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RESCCUE

Ecological restoration and erosion control in Ra Province Diagnosis and action plan



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Front page photo: Tree nursery used to restore TC Winston damages, Ra Province (R.Billé, 2016)

TABLE OF CONTENT

1.	Introduction	5
2.	Land degradation and deforestation	7
2.1	Extreme weather events: droughts and flooding.....	7
2.2	Burning and Grassland fire	8
2.3	Agricultural practices and excessive use of fertilizers.....	9
2.4	Mangroves Degradation/Clearing	9
2.5	Development activities & threats to ecological integrity.....	9
3.	Ecological restoration, conservation, and reforestation interventions.....	10
3.1	Riparian Buffer Restoration	10
3.2	Mangrove Protection.....	11
3.3	Reforestation	12
3.4	Erosion control	16
4.	Existing policies	16
5	Opportunities for RESCCUE implementation.....	18
6.	Potential Threats for RESCCUE implementation	18
6.1	Lack of community support for the project	18
6.2	Lack of knowledge	19
6.3	Limited community capacity	19
6.4	Lack of collective community ownership of the project	19
7.	Action plan	19
7.1	Selection of Pilot Area	19
7.2	Community Engagement and Awareness.....	20
7.3	Ecological Restoration and Erosion Control	21
7.4	Mangrove Replanting	22
7.5	Timeline and indicative budget	22
	References	23
	Appendix 1 – Action Plan Matrix	25
	Appendix 2 – Species of Conservation Concern (IUCN and CITES).....	26

Table 1: Summary of species found in Nakauvadra and Nakorotubu Range. 6
Table 2: Mangrove Seedlings planted through CTI project 12
Table 3: Survival assessment of planted trees in the Nakauvadra Community Based Reforestation
Project 15

Figure 1 Map of Pilot Site in Ra..... 20

1. Introduction

- **Background information**

The Province of Ra is located at the northern tip of Viti Levu and is one of eight provinces found on the main island, with a total land area of approximately 1,341 square kilometers. The 2007 national census estimates that Ra province has a population of 29,464 (Fiji Bureau of Statistics, 2007) with the majority consisting of Indigenous Fijians, followed by Fijians of Indian descent, dispersed across 19 districts and 93 villages.

Ra Province uniquely supports two mountain ranges Nakauvadra and Nakorotubu surrounded by large tracks of grass lands. The mountain ranges are home to a number of endangered and critically endangered species discovered in a 2008 Rapid Biodiversity Assessment (RAP) lead by Conservation International (CI) and the University of the South Pacific (USP). Nakauvadra encompasses a land area of 11,387 ha and elevation ranging from 300-866 meters; Nakorotubu encompasses a land area of 19,701 ha and elevation ranging from 100-560 meters. The Province of Ra lies on the drier side of the island, receiving an estimated 2,000-3,200 mm of annual rainfall, roughly half the amount of the southern side of the island (Raj, 1993). Across Fiji, climate projections suggest that weather patterns will become more extreme in the coming years, with increases in rainfall in the wet season and decreases in the dry season. In Ra Province, these weather changes will aggravate an already sensitive farming and agriculture system which provides livelihood and subsistence for local communities.

In Ra, communities are decidedly more vulnerable to the impacts of natural disasters and weather variances due to the lack of widespread economic development. A 2011 World Bank Report found that Ra Province is one of the most economically depressed areas in the country with an estimated 50% of its population falling beneath the poverty line – the third highest incidence of poverty among the country’s 14 provinces. Intervention is critical to guide communities in sustainable economic development that integrates conservation and management of natural resources, as well as ecosystem-based adaptation approaches to climate change that bolster community resilience and enhance livelihoods.

- **Ecological significance**

The vegetation of western Viti Levu is dominated by talasiga grasslands – meaning “sun burnt land” in Fijian—which refers to the fire-modified or fire-degraded grasslands and fern-lands found on the lower fringes and are depauperate of native flora and fauna. Talasiga grasslands cover much of the dry side of the larger Fijian islands (Parham 1972, Smith 1979). Adverse impacts of slash and burn agriculture and frequent fires, many of which are deliberately lit (Drysdale, 2013), have prevented the successful re-establishment of native tree species across the western district. Talasiga covers about a third of the area of the two main Fijian islands, Viti Levu and Vanua Levu, mostly in the poorer, eroded areas of the western dry zone.

The remaining intact forests in the western side are located in three large forest patches: the Koroyanitu Range in the Ba Province, and the Nakauvadra and Nakorotubu Ranges in Ra Province,

comprising of lowland rainforest, upland rainforest and cloud forest (Mueller-Dombois and Fosberg, 1998). The 2008 RAP assessment of Nakauvadra and Nakorotubu Range provided a baseline for future conservation work in the areas (Morrison and Nawadra, 2009, 2010). Significant biodiversity was observed in Nakauvadra and Nakorotubu Ranges resulting in their designation as Key Biodiversity Areas (KBA) and proposed as National Priority Sites for Conservation in both sites. The RAP was the first of its kind in the Province and the objectives were to:

- collect baseline data on the diversity and conservation significance of major terrestrial flora and fauna taxa;
- identify potential threats to biodiversity in the area, and propose mitigation strategies to enhance biodiversity conservation;
- increase local capacity by providing hands-on training in field biodiversity inventory techniques for students, local guides and local government researchers;
- make RAP data available for conservation management decision makers in Government, local communities, NGOs, academia and the general public.

A summary of the flora and fauna documented from both RAP surveys can be found in Table 1 below. The highlights of the survey were the discovery of endangered and critically endangered species including the Fijian Ground Frog (*Platymantis vitianus*), currently listed as Endangered, which was found in the Nakauvadra Range and was previously thought to have been extirpated from Viti Levu. Another significant discovery was the sighting of the endemic Podocarp species (*Acmopyle sahniana*), a Critically Endangered species, in the Nakorotubu Range. Other globally threatened species found included two rare endemic stick insects (*Nisyurus spinulosus* and *Phasmotaenia inermis*), the Fiji long-legged warbler (*Trichocichla rufa*), the Black-faced shrikebill (*Clytorhynchus nigrogularis*) and the Friendly ground dove (*Gallicolumba stairii*). A list of all IUCN and CITES listed species can be found in Appendix 2.

Table 1: Summary of species found in Nakauvadra and Nakorotubu Range.

Taxa	Total number of species for Nakorotubu	Total number of species for Nakauvadra
Plants	425	418
Herpetofauna	10	11
Birds	38	34
Bats/Mammals	3	9
Terrestrial gastropods/macro invertebrates	22	5

Freshwater crustaceans	12	35
Damselflies and dragonflies	31	
Freshwater fish	15	8
Total	556	520

As a result of the Nakauvadra and Nakorotubu RAP surveys, several recommendations were made (Morrison and Nawadra, 2009, 2010). Two of the key recommendations are as follows:

i. Protection of important habitats

The Nakauvadra and Nakorotubu Ranges remain relatively intact and are two of the large remaining forest tracts in the western side of Viti Levu. It is critical to ensure protection of these two remaining forest patches by working with stakeholders in the public and private sectors. Apart from formal protection of the forest systems, rehabilitation should also be undertaken along the fringes and water catchments areas that are devastated by fire, clearing for agriculture and grazing by animals.

ii. Community awareness and education

Since a majority of the remaining intact forests are owned by Indigenous Fijians, engagement with communal landowners is crucial to secure the success of future conservation initiatives. Community awareness raising and education campaigns coupled with integrated training on sustainable land use and coastal management practice, will be critical to both reduce community activities that negatively impact the environment and simultaneously develop practical alternatives and solutions.

2. Land degradation and deforestation

2.1 *Extreme weather events: droughts and flooding*

The area is already prone to droughts which are exacerbated by seasonal El Nino weather pattern. Since 1989, a series of droughts have significantly impacted Ra, the most extreme of which occurred in 1992, 1997-98, 2003 and 2010. The 2010 event lasted 16 months resulting in water rationing and dispersal of emergency water supplies to many communities. At present, the region is experiencing a drought of similar impact which began in May 2015. These droughts impact subsistence and commercial farming as well as survival rates of livestock as food stocks becomes increasingly depleted.

Tropical Cyclone Winston the strongest tropical cyclone ever recorded in the Southern Hemisphere devastated huge areas of vegetation and coral reef in the Ra Province. Post-cyclone assessment is currently underway.

Across the Province, sugarcane crop yield is also diminished from seasonal droughts, decreasing production of the Penang Sugar Mill, one of four sugar mills operated by the national Fiji Sugar Corporation. Communities in the area are dependent on the sugar industry either through farming or employment opportunities during harvest season. These seasonal droughts cause economic shocks to local populations who have few alternative avenues for income generation and livelihoods.

Flooding is another extreme weather event that greatly impacts the Province and affects livelihoods and wellbeing of communities, which is usually associated with tropical depressions and cyclones. Flooding in the area has been further exacerbated by reduced vegetation on the catchment and gravel extraction which increases stream-flow during extreme rainfall events.

2.2 Burning and Grassland fire

Deliberate and uncontrolled burning is a rampant problem in Ra, especially during the dry season and on sugarcane plantations. As previously noted, the majority of the land consists of talasiga grassland that is continuously exposed to fires, thus decreasing surrounding soil quality and increasing difficulties associated with management of exotic species. Expanded grass land increases the threat of the encroachment of exotic species into the higher elevation pristine areas of the Nakauvadra and Nakorotubu range. A study of the water and nutrient dynamics of pine forest on former grass land soils in south west Viti Levu (Waterloo 1994) concluded that fires should not be used between pine crop rotation as subsequent crop yield will decline significantly. This decline is attributed to massive surge in nutrients released to streams with the first rain after the burn-off. Pine forests are harvested on a 20-24 year cycle while sugarcane fields are harvested annually.

Historically, grassland fires in the project zone have occurred on an annual basis, largely due to pig hunting, careless behavior, and stray fires from sugarcane burning. In 2014 a total area of 169 ha was destroyed by fire compared to 19 ha in 2011 and 2013. This was due mainly to the extreme dry conditions. Apart from replanting the burnt forestry plots, the project applied several fire prevention measures. Trees were planted in mixed arrangements to help contain fires. Fire breaks have been established around the reforestation sites following guidelines developed by Fiji Pine. In the fire breaks, fire-retardant plants such as pineapples, coconuts and citrus trees have been planted. Planting fruit crops in the firebreaks means that communities will take a more active interest in monitoring for fires near the reforestation sites, whilst also providing additional food security and income generation. In years that are particularly dry, community fire wardens have also been trained and hired to patrol the project areas on a daily basis and to report any fire instances directly to the CI Field Office and the Rakiraki Fire Authority. Fire wardens lodge quarterly reports to the Conservation Officer in the Provincial Council for presentation at Tikina and Provincial Council meetings.

Annual fire prevention and educational campaigns at village and tikina meetings have been held in partnership with the District Committee and Methodist Church, which is an important institution in the project zone. The National Fire Authority and the Rakiraki Police Department are also invited to attend such meetings to inform communities on the legal implications of starting fires in accordance with the 2009 Crimes Decree (arson clause).

2.3 Agricultural practices and excessive use of fertilizers

Unsustainable farming practices are defined to include logging on slopes, lack of soil conservation practices on marginal slopes and riverbanks, extent of commercial cultivation to river banks, overuse of chemicals among farmers and slash and burn cultivation methods. The Ra ICM Plan further identified the prevalence of unsustainable farming in six out of the nine ICM sites in Ra (USP, 2015).

Farmers have responded to the loss of soil nutrients and reduced soil quality by increasing the rate of fertilizer applied every year. Loss of organic matter, increased soil compaction and soil acidification have been experienced by farmers. Together with private sector investment, Fiji Government has provided local sugarcane farmers with access to blended fertilizers, but this has been met with contention and complaints regarding unsustainably high prices. Increasing prices has also led to decreased ability to apply fertilizers to cane fields and lower cane yields.

2.4 Mangroves Degradation/Clearing

Mangrove resources in the Ra Province are limited to major rivers and creeks. Three different types of mangrove stands have been observed in the Ra Province, delta mangroves, lagoonal mangroves and stunted mangroves. Largescale mangrove clearing is not evident in the Ra Province but localized mangrove harvesting for firewood still occurs.

2.5 Development activities & threats to ecological integrity

In 2015, Ra Province was declared part of the Tax Free Zone where investors can launch project implementation within 18 months of approval. Black Sand mining in the province of Ra is in an exploration phase and Tengy Cement, a mining company, is awaiting confirmation for a special prospecting license for Navitilevu Bay. The communities that would be affected are discussing establishment and declaration of a Marine Reserve in the Area (USP, 2015) with high likelihood of opposing mining development.

Another development activity that has the potential to impact the ecological integrity is gravel extraction along freshwater systems in Ra. In 2014, the Department of Lands did not issue any licenses for gravel extraction; and the iTaukei Land Trust Board North/Western Office in Ra claimed they would not issue access rights for gravel extraction. Regardless, the Ra Integrated Coastal Management Committee recorded numerous reports from community members of gravel extraction particularly Saivou district in Ra. Following this discovery, there was extensive deliberation on the issue of illegal gravel extraction, and all such activities have been stopped in the Province of Ra. The only legal gravel extraction currently being undertaken is in the district of Naiyalayala by the Dayals Quarries Limited of Ba.

The Provincial Administrator Ra announced at the RESCCUE project inception workshop that a major supplier of river gravel in Fiji has secured approval to source material from Ra. In return, the Province will receive \$5 million for development funds. Although this information has not been substantiated, it must be taken into consideration when developing trade-offs scenarios and models for payment of ecosystem services.

With many farms left idle after the expiration of leases, the Government of Fiji is encouraging indigenous landowners and interested individuals to fully utilize such lands in order to boost sugar production. However, many landowners are ill equipped to till the land . In addition, such lands are often located on medium to steep slopes, usually at a distance from the mill and are susceptible to massive erosion, nutrient loss over time and low yield. These factors, coupled with high transportation costs, render the farming activity in this area uneconomical. Special attention is required to improve the productive capacity of such idle lands. Failure to advocate sustainable farming practices that will return soil nutrient and build organic matter over time may be detrimental to ecological integrity of many idle agriculture lands in rural areas of the Province of Ra.

While the tax free incentive has the potential to attract many investors to the Province of Ra, this investment must be sustainable. Adequate environmental and risk assessments must be conducted to ensure that investment activities do not permanently damage the environment. While economic development is critical to benefit the local population, proper procedures and due diligence are necessary to ensure that the ecological integrity of the natural environment is not compromised for short term gains.

3. Ecological restoration, conservation, and reforestation interventions

3.1 Riparian Buffer Restoration

Very little work has been undertaken in Ra Province in regards to riparian buffer restoration. The most recent work was implemented in 2010 under the Coastal and Watershed Restoration for the Integrity of Island Communities project (COWRIE), funded by Coral Reef Initiatives for the Pacific (CRISP) and administered by CI and USP. The main objective of the project was to empower communities in Fiji to undertake management decisions towards the restoration and protection of their watersheds with specific links to coral reef management. The restoration component of the project was undertaken in the District of Naroko comprising of three villages: Rewasa, Narara, Vatukacevaceva The work involved restoring 30 hectares of talasiga grassland and small water catchments using native and exotic species (USP & Fiji Department of Forests, 2010). Although the project was small, it provided valuable lessons including:

- the need to include and incentivize community members to participate in the restoration program;
- constant maintenance of the seedlings in the nursery to be out-planted to ensure high survival rates in the field;
- maintaining community engagement through regular awareness activities especially fire awareness and other critical issues;
- collaboration is crucial especially working with communities, provincial councils and relevant government agencies such as Department of Forests.

Another project which explored cost-benefit assessment of riparian buffer restoration was implemented in 2012 by Landcare Research New Zealand and USP, under the Climate Development and Knowledge Networks (CDKN) Project. The project worked in the Penang and

Ba River catchments to assess the biophysical and socioeconomic impacts of flooding, a cost-benefit assessment of management options, and the potential impacts of climate change on communities. The aim of the study was to provide information for proactive management through infrastructure development, social solutions, and/or ecosystem-based adaptation to mitigate the risks posed by extreme weather associated with climate change.

The study indicated upland restoration and repair of the riparian buffer zone offered the best cost benefit scenario for communities in Ba and Penang. The cost benefit analysis indicated that the Net Present Value (assuming project life of 100 years and discount rate of 8%) of upland afforestation provides the highest net benefit. While it is acknowledged that planting along streams and riverbanks does *not* provide the highest level of protection from flooding, the low cost of implementation coupled with the provision of ecosystem services (such as carbon sequestration, provision of non-timber forest products, and habitat provision) indicates that riparian planting has the highest impact per dollar spent on mitigation. This assessment analyzed the cost-benefit value and efficacy of restoring the riparian buffer zone in current, moderate, and severe climate change scenarios – riparian buffers remained the best option for all three constructs.

Simply put, riparian buffers are cost effective and most efficient mitigation options. Other mitigation options compared in the cost benefit analysis included other ecosystem based approaches (EbA) such as planting floodplain vegetation, reinforcing river banks; and hard approaches such as raising houses, dredging rivers and mixed intervention. The study also noted that mixed intervention incorporating both hard and EbA is effective under most scenarios and may be preferable to many approaches. However, the cost of hard approaches can be high, and hence the efficiency of mixed interventions is lower than that of some EbA by themselves.

3.2 *Mangrove Protection*

In Ra, the majority of the mangrove protection and rehabilitation interventions have been carried out at the community level with assistance from the Fiji Locally Managed Marine Area Network (FLMMA). Another organization with a long history of mangrove protection in Ra is the Organization for Industrial, Spiritual and Cultural Advancement International (OISCA). In 2012, OISCA replanted a total of 10,000 mangrove seedlings on 3 hectares of the Nakorotubu coast, located within the 10 marine protected areas in 8 villages (OISCA, 2013). A mangrove nursery was also constructed in Saioko Village in Nakorotubu District to supply seedlings for replanting.

In 2015 as part of the Coral Triangle Initiative (CTI) funded by the Asian Development Bank, five coastal villages in Ra undertook mangrove replanting: Navolau, Togovere, Vitawa, Narewa, and Naivuvuni. Approximately 19,000 mangrove seedlings were planted across an estimated 17 ha. of coastal shoreline. The objectives of the mangrove replanting exercise were to educate and encourage mangrove replanting by communities to safeguard and stabilize the coastline.

Table 2: Mangrove Seedlings planted through CTI project

Village	No. Seedlings Planted	Equivalent Area (3x3m spacing between trees)
Navolau	3,081	2.8Ha
Togovere	3,369	3.0Ha
Vitawa	6,780	6.1Ha
Narewa	2,700	2.4Ha
Naivuvuni	3,369	3.0Ha
TOTAL	19,299	17.3Ha

3.3 Reforestation

SPC Reforest Fiji programme

The Pacific Community (SPC) is currently implementing a €9 million (F\$20 million) forestry project initiative funded by the European Union. The objective of this reforestation project is to have about 7.5 million trees planted covering 6000 hectares of forestry plantations and woodlots in a major boost for livelihoods in Viti Levu. The forestry project will provide important long-term environmental and economic benefits for Fiji. Reforest Fiji will involve communities in areas highly susceptible to soil erosion such as Koronubu, Drasa and Malolo. It is envisaged that trees planted under the Reforest Fiji programme, will contribute in generating an estimated 400,000 days of employment. One of the expected outcomes of this forestry initiative is to mitigate the impact of soil erosion sugar cane belt areas. One of the project demonstration sites in Vuniyasi, Malolo, Nadi, in Western Viti Levu. Reforest Fiji is a pilot project that will conclude in June 2018.

Fiji Pine Limited (FPL)

The best known reforestation work undertaken in Fiji is the afforestation of large tracts of talasiga grasslands by FPL with *Pinus caribaea* on land leased from indigenous landowners. Pine plantations were established in Fiji from the 1950's through loans from large donor agencies such as the Commonwealth Development Cooperation supported by the UK, Australia and New Zealand Government (Whyte, 1998). The afforestation activity was and is still carried out on land communally owned by Indigenous Fijians. In 1999 FPL had approximately 77,680ha with just over 40,000 fully stocked *P. caribaea*; 9000 ha idle land; 14,000 non stocked whilst the rest are either in reserve, trial or under research (Oliver, 1999). The main objective of the large scale pine afforestation activity is to:

- Broaden the economic base by providing forest based industry based on pine plantations;
- Provide more than 10,000 rural based community members with economic opportunities for work;
- Generate foreign exchange earnings through export of pine chips;

- Protect and conserve the environment¹ through planting activities on degraded talasiga grasslands that are susceptible to wind/water erosion and wild fires.

Pine plantation estate in the Ra Province is estimated at 2,890ha of fully stocked *P. caribaea* which is equivalent to 4% of the total pine estate in Fiji (Oliver, 1999). There are many small pine woodlots in communal and private lands in Ra Province. Pine woodlots range in size from 25ha to 100ha. These were planted through the Fiji Pine Extension Program of the Department of Forest and were aimed at establishing privately owned pine plantations among rural communities to generate economic returns and supplement Fiji Pine Limited wood resources (Von Maybel, 1998).

The primary objective of FPL is the socio-economic development of rural areas and the alleviation of poverty through stimulation of the rural economy; the establishment of plantation-related business ventures; creation of employment opportunities; and support for education and training of the rural people, particularly for the landowners that the FPL leases land from. Pine forest landowners and local communities benefit from FPL activities through lease payment (F\$12 per hectare), a log stumpage share (12 percent of net log sales), and contracts for all field operations (14 million FJD per year) (Sue, 2010).

Across Fiji, the primary threat to pine plantations is fire. On average, FPL puts out around 150 plantation fires per year and an estimated 50 wild fires. FPL also conducts around 1,000 controlled burns each year (Van Duesen, 2008). In 1997, around \$1million worth of pine plantations were written off due to fire, and between 1987 and 1997 a total of 8,566 ha of pine plantations were written off due to fires (Were, 1997). The main cause of fire is arson arising out of conflict between FPL and the landowners, employment issues, low rate of returns, social equity issues and politics (Were 1997; Van Duesen, 2008). Other major source of fire comes from escaped agricultural fires from the sugarcane belt; followed by grazing; negligence and lighting (Drysdale, 2013).

Future Forests Fiji (FFF)

Future Forest Fiji was established in 2005 by a group of local and overseas investors mainly to specialize in growing teak (*Tectona grandis*) for timber production and export. At the end of 2012 a total of 200 ha were planted (Future Forest Fiji, 2012). As of 2014, the company owns 239 ha of teak plantation under pre-commercial stages with the oldest planted in 2006 and an estimated 60% ranging from 2 to 5 years old (Future Forest, 2015). A majority of the teak plantations are located in Ra and the rest in the Nadroga Province.

Nakauvadra Forest Carbon Project

The Nakauvadra Community Based Reforestation Project in Fiji was developed by CI, and funded through the support of FIJI Water Foundation. The project is located on the northern tip of Viti Levu in the Province of Ra and comprises 1,135 ha of reforestation plots along the Southern and Northern slopes of the Nakauvadra Range. The project commenced in October, 2009 with an initial 100 ha of mixed species (teak-*Tectona grandis* and mahogany-*Swietenia macrophylla*)

¹ *Pinus caribaea* is not considered as an invasive species in Fiji.

spread over five plots. The project's main objective is to develop a multiple benefit, community based reforestation project that:

- reforests an area of 1,135 ha which results in the sequestration of an estimated 280,000 tCO₂ over the 30 year project lifespan, validated and verified to the Climate, Community and Biodiversity Standards (CCBS). So far carbon credits have been sold;
- increases forest cover around the Nakauvadra Range to expand critical habitat for endangered and endemic species while enhancing forest connectivity with other adjacent forest blocks; and
- enables local communities and landowners to benefit from job creation, increased revenue, and the enhancement of livelihoods in both the short and long term.

The project incorporates a community-based reforestation model, planting hardwood timber species on 28% of the total area which can be sustainably harvested upon reaching maturity to provide for long term income generation for the landowning communities. The remaining 72% of the project site was reforested using native and endemic species, especially on the steeper slopes of the Nakauvadra Range which will expand forest habitat and create a 'green wall' around the more pristine upland and cloud forest ecosystems that are found in the rugged and higher elevation areas of the Range. The reforestation sites have been strategically identified to ensure the creation of new forest patches that are envisaged in the long term to help establish a conservation corridor between the Nakauvadra Range and nearby Wabu/Tomaniivi Range, 4kms on the southwestern flanks of Nakauvadra.

The project reforestation sites are all on native land owned by different landowning units (mataqali). Community Conservation Agreements (CCA) have been signed with each landowning unit. The CCA provides guidance and understanding on the roles and responsibilities of each party during the project lifetime. According to the agreement, each mataqali gives full consent to CI to carry out the reforestation project on their behalf and allows project staff to access their land for such purposes. The CCAs further stipulate that the mataqali will maintain the planted trees for 30 years after which the forest stock will become part of the mataqali asset.

Survival rates indicated that the exotic teak (*Tectona grandis*) is very successful especially in the talasiga grassland. It is noted that as teak was gradually phased out and replaced by native species; survival rates decreased from about 94% in 2009 to 27% in 2014. The low survival rates are attributed to the long droughts in 2014 and 2015 in addition to wild fires.

Table 3: Survival assessment of planted trees in the Nakauvadra Community Based Reforestation Project

Year	Average Survival Rates (%)	Planting Ratio (%)	
		Native	Exotic
2009	94	20	80
2010	72	50	50
2011	61	50	50
2012	57	50	50
2013	28	100	
2014	27	100	

Reforestation of Degraded Areas

Fiji has benefited from a number of reforestation campaigns in and projects in recent years. In 2010, the Fiji Government launched the “Our Gift to the Future Generation” campaign. At the end of the year-long campaign, over 1,010,000 trees were planted. The campaign was extended to support the United Nations International Year of the Forest in 2011, after which the total number of trees planted increased to 1,722,000². Under the Nakauvadra Community Based Reforestation Project, CI facilitated capacity building among communities to identify tree species, collect seeds, build low cost nurseries, germinate and tend to tree seedlings. As a result, the communities were able to raise and sell tree seedlings to the project; generating new sources of revenue to improve local livelihoods (Conservation International, 2013).

In 2015, the central government launched the Reforestation of Degraded Forest project, which supported rehabilitation of an estimated 150 ha of degraded forest was rehabilitated across Fiji, mostly on Viti Levu. This was implemented through Fiji Department of Forest (DoF)-Extension Division, and as the name suggests, funded rehabilitation of degraded forest using combination of native and exotic species mainly pine (*Pinus carribea*) and mahogany (*Swietenia macrophylla*) depending on condition of site. Villages interested in participating under the project apply directly to the Conservator of Forests, after which a team is dispatched to assess the area and suitability for selection. DoF then supplies seedlings and technical expertise to carry out the reforestation program. Several villages in the Ra Province were selected in 2015 including Wailevu, Naivuvuni, Nanukuloa and Matawailevu village. The project continued this year (2016) with funding of 500,000FJD targeting an area of 500 hectares for reforestation.

² <http://www.wwf-pacific.org/?200219/1-million-trees-in-support-of-International-Year-of-Forest>

3.4 *Erosion control*

Soil erosion

There has been little academic research to assess the severity and breadth of erosion control across Ra. Since the onset of sugarcane cultivation in the late 1880's soil erosion and erosion control have posed a challenge to sustainable land management, particularly in Fiji's western districts (Drysdale 2013). Increases in agricultural production over the last 30-50 years and lack of sustainable land management practices have exacerbated erosion. Vetiver Grass was introduced as a viable solution in the early 1950's, planted in hedgerows along steep slopes to secure soil (Truong 1994). Erosion has become exacerbated by the shift to production of short term crops, such as taro, cassava, ginger and kava, to increase earnings from exportation of agricultural products (Nakalevu *et al.* 1998).

In view of the limited arable lands in Fiji (Leslie *et al.* 2002), increasing population (Fiji Island Bureau of Statistics 2008) and development programs, it is imperative that sustainable land management be practiced to ensure continuity and sustainability of food production. In addition to the use of Vetiver Grass, other initiatives have emerged using agroforestry models using *Caliandra* trees, mechanically modified slopes and mulching (Ratukalou *et al.* 1999). The choice to decide which erosion control measures to use mainly depends on the type of crops, assessment of land aspect such as slope angle, soil type, weather pattern and land tenure.

Lessons learnt from demonstration activities in Fiji and Vanuatu were documented in a series of four manuals developed under the COWRIE project, aimed to assist communities in ridge to reef watershed management. The manuals covered: (1) watershed management, (2) guide to planting local trees for restoration (3), guide to building a low cost community nursery and (4) use of vetiver Grass in degraded Areas (USP, 2011). These manuals provide best-practice guidelines for watershed management through experiences of ridge to reef landscape planning with communities from the Province of Ra.

4. Existing policies

The People's Charter, 2010–2014 Roadmap (Ministry of National Planning 2009), the Constitution of the Republic of Fiji (2013) and the Green Growth Framework for Fiji (Ministry of Strategic Planning, National Development and Statistics 2014); provides the enabling environment for sustainable development at national scale. These policies encourage sectorial integration and proclaim that sustainable development will be achieved through democracy, fair governance, inclusive development, national unity, and more importantly a healthy natural environment.

From a sectorial perspective, key policies that will impact ecological restoration and erosion control in Ra Province include the Ministry of Fisheries and Forest, Rural Land Use Policy, and Climate Change.

The Forest Policy Statement (2007) reflects the multiple uses and purposes of forest management that have evolved over the years, to increase the environmental, social and economic opportunities of the forest sector. It provides a paradigm shift from timber production

to sustainable multiple-use management regime. This includes sustainable forest management, conservation, and the use of forests as carbon sinks. The policy recognizes the economic potential of the sector as a major source of foreign exchange and aims to develop the sector in a way to ensure this is maintained. It also promotes conservation, rehabilitation and sustainable forest management in line with the Rural Land Use Policy for Fiji and stresses the social role of forestry in creating a sustainable rural environment, employment and income opportunities. It recognizes the need to engage and involve local stakeholders and landowners in the sustainable management, protection, and rehabilitation of resources.

The Rural Land Use Policy for Fiji (Leslie et al. 2006) argues that there is a need to establish long term land use plans to guide farmers on the most appropriate crops suitable to different ecological geographies in Fiji. The vision of the rural Land Use Policy is to protect ecological systems and biodiversity; reduce damage to fragile ecosystem; improve rural environmental conditions; promote sustainable farming and encourage establishment of Land Husbandry Groups.

The National Climate Change Policy (2012) and the National Climate Change Adaptation Strategy (Government of Fiji 2011) have synergies with the Green Growth Framework (2015) but focuses on forestry, agriculture, water, livestock, biodiversity and natural ecosystems through the lenses of Climate Change Adaptation. It aspires to identify and implement efficient and effective activities to manage the existing and anticipated consequences of climate change. With increasing opportunities created through the introduction of the United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD) program, the Department of Forestry has developed a National REDD+ Policy for Fiji (2011).

Despite strong policy frameworks, implementation of policy programs remains a challenge. In addition, supporting legislations to enforce policies are either non-existent or not implemented by line agencies. Current legislations pertaining to fire can be found in various legislations such as the 1985 Land Conservation and Improvement Act which basically covers construction and maintenance of fires breaks and the role and responsibilities of fire rangers. The 2009 Crimes Decree (arson clause) has stricter punishments for burning forestry plots. However, enforcement has been difficult for various reasons such as lack of initiative by community leaders in reporting offenders or offenders seeking traditional reconciliation ceremony and lack of manpower or initiative by local police to investigate and prosecute.

The proposed RESCCUE ecological restoration/conservation activities will endeavor to implement core principles of the all the policies outlined above in a simple and practical way in order to demonstrate that communities can be guides to make informed decision to better management available resources through sound infrastructure development, social solutions, and/or ecosystem-based adaptation that mitigate ecological loss in a cost effective manner. As such, RESCCUE activities represent potential opportunities to increase the effectiveness of these existing policies.

5 Opportunities for RESCCUE implementation

Stakeholders working in the Province of Ra have set the platform to apply a ridge to reef landscape planning framework through various projects including ongoing efforts to protect the Nakauvadra and Nakorotubu Range, the Nakauvadra Reforestation Project at the fringes of the two mountain ranges and the COWRIE project dealing with watershed management. In addition, the CTI/ADB project provided the link between land-based initiatives and the marine environment providing the necessary foundation of establishing clear and strong Governance structures to support the development of the Ra Integrated Coastal Management Plan (Ra ICMP).

The Ra ICMP was endorsed by the Provincial Office in Ra as well as the National Integrated Coastal Management Committee in 2015. The Ra ICMP highlighted eight priority coastal resource issues ranging from gravel extraction, burning, pouching in marine areas, use of destructive fishing methods, waste water management, sustainable financing mechanism for coastal/marine areas, black sand extraction and unsustainable farming practices (USP, 2015).

6. Potential Threats for RESCCUE implementation

Lessons learnt from past experiences in the Province of Ra have indicated the need to include and incentivize community members to participate in all aspects of project implementation. Incentives will be limited to the supply of raw materials used in the demonstration sites. We have also learnt that we need to constantly engage with communities to maintain the level of awareness necessary to drive voluntary community participation. Project staff will attend village meetings, Tikina meetings and where necessary, Provincial meeting. Project staff will also collaborate with working committees set up by the Provincial Office or the Provincial Administrator and other stakeholders to secure support for the project.

6.1 Lack of community support for the project

Since most people prioritize short term benefits, the inadequate provision of benefits in the longer term could lead to the loss of support or abandonment of the project by communities. The project has secured community agreements with all the landowning units involved in the project which outlines the responsibilities and benefits to be accrued by each partner. In addition, the project has been designed so that immediate financial benefits accrue to participating communities in the first five years through the reforestation and maintenance activities. In addition, revenue may be accrued by the community during the harvest of hardwood species upon reaching maturity in year 20. To complement this in the short and medium term, livelihood diversification activities are carried out across the project area, engaging with communities at village level and focusing on income generation through the provision of materials to set up microeconomic enterprises such as honey (provision of beehives), ginger, pandanus leaves, pineapple, coconut and other fruit trees, and sandalwood. It is expected that these initiatives will become financially sustainable in the long term, and leverage the replication of similar enterprises in other neighboring villages.

6.2 *Lack of knowledge*

The lack of knowledge and understanding about the long-term direct and indirect benefits could lead to non-cooperation among community members. The communities will need to understand the benefits of increasing forest cover and the associated long term impacts on the continued provision of key ecosystem services. Clear and direct communication with community members presenting the project benefits and addressing any potential challenges will be an on-going process. To promote the active participation of communities for the long term maintenance and protection of the reforestation sites, information, capacity building and awareness raising activities will be undertaken. Key messages to be conveyed include (1) well maintained forests can provide improved watershed protection; (2) contribute to clean water in the creeks emanating from the Range and (3) contribute to enhancing livelihoods through the provision of forest products (fruits and seeds) and river food. Such benefits will be beneficial to their own families and clan members as direct beneficiaries.

6.3 *Limited community capacity*

The communities involved in the project at the outset have limited capacity to undertake the reforestation and ongoing maintenance and fire prevention activities to ensure the long term success of the project. Conservation International has provided training and capacity building to each community involved in the project on all the reforestation activities including seedling collection, nursery establishment, planting and maintenance. These skills will allow communities to set up their own independent nurseries. The nurseries may support the collection and sale of sandalwood seedlings which are highly sought after in the local area. In addition, the Department of Forests, a key partner to the project is working with CI to offer long term support, such as the provision of training on the sustainable harvesting of the teak, and the incorporation of community nurseries into their own annual program for capacity building delivery.

6.4 *Lack of collective community ownership of the project*

The reforestation sites are owned by different mataqali but not all members of any given community are landowners or involved in the reforestation agreements, which could cause resentment and division in the community as well as generating a lack of ownership for the project within the whole or sections of the community. The livelihood diversification activities are strategically organized at community level regardless of landowning status to ensure that benefits are shared among community members, thus ensuring broad support for the project. This includes the planting of pineapple, coconut and other fruit trees as well as, the provision of sandalwood seedlings, and the establishment of beehives and fish ponds. CI is also engaging community members at multiple levels, including the traditional chiefs, youth and women's groups to ensure that all concerns, issues and voices are heard.

7. Action plan

7.1 *Selection of Pilot Area*

In view of past and ongoing ecological and environmental interventions in the Province of Ra such as the Nakauvadra Community Based Reforestation Project; the COWRIE, Coral Triangle

Initiative, Climate Development and Knowledge Networks (CDKN) Project, the proposed action plan will focus in the Tikina Saivou. Tikina Saivou hosts five villages of Nanukuloa, Barotu, Naiserealagi, Tokia and Rokoroko.

Tropical Cyclone Winston which passed through Fiji on the 20 February 2016 devastated the livelihood and natural environment of people of the Ra province and several other provinces in Fiji. However, the action plan priorities in relation to ecological restoration activities in the province of Ra will be reviewed given there is post-disaster needs assessment (PDNA) being carried out in all the affected provinces in Fiji.

Tikina Saivou is located downstream from Tikina Tokaimalo and adjacent to Tikina Naroko, Nalawa and Nabala. It is situated along the coast of the Viti Levu Bay supporting the estuarine of the Barotu Rriver. Small holder farms are flanked on each side of the river bank from the estuarine approximately 100km inland towards Tikina Tokaimalo.

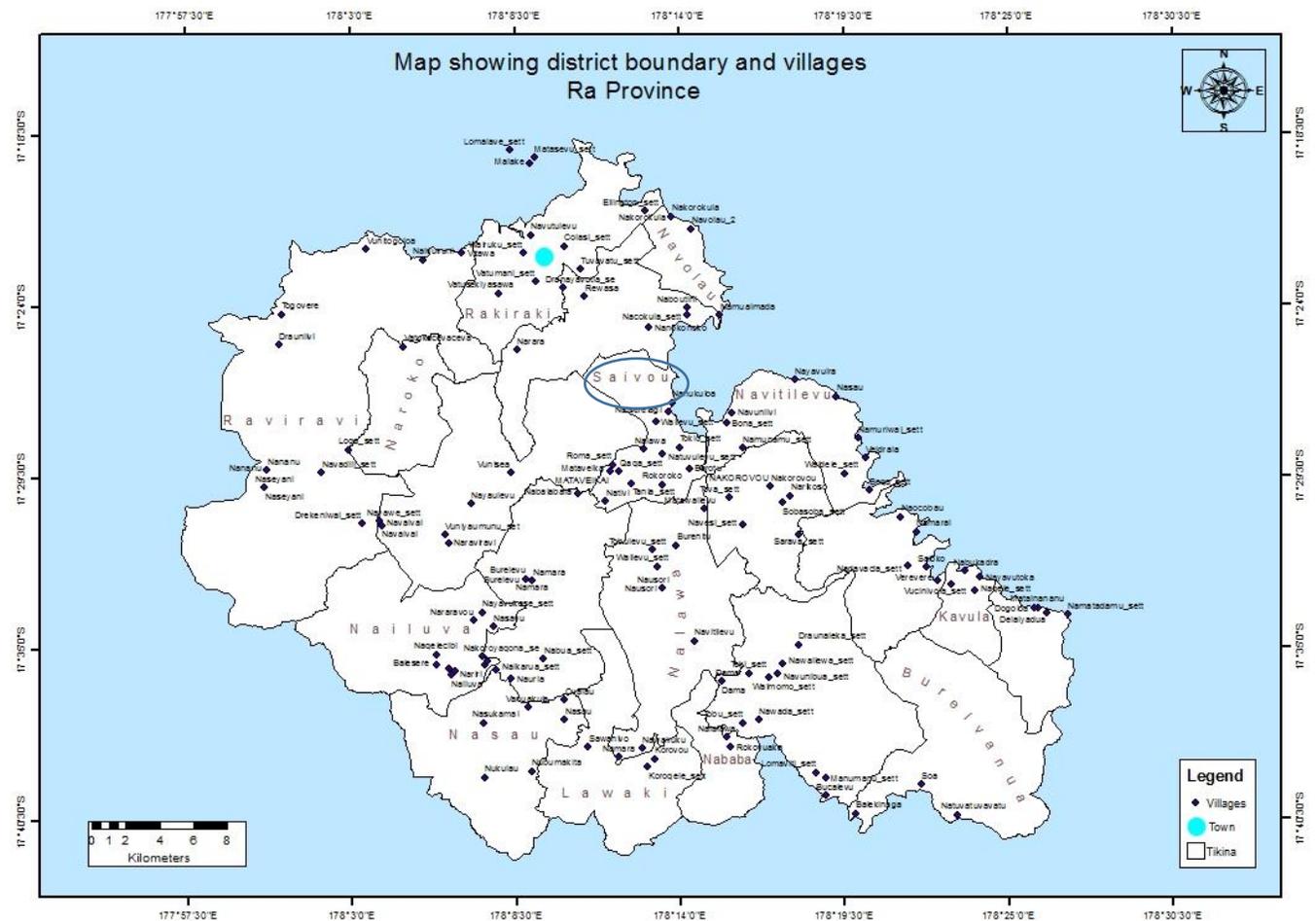


Figure 1 Map of Pilot Site in Ra

7.2 Community Engagement and Awareness

The project will undertake general awareness workshop as a form of introducing its objectives, activities and expected outcomes to community members. The workshop will also serve as a

forum to collate information on local species that currently grow in water catchment areas, riparian zones and flood plains. Community mapping exercise will provide a quick overview of the challenges in the physical environment around the community. Community discussion will identify the problems, root causes and rank appropriate solutions to each issue. Detailed Action Plan Matrix is outlined in Appendix I.

7.3 *Ecological Restoration and Erosion Control*

The most common erosion control found in Ra province is the use of Vetiver grass in the sugar cane areas (Conservation International 2013). The Vetiver grass system is proven to be the best for controlling erosion and reducing rainfall runoffs (Truong 1994). According to the Vetiver Network Newsletter³, appropriate Vetiver grass system can reduce soil erosion by up to 90%. In Fiji when used in sugar cane can increase production up to 55% (Truong 1994).

Vetiver grass and pineapple were used as hedgerows in a soil erosion research in Waibau, Naitasiri. This was tested against 'farmers practice' which does not have any hedgerow barriers along the slope. Results from 1992 – 1999 during a ginger season shows an average soil loss from vetiver grass at 0.3 t/ha, pineapple at 3.5 t/ha while farmer practice produce 17.5 t/ha. Most farmers in the central division adopted vetiver grass hedgerows after they were convinced by the Fiji – German Agroforestry Project demonstration which introduced Caliandra as hedgerows along the mid-slope and vetiver grass at the lower slope (Nakalevu *et al.* 1998).

Although the Nakauvadra Community Based Reforestation Project used pineapple and vetiver grass in a few model farms; it was not effective since most farmer still practice shifting cultivation. In addition, most farmers in Ra Province use large mechanised machines which require wider plots. At the same time it has been observed that the use of vetiver grass has not been widely adopted by the indigenous communities in the Ra Province but is very popular among sugar cane tenant farmers.

The Tikina Saivou is affected by agriculture and coastal land erosion, burning, poaching, destructive fishing methods, waste management and unsustainable farming practices. Ecological restoration and erosion control will focus on planting fruit trees along riparian zones of the Borotu River. The riparian planting will commence from the river mouth to approximately 100km inland. Three rows of contour planting at 3m part will be established. The first row of contour plant, next to the river bank will consist of vetiver grass. The next row will consist of deep rooted fruit trees/medicinal such as *Inorcarpus fagiferus* (ivi), *Dracontomelon vitiense* (tarawau), *Spondias dulcis* (wi) and others and the last row (furthest from the riverbank) will host leguminous plants. The aim of the planting design is to be able to accumulate organic matter over time. Suitable water resistant plants will be planted in the flood plains such as the *Hibiscus tiliaceus* (vau), *Leucaena leucocephala* (vaivai) and firewood species such as *Causarina equisetifolia* (nokonoko) and *Causarina nodiflora* (velau/cau).

Erosion pads will be installed at 50m interval on both sides of the river bank to assess the impact of rehabilitation over time. The pads are made of steel pipes which are driven into the soil. The

³ http://www.vetiver.com/TVN_newsletter_archive.htm

soil level will be marked on the pipe. The pipes will remain in the soil permanently with monitoring to be done every 3 months. The village headman and youth representative will be taught how to monitor soil erosion over time. It is suggested that the results be submitted formally to the Conservation Officer Ra for ease of reference.

Depending on the status of the riverbank and community aspirations, riverbank reinforcing and village drainage may also need to be considered.

7.4 *Mangrove Replanting*

Mangrove planting will be undertaken after a rapid assessment is made on the types of mangrove species in place. The introduction of new species from a remote (different) area will not be entertained. Species of trees above the high tide water mark will also be noted to inform species selection for rehabilitation of flood plains. In case of severe coastal erosion, it may be necessary to consider using green technologies for restoring/reinforcing sea walls from beach sands.

Another aspect often overlooked involves using locally available species as indicators for ecological systems. It is proposed to incorporate such indicator with alternative livelihood. Accordingly, the Ra Integrated Coastal Management Plan proposes the development of ecotourism ventures in Tikina Saivou. The action plan aims to undertake specific skills training for key individuals/youths in the village of Naiserelagi to enable them to identify sea birds. This will be the foundation for future skills development in the area of tour guides for bird avid birdwatchers. At the same time, these individuals/youths would be able to monitor presence and absence of bird species over time.

7.5 *Timeline and indicative budget*

Objective	Activity		Cost	April	May	June	July	August
Community Engagement and Awareness	Community meeting	Provincial Meeting	\$ 200.00					
		Tikina Meeting	\$ 200.00					
		Village Meeting	\$ 200.00					
	Community workshop (2 communities)	Planning workshop	\$ 6,000.00					
Ecological Restoration and Erosion Control	Riparian and flood plain planting (Seeds/seedling costs)		\$ 3,000.00					
Mangrove Replanting	Mangrove planting		\$ 2,000.00					
Erosion Control	Establishment of erosion troughs/erosion pin		\$ 2,000.00					

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Appendix 1 – Action Plan Matrix

Objective	Activity	Target	Output	Indicator
Community Engagement and Awareness	Community Meeting	Tikina Saivou	Increased Appreciation by community members	Increased Community understanding about RESCUE (evaluation forms)
	Community Workshop <ul style="list-style-type: none"> • Ecosystem Services • Community knowledge on Ethonobotany • Community mapping • Problem root cause analysis • Solution Ranking 	Demonstration village in Borotu, Nanukuloa	Community Activities Agreed	Community based Action Plans Clear responsibilities defined
Ecological restoration	Riparian and flood plain planting	Demonstration village Borotu	Water catchment rehabilitation	Timely deliverable
	Mangrove planting	Demonstration village in Nanukuloa & Naiserelagi	Coastal foreshore rehabilitation	Timely deliverable
	Training on seabird identification for Youths	Demonstration village in Naiserelagi	Capacity building for youths	Each trainee must identify at least 4 bird species
Erosion control	Establish erosion pads as monitoring device	Demonstration village in Borotu, Nanukuloa, Naiserelagi	Demonstrate management impact	Community commitment to monitor over time

Appendix 2 – Species of Conservation Concern (IUCN and CITES)

TAXA	IUCN	CITES
Amphibians		
Fiji ground frog <i>Platymantis vitianus</i>	Endangered (EN)	
Fiji tree frog <i>Platymantis vitiensis</i>	Near Threatened (NT)	
Birds		
Fiji goshawk <i>Accipter ruftitorques</i>		Appendix II
Pacific harrier <i>Circus approximans</i>		Appendix II
Black-faced shrikebill <i>Clytorhynchus nigrogularis</i>	Vulnerable (VU)	
Friendly ground dove <i>Gallicolumba stairii</i>	Vulnerable (VU)	
Pink-billed parrotfinch <i>Erythrura kleinschmidii</i>	Vulnerable (VU)	
Masked shining parrot <i>Prosopieia personata</i>	Near Threatened (NT)	Appendix II
Collared lory <i>Phigys solitarius</i>		Appendix II
Fiji long-legged warbler <i>Trichocichla rufa</i>	Endangered (EN)	
Barn owl <i>Tyto alba</i>		Appendix II
Mammals		
Pacific sheath-tailed bat <i>Emballonura semicaudata</i>	Endangered (EN)	
Samoan fruit bat <i>Pteropus samoensis</i>	Near Threatened (NT)	Appendix I & II
Tongan fruit bat <i>Pteropus tonganus</i>		Appendix I & II
Reptiles		
Pacific Boa <i>Candoia bibroni</i>		Appendix II
Plants		
<i>Acropyle sahniana</i>	Critically Endangered (CR)	
<i>Astronidium tomentosum</i>	Near Threatened (NT)	
<i>Degeneria vitiensis</i>	Vulnerable (VU)	
<i>Cycas seemannii</i>	Vulnerable (VU)	Appendix II
<i>Dendrobium biflorum</i>		Appendix II
<i>Geniostoma cf. clavigerum</i>	Critically Endangered (CR)	
<i>Oberonia heliophila</i>		Appendix II
<i>Pandanus cf. joskei</i>	Vulnerable (VU)	
<i>Podocarpus affinis</i>	Vulnerable (VU)	
<i>Podocarpus nerifolius</i>		Appendix III
<i>Cyathea alta</i>		Appendix II
<i>Cyathea hornei</i>		Appendix II
<i>Cyathea lunulata</i>		Appendix II
<i>Cyathea medullaris</i>		Appendix II
<i>Cyathea propinqua</i>		Appendix II