

## OPERATIONALISATION PLAN FOR RESTORATION OF RAINFOREST ALONG THE RIVERS OF SOUTH-EASTERN AUSTRALIA

### Background

The task of restoration is a bit like building a house: it is usually a process undertaken by a professional builder, but one which can be broken down into a series of steps that anyone of us can learn, so as to be able to construct the dwelling. Likewise with restoration: though complex, given the time, aptitude and resources anyone can achieve rainforest restoration by learning the steps required to put a complex ecosystem back together again. This is possible (in no small measure), because we take a systems rather than an interventionist approach, allowing nature to take over the really complex task of rebuilding ecosystems: finishing off what the restorer begins. The *Rainforest Restoration Manual for south-eastern Australia* provides the basis for this Operationalisation Plan for rainforest restoration. The Manual provides all background information to answer questions that are not dealt with by the Plan.

Rainforest restoration is both an art and a science; it is as much a social process as it is the act of reconnecting the frayed threads of a once magnificent natural tapestry. The key objective in rainforest restoration is to undertake the minimal amount of management intervention required, to reduce the threatening processes that will in turn release the ecological brakes that are holding back the recovery of the rainforest stand or site in your care. This approach seeks to use the inherent power contained in ecosystems and their natural resilience to their best effect. Good rainforest restoration relies on the most efficient use of time and resources to ensure that the natural ecological processes that maintain rainforest do as much of the restorative work for you as possible.

There is a rainforest restoration method and a budget to suit any situation that you may come across. The catch is that different levels of skill are required for each method and there is a different time line for achieving the full recovery of a mature rainforest that is related to the restoration method that you choose.

### Steps

These steps take you through the process of rainforest restoration from beginning to end. They help to guide and direct you to the appropriate part of the Manual should you require more information on any of the steps involved. In brief the ten steps are as follows:

STEP 1: Historic context: was it ever rainforest?

STEP 2: What type of rainforest was it?

STEP 3: What does the site need for rainforest to recover?

STEP 4: Can I actually do it or do I need expert help?

STEP 5: What rainforest restoration methods are needed?

STEP 6: What resources and money are needed for rainforest restoration?

STEP 7: Site plans, a project management plan and a project calendar

STEP 8: Project implementation

STEP 9: How to measure success

STEP 10: What resources are needed to maintain the restored rainforest and where to from here?

**Before you begin: what steps first?**

If you have rainforest in your care, there is a simple hierarchy of actions that can help you manage and conserve your rainforest remnant while you work out what is needed, when and how to do it. The hierarchy is divided into a **first phase**: immediately dealing with threats to your rainforest; and a **second phase**: restoring (repairing the damage), extending the rainforest stand and reconnecting it to the surrounding bush. It is important to apply the hierarchy to your site before you rush out and marshal your resources (Figure 3.1), otherwise you will be misleading people and not appreciate what you need to do (if anything), or the order in which you need to do it.

*Hierarchy of goals and actions to manage rainforests***FIRST PHASE: EMERGENCY MANAGEMENT. IDENTIFY THE THREATS AND DEAL WITH THEM.****GOAL 1. Protect existing remnants from their major threats. Implement Restoration Manual Steps 3–7.**

In south-eastern Australia these threats are:

- a. **Threat:** loss of existing stands (land clearing/logging).  
**Action:** stop clearing.
- b. **Threat:** weed invasion by transforming weeds (see Appendix S3).  
**Action:** identify weeds, prioritise control.
- c. **Threat:** habitat loss or change in extent, shape or context. Irrevocable change in land use of past habitat, such as urbanisation or subdivision of very restricted habitat (e.g. limestone gullies around Lakes Entrance that are the habitat of *East Gippsland Coastal* Warm Temperate Rainforest). Loss is not the only threat: making previously broad areas of rainforest even narrower (or smaller) is a significant impediment to their long-term viability because of edge effects and the relationship between size and viability of plant and animal populations.  
**Action:** during subdivision, leave rainforest habitat as consolidated reserves and/or covenant relevant areas; in the short term seal edges and in the longer term aim to make rainforest 'rounder' (as apposed to linear); repair ecotones and aim to reconnect with other areas of bush.
- d. **Threat:** grazing/browsing (domestic stock and pest animals: particularly deer, but also goats).  
**Action:** exclude, manage or cull the species causing the problem.
- e. **Threat:** inappropriate (human-induced) fire regimes: too frequent/too hot or wrong season.  
**Action:** change fire regimes.

**SECOND PHASE: RECOVERY. ENHANCE, RESTORE, EXTEND AND RECONNECT YOUR SITE.****GOAL 2. Repair and extend existing rainforest remnants**

**Actions:** Fix the existing remnant then begin to extend it and if possible repair its ecotone vegetation as well. Implement Restoration Manual Step 5.

**GOAL 3. Connect or recreate missing remnant islands** to enable them to act as stepping stones that can help to 'genetically reconnect existing stands' and thereby help to conserve them. Although physically disjunct, this occurs through dispersal via wind, animals or water (such as along coasts, rivers or gullies).

**Actions:** once your remnant is healthy and the threats to it are addressed, look for ways to reconnect it with the nearest patch of bush. Implement Restoration Manual Steps 1–9.

**GOAL 4. Recreate new stands in more isolated areas** (i.e. unconnected with other rainforest stands) where benefits other than the stepping stone role will accrue.

**Actions:** Create new stands on sites of past habitat to aid with habitat creation and conservation of species. Implement Restoration Manual steps 1–9.

**GOAL 5. Monitor your results:** maintain the restored rainforest in good health and plan your next project.

**Actions:** Keep an eye on how you are going and change your methods as you learn. This will help you to avoid making the same mistakes and improve your results. Implement Restoration Manual Step 10.

**STEP 1: Was it ever rainforest?**

To determine this consult the pre-1750s maps for your area. If these do not exist, then use the Rainforest Divination Tool in the **Manual: Step 1**. Pre-1750s maps of past vegetation are created by people adept at interpreting past vegetation patterns and distributions from a range of evidence. For most people, there is a strong tendency for us to have landscape amnesia (Diamond 2004): that is, we assume that what we see every day is what has always been and always will be.

If you want to restore landscapes, you have to open your eyes to what was there in the past and whether it can ever come back with your help. This process leads to some exciting findings (learning more about your area and its past

history). This involves understanding what limits the development of rainforest (mostly fire frequency and intensity) and proximity of seed sources (other rainforests).

### **STEP 2: What type of rainforest was it?**

This depends on the landform (gully, creek flat, river levee, dune, rock outcrop, etc.), climate, soils, elevation and position in the landscape. You can determine the likely rainforest ecological vegetation class by finding your site on a pre-1750s map or by using the Rainforest Divination Tool (which may give you an indication of the floristic community). Use these tools then consult Appendix M25 of the Manual to determine the species you need for your site.

The generalised descriptions in Chapter 1 Rainforest types covered by the Manual will tell you what it looked like, where it grew and where you can go to look at a piece that is still present. The Additional reading section will give you still more information, if you wish.

It is only on rare and quite specific occasions that you will need to restore a type of rainforest to your site **other** than the type that originally occurred there. These situations are outlined in Chapter 3: Setting your restoration trajectory and goals: what rainforest was it and should this be put back?

### **STEP 3: What does the site need for rainforest to recover?**

The crux of this question is: if it once was rainforest, why isn't it regenerating back into rainforest? This is a fundamental question that must be asked first up because it can save you a lot of time, effort and money. Most of the answers are really simple: you just need to know what to ask and where to find the answer. So here goes:

- Is there any remnant rainforest on your site, next to it or within 500m? If yes: then the prospects for recovery are very good.
- But what is stopping it recovering? You have to identify the ecological brakes in the form of threatening processes (grazing, weed invasion, etc.) that are preventing rainforest from regenerating on your site.

Ecological brakes are very important, because they are the threats that hold back the rainforest's regeneration. Taking steps that are often quite simple such as (fencing), or relatively cheap ones (especially if applied consistently) such as weeding can often rejuvenate the stand with little further assistance.

### **STEP 4: Can I actually do it or do I need expert help?**

This is a very important question. Where natural regeneration is not possible on your site, if it will take a very long time, or the adjacent rainforest stand is species-poor due to past disturbance, then other restoration techniques will be required. These techniques can be very complex and may require a considerable time commitment, resources and/or a significant level of expertise.

Rainforest restoration using techniques other than the Natural Regeneration Method requires a detailed understanding of many ecological principles, a good knowledge of botany and a mindset that enables you to observe natural systems and processes closely, develop hypotheses about cause and effect in these systems and an aptitude to apply these results. The bulk of this Manual is aimed at people who already have this ability, or are keen to learn it, but lack experience in rainforest restoration.

The Manual provides guidance and information that will help you to successfully restore rainforests. This will work for you if you have an aptitude and a willingness to learn (or already possess these abilities) and you have the time and organisational skills to apply them. You will then be able to design management techniques, schedules and actions that should ensure that the rainforest's restoration proceeds quickly and economically.

If, however, you don't have these skills, the inclination or the time to learn them, but still want to proceed, it is then imperative that you engage an expert who can do these tasks for you. Failure to be honest with yourself at this point will inevitably lead to a poor job, a bad result and the wasting of a lot of time, money and effort on your part, as well as of those that you enlist to help you. In Victoria, the experts that you need are called rainforest regenerators, while in New South Wales they are called bush regenerators. Their contact details are provided under Useful Contacts.

**STEP 5: What rainforest restoration methods are needed?**

There are four major rainforest restoration methods and these are detailed in Chapter 5. The four methods are:

- Natural Regeneration
- Framework Method
- Maximum Diversity Method
- Clumped Mixed Species Method.

The choice of restoration technique is very important and is based on a detailed site assessment before you proceed any further. The restoration method becomes the road map that will determine how you proceed, what further steps you may need to take and when to take them. It will also determine whether you do the job yourself, or engage someone who has the time and/or expertise to do it for you.

**STEP 6: What resources and money are needed for rainforest restoration?**

There are four essential resources needed for the restoration of rainforest:

- A site where rainforest used to once exist or can exist now as the result of changed site conditions from those that existed historically on the site (lowered water table, less frequent or intense fire regimes, etc.).
- An agreeable land owner/manager who wants to restore the rainforest and is willing to protect the restored area in perpetuity.
- The skills and commitment to restore the rainforest (see **Step 4** above).
- The money and time to undertake the task (which vary according to the restoration method used: Table 1 below).

This step is closely related to both the restoration method that you have chosen and then a whole series of cycles that range from:

- Funding cycles (when to apply, did you succeed, can it be spent within timelines, etc.)
- Flowering and fruiting cycles (when seed is ready, and does this match your needs?)
- Propagation cycles: (when can you get the seed to the nursery; is it winter growing or summer growing, how fast does it grow?)
- Climatic cycles that regulate planting seasons (is it wet enough to plant, does frost restrict planting season etc.).

**STEP 7: Planning the works**

This involves site assessment, reading the physical features of the site (particularly landforms and the disturbance regimes and conditions that go with them) so that you can:

- Engage the community
- Know how to restore the site
- Understand the threats to rainforest renewal
- Know what to plant where
- The sequence in which to plant
- When to plant it.

**STEP 8: Project implementation**

This step covers:

- Site preparation (from vehicle access to mowing, mulching and herbicides)
- Planting (methods, what to plant, when to plant)
- Pest management (what you may encounter and how to deal with them)
- Planting prescriptions by rainforest ecological vegetation class.

**STEP 9: How to measure success**

Apart from seeing your planting establish; what other measures of success can be used to determine whether ecological health is returning to your restored rainforest stand? Two relatively easy measures that have been used to date include bird censuses and natural regeneration.

The species of birds that use your restored site tell you things such as the diversity of fruiting plants available, the development of the leaf litter layer, the colonisation of the site by lichens and many other factors that relate to the ecological function of the site. Similarly, natural regeneration can indicate the state of the site, regeneration niches that

are available and what seed-dispersing mechanisms or species are using the site. It also tells you if your site is 'dispersally connected' to another rainforest stand when species that are absent at your site begin to appear.

#### **STEP 10: What resources are needed to maintain the restored rainforest and where to from here?**

Rainforest restoration is the hardest part of the processes but the next phase, that of ecological management and conservation, is about to begin. Maintaining the restored rainforest is much less expensive than the restoration process itself (from our experience: ~\$2,000ha<sup>-1</sup> year<sup>-1</sup>). Any of the threats that stalled natural rainforest regeneration on your site in the first instance, may still re-occur. Awareness of the threats will ensure that you are able to eliminate, reduce or manage them. Be sure to identify the threats, when they occur (including their cycle of occurrence, such as after floods) and their magnitude **before** to their appearance, so that you (as the land manager) can combat them. Early diagnosis of a threat and prompt action will keep maintenance costs and the time needed to implement them to a minimum. Now get organised, start a conservation management network and begin other projects.

#### **Planning your works**

1. **Establish the scale of your restoration area** (over what reach or reaches)
2. **Establish the extent of your works** (what you will do on specific sites):
  - a. **How wide will your riparian restoration corridor?**
  - b. **What remnants will need to be restored to support the program?**
3. **Begin engagement with your catchment community:**
  - a. Identify your stakeholders (both urban and rural)
  - b. Identify landholders that about the proposed restoration sites, meet with them discuss their issues and accommodate whatever you can (traditional uses: river access, pump sites, swimming holes etc.).
4. **Establish the historic Ecological Vegetation Classes that used to occur on your site**  
Use these as the basis for your restoration plan unless the site's conditions have irrevocably changed since historic times.
5. **If your site's conditions have changed since European settlement then your restoration trajectory and goals need to be altered from the pre-1750s EVCs.**
  - a. Key questions here are:
    - i. **Has the site's fire intensity or frequency declined?** Often this is the case in cleared sections of lowland floodplains. This means that areas that were once Dry Valley Forest or Riparian Forest in the past are now best restored to rainforest because that is what will establish in the absence or reduced frequency of these disturbance types.
    - ii. **Has the river changed course, and is the site now subject to more frequent flooding?** If so, areas that were once rainforest will now need to be restored to a flood-tolerant EVC (landform and reach dependent: but could include Riparian Shrubland, Gallery Rainforest, Riparian Forest, Dry Valley Forest etc.).
    - iii. **Has the site's salinity changed?** If the river has significant water diversions, dams or there is now a permanent entrance where once there was only a seasonal entrance, then this will change your restoration trajectory from the past freshwater-tolerant rainforest EVC to a salt-tolerant rainforest EVC. Past Warm Temperate Rainforest habitat will need to be restored to Littoral Rainforest; and past Subtropical Rainforest habitat will need to be restored to Littoral Rainforest.
  - b. Does the sites existing or proposed use of sites conflict with the EVC you would wish to restore? Natural vegetation restoration may not fit in with cultural or practical recreational use of the site: use modified vegetation that meets the needs of such areas
6. **Choosing your restoration method (use the Method selection key):**
  - a. **No remnant trees: choose the Framework Method** (essentially revegetation with rainforest additions)
  - b. **Remnant trees: choose the Maximum Diversity Method** (aim to establish 75% of your original rainforest's plant diversity) and/or
  - c. **Remnant Rainforest or other vegetation: choose the Natural Regeneration Method** (identify the ecological brakes and remove them to allow ecological processes to re-establish and natural regeneration to take off).

Table 1. Relative costs and timelines for a range of different rainforest restoration methods.

Restoration Method	Approach	Initial works costs (ha <sup>-1</sup> )	Ongoing management	Ongoing costs (ha <sup>-1</sup> year <sup>-1</sup> )	Duration of works until a: [functioning rainforest emerges] or a (mature rainforest is achieved)
Framework	Fencing out	\$1000*-\$4,000**	Control of transforming weeds for as many years at it takes for colonisation by rainforest species and the emergence of mature rainforest	\$2,000	[30-50 years] (50-100 years****)
	Direct seeding	\$5,000	Control of transforming weeds for as many years at it takes for colonisation by rainforest species and the emergence of mature rainforest	\$2,000	[30-50 years] (50-100 years****)
	Tubestock planting	\$17,000	Control of transforming weeds for as many years at it takes for colonisation by rainforest species and the emergence of mature rainforest	\$2,000	[30-50 years] (50-100 years****)
Natural Regeneration	Manage ecological brakes	\$6,000****	Control transforming weeds, grazing, etc.	\$2,000	[3-5 years****] (not applicable)
Maximum Diversity	Plant 75% of the plant diversity of the relevant floristic community	\$60,000	Control transforming weeds and manage other ecological brakes	\$2,000	[3-5 years] (50-100 years)

\*Assumes only one fence is required and:

- That the fencing rate is \$10.00 m<sup>-1</sup> ( a generous rate that allows the savings against the actual cost to be put into timely and consistent transforming weed management).
- There is a stream or bush that forms the other boundary.
- That the fencing rate is \$10.00 m<sup>-1</sup>.
- That the site is free of transforming weeds in the first instance.

\*\* Assumes that four fences are required of 100m length to fence out 1ha and:

- That the fencing rate is \$10.00 m<sup>-1</sup> ( a generous rate that allows the savings against the actual cost to be put into timely and consistent transforming weed management).
- There is a stream or bush that forms the other boundary.
- That the fencing rate is \$10.00 m<sup>-1</sup>.
- That the site is free of transforming weeds in the first instance.

\*\*\* Assumes that in fragmented landscapes there is a mature and healthy remnant within 500-1000m.

\*\*\*\* Assumes that there is a heavy infestation of transforming shade weeds present at the beginning of the project. The ongoing costs assume such weeds are under control.

### Prioritisation of works

Prioritisation of works is dependent on the scale of your project, the amount of funding, the timing of the funding and you and your project team's capacity to deliver the works. Key components to consider are:

1. Do you have access to all of your restoration sites simultaneously?
2. Framework Restoration is relatively cheap, rapid (2 years) and can be done by relatively unskilled operators as a Sow Grow Plant and Maintain contract.
3. Maximum Diversity and Natural Regeneration Methods are more complex and require specialised restoration practitioners that may need to revisit the same site for as long as 5 years. Consequently, these techniques are more expensive.
4. Any restoration project will be subject to climate variability, seed availability, propagation times, skilled nurseries and the season ahead.

### Key for selecting your rainforest restoration method

- 1a. The project is on a new site, which is next to or within 500 m of an existing rainforest remnant, go to.....2  
 1b. The project is a new site, which is not next to an existing rainforest remnant, go to.....3  
 1c. The project site has had restoration underway for a number of years, but natural regeneration is poor (<20% of the expected species diversity for that floristic community of rainforest), go to ..... 4

2a. Your site consists of: weed-infested gaps within an otherwise high-diversity rainforest stand; the weed-infested margins of an existing high-diversity rainforest stand; or has partial native tree cover over pasture near to a high-diversity remnant (more than 75% of the expected characteristic species for the floristic community), choose.....**Natural Regeneration.**

2b. Your site consists of: weed-infested gaps existing in a low-diversity rainforest stand; the weed infested margins of an existing low-diversity rainforest stand; or has partial native tree cover over pasture near to a low-diversity remnant (less than 75% of the expected characteristic species for the floristic community), choose.....**Maximum Diversity.**

2c. Your site is next to a remnant, but it has no tree cover, choose.....**Framework.**

2d. Your site has partial native tree cover over high-diversity native ground layer, with or without a high browsing level, choose.....**Clumped Mixed Canopy.**

3a. Your site has no native plant cover and is subject to frosts or your funding or resources are modest; make a start (remembering that you will need supplementary planting in future: see 4a below), choose.....**Framework.**

3b. Your site has some good shade cover from remnant trees, choose.....**Maximum Diversity.**

4a. The original site works used the Framework Regeneration Method or revegetation (incorporating a low-diversity species mix) and the site is **farther than 500m from an existing remnant**. There are no other ecological brakes operating to prevent natural regeneration except a lack of a diverse and nearby seed source. Consider switching your restoration efforts to the nearest rainforest remnant that may require restoration so as to provide a high-quality seed source to your current site. If this is not possible, then choose.....**Supplementary planting.**

4b. The original site works used the Framework Regeneration Method or revegetation (incorporating a low species diversity mix) and the site is **closer than 500 m to an existing remnant**. One or more ecological brakes (grazing/browsing, transforming weeds etc.) are still operating, deal with these and monitor for and use.....**Natural Regeneration.**

4c. The original site works used the Framework Regeneration Method or revegetation (incorporating a low species diversity mix) and the site is **closer than 500 m to an existing remnant**. Only one ecological brake appears to be operating: preventing seed dispersal to your site either due to either the operation of an impenetrable barrier for the seed dispersers between your site and the nearest diverse rainforest remnant or a lack of seed dispersers. The site needs to become a diverse functioning rainforest in its own right and so restoration needs to create a new fully functional rainforest, so choose.....**Maximum Diversity.**

If your site is functioning as a healthy rainforest, but your site assessment identifies ongoing, clear and immediate threats to the site's future function and/or health. Such threats may operate at a **landscape scale**, such as fire, climate change, logging, land clearing, plantation operations (including commercial species that act as rainforest weeds (pines, olives etc.); or at the **local scale**, such as subdivision, recreation, inappropriate development, loss of habitat, destruction of ecotones; or those that operate **independent of scale**, such as the use of potentially invasive species in gardens, the arrival of such species through unassisted weed invasion, climate change, fuel or hazard reduction

burning, and so on. Be aware also that **cultural threats** may also exist (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). The solution is to use either *ecological management* (remnant scale) and/or *ecosystem management* (landscape scale).

Having applied the key to your restoration site, you now have one or a number of rainforest restoration methods or approaches that need to be applied to all or some parts of the area that you intend to restore. Armed with this vital information, you now need to understand the Restoration Method and apply it.

**Further information**

Refer to the Manual for further information on Cool Temperate, Warm Temperate, Subtropical, Gallery, Dry and Littoral Rainforests.