# Article for TREAT newsletter

Published January 2013 [http://www.treat.net.au/publications/WnsJan2013.html]

## Can the return of rainforest be accelerated without tree-planting?

Carla Catterall, Luke Shoo and Kylie Freebody

### Challenges for forest restoration

Recent decades have seen a big shift in the public perception of rainforests – from being overwhelmingly viewed as an obstacle to be cleared for agriculture or felled as a source of timber, to being valued by many and mostly protected from further clearing. It is now also several decades since TREAT members and other dedicated restoration pioneers started to develop tree-planting methods aimed at returning a cover of rainforest to former agricultural land in areas of ecological importance. During that time there have been many successes. These include the development of effective revegetation techniques and the creation of continuous ribbons of restored rainforest stretching across the agricultural landscape, and protecting now-flowing streams that were once degraded bogs.

But best-practice high diversity restoration plantings are necessarily intensive and expensive. So this limits the total area of forest that can be restored to a small fraction of that which would be desirable for managing the environment and avoiding the further decline of unique Wet Tropics species, especially in the face of a changing climate.

For this reason, a group of collaborating community and management organisations, researchers and landholders came together in 2011 to start looking at novel techniques for restoring rainforest habitats and biodiversity to former pasture land. This has now become a collaborative project. It was stimulated by seed-funding obtained within a Caring for Our Country grant coordinated by the Wet Tropics Management Authority, whose focus was the revegetation of climate-change refugia in the Wet Tropics uplands.

The return of forest to areas of previously-established pasture involves overcoming a series of different ecological barriers to regeneration. Two barriers appear especially important. First, many pastures consist of vigorous and aggressive open-country grasses, which are often introduced species. For example signal grass (brachiaria) *Urochloa decumbens* and Guinea grass *Megathyrsus maximus* both originate from Africa but are used in tropical pastures worldwide. These grasses grow as dense swards which resist invasion by native rainforest plants. Dense pasture grasses suppress tree seedlings by outcompeting them both above-ground (for light) and below-ground (for water and nutrients). However, if tree seedlings establish and grow to sapling size, then they in turn become capable of out-competing the grass, especially if a closed canopy is formed to shade the soil.

Second, the seeds of most rainforest trees and shrubs are relatively short-lived, so that there is little seed storage in soils beneath pasture. Mature trees can provide seed input to pasture areas adjacent to the edge of existing rainforest, but research suggests that such input may be greatly reduced at distances as little as a few tens of metres away. On the other hand, most rainforest trees and shrubs bear fleshy fruits which are designed for dispersal by fruit-eating animals, especially birds and mammals. Consequently, the addition of perches as bird-attracting structures has potential to increase the input of seed away from rainforest edges. Furthermore, the presence of scattered trees or shrubs (native or non-native) can greatly increase seed availability and seedling recruitment away from forest edges, both by providing nuclei for input of seeds transported by fruit-eating birds, and by creating shade to suppress grasses and a microclimate that favours seedling establishment.

Another challenge to restoring forest ecosystems is the return of fauna to revegetated areas. Research has shown that some rainforest-dependent birds (for example, brown gerygone and black-faced monarch) readily colonise replanted or regenerated areas once a forest-like vegetation structure has developed. However, simply restoring a dense cover of native trees and shrubs may not be enough to reinstate the diversity of the most specialised species (including some important endemics such as the bridled honeyeater, and Victoria's riflebird). Also, the rainforest floor has many large fallen trees and branches (coarse woody debris), providing log habitat which takes a much longer time to develop, but is a critical resource for some animals. For example, the prickly skink Gnypetoscincus queenslandiae is a species confined to Wet Tropics rainforest upland regions and is typically rare in even well-developed replanted sites; outside of remnant rainforest it has only been recorded in old plantations that contain abundant coarse woody debris. Such species may only be able to use revegetated sites if there are specific management interventions to provide the critical habitat features that they need.

After some discussion among the project partners, we planned a project to undertake novel forms of on-ground restoration works within two types of experimental plots: (1) pasture conversion – 'kickstart' trials; and (2) microhabitat supplementation – woody debris addition. Below we provide some further information about both approaches, and the emerging outcomes after the first 12 months.

**Pasture conversion – Kickstart trials**

The Kickstart trials aim to remove or manipulate selected barriers to regeneration in pasture (especially competition from grasses and input of rainforest seeds), and to monitor regeneration. Each trial centres on a Works Plot, of area 80m X 80m (0.64 ha), with one end directly abutting the edge of a large intact rainforest area. Three different Works Plots have been established. Two were installed on the Cloudland property (Dave Hudson and Robyn Land) in November 2011 and one at Ringtail Crossing (Mark and Angela McCaffrey) commenced in June 2012.

To establish each Kickstart Works Plot we apply a series of treatments. First, livestock must be excluded, to prevent grazing of tree seedlings. Second, pasture grasses and some herbaceous weeds are suppressed, using staged repetition of herbicide spray applications. In the first treatment we both sprayed the entire plot and also killed all 'weedy' woody shrubs (native wild raspberry and non-native lantana and wild tobacco) with a combination of spray and stem treatments.

Subsequent treatments are decided separately for each plot, using 'adaptive decision-making' – that is, the plots are regularly inspected to assess the level of new growth of grass or other undesirable ground-covers capable of suppressing rainforest seedlings, and then the nature and timing of each spray depends on the extent to which it is considered necessary (while also aiming to minimise costs). Accordingly, sprays are not needed in winter when growth is slow, and some follow-up sprays have shifted to more use of the grass-selective 'Fusilade' (fluazifop-p butyl) chemical, whereas initial sprays used glyphosate. Apart from the first treatment, fruit-bearing shrubs that both provide cover and attract frugivores are retained (including lantana and tobacco). Each Plot is also subdivided so that outcomes of different types or frequencies of herbicide application can be compared, especially where these involve choices between high or low cost methods.

The third type of treatment relates to the importance of seed dispersers and dispersal. To encourage seed-dispersing birds, each plot contains nine bird-attracting structures – perches about 4m high with 3-5 short branches, constructed by cutting sarsaparilla (Alphitonia petrei) trees from other areas. Each perch is coupled with a small plastic water trough which fills from rain. We also mapped the scattered pre-spray locations of both the few regrowth rainforest trees on each plot and the killed lantana and tobacco bushes So now we can look at whether any of these have more seedlings growing beneath them. And we can also find out the effect of distance on seedling recruitment, since each plot stretches from zero to 80m from the forest edge.

The effectiveness of all these treatments is assessed by systematic monitoring. First, a record is kept of all interventions in the Works Plots and their costs. Second, we do a 'condition assessment' (rapid visual assessment and map) of each plot, about three times per year. Third, we measure the vegetation structure (including ground and canopy cover, plant life form and stem sizes, as per Module 4 of the Revegetation Monitoring Toolkit). Fourth, annual seedling searches are under way to map, measure and tag seedlings across selected parts of the Plot, with important input from staff and students of the School for Field Studies. The design also includes Grazed and Ungrazed Control Plots (each 80m X 20m with one end abutting the rainforest edge) to provide baseline reference points for scientific interpretation.

So what are the outcomes so far? Although monitoring so far is incomplete, and there have not yet been any quantitative data analyses, some things are easily seen when walking around the Cloudland plots. First, there was a clear and rapid response to the grass suppression, with many woody seedlings germinating and growing in the Works Plots within the first six months of treatment. Close to both the bird perches and the locations of pre-treatment shrubs (whether lantana, tobacco or native species), these forest recruits comprise many bleeding hearts (*Homalanthus novoguineensis*) as well as other pioneers such as *Alphitonia petrei* and species of *Polyscias*. Some of these have reached two metres tall in the first 12 months. This visual pattern confirms the importance of frugivore-attraction in rainforest regeneration.

Currawongs are so far the main birds attracted to the perches, and they have been abundantly regurgitating rainforest seeds in and near the water troughs, including some that have not yet been recorded as seedlings (*Cryptocarya* sp, *Elaeocarpus ruminatus*, *Ficus* sp, *Myristica globosa*) and others that have (*Alphitonia petrei*, *Polyscias elegans*, lantana and tobacco). In other parts, most of the woody regrowth has been wild tobacco, which has grown up to 3-4 m, and in some areas has formed clumps which have begun to shade the ground. It seems likely that these tobacco clumps will function to further attract the frugivores and help bring in the rainforest seeds. In other areas, many non-native herbaceous species have germinated, especially thickhead (*Crassocephalum crepidioides*). The next 12 months are bound to be even more interesting and informative …. especially if the coming wet season brings adequate rainfall.

**Microhabitat supplementation – woody debris addition**

The microhabitat supplementation trials aim to manipulate coarse woody debris within replanted areas in order to investigate whether adding such debris is able to firstly provide a 'log microclimate' within replantings, and secondly attract types of ground-dwelling reptiles and invertebrates (e.g., insects, spiders etc) that would otherwise be largely confined to mature rainforest. Some previous restoration projects have included efforts to incorporate microhabitat features such as logs. However we still lack basic information on the effectiveness of such interventions, what time-lags might be involved, and what factors govern their success.

To provide convincing answers to these questions, the microhabitat trials are under way at five different sites, established on three properties between November 2011 and August 2012. Each site contains both an area of replanted rainforest and a large remnant rainforest area located adjacent to each other, and each trial plot straddles a 60m length of the edge between them, extending about 20m into the habitat on either side. At each site we have conducted a series of manipulations of the amount of woody debris. These include adding wood to the replanted areas in the form of some log piles constructed from salvaged logs and other constructed from fence posts, as well as removing wood from sections of the adjacent forest floor. The specific log pile design was carefully considered during the project planning, and aims to create the microhabitat features (e.g., temperature, humidity, availability of small sheltered spaces) of a large decaying rainforest log. Importantly, it may not be the case that 'any old log' can provide the necessary microhabitat. Log piles are achieved by stacking five smaller logs (about 1-1.5m long by 15-25cm diameter) together, in a manner that is both easy to install and can also be easily taken apart in order to survey the reptiles.

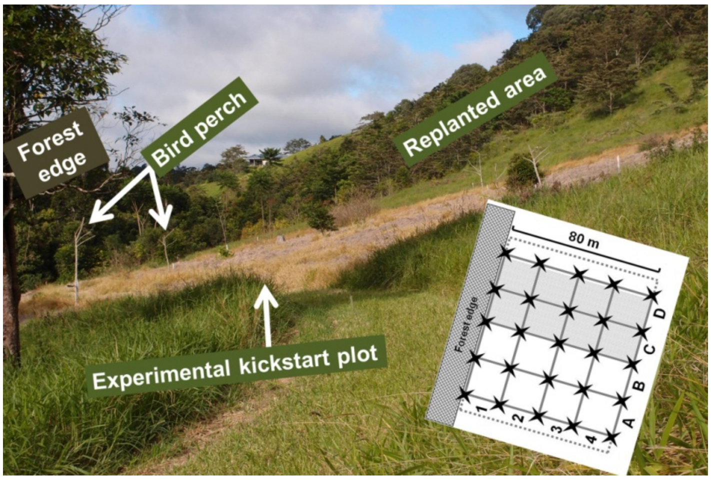
Outcomes are being monitored by surveys of ground-dwelling reptiles twice each year and pitfall trapping of invertebrates, as well as assessments of the rates of wood decay, and of the ways in which the log piles modify their local microclimates. So far, information from automatic data loggers placed in different parts of these sites, and in the log piles, is indicating that the log piles are able to provide a suitable microclimate. Although only a few reptile surveys have so far being completed, the prickly skink has indeed been recorded from a log pile in a replanted site. However, definitive conclusions await further work.

**Where to from here?**

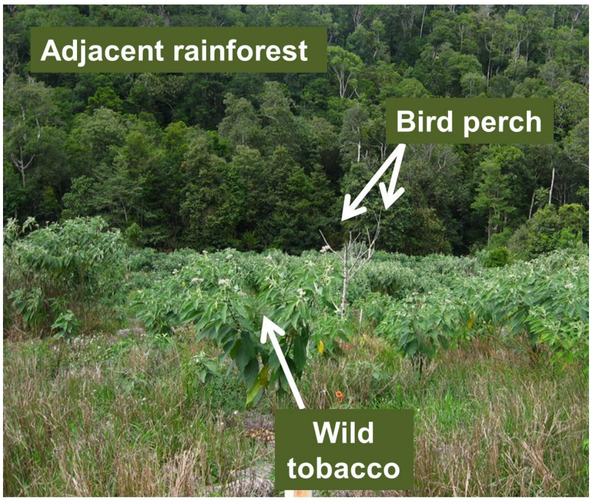
Interesting findings are emerging from these trials, and the greatest return will come from longer-term interventions and follow-up monitoring. Will the amount of rainforest regrowth in the Kickstart plots continue to increase over time? Or will it be suppressed by the invasive plants? Could there be a good time to selectively control the latter to release the rainforest growth? Will the log piles be useful to rainforest fauna? Only time and further experimentation can tell.

The development and implementation of the project has been very much dependent on the collaboration between the project partners - Universities (Griffith University, University of Queensland, School for Field Studies), government organisations (Wet Tropics Management Authority, Qld Dept of Environment and Resource Management, Tablelands Regional Council Community Revegetation Unit), non-government organisations (Tree Kangaroo and Mammal Group, Conservation Volunteers Australia) and private landholders (Dave Hudson, Robyn Land, Angela and Mark McCaffrey and Caroline Emms). Current funding for on-ground works and monitoring does not extend beyond 2013 (thanks so far to Caring for Our Country, the National Environmental Research Program, Toshiba and Landcare Australia), although we hope that some further work will be possible

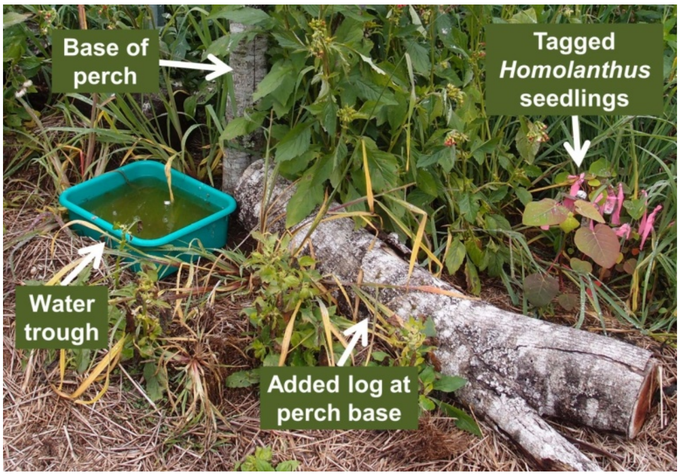
**Pics**




works plot initial stage;




works plot after 12 month




tagged seedling cluster under bird perch after 9 months

logpile