chapter S4: Figure S151 for an illustration of all three.
CTRf	Abbreviation: *Cool Temperate Rainforest*. See also: Cool Temperate Rainforest in Definitions and Synonymy.
cultural fire protection	Fuel or hazard reduction burning (both Aboriginal and more recent forest, rural or urban management), firebreaks and Asset Protection Zones have protected, and continue to protect, rainforests throughout the landscape. Aboriginal-based fuel reduction around rainforests was employed historically to protect rainforests in south-eastern Australia, which included the homes of several Koori totems as well as the rainforest's cargo of materials, textiles, medicines, foods, fibres (often not found elsewhere in the landscape) and Koori sites of cultural importance used for birthing and burials (see also Additional Reading: Koori cultural uses of Littoral Rainforest in south-eastern Australia).
cultural landscapes	Landscapes 'owned' by individuals or groups of people whose claim to the landscape is cultural rather than just through real estate ownership alone. At one level, this includes you and I who are affronted by someone interfering with that which we hold as 'culturally dear' to us. This can be as simple as a spot that we value because it is pleasing to us (although we may only look at it). Everyone knows of such an example: a tree is cut down; a beautiful building is modified or demolished; and no one asked us! These are the cultural landscapes to which we refer: very idiosyncratic, but strongly held and valued. The importance of cultural landscapes in rainforest restoration, is that you need to identify who culturally owns the landscape in which you want to operate and do your restoration project. Once you have done this, you need to gain these people's trust and permission to undertake your works. This is your *social license* to operate in your community. In a very real sense, these people are as much your clients in your restoration efforts as are the rainforest's themselves and the plants and animals that live there, or will do so in the future.
damaged	Refers to acute and obvious changes in an *ecosystem* (SER 2004). Cf. *degraded*, *destroyed* or *transformed*.
decision tree	A flow chart that depicts a *logic train* of thought, where a simple question at each branch of the tree leads the reader to an answer or conclusion based on the logical decisions listed previously in the tree. See: Figures 3.2-3.4; and *logic train*.
deep ecology	'A recent branch of ecological philosophy (ecosophy) that considers humankind an integral part of the environment. Deep ecology places greater value on non-human species, *ecosystems* and processes in nature than established environmental and green movements. Deep ecology has led to a new system of enviroethics. The core principle of deep ecology, as originally developed by Arne Naess's doctrine[1] of biospheric egalitarianism is the claim that, like humanity the living environment as a whole has the same right to live and flourish. Deep ecology describes itself as 'deep' because it persists in asking deeper questions concerning 'why' and 'how' and is thus concerned with the fundamental philosophical questions about the impacts of human life as a part of the ecosphere, rather than a narrow view of ecology as a branch of biological science, and aims to avoid the merely utilitarian environmentalism, which it argues is concerned with resource management of the environment for human purposes.' <www.wikipedia.org/wiki/Deep_ecology>.
deep shade	Shade with very low light levels in the order of: *EV* 4-9. See also: *light shade* and *moderate shade*.
degraded	Refers to subtle changes that reduce ecological integrity and health (SER 2004). Cf. *damaged*, *destroyed* or *transformed*.
DGRf	Abbreviation: *Dry Gully Rainforest*. See also: Dry Gully Rainforest in Definitions and Synonymy.
dehiscent	In reference to fruits: one that opens at maturity to reveal the seeds (CRCfAW 2007a).
delta (deltaic deposits)	Within south-eastern Australia alluvial landforms that develop at the river mouths where they discharge into lakes. In this region, these lakes are usually *estuaries*.
de-snagging	Removal of *snags* from rivers, which leads to increased flow velocities, bank erosion and bed erosion. The importance of this activity is that it has led to significant loss of *riverine rainforest* habitat in south-eastern Australia and much of the riparian rehabilitation now going on, aims to 're-snag' these river reaches to stabilise the stream and improve aquatic habitat diversity and stability. Re-snagging involves the placement of logs in the stream bed or *rainforest restoration* that will ensure that the trees planted today become the snags of the future as they fall into the river. See Chapter S2: Figures S88–S90. See also: *snags*.
destroyed	Refers to the end state where degradation or damage removes all visible life and commonly ruins the physical environment as well (SER 2004). Cf. *damaged*, *degraded*, or *transformed*.
deterrent species	Species that provide a *browsing refuge* because they deter browsing animals from entering or passing through their foliage to access more

[1] A Scandinavian philosopher who cited Rachel Carson's 'Silent Spring' as key influence on his vision of *deep ecology*.

	palatable plant species. The deterrence may be in the form of thorns or spines (Sweet Bursaria *B. spinosa*, Tree Violet *Melicytus dentatus*, native brambles *Rubus* spp., etc.); or stinging hairs (such as Giant Stinging Tree *Dendrochnide excelsa* or Scrub Nettles *Urtica incisa*).

directional dispersal	The ***hypothesised dispersal*** mode of ***rainforest*** fruits or seeds by rainforest animals from one rainforest stand to another because the animal feeds in rainforest on rainforest fruit, moving to the next rainforest stand to receive the same food reward (from one or more species), where it voids the seed collected from the previous meal (Chapter 3: Opener). Evidence includes: • differences in ***seed dispersal*** mechanisms and food rewards between ***rainforest wattles*** and ***non-rainforest wattles*** (Chapter S4: *When does it fruit and who eats what?*); • differences in the proportions of fruiting species in rainforest ecosystem compared to the adjacent sclerophyll forests; • rainforest fruit dispersal being uniform irrespective of distance from rainforest remnant in the former Big Scrub (Neilan *et al*. 2006); • a correlation between the presence of a fruiting tree and the delivery of fruiting species and their establishment beneath its canopy (Neilan *et al*. 2006); and the converse: • where the ***canopy tree*** does not have fruits, the visitation rates (and successful establishment of fruit-bearing rainforest plants) decline with distance from the rainforest stand (Neiland *et al.* 2006).
direct seeding	The direct-sowing of seed onto a ***restoration*** or ***revegetation*** site, using mechanical (seeding machines) or hand-based methods such as ***lyrebirding***. The Figure: ***chlorosis*** is a classic example of the principle of 'nature choosing what will grow' (in that instance, the soil conditions did the 'choosing') and this is widely employed in direct seeding (which is one of the major reasons to employ this technique). If the seed mix has sufficient ***diversity***, the old vegetation patterns (governed by soils, moisture, aspect, etc.) re-emerge in the area that has been direct seeded: ***letting nature decide***. This bypasses the anguish and the stress associated with failure when your plant dies because nature has already pre-determined the conditions for plants at that spot. See also: ***chlorosis***.
dispersal	Dispersal is the process of seed movement away from the parent plant. There are many modes of dispersal including gravity, wind, water and animals. A large proportion of ***rainforest*** seed is dispersed through the ingestion of a seed contained within or attached to a fruit. The dispersal distance in such cases is a function of how long the ***vector*** can retain the seed and the distance it moves from the site of consumption of the seed. In general, most seeds are dispersed close to the parent plant, with a few dispersed a long way away. This tends to reinforce the local population, with the prospect of occasional colonisation at a greater distance and a new population establishing (Murphy 2008).
distinguishing species	These are ***characteristic species*** or less common, (but ***usual species***) that occur in one ***rainforest floristic community*** but not in any co-occurring rainforest communities, and can thus be used to distinguish between the two abutting floristic communities (or ***ecological vegetation class***). This enables you to determine the identity of the community in which you are standing. Using the ***floristic community keys***, if you are finding one or more of the distinguishing species listed is present on the site [in combination with all of the other information that got you to that point (appearance, distribution, ***habitat*** and ***dominant species***)], then it is most likely that you are standing in that particular rainforest floristic community. See: Definitions and Synonymy: Key to the rainforest floristic communities of New South Wales and Key to the rainforest floristic communities of Victoria.
diversity	The number of species, as apposed to the number of individuals of a particular species. Cf. ***abundance***.
division	Plant division is the process of taking a piece of a parent plant with roots and using it to propagate another plant. Such plants are usually colonial (***ferns***, grasses or reeds), but can also include trees that root coppice such as some wattles and canopy species such as Yellowwood *Acronychia oblongifolia*.
dolines	Caves whose roofs have collapsed to produce deep, narrow steep-sided gorges that may afford fire protection for the development of rainforests, with one of the most famous Australian examples being the Undara Lava Tubes in Queensland. In south-eastern Australia, they are ***habitat*** for ***Dry Rainforests***; most notably at the Pyramids in the Murrindal River valley, Victoria.
dominant species	Used in species ***keys***: one or a combination of the canopy and ***emergent trees*** that dominate particular ***rainforest*** stands either at the ***EVC*** or ***FC*** level. See: Definitions and Synonymy: Key to the rainforest floristic communities of New South Wales and Key to the rainforest floristic communities of Victoria.

domino effect	The incremental loss of an element in a system that sustains or supports another element, the loss of the first leading to the loss of the second and so on: an impact that is similar to one domino toppling onto another. This is illustrated by the diagrammatic representation of a ***tunnel gap***, which begins on an edge (orange and green boundary of a Littoral Rainforest stand) with ***canopy attrition*** and initially leads to a linear (tunnel) gap (red). Over time, the wind continues to penetrate the tunnel and the gap moves further into the rainforest stand (domino two). This creates an internal gap (domino 3). In fragmented, damaged or depleted stands, these are very dangerous threatening processes and dealing with their cause is a high priority for land managers and rainforest restoration practitioners alike. Edge effects that lead to canopy attrition are a classic example and their development can lead to ***internal edges*** developing within your rainforest stand. Internal edges formed from natural processes should not be seen as necessarily a bad thing (because many plants and animals use them). However, if they are caused by human interference or continue to threaten a large proportion of the stand or its values, steps should be taken to stop the domino effect by addressing both the threat that began the process and the others (e.g. weeds) that have followed. See also: ***tunnel gaps*** and ***edges***.
	

Dormant seedling storage	The process of holding over primary species in seedling trays (*sensu* Buchanan 2009), for up to 2 years. The process puts the seedlings into a dormancy period, from which they may be slow to emerge, with at least one growing season required for some species such as Lilly Pilly *Syzygium smithii* and Spiny-headed Mat-rush *Lomandra longifolia* to 'revive' (Estelle Gough pers. comm.). Candidate species can be picked by their establishment mode involving germination beneath a primary canopy in shade and a long period of domancy until a canopy gap occurs when the seedlings bolt for the light. See: Propagation Manual worksheet: Local experience (Delivery times column) for likely local candidates.
	DORMANT SEEDLING STORAGE INCREASES THE AVAILABILITY OF SPECIES WHOSE SEED CANNOT BE KEPT
	
	Lilly Pilly *Syzygium smithii* whose seed is short-lived, can be stored in trays as seedlings in shade for several years and then potted on.

DPI	Abbreviation: Department of Primary Industry.
DRf	Abbreviation: *Dry Rainforest*. See also: Dry Rainforest in Definitions and Synonymy.
drought refuge	Places in the landscape that retain either open water (rivers, lakes, etc.), soil moisture or in the form of regular fogs and dews (river valleys, gullies, southern aspects and coasts) during periods of drought. See also: *climate change refuge*.
drupe	A fleshy *indehiscent* fruit with a hard endocarp (coat or covering) enclosing the seed (CRCfAW 2007a).
Dry Gully Rainforest	A *rainforest EVC* that occurs in the lowlands of the *subtropical climate zone*. It is restricted to New South Wales and is generally located in deep, dry (often rocky) gullies of any aspect and characteristically on Ordovician sedimentary geology below 600 m. Its canopy is generally dominated by Grey Myrtle *Backhousia myrtifolia*. It has good *landscape-scale fire protection* and is composed of *characteristic species* and life-forms that are adapted to generally dry conditions and drought. Not to be confused with the New South Wales term Gully Rainforests, which can refer to a floristically simplified version of any rainforest EVC. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Dry Gully Rainforest.

Dry Rainforest	A *rainforest EVC* that occurs in the lower foothills on hot dry aspects with excellent *landscape-scale fire protection* composed of *characteristic species* and life-forms that are adapted to severe exposure and drought. It occurs in the *rainshadow valleys* of these foothills in both East Gippsland in Victoria and southern New South Wales. It occurs at elevations of less than 250 m in Victoria and less than 350 m in southern New South Wales. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Dry Rainforest.
dry sclerophyll forest	In the context of this work, Open Forest that allows more than 70% of incident sunlight to pass through the canopy (*sensu* Specht 1970). It is dominated by eucalypts and occurs in non-moisture conserving *habitats* such as ridges and slopes with aspects other than south (however, note the contradiction in drought-tolerance conveyed by the adjective 'dry' in the discussion in Chapter S4: *Bellbirds: rainforest-protectors?* (particularly Figure S130); and Chapter 4: Case study 4: *Rainforest expansion in a time of climate change*). Dry sclerophyll forests are dependent on fire for renewal and regeneration from seed. Cf. rainforest).
DSE	Abbreviation: Department of Sustainability and Environment.
duricrust	A living duricrust (*sensu* White (1994) is a layer of living plants (*blue-green algae*, *mosses* and *lichens*) that coat the soils' surface with a protective layer that reduces splash erosion from rain, reduces evaporation and allows moisture to penetrate into the soil. The lichen component of these pioneer soil species produces humic acids that release minerals from the soil for other plants. Remarkably, duricrusts also play an important role providing (or preventing) germination in *Littoral Rainforest gaps* (Chapter S5: Why proximity to existing bush is important).
early secondary species	See *secondary species*.
EC	Abbreviation: *ecological community* (New South Wales and Commonwealth terminology: equivalent to any level of the Victorian *typology* including: *ecological vegetation (EVC)* and *floristic community (FC)*.
ecological brake	Ecological brakes arise from a particular *threat*. When an ecological brake is applied to a site or a region, it operates on one or more elements of an ecosystem that retards its normal function. These brakes may be coupled (linked) or uncoupled and either act singly or in concert on a system to prevent the development and recovery of (for instance) *rainforest*, in an otherwise available *niche*. Once the brake is removed, the limiting or constraining factor is neutralised, which then ensures that the rainforest can either rapidly colonise the available niche or recover if it is already present. See also: *threat*.
Ecological Community (EC)	A structural and floristic assemblage that is interchangeably applied both at the regional scale, where its meaning is very broad, and at the local scale, where its meaning can be quite specific. It is a term used in legislation and some examples run the length of Australia (see Definitions and Synonymy: *EPBC Act* disturbance thresholds for the *Littoral Rainforests* and Coastal Vine Thickets of Eastern Australia). *Ecological communities* or ECs can mean both *ecological vegetation class*es (*EVCs*) and *floristic communities* (*FCs*) and in that sense can be confusing. See also: *endangered ecological community* (*EEC*)
ecological first principles	Approaching a site or system for the first time and understanding it from basic observation, the objective being to discover the relationships between its plants and animals and the successional process and the disturbance history that has produced the site that lies before you without reference to any other study, work or knowledge of that site. This was the situation that faced many rainforest restorers 20 years ago. These ecological first principles and the trials undertaken to investigate them and what that they represent have been compiled into the knowledge-based

	systems and approaches contained in this and other restoration manuals. This approach shields you from existing paradigms, but it is a difficult path because you cut yourself off from the collective knowledge of other workers.
ecological health	The state of an *ecosystem* as measured by the intactness of its *ecological processes*, whereby the constituent *biotic* communities in the ecosystem have sufficient reserves and resources (either internally, or by connection to the wider landscape) to be both self-replicating and be able to rebound after significant disruption or disturbance. The greater the ecological health, the greater the *ecosystem resilience* and the lower the likely inputs required from a human or other management systems to maintain the stability and evolutionary potential of the ecosystem.
ecological maintenance	The type of maintenance done by managers **after** the restoration (repair or reconstruction) of an *ecosystem*, *EVC* or *FC*, which is similar to the normal natural resource management applied to an intact or largely natural *ecosystem*. Tasks are prioritised and undertaken to limit the severity, extent and spread of existing *threats* to prevent the emergence of new *threats* and the *ecological brakes* that result, which could disrupt, deflect or destroy *ecological processes* fundamental to the maintenance of *ecosystem health*. Cf. *ecosystem management*.

ecological maintenance cycles	The yearly or seasonal calendar of *ecological maintenance* tasks undertaken to protect *ecosystem health*.
ecological management	Ecological management (as apposed to maintenance) may include the initiation of regeneration, senescence or renewal phases brought on by fire, flood, grazing, and so on. It involves the management of a site after *restoration* is complete, or before a *threat* becomes manifest. It is a process that aims to keep the restored *ecosystem* healthy and functioning. Such management follows a landscape and/or site assessment that identifies ongoing, clear and immediate threats to the site's future function and/or health and can occur or be initiated at any stage of the restoration process.
ecological processes	The diversity and function of a range of processes (nutrient cycling, *food webs*, migration routes, etc.) that when partially or completely intact, confer *ecosystem resilience* and *ecological health* to a site, system or landscape.
Ecological Vegetation Class (EVC)	A group of floristic communities composed of a diverse range of plants that share a characteristic set of *life-forms* and reproductive strategies that respond to disturbance in predictable manner. For example, *Dry Rainforest* is composed of fire-sensitive species including *emergent trees*, *canopy tree*s, prickly *understorey shrubs*, vines and *herbs*. All are able to reproduce in the absence of fire and are drought tolerant. Dry Rainforest occurs in hot dry *habitats* that are virtually fire proof in areas with a high degree of rainfall reliability. Rain-green species are often a feature (plants able to drop their leaves during drought or the dry season and resprout when the rains arrive). An *Ecological Community* is a term used by both the Commonwealth and New South Wales and can be used interchangeably with ecological vegetation class or *floristic community*. Unfortunately, its broad meaning leads to confusion about site or habitat-specific floristic associations (*floristic communities*) and regional groupings of these (ecological vegetation classes).
ecological release	The process by which an *ecological brake* is removed, which leads to a release of the ecological element that was constrained by the brake: i.e. the removal of a *threat* or the modification of a *threatening process*.
ecological restoration	'The process of assisting the recovery of an *ecosystem* that has been *degraded*, *damaged*, or *destroyed*. It is an intentional activity that initiates or accelerates *ecosystem recovery* with respect to its health (*functional processes*), integrity (species composition and community structure), and sustainability (resistance to disturbance and resilience). *Restoration* ensures *abiotic* support from the physical environment, suitable flows and exchanges of organisms and materials with the surrounding landscape, and the reestablishment of cultural interactions upon which the integrity of some ecosystems depend. Restoration attempts to return an ecosystem to its *historic trajectory*; i.e., to a state that resembles a known prior state or to another state that could be expected to develop naturally within the bounds of the historic trajectory. The restored ecosystem may not necessarily recover its former state, since contemporary constraints and conditions can cause it to develop along an *altered trajectory*.' (Clewell *et al*. 2005).
ecology	'The interdisciplinary scientific study of the distribution and abundance of organisms and their interactions with their environment' <www.wikipedia.org/wiki/Ecology>. From the Greek: ecos meaning house.
ecosystem	Consists of the living elements (plants, animals, micro-organisms) within a given area, plus the *abiotic* environment that sustains them and their interactions. An ecosystem can occur at any spatial scale from an area containing only a few organisms to an area showing some degree of structural and taxonomic homogeneity, such as a small-scale and community-based 'wetland ecosystem,' to a large-scale and *biome*-based (SER 2004) *Warm Temperate Rainforest* ecosystem.

ecosystems approach	See *systems (ecosystems) approach*.

ecosystem engineers	Species that can profoundly affect *habitats* through their actions, not only for themselves but for other species as well (Lindenmayer 2007). Local *rainforest* candidates include both native and *exotic species*: • Long-footed Potoroo *Potorous longipes* (of *Warm Temperate Rainforests* in East Gippsland) and Long-nosed Potoroo *P. tridactylus* (of the *Littoral Rainforests* of south-eastern Australia) that dig the soil while foraging for their truffles (fruiting bodies), spreading the *spores* for a range of *fungi* whose *mycorrhizal* associations are fundamental to nutrient cycling, soil development, plant succession and the growth and development of a wide range of Australian plants; • Common Wombats *Vombatus ursinus* who's bulldozing around the countryside produces bare ground that allows *continuous recruitment* of many pioneer and secondary species (Tree Everlasting *Ozothamnus ferrugineus*, Fireweed Groundsel *Senecion linearifolius*, Large Kangaroo Apple *Solanum laciniatum,* etc.) to germinate at the local scale without landscape-level disturbance. Wombats also play another role in rainforest regeneration, that of stimulating *root copping* of a range of rainforest trees. For some root-copping species, the development of root shoots is aided by the exposure of their surface roots to light (this is where the wombats' bulldozing around comes into play). Species observed to respond in this way include (but are not limited to): Blackwood *Acacia melanoxylon*, Yellowwood *Acronychia oblongifolia,* Coast Banksia *B. integrifolia* and Cherry Ballart *Exocarpos cupressiformis* and Common Boobialla *Myoporum insulare*. This produces a new plant when the root is exposed and/or when the root is nipped. It is likely the same result is achieved when similar impacts occur following Echidna foraging. We stimulate this type of regeneration, either incidentally when planting in their root zones or deliberately by ripping; • Mistletoebirds *Dicaeum hirundinaceum* (in south-eastern Australia) whose feeding *ecology* ensures the spread and maintenance of mistletoe populations that in turn feed a huge variety of other birds (e.g. bowerbirds, honeyeaters and cuckoos), possums and insects, while the plants themselves are fundamental to the development of hollows that support a huge number of hollow-dependent birds, mammals, reptiles, amphibians [more than 300 species Australia-wide (Lindenmayer 2007)] and invertebrates. This is a process that takes decades to centuries to occur (Lindenmayer 2007); • Sambar *Cervus unicolor* (in rainforest): both local data (this publication), Peel *et al*. (2005) and a world-wide review by Côté *et al*. (2004) cited in ISC (2008) show this species to be an *ecosystem engineer* whereby their over-*abundance* can tip forest ecosystems to alternative states by changing structure and composition; and • Humans *Homo sapiens.* No explanation required!
ecosystem management	Carefully considered actions applied to an *ecosystem* at a landscape scale that are designed to manipulate it in ways that improve the *ecosystem's resilience*, health or to set it on a defined *trajectory* (to recovery or another state). The actions aim to deal with a single or multiple *threats* (which are often related and can act in synergy). Their impact is manifest as one or more *ecological brakes* and these can operate at any scale. Examples of landscape scale threats include fire, *climate change*, logging, land clearing and plantation operations (including commercial species that act as *rainforest* weeds, such as pines or olives). Examples of local-scale threats include recreation, inappropriate development, and the destruction of *ecotones.* Threats that can act independent of scale include the use of potentially invasive species in gardens, the arrival of such species through unassisted weed invasion, climate change, and fuel or hazard reduction burning. Such threats can also be cultural and often manifest as a lack of understanding of the threats to rainforests, its inherent value, or an appreciation of how on or offsite management or threats can cause the loss or damage of the rainforest in your care. Ecosystem management actions are usually applied within an *adaptive management paradigm*: that is, the management is applied and the results closely monitored. If the result is not as expected, the next manipulation is adapted on the basis of best knowledge and experience available and then tried again. Cf. *ecological maintenance*.

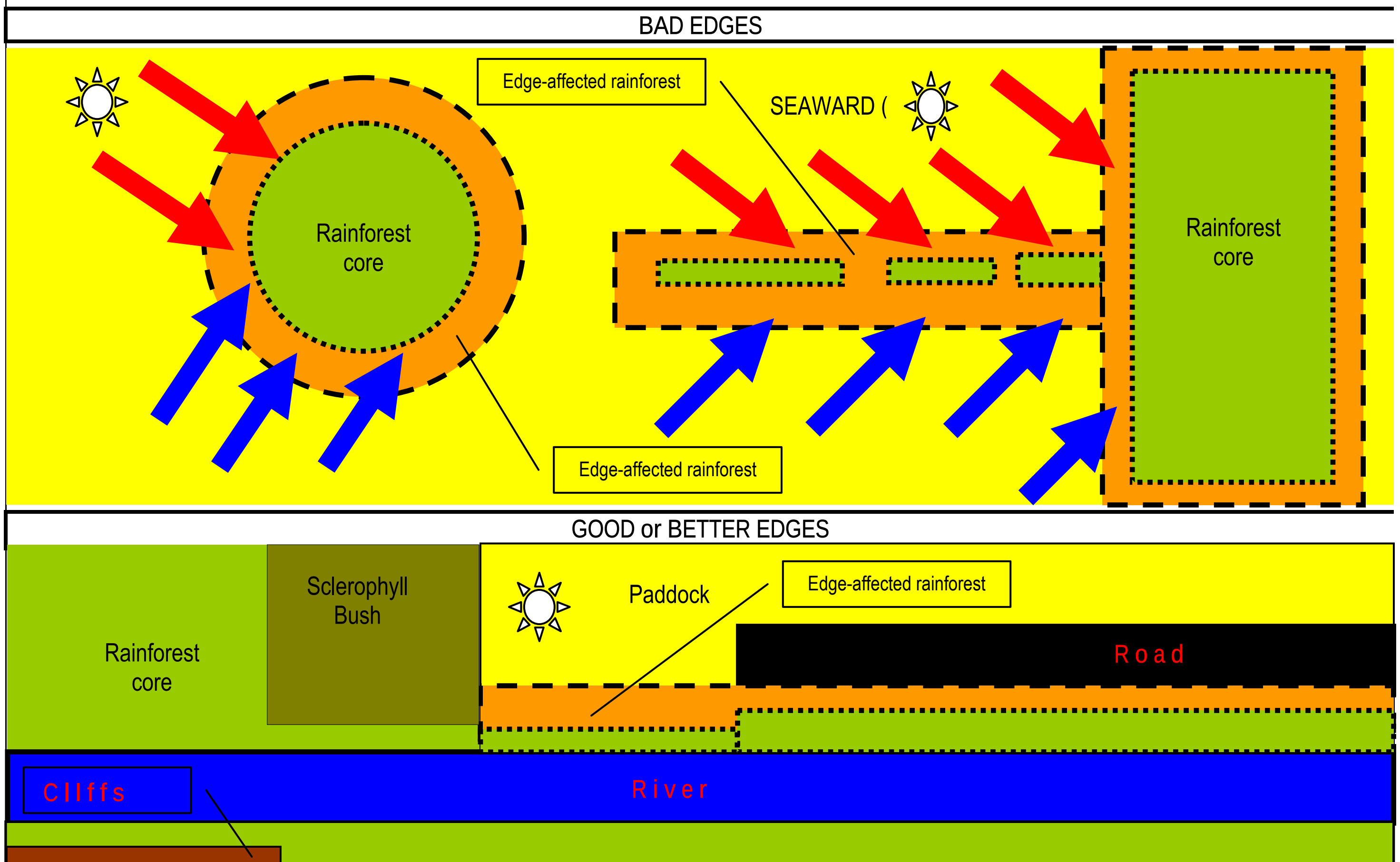
ecosystem fire protection	Fire protection for vegetation that arises from the composition and/or structure of adjacent or nearby vegetation that either will not burn (saltmarsh or mangroves) or that can modify fire intensity, frequency or seasonality. Because rainforests are fire sensitive, ecosystem fire protection sets up '*fire shadows*' in the lee of such *vegetation types* where rainforests can establish and develop. For ecosystem fire protection to work, the ecosystem that is providing the fire protection to the *rainforest* must be between the *fire weather* direction (generally north and/or west) and the rainforest itself; i.e. it must act as a fire break to the rainforest stand. Hence, the fire shadow is in the lee of this vegetation. An example of ecosystem fire protection derived from the composition of adjacent vegetation is wetlands (floodplains) that can protect some stands (or parts of stands) of *Subtropical*, *Warm Temperate*, *Gallery* and *Dry Rainforests*; while on the coasts these do the same for *Littoral Rainforests*. The wetlands either retain water (preventing the passage of fire) or have lower fuel loads than the local eucalypt forests (and so fire intensity is reduced). Other examples of composition-based ecosystem fire protection include the rainforests themselves that often occur as constellations of different types clustered around suitable *habitats*, whereby their own presence (with species dominating that have low flammability, the stand's high humidity, their low fuel loads and breaks in *fuel ladders*) that assists each of the component stands to dampen down the approaching wildfire and, in many cases, *self-extinguish* it altogether without human or other intervention. An example can be seen in the figure associated with *landscape fire protection*. Examples of where the vegetation's structure provides the ecosystem protection include old-growth stands of vegetation that interrupt fuel ladders (e.g. Coast Dune Scrubs near Littoral Rainforest; Wet Forest around Cool Temperate Rainforest; Damp Forest around Subtropical and *Warm Temperate Rainforests*); and Grassy Woodlands whose low ground-fuel loads protect Dry Rainforests (in the Bega and Buchan-Murrindal Valleys); or Limestone Pomaderris Shrublands on rocky outcrops that protect Dry Rainforest in the Buchan and Murrindal valleys.
ecosystem processes	The components of an ecosystem's function that support its development and continued evolution. It can include almost any part of the *ecosystem*: nutrient cycling, *natural regeneration*, genetic interchange, succession, and so on.
ecosystem recovery	The reinstatement of missing *ecological processes* that underpin an *ecosystem* or their repair to the point at which the ecosystem can be said to have 'recovered' some of its original functionality. Such recovery should be defined (as partial or complete) and is dependent on the persistence of the *threat*, the level of damage, the landscape context and alterations to the historic condition of the site being repaired. It is usually achieved by releasing *ecological brakes* to the point where the recovered ecosystem requires less management input and has an improved level of fully or partially functioning ecological processes. Compare with *replacement* and *transformation*. See also: *restoration goals*.
ecosystem resilience	The ability of an *ecosystem* to recover following disturbance (both natural and anthropogenic). Ecosystem resilience is a central concept to *assisted regeneration* (the constellation of *Rainforest Restoration Methods* suggested by this Manual) and hence (ecological) restoration (Harden *et al.* 2004). Ecosystem resilience is an important bridge between *theory* and application: it is one of the concepts that allow us to understand why relatively unsophisticated restoration leads to a synergistic result that is greater than the sum of our efforts. By simply removing the *ecological brake* of *grazing*, a paddock's pasture can (with the right landscape context) regenerate into rainforest. This occurs because some pioneer and secondary species that we call *paddock rainforest starters* can germinate deep in the pasture sward's *full shade*. If mistletoes colonise the paddock rainforest starters, they in turn will attract honeyeaters, some of which disperse *rainforest* seed (Chapter S4 Figure 170). Add the shade from the rainforest paddock starters and the sun-dependent pasture begins to die out and is replaced by tussocks instead of a sward, which prepares the way for regeneration of rainforest plants (Chapter 4 Burning and paddock rainforest starters and Figure 4.5). The ecosystem resilience in this real-life example can be summarised on such sites as: 'regenerating rainforest from grass!' Our fencing of such sites removes the ecological brake of grazing and then ecosystem resilience takes over the process of rainforest restoration. This change is facilitated through the following elements of the ecosystem's resilience: the seed residing in the *soil seed bank*; the birds still present in the locality that are prepared to cross open ground to visit the site and disperse rainforest seed; and the seed available in nearby rainforest stands that can support the eventual succession to rainforest. In the *warm temperate climate zone* of the lowlands, ecosystem resilience can facilitate this process in as little as 10–15 years. We make a judgement about the potential for ecological resilience when we undertake *landscape analysis* and assessment of the ecological brakes operating on the site so that we can choose the rainforest restoration method best suited to the site's rainforest recovery. The logic train for this process would be: pasture in warm temperate lowlands with grazing removed + soil stored seed bank of paddock rainforest starters + mistletoes + honeyeaters + rainforest remnant within 500 m=*greenfields regeneration* of rainforest within 10 to 15 years. See also: Chapter 1 Opener, Chapter 4 Opener and Chapter S1 Opener, *ecological processes*, *landscape analysis*, *logic trains* and *paddock rainforest starters*.

ecosystem services	Services provided by plants, animals and ecosystems to have a wider environmental benefit. A rather tongue-in-cheek example is where humans provide ecosystem services to a wide range of open country species (Crested Pigeons, Budgerigars, Little Corellas, etc.) when we clear land (unfortunately at the expense of the original inhabitants). Plants producing oxygen is probably a better example.
ecotone	The boundary between one ***vegetation type*** and another, often with species shared from each of the abutting ***plant communities***. In rainforest ecology, these boundaries or ecotones can be expanding, contracting or static and they are composed of a range of (generally) broad-leaved ***mesic*** species that have lower flammability (than those of the surrounding ***sclerophyll forest***) and thereby act to protect rainforest from fire (Additional Reading: Ignition times). Frequent fire can cause the ecotones to contract, infrequent fire can cause them to expand and, during exceptionally long inter-fire periods, rainforests may expand into and colonise its ecotone.
ecotypes	These are adaptations expressed within one species (at the population level), that supports their ability to thrive in the specific conditions of the population's ***habitat*** at a particular site. These adaptations may be 'hidden' within visually identical plants of different populations that nonetheless have very different genetically conferred tolerances to environmental variables and this is why the concept of ***provenance*** is so important. However, in other examples, these genetic differences can be linked to a different physical appearance or ***phenotype***. It is thought that these plant ecotypes are important where one species occurs across a wide range of habitats. For example, Muttonwood *Myrsine howittiana* grows in ***Dry Rainforests*** on droughty and skeletal soils with a north or west aspect: a habitat that is so water-stressed, that these plants actually lose their leaves during drought and regrow them when it rains again (a coping mechanism that classes them as ***rain green***). In the same region, tens of kilometres away, this same species also grows in ***Littoral Rainforests*** where the water table is saline (910–10,190 μs/cm) and it can be inundated by fresh or saline water for weeks at a time! It is highly likely that these two plant populations that occur in these separate EVCs represent two separate ecotypes. The theoretical importance of this example is that if you take plants propagated from Dry Rainforest habitats and plant those ecotypes into the Littoral Rainforest habitat just described, it is thought most unlikely that these individuals would survive (and *vice versa*). See also: Chapter 3: Case Study 1, Chapter S8: Genetics, ***phenotype*** and ***provenance***.
edaphic	Relating to, or determined by, conditions of the soil, especially as it relates to biological ***systems***. Environmental conditions determined by the physical, chemical and biological characteristics of the soil (organic carbon, composition (silt, clay or sand), water relations, and so on.
edges	Edges mark the interface between two obviously different environments. Edges can include fire boundaries, a cliff or a road, the boundary between different vegetation (e.g. Riparian Forest and Gallery Rainforest), with the latter based on different structure and/or composition. The margin of a rainforest stand and its surrounding neighbourhood of agricultural land are also ecotones. Edges in general are important in ecology because they are the mixing zones between environments, with many acting as habitats for species that specialise in their use. From a rainforest restoration perspective, edges can be good or bad and everywhere in between. Edges can be natural, truncated or damaged. The characterisation, impact and importance of edges depend on the feature measured across the edge and its ability to penetrate the boundary between the two environments being studied. These ***edge effects*** change the conditions or composition of the interior of the rainforest stand. Many physical parameters change across edges, and some of these can have profound impacts. These include: wind, light and cold that can penetrate the ***rainforest core***. This destabilises the internal ***homeostasis*** of the ***rainforest*** stand and can allow fuels to dry out (increasing the risk of fire penetration), the entry and establishment of weeds, pest animals, and so on. Edges are also more physically exposed than the core and are more likely to suffer the impacts of windthrow (Additional Reading: Edges). Good or better edges are beneficial in some way to rainforest and provide support to rainforest (shelter, propagules, fire suppression, and so on) enhancing the core of the stand. 'Bad' edges allow the penetration of agents or conditions that destabilise the rainforest's core or one or more of its characteristic features (life-forms, species or ecological processes) through edge effects and the ***domino effect***. Each edge has variable effects depending on the feature being studied. The road illustrated in ***edge effects*** (below) provides a better boundary along which weeds can be managed (easy access, easily sealed with dense vegetation), but is a bad boundary for wind throw because the risk of this edge effect remains very high. See also: ***domino effect***, ***edge effects*** and ***rainforest core***.
edge effects	Edges can have positive or negative impacts: a bad edge its deleterious effect is often more obvious, because these have the greatest degrading impact on rainforests. The negative influence of a disturbed ***habitat*** edge on the interior conditions of the adjacent habitat, or on a species that uses the interior habitat. A good example is a study of the movement of weeds across edges that showed that wind and animal-dispersed seeds could penetrate a ***rainforest*** edge in North Queensland by as much as 85 m (Murphy 2008). Remember that most weeds that arrive on edges are ***sun weeds***, but that they can disperse internally and remain dormant in the ***soil seed bank*** until a disturbance creates light and allows it to germinate

and establish (e.g. Cape Ivy **Delairea odorata*). In contrast, ***internal edges*** occur or can be created by the invasion of ***shade weeds*** (especially those dispersed by water) such as Wandering Jew **Tradescantia fluminensis* or Blue Periwinkle **Vinca major*. Their colonisation is every bit as dangerous to the integrity of your rainforest remnant as the external edge.

Good edges help to shield rainforests from invasive or destructive edge effects. Examples of good edges include cliffs, rivers, intact native vegetation, and so on. The difference between good and bad edges is relative and context-dependant, so a road is a bad edge for wind and light, but potentially a good edge for weed control.

Key to external edge diagram below: yellow = cleared land or other degraded neighbourhood (highly variable conditions: full sun, hot, dry, cold windy; weeds dominate); orange = degraded edge (strongly variable conditions: bright, dark, hot, dry cold; windthrow and weedy); red arrow = hot drying winds; and blue arrows = cold winds. Green = *rainforest core* (internally stable conditions: light, humidity, temperature; little windthrow and few weeds).



edge effects (local example)	EDGE EFFECTS (WIND AND SUN EXPOSURE) AS A RESULT OF RAINFOREST CLEARING DURING FIRE SUPPRESSION 

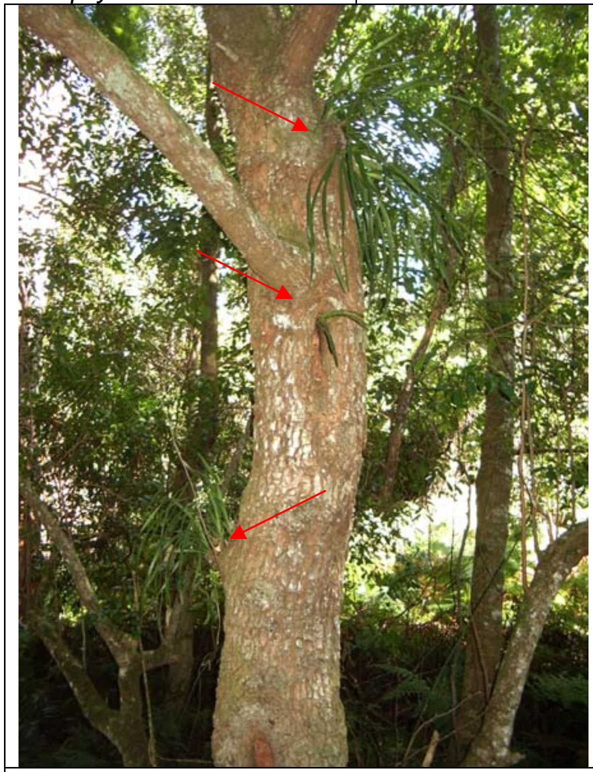
Boulder Creek, Victoria. A wildfire in 2006 led to the clearing of rainforest along Pheasant creek during fire suppression activities by an overseas works crew (top right: background). A healthy Fieldia *F. australis* (left) at the site that is still protected by an intact rainforest canopy (including the rainforest overstorey and a tree-fern layer below). Clearing an area of *Gallery Rainforest* in the creek has led to a number of edge effects (such as greater wind and sun penetration) into the adjacent *Warm Temperate Rainforest*. All of these edge effects occurred on the moisture-conserving eastern aspects of the creek and include the loss of ***lithophytes*** such as Strap Water-fern *Blechnum patersonii* and the loss of ***epiphytes*** on substrates with the least water-holding capacity (trunks of Blackwood *Acacia melanoxylon*, Rough Tree-fern *Cyathea australis*, Sweet Pittosporum *P. undulatum* and Lilly Pilly *Syzygium smithii)*. Epiphytic species affected include Fieldia *F. australis* (dead top right on Blackwood), Kangaroo Fern *Microsorum pustulatum*, Leathery Shield-fern *Rumohra adiantiformis* and filmy ferns. Moisture-dependent ground-ferns also died. Exposure to full sun has also led to sun scorch and death of filmy ferns (bottom right). These are surrogate measures that indicate a much drier atmosphere beneath the damaged canopy, drier fuels and a greatly increased future risk of fire to the remnant rainforest that was not cleared.

Edge specialist	Species whose typical habitat preference are edges: which by definition means that they occur (and use) two distinct habitats. A classic species from south-eastern Australia which often occurs along the edges of rainforest restoration is Superb Blue-wrens *Malurus cyaneus*. This species

	makes regular feeding forays out into open areas of short grass or other vegetation, quickly retreating to the denser rainforest when there is a threat. They also breed (build their nests and raise their fledglings) in the plants of the rainforest's edge.
EG	Abbreviation: East Gippsland.
EGCMA	Abbreviation: East Gippsland Catchment Management Authority.
EGRfCMN or EGRCMN	Abbreviation: East Gippsland Rainforest Conservation Management Network.
EEC	Abbreviation: ***Endangered Ecological Community***.
El Niño	A meteorological phenomenon that links rainfall and drought in south-eastern Australia with the sea surface temperatures of the western Pacific off Ecuador through the Walker Circulation along the equator. When *El Niño* is at its zenith, drought persists over south-eastern Australia and the risk of fire increases significantly. A detailed description of this phenomenon is to be found in Additional Reading at: www.egrainforest.org.au. See also: ***La Niña***, ***Walker Circulation*** and ***Indian Ocean Dipole***.
emergent trees	Tree species that grow 'head and shoulders' above the usual canopy height for any given ***rainforest*** stand. These species come from a variety of genera that include eucalypts, ***strangler*** figs or species such as Cabbage-fan Palm *Livistona australis* and Giant Stinging Tree *Dendrochnide excelsa*.
Endangered Ecological Community	EECs are an ecological community (EC) that has been listed under national legislation (*EPBC Act*) or New South Wales State legislation (*TSC Act*) and refers to a defined ***vegetation type*** that has suffered significant damage or decline and is endangered by one or more ongoing ***threatening processes***. The Victorian equivalent is a *Flora and Fauna Guarantee Act* listed community. For a complete example of this process see Definitions and Synonymy: *EPBC Act* Condition thresholds for the ***Littoral Rainforests*** and Coastal Vine Thickets of eastern Australia. See also: ***ecological community***, ***ecological vegetation class*** and ***floristic community***.
endemic *endemism*	A ***taxon***, ***floristic community*** or ***ecological vegetation class*** whose distribution is limited to a defined region. For example, Limestone Blue Wattle *Acacia caerulescens* (below) is a limestone endemic (being restricted only to limestone geologies) where it grows on the cliffs of the Mitchell, Nicholson and Tambo Rivers, the slopes of the Gippsland Lakes, Lake Bunga and Lake Tyers and in the Buchan-Murrindal district which also makes this beautiful wattle an East Gippsland endemic. *East Gippsland Karst* Dry Rainforest is an example of an endemic floristic community that is only found in the Murrindal Valley and is now extinct in the nearby Buchan Valley.   Toorloo Arm, Victoria. The East Gippsland endemic Limestone Blue Wattle *Acacia caerulescens* (in flower) and Limestone Pomaderris *P. oraria* ssp. *calcicola* (beneath with the rusty coloured buds and leaf Toorloo Arm, Victoria. Here, Limestone Blue Wattle growing on Tertiary Limestone is protected from fire by an estuary to the north and to the south by cliffs, Limestone Box Forest (a grassy ecosystem) and

	edges, are both restricted to the lime-rich soils of the region. Their sensitivity to fire means they are also associated with rainforests where they occur as late and early secondary species, respectively.	Warm Temperate Rainforest. The wattle is growing in *East Limestone* Littoral Rainforest (note references to limestone in the epithet for the names).

endophytes	Plants that establish themselves to the inside of trees, so that the root mass develops in the rotting heartwood of a live or dead host.



Murrah River, New South Wales. Snake Orchid *Cymbidium suave* growing in the trunk of a living Scentless Rosewood *Synoum glandulosum* (red arrows) in Warm Temperate Rainforest in deep shade under the canopy.

Bega Valley, New South Wales. Rusty Fig *Ficus rubiginosa* showing its habit when it is growing as an endophyte in a eucalypt stag in cleared habitat that is suitable for the regeneration of Dry Rainforest.

Wadbilliga, New South Wales. The fig from the figure below has nearly sloughed off its host's trunk which is splitting from the pressure from the expanding fig's root-forming trunk.

Wadbilliga, New South Wales. The endophyte Rusty Fig in the figure above (right) in regenerating *Dry Rainforest*. Note the fire scars on the eucalypt stag's bole, the fig having survived because its roots are contained within the host's trunk. By the time that the trunk is sloughed off, the rainforest may well have developed enough to ***self-extinguish*** wildfire.

endophytes (types)	In south-eastern Australia, two types of endophytes occur: facultative and obligate. The facultative endophytic species is Rusty Fig *Ficus rubiginosa*. Although it is known to establish as a strangler on box-barked eucalypts such as Blue Box *Eucalyptus baueriana* and more rarely on gum-barked species such as Forest Red Gum *E. tereticornis*, it is much more common to find it established in the hollows of eucalypts. If the host species is gum-barked or dead, then it seems to have trouble rooting on the exterior of the trunk. However, when it establishes as an endophyte and the host is already dead, or dies during the life of the fig, then its roots are so massive that they slough-off the encasing host's trunk (endophyte Figure above). Rusty Fig endophytes are known from the Bega and Brogo Valleys (but probably occur much more widely) in ***Dry Rainforest*** and ***Warm Temperate Rainforest***. Snake Orchid *Cymbidium suave* is the only obligate endophyte found in south-eastern Australia's rainforests. It grows in hollows of emergent eucalypts in ***Subtropical Rainforest*** and ***Littoral Rainforest*** (but is also likely in other types with these ***emergents***). Snake orchids have also been found growing in the hollows of rainforest trees such as Scentless Rosewood *Synoum glandulosum* in Warm Temperate Rainforest (endophyte Figure above) where it is obviously very shade-tolerant. It is probably much more widespread in such situations in the rainforests of south-eastern Australia, but to date may have been overlooked. Cf. ***epiphyte*** and ***strangler***. See: 'En' in the Life-form column of Appendix S6 worksheet: All species + FCs.
en masse	French: to arrive as a single group; a large response to a single event. Local examples include blossom-nomads turning up *en masse* to a large flowering event, massive germination of a species following a fire..
enrichment planting	Plantings of new (additional) species not currently present at ***degraded*** or young restoration sites, for which there is evidence that such species should have been, or were, present in the past. A management approach where a lack of ***diversity*** on a ***restoration*** site is identified as an ***ecological brake*** to the improved health or function of the site (usually as a result of a ***landscape analysis*** that identifies that there is a low probability of such species arriving through natural dispersal from existing bushland). Enrichment planting of even a few carefully selected species can have an amazing impact (Chapter 9: Does the diversity of native plants influence bird diversity?). The need for enrichment planting is often manifest as a lack of ***natural regeneration***. This could indicate a lack of mature plants to supply seed, an impenetrable barrier to ***seed dispersal***, the lack of a ***seed disperser*** or dearth of suitable ***niches*** for natural regeneration. Enrichment planting should occur where there is a clear need to increase the site's diversity and can include a myriad of species. High priorities for enrichment plantings include a lack in any of the following groups: • functionally important species (a key nectar source such as Dusky Coral Pea *Kennedia rubicunda*, or Coast Banksia *B. integrifolia*); • a missing food link in the year's chain of nectar or fruit production (any expected, but missing species for a site); • any missing groups of species or ***life-forms*** (***emergents***, ***stranglers***, ***vines***, etc); or • A ***keystone species*** in their own right that brings multiple benefits to the site (good examples include *Ficus* spp. or Sweet Pittosporum *P. undulatum*). Be very careful, however, that you do not turn your site into a garden (filled with species that appeal to you) based on your desires rather than the ecological function of the site or what was or should be *indigenous* to the stand that you are restoring. Cf. *supplementary planting*.
environmental services	The services provided to people by the environment: clean air, water, food, pest control, and so on.

environmental weeds	Weeds that are not native to a specific area (this can include species from other countries, or natives from other regions that are present outside of their natural range). Their impacts can vary from minor to transforming. The legal status of these species varies from not recognised to noxious (NSW) or proscribed (Victoria). A study by Cameron (2008) reported that 80% of the environmental weeds of the far South Coast arrived via gardens. Cameron's (2008) characterisation of the issue is worth quoting: 'The environmental weed problem arises from ill-informed and ill-judged deliberate actions. It is not an unfortunate, unintended by product of European Settlement.' His solution is also worth noting: 'It is essential that all major environmental (read transforming) weeds have a legal status that requires landowners to remove them from their properties ... we must find ways to guarantee continuity of attention and effort, funding and responsibility.' New environmental weeds are arriving all the time from gardening and the gardening media are (still!) strongly encouraging this disastrous practice. To tackle the problem, Cameron suggests with great clarity a hybrid approach consisting of two methods: 1. Priority targets: involves identification of those weeds posing the greatest *threat* and most deserving of priority attention and the mobilisation of resources for their control or eradication. This top-down approach is best suited to agencies responsible for large sections of the landscape and able to mobilise substantial resources; combined with 2. Adopt a patch: where individuals or small groups of local people take on the stewardship of a portion of the landscape that they value. It is a highly effective strategy that has already meant that some high-risk sites along the coast have been maintained in a largely weed-free condition (e.g. Tathra Landcare and their impact on Bitou **Chrysanthemoides monilifera* ssp. *rotundata*). There is a third element to the issue of environmental weeds, which is to do with personal responsibility. As Tim Low (1999) noted in his book *Feral Future*: Australians urgently need to adopt a new gardening ethos. We must accept that gardening within a kilometre or so of bushland entails an ecological responsibility. Weedy species should not be grown. New garden plants should be treated less like exciting new products to brighten our lives and more like wild organisms harbouring the drive to escape. See: Cameron (2008): Coastal Environmental Weeds on the NSW Far South Coast for a comprehensive listing of the species, the issues and a call to arms. See also: *background weeds*, *Bradley Weeding*, *C3 weeds*, *C4 weeds, close weed control*, *landscape-scale weed control*, *transforming weeds* and *Wingham Weeding*
EPBC Act	Abbreviation: the Federal *Environmental Protection and Biodiversity Conservation Act* (1999).
epiparasites	Plant parasites that form an obligate *haustorial attachment* to another parasitic plant. Local examples include various mistletoes growing on the root parasite Cherry Ballart *Exocarpos cupressiformis*, several mistletoe species that grow facultatively on other mistletoes and Golden Mistletoe *Notothixos subaureus*, which is usually an obligate epiparasite of other mistletoes. For mistletoe species of rainforests and their hosts in south-eastern Australia see Appendix S6 worksheet: Mistletoes hosts.
epiphylls	Epiphytic plants that grow on the leaves of other plants. This can include *algae*, leafy *liverworts* or *lichens* (Chapter S4: Figures S109–110). See also: *endophytes* and *epiphytes*.
epiphytes	Plants that live on the surface of other plants without their roots reaching the soil, or deriving nutrition from the sap of the host (cf. *mistletoes*). Mineral requirements are derived from the rain and organic material that falls from the atmosphere or the canopy. See also: *endophytes*, *lithophyte*s, *non-vascular epiphytes*, *stranglers* and *vascular epiphytes*. See: 'Ep' in the life-form column of Appendix S6: All species + FCs.
episodic recruitment	Irregular coppicing, germination and establishment: recruitment that requires some major disturbance or other trigger (flood, fire, landslip, disease, frost, vernalisation, etc.) that releases competition or stimulates germination and thereby initiates the establishment of a new population *cohort*. See: *continuous recruitment*.
ES	Abbreviation: *Early secondary species*.
estuary, *estuarine*	The saline or brackish reach of rivers and their terminal coastal lake systems. Characterised by fluctuating salinity levels (but mostly saline) and a range of *landforms* (e.g. islands and *deltaic deposits*), *berms*, *barrier dunes*, *cheniers* and flats that are affected by salt. Estuary landforms and the salt contained in them provides habitat for *Littoral Rainforest* if the inundation regime and depth to the water table are appropriate.
estuary forcing	A series of factors that alter the stand height of estuaries and may lead to radically different water levels from one end of the system to the other at exactly the same time. Factors that increase stand levels include: storm surges, low atmospheric pressure, winds and entry of flood waters.

eureka moment	'A eureka effect (from the Greek *heurēka*, 'I have found') is any sudden unexpected discovery, or the sudden realisation of the solution to a problem, resulting in a eureka moment (the moment of unexpected discovery). The eureka effect is also known as the aha phenomenon.' <http://en.wikipedia.org/wki/Eureka_moment>.
evaluation	Deciding what the results of your ***monitoring*** can tell you about a subject; for example, the success or failure of your management actions. If your project is monitored, but the results are never evaluated and used to change your management, then you miss an ideal opportunity to adapt. If there is no evaluation, then there is no point to undertaking monitoring (*sensu* Rutherford *et al.* (1999b). Cf. ***monitoring*** and its use in ***adaptive management***.
EV	Abbreviation: Exposure Value. A unit used in photography to describe relative exposure <www.unc.edu/~rowlett/units/dictE.html>. It is an easily accessible measurement (using a photographer's light meter) that provides readings that are a surrogate measurement of the incident light reaching the ***habitat*** on your site. These are important in describing the ***incident light niches*** of ***rainforest*** species, which are very important for the establishment of different ***successional stages*** in rainforests. ***Pioneer species*** like high incident light niches (***full sun***); ***secondary species*** can tolerate partial ***light shade***; whereas ***primary species*** require ***full shade***. Not only do EV readings measure ***insolation*** but they are also a ***surrogate measure*** for other environmental variables that are important to rainforest and its ***ecology*** including: heat, cold, evaporation, relative humidity and condensation regimes. The EV readings presented in this work were taken with a 'Sekonic Digi Lite F' incident light meter set for 400ASA speed film.
evapotranspiration	The sum of moisture loss to the atmosphere from the Earth's surface via evaporation and through plant transpiration through the pores of the leaves of plants during ***photosynthesis***.
EVC	Abbreviation: *Ecological Vegetation Class*. See also: ***ecological community***, ***endangered ecological community***, ***floristic community*** and ***vegetation type***.
exotic species	A species that does not naturally occur in a particular location. Species from other countries are more often referred to as exotic, whereas those that are native to a country but which have been artificially translocated out of their natural range are often termed ***non-indigenous*** natives.
experiment	A trial of series of trials to determine cause and effect. Experiments are usually undertaken to test one variable related to a ***hypothesis*** that has been set up to explain a ***theory***. Experiments usually take the form of single alteration or manipulation of one of the elements of the system or problem being studied.
ex situ	*Latin* for 'off site': for example, *ex situ* conservation of a species means its removal from its ***habitat*** to a safe place for its preservation, breeding and possible reintroduction once the ***threats*** to its conservation in the wild have been addressed. Cf. ***in situ***.
extinction debt	Where the full ramifications of an extinction event are not felt until many decades after the event(s) that set the extinction process in train. For example, the extinction debt levied as a consequence of the removal of all hollow bearing trees in the habitat of a long-lived animal that depends on them for breeding, is not paid until that animal dies out. In other words, the population's numbers may appear stable for decades but there is no recruitment as a result of the loss of breeding opportunities. However, all of the individuals within the population are continuously getting older and, at some point, even if hollows were reintroduced, they could not breed because of age and it is at that point the extinction debt is levied.
extreme temperature refugia	During the 2009 extreme temperature event in Victoria, temperature refuges were identified around the Gippsland Lakes for one ***Littoral Rainforest*** species. The temperature extremes (and accompanying super low relative humidity of <10%) resulted in the death of many mistletoes across a range of species. The species most severely impacted was Coast Mistletoe *Muellerina celastroides*. Higher levels of survival for Coast Mistletoe are correlated with the presence of a large open water body to the north of the population (Additional reading: Extreme weather: Figure AR114). It is thought that the lake acted as an evaporative cooler, increasing humidity and reducing temperature during periods when temperatures in the shade exceeded 43–47^{o}C. Where the 'lake to the north' landscape juxtaposition existed, survival of this species was 55%, whereas if a lake was absent to the north survival dropped to only 4%. Interestingly, the loss of old and complex populations of this mistletoe (if the evaporative cooler ***theory*** is correct), is directly related to the opening of the artificial entrance to the Gippsland Lakes in the 1800s. This allowed the lake (Cunninghame Arm) to silt up to the north of the remnant population at Eastern Beach that suffered most during the extreme temperature event. Ironically, a younger population survived in the same district because a previously ephemeral wetland had been dredged and made into a permanent water body for sewage settling lagoon. See also: ***refugial hosts***.
extrusive	In geology: a molten rock that is extruded from the Earth's crust as a lava or ash to form rocks such as: basalt, rhyolite or tuff. Cf. ***intrusive***.
facultative epiphyte	A species that can establish either on the ground or on a host (e.g. several shrub species such as Prickly Currant-bush *Coprosma quadrifida*,

	which can grow as ***epiphytes*** on the trunks of Soft Tree-fern *Dicksonia antarctica*, but more often establish in the soil). Cf. ***obligate epiphyte***.
facultative parasite	A species that is still capable of manufacturing its own food, but on occasions taps into a host to obtain some other resources (e.g. Cherry Ballart *Exocarpos cupressiformis*). Cf. ***obligate parasite***.
facultative seed regenerator	A species that can regenerate either from seed or from resprouting or layering, etc. Cf. ***obligate seed regenerator***.
facultative strangler	A species that can grow as a ***strangler*** but more often occurs without a host (e.g. Rusty Fig *Ficus rubiginosa*, which is usually a ***lithophyte*** or grows in the soil, but can establish as a strangler, particularly in eucalypt hollows and forks: often on Forest Red Gum *Eucalyptus tereticornis*). Cf. ***obligate strangler***. See: 'FSt' in the life-form column of Appendix S6 worksheet: All species + FCs.
feeding guild	Many Australian birds feed in mixed species flocks called feeding guilds. In south-eastern Australia, these include a range of small ***rainforest*** birds that feed in the forest canopy: Brown Thornbills, Striated Thornbills, Yellow Thornbills, Grey Fantails and Silvereyes; and in estuaries: pelicans, cormorants, terns, White-faced Herons and a variety of egrets.
feldspar	The clay-rich mineral of rocks, which form the basis of clay-based soils. Cf. silica minerals that produce the sand element of soils.
ferns	Vascular non-woody plants that reproduce through ***spores*** and not flowers and seeds.
FFG Act	Abbreviation: for the Victorian *Flora and Fauna Guarantee Act* (1988).
fidelity	A relative scale rating a species' dependence on one type of vegetation: taken to indicate a link between the specialisation of a plant taxon to the ***habitat*** of a particular ***vegetation type*** such as rainforest. This is particularly noticeable in vegetation types that occur in, maintain or create a specialised habitat that mediates the habitability of that niche and therefore restricts the distribution a particular taxon to the vegetation type with those conditions. So, for example, in rainforests, ***deep shade*** and a lack of fire ensure a high fidelity for those taxa that are shade-loving, able to reproduce in the absence of fire and are fire sensitive. In saltmarshes, salt and inundation are the restrictive conditions for some species with high fidelity to that vegetation. Those species that are unable to live outside of these vegetation types are considered to be obligate species for that particular vegetation and have a high fidelity to it. Cf. ***satellite species***. See also: ***high fidelity rainforest species***, ***moderate fidelity rainforest species*** and ***obligate rainforest species***.
fire refuge *fire refugia*	In south-eastern Australia, usually a small and specific locality within the broader fire shadow neighbourhood given the highest degree of fire protection by topographic, vegetation or microclimatic features compared with the more widespread, (and usually higher) fire frequency, which is typical of the fire shadow and the broader adjacent landscape. Within a given fire shadow, fire intensity will vary, with fire less frequent and less intent on its margins, to almost completely absent at its core. It is this core area of a fire shadow that constitutes the fire refuge and becomes habitat for the fire-sensitive rainforests of south-eastern Australia. Fire refugia are afforded to rainforests by: topographic features including south- or east-facing gullies (that conserve moisture, provide wind shelter during high fire risk periods when hot and dry westerly or northerly winds are blowing), rock screes, cliffs, ***marginal bluffs***, rocky gorges, wide perennial rivers, lakes, islands, bare sand, proximity to the sea (and the salt-coated fuels attributed to ***atmospheric accession***). ***Ecosystem fire protection*** is derived from: fire-suppressant vegetation such as saltmarsh, mangroves, wetlands and large expanses of ***rainforests*** themselves; or where fire intensity is reduced by grassy ecosystems (including grassy woodlands, grassy forests and grassy wetlands); or old-growth vegetation that breaks ***fuel ladders*** such as: Headland Scrubs, Coast Dune Scrubs (along the coast) or Blackthorn Scrubs in ***rainshadow valleys***. See Additional Reading: Field observations of Littoral Rainforest persistence and recovery after fire (Figures AR 110–111) for a worked example of how these features combine to produce differential fire behaviour that protected Littoral Rainforest during a summer wildfire. See also: ***fire shadow***.
fire shadow	Broader parts of the landscape (compared with fire refuges) that are sheltered to some extent by some mechanism from ***heading fires*** during high fire risk weather within which a ***fire refuge*** may be created. Fire shadows occur in the lee of the ***landscape fire protection*** (landform and/or vegetation). During high-risk periods of ***fire weather***, fire shadows usually have one or a combination of: lower wind speeds, higher atmospheric moisture, slopes that run counter to the prevailing wind that carries the high-intensity fire (i.e. often south- or east-facing gullies), which are in the lee of hot dry fire weather winds from the north and the west. Fire shadows may also occur in more topographically exposed sites that have an effective fire barrier: such as open water, bare sand, beaches, islands, wide rivers, cliffs, screes, etc. Fire shadows can also be augmented by high humidity environments such as coasts and the interior of ***Gallery Rainforests*** that trap moisture from the stream in the fine fuels of the vegetation (see Figures S278 and S279), high mountain ranges (that have increased: rainfall, cloud (so less evaporation), or fog than the surrounding landscape); salt on or in fuels (especially where other moisture is also provided by a moist ***microclimate*** or the succulence of the plants involved, such as saltbushes or samphires); or ***ecosystem fire protection*** provided by wetlands grassy woodlands, old-growth vegetation or the rainforests'

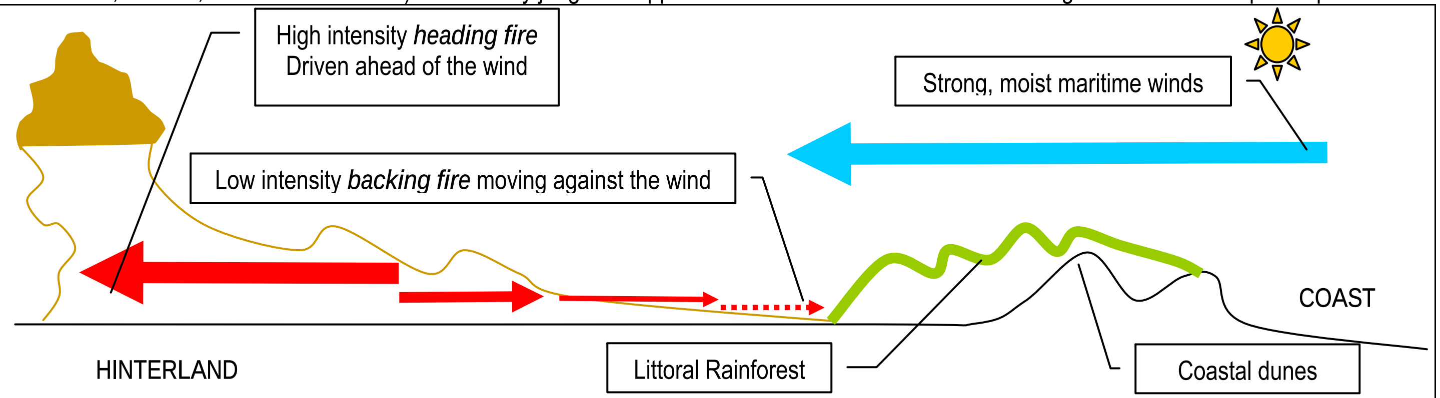
themselves that moderate fire intensity, frequency or seasonality before they enter the rainforests. See also: *fire refuge* and Appendix S18 worksheet: Salt retardation.

fire types

Fire types are defined on the basis of their direction of propagation through a fuel and include: heading, backing or flanking fires. Greg McCarthy (pers. comm.) describes them as ***heading fires***, which account for five-sixths of a fire's area. These are rapidly moving fires that move up slope or ahead of strong winds, they are the most powerful because of their intensity and the ability that this confers to the fire to be able to dry our (or cure) its own fuels and so increase their rate of ignition (remembering fine fuels need to hold less than 20% moisture to ignite). Heading fires can produce *crowning fire* events. Even in such events, the bark types of the forests being burnt have a significant impact on the intensity of the fire. Ironbark, box, and gum-barked species have low flammability bark types (due to their texture producing low or zero levels of fine fuel), whereas stringybarks have highly combustible fine fuel barks. As a consequence, stringybarks tend to be more dominant on slopes and ridges where crowning fires are the norm. The other two types of fire account for the remaining sixth of the extent of most fire areas: *flanking fires* move laterally across the slope and *backing fires* move down the slope. Both of these fire types are slower, and of lower intensity than a heading fire. It is these fires (that usually occur as infill burning of areas missed during the passage of the heading fire), which may continue to trickle around in the *fire shadow* areas for days after the original heading fire has passed. These non-heading fires are the ones that may creep quietly into rainforests where they usually do minimal structural damage (unless they ignite a bark pile at the base of a *bonfire tree* (Appendix S18: Figures fire: AS18-1, AS18-2, AS18-4 and AS18-5). To visually judge the appearance and behaviour of fires see the figure under landscape fire protection.

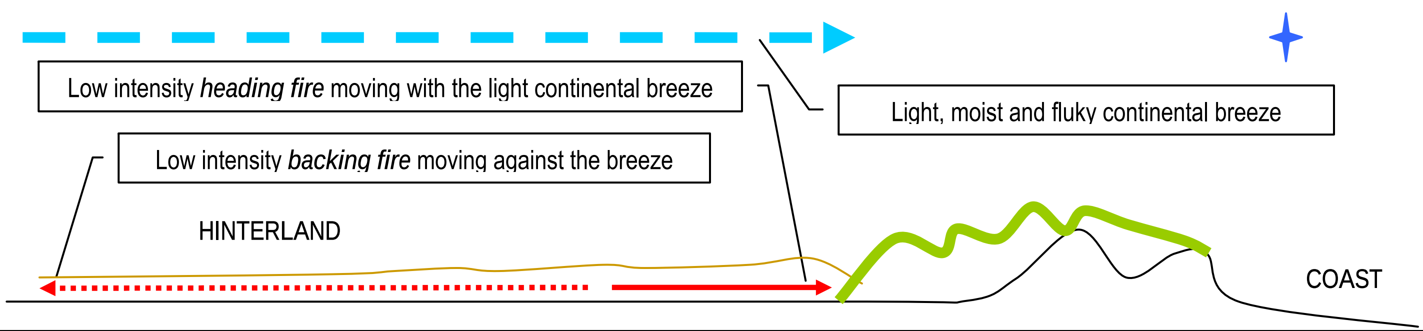
Fire types
How these interact with (and ultimately protect) Littoral Rainforest

DAYTIME CYCLE: high fire intensity is taken driven away from the Littoral Rainforest and low intensity backing fires establishes a burnt break nearer to the rainforest



Fire types

NIGHT-TIME CYCLE: low intensity fire burns back towards the Littoral rainforest where the night-time moisture and the rainforest itself can self extinguish the fire



fire weather

The weather conditions that determine the risk of fire spread and intensity across a region (as measured by the *Forest Fire Danger Rating*). The meteorological components that contribute to the risk of fire and its spread include: wind speed, wind direction, relative humidity and temperature.

	At the local scale, this can vary according to a range of localised phenomena that modulate these components. These localised factors (including smaller scale variations in those already mentioned) can also include: atmospheric inversions and sea breezes as well as the influence of topography (principally elevation and aspect). Additional Reading: Climate systems you should know more about: impacts on rainforest (particularly: Local climate) provides a detailed comparison between the meteorological features of coastal (Littoral Rainforest) habitat and that of the hinterland, many of which contribute directly to fire weather and the severity of the Forest Fire Danger Rating for any given day. See also: ***fire refugia***, ***fire shadows***, ***fire types***, *Forest Fire Danger Rating* and *landscape fire protection*
flanking fire	See *Fire types*.
flipping paradigms (flipping)	The process whereby accepted or perceived wisdom (paradigms, practice or thoughts) should be flipped and looked at from a different angle. This leads to new insights into problems and better methods. Maintain a healthy scepticism and never accept anything at face value: 'give the paradigm a flip' and see what appears. Consider the paradigm as a dice sitting on the table, you can only ever see five of its six sides (or truths/wisdoms), while the sixth side remains hidden). By flipping it, you may discover another perspective or a message on that sixth side that suggests the paradigm is defective our untrue. Failure to adapt and question paradigms by flipping them every now and then is a recipe for stagnation and dogma: not where you want to go in *rainforest restoration*. If we had been doing rainforest restoration in Australia for several millennia, then there would be less need to question, but, as things stand, we are just beginning. See *Wingham Weeding* for an excellent example of flipping paradigms that has significantly improved rainforest restoration for all of us.
flood-mud regenerators	We are all familiar with the amazing regeneration that occurs on the mud in wetlands: aquatic and semi-aquatic species regenerate from seeds in the mud. On alluvial plains following floods, a process called mud drape occurs where mud is deposited over the pre-existing soil surface. This blocks germination from the *soil seed bank* (except where the mud cracks to reveal the original soil surface (Appendix S5 Figure AS5.4). Flood-mud regeneration occurs on the new soil surface left by the mud drape. The regeneration occurs even after gentle floods where there has been no physical disruption to the pre-existing vegetation or canopy. Surprisingly, it also occurs in forests (including rainforests) in any *incident light niche*! The seed sources so far identified that contribute to this mode of regeneration include: in the flood's mud, in the water, or post flood from wind, animals or seed dispersed by gravity after the mud's deposition.
flood-mud regenerator species	Species so far identified in this group have been listed in Appendix S5 and currently number 41 vascular species, with the addition of many primary *successional stage* mosses, liverworts and *ferns* (that remain unidentified and as yet are not included in this total). These plants are often (but not exclusively), secondary species that have trouble regenerating in leaf litter in rainforests (presumably because of the limited food reserves in their small seeds or *spores*). However, the list also includes *rainforest primary species* that are well adapted to regenerating in leaf litter. The secondary species in this group are very interesting. Because high litter loads in rainforests represent germination barriers for these secondary species (as is the case also with mosses and ferns), the mud drape of each flood event provides an important opportunity for regeneration in rainforest *niches* that would not otherwise be available to these *taxa*. Interestingly, many of the species listed as flood-mud regenerators in rainforest are traditionally thought of as requiring fire for regeneration. This important discovery confirms that the species listed in Appendix S5 are species of rainforest that do not require fire for regeneration in rainforest niches. These observations go a long way towards explaining the presence of these traditionally perceived 'fire-dependent ***sclerophyll*** species' in ***riverine rainforests*** that show no evidence of fire. This raises the possibility that there are many other taxa that occur in rainforest (and are still thought of as 'fire-dependent' for regeneration), which may also be recorded as flood-mud regenerators in the future. Here is a guess as to which taxa these might be: • Oyster Bay Pine *Callitris rhomboidea*; • other members of the family Asteraceae: Cassinias *Cassinia* spp., Cudweeds *Euchiton* spp.; • Members of the family Casuarinaea: River Oak *Casuarina cunninghamii*, Swamp Oak *C. glauca* especially because the latter germinates in water (Appendix S4 worksheet *C. glauca* flotation + germination); • other floodplain eucalypts: Coast Grey Box *E. bosistoana*, River Peppermint *E. elata* and Blue Gum *E. globulus*; • other members of the family Myrtaceae: River Bottlebrush *Callistemon seiberi,* Kunzeas *Kunzea* spp., Tea-trees *Leptospermum* spp. and Melaleuca; and • other members of the family Proteaceae. Coast Banksia *B. integrifolia*; Small-flower Grevillea *G. linearifolia* and Gippsland Waratah *Telopea oreades.*

	The type of sediment also seems important: silts and sands allow germination from below the deposited sediment (Appendix S5: Figure AS5-6) from the existing soil seed bank whereas the mud presents a germination barrier to the soil seed bank (Appendix S5: Figure AS5-4). It ensures a competition free environment for the establishment of the species listed as flood-mud regenerators in Appendix S5 (see Figures AS5-3 and AS5-8). Keep your eyes peeled for this important phenomenon and add any new species that you discover to the list in Appendix S5!
floristic community (FC)	A group of plant species that consistently occur together in a particular ***niche*** within a biogeographic region, their co-existence being interpreted as indicative of a range of characteristic ***habitat*** variables for that niche. The floristic community so-defined is a sub-group of an ***ecological vegetation class*** that is composed of one or more floristic communities that occur across a region or ***bioregion***. For example, in the ecological vegetation class ***Warm Temperate Rainforest***: the floristic community *Alluvial Terraces* Warm Temperate Rainforest occurs on fertile well-watered creek or river flats. In contrast, the floristic community *East Gippsland Foothills* Warm Temperate Rainforest occurs in sheltered gullies of the coastal ranges. See also: ***ecological communities (ECs)***.
floristic entities	Distinctive floristic assemblages, suspected of being a floristic or ***ecological communities***, but which are yet to be specifically defined by extensive quadrat data collection and/or subsequent floristic analysis.
foliose	One of three groups in a broad ***lichen*** structural classification. Foliose lichens appear as tufted growths with significantly raised growth off the plane of their substrate, with substantial vertical development and radial thickness (at least at their base). Cf. ***crustose*** and ***fruiticose***. See Chapter S4: Figure S151 for an illustration of all three.
follicle	A dry ***dehiscent*** fruit opening along one line (CRCfAW 2007a) e.g. a grevillea fruit.
food chain	A food chain describes the predator–prey relationships between species within an ecosystem (usually cast as producers, the plants, and consumers, the animals). It represents a flow of energy from one organism to another as each consumes a lower member and, in turn, is preyed upon by a higher member of the chain.
food web	A food web is a set of interconnected ***food chains*** by which energy and materials circulate within an ecosystem. A partial food web associated with Coast Mistletoe *Muellerina celastroides* is graphically illustrated under ***symbiosis***.
forbs	***Herbs*** that are not grasses or grass-like plants (see ***graminoids***).

Forest Fire Danger Rating (FFDR)	The following explanation of the rating is provided by Attiwill (2009). The FFDR is calculated from predictions of air temperature, relative humidity, rainfall and the number of days since rain, a drought index and wind speed. It was developed based on the weather measurements at Melbourne for Black Friday, 13 January 1939. Fire Danger Rating varies from 1 to 100+; and represents the degree of difficulty of fire suppression in a dry eucalypt forest with a fine fuel load of 12.5 tonnes ha^{-1}. It has the following ranges: • Low: <5. Almost no danger of a fire starting, little effort needed by fire-fighters to put the fire out; • Moderate: 5-12. Moderate possibility of fire starting, slightly increased effort needed by fire-fighters to put out the fire. In other words, on days of low or moderate risk a fire will either go out or be easily extinguished; • High: 12-24. Increasing possibility of fire starting, more effort needed by fire-fighters to extinguish the fire. Fires can either be put out rapidly or managed in cooler weather in the evening or on the next day. Houses could be threatened; • Very High: 24-50. Authorities consider a total fire ban, high chance of a fire starting and expanding quickly, fire-fighters need strong efforts to extinguish fires on these days. The fire generates sparks and embers, and property can be threatened. Proper safeguards will enable a house to be protected if a householder stays on the scene to defend the property; • Extreme: 50-100. Total Fire Ban day, very high chance of fire starting. On these days, a fire becomes uncontrollable very quickly and is impossible to put out, even in low fuel areas. Fire-fighting resources are stretched to the limit. • 'Catastrophic': >100. This is a new category that was recommended by the Black Friday Fires Royal Commission and accepted in August 2009 by the Victorian Government that acknowledges fire behaviour that cannot be fought and which threatens catastrophic loss of life and property. Prior to Ash Wednesday 2003, the index had a range of 0-100, but on that day the Index exceeded ~140. On Ash Wednesday 2003 in East Gippsland, most Warm Temperate Rainforest experienced at least crown scorch and a ground fire. On Black Saturday (7 February 2009) it reached ~180. This increase in magnitude of the Index has been attributed to climate change. The index was still 160 in the Yarra Valley a week after Black Saturday 2009 (Attiwill 2009). The importance of the FFDR to rainforest is that it could probably provide a surrogate index for fire risk to rainforests and their combustibility under a range of *fire weather* conditions. Even given the extreme weather conditions in the Black Saturday 2009 fires, Cool Temperate Rainforest was able to self-extinguish fire and even on the most exposed northern aspects the Cool Temperate Rainforest canopy species Myrtle Beech *Nothofagus cunninghamii* had its crown scorched but not consumed beneath an overstorey of Mountain Ash whose foliage was completely consumed in the crowing wildfire (see Figure: *ignition times*). At Boulder Creek wildfire in 2006, both *Warm Temperate Rainforest* and *Gallery Rainforest* were also *self-extinguishing* as were small sections of Gallery Rainforest on the Brodribb River (Chapter S7 Figure S278) during the Granite Creek wildfire. See also: *Ignition times*, *self-extinguishing.*
forestry tube	A plant propagation container with a square cross-section and a tapered length. Usually planted by a *Hamilton Treeplanter*® which is custom-made to fit the shape of the tube. A larger version is called a *super tube* which is used where more advanced plants are required. See also: *hikos*, *super tube* and *rocket pot*.
fossorial	Used in reference to a *guild* of animals that forage on the ground including wombats and echidnas, and birds such as the: Bassian Thrush, Eastern Whipbird, some cuckoos, such as the Brush Cuckoo, and Eastern Yellow Robin..

Framework Method	A *rainforest restoration method* that is applied where there is no tree canopy remaining and few if any groundlayer remnant *rainforest* species present. It uses hardy *pioneer* and *secondary species* to establish a shady canopy to provide protection from exposure to sun, wind and/or frost, for the eventual arrival of the more sensitive *primary rainforest species*. Its use is determined by a landscape analysis that has shown there will be abundant natural regeneration once the ecological brakes are removed, or, if no natural regeneration is expected, then other works will be required. These framework species are sometimes called a *nursery crop*. Once a canopy is established, the primary species are either brought onto the site by dispersal or, if natural regeneration is insufficient to restore the rainforest, then these species are supplied through *enrichment planting*. This approach is used where: there is insufficient shade to apply the *Maximum Diversity Rainforest Restoration Method*; too few indigenous groundlayer species to necessitate the use of the *Mixed Canopy Method*; and one or more *ecological* brakes are operating on the site that would prevent *natural regeneration* from taking place. Ecological brakes that might necessitate the use of this method include extreme exposure to wind, frost or sun and where soils have insufficient carbon to support rainforest until a nursery crop has been established for some time. See Chapter 5: Framework Method for a complete description and how and when to apply this approach. Cf. *Clumped Mixed Canopy*, *Maximum Diversity* and *Natural Regeneration* rainforest restoration methods.
frilling and killing	The method of dispatching woody weeds by cutting frills around the main stems and applying herbicide, which is then translocated throughout the plant.
frontline species	Species able to withstand the full onslaught of salt laden winds, which grow in the frontline behind the beach and providing wind shelter (*storm shutters)* to the plants behind. Examples include Coast Sallow Wattle *A. longifolia* ssp. *Sophorae*, boobiallas *Myoporum* spp. etc. See: storm shutter.
fresh	A local term referring to a small flood of water down a stream that does not breach its banks. Such flows rearrange sand banks and sediment but only within the stream's channel.
frugivore	An animal that eats fruit. Cf. *carnivore*, *granivore*, *herbivore*, *insectivore* and *nectivore*.
fruiticose	One of three groups in a broad *lichen* structural classification. Fruiticose lichens are flattish but with slightly raised growth from their substrate, with some vertical development and thickness. Cf. *crustose* and *foliose*. See Chapter S4: Figure S151 for an illustration of all three.
fuel ladder	The vertical arrangement of combustible fuels that allows the burning fuel below to ignite the fuel above in the 'ladder'. This process transmits fire vertically and through the landscape as the fire front cures the fuels ahead of it and then ignites them. If the fuel ladder is broken (or because the fuel ladder is discontinuous), then the fire consumes the available fuel but fails to spread. Breaks in fuel ladders that prevent fires propagating from low-intensity ground fires into the canopies of trees where they can become high intensity *crowning fires* is a one of several ways that rainforests can protect themselves from wildfire. Breaking fuel ladders is also important in providing fire breaks and protecting assets. See: *fire types*.
full shade	Continuous shade of any level: light, moderate or deep (or transitory). See: *incident light niche*.
full sun	Varies from EV 12 to 17+ (but between 9.30 and 17.30 it is at or above EV 17). See: *incident light niche*.
functional processes	The processes that characterise and support an ecosystem: nutrient cycling, regeneration, senescence, dispersal, etc.
fungi	A diverse group of organisms that are not able to photosynthesise, have cell walls that lack cellulose and lignin (typical of plants), which are instead made of chiton. They reproduce via *spores*. Fungi as a functional group are very important in rainforests, underpinning a range of *functional processes* such as nutrient cycling, pathogenicity and symbiosis through the roots of many plants as well as the structure of *lichens*.
funicle	The stalk of the ovule (or seed), which, in wattles in particular, is small and packed with fats and oils that ants find irresistible. Funicles are the *plant's* reward for short distance ant-dispersal of non-rainforest wattle seed after they have been explosively expelled from their pods. See Chapter S4 When does it fruit and who eats what: Figure S177. Expansion of the funicle results in the formation of an *aril*. See: *non-rainforest wattles* as well as *aril* and *rainforest wattle*.
future-proof	Anticipating the future threats and acting on them now. In *rainforest restoration*: works that you can do today that will reduce the impact of significant change (e.g. global warming) or severe disturbance events (flood, fire, etc.) that will occur, or are predicted to occur, on your restoration sites in the future. For example, planting *rainforest pioneer* and *secondary species* whose seed will remain in the *soil seed bank* should ensure that the site regenerates with native species in the future when it is disturbed and you are no longer there to assist or intervene.

Gaia Hypothesis *Gaia Theory*	The original hypothesis was defined by James Lovelock through a series of articles in the 1970s as: 'A complex entity involving Earth's biosphere, atmosphere, oceans and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet'. <http://wikipedia.org/wiki/Gaia> The original hypothesis has evolved into a new area of scientific endeavour called geophysiology or Earth System Science (that studies the links and feedback loops manifest between the ***biotic*** and the ***abiotic*** at a planetary level. <http://wikipedia.org/wiki/Gaia>. See also: *Landscape reader*.
Gallery Rainforest	A ***rainforest EVC*** that occurs in the lowlands in the ***subtropical climate*** and ***warm temperate climate zones*** and from lowland floodplains to the foothills below 600 m. It occurs along the high flood energy reaches of major and minor (even ephemeral) streams provided there is excellent ***landscape-scale fire protection*** and it is composed of ***characteristic species*** and **life-forms** that are adapted to these high flood energy conditions. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Gallery Rainforest.
gap-maintaining species	Usually long-lived sun tolerant sprawling or colonial species that are able to prevent woody ***rainforest*** pioneers, secondary and mature phase species from establishing, and so maintain ***rainforest gaps*** and edges indefinitely. Lowland rainforest examples include: ***rhizomatous ferns*** such as Bracken *Pteridium esculentum* and Common Ground-fern *Calochlaena dubia*; and vines and scramblers such as Large Bindweed *Calystegia sepium,* Jungle Grape *Cissus hypoglauca,* Forest Clematis *C. glycinoides* and Seaberry Saltbush *Rhagodia candolleana*. Cool Temperate Rainforest examples include Soft Tree-form *Dicksonia antarctica*. In most cases, their dominance is broken following fire, when mass germination of pioneer and secondary species (especially trees, ***shrubs*** and vines) can swamp the resprouting species for long enough to produce a shady canopy. The exception to this may be the case of Soft Tree-fern, with the mechanisms associated with breaking its dominance not currently known. This switches conditions against these gap-maintaining species in favour of the ***primary species*** of rainforest that are shade dependent for establishment. As the ***pioneer*** and ***secondary species*** senesce, the primary species become the canopy, thereby repairing the rainforest gap or even extending the rainforest area. Gap maintaining species can provide vital functions in rainforests.

Gap-maintaining species (examples)	GAP MAINTAINING SPECIES CAN HOLD BANKS TOGETHER	GAP MAINTAINING SPECIES PROVIDE IMPORTANT HABITAT
		
	Bete Bolong, lower Snowy River Victoria. Downy Ground-fern *Hypolepis glandulifera* was planted beneath the original willow cover crop (since removed), to ensure that the bank would not erode when the cover crop was gone. This site forms part of the 'Willows to Natives' trial, earlier pictures of which include Figure S266 and Figure 5.10 in the Manual.	Marlo Road, lower Snowy River Victoria. Not only has the gap-maintaining species Seaberry Saltbush *Rhagodia candolleana* sealed the edge of this 30m wide restoration site, it has provided a spot for this nest of Eastern Whipbird *Psophodes olivaceus* and its young.

gap phase dynamics	The process whereby gaps are created and healed through ***secondary succession,*** which occurs through ***natural regeneration*** in canopy openings as the result of changed light and moisture conditions resulting from the loss of a ***canopy tree***, ***trees*** or ***vines***. Depending on the size, extent, location and the context of the gap, a number of ***pioneer***, ***secondary*** or ***primary species*** will respond to the changed conditions by either regenerating or entering a rapid growth phase (if present prior to the gap and in a growth-restricted state). If the site is healthy, propagules are available and conditions are appropriate (weed levels are low, etc.), there will be extensive and diverse regeneration and the ***gap*** will be filled, first by pioneer and secondary species and eventually by primary species, whereby the gap is considered to be fully repaired. Cf. ***primary succession*** under ***plant community succession.***
gap phase regeneration	The regeneration that occurs as a result of gap phase dynamics. See: ***gap phase dynamics***.
gap regeneration survey	A survey of a rainforest gap that looks for evidence of ***gap phase dynamics***. For examples of these surveys see Chapter 9: Gap regeneration surveys.
genetic transactions	Dispersal events that lead to the transferral of genetic material (pollen and/or seed) between plants, plant populations and sites through some dispersal agent. See also: ***potential vector transactions*** and ***realised vector transactions***.
generalist forest bird	A species that was recorded during a bird census survey period in both ***rainforest*** and eucalypt forest. Cf. ***rainforest-dependent birds***.
genotype	The genetic makeup of an organism, which may or may not be expressed in their ***phenotype***.
geographic edge of range	The limit of distribution of a species (as far north, south, east or west that it occurs). This is thought to be important as the ***taxon's*** presence at the edge of its geographic range is thought to represent its edge of tolerance for the features of that site. Consequently, it is also thought to be the place where speciation occurs, because a species pushed to its limits may retreat, die or adapt producing gaps in its distribution, which leads to the isolation of such populations. The subsequent adaptation and genetic change, if sufficiently different from that of the parent, represents a new taxon.
geomorphology	The structure, origin and development of topographical features of the Earth's crust.
germinants	The first stage of germination (cotyledons (seed leaves) and first mature leaves) appearing above the soil surface. Identification of plants at this early stage can give you an indication of the scale, strength and distribution of native or weed regeneration. Identification of these species at such an early stage is advantageous because it gives you more time to organise your resources to either conserve the native species regeneration or dispatch the weeds. Either way, it is likely that you will use less herbicide and do less damage because you have caught the weeds before they have seeded.
g	Abbreviation: grams.
Gondwanan	Species that arose on the southern super-continent of Gondwana, such as Eastern Leatherwood *Eucryphia moorei* below: a dominant canopy species in ***Cool Temperate Rainforest*** in southern New South Wales and ***Overlap Warm Temperate Rainforest*** in Victoria. At the time, Gondwana consisted of two or more of the following modern-day landmasses: Antarctica, South America, Africa, India, Madagascar and Australia.

Gondwanan species (example)	
Gordian Knot	A legendary knot that could not be unravelled: a seemingly unsolvable problem. Used as a metaphor for an intractable problem that is solved by bold action.
graminoids	A subset of the *life-form* category *herbs.* Graminoids include: grasses and grass-like plants such as flax-lilies, grass-flags, mat-rushes, rushes and sedges. Compare with: *forbs.*
granivore	An animal that eats seed. Cf. *carnivore*, *frugivore*, *herbivore*, *insectivore* and *nectivore*.
grazing	The consumption of grasses and herbs by grazing animals. Cf. *browsing*.

greenfields site	A reference to localities where natural (and usually unassisted) regeneration of ***rainforest*** species (often including initial stages dominated by weed species such as Lantana **Lantana camara*, Privets **Ligustrum* spp. and, further north, Camphor Laurel **Cinnamomum camphora*) on abandoned (hence: greenfield) sites. A good example is the site on the foreshore north of Barragoot Swamp south of Bermagui.
greenfields regeneration	A process (see Chapter S4: Tables S13 and S14) whereby the removal of grazing allows regeneration of native species and weed species (see ***paddock rainforest starters***) that can lead to the development of a mature and functional rainforest. We have documented these species in Appendix S18 worksheet: Paddock rainforest starters; to date there are 111 ***taxa*** recorded. The other major constraint on ***rainforest*** development and persistence is fire and this is greatly reduced in landscapes fragmented by agriculture or suburbia. This change in fire frequency and severity on potential greenfield regeneration sites can alter the extent of regenerating rainforest from the historic state for any one particular site. As a consequence, greenfields regeneration sites may arise at specific sites where no rainforest existed historically or they may be more extensive than the previous historic extent of rainforest on that site. For each site where greenfields regeneration is taking place, the 'natural' extent can be judged by where there is topographic, vegetation or cultural burning protection for such stands. Although there is inherently nothing 'wrong' with more extensive areas of rainforest developing on greenfields sites, the pragmatic and logistical reality is, that it is up to the land manager to decide what is done to define the regenerating rainforest's emerging extent (i.e. the resources available to limit its extent by using fire). Such sites have inherent conservation value and may also have ***conservation significance*** (in that they are rainforest, provide ***habitat*** to rainforest species and may have rare or threatened species present) and cultural value as well. See also: ***oldfield scrubs***.
GRf	Abbreviation: ***Gallery Rainforest***. See also: Gallery Rainforest in Definitions and Synonymy.
guilds	Usually with reference to animals: species grouped together on the basis of behaviour (fruit eaters, insect eaters, etc.), and often used as description for a group of different animal species that feed together as a guild.
Gunai	The collective name of the Aboriginal people of Gippsland in Victoria. See also: ***Kurnai***.
habitat	The dwelling place of organisms or a community that provides the requisite conditions for its life processes (SER 2004). See also: ***niche***.
habitat fragmentation	The loss of habitat continuity and ***contiguity*** that leads to loss of structure, ecological function, ***ecological health***, ***ecosystem resilience***, species and ***edge effects*** including ***weed*** and pest invasions. See: ***edge effects***.
halophytes	Halo = salt; phytos = plant: literally salt-loving plants. These species often occur together as ***halophytic vegetation*** in wetlands, which because of their open water and the high salt content of their foliage can act as significant fire retardants or barriers that protect rainforest. See: ***ecosystem fire protection***, ***fire shadow***.
halophytic vegetation	Vegetation composed of ***halophytes***, which due to the features described under halophytes: provide fire protection to ***Littoral Rainforests***.
Hamilton Treeplanters	Treeplanters designed in the town of Hamilton in Victoria. They are pogo-stick like (and employed using the same action). The hole is dug by a fixed ***auger*** that extracts a soil clod that is the exact shape of a ***forestry tube***. This ensures excellent root ball-soil contact when planting and removes the need for stomping when planting. See also: ***augers***, ***mechanical augers, Potaputkis*** and Chapter S6: Table S22 for a comparison of their relative merits.
hard engineering	In the ***rainforest restoration*** context, the use of inert physical structures to ameliorate erosion or a risk to an asset (natural or built): e.g. rocking of river banks or drains in drainage reserves. It can also include re-introduction of large woody debris back into previously de-snagged streams. Hard engineering may also be used in combination with ***soft-engineering***.
haustorial attachment	A parasitic plant structure (which often resembles a 'sucker') that taps into the host's vascular tissue to enable the transport of the host's sap into the parasitic plant's own vascular system.

hawkers	Birds that catch insects on the wing.
heading fire	See *Fire types*.
heat well	A site that collects solar radiation during the day and stores it in the ground or vegetation to be released overnight thereby reducing frost impacts (see Figure under *nursery crop*).
hemiparasite	A parasite that is only partially dependent on its host; e.g. mistletoes and Cherry Ballart *Exocarpos cupressiformis*, which derive moisture and minerals from the host but manufacture their own sugars through *photosynthesis*.
herbivore	An animal that eats plant material (generally foliage). Cf. *carnivore*, *frugivore*, *granivore*, *insectivore* and *nectivore*.
herbs	Plants that include *forbs*, grasses and *graminoids*.
high fidelity rainforest species	In the context of rainforest species composition, species that are *rainforest-dependent species* that usually are only rarely found in adjacent vegetation. These species are well suited to rainforests, but are not so well suited to other environments. See Appendix S6 worksheet: All species + FCs for rainforest fidelity ratings. See also: *moderate fidelity rainforest species*, *obligate rainforest species* and *satellite species*.
hikos	A small cell plant propagation container (smaller than *forestry tubes*) that are generally planted with a *Potaputkis* or a modified *Hamilton Treeplanter.* Very useful for establishing various *palatable species* in a high *browsing* environment where site preparation involves simply killing the annual grasses sward, but leaving it standing. The small size of the tube stock allows it to establish un-noticed and untroubled in the *browsing refuge* of the dead grass, putting out roots before it is discovered by the *browser*/*grazer*. By the time the animal gives it a tug, the plant is rooted to the spot, and eventually the population of browsers/grazers will move onto something else, allowing your established plant to flourish. In contrast, planting taller tube stock (such as in forestry tubes) means that the browsing refuge does not hide it, it is discovered almost as quickly as you plant them and they are pulled out before establishment sees them rooted to the spot. The other situation in which Hikos are a useful *restoration* planting container is where there are huge numbers of plants to be planted out and there is excellent weed control (such as on a *Maximum Diversity Restoration* site) where large numbers of *forbs* or *graminoids* are required. Hikos should never be planted where *transforming weeds* are widespread or where follow-up maintenance cycles are unfunded, uncertain or unlikely to occur: you are just throwing your money away. See also: *forestry tube*, *super tube* and *rocket pot*.
hilltopping	A behaviour exhibited by many species of butterflies (for example Common Pencil Blue) where the males of these species move from their usual habitat (e.g. rainforest gullies) to congregate over the top of nearby hills or ridges to establish mating territories. Once the territories are established, females join the hilltop aggregations where they mate; after which they return to the rainforest gully to deposit their eggs on their food plants. For further examples of hilltopping butterfly species, see Appendix S9 Butterflies of rainforest in south-eastern Australia.
hinterland	The district lying behind the coast.
historic trajectory	The path of recovery of a rehabilitation site towards its historic state.
Holocene	The geological epoch formerly 11,500 years *BP* to present, after which follows the newly described *Anthropocene* geological Epoch (Flannery 2005).
homeostasis *homeostatic*	The process whereby various feedback loops interact to maintain some steady state; e.g. pioneer species closing *edges* and *gaps* to maintain humidity and light regimes within the *core* (or interior) of the *rainforest* stand.

honeydewers	Plants that produce honeydew or their by-products (e.g. lerp), either from sap wounds or from sap-sucking insects such as psyllids or scale insects. These important sources of carbohydrates are used by a wide range of sap-sucking (and licking) animals including: insects, birds and mammals. Appendix S6 worksheet: Honeydewers lists those that are known from the rainforests of south-eastern Australia. Some species such as Yellow-bellied Gliders *Petaurus australis* are highly specialised sap-suckers where honeydew comprises between 30 and 80% of their dietary requirements (Van Dyck and Strahan 2008). They access this sap flow from special grooves that they cut in the bark of suitable trees that include Spotted Gum *Corymbia maculata*, Mountain Grey Gum *Eucalyptus cypellocarpa*, Messmate *E. obliqua*, Forest Red Gum *E. tereticornis* and Manna Gum *E. viminalis.* The production of honeydew can be important in rainforest ecology, with many rainforest seed-dispersers (particularly honeyeaters) being attracted to such honeydewers. Their visitations to sites that are producing honeydew often correspond to previous meals of rainforest fruit, which they disperse to the site where they consume honeydew and void the seeds from these previous meals. Honeydew is also important for a range of other rainforest animals including butterflies such as Common Brown Butterflies *Heteronympha merope,* which feeds on the sap exudate of Tree Everlasting *Ozothamnus ferrugineus* (Additional Reading: Bird breeding censuses) and the classic example of this phenomena: Tailed Emperor *Polyura sempronius* (Braby 2004).
horning	Action caused by cattle placing their head and horns into bushes and thrashing about until the bush is destroyed.
hot feet species	***Rainforest*** species (usually, but not always) pioneers and some secondary plants species that are able to survive (and often thrive) in situations of bare hot soil. Such ***habitats*** include bare ground generated following fire or flood, which are exposed to ***full sun***. *Cf.* ***cold feet species*** that die in such situations (Appendix S6 worksheet: Hot feet-cold feet species).
humus	This definition (unless otherwise referenced) is sourced from Wikipedia <www.wikipedia.org/wiki/Humus>. The creation of humus is a three-stage process: organic matter created in the ***ecosystem*** from a ***mulch*** of plants, fungi, animals, and microbes that forms in and on the soil. This coarse form of carbon is then broken down by ***fungi*** and microbes to produce ***compost***, which is further decomposed into ***labile carbon*** (unstable carbon, soon lost to the atmosphere as CO_2 or CH_4) and the very stable humus, which may last for 1000 years or more. The end result of decomposition is a gel-like substance that is stable and not further broken down. It gives the soil a black or dark brown colour (Figures S205, S207 and S209). During the process of creating humus, soil microbes that use mulch secrete sticky gums that contribute to the crumb structure of soil by holding the particles together, and this allows greater aeration of the soil. The importance of humus is manifold: • It is a colloidal substance that increases the soils nutrient status because it can store nutrients that are then available to organisms in the soil; • This process of chelation (chemical bonding to the humus) reduces the leaching of nutrients from the soil profile; • It can hold 80–90% of its own weight in moisture and thereby increases the soil's ability to withstand drought conditions; • The biochemical nature of humus allows it to buffer the soil against both acid and alkaline soil conditions.
hybrid plantings	A planting composed of one or more species or ***ecotypes*** from two different EVCs or plant populations from the one EVC. The objective of this technique is to allow environmental factors (or future states; e.g. with ***climate change***) that may be either variable or difficult to define in the field (but are likely to influence the site), to decide the fate and composition of your plantings. For example, ***riverine*** hybrid zones include species from the freshwater reach and the nearby ***estuarine*** reach (characterised by variable salinity) to accommodate the mobility of salinity zones that wax and wane along rivers and their estuaries (see Chapter 3I: *Dealing with altered restoration trajectories when actions or boundaries are not easily identified or defined).* See also: ***letting Nature decide***.

hypothesis *hypothesised*	A hypothesis (from the Greek) consists either of a suggested explanation for a phenomenon or of a reasoned proposal suggesting a possible correlation between multiple phenomena. The term derives from the Greek, *hypotithenai* meaning 'to put under' or 'to suppose.' The scientific method requires that one can test a **scientific hypothesis**. Scientists generally base such hypotheses on previous observations or on extensions of scientific theories. < www.en.wikipedia.org/wiki/Hypothesis> In the context of ***rainforest restoration*** then, a hypothesis is a scenario constructed and used to explain an observation, which can be tested with manipulation of the ***systems*** that may be contributing to the observed phenomenon. This is done by using the experimental or comparative methods

	(Chapter S6: Monitoring methods), which can ultimately lead to the development of a ***theory***. To maintain the rigour of the process (and consequently the validity of your conclusions), you must always be looking for things that will disprove your hypothesis: such a process keeps you honest (and hopefully avoids the temptation of being selective or only acknowledging those observations that support your contentions). Theories may be partially proven (and remain as a theory) or be completely proven beyond doubt and become a law. Laws are usually reserved for the 'hard sciences' (e.g. physics), where every variable except one can be controlled and precise mathematical equations can be developed that completely explain the observations (no matter what variable of the system is manipulated, or to what degree). This is rarely possible in ***ecology*** or ***restoration*** because these systems are complex, they occur outside the laboratory and have compounding factors that cannot be controlled and the factors that influence the observation may be subtle or multiple in natures. Hence the field of biology abounds with theories (theory of island biogeography, theory of natural selection, theory of evolution and so on) but has few laws. Theories therefore are a work in progress: they allow us to go forward (in the absence of complete knowledge, or absolute truths) and so continue to learn and adapt our restoration methods. See also: ***adaptive management***, ***monitoring, Precautionary Principle*** and ***theory***.
igneous rocks	***Plutonic*** rocks derived from the molten state that solidify either as the result of ***extrusion*** by volcanic action (lavas and ash) or by ***intrusion*** into the Earth's crust (usually in south-eastern Australia, these are acidic rocks called granitoids and basic rocks called gabbros).
ignition times	Ignition times are a way of measuring how long it takes for the foliage of species to ignite and under what conditions. Eucalypts have highly volatile oils and combustible foliage that are designed to burn. Many ***rainforest primary species*** and ***secondary species*** do not share these features and it is quite difficult to get them to ignite (as is illustrated by the persistence of scorched canopies on the Myrtle Beech *Nothofagus cunninghamii)* in the photograph to the right despite the passage of a crowning wildfire at this locality. A very crude experiment to determine ignition times was conducted on a range of rainforest species from south-eastern Australia. The results are reported in Additional Reading: Ignition times. The importance of ignition times is that they provide part of the explanation as to how rainforests can persist in an otherwise highly flammable ***sclerophyll*** forest setting and yet be able to ***self-extinguish*** wildfires. The lower flammability of many of its primary and secondary species, its occupation of fire refuges, dense canopy, fuel moisture differentials and so all contribute to their lower flammability. Note: as far as is known there was no human fire suppression at this site. See also: *Forest Fire Danger Rating* and ***self-extinguishing***.  Yarra Ranges National Park, Reefton Spur Victoria. August 2009, 6 months after the Black Saturday wildfire of 7 February. Despite this *Cool Temperate Mixed Forest* experiencing a crowing wildfire, the foliage of Myrtle Beech *Nothofagus cunninghamii*, was on scorched and did not ignite. The Forest Fire Danger Rating at the time of this blaze was ~170.

imbibe	The process whereby a seed absorbs water and swells prior to germination. Imbibing water is a necessary precursor to germination.

incident light niches	Incident light niches describe the amount, duration and timing of light that reaches the ground. It is also a *surrogate* for measuring the likely impacts of *edge effects* that can include exposure to the drying effects of wind and sun and the level of frost exposure that a particular plant will get over the colder months. Experience has shown that establishment success is greatly enhanced (and therefore cheaper) if incident light niche recommendations for particular species are understood and followed. See *shade* and *sun* definitions elsewhere in the Glossary and *edge effects*.
incremental development	In the context of *rainforest* management: the process whereby small incremental changes lead to big (usually) negative consequences for vegetation. Each incremental step is in and of itself only small, and of no apparent or real *threat*, but when taken together and viewed from the perspective of many years, the results are usually devastating and often fatal. *Littoral Rainforest* is a classic case in point, and the following local example (repeated many times over in many other localities in the south-east) illustrates the process. Although it is an allegory, it still holds true. *Deep shade* with a clean and accessible *understorey* next to a pristine beach has proven to be a fatal combination for Littoral Rainforest. It begins with a coastal access track: people come for picnics at the beach in their heavy Victorian clobber and languish beneath its beneficent shade and redolent canopy. In time, they set up permanent picnic areas in the rejuvenating shade: clearing the *understorey* of those troublesome *vines*. In the years to come, people return with their backpacks or wagons to camp. The draught animals have free reign and graze the rainforest, just as well since each year during the off-season, the weeds people have brought in (to make the place more homely) have spread. The draught animals bring more weeds, but they also graze these and for a while things seem to remain about in balance. Then more people arrive and, of course, they have to have more space (now there is even less rainforest). So many people are turning up, an enterprising local farmer by the name of Hobbs sets up a seasonal local kitchen on the corner to cater for the hordes; the rainforest is forced retreat even further. Soon all the rainforest that once covered the sand flat is no more, and all that remains are a few scattered *canopy trees* that attest to the original reason for the camp. In time, motorised vehicles are invented, the roads improve and people arrive with tents and small trailers. But modern life goes on and these tents seem inadequate and these morph into the latest caravans and the obligatory boats. Vehicles now need more room to turn and little of what people originally came to see remains). The shade has gone (and, with it, the rainforest), the people swelter and the holiday numbers are now so great that there is a need for a permanent kiosk. In time, there is generational change and Gran and Pop (who themselves visited as children), have brought a small lot and have set up a holiday home, planting those things that grow from a slip, are incredibly drought hardy and will proliferate while everyone is back at work. These jump the fence and begin to infest what is left of the rainforest (now only holding onto the steeper slopes). By the time Gran and Pop retire to the seaside, a town has sprung up where once there was a pristine beach and a glorious backdrop of Littoral Rainforest. No-one quite remembers what the original attraction was which brought the first holiday makers to Hobbs Corner: but that is OK because the onset of *landscape amnesia* is now complete (see below).

incremental development (example)	 
	Hobbs Corner Tathra, New South Wales in the previous ***habitat*** of ***Littoral Rainforest***: now a permanent camping ground in the bustling coastal town of Tathra. Pictures kindly supplied by Bruce and Chris ('Doris) Hamilton following the author's delivery of the Littoral Rainforest allegory and epitaph (in the absence of precise knowledge of who Hobbs was and why it was his corner) during a ***rainforest restoration*** workshop in 2008. The allegory closely matched the history of the site (to the amazement of the audience): an example of intuitive ecology at work.
indehiscent	With reference to a fruit: one that does not open at maturity to expose the seed (CRCfAW 2007a). Cf. ***dehiscent.***
Index of Stream Condition (ISC)	A standardised and weighted monitoring process that assesses riparian condition across Victoria. The sub-indices that are useful for monitoring changes to the quality and extent of rainforest riparian rehabilitation include: Longitudinal Continuity, Weeds, Recruitment (of native species), Large Wood, Large Trees, Organic Litter, Understorey Recruitment, etc. A subset of the ISC measures have been incorporated into a new riparian rehabilitation process that will form the state wide standard called Riparian Response Curve Forecasting (Peel 2009a), which incorporates ***landscape analysis***, ***landscape context***, ***site assessment***, ***restoration*** methods, ***logic trains***, Riparian Response Curve forecasts and ***adaptive management*** into works programs and project calendars. This more site-specific, but widely applicable, approach will replace the current revegetation paradigm for ***riparian rehabilitation*** that has characterised riparian vegetation works over the last 20 years.
Indian Ocean Dipole	A meteorological phenomenon that links rainfall and drought in south-eastern Australia with the sea surface temperatures of the western Indian Ocean off Indonesia through north-west cloud bands, jet streams and the convective activity along the equator as a part of the *Walker Circulation*. A detailed description of this phenomenon is to be found in Additional Reading at: www.egrainforest.org.au. See also: *La Niña*, *El Niño* and *Walker Circulation*.
indigenous	A species that is native, occurring naturally in a particular locality or ***habitat***: one that is not introduced from another region, state or country.
insectivore	An animal that eats insects. Cf. ***carnivore***, ***frugivore***, ***granivore***, ***herbivore*** and ***nectivore***.
in situ	*Latin* for 'on site': for example *in situ* maintenance or management of a threatened species in its ***habitat*** by addressing the ***threatening processes*** which undermine its ability to survive and evolve on that site or in the landscape. Cf. ***ex situ***.
insolation	The amount of sunlight that a given surface area receives for a given time. This measure is correlated with the distribution of Cool Temperate Rainforest, probably because it helps to reduce temperatures and conserve moisture through reduced evaporation.

integrated weed management	This requires an understanding of both the *ecology* of individual weeds and weed communities and how these interact with the native vegetation that you are seeking to restore. Once this is understood, integrated weed management can be practiced to release the *ecological brake* of weed invasion on your site with the minimum impact on non-target species, and in the most efficient, timely and environmentally sensitive manner. To do this you, must find the weed's (or weeds') Achilles Heel: at what stage is the problem plant at its most vulnerable to control or eradication? It also involves the dispassionate assessment of every weed and its attributes both at the time you see it or suspect its presence on your site in the *soil seed bank*. Your assessment should include: its life-cycle stage (germinating, maturing or dying), the stage of work on your *restoration* site, its ability to spread and its usefulness to the restoration process. Targeted use of the weeds does not include planting weeds but can include using them to your advantage before it is controlled: • As shelter in highly exposed situations (e. g. weedy grasses or annuals to provide shelter from salty winds in *Littoral Rainforests*); • As a guard against browsing (e.g. Lantana **L. camara*, Blackberry **Rubus anglocandicans* etc.) or to control human access (e.g. to prevent worm diggers getting into your *rainforest* soil and turning the whole place up side down); • The provision of shade in *successional planting*; • As food (e.g. Deadly Nightshade **Solanum nigrum* spp. agg., Madeira Winter-cherry **Syzygium pseudocapsicum,* etc.) until your restoration can supply food to rainforest animals (see Appendix S3 worksheet: Method for fruit substitution); and • As refuges (e.g. leaving African Boxthorn **Lycium ferocissimum* following herbicide control as a shelter from *predators* for roosting or breeding by species such as Red-browed Firetails *Neochmia temporalis*) until your plantings can provide equivalent *niches* (e. g. Sweet Bursaria *B. spinosa*). Integrated weed management may require control of some native species at certain stages (e.g. Seaberry Saltbush *Rhagodia candolleana*, following weed control in Littoral Rainforest and Black Wattle *Acacia mearnsii* in the early stages of restoration in *Warm Temperate Rainforest*. Integrated weed control uses a number of techniques with a range of impacts and benefits. Sadly, in the absence of limitless time and money, it requires the use of herbicides. The tool with the greatest finesse (but a very limited spectrum) is *biological control*, followed by *Bradley Weeding,* which has wide spectrum of application. Many would say the most ham-fisted are chemicals, but with good *adaptive management*, the appropriate uses of any of these tools can illicit great subtlety and yield fantastic results. Some of the things that will benefit may surprise you (see Chapter S6: Figures: S249 and S250). Remember that no weed control is without impact. Integrated weed control has less of an impact because careful choices and timing of interventions are made. The use of restoration following weed control is one of the ways of redressing the imbalance caused by *transforming weed* invasions and is a key component of integrated weed management. In Victoria, integrated weed management is required, and must be demonstrated by operators if they are to be able to legally apply off-label use of herbicides. See also: *close weed control, landscape-scale weed control* and *weed succession*.
internal edge	An edge that develops within a rainforest stand as the result of some internal disruption (as around the edge of a *tunnel gap*) or a *shade weed* infestation by a *transforming weed*. See: the *domino effect*.
intrusive	In geology, a molten rock that is intruded into the Earth's crust as a liquid to form geologies such as: gabbro, granite or granodiorite. Cf. *extrusive*.
intuitive ecology	As practised in *rainforest restoration*, intuitive ecology is based on multiple and systematic observations of *ecological processes* from which tentative conclusions regarding cause and effect are drawn. These logically inferred relationships are then applied to the restoration problem or task at hand. Intuitive ecology often leads to a 'gut feel' for a cause and effect. The *correlation versus cause and effect* is often only fully determined by detailed and carefully conceived experimentation (a luxury not usually available to most on ground *restoration practitioners*). In the absence of full knowledge, intuitive ecology is applied to the restoration site anyway before the absolute truth of the relationship is known. From this perspective, it is the practical application of the *Precautionary Principle*, where action is taken before all of the science is understood in the full knowledge that some initial harm may be done, but that with the knowledge gained through *monitoring*, greater benefits will accrue. The resulting trials may work irrespective of whether the relationship is a correlation or cause and effect. In the first instance, it may be successful because of some other factor, coincidence, set of circumstances, or that the chosen method will work irrespective of the suspected relationship. Alternatively, if the observation actually represents cause and effect then a successful resolution to the restoration problem is more likely. Over time, success and deeper understandings of cause and effect lead to a useful body of knowledge that can be used to achieve successful restoration,

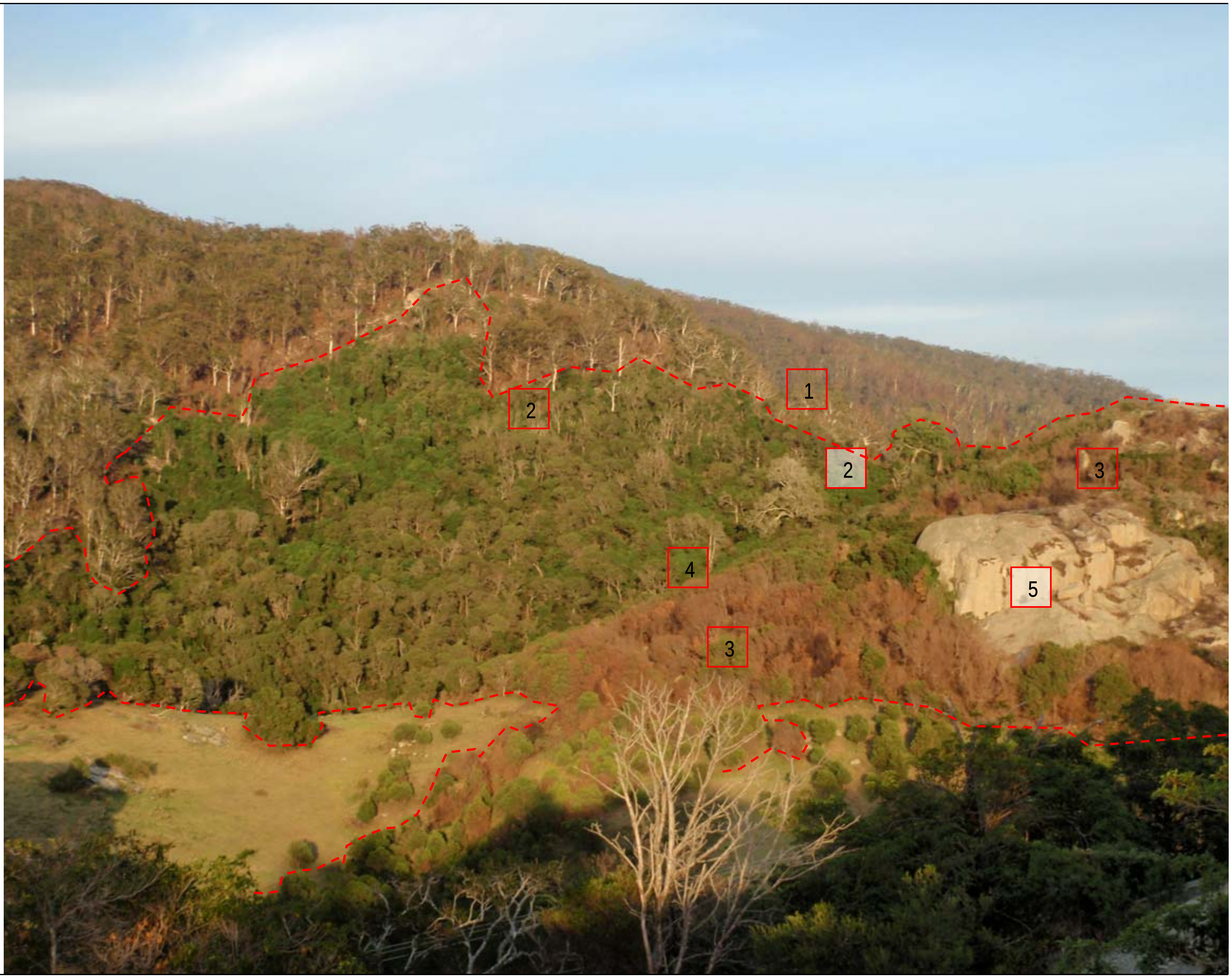
	which started out as the application of intuitive ecology. For a practical example of what we mean, see Preamble: How to make intuitive ecology work for you and its Figures P10–12. See also: ***evaluation***, ***monitoring***, ***Precautionary Principle*** and ***trials***.
invertebrates	Animals without backbones. Terrestrial (land invertebrates) include animals as diverse as insects, crayfish, spiders, centipedes and mites. These are important food sources and often play important roles in nutrient recycling, pollination and pest control. Though generally understudied or even classified, some are known to be rare or threatened (Appendix S1 worksheet: Fauna).
ISC	Abbreviation: Index of Stream Condition and Invasive Species Council.
Island Biogeography Theory (general)	This is a theory that attempts to explain the species richness of natural communities. The ***theory*** was initially developed to explain species richness on actual islands. It has since been extended to mountains surrounded by deserts, lakes surrounded by dry land and forest fragments surrounded by human-altered landscapes. For biogeography purposes, any area of suitable habitat surrounded by unsuitable habitat is considered to be an island. Now the term island biogeography is used in reference to any ecosystem surrounded by unlike ecosystems <http://en.wikipedia.org/wiki/island_biogeography>. Non-natural ***systems***, ***rainforest*** remnants that are reconstructed (by definition, they are essentially non-natural at the beginning of their existence) and those that occur in urban areas, are still likely to operate in ways that are still referrable to island biogeography theory. The theory proposes that the number of species present on an island is a function of immigration, emigration and extinction. Thus, the rates of extinction and colonisation of 'islands of ***habitat***' (whether physical islands or isolated ***vegetation types*** in a sea of other different vegetation) is related to the size and isolation of the island (Macarthur and Wilson 1967). Island or stand size is important: larger islands reduce the probability of extinction because the required habitat is more diverse and recurs many times, thereby reducing the likelihood that a chance extinction event will wipe out all examples of the species in that habitat (the: 'Don't put all your eggs in one basket' maxim). Precepts of Island Biogeography Theory that are relevant to rainforest ***ecology*** and ***rainforest restoration*** (assuming individual stands act as islands and closely spaced stands act as island archipelagos with some level of interaction) include: larger islands usually have more species ***diversity***; closer islands share more species than do those further apart; chance loss of species is more likely on smaller islands than bigger islands; and ***recruitment*** to more isolated stands is slower because dispersal events are less frequent and consist of fewer individuals. Remember, though, when conceptualising this important theory and how it might relate to your rainforest: what is an island for one species (i.e. those that have limited dispersal ability across the intervening 'hostile sea' of unsuitable habitat), might not act as a dispersal or ***migration barrier*** for another species. Bold or highly mobile species of animals are more likely to cross unsuitable (non-rainforest) habitat barriers; plants with heavy seed are unlikely to reach other rainforest islands unless their dispersal agent travels fast, is bold and prepared to cross the intervening hostile non-rainforest 'sea' between the rainforest 'island' stands. See also: ***random dispersal*** and ***directional dispersal***.

Island Biogeography Theory (influencing factors that may relate to rainforest restoration)	It is worth considering the influencing factors listed in Wikipedia that are related to this theory and how these may relate to your *rainforest restoration* (in parentheses): • Degree of isolation: distance to nearest neighbour and mainland i.e. source of species (several local studies reported in the Manual and its appendices suggest this is the case for rainforests in this region, including dispersal distances for bird-dispersed fruit (Chapter 3 Opener and Chapter S5 Opener) and colonisation by rainforest birds (Chapter 9: When does distance and isolation matter; Appendix 9.2). This is why proximity and habitat corridors are so important); • Length of isolation (if a stand has existed in an isolated state for a long period, it is likely to have lost more species than one isolated for only a short period or one that remains connected to other stands with those species still present in them (so reconnection is vital); • Size of the island or island archipelago of rainforest stands (the bigger the stand the more species, including rare or threatened species: certainly the case on the lower Mitchell, Lakes Entrance, Snowy River and Howe Range compared with more isolated stands in the Strzeleckis and Mt. Moornappa. So in *restoration*: think big and/or many); • *Climate* (like reinforces like because of differences in species composition based on climatic criteria: that is why there is a compositional and climatic distributional differentiation between: *Cool Temperate Rainforest*, *Warm Temperate Rainforest* and *Subtropical Rainforests*); • Location relative to dispersal pathways (being on a dispersal route will ensure that such rainforest stands will receive more 'parcels of genetic material from other island relatives' than those that are not on the pathway or are at the end of the route: this partly explains why stands at the edge of their biogeographic range are more species poor); • Initial animal and plant composition, if previously attached to a larger stand (these are the building blocks of the ecosystem: the more there are, the more diverse and stable the ecosystem will be in the face of isolation and disruption); • The species composition of the earliest arrivals. The first arrivals will dominate the site and set in train its structure, function and composition: later arrivals will have much more limited colonisation and establishment opportunities because the first arrivals will have dominated most *niches*. (This is why it is so important to carefully consider what you plant and to ensure that it is as diverse as possible: which *lets Nature decide*); and • Serendipity: chance arrivals can significantly alter ecosystems. Take the case of the arrival of Sambar in a stand: its composition and structure declines as a function of the species' activities, whereas in stands that are isolated from this large introduced *herbivore* (all other factors being equal) will maintain its original structure and quota of species. Human activity (as ecosystem engineers *par excellence* we have the power (which we often wield) to add species remove species or take away or modify habitat). Accidental or intentional introduction of pest species (both plants and animals) can have a disproportionately large impact on rainforest islands because the species of these isolated communities have limited dispersal capabilities and rapidly invading species can wipe them out very quickly (within decades) before they can recolonise. For this reason, agents of change that are pervasive across the landscape such as deer, *climate change* and *mega-fires* are particularly dangerous to rainforests and their constituent *taxa*.
IUCN	Abbreviation: International Union for the Conservation of Nature (see Appendix S1 worksheet: IUCN flora determination method for the criteria for determining conservation status using this method; and Appendix S1 worksheet: Flora for a summary of the results for a partial examination of the Victorian Rainforest flora by the author and David Cameron of *DSE* and other workers).
JAMBA	Acronym: Japanese-Australia Migratory Bird Agreement, which provides legal protection to both these migratory species and their habitat in each country of the parties to the agreement. See also: *CAMBA* and *ROKAMBA*.
jetting	A method for applying herbicide that involves using high pressure to penetrate the dense foliage of weeds that must have both surfaces of their leaves coated with herbicide for maximum exposure to the chemical. If you need to learn this technique, just imagine that you are trying to make absolutely sure that you have extinguished a ground fire with your hose. This technique is especially important for weeds such as English Ivy **Hedera helix* and Blue Periwinkle **Vinca major* that have waxy cuticles and require *penetrants* or *surfactants* for effective control. This technique should only be used in specific situations where there is little chance of off-target impacts (i.e. no natives beneath the weed's canopy). Contrast with *over-spraying* and *splatter-gun spraying* that both conserve any native species present.

jungle	A term often used for (or in association with) rainforest: e.g. a 'jungle flat'; the term is not often used today, but is preserved in place names indicating ***rainforest*** such as Lochend Jungle on the lower Snowy River in Victoria. The term is a little archaic being more common in the past description of rainforest (e.g. Howitt's 1854 description of the Mitchell at Eastwood near Bairnsdale and many other 19th century accounts of this vegetation). See also: Additional Reading: Comprehensive account of historic information for rainforest on the lower Snowy, ***brush*** and ***scrub***.
keys	A logically ordered structured hierarchy for organising complex information, using a series of questions or instructions that lead the reader to a conclusion. Used extensively in the Manual for a range of situations, including: ***rainforest ecological vegetation class keys*** and ***floristic community keys***. See: Definitions and Synonymy: Rainforest keys to south-eastern Australia.
keystone species	Those species that, if removed, produce important changes to an ecosystem's structure or function (Lindenmayer and Burgman 2005). Keystone species or groups that are associated with ***rainforest*** in south-eastern Australia include: Coast Banksia, figs, mistletoes, Sweet Pittosporum, wattles, flying foxes, termites and fungi (Additional Reading: Keystone rainforest species of south-eastern Australia).
key threatening process (KTP): NSW definition	A threatening process specified under Schedule 3 of the *Threatened Species Conservation Act (1995)* that adversely affects threatened species, populations or ecological communities, or could cause those that are not threatened to become so (DECC 2007). Examples include: weeds or deer or land clearing. Broadly the equivalent of Victoria's *Flora and Fauna Guarantee Act (1988)* ***Potentially Threatening Processes*** (***PTP***s).
key threatening process (KTP): Commonwealth definition	'A key threatening process threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. Invasive species listed as key threatening processes are: predation by the European Red Fox, feral rabbits and unmanaged goats. A process can be listed under the EPBC Act if it could: • cause a native species or ecological community to become eligible for inclusion in a threatened list (other than a conservation dependent category); or • cause an already listed threatened species or threatened ecological community to become more endangered; or • adversely affect two or more listed threatened species or threatened ecological communities. The assessment of a threatening process as a ***key threatening process*** is the first step to addressing the impact of a particular threat under Commonwealth law.' <http://www.environment.gov.au/biodiversity/threatened/ktp.html>.
Kn	Abbreviation: knots: the nautical wind speed measurement.
knockdown weed control	Knockdown (primary) weed control is one half of the strategic ***landscape-scale weed control*** approach (***bush regeneration*** is the other). It is used first where weed infestations are either large and/or dense. In contrast, the bush regeneration approach should be employed either when there are small, but high cover, weed infestations in or near good quality bush (the control program should ensure ***natural regeneration*** repairs the damage) or where there are lower levels of infestations or small stature weeds over much larger areas (the earlier phases of weed invasion). Bush regeneration is particularly important as a site preparation technique prior to knockdown weed control programs such as before aerial spraying with Bitou, where there is a risk of ***weed succession*** from other ***transforming weeds***. This is often the case near urban areas (whose gardens and people supply these extra weeds). Each site should be assessed on its merits and the appropriate technique combinations applied in the appropriate order. Another good example of failure to heed this advice is with control of Willows (Chapter S6: Figure S256). Bush regeneration is usually essential following knockdown weeding in order to round up any seedling or other regeneration of the target weeds initially knocked down by the previous treatment, as well as to pre-empt weed succession from other transforming weeds that have been released by the knockdown weed control. This approach ensures that sites treated by knockdown weed control have the maximum amount of natural regeneration establish and thereby achieve full recovery. The author acknowledges Graeme Guy (Port Macquarie Hastings Council) for making this important operational task abundantly clear through inspection of his restored sites. See also: ***close weed control*** and ***landscape-scale weed control***.
Koori	The name for (and used by) Aboriginal people of south-eastern Australia. See also ***Gunai/Kurnai***.
krasnozems	A red deep friable loam with a good structure, acidic pH, and with little difference in texture throughout the profile; often derived from fertile geologies during extended periods of humid conditions. Russian for red soil, hence the synonym: red earths.

Kurnai	The collective name of the Aboriginal people of Gippsland in Victoria. See also: *Gunai*.
labile carbon	In the third stage of the soil carbon formation process, being the volatile form carbon that is quickly lost from the soil to the atmosphere. See also: *compost*, *humus* and *mulch* (the whole process being defined under humus).
lacustrine	Derived from processes associated with lakes. In the context of this work: estuaries and usually referring to *berms* and *cheniers* (cf. *aeolian*).
landform	Components of landscapes defined by their form; for example, *marginal bluff*, gully, *berm* and *chenier*. Many landforms are useful in describing species and plant community habitat and distribution; however, the relationship is variable with some being pivotal, others defining partial extent, while others are not at all relevant.

landscape analysis	The process in ***restoration ecology*** that assesses the potential of a site to recover based on an analysis of the sites' ***landscape context***. These analyses are conducted at many levels (Appendix 7.1: Site assessment and project management hierarchy and checklist): • **Globally**: consider the impacts of ***climate change*** (reduced rainfall, increased risk of fire, inundation, etc.); • **Regionally**: consider ***habitat*** fragmentation, remnant isolation (loss of ***contiguity*** and ***connectivity***), decline in the health of nearest remnant neighbours, alterations to flow regimes caused by dams on rivers, over-allocation of irrigation rights, etc.; • **Locally**: consider changes to fire frequencies, intensity, seasonality and extent, salinity levels, arrival of pests such as deer from the historic state. All of these assessments give you an idea of the health of such remnants, the ecosystem's health and its function, which, in turn, gives you a feeling for how much help there will be from ***landscape*** for your restoration site. This landscape support dictates whether your site will receive 'help from outside' (is your site still visited by a range of fauna that bring pollen or seed onto your site, do insectivorous animals still visit so your site will still be kept healthy by them?). At the end of your landscape analysis, you will have some important decisions to make: including whether there is some historic component of your site that has been altered so much that you must consciously change the ***restoration trajectory*** for your works and transform the site's vegetation into another ***FC*** or ***EVC***. Ultimately, your landscape analysis will lead you to choose a particular ***rainforest restoration method*** based on your landscape analysis and best judgement as to the ***ecosystem resilience*** that remains. Where your analysis says that the ecosystem resilience is still largely intact, your choice will be: the **Natural Regeneration Method**; where only slightly impaired, and money or resources are short, it may be Framework Restoration; if your site is completely disconnected and the ecosystem resilience is low: ***Maximum Diversity Restoration*** will get you the right results. See also: ***landscape context***, **rainforest** ***restoration methods*** and ***site analysis***.
landscape context	The position of your ***restoration*** site in the landscape relative to other remnants, land uses and ***ecological processes***. ***Landscape analysis*** provides the necessary insights into the level of ***ecosystem*** function remaining, the ecosystem's resilience and how these may assist you and your rehabilitation efforts on your chosen ***rainforest restoration*** site. Sites with good landscape context will be near to existing rainforest remnants that are in good health, they will be physically or virtually connected to other areas of bush or rainforest, migration routes for rainforest species will not have been broken or severely disrupted, ***dispersal*** of propagules to your site will be able to convey a diverse array of plant and animal species, and your site will have one or more ***ecotones*** present that will reduce ***edge effects***.
landscape fire protection	Fire protection for ***rainforests*** that is provided by some fire-retarding ***landform*** element in the landscape. Rainforests are often found 'sheltering' in the lee of such features (their ***fire shadow***). Landscape fire protection is usually found adjacent to the rainforest that it is protecting (otherwise the fire can spread into the intervening flammable bush and re-intensify before entering and damaging the rainforest). Examples of landscape fire protection include: open water [the sea, estuaries, large rivers, (as well as small but perennial streams that provide moisture to the sub-canopy of the overhanging ***Gallery Rainforest*** (Chapter S7: Figure S278), bare soil (usually sandy beaches, dune blowouts, etc.), cliffs, rock scree, rock outcrops, islands and ***tombolos*** (narrow sand spits that have captured near-shore islands that restricts the fire's entry points]. More recently, land clearing, roads, and suburbia also help provide landscape protection from fire. See also: ***cultural fire protection***.

Landscape fire protection (example) Key: Rainforest extent: - - - - - - - -	

Gulaga, Tilba Tilba New South Wales. In 2009, a wildfire burnt over this ridge (from right to left). This ***heading fire*** became a ***crowning fire*** when it hit the ridge (1). The ***backing fire*** lost intensity as it moved down slope with the rainforest helping it to ***self-extinguish*** (2). Among the monzanite tors, the scorched crown area (3) is recovering Dry Rainforest dominated by secondary regrowth wattle. Their lower flammability suppressed the fire's intensity and again it-self-extinguished in the Subtropical Rainforest gully (4). Despite the severity of the drought, which saw clumps of Rock Orchid *Thelychiton speciosum* burnt on bare tors (5), landscape fire protection and the vegetation itself, sees the rainforest live on. See also: ***fire types***.

landscape reader	An ecological term used to describe people who read landscapes at a deeper level than most of us do on a day-to-day basis. It is, however, a term that could be applied to the best operators in many professions (farmers, river engineers, foresters, etc.) and is manifest in the cultural knowledge of most indigenous peoples. It describes talented observers of Nature who almost subliminally study natural processes, interconnections, networks and ecology wherever they go. These deep understandings are then applied to the landscape, ecology and society to gain better insights into the way the planet operates and our place within the systems that support it and us. James Lovelock is a quintessential manifestation of such a mind and his *Gaia Theory* is probably the best 'western' encapsulation of this process.

landscape-scale weed control	Landscape weed control strategically applies two broad approaches: ***knockdown weed control*** and ***bush regeneration*** techniques (involving Bradley and Wingham Weeding). These two approaches are appropriate for different situations and should be seen as complementary. Their strategic application means that each technique is applied according to a sliding scale of weed cover, growth stage and susceptibility to the control method. Some sites will require only landscape-level knockdown weeding (foredune infestations of Bitou remote from urban weed *dispersal*); others will require both (knockdown sites with other ***transforming weeds***); while other reserves or parts of reserves in good health only require bush regeneration. Successful landscape-scale weed control requires integration between the bush regeneration approach and the knockdown weed control approach. *Site assessment* of the risk of posed by knockdown weed control of (for example) Bitou should involve an assessment of the potential for *weed succession* to be able to provide appropriate staging and resources to be delivered to specific sites if problems are identified. Then the disparate roles of knockdown and bush regeneration can be logically and tactically assigned as required. The integration of the two approaches is explained in the following example. Broad-acre foliar spraying of adult plants in larger infestations uses the knockdown weed control approach, while the application of bush regeneration techniques such as hand-pulling, scraping/painting or spot spraying their seedling offspring is the appropriate technique to prevent reinvasion and weed succession. These techniques allow for *natural regeneration*, which conserves the native species *recruitment* potential of the site. Other synergies gained through integration of knockdown weed control and bush regeneration include: *integrated weed management*; better communication of issues; ideas and techniques between knockdown weeding operators and *bush regenerators*; an more appropriate and timely interventions by the two groups to provide integrated control on all actively managed sites. Where large-scale weed control is contemplated, such as aerial spraying, it is imperative that there are sufficient resources available to effectively undertake the follow-up control of target weed regeneration as well as other weeds that may step into the vacant *niche* left by the knockdown program. A good example is Bitou, where the initial site preparation must also deal with any other transforming weeds that might emerge as a result of the control of Bitou. If such funds are not available, then the landscape-scale weed approach to Bitou control would suggest that action did not occur until funds are available. Instead, in these situations, continue to hold the line (geographically) and in sites currently under control until funds become available to tackle the next section of coast. Remember that a dense Bitou infestation holds the line against both natives and other *transforming weeds*, and a few years delay until the necessary resources are marshalled will not be the end of the world. Remember that controlling one weed is much easier than a plague of many species that may be unleashed by landscape weed control that does not factor follow-up weed control into future works programs.
La Niña	A meteorological phenomenon that links good rainfall in south-eastern Australia with the sea surface temperatures of the western Pacific off Ecuador through the *Walker Circulation* along the equator. When La Niña is at its zenith, good seasons are likely over south-eastern Australia and the risk of fire decreases significantly (in both intensity and extent). A detailed description of this phenomenon is to be found in Additional Reading: Climate systems you should know more about: impacts on rainforest. See also: *El Niño*, *Indian Ocean Dipole* and *Walker Circulation*.
late secondary species	Secondary species that come along late in the *secondary succession* process, but before *primary species*. See: *secondary species*.
latitudinal gradient	The north–south gradient of latitude that correlates with changes in climatic regime from subtropical in the north to warm temperate in the south. This gradient is reflected in the composition of the vegetation along the east coast of Australia. Subtropical species present in the north drop out moving south, just as warm temperate species decline moving from south to north (retreating to higher cooler habitats) in a process known as *latitudinal sifting*.

latitudinal sifting	As latitude changes, species are lost and others substituted to fill the vacated ***niches*** in the same ***ecological vegetation class*** (for example, ***Littoral Rainforest*** and ***Dry Rainforest***). Going from north to south in south-eastern Australia, ***subtropical climate zone*** species are lost and ***warm temperate climate zone*** species are gained. The reverse is true if the direction is changed to south to north. See: ***vernalisation.***

layer *layering*	The capacity of a plant to root when aerial stems touch the ground to produce daughter plants. Examples include Fireweed Groundsel *Senecio linearifolius*, Mother Shield-fern *Polystichum proliferum* and Seaberry Saltbush *Rhagodia candolleana*. In propagation, layering employs this propensity to produce a new plant from the 'host' plant while it is still attached to the parent plant. This is achieved by partially severing the stem (parallel with its length), jamming in sphagnum moss to keep the slit open and moist, then wrapping the whole plant in plastic and waiting for roots to emerge. If the stem is nearer to the ground, the same result can be achieved by slitting the stem (as before) and pegging it into a shallow hole in the soil. When roots emerge, the stem's foliage is trimmed and the new plant fully severed from the parent plant. The trimming of the foliage aims to match the small root mass with the amount of leaf area that loses moisture during ***photosynthesis***.
lerp	The carbohydrate secretions (honeydew) of sap sucking insects called psyllids that are found on leaves and form an intricately-patterned basket like-structure that protects the insect. See Appendix S6 worksheet: Honeydewers for other non-flower based sources of nectar and carbohydrates used by rainforest animals (birds, ***invertebrates*** and mammals) in south-eastern Australia.
letting Nature decide	In the absence of perfect knowledge, we will almost never have sufficient information to determine the exact boundaries between ***vegetation types*** that have been completely cleared, or to be able to detect or understand the vast array and the sum of all the variables that determine these boundaries. As such, we usually have to take a best guess and undertake a ***hybrid planting*** across such boundaries (crudely read by us as changes in, aspect, ***landform***, soils and salinity regimes, etc.): letting Nature decide 'which of our planting decisions' align with the actual conditions on the ground.
LGA	Acronym: Local Government Area (New South Wales terminology. The Victorian equivalent: shire).
liane *lianas*	Climbers. There are many types, with the broadest divisions being woody lianes such as Jungle Grape *Cissus hypoglauca* and wiry lianes such as Austral Sarsaparilla *Smilax australis*. See: ***vines***.
lichens	Organisms formed by symbiotic associations between ***fungi*** and green ***algae*** and/or ***blue-green algae***. Often found on soil, rock and trees, there are some species that are important structural and/or camouflage elements in the nests of birds (Chapter S4: Figure S151 and Table S10; Additional Reading: Figure AR78). The fungi provide the structure of the lichen while the alga contributes to the colour of the lichen and photosynthesises on behalf of both members of the union. Blue-green algae may be present, which fix nitrogen, and look like small blackish nodules on the surface of the lichen. If such lichens are present in the rainforest, they contribute to the nitrification of atmospheric N_2, which benefits the site. Lichens are broadly classified on their structure: ***crustose***, ***fruiticose*** and ***foliose***. Cf. ***algae***, ***blue-green algae***, ***mosses and liverworts***.
life-form	Growth habit of plants. Those used in this study: ***emergent trees***; ***canopy tree***s; ***shrubs***; ***vines*** (including woody ***lianes***, wiry lianes, ***twiners*** and ***scramblers***); ***forbs*** (non-***graminoid herbs***); graminoids (grass-like plants); and ***ferns***.
light shade	Shade with relatively high light levels in the order of: eV 13–15. See: ***incident light niche***. See also: ***moderate shade*** and ***deep shade***.
lithophyte	A plant that grows on bare rock in little or no soil. See also: ***endophytes***, ***vascular epiphytes***, ***non-vascular epiphytes*** and ***epiphytes***.
littoral	From the *Latin* word *'littoralis*' meaning of the seashore. Used as an adjective with reference to ***rainforest*** stands that occur on the coast and some the coastal species that characterise these stands.
Littoral Rainforest	A ***rainforest*** EVC that occurs on the coast (including the estuarine reaches of rivers) wherever there is an influence from salt. The salt is derived from the sea and may be delivered to the Littoral Rainforest stand's habitat by ***atmospheric accession***, the water table and, very rarely, through limestone geology. Within south-eastern Australia, Littoral Rainforest grows in the ***subtropical climate*** and ***warm temperate climate zones***. It occurs on a variety of coastal ***landform***s ranging from dunes, to headlands, islands, ***estuarine deltaic deposits***, ***berms*** or ***cheniers***. It has excellent ***landscape-scale fire protection*** and is composed of ***characteristic species*** and **life-forms** that are adapted to salt and high wind exposure. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Littoral Rainforest.

liverworts (including hornworts)	***Non-vascular*** plants that live either as ***epiphytes,*** where they are common in the wetter rainforest types in south-eastern Australia, as well as growing on moist earth and rocks. They reproduce via ***spores***. Two types are recognised: one has leaves that are lobed or have lobules. These leaves are arranged in two series (those beneath the stem being different in form to those on the top or sides of the stem). These leafy liverworts superficially resemble ***mosses,*** but the leaves and spore holding structures are very different. The other type are the thallose liverworts that resemble ***lichens***, but are usually a brighter green and have small hair like rootlets called rhizoids which are lacking in lichens. Unlike lichens, liverworts possess their own ability to ***photosynthesise*** without the aid of ***symbiotic algae***. Some hornworts are symbiotic with *nitrogen fixing* ***blue-green algae,*** especially from the genus *Nostoc.* See also: ***algae***, ***lichens*** and ***mosses***.

living mulch	These mulches are derived from sun-adapted ground-cover species that act as living mulches (providing shade to the soil) thereby reducing soil temperatures and conserving soil moisture. Living mulches can be ***exotic*** or natives and useful species we have used in south-eastern Australia include: Nodding Saltbush *Einadia nutans*, Lax Goosefoot *Einadia trigonos*, Kikuyu **Pennisetum clandestinum* and New Zealand Spinach *Tetragonia tetragonioides*. Although other species are good groundcovers (e.g. Large Bindweed *Calystegia sepium*, Seaberry Saltbush and *Rhagodia candolleana*), their usefulness as living mulches is reduced because of their tendency to swamp or overrun other species planted within them. The best living mulches should be out-competed by the shade cast by the species that you plant in them. In most cases, this means that they are pioneer taxa that are not shade-tolerant. See also: ***artificial mulches***.
logic train	Logic trains are a series of statements with a conclusion: this + this + this + this = that. This method allows you to systematically set out what you expect will happen to a system before you watch it or intervene. It provides a logical method for detailing your ***hypothesis*** and, in rainforest restoration, gives you a chance to try your hand at ***intuitive ecology***. Logic trains also allow other people to follow your thought process and they provide valuable information on projects if you have to leave or pass them on. Logic trains can take many forms: decision trees (Chapter 3: Figures 3.2-3.4; tables or matrices: Appendix S14: the logic trains in the Nyerimilang example and the ***climate change bump-along tables***.
low concentration herbicide mix	A technique used when a specific ***weed*** is susceptible to herbicide concentrations well below the standard mixing rate, as is the case with Bitou **Chrysanthemoides monilifera* ssp. *rotundata*. This technique is so effective it allows aerial spraying to be undertaken over very precious ***rainforest*** remnants with minimal impacts on the native species interspersed in the target weed infestation and can produce ***landscape-scale weed knockdown*** in very short periods, such as has occurred several months before this photo was taken of this ***Littoral Rainforest*** site at Shelly Beach in Port Macquarie* on the Mid North Coast of New South Wales. Beware however, that the mix must be well dissolved, the time of year must be established when natives are the least susceptible and small scale trials must prove its efficacy before it is applied over broad areas, otherwise you risk losing a lot more than weeds! *Note: the daisy-bush in the left foreground of the figure is not Bitou, but the native beach coloniser: Melanthera *M. biflora*. 
LRf	Abbreviation: ***Littoral Rainforest***. See Littoral Rainforest in Definitions and Synonymy.
LS	Abbreviation: ***Late secondary species***.
lyrebirding	A hand-based ***direct seeding*** method where a rake hoe or rake is used to displace leaf litter before sowing the seed. Successfully used by Ned

	Rickard for direct seeding Weeping Grass *Microlaena stipoides* beneath Black Wattle *Acacia mearnsii* on the Demonstration Site at Orbost, Victoria.
m	Abbreviation: metre.
manna	Sap exudates that dry on contact with air that produce sugary secretions on the leaves of some eucalypts. These can be an important food resource for a broad range of animals including: insects (particularly ants), birds (e.g. honeyeaters and pardalotes) and mammals (e.g. Sugar Gliders and Yellow-bellied Gliders).

marginal bluff	A bluff (cliff or steep ***landform***) whose erosion has slowed and, in the context of this study, is either: • formed at one time by wave action from the sea eroding a resistant coastal geology, but which is now remote from this erosive force synonymous with an abandoned ***sea cliff*** (Chapter S1: Figure S39); or • formed by ***riverine*** erosion, but the river's course has moved from its base or the valley is now flooded by an estuary or infilled by sediment. Marginal bluffs are often ***habitat*** for ***Littoral Rainforest,*** especially where an estuary subtends them: e.g. Gippsland Lakes, Lake Tyers, Toorloo Arm, Mallacoota Inlet, Genoa River, Edrom Beach and Wallaga Lake; while along streams they often protect Dry Gully Rainforest, Dry Rainforest, Gallery Rainforest and Warm Temperate Rainforest from fire. Cf.: ***riverine cliff*** and ***sea cliff***.
maritime	Of the oceans, as in the winds and the weather that they produce. Cf. ***continental***.
marl	Muddy limestone.
marsupial lawn	An area of heavily grazed (and therefore lawn-like) grass maintained by marsupials (usually Eastern Grey Kangaroos, but also Common Wombats and occasionally Red-necked Wallabies (such as at Fisheries Beach on Twofold Bay south of Eden, Pebbly Beach and Durras Mountain in Murramarang National Park). Usually composed of both introduced and native sward-forming grass species. These areas often change over time, with the colonisation of less palatable tussock species (Bergalia Tussock *Carex longebrachiata* and Common Tussock-grass *Poa labillardeirei*, such as on Durras Mountain) and Spiny-headed Mat-rush *Lomandra longifolia* and Swamp Lily *Crinum pedunculatum* (such as at Pebbly Beach. See ***storm shutter***). This, in time, allows the germination of shrubby species (not favoured by ***grazing*** animals) and ***succession*** takes place when these establish (e.g. Coast Wattle *Acacia longifolia* ssp. *sophorae*: at Bingi Point) that can lead to the eventual emergence of ***rainforest***. The grazing by these mammals appears to keep otherwise rampant non-native sward-forming grasses such as Kikuyu **Pennisetum clandestinum* under control while the regeneration and succession of native species can get underway.
Maximum Diversity Method	A ***rainforest restoration method*** that is applied where there is a tree ***canopy*** remaining and few if any groundlayer remnant ***rainforest*** species present. It uses the full range of ***pioneer***, ***secondary*** and ***primary species*** to establish a functioning rainforest. Its use is determined by a landscape analysis that has shown there will be inadequate natural regeneration once the ecological brakes are removed. This method aims to create a self-sustaining rainforest node to connect other areas of rainforest in the landscape. This method aims to restore a rainforest stand that can either function on its own (in isolation from other stands), or to act as a missing stepping stone to link nearby rainforest stands to others further along the island archipelago of rainforest stands in the district. See Chapter 5: Maximum Diversity Method for a complete description and how and when to apply this approach. Cf. *Clumped Mixed Canopy Method*, *Framework Method* and/or the *Natural Regeneration Method*.
mechanical auger	A corkscrew-like device driven by hand or an engine that removes soil to allow planting of nursery stock. The process produces a fine tilth in all but the most clayey soils, but, wherever clay is present, it can polish the sides of the hole, which is believed to increase the risk of root binding in the growing plant. It is recommended for use in damp sands, silts, loams and clay loams provided some effort is put into preventing air pockets around the roots when planting is undertaken. See also: *Hamilton Treeplanters* and *Potaputkis* and Chapter S6: Table S22 for a comparison of their relative merits.
Mediterranean climate	A reference to the climate of the Mediterranean region of southern Europe, characterised by a cool wet winters and hot dry summers, which confer a high fire risk and consequently a high fire frequency. This Mediterranean climate is shared with much of the warm temperate lowlands of south-eastern Australia. This is important because of the fire sensitivity of ***rainforest***s, which means that if they are to survive in such regions, they will be found in ***fire refuges***. See also: ***subtropical climate zone***, ***warm temperate climate zone*** and ***cool temperate climate***

	zone and for more detail on climate: Additional Reading: Local climate.
mega-fire	An American term (now used locally) that applies to fires in Australia that are on an unprecedented scale since European arrival, covering more than 1 million ha in extent. Thought to be due in part to extended droughts linked to ***climate change***. Jerry Wilkins cited in Rural Fires Bulletin (2007) included the following features in his definition: they are extraordinary because they are the largest, most complex and resistant to control and represent only about 1% of all fires.
mesic	Moist: usually with reference to vegetation (Wet Forest, Damp Forest, Subtropical Rainforest, Cool Temperate Rainforest, etc.) or habitats (south- or east-facing gullies, river flats, swamps, etc.). Antonym: xeric (e.g. vegetation: Dry Rainforest and habitat: e.g. cliffs and rock scree).
mesophyll	A reference to leaf size in ***physiognomic*** classifications of ***rainforests*** by Webb (1968) (in common usage in Queensland). The leaf size typical of such rainforests and their constituent plants ranges from 12.5 cm to 25 cm long.
metapopulation	Physically separated populations of the same species that interact in some way (the component sub-populations may be separated by unsuitable or suitable (but unoccupied) habitat).
metasediment	Sedimentary rocks that have been subjected to some form of metamorphism (deformation, heating, or both).
microclimate	The climatic conditions of a small localised area compared with the wider area, which are mediated by vegetation, soils and topography.
microphyll	A reference to leaf size in ***physiognomic*** classifications of ***rainforests*** by Webb (1968) (in common usage in Queensland). The leaf size typical of such rainforests and their constituent plants ranges from 2.5 cm to 7.5 cm long.
migration barrier	A feature of the environment (seas, mountains, temperatures, distance, inhospitable or unsuitable vegetation, a lack of sustaining resources, etc.) that prevents one or more organisms from moving from one patch of suitable habitat to another.
moderate fidelity rainforest species	In the context of rainforest species composition, species that often occur in rainforests, but are also sometimes found outside rainforest vegetation. These species are well suited to rainforest but have sufficient flexibility to occur in other environments as well. See Appendix S6 worksheet: All species + FCs for rainforest fidelity ratings. See also: ***high fidelity rainforest species***, ***obligate rainforest species*** and ***satellite species***.
moderate shade	Shade with low light levels in the order of: eV 10–12. See also: ***deep shade*** and ***light shade***.
Modified Bradley Method	The original ***Bradley Method*** did not espouse the use of herbicides, but subsequent refinements of the technique have incorporated careful and highly targeted use of herbicides (drilling, ***frilling,*** etc.) that minimises the creation of new ***weed niches*** while causing large, troublesome or difficult to remove species to just 'melt away'. This is called the Modified Bradley Method: in the first instance, respecting the techniques of the original, with the additional careful use of herbicides where appropriate. Broad-acre spraying of weed infestations is not recommended in either version of the Bradley Method, and really comes under the heading of site preparation for sites where you are beginning from scratch or ***Wingham Weeding***. Instead, ***Bradley Weeding*** is used where the ***restoration*** work has largely succeeded and there is abundant ***natural regeneration*** occurring. Although ***Bradley Weeding*** or the modified method works in many situations, it is not appropriate for every weed scenario on your restoration site. In ***subtropical climate zones*** and in ***Subtropical*** (and probably Tropical) ***Rainforests*** where growth rates of some vines can exceed 1 m week^{-1}, the ***Bradley Weeding*** method will usually not work. The solution has been developed by workers at Wingham ***Brush*** on the Manning River in New South Wales (Stockard 1998) and is here referred to as the ***Wingham Weeding Method***. See also: ***Bradley Weeding*** and ***Wingham Weeding***.
moisture niche	The preferred moisture regime for a particular plant species (see Appendix S6 worksheet: Moisture niches).
montane	In south-eastern Australia, an area generally above 900 m, that has (until now) generally received occasional snow every year.
monitoring	The task of collecting information about the effectiveness of a particular treatment (*sensu* Rutherford *et al.* (1999b). Cf. ***evaluation***.
mosaic	A vegetation mapping term used to describe a map unit composed of more than one vegetation type. There may be two reasons for this, the scale of the map (which does not allow all of the types present to be displayed individually), and/or some vegetation types (e.g. rainforest) can occupy a ***temporal niche*** in that locality. That is, the vegetation may move around within the mapped unit according to the disturbance regime. It can occur anywhere in the mapped unit, but its position at the time of the mapping may be different to 100 years previously or in 100 years time.
mosses	Non-vascular plants that reproduce by ***spores,*** which are one of a group called bryophytes, the other members of which are hornworts, leafy

	liverworts and thallose liverworts. Mosses can be distinguished from other bryophytes by having leaves without lobes or lobules that are spirally arranged around the stem. Mosses are very common in moist environments including rainforests. Often found on soil, rock and trees, there are some species that are important structural and/or camouflage elements in the nests of birds (Chapter S4: Table S10). Cf. ***algae***, ***blue-green algae***, ***lichens*** and ***liverworts***.
MOTS Beach	Acronym: Mouth of the Snowy Beach (the beach opposite the mouth of the Snowy River) where it enters Bass Strait at Marlo.
MSDS (Material Safety Data Sheet)	Acronym: Material Safety Data Sheet. Essential information for the safe and effective use of poisons including herbicides and pesticides. Information included on the MSDS includes: product identification; health hazard information; precautions for use; safe handling information; and other information.
mulch	A collective term for all of the fallen plant and animal material on the ground (leaves, twigs, branches, bodies) that represents the first stage of soil carbon formation. See also: ***compost***, ***humus*** and ***labile carbon*** (the whole process being defined under humus)
Mulching	The provision of mulch: a useful technique for establishing rainforest in sites with high exposure or low soil carbon.
multiple seed dormancies	See: ***seed dormancy*** and Rainforest Plant Propagation Manual for south-eastern Australia.
Mya	Abbreviation: million years ago.
mycorrhiza *mycorrhizal*	Fungal associations with plants whereby fungi clothe or invade the fine feeder roots of many Australian plants in a ***symbiotic*** relationship that benefits both partners. The fungal hyphae range far and wide, returning nutrients to the roots of their hosts, while the hosts feed the mycorrhizal fungi with ***photosynthates*** (the sugars and derived organic compounds from ***photosynthesis***). Such mycorrhizal fungi are thought to be a keystone group that help to sustain the health of forest ecosystems that grow on Australia's nutrient poor soils.
naturalisation/ naturalised	The process whereby ***non-indigenous native*** and ***exotic species*** successfully reproduce and establish beyond their original site of introduction.
natural regeneration	Regeneration that comes from establishment of plants from either the planted species on the ***restoration*** site or from other members present in the original or nearby remnants. New plants may arise from seed, ***root coppicing***, ***layering***, rhizomes, fragmentation or daughter plantlets.
Natural Regeneration Method	A ***rainforest restoration method*** that is applied where the landscape analysis has determined that there is a strong likelihood of natural regeneration leading to the colonisation of the site by ***rainforest*** species once the current ***threats*** are identified and their ***ecological brakes*** are removed. A ***canopy*** may or may not be present, because ***paddock rainforest starter species*** can lead to a canopy forming in the absence of ***grazing***. If mistletoes colonise these canopy species and a diverse and mature rainforest remnant is nearby, then rainforest will emerge (Additional Reading: Figures AR 31–32) on the site provided other ecological brakes are managed in the meantime (Additional Reading: Mistletoe and rainforest regeneration: vital in fragmented landscapes). On sites where there has been well planned and effective rainforest ***restoration*** using other methods, the need to apply the Natural Regeneration Method marks the successful restoration of the rainforest site, because dispersal and establishment are beginning to occur. Similarly, the application of the Natural Regeneration Restoration Method to most rainforest stands simply involves identifying the offending ecological brake and removing it. Because most ***rainforest remnants*** have a high degree of ***ecosystem resilience,*** natural ***regeneration*** will follow. See Chapter 5: Natural Regeneration Method for a complete description and how and when to apply this approach. Cf. ***Clumped Mixed Canopy***, ***Framework*** and ***Maximum Diversity*** rainforest restoration methods.
nectivore	An animal that eats nectar. Cf. ***carnivore***, ***frugivore***, ***granivore***, ***insectivore*** and ***nectivore***.
net gain	A legal requirement under Victorian law set out in Victoria's Native Vegetation Management – A Framework for Action (DSE 2000) <www.dse.vic.gov.au> that there be a net gain in extent, quality (condition) and protection level for all native vegetation in the state including rainforests (see Appendix S1 worksheet: Recovery actions). This requirement, in tandem with the relevant listings under state and federal law, means there is an onus on the community at large to protect, restore and extend the area of rainforest in south-eastern Australia. This, in turn, means that there should also be government funding available to help you achieve these goals of net gain with respect to the restoration and protection of rainforests.
niche	The particular aspects of a ***habitat*** that are required for a single species to survive, grow and reproduce.
non-indigenous natives *non-indigenous species*	Species that occur naturally in one part of the country, but when found outside their natural range (and as the result of un-natural ***translocation***) are called non-indigenous natives. A classic example is the ***naturalisation*** of many horticulturally popular native ***rainforest***

	species that are colonising adjacent urban and native bush. Cf. ***indigenous***.
non-rainforest species	Those plant or animal ***taxa*** with a low fidelity to ***rainforest***, which regularly occur outside rainforest and are not dependent on its resources or habitat for successful reproduction. Plants with varying levels of ***fidelity*** to rainforest are listed in all species list appendices (e.g. Appendix S6 worksheet: All species + FCs) and can be found in the rainforest fidelity column.
non-rainforest wattle	Wattles with a ***funicle*** that lack an ***aril*** and are consequently not dispersed between rainforest stands by fruit-eating ***rainforest*** animals. These wattles are instead dispersed are explosively dispersed near to the parent tree and in a uni-directional manner rather than through ***directional dispersal*** (as is the case with ***rainforest wattles***). Non-rainforest wattle seed may later be dispersed over short distances (metres) by ants that use the small oil-rich ***funicle*** for food. Cf. ***aril***. See also: ***funicle***, ***rainforest wattles*** and Chapter S4: *Wattles*.
non-vascular epiphyte	***Mosses***, ***lichens*** and ***liverworts,*** which lack a vascular system. See: ***lithophytes***, ***vascular epiphytes*** and ***epiphytes***.

notophyll	A reference to leaf size in ***physiognomic*** classifications of ***rainforests*** by Webb (1968) (in common usage in Queensland). The leaf size typical of such rainforests and their constituent plants ranges from 7.5 to 12.5 cm long.
noxious weeds	This is a definition category that is always subject to review (both for its meaning and for the species that are included in it). Basically, any weed that is a ***threat*** to agriculture or assets (and increasingly environmental assets, though this aspect of the definition is taking a long while in some quarters to take hold). In some ways, it is a political, commercial and social problem because weeds are often useful in some other context (e.g. agriculture, or the garden industry) but become a major threat to you or your land. In the broadest sense a noxious weed is one that you are by law required to notify, control or destroy wherever you find it on the land that you are managing. Laws differ from state to state and region to region as do the weeds classified as noxious. It is recommended therefore that you consult your local primary industries department for the latest definition, sub-categories and legal requirements for the control or eradication of the plant in question.
NPWS	Abbreviation: National Parks and Wildlife Service (NSW).
NRM	Abbreviation: Natural Resource Management: managing natural resources sustainably for the benefit of the community, environment and economy.

<table>
<tr>
<td>nursery crops</td>
<td colspan="2">A collective term for a planting (or naturally occurring stand) of pioneer and/or secondary species that are indigenous (Appendix S17), which are used as canopy cover to suppress sun weeds and provide the right niche for the germination of shade-dependent primary rainforest species under the requisite light to moderate shade conditions. This is not the same as a cover crop: which are pre-existing or planted exotic species used to cover or retain cover on soil prior to rainforest planting (BSRLG 2005; and Andresen 2005). Cover crops of exotic species can be used to establish nursery crops. As the nursery crop develops, the cover crop dies out providing the ideal conditions for the establishment of the primary rainforest species (see below). Cf. cover crop.</td>
</tr>
<tr>
<td rowspan="3">nursery crop (beginning and young examples)</td>
<td>USING A COVER CROP TO ESTABLISH A NURSERYCROP</td>
<td>THE NURSERY CROP ALLOWS RAINFOREST TO EMERGE</td>
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<tr>
<td>Demonstration Site, lower Snowy River Victoria. Here Kikuyu *Pennisetum clandestinum is being used as a cover crop for this Framework Rainforest Restoration planting which is assisting in the early establishment of this emerging nursery crop of native species . The cover crop provides wind protection, moisture conservation and the creation of heat wells (red ellipse and arrows) for the young plants. Planting established in late autumn 2009; this photograph December 2009. The Figure to the right shows where this site will be in two and a half years time.</td>
<td>Jarramond, lower Snowy River, Victoria. Here Kikuyu *Pennisetum clandestinum was the original cover crop for this Framework Rainforest Restoration planting. The planted nursery crop is 3 years old. The cover crop having done its job is now declining as the nursery crop takes over. In time, nearby rainforest plantings and remnants will supply the primary species seed needed to convert the cover crop into mature phase rainforest. Planting established in autumn 2006; this photograph December 2009.</td>
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</table>

nutrient trap	A part of the landscape that traps water-borne nutrients, with phosphorus being trapped and processed on floodplains and in estuaries, and nitrogen being trapped and processed at the water–land interface around wetlands and along the margins of streams. These sites (often rainforest) are very important in reducing nutrient pollution and regulating nutrient levels in waterways (Chapter S2: Rainforests as nutrient traps and waterway health). See: ***sinks***. (Chapter S2: Figures S52–S57).
obligate epiphyte	An ***epiphyte*** that does not occur in any other situation other than on another living plant (e.g. Tangle Orchid *Plectorrhiza ridentate*). Cf. ***facultative epiphyte.***
obligate parasite	A species that can only exist as a parasite on a host (e.g. Variable Mistletoe *Amyema congener*). Cf. ***facultative parasite***.
obligate rainforest species	In the context of rainforest species composition, species that are almost never found outside rainforests. These species have the highest fidelity to rainforest. See Appendix S6 worksheet: All species + FCs for rainforest fidelity ratings. See also: ***high fidelity rainforest species***, ***moderate fidelity rainforest species*** and ***satellite species***.
obligate seed regenerator	A species whose regeneration only occurs from seed. Cf. ***facultative seed regenerator***.
obligate strangler	A strangler species that usually only establishes on a host tree and not on the ground (e.g. Small-leaved Fig *Ficus obliqua*). Cf. ***facultative strangler***. See: 'OSt' in the life-form column of Appendix S6 worksheet: All species + FCs.
oldfield regrowth *oldfield scrubs*	Regrowth native vegetation that has colonised abandoned, degraded or no longer grazed paddocks previously cleared of their original native vegetation. Local examples include: ***Subtropical Rainforest*** around the footslopes of Gulaga in the Tilba Tilba district and at Durras Mountain; many areas of ***Warm Temperate Rainforest*** in the Strzeleckis; and former ***Cool Temperate Rainforest*** in the Otway Ranges.
orographic uplift	The process of mountain ranges forcing air masses to rise when wind flows over them. If the air mass is moist, this will cause condensation, cloud formation and precipitation to occur on the windward side of the range, and conversely lead to a ***rainshadow*** on the leeward side of the range where the (now drier) air mass descends. See also: ***rainshadow valley***.
outcrossing	Genetic interchange between individuals with different genetic make-up.
Overlap Rainforest	Used to describe several Victorian ***rainforest floristic communities*** that straddle the ***cool temperate zone*** and ***warm temperate climate zone*** divide. As a consequence they have a ***floristic composition*** that is intermediate between ***Cool Temperate Rainforest*** and ***Warm Temperate Rainforest EVCs***. See: Definitions and Synonymy–Key to the rainforest floristic communities of Victoria.
over-spraying *over-sprayed*	A technique for herbicide application that involves the use of high pressure nozzles to apply herbicides via a fine mist (Figure 8.42), which lightly settles on the leaves of densely foliaged plants (especially vines as well as some shrubs and trees) where there is a native ***understorey*** that is to be conserved. This approach kills only the ***overstorey weed***, and the application is light enough to prevent penetration of herbicide through the weed's ***canopy***, thereby protecting the non-target native species beneath. To date it has been very effectively applied through aerial and on-ground spraying of Bitou **Chrysanthemoides monilifera* ssp. rotundata, Blackberry **Rubus fruiticosus* spp. agg., Cape Ivy **Delairea odorata* and weedy areas of Seaberry Saltbush *Rhagodia candolleana* (Figure 8.42 shows the technique and 8.44 the result). Cf. ***jetting*** and ***splatter-gun spraying***.
overstorey tree	Trees that rise above the closed canopy of the rainforest below: the term is used interchangeably with ***emergent tree***. Common overstorey trees include: some wattles, such as Blackwood *Acacia melanoxylon* in ***Warm Temperate Rainforest***; Coast Banksia *B. integrifolia* in ***Littoral Rainforest***; Kurrajong *Brachychiton populneus* in Dry Rainforests; and Giant Stinging Tree *Dendrochnide excelsa*, Small-leaved Fig *Ficus obliqua* and Cabbage Fan Palm *Livistona australis* in Subtropical Rainforests. The most ubiquitous overstorey trees are the eucalypts that may tower over many rainforest stands.

paddock rainforest starter species (natives)	***Rainforest*** plants that are able to germinate in deep dense grass swards or on soils bared by drought. One hundred and eleven ***taxa*** have so far been determined to fall into this group (the lists of them and how to find them are in Appendix S18). Of these, 41% are ***pioneers species***, 25% are ***early secondary species***, 24% are ***late secondary species*** and only 10% are ***primary species***. What is remarkable is that the pioneer species can germinate at all in the dark (which is contrary to most people's understanding of a pioneer species' germination requirements), i.e. ***full sun***. As a whole, this group of species regenerate in response to the removal of ***grazing*** from paddocks (though this is herbivore-specific: horses, being mostly grazers, will allow more woody species to establish; for example, see Figures: 8.45-8.46. The growth of paddock rainforest starters shades out the sun-dependent pasture species and primary rainforest ***succession*** begins. This leads to the process known as ***greenfields regeneration***. To illustrate the concept, a small subset of these paddock rainforest starter species are listed below by successional stage: • Rainforest pioneers such as: Coast Wattle *A. longifolia* ssp. *sophorae*, Sallow Wattle *A. longifolia* ssp. *longifolia*, Bower Wattle *A. subporosa*, Dusky Coral Pea *Kennedia rubicunda*, Tree Everlasting *Ozothamnus ferrugineus,* Fireweed Groundsel *Senecio linearifolius* and Coast Rosemary *Westringia fruticosa*; • ***Early secondary species*** such as: Black Wattle *Acacia mearnsii*, Climbing Lignum *Muehlenbeckia adpressa* and Coast Beard-heath *Leucopogon parviflorus*; • ***Late secondary species*** such as: a furry-leaved form of White Sallow Wattle *Acacia floribunda* (restricted to Durras Mountain and regenerating ***Subtropical Rainforest***), Blackwood *A. melanoxylon*, Sea Box *Alyxia buxifolia*, Coast Banksia *B. integrifolia,* Coffee Bush *Breynia oblongifolia*, Black-fruit Saw-sedge *Gahnia melanocarpa*, Large Mock Olive *Notelaea longifolia*; and quickly followed by a limited range of: • Drought hardy ***primary species*** such as Grey Myrtle *Backhousia myrtifolia* or Sweet Pittosporum *P. undulatum* that establish rapidly in the ***niches*** provided by the pioneers and secondary species.
paddock rainforest starter species (weeds)	Paddock rainforest starters can include ***transforming weeds*** and others that act as pioneers (Figure 8.54) for later ***rainforest*** development and these are classified generally as ***cover crops*** (Chapter S6: To weed or not to weed: that is the ecological and logistical question?). Such species are usually the pre-existing pasture, but, in some cases, these pasture species may be deliberately sown to achieve a soil cover before rainforest regeneration occurs. There is also a range of other species including woody weeds that can fulfil this role, but due to the high risk of their spread and difficulties in controlling such species, none are recommended for sowing or establishment. Instead they are used for convenience in the restoration process where your site already has pre-existing infestations. Consequently, the species listed below are used for as long as they provide an advantage to the restoration process (as against the risk of spread) and further off-site damage. Retention of these berry-bearing species (until substitute food sources are provided) is also thought to be important where they have become an alternative food resource for local rainforest fauna wherever their original rainforest food sources have been cleared or damaged by other ***threatening processes*** [Chapter S6: Weed replacement plants for use by fruit eaters (replacing take-away with eat-at-home locals)]; and Appendix S3 worksheets: Vic. fruiting plant substitutes; and NSW fruiting plant substitutes). Paddock rainforest starter species largely from the ***subtropical climate zone*** include ***transforming weeds*** such as: • Bitou **Chrysanthemoides monolifera* ssp. *rotundata* on dunes and other sandy or rocky near coastal sites with high exposure to salt-laden winds; and • Lantana **L. camara* across a broad range of subtropical sites on heavier soils of the hinterland. Those that are largely from the ***temperate climate zone*** include transforming species such as: • Bridal Creeper **Asparagus asparagoides* (but only where biological control is active and effective); • Cotoneasters *Cotoneaster* spp.; • A range of privets and cherry plums; and • Blackberry **Rubus fruiticosus* spp. agg.; Transforming weeds that are paddock rainforest starter species that straddle the ***subtropical*** and ***warm temperate zones*** include: • Kikuyu **Pennisetum clandestinum.*
palaeochannels	Ancient (and abandoned) river channels that can still be located on floodplains today (Chapter S2: the green arrows in Figure S88).

paradigm	The dominant idea, method or ***theory*** of the time for the field of study theory or practice that you are undertaking. Paradigms are 'potted wisdoms' or perceived truths that are very useful if they are correct or can be applied to your problem at hand. They are dangerous if incorrect or do not fit your site or particular problem. For example, consider the following paradigm: 'Bitou is *Weed of National Significance* (*WoNS*), it is bad and must be removed wherever it is found'. So the management ethos that arises from this might be: 'to get rid of Bitou wherever you find it', but that is not a licence to go ahead irrespective of your site's context and the damage you could do in getting rid of this ***transforming weed***. Make no mistake, Bitou is a profound ecological ***threat*** and must be dealt with, but this should not result in more harm during its eradication than the weed itself is doing to your site. So what will replace it and what damage will you do if you take an individual or a whole stand of Bitou out in one hit? At the stand level (for large infestations), it represents a considerable food resource for native fruit-eating species (Appendix S3 worksheet: Seeding and flowering calendar) and with our ability to control it with aerial spraying over extensive areas, we need to consider its removal at an ***ecosystem*** level (Appendix S3 worksheet: Example Bitou impacts), as well as what will happen if large stands are 'removed overnight'. Part of this consideration is that it could put significant pressure on local ***frugivore*** populations that may rely on it (Appendix S3 worksheets: Method for fruit substitution; Vic. Fruiting plant substitutes; and NSW fruiting plant substitutes). At the local scale, the removal of a single plant could have a huge impact if done without thought for the consequences (Chapter S6: Figure S268). So when you come across a paradigm that relates to your site or what you intend to do, examine it closely before blindly accepting it. See also: '***flipping paradigms***'.
partial sun	'Shade' in the order of: *eV* 15.
PAS (Priority Action Statement)	Acronym: New South Wales Threatened Species Priority Action Statements (DECC 2007), which ensures the preparation of *Threat Abatement Plans* (*TAPs*) to mitigate a *Key Threatening Process* (*KTP*) under Part 5 of the Threatened Species Act (1995). <www.environment.nsw.gov.au/resources/threatenedspecies/threatspecpas07168.pdf>.
pasture maps	Maps of pasture species (grasses and ***forbs***) that indicate the soil type and the moisture condition of the spot with that particular pasture composition. These maps are very useful for planning ***restoration*** on cleared lands because they indicate conditions that are directly relevant to the past vegetation and (in extreme situations) can dictate whether ***rainforest*** can be re-established there today (Chapter 7: Undefined (swamped) riparian systems). These pasture maps should be constructed and correlated to soil composition, water table depth and water table salinity. In order to calibrate such a map for your district, you will have to ***auger*** a series of holes to 60 cm or so and place agi-pipe ***piezometers*** in them. This enables you to test the soils, the water tables and its depth and salinity. Once you have been able to align the pasture composition with the soil conditions, all that needs to be done is to record this and seek rainforest ***reference sites*** that have the same ***landform***, soils, water-table depths and soil salinities. Then you will be able to convert that information into planting lists and return to your cleared site. The pasture zones are then converted into rainforest planting zones. The piezometers also provide a very useful means of ***monitoring*** the ways that your plantings can change these important site factors (for example, using eucalypts to lower water tables).
pasture transformation	In ***restoration****,* a process whereby diverse ***exotic*** pastures can be converted into a groundlayer dominated by native species simply by planting or allowing some very useful native species to naturally regenerate. These species are generally trees, with the most useful taxa including eucalypts and wattles. It is believed that the transformation occurs through changes in light, soil chemistry and moisture levels as a result of the establishment and growth of these trees. See also: ***greenfields regeneration***, ***paddock rainforest starters*** and ***pasture transformers***.
pasture transformers	The species of plants that achieve ***pasture transformation***. The largest and most obvious group are wattles, but in ***rainforest restoration*** (in addition to wattles) they also include: She-oaks *Allocasuarina* and *Casuarina*, Coast Banksia *B. integrifolia*, Coast Tea-tree *Leptospermum laevigatum*, Giant Honey-myrtle *Melaleuca armillaris* and Swamp Paperbark *Melaleuca ericifolia*. Shrubs species include Tree Everlasting *Ozothamnus ferrugineus* and Fireweed Groundsel *Senecio linearifolius*. The shade they cast, the soil changes they bring (nitrification in the case of wattles and she-oaks), the carbon building and high water demand, transform the field-layer composition to native species within a couple of years (without the need for herbicides or other intensive or expensive weed control techniques). Native species still present in the pasture are favoured by the growth of these species and their populations begin to expand as the ***exotic*** pasture species decline. New species are brought onto the site by wind, water and animals and the transformation of the paddock back to native vegetation is then well underway. Complete conversion is species dependent (both the **pasture transformer** and the exotic pasture species involved) and, in most cases, it is not complete until the original **pasture transformer** matures and thereby allows progression to the next ***plant community successional*** stage. See also: ***pasture transformation*** and ***seed rain*** Figures.

penetrants	A class of chemical used in herbicide mixes that are designed to ensure penetration of the active chemical agent (that kills the plant) through the waxy cuticle a plant's leaf.
peri-urban	The interface between urban (built-up areas dominated by housing) at the fringe of settlements and the surrounding land; a zone often characterised by changing land use and attitudes as formerly productive agricultural areas are subdivided and new 'lifestyle' lots are subdivided into farmlets and acreage lots. This change of land use can lead to a new population with different attitudes towards the environment, often more disposable income and time: a great opportunity for ***rainforest restoration***.
pers. comm.	Abbreviation: an acknowledgement of information conveyed through a personal communication; attributable to a source other than the author and the literature. See also: *pers. obs*.
per se	*Latin*: in and of itself; with respect to its inherent nature.
pers. obs. *personal observation*	Abbreviation: information supplied through the personal observations of the author.
pest animals	An animal (native or exotic) that is a pest to someone or something. In the context of this work, usually an exotic species such as rabbits or deer. We rarely regard native species as pests, because they are effectively one of the groups or 'clients' for whom we do our work.
phenology	The study of plant and animal cycles as linked to season or time of year (flowering calendars, seeding calendars, fruiting times, ***pollinators***, ***seed dispersers*** and ***seed predators***). Such knowledge is invaluable in understanding the ***ecology*** of individual species and their links to others in building ***food webs*** and ecological processes. See the various planting Appendices: S3, S6, S8 and S17.
phenotype	The observable traits or physical appearance of an organism, which may or may not represent genetic differences (size, weight or colour, etc.). Cf. ***genotype***
photosynthates	The chemicals produced in plants during ***photosynthesis***.
photosynthesis	Literally and poetically the synthesis of light that transforms the energy in light to the energy of chemical bonds in molecules. The chemical process employed by plants that captures the energy of the sun and stores it in the chemical bonds of carbohydrates (called ***photosynthates***), such as sugars. The energy from the sun is captured by the coloured pigment (mostly in leaves) in chloroplasts (intricate internal cell structures) where carbon dioxide and water are combined according to the following formula: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$.
physical dormancy	Dormancy in seeds that is maintained by an impervious hard seed coat. To disrupt physical dormancy, the seed coat must be broken by natural processes such as abrasion, nicking or through soil fungi; in propagation, hot water treatments are a common substitute. See also: ***chemical dormancy***, ***physiological dormancy*** (including: ***stratification*** and ***vernalisation***).
physiological dormancy	Dormancy in seeds that is imposed by the lack of initiation of a physiological chemical pathway in the seed. These can be broken in a number of ways; for example, ***after-ripening periods*** can be broken by the passage of time (maturation of the seed) and/or ***vernalisation***. See also: ***chemical dormancy*** and ***physical dormancy*** (including ***stratification*** and ***vernalisation***).
physiognomy	The descriptive terms used to describe the form, life-form and habit of a taxon that is used in some rainforest classifications where patterns are noticeable (most notably in Australia the system erected by Webb 1968).
Pi	Abbreviation: ***pioneer species***.
piezometers	A small diameter well used to measure ground-water depth. An easily constructed version is to auger a hole and insert agi-pipe: the ground-water flows into the well and then you can use a dry stick to measure the depth to the water table. This is important information for restoration sites where native vegetation has been removed and the habitat of a range of EVCs (ECs) needs to established for future planting (Chapter S2: Figure S54 and then for the result see Figure 7.4). See also: ***pasture maps***.

pioneers *pioneer species*	As the name suggests, the first plants on the scene to germinate and colonise the site after disturbance. They are the first in the ***primary succession*** race, which, if the site is left undisturbed, will in time finish with the regeneration of a mature ***rainforest*** composed of its ***primary species***. The race they run and the role they play is vital, but relatively short in duration. For a full definition see Chapter S4 (*Pioneer species*). Pioneer species have the following establishment requirements: • They colonise sunny gaps in rainforest (*eV* readings of 16–17); or • those with ***transitory shade*** (with long periods of sun from midday to afternoon). General: Their seeds are durable and long-lived, often being stored in the ***soil seed bank*** for decades, or even centuries, to await the next disturbance event that will see them regenerate *en masse*. Another important feature is that they have a short leaf-life and rapidly form leaf-litter: a significant ecological milestone for young rainforests. Examples include: Coast Wattle *Acacia longifolia* ssp. *Sophorae*, Sallow Wattle *A. longifolia* ssp. *longifolia*, Varnish Wattle *A. vernicaflua*, Tree Everlasting *Ozothamnus ferrugineus*, and Fireweed Groundsel *Senecio linearifolius*. Uses: Planted first, they are the ***nursery crop***s that shelter the more sensitive secondary and primary species from the extreme elements of full exposure: wind, sun, drought, fire and frost. See also: ***primary species*** and ***secondary species***, ***succession*** and ***successional planting***.
plant community	A generalised term for a defined association of plants that regularly occurs in a similar niche within a region or locality. See: ***ecological community*** and ***floristic community***.
plant community succession	A process whereby plant species establish on a site and change the ***habitat*** in some fundamental way that, in turn, makes it unsuitable for their own continued occupation of that space (Additional Reading: Plant community succession and how it all works: competition, changing soils, water depths and?). In so doing, their time on the site creates a new ***niche*** better suited to another species, which ultimately establishes and 'succeeds' the previous occupant. It is one of the most useful processes that can be harnessed by the rainforest restoration practitioner. There are two types of succession important in ***rainforest*** dynamics. The first is ***primary succession*** (Chapter S4: Figures S111–S114). Using an example from rainforest, pioneer species are sun, exposure and frost hardy and colonise open sites after disturbance. They shade and shelter the site from exposure, frost and sun. This provides conditions suitable for ***secondary species*** that can establish in the pioneer's ***light shade***. These secondary species are longer lived (wattles are a good example) and these in turn cast a deeper shade as they grow they. During their life-times, they attract birds and mammals that deposit seed (including mistletoes), while their large structure act as wind rakes to capture wind-borne seed of ***primary species*** (which are ***deep shade*** tolerant). In their shadow, these final mature stage rainforest species find niches ideal for their germination and the mature rainforest is born. In time, as the ***secondary species canopy*** senesces, the ***primary species*** canopy (and mature rainforest) takes over. Similar primary succession processes occur in coastal dune succession, where the changes are affected by shade, exposure and soils: older dunes being more sheltered and their soils lower in calcium and iron but much richer in organic carbon (Chapter S5: Figures S205–S209). These processes lead to plant ***community succession*** from Coast Dune Grassland to ***Littoral Rainforest*** (Chapter S5: Why proximity to existing bush is important). The second type of plant community succession that occurs in rainforest is: ***secondary succession*** and it occurs during the development and repair of canopy gaps. Gaps are repaired both by pioneer and secondary plant species that regenerate when the gap appears, but also when ***primary species*** that have germinated beneath the intact canopy are 'released' and rapidly grow to fill the gap. See also: ***pasture transformation***, ***pasture transformers***, ***primary succession***, ***secondary succession***, ***succession*** and ***successional planting***.
PlantNet	An online service composed provided by the Royal Botanic Gardens Sydney that provides a mapping service and other data sources to the public that plots the distribution of plant taxa in New South Wales. <http://plantnet.rbgsyd.gov.au/>. See also: ***Australia's Virtual Herbarium (AVH)***.
plate tectonics	A theory that helps to explain *Continental Drift*.
plutonic	Igneous (molten) rocks that form and solidify within the Earth's crust, to be later exposed by erosion.
pod	A dry ***indehiscent*** fruit opening along two lines (CRCfAW 2007a) e.g. a wattle pod.

pollinator	An animal that successfully transfers pollen from one flower to another to effect fertilisation of the embryo. Note, however, that species listed as pollinators in the planting Appendices: S6, S8 and S17 are recorded as consuming the nectar of flowers, but whether they successfully transfer of pollen (that ensures pollination) has yet to be proven in every case.
potaputkis	A foot-operated shovelling device that creates a hole for the insertion of tube stock plants. The device is used in friable soils and produces a poor fit between root ball and soil-surface, which is generally dealt with by stomping beside the planted tube stock to collapse the adjacent soil onto the plant's root ball. Great care must be taken when using this method of planting. In particular, the root ball must be firm and old (best suited to woody species rather than soft-rooted herbaceous species) since the act of dropping the de-potted plant down the shaft of the potaputkis into the soil can damage soft roots and the act of stomping can deform and damage the root ball further, leading to low levels of establishment. Compare with ***Hamilton Treeplanter***. See also: Chapter S6: Table S22.
potentially threatening process	A legislative description under Schedule 3 of the *Flora and Fauna Guarantee Act (1988)*: a process which could pose a significant threat to the survival, abundance and evolutionary development of any taxon or community of flora or fauna. Such a process is eligible for listing if, in the absence of appropriate management, it poses or has the potential to pose a significant threat to the evolutionary development of a range of flora and fauna. See also: ***key threatening processes*** or ***KTP***s for New South Wales and the Commonwealth.
potential vector transactions	The number of potential movements of seed via a ***vector*** (based on the known consumption of a particular species' fruit by a single vector) for a defined period. Used to gain an appreciation of the quantum of seed movements by particular vectors (see Appendix S4 worksheet: Honeyeaters). See also: ***genetic transactions*** and ***realised vector transactions***.
Pr	Abbreviation: ***Primary species***.
Precautionary Principle	Many of the concepts underpinning the Precautionary Principle pre-date the term's inception. For example, the essence of the Principle is captured in a number of cautionary aphorisms such as 'an ounce of prevention is worth a pound of cure', 'better safe than sorry', and 'look before you leap'' [10]. The Precautionary Principle may also be interpreted as the evolution of the ancient medical principle of 'first do no harm' to apply to institutions and institutional decision-making processes rather than individuals. <www.en.wikipedia.org/wiki/Precautionary_principle>. In terms of ***rainforest restoration,*** the definitions of the Victorian Coastal Council's 2008 Victorian Coastal Strategy (paraphrased from Principle 15 of the Rio Declaration (1992) state: 'where there are threats of serious irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation' <http://www.vcc.vic.gov.au/2008vcs/glossary.htm>. This is exactly our take on the Principle as we have applied it to rainforest restoration. Despite considerable pressure from some quarters in the beginning not to take action to restore rainforests because of a lack of knowledge, faced with ongoing degradation, the risks of doing nothing forced our hand. In other words, we could no longer be constrained by a lack of certainty or knowledge, before we set out on the road of learning about rainforest restoration. To relieve you of this problem, we have created this Manual and its principles (particularly ***intuitive ecology***) to guide you, so that you can learn how to do it along the way, which should (in deference to the Principle) minimise the harm you do to your site while learning how to repair and reverse the current inexorable decline in quality and extent of rainforest in south-eastern Australia. Things have to be done, decisions have to be taken and mistakes will be made, but these are one of the best ways of learning, so make a start and ***monitor*** your results, ***evaluate*** them and apply ***adaptive management*** to improve your methods and to help others as well. Where our interpretation of the Principle departs from its most common usage is that some damage may be done in the absence of full knowledge, but gaining that knowledge is more important in the long term because what we learn will be of much greater benefit to rainforest restoration in the future. See also: ***intuitive ecology***.
predator	An animal that kills and eats another animal***; seed predator***: an animal that consumes the endosperms (and therefore kills) the seed.
prescription	A set of instructions usually incorporated into a code of practice, as in 'rainforest prescriptions' in Victorian forestry practices, where a set of instructions on how big a rainforest must be before it is protected from logging and, if it is to be protected, how wide the buffer of non-rainforest vegetation must be.
Pre-1750s vegetation mapping (*Pre-1750s mapping*)	Vegetation mapping based on the knowledge of a ***damaged*** ecosystem's pre-existing structure, composition and functioning, derived from studies on comparable intact or partially intact ecosystems, information about regional environmental conditions, and analysis of other site-based ecological, cultural and historical information.

primary (mature phase) species	Primary or mature phase species are very different in their establishment requirements and the ***niches*** that they create in ***rainforest*** compared with ***pioneer*** and ***secondary species***. Primary species develop into what most people (perhaps even you) think to be rainforest: dark, moist and festooned with ***ferns*** and vines. The reality is though, without the earlier stages, it is like taking only the 60–100 year olds in our society and saying that is the sum of the human race. Clearly they are not, and ignoring the other earlier stages and species in rainforest establishment, renewal and persistence would be just as inappropriate when describing rainforest and considering rainforest ***ecology***. Primary species constitute the mature rainforest. The reality is, though, that there are few extensive areas composed entirely of primary species alone, because minor disturbances such as tree-fall or ***canopy*** death allow the ***late secondary species*** into these small gaps. Such gaps also 'release' the primary species seedlings that have previously established (and exist as small ***shrubs*** or saplings beneath the deep shade of the mature rainforest canopy). These mature phase primary species then have the ability to be able to quickly switch into growth mode and fill these small scale gaps in the rainforest's canopy. Importantly, these primary species have seedlings that are able to keep growing beneath the crowns of the secondary species because they only caste ***light*** to ***moderate shade***. In time, they gradually grow in size and gain strength. By the time that the secondary plants have begun to senesce and near the end of their live, the young vigorous primary species are ready to assume their role in closing out the canopy. If everything has gone to plan, by the time that the secondary species die, the canopy is virtually filled by the primary species that established beneath them. Primary species have the following characteristics: General: The seed of primary species is generally short-lived and must gain a foothold for germination almost as soon as it is shed. In contrast to all of the previous categories, primary species have long-lived leaves; some (e.g. White Supplejack *Ripogonum album*, Large Mock-olive *Notelaea venosa,* and many others) being maintained so long as to allow ***epiphylls*** and ***lichens*** to become established (Figures S109 and S110, respectively). Lastly, most primary mature phase rainforest species are intolerant of frequent catastrophic disturbance (especially fire) and are simply expunged from the landscape if such disturbance regimes are the norm. Examples of primary species include: Black Stem *Adiantum formosum*, Brush Bloodwood *Baloghia inophylla*, Prickly Currant-bush *Coprosma quadrifida*, Bolwarra *Eupomatia laurina*, Jasmine Morinda *M. jasminoides*, Jungle Brake *Pteris umbrosa*, Buff Hazelwood *Symplocus thwaitesii* and Lilly Pilly *Syzygium smithii*. Uses: These are the last stage species that complete the rainforest family: providing food and shelter to ***rainforest-dependent*** plant and animal species and must be included to complete the final phase of ***restoration***. Cf. ***pioneer species***, ***secondary*** species *and* ***succession***. See Chapter S4: Primary species (the race finishers that become the mature rainforest).
primary succession	In the context of ***rainforests***, the process of ***community succession*** that occurs in the absence of large scale or severe disturbance. In this process, continual germination or establishment of species contributes to species composition and ***abundance*** changes. This may occur in the absence of disturbance; for example, shade tolerant ***lianes*** germinating beneath the closed ***canopy*** and, over time, reaching maturity in the absence of disturbance. Alternatively, small-scale disturbances such as the senescence or ***wind throw*** of individual ***canopy trees*** may permit individuals that are already established beneath the canopy to fill the canopy gap. This process is used in rainforest restoration through ***successional planting***. See also: ***secondary succession*** and ***successional planting.***
propagule	Some part of a plant that can reproduce an adult plant. Examples include: fragments (leaves, stems, and roots), daughter plants and seeds.
provenance	The specific locality (and conditions) under which a particular plant grows and to which a specific individual is believed to be most adapted. It is certainly true in some cases, but in the absence of absolute knowledge, using provenance-specific plant stock reduces the risk of a mismatch between the collection site and planting site. By ensuring that the propagation material for a particular plant closely resembles the site into which it is to be planted or sown, you will maximise the chances of successful plant establishment because your genetic material is most likely to have the closest link to the conditions of the planting site. Some plants are narrowly adapted to the conditions in which they grow and will not prosper and can in fact die (see ***chlorosis***) if planted at a site whose conditions do not suit them. In contrast, other individuals have wider tolerances and will cope well even if the source provenance's conditions do not closely match those of the planting site. The problem for the propagator and the restorer is that such variation may not be visible in the plant, and may be hidden in an ***ecotype*** that looks the same in both cases: but which has very limited environmental or climatic tolerance. Failure to heed provenance could lead to planting failure. See: ***ecotype*** and ***phenotype***.

proximity	The distance between remnants. This is major factor in determining how many species will move to or stay in your ***restoration*** site if it is disconnected by cleared land or some other barrier of unsuitable habitat or distance. The larger the distance, the lower the ***dispersal*** rate from areas of natural bush. Some species such as Pied Currawongs move large distances [even over open sea to the forests of near-shore islands (Bowen Island 0.6 km off Governor's Point at Jervis Bay) or oceanic islands (such as Lord Howe Island, 700 km off the coast)] while others such as Lewins Honeyeater are loath to move through open country. See also: ***contiguity*** and ***Island Biogeography Theory***.
PV	Abbreviation: Parks Victoria
rainforest	In the context of this work, closed vegetation: where more than 70% of incident sunlight is intercepted by the ***canopy*** (*sensu* Specht 1970): dominated by non-eucalypt canopy species (though eucalypts may be present) and whose regeneration is not dependent on fire (see also: ***flood-mud regenerators***). More particularly, rainforests must specifically meet six criteria whose circumscription comes from three separate sources, as no single definition has been sufficient to both define rainforest ecologically or to delineate it in the field. Three of the criteria (CFL 1987) are: 1. 'Rainforest is defined ecologically as closed broadleaved forest vegetation with a more or less continuous rainforest tree canopy of variable height'[1]; 2. 'and with a characteristic diversity of species and life-forms'; and 3. 'Rainforest canopy species are defined as shade tolerant trees species that are able to regenerate below an undisturbed canopy, or in small canopy gaps resulting from locally recurring minor disturbance, such as isolated windthrow or lightning strike, which are part of the rainforest ecosystem. Such species are not dependent on fire for their regeneration'. The fourth criterion is as equally important for the ecological circumscription of rainforest. This definition was adopted by the Ecological Society of Australia (Dale *et al*. 1980), but was left out of the final Conservation Forests and Lands (CFL 1987) definition (Cameron 1992) for political and economic reasons. This criterion for rainforest definition used here forms part of the Society's ecological definition of rainforest: 4. Transitional and seral communities with ***sclerophyll emergent trees***[2], which are of similar botanical composition to mature rainforest stands in which sclerophylls are absent. This component is especially important for restoration ecology and the repair of rainforests. Additional components to the definition are provided by this work (and its literature review of available rainforest data) and help to circumscribe rainforests at the regional scale in south-eastern Australia: 5. Rainforests are composed of a floristically discrete and characteristic combinations of species (Appendix S6 worksheet: All species + FCs) that differentiate them from the surrounding sclerophyll (and usually fire-dependent vegetation) plant communities; and 6. They are composed of a characteristic and distinctive set of life-forms (Appendix S6 worksheet: All species + FCs). Rainforests are fire sensitive, and though some of their constituent species regenerate following fire, fire damages their structure and alters their composition. The primary determinants for the distribution in the landscape are the presence of a fire refuge (Bowman 2000), along with good soil nutrient status (for some types). Most rainforest types (***Subtropical Rainforest***, ***Warm Temperate Rainforest***, ***Cool Temperate Rainforest*** and ***Gallery Rainforest***) occur in moisture-conserving ***habitats*** such as ***montane*** plateaux, gullies, river flats, and south and east aspects. The rest (***Dry Rainforest***, ***Dry Gully Rainforest*** and ***Littoral Rainforest***) grow in non-moisture conserving ***habitats*** such as north- or west-facing gullies, dunes, cliffs, bluffs, rock screes, ridges and slopes that are protected from fire (to the point of being virtually fire-free environments). This fire protection is provided by one or a combination of: ***cultural fire protection***, ***ecosystem fire protection*** or ***landscape fire protection***. For this latter group, note the contradiction in drought-tolerance/moisture dependence conveyed by the adjective 'rain-' (see: Chapter S4: Bellbirds: rainforest-protectors? (particularly Figures S127 to S130); and Chapter 4: Rainforest expansion in a time of climate change). Rainforests are not dependent on fire for renewal and regeneration from seed. Useful characteristics for their circumscription (including habitat, key features, distribution and major differences from closest 'relatives') will assist you in your identification of each of the rainforest ecological vegetation classes in south-eastern Australia (Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia). Cf. ***dry sclerophyll forest***.

[1] At the time of the development of the Victorian definition, Littoral Rainforests were not recognised. Strict adherence to the forest criterion in stands that were not of forest height but which were floristically rainforest would have meant arbitrary exclusion of important data from stands right on the shoreline (i.e. Littoral Rainforest habitat). More weight was therefore given to rainforest composition than the concept of 'forest'. As a consequence, several rainforest stands as low as 3–5 m high and one of about 1 m in stature on Rame Head have been sampled for this work.
[2] It was suspected that many of these species might regenerate under rainforest disturbance regimes (i.e. in the absence of fire): to be later confirmed by this work, with landslips and flood-mud regeneration being important.

rainforest climate change arks	A concept whereby a suite of ***rainforest*** plants facing insurmountable ***migration barriers*** (that are at risk from the rate and scale of ***climate change***), would be translocated beyond their natural range to new sites where their old ***climate envelope*** now resides: the 'ark'. If the right combination of species is placed in the right climatic envelope, then they will disperse from the ark to colonise nearby rainforest ***habitat***. Note: at present, this course of action is not recommended, but proposed for discussion only as we come to grips with the scale and impact of climate change on the rainforests of the south-east. Because the risks of such actions could be catastrophic, it requires careful thought and agreement before such a suggestion is implemented. See: Chapter 3: The altitudinal and latitudinal shift in climate zones: facilitating climate change migration of rainforests, Chapter 4: Climate change: multiple threats, magnitudes and synergies, Additional Reading: Rules for climate change intercession across climate change barriers (Table AR22), ***climate change canaries***, ***climate change coloniser***, ***climate change freeways***, ***climate change immigrants***, ***climate change migrants***, ***climate change refugia*** and ***migration barriers***.
rainforest core	The interior of the rainforest that is devoid of specified edge effects. Edge effects operate at different intensities and over different distances depending on the edge effect, the nature of the edge, the agent involved and the structure and composition of the vegetation. As a consequence, defining the zone that is the rainforest's 'core' is contingent on the edge effect involved and the stand's context (Additional Reading: Edges (Table AR10). See also: ***edge effect***.
rainforest-dependent: *animals* *birds* *plants, etc.*	General definition: rainforest dependence is defined as an organism that relies on one or more aspects of ***rainforests*** for resources, which are essential to their life cycle in that locality. This more general definition is used when assessing species that have not been the subject of specific local studies, for which there is only more generic information available from the literature regarding diet and habitat. So, for example, Figbirds *Sphecotheres viridis* are considered to be rainforest birds in south-eastern Australia because their diet consists of many fruiting species largely only found in the rainforests of the region. Others such as Topknot Pigeons *Lopholaimus antarcticus* have rainforests listed as their main habitat and this corresponds with their observed distribution in south-eastern Australia. More specifically defined rainforest dependence has been developed based on local studies of rainforests. These include: • Rainforest-dependent birds: These are a specific subset of the general definition above, and its delineation is based on bird censuses of remnant rainforest and ***rainforest restoration*** sites on the lower Snowy River and elsewhere in East Gippsland (Appendix 1.1). These are birds that were only recorded in ***rainforest*** and in well-advanced rainforest restoration sites during the survey period. Such species include Lewins Honeyeater *Meliphaga lewinii* and Rufous Fantail *Riphidura rufifrons*. They appear to be reliant on rainforest for resource/s essential to their survival for some period or other during the year (Additional Reading: Bird breeding censuses). Such a classification may be site-, district- or study-specific whereby a bird that is classified as rainforest species at Lakes Entrance may have different ***habitat*** preferences to its cousins (of the same species) living at Tilba Tilba, for example. Compare this to generalist forest birds that have been similarly defined, but which occur in both rainforest and ***sclerophyll forest***. • Rainforest-dependent plants: These have been classified indirectly in this work through the assignment of rainforest fidelity for each taxon (Appendix S6 worksheet: All species + FCs) based on their distribution within and outside the rainforests of south-eastern Australia. Rainforest fidelity is assigned based on the distribution of a taxon within and/or outside of the region's rainforest. The four classes are: o Obligate rainforest plants: only occur in rainforest; o High fidelity rainforest plants: are usually restricted to rainforest, being only rarely found outside them; o Moderate fidelity rainforest plants: occurs regularly in rainforest but also in other non-rainforest EVCs; and o Satellite plants: are occasionally recorded in rainforest (and sometimes only one type) but occurs widely outside rainforest. As with rainforest birds, such a classification has been found in a few cases to be district-dependent, whereby a species has a particular fidelity in Victoria, but another in New South Wales. A good example is that of Scrambling Lily *Geitonoplesium cymosum,* which is an obligate rainforest species in Victoria, but only has a high fidelity in New South Wales where it is also found in Brogo Wet Vine Forest (Appendix S6). See also: ***high fidelity rainforest plants***, ***moderate fidelity rainforest plants***, ***obligate rainforest plants*** and ***satellite plants***.

Rainforest Divination Tool	A tool that is based on the collection of easily identifiable information from a locality of interest (e.g. a prospective ***rainforest restoration*** site that is partially or completely cleared), which relates to the distribution of ***rainforest*** in that landscape. The components of this information, along with any remnant species that may have survived, are given a weighted score, the sum of which (based on a graded scale) gives the lay observer (and rainforest restorer) some sound indication as to whether the locality has ever carried rainforest in the past. The Tool is important because it demystifies the 'divination process' by breaking down the relevant (but complex) ecological information that determines rainforest distribution across the landscape. For the process of working out what rainforest used to occur on your site, the Rainforest Divination Tool provides an alternative to ploughing through rainforest locality, ***EVC*** or ***FC keys*** and is a safeguard against your site not being listed in Chapter S9: Rainforest depletion in south-eastern Australia and its attendant Appendix S1 worksheet: Rainforest depletion.
rainforest gap	A break in the tree or vine canopy of rainforest where ***gap phase dynamics*** and ***secondary succession*** occurs as a result of greater exposure that increases light levels, wind frequency and strength, lowers humidity and increases temperature variation compared with beneath the intact rainforest canopy. See also: ***gap***, ***gap phase dynamics***, ***primary succession***, ***relay succession***, ***secondary succession, successional planting*** and ***successional stage***.
rainforest restoration	This is the purpose of the Manual. The process of rainforest restoration is set out as a series of ten steps. Restoring ***rainforest*** sites is context dependent and requires an understanding of its history, current condition, ***EVCs***, ***FCs***, ***ecological resilience*** and your resources. Rainforest restoration is enabled through the release of ***ecological brakes*** (e.g. ***weed*** control), wholesale planting 'from the ground up', through partial or ***enrichment plantings*** and other management techniques as dictated by the site's ***landscape context***, current condition, history, ***successional stage*** and ***restoration trajectory***. The following chapters have introductory and implementation material relating to rainforest restoration: Chapter 2 Understanding your rainforest and applying first aid, Chapter 3 Your rainforest and regional context, Immediate actions and site planning and Chapter 5 Choosing the method of restoration. See also: ***landscape analysis***, ***site assessment***, ***rainforest restoration methods (Clumped Mixed Canopy***, ***Framework***, ***Maximum Diversity*** and ***Natural Regeneration methods)***, ***restoration ecology***, ***restoration goals*** and ***restoration trajectory***.
rainforest restoration methods	One or a number of codified site management regimes codified into methods for restoring rainforest that use ecological principles (such as releasing ***ecological brakes***) and ***adaptive management*** to rehabilitate or recreate rainforests. See also: rainforest restoration method listings in Chapter 5: ***Clumped Mixed Canopy Method***, ***Framework Method***, ***Maximum Diversity Method*** and ***Natural Regeneration Method***.
rainforest type	A generic term applied to ***rainforest***s at different levels in a regional ***typology*** (i.e. ***ecological community***, ***floristic community***, ***ecological vegetation class***).
rainforest wattles	***Rainforest*** wattles do not explosively release their seed, but instead open their pods and dangle their black seeds from the end of a large and brightly coloured ***aril*** (Figures: S177 and S178; Chapter 3: Opener). The aril is oil-rich and this entices birds to do the plant's bidding by dispersing the seed far from the parent plant where, in time following disturbance, it may germinate. The seed may be displayed for up to 8 months in this manner (Figure S178). If the fruit-dispersing bird is a rainforest species, then it is highly likely it will fly elsewhere in the rainforest or to the next stand and deposit the seed there. Such ***directional dispersal*** of seed occurs across hundreds of metres (if not kilometres); in other words, the rainforest plant is finding its way to new rainforest ***habitats*** through the bird's habitat and feeding preferences (Chapter S1: Opener). Rainforest species with arils (and their attached seed) that are dispersed in this manner include: Lightwood *Acacia implexa* (principally represented in Subtropical, Dry and Littoral Rainforests), Frosted Wattle *A. frigescens* (from Cool Temperate Rainforest), Blackwood *A. melanoxylon* (principally represented in Subtropical, Warm Temperate, Cool Temperate, Gallery, Dry and ***Littoral Rainforests***), Coast Sallow Wattle *A. longifolia* ssp. *sophorae* and Sallow Wattle *A. longifolia* ssp. *longifolia* (both represented only in Littoral Rainforest) and Maidens Wattle *A. maidenii* (principally represented in Subtropical and Littoral Rainforests). Cf. ***random dispersal*** of ***non-rainforest wattles***.

rain green	A survival mechanism employed by some plants whereby they shed their leaves to conserve moisture during the dry season or periods of prolonged drought, only to resprout during more favourable weather. Local rain green deciduous species include: Kurrajong *Brachychiton populneus* (note the new regrowing red foliage in the photo on the right), Staff Climber *Celastrus australis* and Muttonwood *Myrsine howittiana*. Such species are usual in ***Dry Rainforests*** where this adaptation favours their survival in its hot and dry habitat. A full list is provided as annotations in Moisture niche worksheet of Appendix S6. It is important to note that this feature of individual species being rain green carries over into whichever rainforest EVC they occur provided the site becomes sufficiently water-stressed. So, for example, Sandpaper Fig *Ficus coronata* is rain green in Subtropical, Warm Temperate, and Littoral Rainforest, while Small-leaved Fig *F. obliqua* is rain green in Subtropical Rainforest and Littoral Rainforest during severe and prolonged drought. It has been observed that individuals of some rain green species (Red Ash *Alphitonia excelsa*, and Hairy Clerodendron *C. tomentosum* that are setting seed will retain their leaves even though all of their compatriots in the same stand have lost theirs. An interesting feature of this group of Kurrajongs at Nyerimilang in Victoria (right) is the regularity with which this new foliage is eaten by Rainbow Lorikeets *Trichoglossus haematodes* (previously noted as ***frugivores*** and ***nectivores***, but not ***herbivores***). This new rain green foliage appears especially attractive as it is not eaten when it is mature. A similar phenomenon is also recorded for the rain green species *F. fraseri* (a sandpaper fig) but the herbivore in this case being Grey-headed Flying Fox *Pteropus poliocephalus*.	

rainshadow	Literally a valley that is in a rain shadow: having substantially drier climate than the windward side of the adjacent range. This is usually caused by being on the leeward side of a mountain range or ridge that is subjected to moist prevailing winds whose rainfall occurs through ***orographic uplift***. By the time the air mass passes onto the leeward side of the range and the valley below, most of its moisture has been 'rung-out' by the mountain range forcing the moist air mass to rise and dump its moisture as rain or snow on the windward side of the mountain. Major rainshadow areas in south-eastern Australia include the Tambo River valley upstream of Ensay, the Buchan-Murrindal River valleys, the Snowy River valley upstream of Tulloch Ard, the Monaro Tableland, the Bega-Brogo River valleys and around Araleun. Some of these valleys are habitat for ***Dry Rainforests***.
random dispersal	***Seed dispersal*** that is random and usually not directional (i.e. explosive or using wind or gravity). For example, Sunshine Wattle *Acacia terminalis*, which is not a rainforest wattle (Figure S177), produces a seed that has a very small insipidly coloured adornment called a funicle. The seed is explosively shed from the ***pod*** on a hot early summer's day. This small funicle is very attractive to ants (but too small to gain the notice of birds) and encourages the ants to harvest the fallen seeds and take them into their burrows (effectively sowing them) where the funicle is chewed off for food, but the seed is left intact. Such dispersal is only metres distant from the parent tree, multidirectional and random. Cf. ***directional dispersal*** of ***rainforest wattles***.
raptor	Bird of prey: hawks, eagles, falcons, etc. (but not owls and their allies).
realised vector transactions	The number of potential movements of seed via a ***vector*** (based on the known consumption of a particular species' fruit by a single vector) for a defined period, where the movement has resulted in the establishment of the species involved. Used to gain an appreciation of the quantum of movements of seed by particular vectors required to produce a successful establishment of a plant species (see Appendix S4 worksheet: Honeyeaters). See also: ***potential vector transactions***.
recovery	An improvement in health or extent of a damaged ***vegetation type***. See: ***ecosystem recovery*** and also compare with ***replacement*** and ***transformation***.
recruitment	Recruitment is ***natural regeneration*** of species from plants or seed stores contained on the restoration site or from areas outside the site. There are two broad categories: ***continuous recruitment*** and ***episodic recruitment***.
reductionist approach	A useful approach that seeks to break down a complex whole into its component parts. It is an important method for understanding complex ecological systems at certain levels. All too often, however, the conclusions drawn from an understanding of a part of a system using this approach are misapplied as representing the function of the whole. This can lead to huge problems if such partial answers are applied unthinkingly to ***rainforest*** and landscape level restoration. In the latter form, it can be manifest as an immediate and reactionary management ***paradigm*** that requires maximum 'intervention or interference' at every step of the recovery process: one that fails to see the long-term restoration goal and the ***ecosystem processes*** that underpin a healthy natural landscape. Such misadventures can be both expensive and time consuming and are not appropriate to the task of ***rainforest restoration*** because they fail to understand the bigger '***systems*** picture'. For example, a reductionist approach ***logic train*** for the preparation of a site for planting pioneer species would be: you need to completely spray out a Kikuyu sward because it is a ***weed*** and you know that pioneer plants hate competition. In contrast, the systems approach would recognise the pitfalls: to blanket spray risks a failure to gain control of the site through establishment of a shady canopy that inturn exposes the soil and thereby sets off repeated annual and biennial weed seed germination (which will oblige you to use endless amounts of herbicide or labour to get the site back under control). The systems approach understands that 'a little is better than more' in this instance, and would require a trial first and then only spot spraying in order to establish the pioneer and ***secondary species*** (realising that their shade will weaken and kill the remaining Kikuyu). The systems approach is also less risky, because if your establishment of a shady canopy was to be only partially successful, you can always regrow your soil-protective ***cover crop*** of living Kikuyu mulch ready for another try. See also: ***systems approach***.
reference sites	A place of reference for the site you wish to restore. It may be relatively intact (or the best available) equivalent vegetation to the one that you intend to restore or it can have any level of disturbance. You should have a range of reference sites that have been disturbed by different means and are at different stages of recovery. This is important because you can deduce growth patterns and sequences for use in designing ***successional planting***s and learn the responses of vegetation to different types and levels of disruption. Such sites are used to determine the soil, inundation, temperature, floristic composition, structure, ***landform***, flooding regime, and climatic requirements of the vegetation that you want to repair or recreate. Such sites provide the ***benchmark*** towards which your efforts at ***ecosystem*** restoration are directed.

refuge *refugia*	A haven that provides respite for a particular species or plant community sheltering from some widespread landscape-scale feature or condition that threatens its existence or wellbeing. The context for the operation of refugia is both locality and species or plant community-specific. For example, ***riparian*** areas are considered ***climate change refugia*** in south-eastern Australia, because one of the forecasted impacts of climate change in the region is a significant drying associated with reduced rainfall, changed seasonality of rainfall (a reduction in rainfall over spring and summer) and higher evaporation. As a consequence, those species that rely on a currently widespread ***habitat*** or condition (in this case, high and reliable rainfall), will have to 'seek shelter' in the refuge offered by riparian systems (which it is believed will persist) during the coming travails of climate change. Conversely, on the Mid North Coast of New South Wales, rainfall is expected to increase. Thus freshwater wetlands in this region are not a climate change refuge for the species already present. However, given that most of Australia will face a critical shortage of such habitat because of the drying effects of climate change, such freshwater wetlands will act as climate change refugia for wetland dependent species at a ***continental*** scale. An example of a regional scale refuge is the presence of ancient emergent eucalypts within rainforests that usually avoid a crowing wildfire. Their cargo of mistletoes (which are fire-sensitive and die in such fires) are conserved in this refuge during wildfire events and can therefore recolonise the surrounding landscape between fire intervals. A striking example of a local refuge (ranging across only a narrow band metres wide) is that of Sea Box *Alyxia buxifolia,* which sustained Coast Mistletoe *Muellerina celastroides*, during the February 2009 extreme temperature event, Only those that were within 10-20m of the lakeshore and its evaporative cooler effect survived. See Additional reading: Extreme weather (Table AR13).
refugial hosts	A host-specific plant species that provides a refuge from a threat independent of its locality (c.f. ***refuge***). Depending on the threat, its severity, frequency and duration, not all host plant species can provide such refugia. A good example of this phenomenon is Coast Mistletoe *Muellerina celastroides*, which showed variable mortality rates at the same site for the same event which appeared to be dependent on the host. At sites without ***extreme temperature refugia*** characteristics, mortalities of 45-100% occurred where the host was Coast Banksia *B. integrifolia*. However, other hosts were able to sustain 100% of this species' population (even in ***full sun***) under the same conditions. These included Blackwood *Acacia melanoxylon* and on the ***non-indigenous*** Weeping Bottlebrush *Callistemon viminalis*. These hosts can be considered to be refugial hosts for Coast Mistletoe under extreme temperature event conditions. In this case, it is postulated that such refugial hosts could be able to sustain populations allowing recolonisation of the wider landscape if the intervals between these extreme temperature events are sufficient. See Additional Reading: Extreme weather, in particular: Impacts on mistletoes.
regeneration event	The event, and its causal factors, that leads to a new regeneration ***cohort*** including: rainfall and temperature for ***continuous recruitment***; and disturbance, light, heat and smoke for ***episodic recruitment***. See also: ***continuous recruitment***, ***episodic recruitment*** and ***soil seed bank***.
Regular Riparian Response Region	One unit of a landscape-scale classification system (based on bioregions) that denotes a region where natural regeneration events in riparian ecosystems (including associated rainforest EVCs) is both regular (as in germination) and successful (as in establishment of new plants that are successfully recruited to the population). This occurs because the climate is mild (temperature is not limiting) and rainfall is regular and reliable (water does not prevent establishment) and other extreme events such as frost or drought are moderate and irregular. East Gippsland is a Regular Riparian Response Region, whereas (for comparison) the Mallee is not.
regurgitation	In ***rainforest ecology,*** regurgitation is very important: e.g. the regurgitated pellet produced by a Pied Currawong is something from which we may learn a great deal. Chapter 3 Opener illustrates the ***dispersal*** statistics of this behaviour. Species other than those analysed in the opener include: Jungle Grape *Cissus hypoglauca* (25 seeds per pellet or potentially 800 per day) and Lilly Pilly *Syzygium smithii* (3 per pellet or 96 per day). However, the number of seeds dispersed is dependent on how big the fruit is, how big the seed is and the variability of these two factors within the one species (e.g. Lilly Pilly).
relay succession	The ***theory*** that there are a number of stages of regeneration within a specific plant community that can occur in response to disturbance. For example, pioneer species establish in ***rainforest*** gaps, followed by ***late secondary species*** and finally by ***primary species*** that repair the ***canopy*** gap and return the rainforest to the mature phase. See also: ***plant community succession***, ***primary (mature phase) succession***, ***primary succession***, ***secondary succession***, ***gap phase dynamics*** and ***truncated succession***.
replacement	In restoration, where the original EVC can no longer exists on the site and your ***restoration*** aims to restore the ***historic trajectory*** and return the ***pre-1750s vegetation*** to the site. Cf. ***recovery*** and ***transformation***. See also: ***restoration goals***.
resilience	An inherent strength or capacity of a system or species to resist an external force. See: ***Ecosystem resilience***.
restoration	An intentional activity that initiates or accelerates the recovery of an ***ecosystem*** with respect to its health, integrity and sustainability. Frequently,

	the ecosystem that requires restoration has been *degraded*, *damaged, transformed* or entirely *destroyed* as the direct or indirect result of human activities. In some cases, these impacts to the ecosystems have been caused or aggravated by natural agencies, such as wildfire, floods, or storms, to the point at which the ecosystem cannot recover its pre-disturbance state or historic development trajectory.
restoration ecology	The science that provides clear concepts, models and methodologies and the tools needed for *restoration* practitioners to undertake the restoration of *ecosystems*, *EVCs* and *FCs* that are degraded or have been lost.
restoration goals	Restoration goals (*sensu* Clewell *et al*. 2005), can vary according to the amount of information available to the project and the budget available: • *Recovery*: returning a *degraded* or *damaged ecosystem* to its former state. Most, or at least some, of the remnant remains so that it can be recovered by using the Natural Regeneration Method, perhaps with a little Framework Method to fill in the gaps; • *Replacement*: an entire ecosystem (entirely destroyed) has to be replaced: this can be achieved using *Framework* and/or *Maximum Diversity Method* followed by Natural Regeneration Method during the ongoing ecological maintenance period following ecosystem restoration; and/or • *Transformation*: Conversion of an ecosystem to a different kind of ecosystem to match today's site conditions because the historic site condition has been more or less permanently and irreversibly changed. This goal aims to restore a new (but *indigenous*) *ecosystem* that will match the current site conditions. For example, with altered salinity: where a historically freshwater river reach that would have once hosted *Gallery Rainforest* on the bank and *Warm Temperate Rainforest* on the levee is transformed (through restoration) to be Swamp Scrub on the bank and *Littoral Rainforest* on the levee. Any restoration method can be used, but it generally begins with Framework and/or Maximum Diversity. See also: *restoration trajectory.*

restoration trajectory	Where the site is (or can) go in terms of its *restoration*. The first aim is to return to the site's vegetation to the historic state (i.e. historic trajectory). If site conditions have changed so much as to make such an attempt impossible, then a *transformation* is required and a new site or restoration trajectory is required based on the site's condition today.
resurrection plants	Species that are able to survive droughts by dehydrating their leaves (but retaining them) and stopping *photosynthesis* and thereby reducing water loss. Once it rains again, they rehydrate and re-expand their leaves to begin photosynthesis. Such physiology is found in plants as diverse as *lichens*, *blue-green algae* and ferns such as Green Rock-fern *Cheilanthes austrotenuifolia*, Bristly Rock-fern *C. distans*, Narrow Rock-fern *C. sieberi*, Blanket-fern *Pleurosorus rutifolius*, Sickle Fern *Pellaea falcata* and Rock Felt-fern *Pyrrosia rupestris* that are found in *Dry Rainforests*. Cf. *rain green* plants.
revegetation	The general term for replanting an area and altering it from a less vegetated state to one with more (often woody) vegetation. Regularly used for converting eroded site to pasture, pasture to plantation, and pasture to shelter belt. This term as it is generally applied, is usually a simplified planting of low *diversity* that does not necessarily take into account the previous natural vegetation that once occupied the site, nor is it the aim of revegetation to restore it. For a comparison of the features of revegetation, restoration and gardening, see Chapter S8: Genetics and sourcing plant propagation material.
reverse transpiration	A process whereby plants take in moisture condensed on their leaves and release it through their roots overnight. This process is thought to assist the *symbiosis* between a plant and its *mycorrhizal fungi*.
riparian	Of, or influenced by, streams, including their floodplains; the processes that occur there as well as its vegetation and fauna. Cf. *riverine* and *estuarine*.
riverine	Closely associated with a river's course and its water e.g. *Gallery Rainforest*. Cf. *riparian*.
riverine cliff	A cliff produced by undercutting erosion of a river against its valley side (Additional Reading: Figure AR38). Cf. *marginal bluff* and *sea cliff.*
rhizomatous plants	Plants that produce colonies through their habit of developing creeping stems that send up shoots at intervals. Common in groups such as ferns, forbs and grasses.
rhizosphere	The root zone in soil profiles.
rocket pot	A large and ingenious round pot that encourages air-pruned roots and prevents root binding in advanced plants. Usually used for advanced trees or rare and threatened species that require special nursery attention before being planted out. See also: *forestry tubes*, *hikos* and *super tubes*.
ROKAMBA	Acronym: Republic of Korea-Australia Bilateral Migratory Bird Agreement providing legal protection to both these migratory species and their

	habitat in each country of the parties to the agreement. See also: *CAMBA* and *JAMBA*.
root coppicing	See: *coppicing* and *ecosystem engineers*.
ROTAP	Acronym: Rare or Threatened Australian Species. Cf. *VROTs*.

salt haze	For the purposes of this work, salt haze has the characteristics of those listed in the references below but is more often a damp haze than a dry haze, coating vegetation (and the observer) with a clammy salty atmosphere (Additional Reading: Salt and dust hazes atmospheric accession and dry deposition; Figure AR14). In the definitions of salt haze given below, those features that have been observed along the coastline of the study area where **Littoral Rainforest** communities occur are in **bold**: • **Suspensions in the atmosphere of minute dust** or **salt particles that are not individually seen but that nevertheless reduce visibility.** So-called damp haze and dry haze produce different optical effects because the particles of each are of different sizes, with the dry haze particles being smaller. Damp haze may develop from dry haze when water condenses on moisture-absorbing dry haze particles. (Columbia Encyclopaedia 6th Edition 2001). **It is likely both damp and dry salt hazes are present in the study area, as sometimes only the optical effects are noticed while at other times, both the observer and objects exposed to the haze become damp;** • Salt haze has the following characteristics: o **It is most prevalent during the summer and early autumn;** o **Its colour is bluish white** (when the sun is behind the observer) ranging through to a straw colour when the observer looks through the haze into the sun at a low azimuth, as opposed to the brown or red of a dust haze; o **Salt haze scatters and reflects light rays much more than does dust haze;** o Salt haze sometimes extends to over 12,000 ft and has been reported up to 20,000 ft; o **Surface visibility in salt haze may be as high as 4-6 nautical miles;** o Salt haze is sometimes thicker aloft than at the surface; o **Salt haze is most likely to develop in a stagnant air mass when there is a lack of mixing. It is especially prevalent when there is a strong ridge (an anticyclone or high pressure system) present at the surface and aloft** (Navel European Meteorology and Oceanographic Centre <https://www.nemoc.navy.mil>); and o **Consists of fine salt particles in the air, too small to be individually apparent, but in sufficient number to reduce horizontal visibility and cast a bluish or yellowish veil over the landscape, subduing its colours and making objects appear indistinct.**
sand river	Rivers whose sediments are dominated by sands, as apposed to those with silts or clays. Examples include the Snowy, Genoa, Bega and Brogo Rivers (Chapter S1: Figure S15).
satellite species	In the context of rainforest species composition, species that only occasionally occur in rainforests (and then sometimes only in one type), but which are also widespread outside of rainforests. These species have very low fidelity to rainforest. See Appendix S6 worksheet: All species + FCs for rainforest fidelity ratings. See also: *obligate rainforest species*, *high fidelity rainforest species*, *moderate fidelity rainforest species*.
scat	A generalised term for animal excrement. Useful in rainforest restoration for the information they contain (which animal deposited it), correlations with natural regeneration or damage, etc. One of the major mechanisms for the dispersal of rainforest plant seed.
sclerophyll	In the context of this work, a term to indicate *non-rainforest* plant species and vegetation that is largely fire-dependent for its regeneration.
Scrambler	A vine without specialised climbing adaptations. Local rainforest examples include: Sea Box *Alyxia buxifolia* and Seaberry Saltbush *Rhagodia candolleana*. These species use their stiff stems to grow to a height beyond which their spindly branches could normally support their weight if it were not for the support of another woody plant (usually a tree).
scree	A collection of loose rock at the base of a cliff or bluff. See the figure for *sea cliff*.
scrub	A New South Wales term for an extensive and more-or-less continuous area of *rainforest*. For example, the Big Scrub in the in northern New South Wales. Not to be confused with the Victorian use of the term, which describes any thick impenetrable thicket of *shrubs* or small trees: hence Blackthorn Scrub, Headland Scrub, Swamp Scrub, etc. The term scrub in Victoria does not mean rainforest, just low thick bush. *See also: brush* and *jungle*.

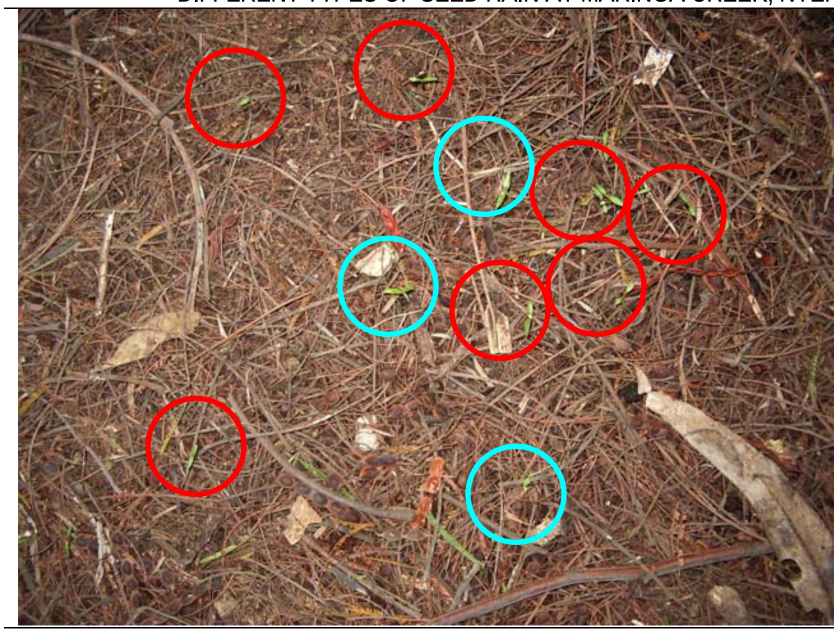
sea cliff	A cliff or bluff still on the sea coast, often, but not continuously, eroded by the wave action of the sea. Those that are not continuously eroding are called ***marginal bluffs*** , which provide excellent ***habitat*** for ***Littoral Rainforest***. Examples of sea cliffs include 90 Mile Beach between Lake Bunga and Lake Tyers in Victoria (Chapter S5: Figures S195–196) and Breakaway Beach Bermagui in New South Wales. Cf. ***marginal bluff***. See also: Chapter S5: Figure S193–194
	
	Mimosa Rocks National Park, New South Wales. Here the sea cliffs are marked by the bare rock near the sea (being too frequently eroded to allow for the establishment of vegetation. At the foot of the observer, is a ***marginal bluff*** that is several hundred metres high and partially clothed in rainforest. The middle right of the photo shows extensive Littoral Rainforest development on the marginal bluff's subtending rock ***scree*** (with uncolonised areas appearing as grey patches between the rainforest stands).
secondary colonisation	In reference to colonisation of mistletoes onto other areas of the host upon which you first planted them, or onto other plants and other species: an aspect of ***natural regeneration*** following your first plantings (Additional Reading: Figure AR64).
secondary growth	***Rainforest*** regrowth dominated by ***secondary species*** that follows significant disturbance (fire, flood, logging, drought, land clearing and agricultural

	abandonment of cleared land), which provides important ***habitat*** for a range of plant and animal species such as Fantail Cuckoos *Cacomantis flabelliformis* (Higgins 1999). See also: ***greenfield regeneration*** and ***oldfield scrubs***.

secondary species	As their name suggests, they are the second to come on to the scene and establish. They most often do so as a result of large-scale disturbance in the presence of the ***pioneer species*** that supply the shelter from the elements that they need to establish. The secondary species are the middle distance runners of the ***succession*** race. These species have an intermediate life-expectancy: living longer than pioneer species, but generally shorter than the ***primary species*** in the same ***life-form*** category. For a full definition see Chapter S4: Secondary species. General: Their seed has varying longevity, with species such as wattles lasting decades, if not centuries, and those that are wind-dispersed such as Coast Banksia *B. integrifolia*, dying within the year after being shed. Each group employs a different strategy after disturbance: those with long-lived seed await the next disturbance in the ***soil seed bank***; those with short-lived seed rely on having ripe seed on the plant within ***dispersal*** distance of the new ***niche***, at the time of the seed being shed. Secondary species are believed to have life-expectancies for their leaves that are intermediate between pioneer species and primary species. Secondary species can be further divided into two groups: • *Early secondary species*: these species establish in ***light shade***, but because of their diminutive life-form (***shrubs***, grasses or ***ferns***) compared with the rest of the forest, they are unable to compete when moderate to ***deep shade*** develops as ***rainforest succession*** moves towards the climax state (a ***canopy*** dominated by the light impermeable crowns of the primary species). • *Late secondary species*: These plants are usually long-lived trees or vines that may persist on the site for decades after the initial disturbance event that allowed them to germinate and establish. They accommodate their need for light by being big enough, in the case of trees, or agile enough, if they are vines, to be a part of the canopy. Examples of early secondary species include: some grasses: Sword Tussock-grass *Poa ensiformis*, Common Tussock-grass *P. labillardierei*, and ferns such as Downy Ground-fern *Hypolepis glandulifera* and Harsh Ground-fern *H. muelleri* (compare these with primary species in the same life form categories under the definition of pioneer species). Examples of late secondary species include: Black Wattle *Acacia mearnsii*, Blackwood *A. melanoxylon*, Red Ash *Alphitonia excelsa*, Black Wattle *Callicoma serratifolia*, Brush Kurrajong *Commersonia fraseri*, Southern Kurrajong (Blackfellow's Hemp) *C. rossii*, Giant Stinging-tree *Dendrochnide excelsa*, Dubosia *D. myoporoides*, Guioa *G. semiglauca*, Gippsland Hemp Bush *Gynatrix macrophylla*, Pencil Cedar *Polyscias murrayi*, Hazel Pomaderris *Pomaderris aspera* Uses: Secondary species are bigger and longer-lived, and so have a role in providing shelter and niches for the establishment of slower growing primary species and the development of the mature rainforest canopy which (when young) are sensitive to full sun and frost).
secondary succession	In the ***rainforest*** context, the process of ***community succession*** that occurs as the result of severe disturbance such as fire, landslips or widespread storm damage that disrupts the closed ***canopy*** of the rainforest over wide areas, or on smaller scales in smaller gaps or as the result of ***canopy attrition*** and ***canopy decapitation***. This event sets the clock back for the mature rainforest (but not to zero). Pre-existing species recover (resprout) and others in the ***soil seed bank*** germinate (and, in time, others disperse to the site on the wind, in water or via animals ***vectors***). The pioneer and ***secondary species*** occupy these disturbed ***niches*** and are generally dependent on higher light environments such as along rainforest margins and in sunny rainforest gaps that are more exposed compared to the requirements of ***primary mature phase species*** that are able to germinate under the mature closed canopy. See also: ***relay succession***, ***succession*** and ***successional planting***.
seed dispersal	The movement of viable (able to germinate) seed from locality to another (CRCfAW 2007a) by one or more ***vectors***.
seed dispersers	Animal species [birds, mammals and insects, (mostly ants, in south-eastern Australia) and sometimes fish (though the latter, is not known from this region] that move viable seed from the parent plant or its surrounds to another place and deposit the seed in a viable condition. The plant–animal transaction occurs for the fruit, funicle or aril's nutriment (rather than the food value of the endosperm), which is left intact. Cf. ***seed predators***.
seed dormancy	A protective mechanism in plant seed that ensures that the germination of the seed occurs under optimum conditions. Seed dormancies can include ***after-ripening periods***, ***chemical dormancy***, ***physical dormancy***, ***physiological dormancy*** and ***vernalisation***. Some seeds have ***multiple seed dormancies***, each of which must be broken in turn for the plant's seed to germinate. See also: ***after-ripening periods***, ***chemical dormancy***, ***physical dormancy, physiological dormancy, stratification, vernalisation*** and Rainforest Plant Propagation Manual for south-eastern Australia.

seed predators	Animal species (birds, mammals and insects in south-eastern Australia) that collect viable seed from the parent plant or its surrounds and move it to another place and deposit the seed in an unviable condition as a result of their feeding habits. The food value for seed predators is derived from the endosperm the consumption of which, kills its germ-plasm resulting in dispersal failure, rather than consuming the fruit and leaving the associated seed unharmed, which would have successfully disperses it. Cf. *seed dispersers*.
seed rain	The ongoing fall of seed onto and into the ***rainforest*** stand that is delivered through animals (reptiles, birds and mammals), machinery, wind, water or gravity (see ***seed dispersal***). Seed rain, like rainfall itself, is not uniform. One of the best ways of concentrating seed rain is to have a perch. The seed rain is further enhanced if your perch has an attractant such as dense foliage, nectar, fruit or honeydew (Appendix S6 worksheet: Honeydewers). Alternatively, seed rain can be concentrated by behaviour, such as the need to drink (Chapter 4: Opener), or the return of an animal, herd or flock to a particular roosting site time after time. The pattern of seed distribution can be characterised as ***diffuse seed rain*** or ***concentrated seed rain*** (see below). Cf. ***spore accession***.

DIFFERENT TYPES OF SEED RAIN AT MARINGA CREEK, NYERIMILANG VICTORIA IN 5 YEAR OLD FRAMEWORK RESTORATION



Diffuse seed rain: typical of regurgitated pellets that have fallen through the canopy and been scattered by their collision with branches on the way to the ground. The effect of seed scattering can also be achieved from the more ***concentrated seed rain*** of intact ***scats*** (Figure right and below) that have been subsequently disturbed by the scratchings of other animals or water movement across the site. The seed rain illustrated in this Figure contains ***germinants*** of Sweet Pittosporum *P. undulatum* (blue circles) and Seaberry Saltbush *Rhagodia candolleana* (red circles).

Concentrated seed rain patterns are indicative of bird and/or mammal origin. The concentrated seed rain (green circle) is one or a combination of: *Solanum aviculare*, *S. laciniatum* or **Solanum nigrum* spp. agg., which are usually dispersed by birds and some mammals. Mass germinations such as these lead to few individuals surviving as the previous germination of Seaberry Saltbush (red arrow) and Tree Violet *Melicytus dentatus* (yellow arrow) illustrate. This site is a bird roost. The lower cluster (purple circle), however, is likely to be from mammal dispersal because the germinants are Bidgee-widgee *Acaena novae-zelandiae,* which is usually brought on to sites on the fur of an animal or the clothes of a human where it is preened off and deposited ready for germination. ***Diffuse seed rain*** is also evident everywhere else in this image.

Wombats disperse rainforest seed. This is a fresh wombat ***scat***. Note the ***diffuse seed rain*** germination of Seaberry Saltbush from another earlier seed rain event to the right of the scat (red circle) .

Wombat scat from the previous summer. This scat contained Seaberry Saltbush which has germinated in one event (blue arrow) and is another example of ***concentrated seed rain***. Red circles indicate ***diffuse seed rain*** containing the same species.

seed rain (cont'd.)	 Seed rain comes from many sources. In this image, there are animal-dispersed species including Seaberry Saltbush (red circles), Solanums (green circles) and possibly Nodding Saltbush *Einadia nutans* (blue arrow); there are wind-dispersed seed such as *Senecio* (red arrow) and possibly *Clematis* (orange arrow); the seeds of two explosively dispersed plants: *Oxalis* (orange circle) and *Acacia* (black circle); and one species dispersed by animals on their fur: Slender Dock *Rumex brownii* (yellow arrow). Many of these species can persist in the ***soil seed bank***. The seed rain in an area of less than 0.25 m^2 comprises seven species in all, from a variety of sources, dispersal distances, timing and ***vectors***! It comprises sixteen ***germinants*** and only from four separate germination events. Imagine what could take place over a year in a fully mature rainforest.

self-extinguishing	The ability of ***rainforest*** (under some circumstances) to self-extinguish wildfires. This ability is conferred by a combination of features that include: their ***fire shadow*** habitat, the low flammability of the foliage most of its ***primary species*** (see below and Additional Reading: Ignition times); their often moist humid niches; an abundance of water; their closed canopy (and consequent high sub-canopy humidity and fine fuel moisture content); low ground fuels (Additional Reading: Leaf litter); breaks in fuel ladders; a lack of flammable bark and similar features of their ***secondary species*** and those that occupy the fire-suppressant ecotones. Some types, such as Littoral Rainforest, can have salt-encrusted fuels, which are less flammable than those without salt. See also: Additional Reading: Ignition times.
	 Reefton Spur, Victoria. Even in the face of a crowing wildfire that consumed the foliage of all of the surrounding eucalypts, the low flammability of this Myrtle Beech *Nothofagus cunninghamii* canopy left it scorched but unburnt. This is one of the features that assist rainforest in resisting fire and, when many such trees congregate together, the rainforest stand at some sites can withstand high-intensity wildfires.  Reefton Spur, Victoria. The raging Black Saturday wildfire crowned up the ridge from the south less than 100 metres behind the photographer. The change in topography reduced its intensity as it moved north onto the plateau, but it still remained a substantial understorey fire with flame heights of tens of meters as it burnt into the Wet Forest in the foreground next to the rainforest. Then it entered the margin of the Cool Temperate Rainforest dominated by Myrtle Beech and was self-extinguished by it. Note: as far as is known, no human fire suppression occurred at this site.
sensu	*Latin* for: 'in the sense of' (something else, another persons work or description).
sequential hollow use	It is widely reported in eastern Australia that individual hollows (particularly in eucalypts) are used sequentially by different animals: one species of parrot followed by another, then a possum, for example. This greatly increases the value of individual hollows for a wider range of species.
seral stage	See: ***successional stage***.

severe stochastic event	A disturbance for a particular site and for a particular *EVC* or system that is large by everyday measures. Rivers, for example, produce multitudes of *freshes* and minor floods, but it is the catastrophic floods that are the severe stochastic events that usually shape both the river systems and the vegetation (including *rainforests*) that grow along them. Rather than the everyday average disturbance regime and *climate*, it is these severe stochastic events that most often determine the distribution, structure and function of *ecosystems*. The reason for this is that plants and animals have specific tolerances for fire frequency and severity, minimum and maximum temperature and periods of inundation, etc. When a severe stochastic event occurs, these tolerances are exceeded and major changes to structure, composition and function of the affected system occur (compare Chapter S6: Figure S239 with Figure 3.9). Severe stochastic events can re-set the successional clock or change the vegetation type (see below). See also: *succession*, *successional stages*.
	
	Nobby's Beach, New South Wales. Severe storms in 2009 blew saline foam across this Littoral Rainforest (right to left) producing a fire-like affect, with much of the damaged area returning to Themeda Headland with the aid of a subsequent fire. Photo: Thor Aaso.

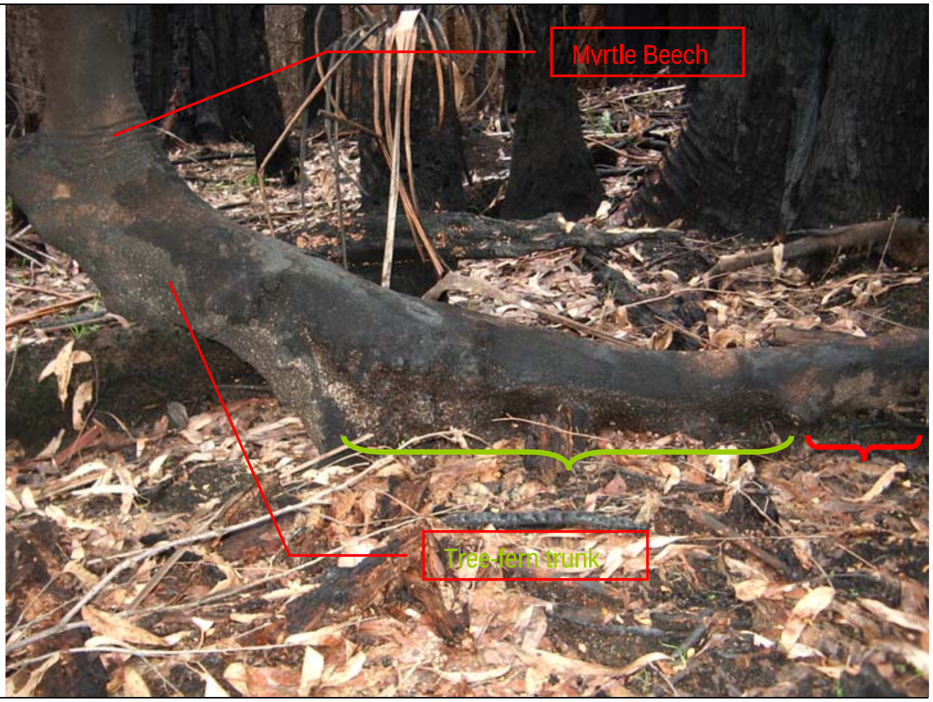
shade definitions (eV)	*Shade*: any place shielded from ***full sun***. ***Full shade***: continuous shade of any level: light, moderate or deep that persists for the whole day; ***Transitory shade***: a gap or area that has full shade at some time and full sun at other times; ***Deep shade***: eV 4–9; ***Moderate shade***: eV 10–12 ***Light shade***: eV 13–15; ***Partial sun***: eV 15; and ***Full sun***: a place that is never in shade, though the light levels in summer for Victorian latitudes will vary from eV 12 to >17 (being above eV 17 between 09:30hrs and 17:30hrs).
shade weed	A weed species adapted to living and thriving in ***full shade***. Wandering Jew **Tradescantia fluminensis* is a good example.
shrub	A woody ***life-form*** with multi-stemmed habit.
sinks	A place where nutrients are retained on, rather than exported from, a site (Chapter S2: Figures S52–S57). Cf. ***nutrient traps***.
site assessment	The process of systematically examining a site for remnant species, ***weeds***, ***ecological brakes*** and ***ecosystem resilience***. Site analysis forces the rainforest restorer to logically and systematically examine all of the elements of the site's history, current condition and future prospects. By doing so, a works calendar and priorities can be developed that will ensure the most efficient path to ***rainforest restoration*** and recovery for the site. See: Chapter 7: Site assessment and project planning and Appendix 7.1: Site assessment *proforma*.
s.l.	Abbreviation: *sensu lato*. *Latin* for in the broadest sense used to describe a taxon that has a great deal of variability contained within it that is subsequently divided into several other ***taxa*** after taxonomic revision. Cf. ***s.s.*** (***sensu stricto***).
sleeper weeds	Weeds that are introduced that currently have a limited distribution, but which have the potential to become significant weeds (Scott 2009). See also: ***background weeds***, ***transforming weeds*** and ***weed alert species***.

snags	Woody material that has fallen into a stream. It provides habitat for the aquatic ecosystem and acts like reinforcing in concrete to reduce the rate of water scour in the stream bed (Chapter S2: Figure S89). The removal of snags (***de-snagging***) has catastrophic impacts for the river (Chapter S2: Figures S88 and S90). The significance of rainforest in this process is that it is often the vegetation lining the stream that supplies these trees that become these all-important snags. Likewise, it is the first to be destroyed by the resultant erosion after de-snagging.
social contract	The pact that you make with your community that enable your restoration works to be undertaken. This provides you with a ***social licence*** (or permission) to do your project. These contracts are well worth spending time on: failure to do so will mean that your project will not have the support of the community in which you work. Clearly you need these contracts to have successful projects, ones that are valued, defended and conserved by the community who become the stewards of these sites into the future.
social license	This is your community's consent for your ***restoration*** plans. This permission will happen if you have been able to engage them in a way that informs, involves and empowers them so that they can understand why ***rainforest restoration*** in general is important, and why your restoration project in particular has merit for the site on which you propose to do it. The social license is important because it represents community ownership. This gives your project community standing and acceptance, and thereby provides your restoration site with a high level of future security so that it can grow, evolve and prosper. See: ***social contract***.
soft-engineering	In the ***rainforest restoration*** context: the use of vegetation to protect an asset (built or natural). Cf. with ***hard engineering***.

soil seed bank	The accumulated regeneration potential of species with long-lived seeds that are stored in the soil until the right conditions for their germination can occur. This includes any species whose seed does not immediately begin germination on contact with the soil. In south-eastern Australia, soil seed storage may last for as little as 4-9 months (as is the case with Tree Violet *Melicytus dentatus*), whose seeds are deposited in the soil seed bank between December and April ***vernalised*** over winter, which then ensures germination in August–September. For daisies and wattles, the storage period may stretch to a century or more. The accumulated wealth of past generations and their deposits into the soil seed bank from previous flowering and seeding seasons are released either wholly or partially in a ***regeneration event*** that may include species that have never been seen on the site in living memory. Regeneration events can occur at any scale and are dependent on the disturbance type. Small-scale disturbance includes scratching of animals and localised landslips, while larger scale disturbances include flooding, storm surges, ***tsunamis*** and fire. There are a wide range of plant families and genera involved in rainforests in south-eastern Australia that are known to store their seed in the soil seed bank including: Apocynaceae (sea box), Araliaceae (elderberry panax and possibly pencil cedar), Asphodelaceae (bulbine lilies), Asteraceae (daisies, daisy-bushes, cassinias, everlastings Indian weed, New-Holland daisies), Aizoaceae (spinaches), Brassicaceae (bitter-cresses), Caryophyllaceae (starworts), Chenopodiaceae (saltbushes), Convolvulaceae (bindweeds), Cucurbitaceae (cucumber), Cunoniaaceae (black wattle), Cyperaceae (saw-sedges, sword-sedges), Dillenaceae (guinea-flowers), Elaeocarpaceae (oliveberries), Euphorbiaceae (bitter-bushes, bleeding-hearts, spurges, turpentine and wallaby bushes), Fabaceae (peas: bitter-peas, coral-peas, glycines, gold-tips, indigoferas, senna, tick-trefoils), Geraniaceae (geraniums, pelargonium), Goodeniaceae (hop-bushes), Haloragaceae (raspworts), Lamiaceae (cocks-spur flowers, mint-bushes), Malvaceae (hemp bushes, howittia, lantern bush), Myoporaceae (boobiallas), Passifloraceae (passionfruits), Phormiaceae (flax-lilies), Pittosporaceae (apple-berries, bursarias, pittosporums), Polygonaceae (lignums), Portulacaceae (pigweeds), Proteaceae (geebungs), Rhamnaceae (pomaderris, red ash), Ranunculaceae (buttercups), Rutaceae (correas, phebalium, satinwood, yellowwoods, zierias), Santaliaceae (cherry ballarts), Sapindaceae (guioa, hop-bushes, native quince, native tamarind), Solanaceae (corkwood, devil thorn, kangaroo apples, nightshades, tobaccos), Sterculiaceae (brush kurrajongs, velvet bushes), Thymeleaceae (rice-flowers), Ulmaceae (poison peaches), Urticaceae (nettles, pellitory), Violaceae (violet, tree-violet). See also: ***continuous recruitment***, ***episodic recruitment***, ***regeneration event*** and ***vernalisation*** and Appendix S18 worksheet: Indigenous species.
solarisation/solarising	A weeding treatment technique where either clear plastic sheeting is placed directly over ***weeds*** *in situ* to overheat them and kill them using solar UV radiation concentrated through the plastic; or a collection of weeds that are either bagged or covered by black plastic so that the heat of the sun and a lack of light kills the covered weeds and turns them to ***mulch***.
south-east trade winds	See ***trade winds***.

sp.	Abbreviation: for species (singular).
splatter-gun spraying	A technique for herbicide application whereby a blob of herbicide is 'lobbed' at wide spacings onto the foliage of a highly herbicide sensitive species that will ***translocate*** this splatter throughout the plant and kill it, thereby conserving whatever other native species are mixed in or occur below its ***canopy***. It is most useful on species which form large rambling plants that overtop native species. Used with great success on the ***transforming weed*** Lantana **L. camara* and is worth trying on Bitou **Chrysanthemoides monilifera* ssp. *rotundata* and Blackberries **Rubus fruiticosus* spp. agg. Cf. ***over-spraying*** and ***jetting***.
spore	A single-celled reproductive structure inside a strong outer coat that is capable of hibernating for extended periods until suitable germination conditions arise. Typically found in mosses, liverworts, fungi and bacteria, spores are the equivalent of seeds in higher plants. See also: ***flood-mud regenerators*** and ***spore accession***.
spore accession	The capture of the dust-like atmospherically-borne spores of a range of organisms by vegetation, including rainforest. The dispersal mechanisms are varied and include explosive, wind, water and fauna. Unlike seed rain, which is much more visible, spore accession happens at the microscopic level and goes largely unnoticed (though it is very important in rainforest ecology). Often the first evidence of successful spore accession is the germination of the spores of a range of plants (Appendix S5: Figures: AS5–5 and AS5–8); the germination of other more cryptic ***taxa*** such as fungi is much less obvious. Spore accession is very important in rainforests because it adds greatly to their diversity as well as contributing many ***functional groups*** (decomposers, parasites and nitrogen-fixers) and life-forms upon which rainforests in general and their attendant biodiversity depend. These include: • Algae, which includes both free-living species (most obviously seen as the lemon yellow wash on tree trunks and limbs), and also in symbiotic partnership with fungi that leads to the creation of lichens; • Bacteria whose roles are varied and include pathogens, adjuncts to digestion, decomposition, nutrient cycling and nitrogen fixation (such as in wattles); • Blue-green algae, which are a group related to bacteria that can ***photosynthesise*** while some can fix nitrogen, a subgroup of which are symbionts that occur in lichens (especially the genus *Nostoc*) and in the roots of she-oaks and coralline roots of Cycads (*Macrozamia communis* in south-eastern Australia); • Ferns, which are typical rainforest life-forms; • Fungi (free-living and symbiotic types), which through decomposition are the foundation for the tight nutrient cycles that typify rainforest ecosystems; these, in turn, maintain lower ground fuels that keep fire risk lower (Additional Reading: Leaf litter: rainforest versus adjacent non-rainforest communities). Fungi also contribute to the formation of humus (which retains soil moisture and ensures nutrient cycling) as well as providing the species that develop ***mycorrhizal*** fungal associations. The fruiting bodies of these 'truffle-like' fungi are major diet items for rainforest mammals such as the regionally ***endemic*** Long-footed Potoroo *P. longipes*, Long-nosed Potoroos *P. tridactylis* and Long-nosed Bandicoots *Perameles nasuta* which in turn spread their spores. Other symbiotic fungi provide the structure of lichens that house the single-celled algae that make food for themselves and their fungal hosts. Some lichens also fix nitrogen with the aid of blue-green algae. Many lichens are used by birds for nest camouflage; • Liverworts, which are common in rainforests and grow on rocks, trees and damp ground. Two types are recognised: leafy (that look superficially like mosses) and thallose (that look like some lichens); and • Mosses, which are common in wetter localities and retain moisture and organic matter that underpins whole ecosystems within these tiny worlds. Many species are important to birds for nest construction materials and others for nest camouflage.

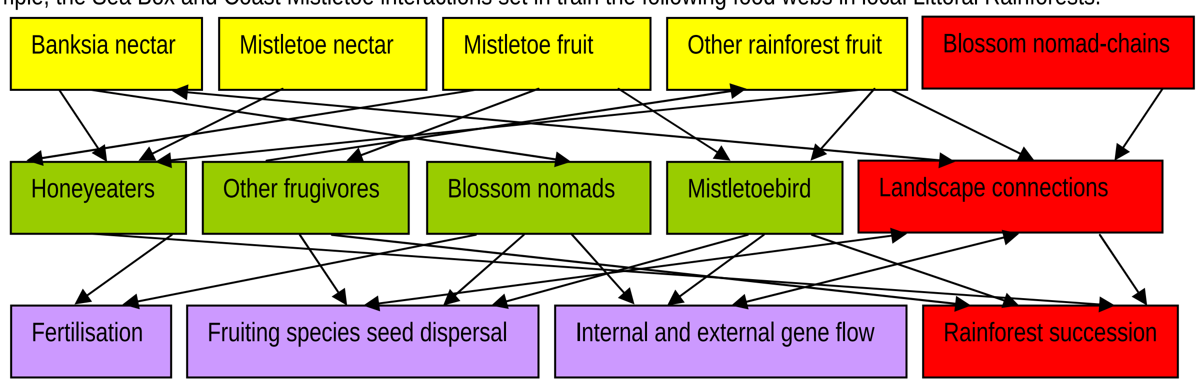
spp.	Abbreviation: for more than one species (plural). So for example *Rubus* spp. could include: **Rubus anglocandicans*, *R. parviflorus*, *R. nebulosus*, *R. moluccanus* and/or *R. rosifolius* etc. Cf. *sp*.
spp. agg.	Abbreviation for a species aggregate (treated as one taxon) in the full knowledge that it contains more than one other taxon that is yet to be described. Cf. ***s.l. (sens lat)***.
s.s.	Abbreviated in *Latin* for: *sensu stricto*. Meaning: in the narrowest sense (to describe a taxon that has narrowly defined after taxonomic revision. Cf. ***s.l.*** (***sensu lato)***.
ssp.	Abbreviation: subspecies.
stag (as in tree)	The remains of a dead (usually emergent) tree. In south-eastern Australia, usually eucalypts, whose presence and conservation are important for the tree hollows that they often contain. In rainforest restoration, their importance extends to being perches from which many birds contribute towards ***seed rain*** and as such are fundamental to ***rainforest succession*** on your site.
stag (as in deer)	A male deer.
stag-headed	A living tree with some or all of its major crown-bearing branches dead and projecting out as stags in the head of the tree. Usually applied to late mature or senescing eucalypts *sensu* Woodgate *et al*. (1993).
stochastic	See ***severe stochastic event***.
storm shutter	Vegetation that provides protection from the entry of salt-laden winds in ***Littoral Rainforests***. To be effective, these must be present as a series of overlapping and interlocking canopies from ground level to the highest point (the wind-sheared ***canopy*** typical of Littoral Rainforest stands) in wind-exposed positions (right). They are usually composed of many species at any one site. The loss of any one component breaches the storm shutter resulting in ***canopy decapitation*** and the formation of a ***rainforest gap***. If the rainforest stand is unable to recover, the ***canopy attrition*** that follows may 'blow out' allowing the salt-laden winds to attack the ***hinterland*** rainforest (often in the gully behind). A classic example of such a blow out occurs at Little Pebbly Beach (north of Pebbly Beach) in Murramarang National Park. Very early ***restoration*** of these storm shutters at Pebbly Beach has halted this attrition and reversed the damage where a range of ***frontline species*** are creating storm shutters (right). 

strangler	A form of establishment (principally by trees) that involves the germination of the strangler's seed on a host, followed by extensive root development that encloses (***anastomoses***) around the host's trunk, eventually strangling it to death. By this time the strangler has been able to build an interlocking lattice of roots that has formed a trunk. Usually associated with Figs of the genus *Ficus* (in ***Subtropical Rainforests***), which can establish on many hosts. In this region this is the obligate form of establishment of Small-leaved Fig *Ficus obliqua* and the facultative means of establishment for Rusty Fig *Ficus rubiginosa* (the latter more often establishing on rock outcrops or in the soils of south-eastern Australia). ***Facultative stranglers*** also include other (less often recognised) species such as: Blackwood *Acacia melanoxylon* (***Warm Temperate Rainforest*** and ***Cool Temperate Rainforest***) Southern Sassafras *Atherosperma moschatum* (Cool Temperate Rainforest) Myrtle Beech *Nothofagus cunninghamii* and Possumwood *Quintinia sieberi* (Warm Temperate Rainforest). In these cases the strangled host is principally Soft Tree-fern *Dicksonia antarctica* (right and Figures S143 and S144). One vine, English Ivy **Hedera helix,* is known to be a strangler in south-eastern Australia and although it germinates on the ground, its aerial stems quickly ascend any nearby structure. Over time, its stems anastomoses around the trunk and it has been recorded as strangling mature eucalypts, Muttonwood *Myrsine howittiana*, Sweet Pittosporum *P. undulatum* and Lilly Pilly *Syzygium smithii.* See also: ***facultative strangler*** and ***obligate strangler***. Cf. ***endophyte***.	 Myrtle Beech *Nothofagus cunninghamii* has strangled a Soft Tree-fern *Dicksonia antarctica*, the remains of which are only just visible below the decumbent trunk of the burnt tree. The remaining extent of the Soft Tree-fern's trunk is indicated by (⏟). The remainder of the original host has long since rotted away ⏟

stratification	A cold-treatment for seed that ***vernalises*** them and breaks a ***physiological dormancy*** to ensures that they germinate in a climatically benign season. Stratification first requires other dormancies that may also be present to be broken such as ***chemical dormancy*** (through leaching, for example) and ***physical dormancy*** (through breaking the seed coat) to allow the seed to ***imbibe*** water. The seed is then subjected to a period of cold before germination occurs in spring. This process can be artificially manipulated in the nursery to coordinate germination to ensure that nursery stocks are ready for the appropriate planting season in the field. Stratification can be artificially induced by placing appropriately pre-treated seed (as above) into the crisper drawer of your fridge (at about 4°C) for several weeks and then sown as normal (Propagation Manual). Little is known of the requirements for Australian species with regard to stratification, but it has been successfully applied to the following genera with species represented in the rainforests of south-eastern Australia: *Banksia*, *Billardiera*, *Boronia*, *Grevillea*, *Rubus* (Elliot and Jones 1983), *Eucalyptus*, *Pomaderris* (Royal Tasmanian Botanic Gardens 2009), *Coprosma* and *Melicytus* (Hepp pers. comm.). It is likely that stratification will be necessary for many other high elevation species (Australian Society for Growing Australian Plants 2009). Based on that advice, much more research is required on this subject for rainforest plants in south-eastern Australia and this is likely to be especially important for rainforests of the cool temperate zone (Cool Temperate Rainforest) and warm temperate climate zone (Warm Temperate Rainforest, Gallery Rainforest, Dry Rainforest, Dry Gully Rainforest and perhaps Littoral Rainforest) because these rainforest types all experience winters where growth is limited by low temperatures. If species from Subtropical Rainforest are not germinating and all other treatments have failed (Rainforest Plant Propagation), stratification should be tried. Rainforest species that occur in south-eastern Australia that are currently known to require stratification (based on the literature) are listed under ***vernalisation***. A map-based method for predicting those species likely to require this treatment is provided under vernalisation. See also: ***chemical dormancy***, ***physical dormancy***, ***physiological dormancy*** and ***vernalisation***.
stream bank nomenclature	'Left bank' and 'right bank' are always taken to be from the perspective of looking downstream.
STRf	Abbreviation: **Subtropical Rainforest**. See also: Subtropical Rainforest in Definitions and Synonymy.
subtropical climate zone	A region characterised by mild winters (largely frost-free), mild and wet summers. In south-eastern Australia (up until the advent of climate change and significant impacts on temperature (pre-1970s), the area north of Bunga Head, just south of Bermagui on the Far South Coast of New South Wales. See also: ***climate change climate change bump-along-tables***, ***cool temperate climate zone***, ***warm temperate climate zone*** and ***Mediterranean climate***. See: Additional Reading: Climate change in south-eastern Australia for a more detailed treatment of the delineation of climate zones and: Local climate (Table AR3) for the temperature changes attributed to climate change since the 1970s.
Subtropical Rainforest	A ***rainforest EVC*** that occurs in the lowlands in the ***subtropical climate zone*** where summer rainfall is usual and reliable. It occurs at its biogeographic edge of range on the south coast of New South Wales, where it requires a warm aspect (north-, west- or north-east-facing gullies below 300 m elevation). It requires excellent ***landscape-scale fire protection*** and is composed of ***characteristic species*** and **life-forms** that are adapted to humid subtropical conditions. In this climate zone its habitat is characterised by fertile geologies (in contrast to ***Warm Temperate Rainforest,*** which, in the same climate zone, is restricted to lower soil fertility sites. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Subtropical Rainforest.
succession	The sequential occupation of a single site by a range of plant species over time. The process occurs when vegetation observed on one site at a specific time, changes with time into another with differences in structure and composition as conditions are changed by the original vegetation's species complement. For example ***pioneer species*** shade a site, add organic material and are succeeded by ***late secondary species*** that establish in the ***light shade*** that the pioneer species cast; these are, in turn, succeeded by ***primary mature phase species*** that are adapted to establish beneath the ***moderate*** to ***deep shade*** created by the secondary species. See also: ***gap phase dynamics***, ***plant community succession***, ***primary succession***, ***relay succession***, ***successional planting***, ***shade definitions***, ***truncated succession*** and ***weed succession***.

successional planting	A planting technique used in *rainforest restoration* that recognises the sequential occupation of a single site by a range of plant species over time and how this may assist the repair and recovery process. Many plant species have very specific growing requirements and the *niches* that they require for establishment, growth and maturation are therefore often transitory. Their own growth changes the site's conditions and produces new niches for other species that have different niche requirements to those that grew on that site before them. The technique accommodates these processes by classifying all *rainforest* plants into the following *successional stages* (detailed in Chapter S4: Ecological principles), which then dictates when they should be planted: • *Pioneer species* (first planted): requiring *full sun*: planted first; • *Secondary species* (planted second): requiring a little shelter: planted second in the shade and shelter of the pioneers; and • *Primary species* (planted last): requiring *full shade* for establishment: planted last as the secondary species mature. See: Chapter S6: Successional planting, Appendix S16 and any of the species list appendices for both their successional stage and the year in which they should be planted.
successional stage	The seral stage of a rainforest site as judged by the dominant species and their position in the successional sequence: early: *pioneer species* dominated, transitional (mid): *secondary species* dominated, mature: *primary species* dominated and senescent: old/dying or renewing (often with a mixed composition). To assist you to convert these successional stages into a useful planting sequence, we have codified the successional/seral stage with a series of light niches and years for planting for every rainforest taxon in south-eastern Australia (see Appendix S6 worksheet: All species + FCs for the full list and the other planting appendices for *successional stage* stratified by year of planting). Synonym: *seral stage*.
sun scorch	Sun-sensitive (often) broad-leaved *secondary species* and many *primary species* in *rainforest* whose sensitivity is manifest by their leaves being scorched by *full sun* (Chapter S4: Figures S137 and S139). For some this sensitivity lasts all of their lives (such as many of the primary fern species), while for others (for example many of the primary canopy tree species) the sensitivity lasts only for a number of years until they develop a reasonable canopy. From our experience, sensitivity to sun scorch is likely to be linked to the plant's final *incident light niche* at maturity (those restricted to deep shade at maturity are likely to always remain sun-sensitive), while those that are primary species of the canopy (trees and vines) only experience transitional sensitivity to sun scorch. The significance of this observation is that at the time of planting you must make a predictive judgement as to the future light niche at that site and match this with the plant that you install at that spot. To help you we have codified the light niches for every rainforest plant in south-eastern Australia (see Appendix S6 worksheet: All species + FCs (Incident light niche column) and the other planting appendices for the *successional planting* stratified by *seral stage*). See also: *shade definitions*, *succession*, *successional planting* and *seral stage*.
sun weeds	*Exotic* weeds that establish and thrive in *full sun*. If they germinate but are subsequently shaded, they fail to thrive and in time the adult plants die out (but beware their seed is usually stored in the *soil seed bank* awaiting the next disturbance event). Consequently, such species are often favoured by bare soil and soil disturbance. The native equivalents are pioneer species.
sun well	A sunny gap in your plantings that stores warmth from the sun during the cool season's afternoons, from which your site can re-draw the heat stored in the well during the long cold night. This helps to ameliorate the effects of frost. See: *nursery crops* Figures.
super tube	A large plant propagation container with a square cross-section and a tapered length similar in overall form to a *forestry tube*. Useful for advanced trees or rare or threatened species that require extra nursery attention or care before being planted out. See also: *forestry tubes*, *hikos* and *rocket pots*.

supplementary planting	A management approach where a lack of structure on a ***restoration*** site is identified as an ***ecological brake*** to the improved health or function of the site. Supplementary planting adds more individuals of the **same species** already present on the site to augment or repair the site's structure. Supplementary planting of even a few carefully selected and placed plants can have an amazing impact, especially with regard to weed dynamics. The need for supplementary planting is often manifest as a lack of ***natural regeneration*** due to sun weeds. Attempt to replicate the missing structure and time to plant with the successional stage of your site by choosing the appropriate species (Appendix S6 worksheet: All species + FCs). Cf. *enrichment planting*.
surfactant	A wetting agent that helps herbicides to stick to the leaves of a target plant for long enough to allow the herbicide to penetrate the leaf's waxy cuticle and thereby kill the plant. Cf. *penetrants*.
surrogate measure	A measure or recording that implies another component is present. For example, recording the amount and ***diversity*** of ***natural regeneration*** of plants on your ***restoration*** site is a surrogate for a number of other ***ecosystem processes***. These include: ***dispersal*** by wind, water and animals; seed successfully reaching your site; appropriate establishment ***niches*** for these plants; regeneration of ***food webs*** and re-establishment of dispersal pathways across the landscape; as well as good ***weed*** control. In this way, one carefully selected measure can supply information about other components that you have not yet measured. As a consequence, surveys of natural regeneration are very powerful because they are a surrogate for the re-establishment of a range of ecosystem processes on your site.
swamped riparian systems	Alluvial sites where the channels have in-filled with sediment, which has caused their water tables to alter (Figures 4.23-4.26 and 7.3-7.4).
symbiosis *symbiotic*	Two or more *taxa* living closely together in a manner that appears to be interdependent is called a symbiotic relationship. The strength of the symbiosis can vary. This group of interactions is further subdivided into: • *Commensalism*: where one of the parties benefits but the other party appears unaffected (cf. parasitism). For example, Coast Mistletoe *Muellerina celastroides* on Coast Banksia *B. integrifolia*, where even abundant colonies have yet to be seen to cause the death of host trees in good health (see below: image left). • *Mutualism*: where both parties benefit. For example, Coast Mistletoe *Muellerina celastroides* is commonly found on Sea Box *Alyxia buxifolia*. The Mistletoebird is attracted to the Sea Box to feed on its berries that are conspicuously displayed on the tips of its branches. The berries are the same size and colour (though a different in hue) as those of the Coast Mistletoe whose berries are hidden in its dense foliage. While feeding on the Sea Box berries, the Mistletoebird also discovers and feeds on the Coast Mistletoe berries. Both species have their berries (and the seed they contain) dispersed by the Mistletoebird. The foliage of the mistletoe and the Sea Box are similar. No death of the host plant has been observed to have occurred as a result of mistletoe colonies, but both parties benefit through having their fruits (see below: image right) dispersed by Mistletoebirds. • *Parasitism*: where one party benefits at the expense of the other; for example, where cuckoos parasitise the nests of other birds to raise their young (usually with the destruction of the host's own brood or eggs). Symbiotic relationships often lead to complex and interdependent relationships and ***food webs*** in rainforests where they occur. For example, the Sea Box and Coast Mistletoe interactions set in train the following food webs in local Littoral Rainforests:



Element	Legend
Resources	
Vectors	
Processes	
Consequences	

symbiosis examples		
	A healthy Coast Banksia *B. integrifolia* with a large (and healthy) colony of Coast Mistletoe *Muellerina celastroides* (red foliage).	Sea Box *Alyxia buxifolia* with a colony of Coast Mistletoe in the foreground. The fruit of Sea Box (red circles) closely resembles in size and colour the fruit of the Coast Mistletoe.
systems (ecosystems) approach	A systems approach is based on systems thinking which is defined on Wikipedia as: 'An approach to integration that is based on the belief that the component parts of a system will act differently when isolated from the system's environment or other parts of the system. Standing in contrast to Descartes' and others' reductionism and philosophical analysis, it proposes to view systems in a holistic manner. Consistent with systems philosophy, system thinking concerns an understanding of a system by examining the linkages and interactions between the elements that comprise the entirety of the system.' As applied to ***rainforest*** and landscape scale ***restoration***: management that facilitates ***ecosystem recovery*** by keeping expensive and time-consuming interventions to a minimum, instead choosing management actions that are timely and focused on tweaking the system to produce a cascade of beneficial results rather than 'chasing your tail' because you have failed to understand the system. The systems approach to a Kikuyu sward is to understand that this '***weed***' is the ideal starting point for ***Framework Rainforest Restoration*** and appropriate management of the sward can ***future-proof*** your restoration site. In so doing, we over plant the Kikuyu with ***pioneer*** and ***secondary species,*** which shade out and kills the Kikuyu, add massive amounts of native pioneer seed to the ***soil seed bank*** (the future-proofing) that should ensure that when the site is ready for the next disturbance event it is likely that there will be multiple native species germinating to out compete the weed species still left in the soil seed bank. In taking such an approach, the aim is to support the ***ecological processes*** that underpin the landscape, so that nature does as much of the healing as possible, rather than falling into the black hole of inappropriate management actions based on a ***reductionist approach***. Cf. ***reductionist approach***.	
TAP	Acronym: *Threat Abatement Plan* required under the New South Wales *Threatened Species Conservation Act* (1995). See also: *PAS* (*Priority Action Statement*).	
taxa or taxon	A general reference to any number of biological entities of any taxonomic rank (species, subspecies, variety, form, etc.).	

temporal niche	A niche that is temporary or transitory. For example, a pioneer species that germinates in a ***rainforest gap*** and requires full sun and exposure is said to occupy a temporal niche, which is soon lost to the pioneer species as it grows, castes shade, creating a niche no longer suited to its establishment, but which is ideal for secondary species to develop in the gap. The secondary species, in turn, will reduce exposure and increase shade. Ultimately, the original temporal niche of the gap becomes habitat for ***primary species***. The term also describes rainforest occupying a temporal niche in areas with sub-optimal habitat with regard to fire or flood whereby natural variability in disturbance frequencies and intensities can cause individual rainforest stands to appear and disappear within a suitable habitat envelope following one or more disturbance events. Such is the case for many rainforest stands on lowland river flats in south-eastern Australia. See: ***mosaic***.
TfN	Abbreviation: Trust for Nature.
theory	See: ***hypothesis***.
threat *threatened*	A factor that negatively impacts ***ecosystem health***. It is manifest as an ***ecological brake***. One threat may apply one ecological brake or several. For example, cattle are a threat to ***rainforest***. The ecological brakes that cattle apply to this ecosystem include suppression of ***natural regeneration***, selective ***grazing*** of certain species, trampling, soil compaction and disruption of structure through their consumption of plants, their passage through or camping in rainforest and ***horning*** of the vegetation. If the threat is removed, the brake should also be removed, though if coupled to another, the expected rebound on the site may not occur. See: ***ecological brake***.
Threat Abatement Plan (TAP)	A plan made or adopted under Section 270B Section 271(1) of the *Threatened Species Conservation Act* (1995), requiring that a *TAP* must provide for the research, management and other actions necessary to reduce the ***key threatening process*** concerned to an acceptable level in order to maximise the chances of the long-term survival in nature of native species and ecological communities affected by the process. <http://www.environment.gov.au/biodiversity/publications/research-priorities/appendix3.html>. For example, the NSW Threat Abatement Plan: Invasion of native plant communities by **Chrysanthemoides monilifera* (bitou and boneseed) is specifically relevant to the conservation and management and long-term survival of Littoral Rainforest in the wild in New South Wales.
threatening process	A threat that is operating at a particular place at a particular time and the processes that the threat initiates (an ***ecological brake***). For example, ***weed*** invasion is a general threat, while the threatening process is the invasion of transforming species that can alter the ecological systems that maintain the site's ***diversity*** and ecological health. One of the ecological brakes is to restrict or deter **natural regeneration** of native species; another is to take up niches, and yet another is to kill local ***indigenous*** species.
tilth	The soil that results from cultivation. It is finer in structure than before cultivation: the clod becomes the tilth.
tipping point	A critical juncture for a species, ecosystem, biome or planet, whereby a slow reversible change becomes irreversible, usually with dramatic consequences.
tombolo	A depositional ***landform*** that comprises the isthmus that connects a near-shore island to the shore or one or more islands to each other. Because of reduced fire frequencies on such ***landforms***, they are often important ***habitat*** for ***Littoral Rainforest***.
trade winds *(south-east trade winds)*	Winds that blow consistently and reliably for long periods north and south of the doldrums (belts of little or no wind along the equator), that were used by sailing ships to ply the world's oceans on trade routes, hence the term trade winds. This wind belt migrates south as the subtropical high pressure belt moves poleward over summer. These summer easterlies blow persistently onshore into the ***continental*** low pressure generated over summer in the dry interior of Australia. In south-eastern Australia (being powered by the sun), they pick up by around 9.00 am EDST blowing hard and long for about 12 hours to decline soon after sunset. Their importance to rainforest is that they bring moisture to the continent and (through orographic uplift) storms along the eastern trough lines of the Great Divide, that stretch to the coast by mid to late afternoon. They also deliver tonnes of salt to the coast where their wind-pruning of the canopies of Littoral Rainforest leads to ***canopy attrition***, the coating of the vegetation in salt, which both adds important nutrients (Additional Reading: Table AR2) and provides fire retardant to its fine fuels (Additional Reading: Influence of salt on ignition times: on fine fuels of Coast Tea-tree).
trajectory	The path towards a ***restoration*** end point, where you are aiming to get to: ***pre-1750***s state, an alternative or lower quality state all

	are trajectories.
transformation	In ***restoration***, the conscious act of the restorer to change the ***restoration trajectory*** of a site to a different kind of ***ecosystem*** to that of the historic state, so as to match today's site conditions because the historic site condition and irreversibly changed. The aim is to restore a new (but ***indigenous***) ecosystem that matches current site conditions. Changes in salinity are common reason to transform Subtropical or Warm Temperate Rainforest into Littoral Rainforest. Cf. ***recovery***, ***replacement*** and ***transformed***. See also: ***restoration goals***.

transformed	An ***ecosystem*** that has undergone a quantum shift in composition and structure; for example, where ***rainforest*** is converted to ***sclerophyll***-dominated forest by one or more disturbance events such as landslip or fire. Cf. ***degraded***, ***damaged*** or ***destroyed***.
transforming weeds (also ***transformer weed***)	A class of weeds that, once established can, in the absence of further disturbance (or even on undisturbed sites), overtake areas of native vegetation, out-competing and killing the species already present, while simultaneously preventing the usual levels of ***natural regeneration*** and ***recruitment*** and thereby ***transforming*** the ***ecosystem***. Such infestations are capable of completely destroying mature ***rainforest*** stands without further disturbance. Pre-existing ***ecological processes*** are disrupted, diverted or destroyed. Rainforest stands invaded by transforming weeds have reduced biodiversity and ***abundance*** of native species compared with their ***diversity*** prior to the infestation. Examples of transforming weeds of rainforest include: Madeira Vine **Anredera cordifolia*, Bitou Bush **Chrysasanthemoides monolifera* ssp. *rotundata*, English Ivy **Hedera helix*, Lantana **Lantana camara*, Kikuyu **Pennesetum clandestinum*, Wandering Jew **Tradescantia fluminensis* and Blue Periwinkle **Vinca major*. See also: Appendix S3 worksheet: transforming weeds.
transitory shade	***Niches*** that have shade for part of the day and ***full sun*** at other times. See: ***shade*** definitions.
translocation	1. Involves plant ***division*** (where only a small part of the parent plant is removed) or transplantation (where the whole plant, usually a seedling is removed). Translocation is widely used in ***rainforest restoration*** where there is an imminent ***threat*** to a significant species or population and for a range of reasons where propagation at the scale required is difficult, inefficient, slow or not possible. 2.. In the application of herbicide, where it is translocated from the place of contact throughout the plant.
tree	A woody ***life-form*** with a single or multiple stems, greater than 5 metres in height.
trial	An action that is monitored with the intent of testing a hypothesis and evaluating the result to increase understanding of a key question, theory, problem or problem.
truncated succession	'A ***theory*** that states that the progression of an ***ecosystem*** to the mature ***seral stage*** via ***succession*** is interrupted by repeated disturbance' <http://www.tereco.sr.unh.edu/definitions.html>. Thus the direction or speed of primary or ***secondary succession*** is disrupted, stopped or diverted by any one of a range of factors that delays (Figures 3.8–3.9) or prevents the achievement of the climax state of that vegetation. Factors that can deflect ***plant community succession*** can include: another disturbance event before the climax phase of the vegetation is achieved; domestic stock ***grazing*** (Figure 8.115); the advent of a pest species (especially uncontrolled numbers of ***exotic species*** such as rabbits or deer, that are also ***ecosystem engineers***); and severe weather events such as high temperatures that can kill ***keystone species*** (Additional Reading: Extreme weather) such as mistletoes that are fundamental to the successional process (Additional Reading: Table AR13). Other local examples include severe or extended drought. A related process, which does not fit the repeated disturbance component of the truncated succession definition, but produces the same result, is where succession begins (such as occurs in some ***oldfield scrubs*** when ***paddock rainforest starters*** germinate, establish and die), but no rainforest develops because there is a lack of ***primary (mature phase) species*** available on the site or near enough to be able to disperse to the site to form the final ***seral stage*** and the mature rainforest.
TSC Act	Abbreviation: the New South Wales *Threatened Species Conservation Act* (1995).

tsunamis	Oceanic waves generated by events other than wind. Derivation: from the Japanese word for: 'harbour wave'. Tsunamis can include waves created by an undersea seismic disturbance or a meteorite crashing into the sea. Unlikely though it may seem, such events are known to have shaped the east coast of Australia, including the south-east, even in contemporary times: a tsunami warning was listed at 7.22 pm EST on the 15 July 09 (BoM 2009) on the Bureau of Meteorology website as the result of an earthquake on the west coast of the South Island of New Zealand measuring 7.9 on the Richter Scale. Tsunamis shape our coastline in rare and occasionally cataclysmic episodes such as the Tura Event some 500 years ago (see below), where it is thought that a fragment of a comet plunged into the Tasman sea off Tura Beach on the south coast of New South Wales (Bryant in Catalyst 2002). Large tsunamis produce characteristic landforms such as gulches, 'toothbrush' headlands and the deposition of beach materials well above the current sea level. Tsunamis may also explain salt in the lower reaches of coastal stream valleys. Tsunamis are especially important for Littoral Rainforests and their coastal habitat because, although rare, they can completely wipe out such stands and their habitat. An examination of the habitat of Littoral Rainforest stands on the coastal landforms of Far South Coast of New South Wales and the tsunami literature for the same area revealed the following correlations: • There are many tsunami-specific landforms on the east coast of Australia (Bryant on Catalyst 2002; Bryant 2002a; Bryant 2002b; Bryant 2002c; Bryant 2002d; Bryant 2002e, Bryant 2002f) that now host Littoral Rainforest. These include massive aligned (imbricated) boulders on wave ramps associated with headlands, serpentine erosion channels on wave ramps and seashell deposits atop sea cliffs that are not associated with Aboriginal middens (Bryant in Catalyst 2002). • Most tsunamis are small (less than a metre in height once the coast is reached), although on an Australia-wide basis relatively frequent with an average of two a year (Geoscience Australia 2002). Tsunamis are classified according to their threat and this is based on their wave height on reaching land. Low threat events have waves of less than 1 m in height, moderate threat 1–4 m and high threat 4–32m or greater (Geoscience Australia 2002). • The last major tsunami to have hit the study area coastline (dubbed the 'Tura Event') was dated at about 1500AD (Bryant in Catalyst 2002) and thought to have originated close to the coast near Tathra. From this origin, the wave radiated north and south (Bryant 2002b) within the study area. This event was a mega-tsunami, which deposited material on headlands behind Steamer Beach on the south side of Jervis Bay that are 130 m above sea level (Bryant 2002f). • Depending on their regularity, whether derived from meteorite impacts as is postulated for the wave of 1500 AD, (Bryant in Catalyst 2002; Bryant 2002b), or the results of ***plate tectonics*** across the Tasman Sea in New Zealand or submarine landslides, these events would have a significant impact on Littoral Rainforest stands. From broad range of evidence, it seems that a significant tsunami occurs on average every one thousand years or so along the southern New South Wales coastline (Bryant 2002g). Within the Far South Coast portion of the study area, it appears that some of the fire-protected landforms on which Littoral Rainforest stands grow are the result of tsunami events. Based on the photographic compendium of Bryant (2002 a–g), there are at least five Littoral Rainforest sites that occupy landforms consistent with those derived from tsunami events (see images below). These include: • *boulder berms* at Leather Jacket Bay on the south side of the creek composed mainly of Eden metasediments; • anomalous gully systems at Bunga Head (Silurian rhyolites); • ravines on the head at the northern end of Tathra Beach facing into Mogareeka Inlet at its ocean mouth (Ordovician Eden metasediments; • a ravine and three gulches in Turingal Head; and • wave ramps with cavitation erosion features (Bittangabee Bay) on Devonian red beds (Eden metasediments). From an ecological perspective, the horrendous television footage of the Boxing Day 2004 Indian Ocean tsunamis showed that the effects of such waves vary enormously. The impacts are dependent on the height and the number of tsunamis, with the impacts ranging from significant understorey disturbance that leaves *overstorey trees* intact to complete destruction of most vegetation and the stripping of topsoil.

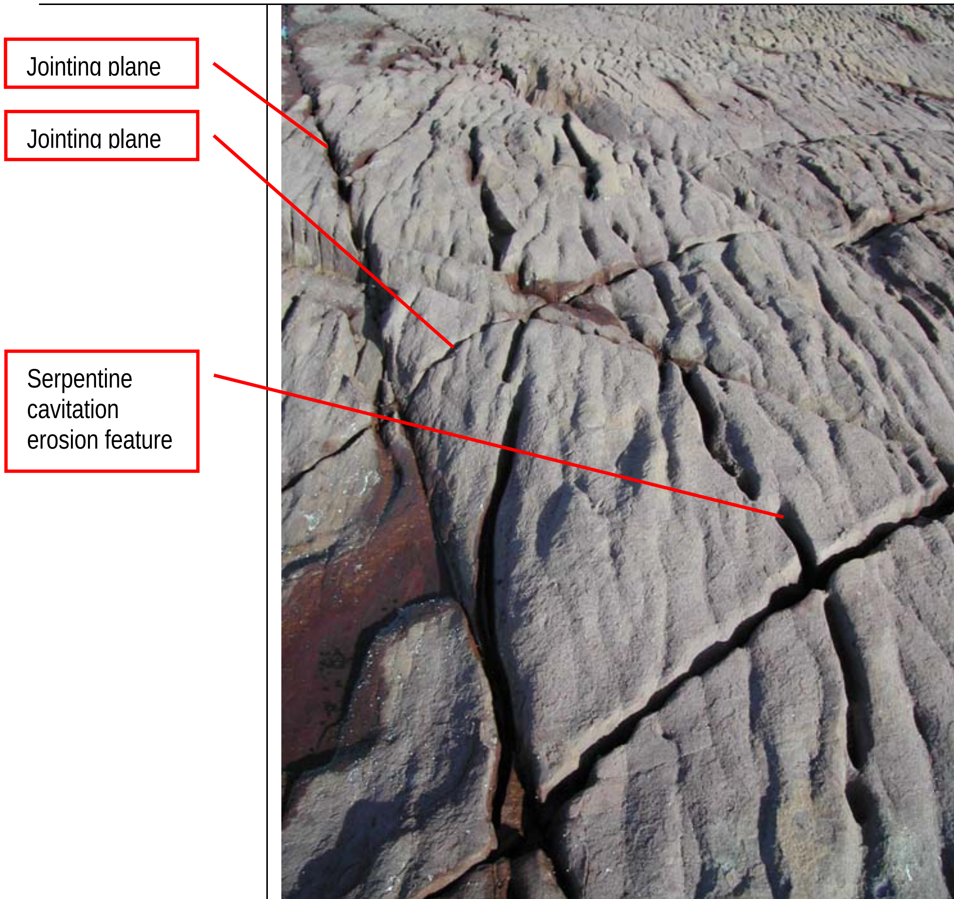
Tsunamis (cont'd)

Leatherjacket Bay NSW with boulder berm and Littoral Rainforest.

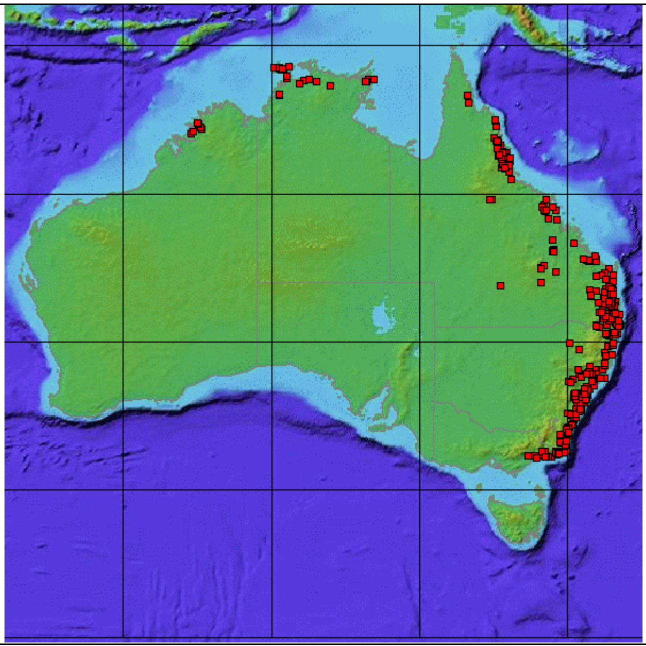
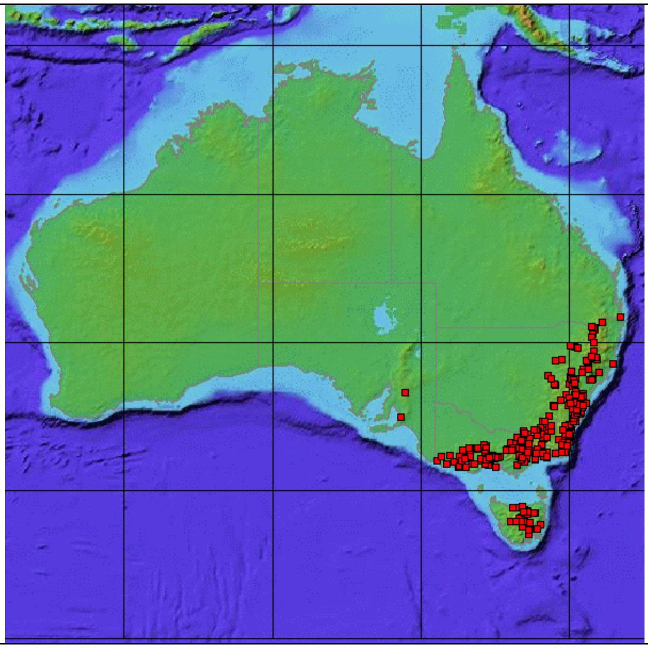
Mimosa Rocks NSW with anomalous gully systems.

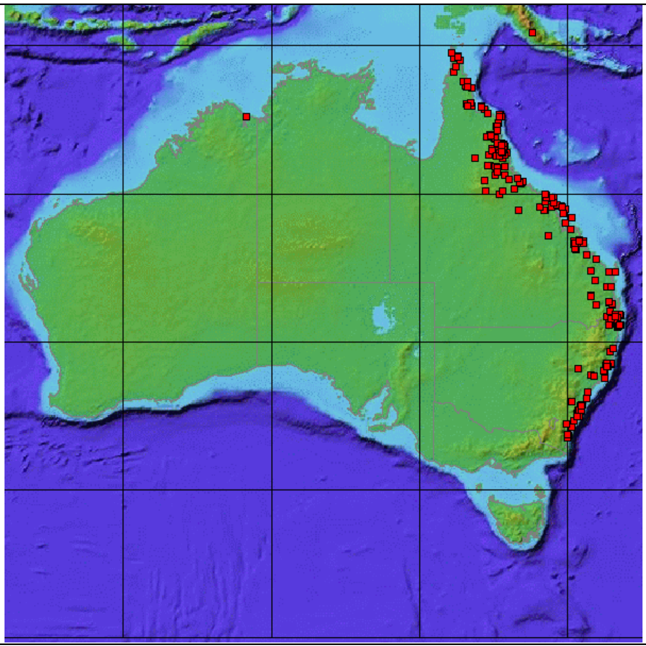
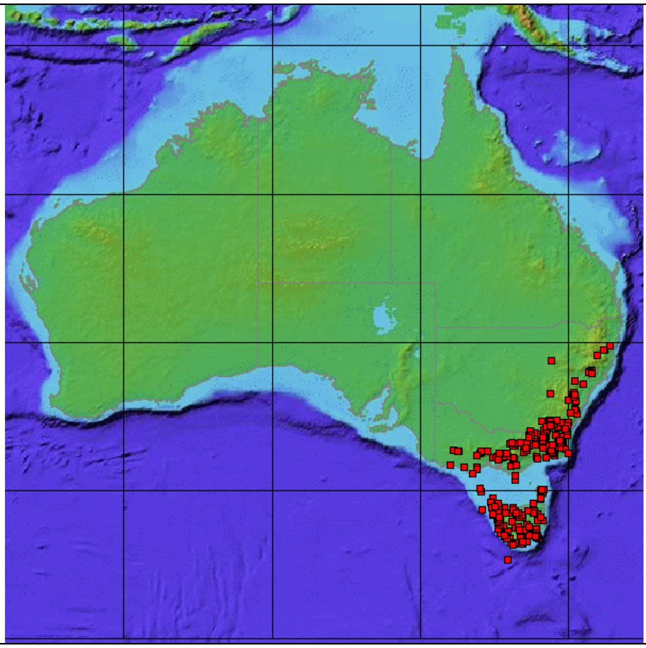
Mogareeka Inlet NSW looking north, showing two ravines with Littoral Rainforest. The Tura event began just south of this site and behind the photographer. The tsunami would have been propagating northwards when it slammed into the cliff system to create this landform and Littoral Rainforest habitat.

Turingal Head NSW. The ravine shows the sea entry, one gulch is behind the photographer (the other two are to the left and right off the ravine). The gulch to the right contains a small stand of depauperate Littoral Rainforest.

		
	Bittangabee Bay, NSW. Wave ramp and serpentine cavitation erosion features that are consistent with those described by Bryant (2002a) and found elsewhere on the south coast of New South Wales.	Bittangabee Bay, NSW. Wave ramp with tsunami erosion features (pictured left), is in foreground of this photograph and Littoral Rainforest in the background on a boulder berm.
twiners	Weak stemmed vines that use their stems to twine around their support. Local examples include Twining Glycine *G. clandestina* and Bearded Tylophora *T. barbata*.	
typology	A descriptive system that sets out in a logical sequence, the units of a particular classification. In the context of this study, the units are: • ***Rainforest ecological vegetation classes*** that are differentiated on ***habitat***, ***life-forms***, life-histories and response of vegetation to disturbance; and • ***Littoral Rainforest*** floristic communities that are differentiated on the basis of floristic analysis and correlations with habitat.	
understorey	The vegetation below the ***canopy***. This can include understorey trees, ***shrubs***, vines, ***ferns***, mosses, epiphytes, forbs and graminoids.	
unpalatable species	Plants that modulate ***browsing*** or ***grazing*** of themselves (and anything else growing in or very close to them), by way of chemical factors. Some taxa use chemicals including *Solanum* spp. and Asteraceae (daisies and everlastings) and others use inclusions of silica such as in *Poa* spp. Cf. ***camouflage species***, ***deterrent species*** and ***browsing refuges***.	

usual species	Species recorded at less than 30% frequency in vegetation quadrat sampling that are expected in a particular floristic community of ***rainforest***. Their low frequency may be due to a number of causes that include: depletion by plant poaching or being disturbance dependent (and consequently recorded less often where there is a bias in sampling towards rainforests that are old). Other causes of the low frequency of occurrence of usual species can include: clearing, ***weed*** invasion, ***browsing*** (e.g. feral deer) or some other ***threat*** that is operating on the sampled sites. See Appendix S6 worksheet: All species + FCs (denoted in the currently known distribution by rainforest type column as: 'dep.', 'poa.' respectively indicating the known cause for their low frequency). Alternatively, usual species (in relatively intact and/or undisturbed rainforest types) are inherently uncommon or rare. See also: ***character species*** and ***distinguishing species***.
valley-constrained *valley constraint*	Where the floodplain of a stream is too narrow (being constrained by the stream's valley-sides) to conduct floodwaters at a velocity low enough to allow ***Gallery Rainforest*** to form a tunnel (or gallery: Figure S29) over the stream. The result is that Gallery rainforest is present, but on each bank separated by the open water of the flood channel (Figure S30).
vascular epiphytes	Plants with a vascular system (***ferns***, flowering plants, etc.) that live entirely on the surface of other plants. See: plants listed in the life-form category of Appendix S6: All species + FCs as 'Ep', ***non-vascular epiphytes***, ***epiphytes***. Cf. ***Lithophyte*** and ***endophyte***.
vector	An agent that transfers something from one place or one plant to another. In rainforest restoration, it generally refers to the transfer of plant seed and propagules by animals as well as in pollination. See also: ***potential vector transactions*** and ***realised vector transactions***.
vegetation type	A generic term used for vegetation at any level of a plant community typology.
vernalisation	The term comes from the *Latin vernus* meaning spring. A period of cold experienced by a seed that initiates germination or flowering in a mature plant (usually timed for spring). In seeds, this is an example of ***physiological dormancy***. The process is important for species where cold is a limiting factor over winter for germination and/or flowering. The process is well understood in flowering, whereby the cold treatment (***stratification***) causes the release of a plant hormone florigen, which resides in the leaves, which in turn initiates the development of flowers in the meristem (apex of a plant shoot) that ultimately leads to flowering at the end of the cold treatment <www.wikipedia.org/wiki/Venalization>. Vernalisation for flowering is important in many biennials <www.wikipedia.org/wiki/Venalization> and other non biennials including at least one native species *Boronia megastigma* (Day 1992). Only one example of vernalisation is known with certainty to the author for a species from the rainforests of south-eastern Australia and that is for the germination of Tree Violet *Melicytus dentatus* seed. Several species require stratification to vernalise seed in the nursery in order to break their dormancy and to synchronise and improve germination results. These include: Rock Lily *Bulbine* glauca, Leek Lily *B. semibarbata,* (Rainforest Plant Propagation Manual for south-eastern Australia), Prickly Currant-bush *Coprosma quadrifida* and Tree Violet *Melicytus dentatus* (Jurg Hepp pers. comm.), Alpine Ash *Eucalyptus delegatensis*, Eurabbie *E. globulus* ssp. *pseudoglobulus*, Snow Gum *E. pauciflora* (Australian Society for Growing Australian Plants 2009) and lowland populations of Hazel Pomaderris *P. aspera* (Tasmanian Botanic Gardens 2009). The requirement for vernalisation is suspected in a wide range of other species including: Tasman Flax Lily *Dianella tasmanica*, Black-fruited Saw-sedge *Gahnia melanocarpa*, Austral Mulberry *Hedycarya angustifolia*, Coast Beard-heath *Leucopogon parviflorus*, Large Mock Olive *Notelaea venosa* and Common Reed *Phragmites australis* (Rainforest Plant Propagation Manual for south-eastern Australia). Whether this requirement for germination in the wild (as an essential part of their ecology) translates as a necessary treatment in the nursery is yet to be ascertained. Logically, it is suspected that vernalisation is likely to be more important for foothill and montane rainforest species and communities of the warm temperate and cool temperate climate zones than it would be for subtropical climate zone (see Australia's Virtual Herbarium images below). See also: ***after-ripening period***, ***chemical dormancy***, ***physical dormancy***, and ***physiological dormancy***,, ***seed dormancy stratification*** and Rainforest Plant Propagation Manual for south-eastern Australia.

vernalisation (known vernalisation requirements illustrated by AVH mapping)	VERNALISATION KILLS WARM-GROWING SPECIES	VERNALISATION IS NEEDED FOR SOME COOL-GROWING SPECIES
		
	Jasmine Morinda *M. jasminoides* distribution, which illustrates a warm-growing plant's habitat preference for warm ***climate envelopes*** in the lowlands of the warm temperate climate zone and equivalent climate envelopes in the lowlands and higher elevations at lower latitudes in the tropical and ***subtropical climate zones***. This leads to a known mortality if the seed is subjected to vernalisation. Cf. the distribution (below) of a species whose seed is thought likely to be killed by vernalisation (Small-leaved Fig *Ficus obliqua*). Image: *AVH*: August 2009.	Tree Violet *Melicytus dentatus* distribution, which illustrates a cool to cold-growing plant's habitat preference for cool ***climate envelopes***. In the lowlands of western Victoria, it occurs in the ***cool temperate climate zone*** and the cooler habitats of the warm temperate climate zones elsewhere in Victoria (such as frosty gullies and river valleys). Further north, this species is confined to the same climate zone which is absent in the lowlands of the subtropics. As a consequence, it is restricted to its cool climate envelope, which is found at higher elevations at lower latitudes. This species has a known requirement for vernalisation. Cf. the distribution below of a species whose seed is thought to require vernalisation (Tasman Flax-lily *Dianella tasmanica*). Image: AVH: 08-2009.

Vernalisation (predictive methodology using AVH mapping)	USING DISTRIBUTION AS A PREDICTOR FOR THE NEED TO VERNALISE SEED  **Small-leaved Fig** *Ficus obliqua*. The subtropical climate zone distribution of this species is used to hypothesise that this species may not require vernalisation. Cf. the distribution above of a species whose seed is killed by vernalisation (Jasmine Morinda *M. jasminoides*). Image: AVH: 08-2009.  **Tasman Flax-lily** *Dianella tasmanica*. The cool temperate climate zone distribution and cool temperate climate envelope distribution of this species in the warm temperate climate zone is used to hypothesise that this species may require vernalisation. Cf. the distribution above of a species known to require vernalisation (Tree Violet *Melicytus dentatus*). Image: AVH 08-2009.
vines	A range of woody, wiry or herbaceous plants that are mostly rooted in the soil (and so are not epiphytes) that rely on other more-robust species for support. They can occur as canopy or understorey species and are a feature of most rainforest types in south-eastern Australia, being least prominent in ***cloud forests*** and ***Cool Temperate Rainforests***. The most robust are the lianes, which are woody and can reach 30 cm in diameter, whose stems can become so heavy that they gradually collapse from the canopy to form large rope-like coils on the rainforest floor (Chapter S8: Figure S301). Each vine has one or more climbing adaptations that include twining stems, leaf petioles, hooks, spines or prickles, tendrils, suckers or adhesive roots, and/or an ***anastomosing*** habit. Vines of just one genus in south-eastern Australia are parasites that are not rooted in the soil: the dodder-laurels *Cassytha*.
virtual connectivity	The genetic connectivity between physically disconnected stands that is facilitated by ***pollinator*** or ***seed dispersal***.
VROTs	Acronym: Victorian Rare or Threatened species. Cf. ***ROTAP***.
v s.	Abbreviation: versus.
Walker Circulation	A meteorological phenomenon that links areas of high and low pressure along the equator in the ***El Niño–La Niña*** climatic cycle. This cycle has profound impacts on the season's rainfall conditions that are likely over south-eastern Australia and the risk of fire. See also: ***El Niño***, ***Indian Ocean Dipole*** and ***La Niña*** and Additional Reading: Climate systems you should know more about: impacts on rainforests,.

warm temperate climate zone	A region characterised by cool moist winters (often with frost) and hot dry summers. In south-eastern Australia, the lowlands below 600 m south of Bunga Head, just south of Bermagui on the Far South Coast of New South Wales to Wilsons Promontory in Victoria. North of Bermagui, this zone extends up to 700 m and only as low as 350 m as the ***subtropical climate zone*** begins to edge in along the coast with decreasing latitude (as you move further north). See also: ***cool temperate climate zone***, ***subtropical climate zone*** and ***Mediterranean climate***. For a more detailed treatment and Additional Reading: Local climate.
Warm Temperate Rainforest	A ***rainforest EVC*** that occurs in the lowlands on infertile geologies and in the foothills of the ***subtropical climate zone*** and in the lowlands of the ***warm temperate climate zones*** from near sea level to 700 m in Victoria and from sea level to 800 m in New South Wales. It occurs in deep south- or east-facing gullies in lower rainfall areas, but may extend into gullies of any aspect and onto ridges in higher rainfall areas. It has excellent ***landscape-scale fire protection*** and is composed of ***characteristic species*** and **life-forms** that are adapted to warm moist conditions, and can tolerate some severe drought events. In the warm temperate climate zone, it can be found on both lower and higher fertility soils. However, in the subtropical climate zone, its habitat is restricted to less fertile geologies and this factor separates it from ***Subtropical Rainforest,*** which occurs on the most fertile geologies. See: Definitions and Synonymy: Differential rainforest definitions for south-eastern Australia: Warm Temperate Rainforest.
water-hogging weeds	A postulated process regarding groundlayer weeds that appear to be very effective at robbing water (especially from light rain shower events) and storing it, before other ***rainforest*** plants can get their share. It is thought that this process can occur because many rainforest plants are surface drinkers and feeders, with much of their root mass in the leaf litter or the soil surface, where they can intercept passing showers and other rainfall (Additional Reading: Leaf litter: rainforest versus adjacent ***non-rainforest*** communities). Suspected examples include Asparagus Fern, **A. aetheopicus* (Additional Reading: Susceptibility of rainforests to water hogging weeds: Figures AR99–AR102), Wandering Jew **Tradescantia fluminensis* and Blue Periwinkle **Vinca major* (Figures 4.3–4.4). The effect of this 'water theft' is that the other rainforest species (including ***canopy trees***) die of thirst. Controlling these water hogs produces immediate relief and (provided the damage has not gone too far), the recovery is very quick. This is easily seen with the canopy regrowth and often prolific flowering and fruiting that follows. ***Littoral Rainforest*** sites where this impact has been observed include Second Island in the Marlo Estuary (in Victoria, with Wandering Jew and Blue Periwinkle); and outside the study area at Googleys Island on the Cambden Haven River estuary (in New South Wales, where the culprit was Asparagus Fern). To date, the observed examples of this phenomenon are generally on droughty (well-drained soils). ***Canopy trees*** observed to decline as a result of this process are many and varied. On First and Second Island in the Marlo Estuary in Victoria they include Common Boobialla *Myoporum insulare*, Muttonwood *Myrsine howittiana*, Sweet Pittosporum *P. undulatum*, Yellow Elderberry *Sambucus australasica* and Lilly Pilly *Syzygium smithii*. On the Entrance Walk at Lakes Entrance, Victoria where the weed was Bridal Creeper **Asparagus asparagoides* and the beneficiaries of its biological control was Littoral Rainforest, the main species saved were Coast Banksia *B. integrifolia* and Sweet Pittosporum *P. undulatum* (Chapter S6: Figures S257–S259)]. At Googley's Island near the mouth of the Cambden Haven River in New South Wales, the weed is Asparagus Fern **Asparagus aetheoipicus* and the plants that are dying from this water-hogging weed are Coast Banksia, Tuckeroo *Cupaniopsis anacardioides* and Port Macquarie Beech *Euroschinus falcatus*. The impacts are so bad at this site as to be killing Camphor Laurels **Cinnamomum camphora* as well! See: Additional Reading: Susceptibility of rainforests to water-hogging weeds.
weed alert species	Weeds that may be scarcely noticed at present, but that are in their early stages of establishment with the potential to become a significant threat to biodiversity (Scott 2009). See also: ***sleeper weeds***.
Weed of National Significance (WoNS)	One of the 20 worst weeds in Australia as determined with reference to its invasiveness, potential for spread, and economic and environmental impacts (CRCfAW 2007a). Abbreviated to *WoNS*. See also: ***background weeds***, ***knockdown weed control***, ***landscape weed control*** and ***transforming weeds***.
weeds	In the broadest sense: any plant (***exotic*** or ***non-indigenous native***) that does not belong in a particular place (i.e. a plant that is not indigenous to a particular site). See: ***background weed***, ***transforming weed***, ***weed alert species***, ***sleeper weeds.***

weed succession	In native plant succession: the removal of one or more species (in this case: dominant ***weeds***) that leads to a change in the site's condition that favours the emergence of one or more 'new' weeds that were previously suppressed, dormant or stored in the ***soil seed bank***. An example from the ***warm temperate climate zone*** is that of the removal of perennial grass cover such as Kikuyu **Pennisetum clandestinum,* which ,through the shade of its sward suppresses ***sun weeds,*** which emerge once the herbicide-derived mulch breaks down to expose the soil to sunlight. The weed response can include: Spear Thistle **Cirsium vulgare (*Figures 5.16-5.17), Prickly Lettuce **Lactuca serriola*, Wild Radish **Raphanus raphanistrum* (Additional Reading: Figure AR29) and a myriad of other ***transforming weeds*** (Chapter S6: Figures S264 and S266). This sun weed response is so significant, and so expensive to control the resultant weed infestations, that operators have successfully resorted to the use of Perennial Rye **Lolium perenne* (Additional Reading: Figure AR30 compared with its previous state (Figure AR 29) when the Kikuyu was removed) to temporarily prevent sun weed germination and hold the line until ***canopy*** plantings can permanently shade out the transforming sun weeds that are stored in soil seed bank. An example from the ***subtropical climate zone*** is that of Bitou **Chrysanthemoides monilifera* ssp. *rotundata* control without first removing other transforming weeds, which can lead to massive and expensive weed succession outbreaks of Rambling (Turkey) Dock **Acetosa sagitata*, Asparagus Fern **Asparagus aethiopicus*, Mile-a-minute **Ipomea caraica*, Morning Glory **Ipomea indica*, Lantana **L. camara* and many others (Peel 2009). See: Chapter S6: To weed or not to weed: that is the ecological and logistical question?
wheat-field regeneration	A forester's parlance indicating very dense and even-aged regeneration, as in a field of sown wheat. Examples from the study area are the regeneration of Giant Honey-myrtle *Melaleuca armillaris* or Coast Tea-tree *Leptospermum laevigatum* that follows severe disturbance (fire, dune blow-out or tsunami).
wick wiping	A method of ***weed*** control that uses an absorbent material as a wick to draw up herbicide that is then used to transfer the herbicide by wiping or dabbing the weed.
wind attrition	Synonym for ***canopy attrition***.
wind rakes	The process whereby the tallest elements of the vegetation 'capture' wind-borne seed by slowing wind velocity and allowing seed to fall to the ground (effectively raking them out of the wind). The effectiveness of wind rakes is likely to be contingent on their position relative to the seed source and their effectiveness at catching the seed, with site characteristics such as the site's perpendicular width relative to the wind playing a role. Narrow sites do not capture many seeds, but wider sites seem to fare better as wind rakes (Additional Reading: Natural regeneration: Figure AR109).
Wind-throw	The toppling of trees as the result of winds associated with storm events or from persistent winds where a tree is otherwise weakened. The wind throws the tree, which produces a gap in the ***rainforest canopy*** leading to ***secondary succession***.
wind tunnel gaps	These gaps are typically found only in ***Littoral Rainforest*** where a disturbance event (storms producing a windthrow, a landslip, death of a tree, ***weed*** invasion, weed control, tracks, roads, etc.) leads to a nick in the ***storm shutter*** of the ***canopy***. Prevailing winds then funnel into the gap to produce ***canopy decapitation,*** which promulgates a linear wind tunnel gap. Though often narrow and linear, these gaps can splay out in gully heads or on landslips where the topography aids the winds movement (see: ***domino effect***). Such gaps are aligned with the prevailing winds on topographically uniform (flat) sections of the coast. However, on rocky coasts where coves have developed with a steep slope at the rear of the beach, these wind tunnel gaps develop in a radial fashion perpendicular to the shore line. This is presumed to be the result of the slope at the back of the beach splaying the incoming unidirectional prevailing wind up and over the vegetation. Look up Google™ Maps to confirm this wind behaviour in Littoral Rainforests in your area.

Wingham Weeding Method	The tenets of this method were developed at an horrendously ***weed***-invaded site in ***Subtropical Rainforest*** at Wingham Brush, inland from Taree in New South Wales, after the original strict application of the ***Bradley Weeding*** Method failed (Harden *et al.* 2004), and some members of the ***restoration*** group questioned the usefulness and appropriateness of applying this weeding ***paradigm*** to a Subtropical Rainforest restoration project. The change in tack was necessary because the strict adherence to herbicide prohibition was leading to a failure of the restoration attempt at this site. It is highly recommended that you visit this nationally important example of ***rainforest*** restoration at Wingham Brush (after which this newly created weeding method is named), to marvel at what was achieved and to understand why the Bradley Weeding ***paradigm*** was ***flipped*** by those working on this site. The summary of the method from Stockard (1998) is outlined below:
	1. Gain a weed free ***canopy*** by eradicating canopy weeds (this will assist its closure);
	    a. Herbicides usually are essential;
	    b. Canopy influences the composition of the ground flora; and
	    c. A dense healthy canopy inhibits weeds.
	2. Promote ***succession*** in large gaps/clearings by transplanting/plantings of early successional trees;
	    a. This maintains genetic integrity.
	3. Assist ***natural regeneration*** towards a climax community;
	    a. Propagate and plant rare or threatened species if their natural regeneration is inadequate.
	4. Remove ground weeds after canopy recovery;
	    a. Unless coincident with removal of canopy weeds; and
	5. Flexibility is paramount with each site requiring individual assessment.
	    a. There is an exception to every rule;
	    b. The method should adapt to the site; and
	    c. The site should not conform to ideology.
	The last point is telling: it says to ***flip*** the ***paradigm*** and not go on blindly where the evidence suggests that you are not succeeding: See also: ***flipping***, ***integrated management*** and ***paradigm***.

WoNS	Acronym: ***Weeds of National Significance***.
WTRf	Abbreviation: ***Warm Temperate Rainforest***. See also: Warm Temperate Rainforest in Definitions and Synonymy.