



Australian Government

Department of the Environment, Water, Heritage and the Arts

Marine and Tropical Sciences Research Facility Milestone Report, November 2009

**Program 9: Sustainable Use, Planning and Management of
Tropical Rainforest Landscapes**

Project 4.9.5: Restoring tropical forest landscapes

Project Leader: Assoc. Prof. Carla Catterall, Griffith University (GU)

Summary

Between June and November 2009, the core project team (Carla Catterall, Debra Harrison, Kylie Freebody and Amanda Freeman, together with colleagues and students) undertook activities consistent with the project's three tasks:

- (a) Develop and apply toolkits and indicators for monitoring and evaluating degradation and restoration;
- (b) Develop and communicate a functional understanding of reforestation and restoration processes; and
- (c) Improve facilitation and future optimisation of regional investments and management actions.

Across Tasks (a) and (b), there has been good progress in the field study of rates of biodiversity development in 67 reforested and reference sites. During this reporting period the field data collection was completed as planned; initial data entry for vegetation structure and floristic composition was completed; analysis of bird data was progressed; and writing of a manuscript for scientific publication was commenced on rates and indicators of development of bird communities in replanted sites.

For Task (c) a general article about findings from MTSRF Project 4.9.5 (this project) was published in the CSIRO's *Ecos* magazine, entitled 'Low success from rainforest revegetation investment'. Further development of the Terrain NRM Ltd Vegetation Projects Database has been successful, with 76 projects and 153 sites now registered from its recent projects (in addition to 34 projects and 71 sites located and recorded through previous MTSRF research). Previous 'learnings' from the experience of registering and tracking revegetation projects have been applied to the development and management of a farm practice survey and project registration process for the *Reef Rescue* scheme.

A range of related liaison and communication activities occurred across all tasks, including various meetings and discussions with stakeholders. Across all tasks there were major reporting events associated with the SERI World Conference on Ecological Restoration: 'Making change in a changing world' (19th Conference of the Society for Ecological Restoration International), where seven papers were delivered, and a Workshop on 'Ecological Offsets' was organised and conducted within the 10th INTECOL Congress held in August in Brisbane. Additionally, two papers were accepted for publication in international journals, one paper was submitted for publication, two reports were prepared and progress

was made on three further journal articles at various stages of preparation, submission, and pre-publication processes.

Project milestones extracted from Project Schedule

Targeted Activity	Due Date
<ul style="list-style-type: none"> Spoken papers on restoration outcomes presented to two international conferences (10th INTECOL Congress; SERI World Conference on Ecological Restoration 'Making change in a changing world') Completion of data collection in reforestation biodiversity study. Fact sheet on reforestation processes and restoration in practice. Article on restoration costs and benefits submitted to journal. 	November 2009

Project Results

Milestone 1: Spoken papers on restoration outcomes presented to two international conferences (across Tasks (a), (b) and (c))

Seven different spoken presentations were delivered at the following major international conferences:

<p>10th INTECOL Congress: 'Ecology in a Changing Climate: Two Hemispheres, One Globe'</p>	<p>Catterall, C., Kanowski, J. & Freebody, K. (2009) <i>Ecological outcomes of rainforest restoration projects: Dreams and realities.</i> 10th INTECOL Congress, Brisbane, August 16-21.</p> <p>Laliberté, E. Wells, J., DeClerck, F., Metcalfe, D., Aubin, I., Catterall, C.P., Queiroz, C., Bonser, S.P., Ding, Y., McNamara, S., Fraterrigo, J.M., Morgan, J.W., Vesk, P.A. & Mayfield, M.M. (2009) <i>Land use intensification reduces functional redundancy and response diversity in plant communities.</i> 10th INTECOL Congress, Brisbane, August 16-21.</p> <p>Paul, M., Catterall, C., Kanowski, J. & Pollard, P. (2009) <i>Restoring rainforest ecosystems: How do different reforestation pathways affect soil properties?</i> 10th INTECOL Congress, Brisbane, August 16-21.</p> <p>Catterall, C. (2009) Ecological offsets: An Australian case study – vegetation offsets for land clearing. 10th INTECOL Congress, Brisbane, August 16-21.</p>
<p>SERI World Conference on Ecological Restoration: 'Making change in a changing world' (19th Conference of the Society for Ecological Restoration International)</p>	<p>Catterall, C.P., Kanowski, J., Freeman, A. & Grimbacher, P. (2009) <i>Trajectories of biodiversity development for fauna during rainforest restoration.</i> SERI World Conference on Ecological Restoration, Perth, August 23-27.</p> <p>Freebody, K, Catterall, C, Kanowski, J. & Harrison, D. (2009) <i>Planting models and their revegetation outcomes in the Australian upland Wet Tropics: a retrospective assessment.</i> SERI World Conference on Ecological Restoration, Perth, August 23-27.</p> <p>Neilan, W., Catterall, C., Kanowski, J. (2009) <i>Landscape-scale resilience: A woody weed's role within planning for rainforest restoration, Byron Shire, Australia.</i> SERI World Conference on Ecological Restoration, Perth, August 23-27.</p>

Milestone 2: Completion of data collection in reforestation biodiversity study (Tasks (a) and (b))

This field study aims to improve knowledge of the processes and trajectories involved in the recovery of biodiversity and vegetation structure during reforestation. Specifically, it will fill knowledge gaps relating to the rate of biodiversity acquisition in replanted sites; its relationship with canopy closure; the development of a recruited seedling bank whose species composition indicates likely future similarity to intact rainforest; and the rate of acquisition of suitable animal seed-dispersal vectors.

The project involves selecting a network of replanted rainforest sites, together with reference sites (rainforest and pasture); measuring biodiversity attributes at these sites; and conducting statistical analyses to describe the rate and pattern of biodiversity development in the planted sites, and the comparative site development patterns seen in uplands and lowlands. The site network comprises 67 sites in all (38 upland, 29 lowland, with eight forest and five pasture sites in each landscape, 24 upland reforested sites and 16 lowland reforested sites, with reforested ages of 2-24 years.

During this reporting period:

- Field data collection was completed as planned – all sites have now been surveyed for vegetation structure and floristic (plant species composition);
- Data entry for vegetation structure and floristic composition has made excellent progress and initial entry is completed, with further checking and error-screening, and addition of taxonomic and function information for some species expected to be finished early in the new year; and
- The analysis of previously-entered bird data has progressed, and writing of a manuscript for scientific publication, about rates and indicators of development of bird communities in replanted sites, was commenced.

Milestone 3: Fact sheet on reforestation processes and restoration in practice (Task (c))

General article on reforestation: The following article about findings from MTSRF Project 4.9.5 was published in the CSIRO's *Ecos* magazine (prepared by Robyn Taylor in consultation with Carla Catterall and RRR):

Taylor, R. (2009) Low success from rainforest revegetation investment. *Ecos* 33: 151 (www.ecosmagazine.com)

The article made the point that a substantial proportion of rainforest replanting projects funded under the Natural Heritage Trust (NHT) scheme had poorer than expected ecological outcomes, due in many cases to a lack of monitoring connected with the government's policy of providing funding on a year-to-year basis for short-term revegetation works only. A copy is attached (Appendix 1).

A fact sheet for publication by the RRR on reforestation approaches, costs and outcomes, is in advanced draft format.

Milestone 4: Article on restoration costs and benefits submitted to journal (Tasks (b) and (c))

Preparation of this article is under way and it should be ready for submission in early 2010.

Other activities: Terrain NRM Vegetation Projects Database and reef Rescue project tracking (Task (c))

During this reporting period, further development of the Terrain NRM Vegetation Projects Database has been successful, with 76 projects and 153 sites now registered from its recent projects (in addition to 34 projects and 71 sites located and recorded through previous MTSRF research). This component of the project involves close liaison with the regional natural resource management body, Terrain NRM Ltd, with the aim of improving regional capacity to track and monitor projects in both vegetation restoration and other forms of environmental improvement. Previous 'learnings' from the experience of registering and tracking revegetation projects have been applied to the current *Reef Rescue* scheme, and MTSRF Project 4.9.5 researcher Debra Harrison has developed and managed a farm practice survey and project registration process which resulted in significant input to the following recent reports:

Vella, K., Harrison, D., Sing, N, Blankeney, S., Reghenzani, J. & Cosgrove, M. (2009) *Wet Tropics Farm Practice Benchmark Survey 2008-09 Results: Draft for internal comment.* Report to Department of the Environment, Water, Heritage and Arts. Terrain NRM Ltd., Innisfail (51pp.).

Vella, K., Harrison, D., Sing, N, Blankeney, S., Reghenzani, J. & Cosgrove, M. (2009) *Wet Tropics Reef Rescue Impact Report (Draft).* Report to Department of the Environment, Water, Heritage and Arts. Terrain NRM Ltd., Innisfail (87pp.).

Problems and opportunities

Due to the wide range of activities and outputs, some milestone publications are being, or have been, slightly delayed. However, there are simultaneously other new publications and communications being achieved which meet the project's strategic objectives (see details under 'Communications' below).

Communications, major activities or events

10th INTECOL and SERI Conferences, August 2009

Spoken presentations: Seven different spoken papers were presented at these major international conferences about ecology and restoration ecology (see report under Milestone 1 above).

Workshop on ecological offsets: Carla Catterall (MTSRF Project 4.9.5) and Steve Turton (MTSRF Project 4.9.3) organised a Workshop at the INTECOL Congress on 'Ecological Offsets'. The event was very successful, and attended by 18 delegates from five countries. Views and approaches to the planning management and meaning of ecological offsets were communicated and exchanged.

General article on reforestation: A general article was published in *Ecos Magazine*, as reported under Milestone 3 above.

Other communications: A range of other communications, activities or products, apart from those specified in the reporting milestones occurred during this reporting period, as follows:

Community presentations: The following invited presentations were made to community groups:

Freebody, K. (2009) *Tree planting outcomes of the Tablelands Community Revegetation Unit: A retrospective assessment*. Talk presented to the Atherton Tablelands branch of the Society for Growing Australian Plants (SGAP), Tolga CWA Hall, 28 October 2009. The talk was attended by twenty SGAP members.

Freebody, K. (2009) *Tree planting designs and the revegetation outcomes – Implications for wildlife*. Talk presented to the Tree Kangaroo and Mammal Group (TKMG), Malanda Hotel, 5 November 2009. The talk was attended by thirty people including TKMG members, community tree planters and conservationists.

2009 CERF Conference: A poster on aspects of research in MTSRF Project 4.9.5 was presented by RRRRC staff to the 2009 CERF Conference 'Impacts of the MTSRF: Improving outcomes and monitoring of revegetation'.

Scientific papers with MTSRF attribution: The following two papers were accepted for publication during this reporting period with MTSRF attribution:

Moran, C. and Catterall, C.P. (In press) Can functional traits predict ecological interactions? A case study using rainforest frugivores and plants in Australia. *Biotropica* [doi:10.1111/j.1744-7429.2009.00594.x]

This paper demonstrates that a few key functional characteristics of bird species perform well in predicting their roles as seed dispersers of rainforest plants: a crucial process in rainforest restoration.

Laliberté, E., Wells, J., De Clerck, F., Metcalfe, D., Catterall, C.P., Queiroz, C., Aubin, I., Bonser, S., Ding, Y., Fraterrigo, J., McNamara, S., Morgan, J., Sánchez Merlos, D., Veski, P. & Mayfield, M. (2010) Land use intensification reduces functional redundancy and response diversity in plant communities. *Ecology Letters* 13: 76-86 [doi:10.1111/j.1461-0248.2009.01403.x]

This paper demonstrates that the simplification of forest ecosystems during agricultural intensification is associated with a reduction in functional resilience of plant communities.

The following paper was submitted for publication during this reporting period with MTSRF attribution (this is a resubmission of a manuscript prepared under a previous reporting milestone):

Kanowski, J. and Catterall, C.P. (Submitted) Carbon sequestration under differing revegetation designs in north-east Australia. *Ecological Management and Restoration*.

This paper demonstrates that tree planting techniques used for ecosystem restoration sequester carbon more rapidly than do plantation designs which have been developed for timber production. The restoration-planting designs maximise both biodiversity and carbon outcomes, although their per-hectare costs are greater.

Scientific papers with Rainforest CRC attribution: The following manuscripts from related work were published or in press (without MTSRF attribution, but with acknowledgement of Rainforest CRC):

Nakamura, A., Catterall, C.P., Kitching, R.L., House, A.P.N. and Burwell, C.J. (2009) Effects of shading and mulch depth on the colonisation of habitat patches by arthropods of rainforest soil and litter. *Insect Conservation and Diversity* 2: 221-231.

Nakamura, A., Catterall, C.P., Burwell, C.J., Kitching, R.L. and House, A.P.N. (2009) Effects of mulch type and depth on the colonisation of habitat patches by soil and litter arthropods. *Pacific Conservation Biology*.

These two papers provide new information on the way in which soil and litter invertebrates respond to the restoration of habitat, and provide useful insights to the design of rainforest restoration projects that desire to recover soil and litter assemblages.

Other publications in preparation: Work progressed on three other different journal articles at various stages of preparation, submission, and pre-publication processes.

General liaison activities undertaken through course of Year 3 of project: A summary of major liaison activities undertaken from June-November 2009 is provided in Appendix 2.

Plans for next milestone reporting period

Plans are currently being discussed for potential workshopping of regional revegetation priorities with stakeholders, and at least one scientific conference presentation during the next reporting period, although these plans are not yet finalised.

Forecast variations to planned milestones

Due to the wide range of activities and outputs, some milestone publications are being, or have been, slightly delayed. However, there are simultaneously other new publications being achieved which meet the project's strategic objectives.

Appendix 1: Ecos article 'Low success from rainforest revegetation investment'



Kylie Freebody (centre) and colleagues review a forestry revegetation site. *Cathy Downey*

Low success from rainforest revegetation investment

A project to investigate the outcome of large government investments in community-based rainforest revegetation has found that only about half the area reported as revegetated was actually forested after six to 11 years. About half of this forested area was in poor or very poor condition – often due to a lack of monitoring or maintenance.

Project leader, Associate Professor Carla Catterall of Griffith University, says that despite the expenditure of tens of millions of dollars on replanting rainforest vegetation, and the dedicated enthusiasm of many community members, only about one per cent of previously cleared rainforest in tropical and subtropical Australia has been replanted with rainforest trees.

Dr Catterall and co-researchers Debra Harrison, Kylie Freebody and John Kanowski, funded by the Marine and Tropical Sciences Research Facility and Terran NRM, followed up on a

compilation of all available records of revegetation projects funded by the Natural Heritage Trust (NHT) in the Wet Tropics between 1997 and 2001. These projects covered a total area of 644 hectares at a total cost of more than \$16 million (of which about \$6 million was NHT funding).

Although some monitoring of project outcomes had occurred, the researchers noted that it often consisted of simply taking photos and in very few cases were surveys of the vegetation or fauna carried out.

'Photos and visual observations can only indicate whether a small part of a planting is growing well at a particular point in time,' says Dr Catterall.

Subsequent mapping and systematic recording of vegetation condition in a large number of six- to 11-year-old projects indicated that even where many trees had grown well, not all plantings had recruited a diverse rainforest understorey as intended.

'Without the data that regular monitoring provides, the reasons for this poor development cannot be determined,' says Dr Catterall. 'In many cases the lack of monitoring was connected with the government's policy of providing funding on a year-to-year basis for short-term revegetation works only.'

'Standard reporting processes covered the work done rather than the longer-term outcomes.'

She says appropriate targets to monitor during the establishment phase of reforested sites include survival and growth of planted trees, development of canopy closure, and the proportion of ground covered by grasses and weeds that might suppress the recruitment of rainforest plants.

In the later building and maintenance phases, appropriate monitoring targets include vegetation structure, floristic composition, the recruitment of plants and the use of reforested sites by wildlife.

Member of the project team and co-manager of the Tablelands Community Revegetation Unit, Kylie

Research

Freebody, says the project showed that monitoring needs to continue beyond the establishment phase.

'We are predicting that you probably need to have annual monitoring of the planting for at least five years, and maybe 10 years, just to keep track of it,' she says. 'By monitoring, for example, cyclone damage which may have left big gaps in the canopy, you can see where maintenance is needed.'

This maintenance might involve, for example, intensively managing grasses and weeds with carefully applied herbicide

for six to 12 months until the foliage of the undamaged trees grows back to block out the light.

Dr Catterall says funding agencies must recognise the need for continuous funding for independent regional management, monitoring and record-keeping of rainforest revegetation activities, especially given the long-term nature of the work and its increasing significance in the context of environmental offsets and carbon storage.

However, she says, typical reactions are often 'we don't have time to monitor, we don't know what to do, we don't have enough funding ...'

The finding that the NHT-funded projects had much poorer outcomes than indicated by standard reporting processes raised awareness of the need for a better-coordinated, regional-scale funding effort. Dr Catterall says that given the increased future role for carbon sequestration and offset markets, this will be crucial for credibility of reforestation in the Wet Tropics.

Largely as a result of this project, a regional monitoring and evaluation program

'In many cases the lack of monitoring was connected with the government's policy of providing funding on a year-to-year basis for short-term revegetation works only.'

Involving collaboration between ecologists, revegetation practitioners and community groups, and the development of a regional-scale project database, has recently begun in the Wet Tropics region.

© Robin Taylor

More information: Kanowski J, Catterall CP and Harrison DA (2008) Monitoring the outcomes of reforestation for biodiversity conservation. In: *Living in a Dynamic Tropical Forest Landscape*. (Eds N Slocum and S Turton) pp. 526–536. Wiley-Blackwell, Oxford.

Appendix 2: Summary of meetings and liaison occurring within MTSRF Project 4.9.5, 1 June-31 November 2009

Note, the following table excludes some 'within-project' meetings.

Date(s):	Place (or coord. point):	Project staff involved:	Other participants' names and organisations	Type of interaction	Purpose of interaction	Outcomes of interaction (or ref. to separate minutes or documents)
19-Sept-09	Brisbane	Carla Catterall	M.Mayfield, D. Metcalfe, J. Wells, J. Morgan, P. Vesk, S. Bonser, F. De Clerk, Others from various research organisations.	Meeting/ Workshop	Develop ideas and analyses for collaborative research outputs that build on data sets held by participants	Development of plans for data analyses and published outputs
05-Oct-09	Innisfail	Debra Harrison	Terrain Staff – Bart Dryden Cassowary Coast Regional Council – Ken English	Meeting	Discuss and document Cassowary Coast Revegetation Projects	Cassowary Coast Revegetation Projects recorded in Toolkit format.
09-Oct-09	Cairns	Debra Harrison	Terrain Staff – Bart Dryden, Gavin Kaye	Meeting	Discuss and finalise layout of Reef Rescue System Repair Report	Report layout finalised
18-Oct-09	Caloundra	Carla Catterall	Les Hall, Ron Sharpe	Meeting and field visit	To discuss management and biodiversity monitoring in a significant rainforest remnant	Provided advice, developed plans for liaison
28-Oct-09	Tolga, Atherton Tablelands	Kylie Freebody	The talk was attended by 20 SGAP members	Presentation	'Tree planting outcomes of the Tablelands Community Revegetation Unit: A retrospective assessment'	Increasing knowledge of tree planting outcomes and the need for monitoring
5-Nov-09	Cairns	Carla Catterall	WTMA staff and other committee members	Meeting	WTMA Scientific Advisory Committee meeting	Discussions and advice on scientific basis for managing the Wet Tropics World Heritage Area
5- Nov-09	Malanda	Kylie Freebody	The talk was attended by 30 people including TKMG members, community tree planters and conservationists	Presentation	'Tree planting designs and the revegetation outcomes – Implications for wildlife'	Increasing knowledge of tree planting outcomes and the preliminary monitoring results of MTSRF Project 4.9.5

Date(s):	Place (or coord. point):	Project staff involved:	Other participants' names and organisations	Type of interaction	Purpose of interaction	Outcomes of interaction (or ref. to separate minutes or documents)
6-Nov-09	Atherton Tablelands	Carla Catterall, Kylie Freebody		Meeting	To analyse data errors in spreadsheets and to discuss initial bird monitoring results	Data errors sorted and data checking progressed
5-Nov-09	Cairns	Carla Catterall	Various MTSRF researchers	Meeting	RRRC Rainforest & Catchments Operations Committee meeting	Discuss progress and plans relating to MTSRF research
09-Nov-09	Cairns	Debra Harrison	Terrain Staff – Geoff Onus	Meeting	Discuss and document current revegetation Projects	Current Revegetation Projects recorded in Toolkit format (Establishment Statistics)
18-Nov-09	Cairns	Debra Harrison	Terrain Staff – Mel McDonald	Meeting	Discuss and document current revegetation Projects	Current Revegetation Projects recorded in Toolkit format (Establishment Statistics)
18-Nov-09	Cairns	Debra Harrison	Terrain Staff – Steve Bailey	Meeting	Discuss and document current revegetation Projects	Current Revegetation Projects recorded in Toolkit format (Establishment Statistics)
22-Nov-09	Cairns	Debra Harrison	Terrain Staff – Michael Nash	Meeting	Discuss and document current revegetation Projects	Current Revegetation Projects recorded in Toolkit format (Establishment Statistics)
22-Nov-09	Cairns	Debra Harrison	Terrain Staff – Bob Stewart, Sharlene Blakeney	Meeting	Discuss, map and document current and historical revegetation Projects	Current and historical Revegetation Projects recorded in Toolkit format (Establishment Statistics) and mapped
27-Nov-09	Byron Bay	Carla Catterall	Around 50 people from local and state government and the broader community	Workshop	Byron Shire Camphor Laurel workshop: presented a talk and participated in discussions	Develop plans for sustainable management of camphor laurel regrowth