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CRISP



Coral Reef Initiatives for the Pacific
Initiatives Corail pour le Pacifique

TRAINING MANUAL

A guide to planting local tree species for forest restoration



CONSERVATION
INTERNATIONAL



USP

Compiled by:
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CRISP



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Initiatives Corail pour le Pacifique

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The CRISP Coordinating Unit was integrated into the Secretariat of the Pacific Community in April 2008 to insure maximum coordination and synergy in work relating to coral reef management in the region.



The CRISP programme is implemented as part of the policy developed by the Secretariat of the Pacific Regional Environment Programme for a contribution to conservation and sustainable development of coral reefs in the Pacific.

The Initiative for the Protection and Management of Coral Reefs in the Pacific (CRISP), sponsored by France and prepared by the French Development Agency (AFD) as part of an inter-ministerial project from 2002 onwards, aims to develop a vision for the future of these unique ecosystems and the communities that depend on them and to introduce strategies and projects to conserve their biodiversity, while developing the economic and environmental services that they provide both locally and globally. Also, it is designed as a factor for integration between developed countries (Australia, New Zealand, Japan and USA), French overseas territories and Pacific Island developing countries.

The CRISP Programme comprises three major components, which are:

Component 1A: Integrated Coastal Management and Watershed Management

- 1A1: Marine biodiversity conservation planning
- 1A2: Marine Protected Areas (MPAs)
- 1A3: Institutional strengthening and networking
- 1A4: Integrated coastal management

Component 2: Development of Coral Ecosystems

- 2A: Knowledge, monitoring and management of coral reef ecosystems
- 2B: Reef rehabilitation
- 2C: Development of active marine substances
- 2D: Development of regional data base (ReefBase Pacific)

Component 3: Programme Coordination and Development

- 3A: Capitalisation, value-adding and extension of CRISP activities
- 3B: Coordination, promotion and development of CRISP Programme

COMPONENT 1A – PROJECT 1A4

Integrated Coastal Reef Zone and Watershed Management

The GERSA Project led by IRD – Space Unit 140 and the COWRIE Project, led by the Institute of Applied Sciences at the University of the South Pacific, both aim at developing methodologies and tools for the high Pacific islands, integrating interactions between watersheds and coral reefs, as well as local communities dynamics in the implementation of sustainable management system, for instance such as MPAs management plans.

The project 1A4 is composed of 5 main activities:

- **ACTIVITY 1: SPATIAL APPROACH (GERSA PROJECT)**
- **ACTIVITY 2: TERRITORIALITY AND SOCIO-ECONOMIC VALUES (GERSA PROJECT)**
- **ACTIVITY 3: ENVIRONMENTAL INFORMATION SYSTEMS AND MODELISATION (GERSA PROJECT)**
- **ACTIVITY 4: DYNAMICS AND MODELISATION OF WATERSHED (GERSA PROJECT)**
- **ACTIVITY 5: TOWARDS COASTAL AND WATERSHED RESTORATION FOR THE INTEGRITY OF ISLAND ENVIRONMENTS (COWRIE PROJECT)**

THE CRISP PROGRAMME IS FUNDED BY THE FOLLOWING PARTNERS:





A Guide to Planting Local Tree Species for Forest Restoration

A Training Manual for Communities

Compiled by:

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Department of Forestry

Preface

As part of outputs under the COWRIE Project (Towards Coastal and Watershed Restoration for the Integrity of Island Environments), a series of four manuals/guides on best-practice restoration activities have been developed.

The COWRIE project funded by Coral Reef Initiatives for the Pacific (CRISP) and Conservation International was implemented over fourteen months from August 2009 by the Institute of Applied Sciences of the University of the South Pacific. The main objective of the project was to empower communities to undertake sustainable management decisions in the protection and restoration of their watershed areas. The project takes the “ridge to reef” approach highlighting the connectivity of land-use practices in the upper catchment directly impacting the marine environment.

Lessons learned from demonstration activities of the project in Fiji and Vanuatu have been documented, and resulted in the development of the following four manuals:

- 1.What is a Watershed and Why Look after It?
- 2.A Guide to Planting some Local Tree Species for Restoration Purposes.
- 3.How to Build a Low-Cost Community Nursery.
- 4.The Use of Vetiver Grass in Extremely Degraded Areas.

These manuals provide a simple guide of restoration activities that can be undertaken by communities towards managing their watershed environment from the ridge to reef.

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Acknowledgement

This manual is the result of an extensive effort of a number of people from various organizations who have been part of the COWRIE project (Towards Coastal and Watershed Restoration for the Integrity of Island Environments).

We would like to thank Fiji Department of Forestry for their support in all aspects of our project activities; in particular, we acknowledge Binesh Dayal for his substantial technical input in the on-ground demonstration activities and in the development of the training manuals. We also acknowledge Jone Navuso for his supervision of the replanting demonstration plots at Naroko, Ra and, Peni Cawani and Setareki Qaliduadua who conducted the nursery construction training in Nakorotubu, Ra, Fiji.

We also thank the Ra Provincial Office, Provincial Administrator's office, the Mata ni Tikina and communities of Naroko, Nakorotubu and Rakiraki, Ra, vinaka vakalevu for warmly receiving us and making our work easier to implement over the last year.

We also acknowledge our Vanuatu counterparts from the Foundation of the Peoples of the South Pacific International, the chiefs and community of Epau, the Area Secretary, Mr. Joseph Kalpeau, Mr. Ben Kai, President and staff of the SHEFA Province Council, Mr Tate Hanington , Mr. Philomena Ala and Mr. Russell from the Vanuatu Department of Forestry and Mr. Vatu Molisa and Mrs. Touasi Tiwok from Vanuatu Department of Environment. For the second Vanuatu site of Aneityum Island, we thank Mr. Don Miller from Farm Support Association, the communities of Aneityum in particular, Henry Kathecau , Henry Naumu, and Mr. Nick Lambrechtsen.

To our partners, Conservation International Fiji Office, Secretariat of the Pacific Community, SPC-GTZ Pacific German Regional Programme, Landcare Research and International Union for the Conservation of Nature, we thank you for your support over the project period.

And finally to the IAS family, vinaka vakalevu, this has been a team effort indeed.

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Introduction

Forests play an important role in the function and management of our watersheds. They

- stabilize soil, minimize soil loss and landslides by slowing down and spreading out water flow.
- maintain a sustained water supply.
- provide a seed bank for plants.
- are a source of cultural and economic services (i.e. food, medicine, construction materials, totems)
- are a habitat for other organisms.
- maintain and cool the surrounding environment,

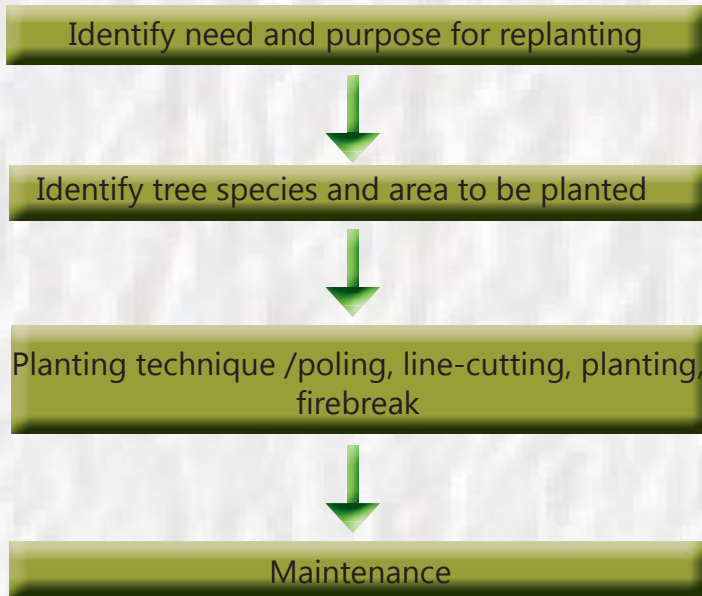
In addition, many animals that are unique to a particular environment are found in forests.

Sadly most of our forests are being cleared unsustainably especially through burning to make way for agricultural development and human habitation. The area is then subjected to poor land-use practices that contribute to lack of soil fertility and soil erosion and in extreme cases, landslides. Communities working in collaboration with key government and non-government partners play an important part and help create a better future for forest restoration. Forests need to be conserved and restored to prepare them for the impacts of climate change.

This booklet explains the what, where and how of restoring forests.

It further elaborates on how we can repair the degraded land that we have created through tree planting and identifies needs and purposes for replanting, species to site selection, planting techniques, and monitoring & maintenance.

The diagram below depicts the steps described in this manual.



What is Forest Restoration and its Importance?

Forest restoration is restoring a healthy, diverse and resilient watershed system through the replanting of native forest plants especially trees species to get it closest to the original form of the forest.

It is important because it re-establishes the structure and function, and protects and restores critical habitats, riparian areas, watersheds and many other attributes.

It is usually recommended that seedlings for replanting be sourced from within the existing forest.

Need and Purpose for Planting

In order to select the most appropriate tree species for replanting, you will need to identify your main purpose for wanting to replant trees.

Listed are some questions you need to consider:

Is it for food security? For economic development? Greater biodiversity?

Do you want to make the soil fertile again?

Is it to stop soil erosion and sediments entering your waterways (cleaner water)?

Do you want to prevent fires?

Is it mainly for food source or cultural connection (e.g. medicinal)?

Do you want to look at some timber species for longer-term economic gains?

It will usually be a combination of the above factors.

Area and Tree Species Selection

Once you have considered your purpose for planting, you will then need to identify your area or site for your replanting.

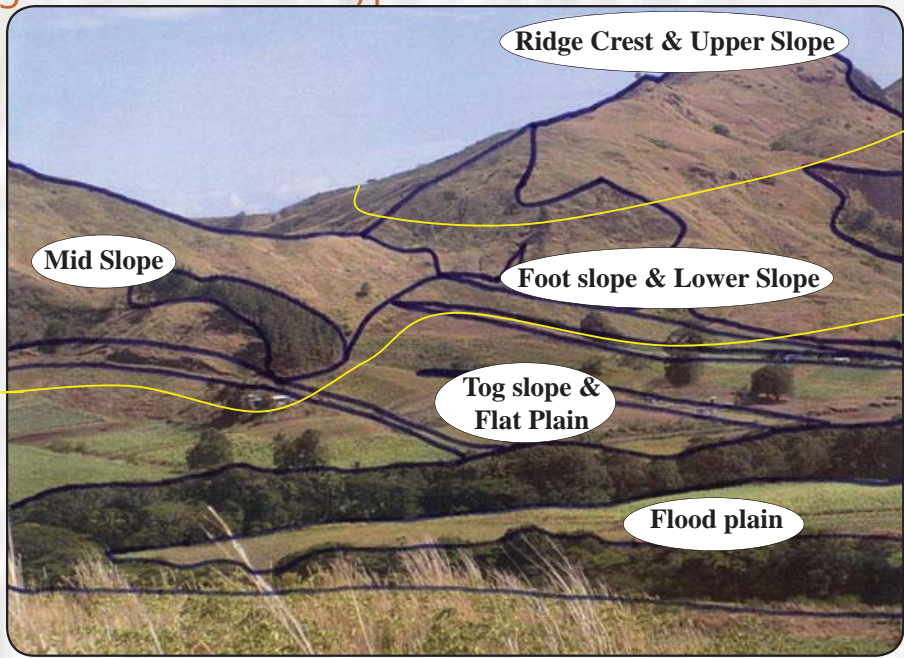
The area requiring restoration is initially assessed for the various types of "land units" found within (see Fig. 1). Factors to consider are:

- Area soil type,
- Fire vulnerability,
- Existing trees and vegetation (in the immediate area and similar areas nearby), current and potential land–use practices.

The tree species are then selected based on the above conditions. This is an important step because it will determine which trees are best suited to the above conditions.

The following diagram shows the different land unit types. You can use this to identify the different land unit types at your identified area.

Figure 1: Land Unit Types



The table at the end of this booklet lists the recommended native tree species that can be used for restoration purposes. For each tree species, the table shows which land unit type it grows best in, and its use.

Planting Techniques

Various types of planting techniques may be implemented depending on the area to be replanted. The planting technique described below is mostly relevant for extensive planting plots that are about one hectare (size of a rugby field) or more. There is the smaller scale planting of mainly focusing on surrounding village environments for subsistence purposes as well as soil protection near coastal and riverbanks and soil improvement. For these purposes, you can also use the land unit types in figure 1 as well as the table of recommended species at the end of this manual for native tree species. For advice on fruit trees, you can contact the Department of Agriculture for assistance.

It is advisable that planting be done during the wet season from November – March as this ensures higher survival rates and rigorous initial growth.

Poling

Poling will allow you to space your trees a set distance apart within your selected area of planting. In this case, we have used the standard planting space of 6m x 6m used for replanting of native tree species in accordance with the Fiji Department of Forestry's advice. Planting trees 6 metres apart will allow space for the tree to grow and spread out its branches.

Various types of planting techniques may be implemented, depending on area to be replanted, the planting technique mentioned below is mostly relevant for extensive planting.

Within your selected planting area, place poles (about 1.5 m in height) 6 m apart in the direction of the sunrise and sunset (east to west directions). Do this for the whole area of your planting site. This will ensure that the plants receive a maximum amount of sunlight to survive. Another method that you can try is planting lines across the slope (contour planting practice).



Poles placed 6m x 6m apart across the site in east-west direction for maximum amount of sunlight.

Line-Cutting

The next step is line-cutting. From the lined poles sloping downwards, clear one metre on either side from each pole (pole will be in the middle). Work your way all the way down the slope following your lined poles. At the end of it, you should get cleared columns (belts) of 2 metre widths all the way down your plots.

The main purpose of line-cutting is to protect the new plant from surrounding vegetation and for moisture retention purposes in the soil. In dry areas or grasslands, the width of planting lines to be cleared could be reduced to a metre total width for moisture retention purposes in the soil.



Weed 1m on either side of the stick all the way down. The arrows in the picture indicate 1m for clearing on either side of each pole/stick. This is to be continued all the way down for each line

This is what your plot will look like at the end of line-cutting.



Planting

Forest restoration in degraded areas with no forest cover requires planting space to be close. The planting space of 6m x 6m is normally adopted for planting native forest tree species. Different planting spaces are used when establishing forests in non-forest areas (grasslands), open-forests (scattered) and closed-forests (full canopy). In open and closed forests, spacing needs to be wider to improve the growth of the trees planted as there are other vegetation competing for sunlight and soil nutrients. It is important to note when replanting or establishing forests, you need clear objectives or purpose for the species selected. If it is for commercial purpose then silvicultural practices are to be adopted such as thinning where undesirable trees are discarded and branches are pruned to improve the bole of the trees to attain reasonable merchantable height. These practices are adopted when the commercial trees have stabilized and attained a reasonable age where these silvicultural practices could be adopted.



Buffer Zones

Native forest tree species are used for planting along the waterways. The main purpose for using the indigenous species in the buffer zones is for the management of the watershed and maintaining the waterways for continuous supply of quality water and purification. The buffer zone of 20 to 30 meters on either side of the waterways must be maintained. For restoration in the buffer zone native forest tree species that adapt themselves well in the stream banks/riparian should be used.



Buffer zones of 20-30 metres on either side of the waterways must be maintained.

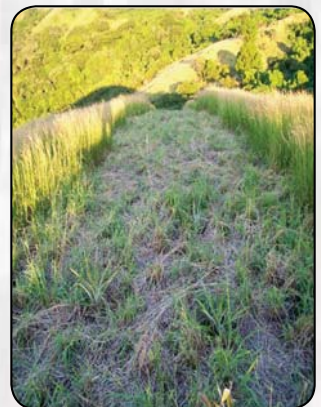
Firebreak Clearing and Planting

A majority of the degraded areas in the country is covered with grassland and is prone to constant fires. Firebreaks with a width of five meters are cleared along the ridges and boundaries of the forest established. The overall aim of clearing firebreaks is to stop fires encroaching into the planted areas. Fruit trees that are fire resistant could be used for planting in the firebreak such as mango, jackfruit and breadfruit. Root crops that are short term could also be used for planting in the firebreaks cleared.

The reason behind selecting fruit trees that are fire resistant to be planted in the firebreaks is for food security, economical returns that can be gained from sale of produce and most importantly for the constant maintenance of the firebreaks when short term root crops are intercropped within.



Firebreak plots with a width of 5 metres comprising fruit trees and selected cash crops strategically surround the plots to protect plants from fires.



Management

Management of the planted trees is the crucial component of any planted trees or restored forests. The guidelines adopted in maintaining (weeding and cleaning) established forests is that during the first year it is maintained monthly, second year after every two months, third year on a quarterly basis and on the fourth and fifth year biannually until the plants have stabilized. Adopting these guidelines would allow close monitoring of the restored forest and timely maintenance within the areas planted.



Appendix

APPENDIX 1 – RECOMMENDED SPECIES FOR RESTORATION

Appendix 1.1 Recommended Tree species for Hills, Flood plains and Coasts

This table lists species suitable in Fiji. A local assessment will be required to provide a more definitive list appropriate to each island nation.

Scientific Name	Name	Mature Size Range (m)	Habit/Form	Growth Rate	Land Unit Types											Uses/Purpose										
					Ridge Crest & Upper slope	Mid slope	Lower slope & Foot slope	Flood plains	Dry Forest	Flat Plains	Coastal Forest	Mangrove	Riparian/Stream	Grassland	Timber tree species	Erosion control	Traditional	Soil Improvement	Water Management/Ecosystem/Biodiversity							
<i>Acacia richii</i>	Qumu	20	Tree	M	✓	✓	✓									✓		D	✓	✓						
<i>Acacia auriculiformis</i>	Northern black wattle	30	Tree	F	✓	✓	✓													✓						
<i>Agathis macrophyllum</i>	Dakua makadre Lauçi	30	Tree	M	✓	✓	✓												✓		✓					
<i>Aleurites moluccana</i>		15	Tree	F	✓	✓	✓												I		✓					
<i>Alphitonia franguloides</i>	Doi damu	15	Tree	S	✓														✓		✓					
<i>Alphitonia zizyphoides</i>	Doi	25	Tree	F	✓	✓	✓												✓		FW	✓				
<i>Alstonia costata</i>	Sorua	10	Tree	F	✓	✓																✓				
<i>Alstonia vitiensis</i>	Sorua draulevu	15	Tree	F	✓	✓																	✓			
<i>Amaroria soulameoides</i>	Vasa ni veikau	25	Tree	M	✓	✓	✓															M	✓			
<i>Artocarpus attilis</i>	Breadfruit	20	Tree	F	✓	✓	✓																F, M			
<i>Artocarpus heterophylla</i>	Uto-ni-dia	20	Tree	F	✓	✓	✓																	F, FB		
<i>Atuna racemosa</i>	Makita	15	Tree	M			✓																	T, D, M	✓	
<i>Barringtonia asiatica</i>	Vuturakaraka	20	Tree	M																				✓ O	✓	
<i>Barringtonia edulis</i>	Vutu	20	Tree	F			✓																	F	✓	
<i>Barringtonia racemosa</i>	vutu wai	10	Tree	F																				✓	Fencing	
<i>Bischofia javanica</i>	Koka	25	Tree	F	✓	✓	✓																	✓	FW, D, SS	✓

