Pacific Islands FORESTS & TREES

No. 3/95 September 1995

NATURAL FOREST MANAGEMENT & LOGGING WORKSHOP

During July 1995, 14 Pacific men and women foresters were lucky enough to be chosen by their country to attend a Natural Forest Management and Logging Workshop organised by the UNDP/FAO South Pacific Forestry Development Program. Twelve represented their country's forest authority, and two represented NGOs. The workshop was organised in response to a communique issued by the July 1994 Heads of Forestry meeting which expressed *"profound concern for the ecologically unsustainable rate of forest exploitation now occurring within several island countries"* and which accorded high priority to a regional training workshop on natural forest management and logging practices.

The workshop consisted of:

(a) An eight day training course in Harvesting Planning and Management run at the Queensland Forestry Training Centre in Gympie, Queensland, by Forestman.

(b) A week visiting logging operations in Sabah, Malaysia, including conventional logging, reduced impact logging (or RIL), and a comparison of the two in terms of achieving ecologically sustainable natural forest management. This was hosted by the Innoprise Corporation Sdn Bhd from their Luasong Forestry Camp.

(c) A week of field and classroom sessions examining various aspects of natural forest management including post logging forest evaluation, development of silvicultural options, eco-tourism and funding through the use of carbon off-set credits. A highlight was a presentation on the findings of the Ministry of Forestry/CIRAD-Foret STREK project (the acronym for *"The development of Silvicultural Techniques for the Regeneration of logged-over rainforest in East Kalimantan"*). This part of the workshop was organised by CIFOR, and held at Innoprise's Danum Valley Field Centre.

(d) A visit to the Forest Research Institute of Malaysia (FRIM).

All aspects of the workshop were practical, and participants spent much of their time in the field on foot, huffing and puffing their way through the forest or up and down skid trails. Participants found the logging planning and management course in Gympie a very useful and practical basis for evaluating logging practices seen in the field, and for evaluating the opportunities for improvement in their own countries.

Participants at Gympie

The opportunity to directly compare the effects of conventional free-style logging and RIL was especially useful. Participants agreed that some of the free-style logging seen in Sabah was more destructive than any of them had ever seen in the Pacific. Post logging evaluations undertaken by the participants showed clearly that the conventional logging had effectively destroyed the forest, whereas the RIL operations enabled logging to be undertaken in such a way that both forest productivity was protected, and environmental impact was minimised. The unit cost of RIL logging was estimated to be only

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INSIDE

Quote

"Some day, after we have mastered the winds, the waves, the tides and gravity,.....we shall harness.....the energies of love. Then, for the second time in the history of the world, Man will have discovered fire,"
Teilhard de Chardin

News/Updates

Agroforestry Development in Tonga - FAO/TCP/TON/4451

Mr. Patrick Evans, FAO consultant, stopped over in Nadi, Fiji on 03 June to informally brief SPFDP, GTZ Regional Forestry Project and CIRAD-Foret representative in Fiji, on the findings of his six-month mission in Tonga. The formal briefing was provided at FAO Rome after the Nadi stopover.

Forest Sector Study and Implications on Forest Policy

Dr. Robert Thistlethwaite, of Integlan Pty., Australia, arrived in Suva, Fiji for a briefing on 26 June with UNDP and SPFDP before proceeding to Vanuatu to carry out the above study under UNDP/TSS-1 funding. He will provide a briefing on his findings and recommendations at UNDP Suva on 02 October 1995.

Roving Watershed Management Workshops

Dr. James McKean, USDA Forest Service, and *Mr. Pradip Baisyet*, CTA UNDP/FAO Watershed and Conservation Education Project in W. Samoa, arrived in Nadi, Fiji for a briefing on 26 August with SPFDP before proceeding to Tonga, Cook Islands, Pohnpei (FSM) and Palau to conduct the second series of roving watershed management workshops. They will give a debriefing on their mission on 27 Sept. at the Heads of Forestry meeting in Nadi, Fiji. The mission is funded by USDA Forest Service and SPFDP, with the support of the respective Governments.

Kiribati Mangrove Assessment

Mr. William Metz, USDA Forest Service, arrived in Suva, Fiji for a debriefing on 21 August with SPFDP before proceeding to Kiribati to carry out an assessment of their mangrove forests. Mr. Metz will describe and assess the mangrove resources present, and make recommendations for their long term use, management and development. He will present the results of his mission in Nadi on 30 September, one day after the Heads of Forestry meeting ends. His mission is funded by the USDA Forest Service and SPFDP, with the support of the Government of Kiribati.

FAO Regional Expert Consultation on Development and Application of Guidelines for Sustainable Forest Management, 03-06 October 1995, Bangkok, Thailand.

Mr. Ram Swarup, Conservator of Forests, Fiji, has been nominated by FAO for this meeting.

FORSPA Training Workshop on Forestry Research Strategy Formulation and Planning, 19-25 Nov. 1995, Chieng Mai, Thailand.

Mr. Semion Iputu, Senior Research Officer, Forestry Division, Solomon Islands and Mr. Joseph Tungon, Ag. Head of Research, Forestry Department, Vanuatu, have been nominated by FAO for this workshop.

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marginally more than for conventional logging, but the average yield per hectare was reduced mainly due to the larger unlogged buffer zones along water courses, and the exclusion of steep areas.

Two key lessons which came out of the workshop are that:

(a) Ecologically sustainable logging is possible. It requires that logging is treated as an integral part of forest productivity and the environment. This in turn requires appropriate scale topographic maps (at minimum 1:50,000 with a 20m contour interval), and typically more field staff for planning, monitoring and control.

(b) Effecting change to more forest and environment friendly practices can be a challenge. Generally change does not happen quickly. Governments with the will can speed the change to ecologically sustainable forest management by creating an effective regulatory framework, and by providing the resources required to effect change to their forest authorities. Without political will the chances of achieving ecologically sustainable forest management (except for trial and demonstration areas) are remote. NGOs are considered to have a key role to play in convincing Governments of the value of sustainable forestry management practices.

The workshop also provided an opportunity for participants to experience and enjoy culture and wildlife not seen before. The Kadazan people at Luasong Camp put on a much appreciated and enjoyed cultural performance. Many of the participants had their first attempt at doing the Hornbill dance, but none could match the adept foot stepping required for the stick dance - the risk of getting feet caught between two fast moving and very solid sticks was just too great. The wild life which left the greatest impression were the wild orangutans and monkeys, and the tiger leeches. The leeches will be particularly remembered as they were the inspiration for the very popular "Western Samoan Leech Dance."

Overall participants considered the workshop to be very successful, and many lessons were learnt with applicability to their own countries. They wish to record their thanks to the organisers and contributors, in particular SPFDP and the Innoprise Corporation of Sabah. The participant's view is that should others be lucky enough to have a similar opportunity, they should grab it with both hands.

Participants came from Fiji (2), Vanuatu (4) Solomon Islands (3) Papua New Guinea (3), Western Samoa (1) and the Federated States of Micronesia (1)

(From
Ben Everts
Forest Authority
PNG
Accompanying resource person)

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In short, the Forestry Division of the Ministry of Agriculture and Forestry in the Kingdom of Tonga has been able to develop a model for coastal reforestation and a system for collecting and preparing appropriate salt-tolerant indigenous coastal species for replanting. The results should be widely applicable to other coastal sites in Tonga and elsewhere in the Pacific Islands. Species that should be considered are shown in Table 2.

It is strongly recommended that the project be continued and funding be sought. However, the emphasis during the second phase should focus on:

1) co-management of the current site by the people of Houma and the Forestry Division;
2) carrying out an inventory and the close monitoring of the reforested area at the Houma;
3) the refinement of propagation, planting and maintenance techniques;
4) selected enrichment planting and experimentation with new species at the Houma site;
5) the use of the existing site as a demonstration and training site and a source of planting materials for the future; and
6) the development of training programs to involve more communities in self-motivated coastal protection and reforestation efforts, with appropriate extension assistance and the provision of selected planting materials by the Forestry Division.

If carried out, such activities could ensure the long-term success of the project and help to spread the benefits and technology throughout Tonga.

(by R.R. Thaman, Prof. of Pac. Is. Biogeography, USP, Suva.
A.Smith, Coastal Management Officer, SPREP.
T.Faka'osi, Head of Forestry, Tonga.
L. Filiai, Forestry Ext. Officer, Forestry Division, Tonga).

Nutrition of High Value Timber Trees

The nutrition of high value tropical timber tree species in the Solomon Islands, Niue and Australia is being investigated in a project supported by the Australian Centre for International Agricultural Research (ACIAR). The aim of the research is to improve the establishment and early growth of plantations by addressing nutritional problems in both the nursery and the field.

The following is an account of some of the research that has been conducted in the Solomon Islands in collaboration with research staff at Kolombangara Forest Products Limited (KFPL). The Australian research staff are from CSIRO (Division of Soils) and the Queensland Forest Research Institute.

Nursery Nutrition

The nursery research has focused on improving the quality and growth rate of nursery stock by optimising fertiliser use.

The KFPL nursery presently uses locally produced coir (ground coconut husk) as a potting medium Coir is readily available, has good water holding capacity, and has proven to be an effective medium for the production of *Gmelina arborea* from cuttings. Unfortunately, when no fertilisers are applied, growers have experienced serious problems in obtaining good growth in species such as *Tectona grandis*, *Cedrela odorata* and *Acacia mangium*, which are raised from seed. For example, growth of *Cedrela* seedlings was very poor (see diagram) and plants appeared unhealthy.

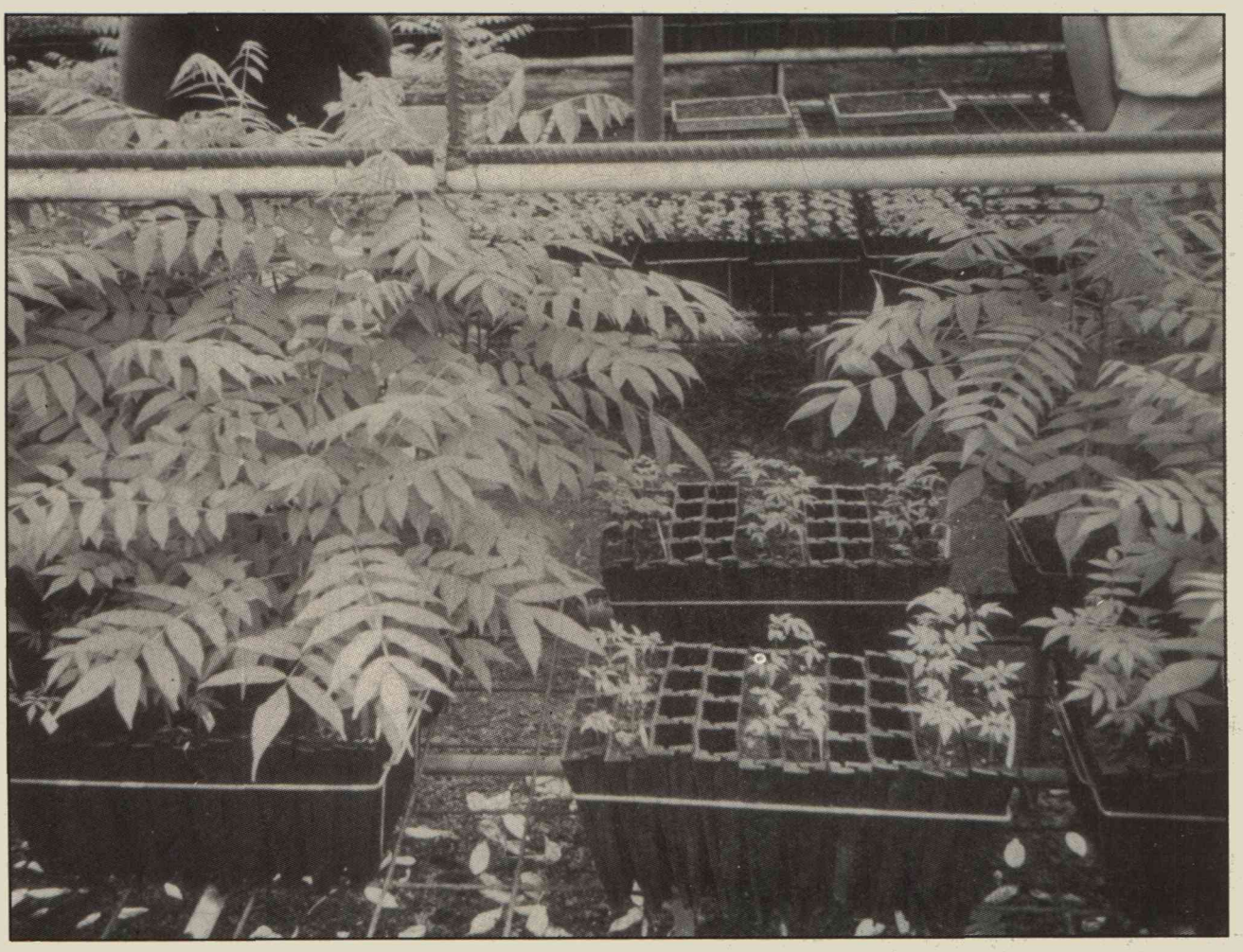
However, even adding **soluble** fertilisers was not much better than when no fertiliser was added. (The researchers thought that the soluble fertilisers were probably leached from the coir and were thus ineffective, under the high frequency watering regime in the nursery). However, by using **slow-release** fertilisers, they obtained much healthier and bigger plants (see diagram and photograph). The researchers also found that not all slow-release fertilisers were equally effective.

The next step was to determine how much slow-release fertiliser was required to produce maximum seedling growth so that fertiliser (and money) was not wasted, and that production time in the nursery could be minimised. They used a slow-release fertiliser (blend of 'nutricote blue' and 'nutricote black') at rates of up to 48 grams of fertiliser per litre of coir and tested four species (*Gmelina arborea, Tectona grandis, Cedrela odorata, and Flindersia brayleyana* (Queensland maple)). The team found that 8 to 12 grams of slow-release fertiliser per litre of coir produced maximum dry weight for three of the species tested. Amazingly, *Cedrela odorata* had not reached maximum dry weight even at 48 grams per litre!

Thus the team have identified which fertilisers are best and how much is required for each species when grown in the nursery situation at the KFPL nursery. Research is continuing to incorporate this knowledge into operational practices for routine nursery use at KFPL.

Field Nutrition

In parallel with the above research, the team had identified nutritional factors that affect the establishment and early growth of high value cabinet timbers on plantation soils (fine textured, deeply and highly weathered soils of basaltic origin). These experiments were done with both pot trials in the nursery and field



Improved growth of *Cedrela odorata* through good nutrition in a coir-based potting medium. The centre basket has not received any fertiliser. The outside baskets received small amounts of a slow-release fertiliser.

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Building on Past Agroforestry Experiences in Fiji

A workshop was held in cooperation with 13 extension officers of MAFF (Ministry of Agriculture, Fisheries and Forest/FIJI) from 21-25 August 1995 at CATD, Nadave. The workshop addressed former agroforestry experiences by the staff, who were trained in the former three years in the field of agroforestry (A/F). It was the first step from A/F training courses towards a participatory approach together with extension staff in a workshop atmosphere this year. The A/F-unit felt that the work done so far should be evaluated by the trained officers themselves.

We invited officers from all regions and different departments (for example Livestock and Cashcrop Extension staff). Everybody had to present his past experiences in A/F and the A/F-unit prepared an overall review of the approaches and goals of the former A/F project. An outlook into future activities and approaches was also done.

After long, intensive discussions, one of the conclusions was that the former project had put too much focus on A/F with one single species *(Calliandra callothyrsus)*, which was introduced from other countries. Most of the participants, when asked "What is *agroforestry*", gave only one answer: *Calliandra.*

So our main task in the future will be to widen the view of farmers and extension staff. There is a wide variety of A/F species in Fiji right now. Different A/F methods could be practised here, including traditional A/F-systems.

The former practical work focused more or less on hedgerow cultivation on contour lines with six meter wide alleys for cashcrops like ginger, taro and cassava. Promising results were mentioned by the Livestock staff, where a significant improvement in fodder for dairy-cattle could be achieved. Also the good fuelwood quality of *Calliandra* was mentioned. A lot of environmental problems were discussed. Soil erosion on steep slope cashcrop cultivation was especially mentioned.

As a result of the workshop we can say that our A/F-unit should in future focus more on the needs of the farmers and on integration of crop and livestock by combining different A/F methods with ecological goals and environmentally friendly practices in order to conserve and sustain our natural resources. A new approach of including the knowledge of farmers and extension staff in future activities with RRA and PRA methods was also mentioned. It was also said that in the near future more workshops like this should be conducted for the other extension staff, so that their knowledge and practices can also be included.

The very positive result was that we have started from now on to spread the news, that A/F will no longer be restricted to *Calliandra* hedges in Fiji and that we will focus on a wide variety of perennials like shrubs and trees with multipurpose use. Uses can range from fruits, nuts, timber, building material, fuelwood, shade and support, soil improvement, medicine, natural pesticides, to protein rich fodder for livestock and others. To turn at least some of these ideas into practice it was suggested, that we should conduct more training or awareness courses together with the farmers and improve cooperation with the Livestock unit. The A/F unit will, as a result of the review and the workshop, react and widen the approach towards the farmers' needs.

(by H.W. Raedler, GTZ AF-trainer, Nausori, Fiji)

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trials at sites representative of those used for plantations.

Results from the pot experiments demonstrated that phosphorus was the major nutrient limiting growth of *Cedrela* seedlings on the most widespread plantation soil in Kolombangara. Other results have suggested that other nutrients, most probably nitrogen and, in some cases zinc and iron, are also limiting growth on these soils.

Field trials confirm that phosphorus is the major limiting nutrient in the growth of *Gmelina* and teak and that the current rates of phosphorus fertilisation are probably inadequate for maximum growth. A second field trial has been established to more closely determine exactly how much phosphorus needs to be added to this soil to achieve the optimal growth rates.

The close collaboration between KFPL research staff and Australian research staff has enabled the team to suggest appropriate improvements in nursery and field nutrition practices that are in line with KFPL's current operational strategies. It has also provided an opportunity to demonstrate techniques in designing experiments so that other staff are more confident in establishing their own experiments.

Can these results be useful elsewhere?

The researchers consider that these results will applicable to other areas with similar soils and climate and to nurseries with similar production practices. Under different circumstances, simple experiments like those described above can be conducted to determine the optimum fertiliser use for that particular situation.

The researchers from Australia are currently compiling a Research Methods Manual with its focus on the design and interpretation of tree nutrition experiments. This manual should be available by the end of 1995.

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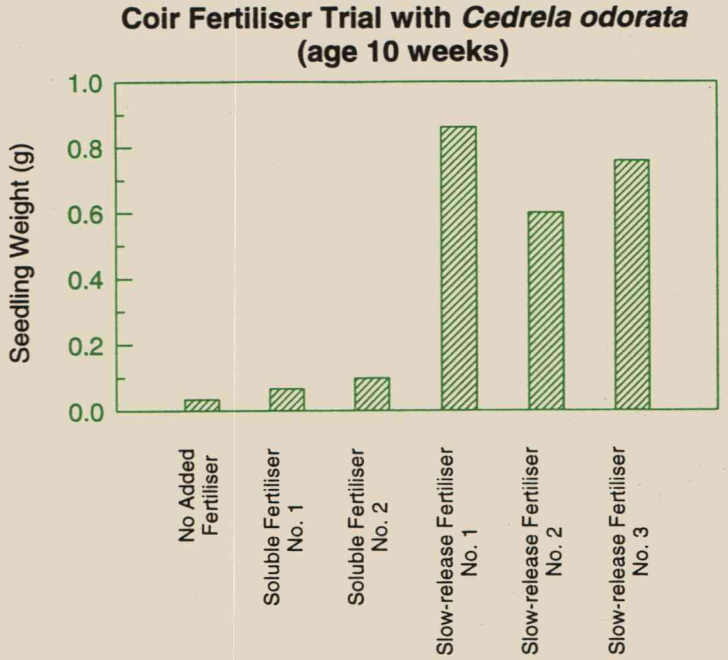

Promising Indigenous Tree Species for Plantations in W. Samoa

Summary

Information on growth rates of trees of known age and end-use was used to evaluate the potential of seven indigenous species for use in the reforestation programme currently being conducted in W. Samoa.

Height growth in the first 12 months was rapid for three of the indigenous species, namely *Flueggia flexuosa* (145cm), *Garuga floribunda* (134cm), and *Calophyllum neoebudicum* (67cm).

Another promising species which is known to grow well and produce good general purpose sawn timber is *Terminalia richii*.

Introduction

With technical assistance and funding from New Zealand, the Forestry Division of W. Samoa has undertaken a major program of line planting of exotic timber species.

At least 17 species, all of them exotic, have been used operationally since the reforestation program began in the mid 1970's. Many species were found to be unsuitable for various reasons, including heart rot, slow growth rate and high susceptibility to wind damage.

The current research was initiated to evaluate the potential of the well-known indigenous tree species for line planting. The objective is to pinpoint several indigenous species which grow quickly and produce good timber as a part substitute for exotic species in the planting programme. To date, little research has been carried out to properly evaluate the suitability of indigenous species under line planting conditions.

It has also become evident that some indigenous species may be more resistant to cyclone damage which has recently caused a major re-evaluation of exotic species suitability in W. Samoa.

Materials and Methods

Trial 1

Seven indigenous species were planted in a 20-ha compartment at Masamasa in Savaii, W. Samoa. The species (with Samoan common names in brackets) planted were *Pometia pinnata* **(tava)**, *Calophyllum neo-ebudicum* **(tamanu)**, *Intsia bijuga* **(ifilele)**, *Syzygium sp.* **(asi)**, *Garuga floribunda* **(magaui)**, *Flueggia flexuosa* **(poumuli)** and *Planchonella torricellensis* **(mamalava)**.

Standard practices of land preparation and tending which have been developed for line planting of exotic species in W. Samoa were carried out. This involves clearing a two-metre swath of weeds and understorey in lines through the secondary forest and ringbarking any trees which overhang the line. Lines were spaced at an interval of 10m and trees were planted at 2m intervals along the line. The source of planting material for this trial was wildings (seedlings uplifted from native forests) for all species except *Flueggia flexuosa* and *Calophyllum neo-ebudicum*, which were propagated from seed.

Trial 2

In addition to the above, it was possible to locate and remeasure some individual trees and older trials of *Terminalia richii*, **(Malili)**, *Pometia pinnata* and *Intsia bijuga*.

- *Terminalia richii*, planted 1972 at Masamasa, Savaii. Assessment of this stand involved measuring the diameter at breast height (DBH) of all 34 undamaged trees within a 50 by 50m plot subjectively located within the compartment which has a total area of around 2 ha. Top height was measured on three trees.

- *Pometia pinnata*, planted 1974 at Masamasa. Seventeen trees were measured for DBH and top height measurements were made on three trees. It was not possible to estimate stocking rates because a number of the original trees had been felled by farmers encroaching on the site.

-*Intsia bijuga*, planted 1985 at Cpt 108.4 (14 ha) at Aopo, Savaii. Several individual trees of known age were assessed as well.

Results and Discussion

In Trial 1, which involved measuring early growth trends, good height growth was observed for two species, *Flueggia flexuosa* and *Garuga floribunda* (Table 1). Height growth of around 1.5 to 2m in the first year is considered acceptable in W. Samoa for exotic timber species such as *Eucalyptus pellita*[1]. Maintenance and observation will be carried out to determine longer term growth trends for all these species.

In Trial 2, involving measurement of older trees, the *Terminalia richii*, measured at 22 years of age, consisted of 136 unbroken stems per hectare, with a mean DBH of 38.7cm and a top height of around 28m. The most common form of cyclone damage was stem breakage at 6-10m from the ground. Two cyclones Val and Ofa in 1990 and 1991, reduced an overstocked stand (>300sph, est) to a well stocked stand, assuming no further loss of stems. The stand suffered significantly less damage than neighboring stands of exotic species during the cyclones.

The *Pometia pinnata* stand had a mean DBH of 37.4cm and a top height of around 17m. Cyclone damage took the form of broken branches in the upper canopy, rather than stem breakage. Stems were characteristically fluted and slightly crooked.

Intsia bijuga was found to be slow growing and of bad form for a timber producing tree but further research on selection and silviculture is recommended because of the local importance of the species and its threatened status in the wild.

Table 1. Mean height at 12 months of age and no. (n) of trees assessed.

Species	Ht (cm)	N
Flueggea flexuosa	145.4	54
Garuga floribunda	133.6	54
Calophyllum neo-ebudicum	66.4	191
Intsia bijuga	55.7	72
Pometia pinnata	53.3	63
Planchonella torricellensis	49.2	108
Syzygium sp.	43.9	176

Conclusions

Planting of *Flueggia flexuosa* should be maintained at around 5% of the annual planting program. As well as having rapid initial growth, it is also easy to propagate from seed and quickly produces poles which require no processing and are in demand in rural areas for traditional style house construction.

Based on current information, *Terminalia richii* appears to be the most favoured choice of indigenous species to grow in plantations for general purpose timber because of its proven growth performance, good resistance to cyclone damage and good timber properties[2]. Research is required on techniques for vegetative propagation of this species because trees in W. Samoa have not produced seeds since the two cyclones.

References

[1] Woods, P.V. and Aspinall, Q. 1995: Early growth of *Eucalyptus pellita* on a range of sites in W. Samoa. FAO Forest Genetic Resources Information (in press).

[2] Wilcox, M.D. 1991: Species review for W. Samoa plantation forestry programme, New Zealand Ministry of External Relations and Trade.

(by Tolusina Pouli,
Etenei Tuilaepa
Division of Forestry, Min of Agric, Forests,
Fisheries and Meteorology, W. Samoa
and Paul V. Woods
Forestry Devt Project,
Groome Poyry, W. Samoa)

Review of PNG National Forest and Conservation Action Programme

PREFACE

The Review Team of Meg Taylor, Phillip Siaguru, John Millet, and Lance Hill was tasked with evaluating the success or otherwise of the NFCAP over the past five years. The four of us came together as individuals who have been involved in different aspects of Papua New Guinea's development over the past twenty years; all of us were well aware of the devastating effects past practice in the forest industry had on individuals, people in our communities, our forests and indeed Papua New Guinea's international reputation. These had been eloquently and painstakingly described in the twenty volumes of the Barnett Enquiry.

The Government responded appropriately by hosting a World Bank Mission and embracing a National Forestry and Conservation Action Plan. Implementation of its various facets has been beset with a range of problems: understandable suspicion between players, bureaucratic inertia, failures in capacity of our organisation, differences in donor agendas, abuse of process and the pressures of continuing bribery and corruption.

Our terms of reference did not call for investigation or comment on some of these aspects. However, during the course of our widespread discussions we were presented with verbal accounts and examples of on-going harassment including physical abuse to the extent of threats to the lives of individuals; also with various examples of abuse of procedure and process. It is sad to note that our forestry sector is still riddled with many of the unsavoury features revealed by the Barnett Enquiry.

We would like to record our concern that professional public servants, and indeed some of our politicians, are being subject to this sort of abuse. They are tasked with serving our country and people with integrity and professionalism. It is a tribute to NFCAP that it has achieved considerable success. More importantly it is a tribute to the resilience, commitment and honesty of many of the staff (both national and expatriate) involved that haven't given up but continue to work tirelessly to build a better tomorrow in the forestry sector. Much more remains to be done: we hope NFCAP II will achieve what NFCAP I has started. It must empower our communities to take control of their own destiny in an increasingly complex world for this is what 'integral human development' and ecological sustainability is about. We further hope that this review of the past five years will contribute to furthering this process.

The review process is described in Annex 4. At a public seminar towards the end of that process the team accepted the suggestion that action agencies be designated in the recommendations. How they fulfil these roles is a matter for them and the Steering Committee.

We would like to acknowledge the splendid co-operation rendered by everyone. In particular, the Managing Director and General Manager, NFA kindly allowed us access to 'their Conference room and facilities. UNDP generously funded the review and Mr. J. Bisa facilitated our work. Staff of the KGID Project, and in particular Mr. T. Vigus, provided invaluable assistance in West New Britain. We appreciated the detailed presentations from major donors - World Bank, AIDAB, IIED, and UNDP. Finally, the unstinting assistance from Ms. T. Moseturi who worked with us for the duration of the Review, has been highly regarded. To all we say thank you.

RECOMMENDATIONS

- **NFCAP has been partially successful in achieving its objectives.**

Recommendation 1 (a):
NFCAP should continue but requires a strong and explicit political commitment to sustainability and conservation in the forest sector.

(Action: Prime Minister and NEC)

Recommendation 1 (b):
Effective implementation requires a transparent administrative and legal process in forest sector backed by adequate financial and human resources.

(Action: DFP, NFA & DEC)

- **NFCAP has been successful in institutional strengthening but less successful in enhancing resource owner involvement and the field operations of NFA and DEC.**

Recommendation 2:
NFCAP II be orientated to rectifying this imbalance by;
- rationalisation of an accelerated landowner awareness/mobilisation programme;
- strengthening local level capacity in forest management;
- non-timber forest products, and biodiversity products and services evaluation;
- promoting greater awareness of NFCAP aims and objectives, programmes, projects, results and opportunities;

(Action: NFCAP Steering Committee)

- **The NFCAP Steering Committee - despite some problems, has provided a forum for discussion and co-ordination of projects.**

Recommendation 3:
The NFCAP Steering committee should be retained, but its effectiveness must be enhanced by the designation of senior (e.g.: FAS level) agency representation, with the delegated mandate to make binding decisions. It would also be desirable to include representation from FIA.

(Action: All affected agencies)

- **The NFCAP Co-ordinator has played a pivotal role in the process.**

Recommendation 4:
The NFCAP Co-ordinator's position be continued, in DFP (or the proposed national planning agency), with appropriate administrative and financial support.

(Action: DFP)

- **The Technical Support Project (TSP) has been successful in driving NFCAP I. The proposed reorientation of NFCAP II (recommendation 2) will require a continuing TSP, but comprising different expertise.**

Recommendation 5:
The TSP component will be:
- NGO advisory
- Landowner awareness advisory
- Environment resource economist advisory

(Action: NFCAP Coordinator)

- **The existing National Forest Policy re lates to the productive wood sector. In the light of NSDS, there is a need to develop a policy, by a broad consultative process with landowners, taking into account the wider service and productive aspects of the forest resource.**

Recommendation 6:
NSDS process define a sustainable forest and conservation policy statement by means of a consultative process.

(Action: NSDS Steering Committee)

- **There is a lack of co-ordination in natural resource use planning, within a frame work of longer term national planning, linked to local level planning at community and provincial levels.**

Recommendation 7:
Establish a strategic planning function within the machinery of Government e.g. at DFP, PM OR NPO which could integrate the NSDS process.

(Action: PM and NEC)

- **Natural Resource Use Database: There is a need for the wider availability of natural resource data and information. The PNGRIS Database project has made a useful contribution to this need.**

Recommendation 8 (a):
- The membership of the PNGRIS user group be broadened to include other interested parties such as; provincial governments, universities, landowner groups and NGOs.

(Action: PNGRISUserCommittee)

Recommendation 8 (b):
- This database must be made available to institutions in PNG, (such as UPNG and UNITECH) who do not have full access to it.

(Action: PNGRUserCommittee)

Recommendation 8 (c):
- Training of PNG nationals in the use of PNGRIS should be undertaken within country.

(Action: PNGRISUserCommittee)

- **The Forest Act is basically sound except for Section 19. The Act provides for the necessary checks and balances and for the participation of landowners and NGOs. It does not need change; enforcement is required. However, effective im plementation of the Act is hampered by the lack of National and Provincial Forest Plans, and operational regulations such as licensing provisions, forms and aspects of the revenue system. Sustainability has not yet been demonstrated in current forestry operations for this and other reason.**

Recommendation 9:
- Prepare National and Provincial Forest Plans.
- Draft Regulations
- Renegotiate sustainable cut, permit by per mit, within the context of Provincial Forest Plans or major watersheds
- Introduce performance bond

(Action: NFA)

- **The large scale downstream processing requirement in the guidelines was based on inadequate analysis and is in conflict with the revenue system; the FIDS is not meaningful; and there are some actual investment proposals awaiting evaluation.**

Recommendation 10 (a):
Department of Finance and Planning to:
- Evaluate these investment proposals
- Re-evaluate the large scale processing strategy
- Establish the explicit permissible subsidy for employment generation from processing.

(Action: DFP&NFA)

Recommendation 10 (b):
National Forest Authority to:
- Promote small scale processing for domestic and niche export markets
- Phase out log export, geared to the demand from small scale processing.

(Action: NFA&DCI)

- **Delays in implementing the Revenue System have cost resource owners money.**

Recommendation 11:
A Revenue system with the following features be implemented urgently:
- Progressive export tax and fixed charges
- Not less than 50% of FOB value going to the resource owner and the State
- Performance bond
- Not less than 40% of Resource owners income going to a Development Trust.

(Action: NFA&DFP)

- **Monitoring and control; there is inadequate control and monitoring of logging operations, specifically on aspects of silvicultural systems.**

Recommendation 12:
- NFA to develop a logging code of practice and conduct, in consultation with Department of Environment and Conservation, Water Resources Board, Forest Industry Association, and resource owners.
- Develop clear guidelines (within the logging code) on follow-up silvicultural practices.
- Develop an evaluation system to assess implementation of the code of practice.
- Certified training of logging and chain saw operators should be included in the HRD project.
- Ensure the early involvement of landowners in monitoring and post-harvest regeneration activities funded through the reaf-forestation levy.

(Action: NFA&DEC)

- **Financial implications; because of the current public finance deficit, the operations of the NFA have been obstructed e.g. the border surveillance monitoring programme is currently in jeopardy with the potential loss of considerable revenue for the country.**

Recommendation 13 (a):
It is recommended that a concessional loan be raised by the NFA specifically earmarked for the monitoring operations.

(Action: DFP&NFA)

Recommendation 13 (b):
The World Bank continue to be the lead agency, in co-ordinating donor funded programmes for NFCAP II.

(Action: DFP/OIDA&NFCAP Coordinator)

Recommendation 13 (c):
The AIDAB Trust Fund or a similar mechanism be continued for the support of on-going and new landowner and NGO initiatives.

(Action: DFP/OIDA&NFCAP Coordinator)

- **Alternative forest use: The NFCAP process has not raised substantial income alternatives for the use of forest resources by landowners and the State.**

Recommendation 14:
- investigate marketing significant areas of PNG's forests as major global "carbon sink" assets, biodiversity prospecting etc.
- accessing GEF and other donor funds for the establishment of a major Trust Fund to provide developmental services to communities that choose not to use the forest resource for commercial timber production purposes.
- explore other revenue mechanisms for the State to rent intact forests for biological and cultural uses.
- prepare detailed project evaluations, for the marketing of non-timber forest products, heritage and eco and community based tourism.

(Action: NFCAP Steering Committee)

- **Landowner mobilisation: The land groups incorporation process is pivotal to landowner empowerment. It is a tool for all-resource development projects. Further capacity building is required.**

Recommendation 15:
- The land groups incorporation process be rationalised and relocated out of sector departments, so that it's clients are the landowners and not the departments.

(Action: NFCAP Steering Committee)

- **HRD (Human Resource Development) Capacity building at the local level is lacking in forest resource planning, management and monitoring.**

Recommendation 16:
- accelerate training workshops at landowner level to address the above.
- provide funding support to enable NGO's in developing pictorial manuals on sustainable management.

(Action: NFCAP Steering Committee)

- **Technical Capacity Strengthening: NFCAP has involved a considerable number of technical advisors. Opportunities have been missed for national technical capacity building.**

Recommendation 17:
To the maximum extent possible technical advisors should be drawn from within country; where overseas recruitment is necessary there should be mandatory local counterparts.

- **NGO (Non Government Organisation): NFCAP has provided opportunities for significant participation by NGOs.**

Recommendation 18:
Further capacity building is required.

Tasks to be completed include:
- conduct project preparation workshops and follow-up training for NGOs.
- establish a register of people who can and are prepared to act as medium term 'change agents' at the community level.
- develop an NGO directory of capacities and needs.
- conduct specific projects in LO/NGO awareness and skills assessment to be carried out.
- conduct "team" and skills workshops, focusing on resource management andalternatives for landowners.

(Action: NFCAP Steering Committee/TSP-NGO Advisor/TSP-Landowner Awareness Advisor)

- **Sustained yield: Limited scientific data means it is not possible to provide a concise definition of sustained yield by species or area.**

Recommendation 19:
a) Precautionary practice and a conservative approach to allowable cut is urged until higher sustainable cuts can be demons trated.

b) A continued research effort, based on standardised methodologies into sustained yield, regeneration and growth is required. This should be based at FRI, but draw on both in-country and overseas expertise.

(Action: NF,FRI&Universities)

(From "Review of the (PNG) National Forest and Conservation Action Programme", by Meg Taylor, Phillip Siaguru, John Millet, and Lance Hill).

Tonga Coastal Reforestation and Protection Project

The Tonga Coastal Protection and Reforestation Project was funded by AusAID through SPREP, at the request of the Tongan Government. The project was implemented by the Forestry Division of the Ministry of Agriculture and Forestry (MAF) with technical support from SPREP and University of the South Pacific (USP) to address problems created by years of indiscriminate coastal deforestation.

As a result of these problems, the Prime Minister of Tonga, the Honourable Baron Vaea, who is also the noble of the Houma area, approached Dr. Vili Fuavao, the Director of SPREP, to fund pilot coastal reforestation efforts in the Houma area on the southwest coast of Tonga's main island of Tongatapu. After reconnaissance visits to the proposed site, a project proposal was prepared and submitted to SPREP and AusAID by the Forestry Division on behalf of the Tongan Government. The proposal, for a two-year project, was funded at a level of $US12,000 by AusAID through SPREP.

Loloma'ania Filiai with newly planted coastal species proteced by a *Casuarina* windbreak on the left.

Project Objectives

The main project objective was to design and implement a coastal reforestation and protection strategy that could address serious problems caused by coastal deforestation and excessive salt spray and wind damage. A secondary objective was to develop effective community-based programs for coastal reforestation and protection. It was also hoped that lessons learned from the project could be used to address similar problems in other Pacific Islands.

Site Description

The project site is located in a rocky, uplifted windward coastal area near Houma on the windward coast of southwestern Tongatapu. The reforestation efforts have been focused on a zone between the landward edge of the existing degraded salt-tolerant scrub and vegetation and the seaward edge of the cropping area of adjacent inland agricultural allotments. The width of the actual reforestation (planting) zone ranges from about 5 to 25m, and averages about 12m in width, depending on the distance from the sea, the state of existing littoral vegetation, and the nature of the soil and terrain, At the onset of the project, the existing coastal littoral vegetation was in a very degraded state, with most of the original littoral forest trees having been cut down or seriously damaged by fire, salt spray or human abuse.

Site Preparation

The clearing and demarcation of the area involved clearing by manual labour of Guinea grass and the shrubby vegetation in the area. The total area cleared was approximately 2.4 ha. The inland side of this clearing functioned as a firebreak (2-5m wide) and the areas to seaward of the firebreak were cleared for planting. The larger shrubs and trees were left in place and, if necessary, freed from competition from weeds. The eastern and western boundaries of the project area were fenced to demarcate the reforestation area and to minimise disturbance to the plantings from both people and free ranging animals. Signs were erected which included information about the project.

As indiscriminate burning and wild fires were a serious threat to the success of the project, a five metre-wide firebreak was cleared along the inland boundary of the entire cleared area. The firebreak was initially planted with two to four rows of cassava **(manioke)** to assist in keeping the area free of grasses and combustible vegetation, and to demarcate the planting area so that people would not trample or drive vehicles over the young trees within the reforestation site. Although two major fires occurred in October 1993 and again in October 1994, the firebreak proved effective in protecting the planting from serious damage.

Plant Collection and Propagation

A key aspect of the project was the collection of seeds and the propagation and collection of seedlings for transplanting and direct planting to the site. The selection of species was based on a plant's ability to tolerate salt spray, resistance to wind, growth characteristics and availability of planting material. The plants trialled were mostly coastal species, many of which have rarely, if ever, been propagated for deliberate planting.

As the project progressed it became apparent which species had higher survival rates and were more tolerant to conditions at the site. These became the species of preference for collection and transplanting in the latter stages of the project.

The majority of plants were collected as seedlings from natural regeneration in remaining littoral forests on Tongatapu. These seedlings were transplanted into polythene bags and taken to the Forestry Nursery at Tokomololo where they were cared for until they were considered strong enough or large enough to be transplanted to the project site. Table 1 summarises information on the names, source of planting material, method of propagation, approximate time required in nursery, and total numbers propagated and planted and estimated survival rate for the species collected and/or planted at the site. Table 2 is a complete list of those species that could be considered for protection or reforestation throughout the Pacific Islands.

Planting and Maintenance

Almost all seedlings were transplanted to the Houma site from the Tokomololo Nursery. After the initial plantings, selected enrichment planting was carried out to improve species composition and stock density.

Maintenance consisted of frequent weeding or "releasing" of the planted trees. The importance of weeding was two-fold, to prevent the seedlings and desirable existing plants from being overgrown and to reduce the amount of fuel for fires. This is an on-going activity conducted by the Forestry personnel, with the assistance of the people of Houma.

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Project Results

The two objectives of the Tonga Coastal Protection and Reforestation Project were:
1) to develop and implement an effective model for coastal reforestation in the area bordering the Blow Holes at Houma; and
2) to develop effective community-based coastal protection and reforestation programs.

As coastal reforestation using a mixture of indigenous species, has not (to the best of the authors' knowledge) been attempted before in the Pacific Islands, the project components were modified as the project progressed. With the appropriate modifications to the project, the first objective has been achieved.

However, because of the short (2-year) time frame of the project, there was inadequate time to effectively involve the local community in all aspects of the project. A development phase, of at least six months, would have been preferred. This would have permitted more time to refine plant selection and propagation techniques, and allow stocks to be built up prior to the commencement of planting. A complicating factor, in terms of community involvement, was that the recent history of agriculture and forestry projects involving communities has not been very successful. A number of times, when farmers have been convinced to invest time, effort and money in new concepts and procedures, these have failed, leaving the farmers wary of unproven new ideas. The Forestry Division therefore concentrated on the technical problems of plant collection and propagation, site clearance and planting. It was believed that the most effective way to ensure community involvement was to take a longer term approach by demonstrating that coastal reforestation is possible. Indications in July this year were that the community is now being progressively involved in the project, now that the potential benefits of mixed-species coastal reforestation are apparent.

The initial plant selection was by the Forestry Division staff with the assistance of one of the advisors (Thaman). Their combined general knowledge of coastal species was invaluable. The propagation of some of these species was especially difficult due to the Tokomololo Nursery staff's minimal experience in working with indigenous coastal species, their primary experience being with timber and commercial species. However, their considerable skill and knowledge of collection and propagation techniques allowed them to adjust their techniques to suit most of these new species.

Although the length of coastal area to be reforested in the initial proposal was to be about 500m, after two years a strip about 2 km has been planted. Given an estimated average width of 12m, this works out to a total replanted area of about 2.4 ha. As a result, the original budget proved to be inadequate for the eventual size of the project. The reasons for extending the area were:
1) to ensure that the project site was large enough to be visible and recognisable;
2) to include enough variation of existing coastal habitats and vegetative cover types.

Conclusions and Recommendation

Two years is a very short time for a reforestation project, and especially one that required new techniques to be developed. Despite the technical, financial, and time constraints discussed above, and the limited involvement of the Houma community in the reforestation effort, the project seems to have been a success. A total of almost 25,000 tree seedlings, consisting over 20 different species of indigenous coastal trees, have been planted along some 2km of coastline and covering an estimated area of about 2.4 hectares. Of these approximately 80% (about 19,400) had survived as of the official end of the project in June 1995 (See Table 1).

Table 1. Summary of names, source of planting material, method of propagation, time required in nursery, total propagated (collected or planted from seed and looked after in the nursery), total planted and estimated survival rate *(Key: 1) under "Tongan Name", * = introduced, non-indigenous species; 2) under "Source", A = Australia E = 'Eua, I = inland Tongatapu; Ha = Ha'apai, HI = Haveluliku, Ht = Ha'ateiho, Ho = Houma; S = Sopu, T = Talafo'ou,; 3) under "Method of Propagation", d = direct transplant from source to project site, s=planted from seed in the nursery and then transplanted to project site; t = transplanted from source to nursery and then to project site, v = propagated from vegetative cuttings and then transplanted to site).*

Scientific name	Tongan name	Source	Method of propagation	Time in nursery (mths)	Total propagated	Total planted	Estimated Survival at site % (approx. #)
Casuarina equisetifolia	toa	S,T	s, d	4-6	1176	9510	90 (8559)
Tournefortia argentea	touhuni	S, Ho	t	6-8	2253	2167	90 (1950)
Calophyllum inophyllum	feta'u	Ha	s	4-5	26	2130	95 (2024)
Terminalia catappa	telie	S, Ht	t	6-8	315	1824	80 (1459)
Excoecaria agallocha	feta' anu	S, Ht	t, d	4-5	2888	1691	90 (1522)
Neisosperma oppositifolium	fao	Ht	t	5-8	429	1191	60 (715)
Rhoeo spathacea	fainakula	S	t	2		1000	40(400)
Syzygium richii	heavula	Ho	t	6-8	250	970	60 (582)
Pandanus tectorius	fa/fafa	Ho, Ht	t	5-8	30	853	90 (768)
Scaevola sericea (taccada)	ngahu	S, Ho, Ht	t	6-8	792	747	90 (672)
Eucalyptus saligna	pulukamu *	A	s	4-6		511	0
Hernandia nymphaeifolia	fotulona	Ht, HI	t	5-8	241	410	60 (246)
Pinus caribaea	paini*	A	s	4-6		400	0
Vitex trifolia	lala tahi	I	t	5-8	42	259	50 (130)
Swietenia macrophylla	mahokani*	A	s	4-6		253	n.a. (outside site)
Hibiscus tiliaceus	fau	Ht, S	v, t	4-5	82	228	70 (160)
Morinda citrifolia	nonu	I		5-8	66	204	10 (20)
Cerbera odollam (manghas)	toto	Ht, S	t	5-8		203	60 (122)
Intsia bijuga	fehi	E	t	5-8	77	96	0
Planchonella grayana (costata)	kalaka	Ht	t	8-12	3	88	40 (35)
Cocos nucifera	niu*	Ho, Ha	s,t	6-8		42	70 (29)
Polyscias guilfoylei, P. filicifolia	tanetane*	I	v	6-8		38	0
Codiaeum variegatum	kolotoni	I	vn	6-8	30	30	0
Myristica hypargyraea	kotone	Ht	t	8-12		27	0
Bixa orellana	loa*	I	v	4-5		15	0
Heritiera littoralis	ifi tahi	S	t	12	14	8	30 (3)
Thespesia populnea	milo	E	t	6-8		5	0
Barringtonia asiatica	futu	Ho	t	6-8	1	4	25 (1)
Acacia simplex	tatangia	S	t	6-8	21	3	100 (3)
Guettarada speciosa	puopua	HI	t	6-8	2 9	3	0
Terminalia samoensis	telie'amanu	S	t	8-12		3	0
Diospyros elliptica (ferrea)	kanume	Ht	t	6-8		1	0
Elattostachys falcata	ngatata						
Ficus benjamina	ovava Fisi	S t,	t,v	4-6	32		0
Gardenia taitensis	siale Tonga	I	v	8-12			
Inocarpus fagifer	ifi	I	t	6-8			n.a.
Phaleria disperma	huni	I	t				n.a.
Pisonis grandis	puko	HI	v		49		n.a.
Santualum yasi	ahi	E	t	4-5			n.a.
Schleinitzia (Leucaena) insularum	feifai	S	t	4-5	3		n.a.
Ximenia americana	vi tahi	S					
Total						24914	(19400)

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Table 2. Indigenous coastal species recommended for replication, planting, rehabilitation and insitu protection in the Pacific Islands *(Notes: 1) most of these species are either indigenous to most Pacific Islands, or, in some cases, indigenous to some countries but only recent introductions to some of the smaller islands in the eastern pacific, e.g. casuarina and Rhizophora mangroves; 2) species are listed in alphabetical order by the Tongan name; 3)* = species not present in Tonga but present in other coastal areas in the Pacific Islands; 4) H = species successfully planted or naturally present at the Houma reforestation site; and, 5) A = species that have been recorded present on some Pacific atolls and that have shown high tolerance to salt-spray and physiological drought.*

Priority Pioneer Species (species that are easy to propagate, fast-growing or very salt and drought tolerant; trees that should be propagated in great numbers for initial coastal reforestation planting)

- **fa, fafa,** pandanus *(Pandanus tectorius)* (A,A)
- **fau,** beach hibiscus tree *(Hibiscus tiliaceus)* (H,A)
- **feta'anu,** blinding tree *(Excoecaria agallocha)* (H)
- **feta'u,** Alexandrian laurel *(Calophyllum inophyllum)* (H,A)
- **ngahu,** saltbush or half-flower *(Scaevola sericea)* (H,A)
- **telie,** beach almond *(Terminalia catappa)* (H,A)
- **telie 'a manu** *(Terminalia litoralis)* (H,A)
- **touhuni,** beach heliotrope *(Tournefortia argentea)* (H,A)

Priority Non-Pioneer Species (Priority non-pioneer species commonly found in coastal forest, but which are not normally found in the very exposed outpost zone)

- **fao** *(Neisosperma oppositifolium)* (H,A)
- **fotulona,** lantern tree *(Hernandia numphaeifolia)* (H,A)
- **futu,** fish-poison tree *(Barringtonia asiatica)* (H,A)
- **lala tahi,** beach vitex *(Vitex trifolia)* (H,A)
- **leva** *(Cerbera manghas)* (A)
- **niu,** coconut palm *(Cocos nucifera)* (H,A)
- **puko,** coconut palm *Pisonia grandis)* (A)
- **puopua** *(Guettarda speciosa)* (A)
- **tatangia,** beach acacia *(Acacia simplex)* (H)
- **toto** *(Cerbera odollam)* (H)

Priority Littoral or Coastal Forest Species for Forest Enrichment (coastal species that offer potential for enrichment (both ecologically and culturally) of the coastal protection forest)

- **ahi,** sandalwood *(Santalum yasi)*
- **fehi,** *(Intsia bijuga)*
- **feifai** *(Schleinitzia/Leucaena insularum)* (H)
- **heavula** *(Syzygium richii)* (H)
- **ifi,** Tahitian chestnut *(Inocarpus fagifer)* (A)
- **ifi tahi, mamea** *(Heritiera littoralis)* (H)
- **kotone,** wild nutmeg *(Myristica hypargyraea)* (H)
- **kalaka** *(Planchonella grayana)* (H)
- **lala tahi** *(Dendrolobium umbellatum)*
- **masi** *(Ficus tinctoria)* (H,A)
- **milo** *(Thespesia populnea)* (A)
- **ngatae,** coral tree or dadap *(Erythrina variegata var. orientalis)* (A)
- **'ovava, 'ovava Tonga,** banyan *(Ficus obliqua)*
- **'ovava, 'ovava Tonga,** banyan *(Ficus prolixa)* (A)?
- **puataukanave** *(Cordia subcordata)* (A)
- **pukovili** *(Xylocarus americana)*
- **siale Tonga,** Tahitian gardenia *(Gardenia t aitensis)* (A)
- **unuoi** *(Eugenia reinwardtiana)*

Other Littoral or Coastal Species for Forest Enrichment (Non-dominant, secondary or understorey salt-tolerant species that grow naturally in littoral and coastal primary and secondary vegetation that offer some potential for enrichment and/or could be protected)

- **ahi vao** *(Vavaea amicorum)*
- **fekika vao** *(Syzygium clusiifolium)*
- **filimoto, fululupe** *(Xylosma orbiculatum)* (H)
- **fo'ui** *(Grewia crenata)* (H)
- **kanume,** coastal ebony (Diospyros ellipti cal/ferrea)
- **huni** *(Phaleria disperma)*
- **lata, fetu' a tahi?** *(Sophora tomentosa)*
- **loupata,** macaranga *(Macaranga harveyana/ tanarius)* (H)
- **masi** *(Ficus scabra)* (A)
- **masi'aukava, masikona** *(Pittosporum rhorescens)*
- **malolo. masikoka** *(Glochidion ramiflorum)*
- **nonu,** Indian mulberry *(Morinda citrifolia)* (H,A)
- **olonga** *(Pipturus argenteus)* (A)
- **takafalu** *(Micromelum minutum)*
- **tanetane, tanetane vao** *(Polyscias multijuga)* (H)
- **te'epilo'amaui** *(Geniostoma spp.)* (H)
- **vitahi** *(Ximenia americnaa)* (A)
- **volovalo** *(Premna serratifolia)* (A)

Mangrove Species (species that could be used in mangrove or low-lying, swampy coastal sites)

- **fa'onelua** *(Bruguiera gymnorrhiza var.)* (A)
- **feta'anu,** blinding tree *(Excoecaria agallocha)* (H)
- **hangale** *(Lumnitzera littorea)* (A)
- **ifi,** Tahitian chestnut *(Inocarpus fagifer)*(A)
- **ifi tahi, mamea** *(Heritiera littoralis)*
- **lekileki,** cannonball tree, puzzlenut *Xylocarpus granatum* and *Xylocarpus moluccensis)*
- **tongolei** *(Rhizophora mangle* and *Rhizophora stylosa)* (A)
- **tongo ta'ane** *(Bruguiera gymnorrhiza)* (A)
- ** Avicennia marina*
- ** Ceriops tagal*
- ** Rhizophora apiculata*
- ** Sonneratia alba* (A)

Ornamental/Useful Salt-Tolerant Non-Indigenous Species (species that can be planted on the inner margins of coastal forest, bordering agricultural areas, along coastal roads or in coastal areas where hedges or ornamental plants are required, e.g., near touristic sites).

- **faina kula,** oyster plant, rhoeo *(Rhoeo spathacea)* (H)
- **lile,** spider lily *(Hymenocalis litoralis)* (A)
- **'ohai,** poinciana, flame tree *(Delonix regia)* (A)
- **'ovava Fisi,** weeping banyan, Benjamin tree *(Ficus benjamina)*
- **paini,** Norfolk Island pine *(Araucaria heterophylla)*
- **samoa,** crinum lily *(Crinum asiaticum)* **(samoa)** (A)
- **tanetane,** hedge panax *(Polyscias guilfoylei, P. fruticisa, P. scutellaria)* (A)
- *Indian or Bengal banyan (Ficus benjamina)

Understorey or Outpost Zone Species to be Protected ro Introduced for Site Improvement or Replacement of Non-Indigenous Weeds and Grasses (Note: These species may need to be controlled if competing with tree seedlings planted or protected as part of reforestation efforts).

- **Ferns:** *Asplenium nidis* **(pununga)** (A); *Davallia solida; Nephrolepis* spp. **(hulufe)** (A); *Phymatosorus scolopendria* **(laufale)** (H,A)
- **Herbs:** *Achyranthes aspera/canescens* **(tamatama)** (A); *Boerhavia repens* **(akataha)** (A); *Chamaesyce atoto* (kihikihi tahi?) (H,A); *Hedyotis biflora* (A); *Portulaca lutea* **(tamole)** (A); *Portulaca samoensis* **(tamole?)** (A); *Sesuvium portualucastrum* **(kihikihimaka?)** (H,A); *Tacca leontopetaloides* **(mahoa'a Tonga)** (A); *Tetragonia tetragonioides; Triumfetta procumbens* **(mo'osipo tahi)** (A)
- **Grasses and Sedges:** *Cyperus javanicus/ Mariscus javanicus* **(mahelehele)** (H,A); *Cyperus stoloniferus* **(pako, pako failolo)** (H); *Digitaria setigera (H,A); Fimbristylis cymosa* **(pakopako)** (H,A); *Ischaemum murinum* **(totoa)** (H); *Lepturus repens* (H,A); *Paspalum conjugatum* (H,A); *Paspalum distichum* (H,A); *Sporobolus virginicus; Stenotaphrum micranthum* (H,A); *Thuarea involuta* (musie likum kefukefu, mohuku'apopoa tahi) (A)
- **Vines and Lianas:** *Abrus precatorius* **(moho);** *Canavalia cathartica* **(fue tahi veveli)** (H,A); *Cassytha filiformis* **(fatai)** (A); *Derris trifoliata* **(kavahaha)** (A); *Entada phasioloides* **(valae, sipi, pa'anaga)** (A); *Hoya australis* **(lau matolu)** (H); *Ipomoea macrantha* **(fue hina)** (H,A); *Ipomoea pes-caprae* **(fue tahi)** (A); *Mucuna gigantea* **(valae)** (A); *Vigna marina* **(lautolu tahi)** (H,A)
- **Shrubs:** Bikkia tetrandra **(sialetafa);** *Caesalpinia bonduc/major* **(talatala'amoa)** (A); *Capparis cordifolia/sandwichiana; Clerodendrum inerme* **(talatala'amoa)** (A); *Capparis cordifolia/sandwichiana; Clerodendrum inerme* **(tutu hina)** (H,A); *Colubrina adiatica* **(fiho'a)** (H); *Dodonaeaviscosa* (A); *Pemphis acidula* **(ngingie)** (H,A); *Solanum amicorum* **(polo Tonga)** (H); *Suriana martitima* **(ngingie)** (A); *Tephrosia purpurea* **(kavahuhu);** *Wollastonia biflora* **(ate)** (H)

Carbon Offsets and Forestry : An Introduction

Introduction

The primary long-term environmental threats to the islands of the South Pacific are ozone depletion and climate change. While the Montreal Convention and its associated protocols promise to control and eliminate most production of ozone depleting CFC's, the collective response to global warming has been troubling from the perspective of Small Island Developing States (SIDS). In response, island countries have been among the most aggressive participants in attempts to create a more stringent greenhouse gas emission control and have generally been considered among the moral leaders of the climate change debate through the Association of Small Island States (AOSIS).

Greenhouse gas policies in the industrial countries are evolving towards greater acceptance of responsibility for alleviating greenhouse gas emission. In New Zealand, the government has ruled that the implementation of a new 400 MW power plant must implement a plan to sequester an equivalent amount of greenhouse gas that the plant is projected to emit over its operational lifetime, i.e. a total of up to 45 million tonnes of CO2 over the presumed 30 year lifetime of the plant. This past year, Denmark implemented a US$6.50 per/tonne carbon tax, and there is renewed call for such taxes at the European Community level. While the movement towards these actions is not as fast as some activists may wish, there are indeed signs that pro-active measures are forthcoming from the world's major greenhouse gas emitters.

Moreover, under the Framework Convention on Climate Change (FCCC), signed by 153 nations at the 1992 Rio Conference on Environment and Development, countries can voluntarily collaborate in ways to cost-effectively reduce, avoid or sequester greenhouse gas emissions. This concept of "joint implementation" has entered an official pilot phase, following the first Conference of the Parties (COP) in Berlin in April 1995. This pilot phase, reporting to the United Nations Technical Office, will be likely to spur polluting firms in industrial nations to implement trial investments in international emission control projects, supplementing their own greenhouse gas control efforts at home. As such, an increased flow of private sector funds to developing countries for environmental improvements, in the forestry and energy sectors, is anticipated to be forthcoming through "carbon offsets". Already a number of small carbon offset projects have been implemented in Malaysia, Costa Rica, Guatemala and Czechoslovakia.

A carbon offset is an investment made to *decrease emissions of greenhouse gases* or *increase the sequestration of such gases*. Offsets are specifically undertaken away from the offending source of emissions as a financially attractive alternative to more expensive measures for decreasing emissions at the source. Joint Implementation is the terminology for carbon offset projects in which the finance support for the activity originates in a different country than where the project is actually undertaken. The United States Initiative on Joint Implementation is a US-based pilot project review system which tries to ensure that proposed programs achieve the claimed emissions reductions, meet the highest standards of environmental sustainability and are consistent with host countries' development priorities.

In the future, investors in carbon offsets will represent countries (such as Japan, Australia or the US) or companies within them, exceeding emission "quotas" under either the FCCC or domestic legislation. During the pilot phase, there is no direct crediting between countries. However, some private party transactions may be creditable against sub-national goals and programs and thus have economic value. As such, pilot phase investors/participants will likely be private sector entities seeking to gain advantage from early entry into this incipient market, primarily from the electric utility industry and the financial services community. Pilot projects are designed to accelerate the global learning curve about greenhouse gas reductions. It is generally agreed that the pilot phase of carbon offsets and JI is the first step towards a global trading market for CO2 allowances and reduction credits.

Forest Management Techniques and Carbon Offset Strategies

The substantial majority of greenhouse gas accumulations in the atmosphere derives from the combustion of fossil fuels. Loss and degradation of temperate and tropical forests contribute approximately 30 percent of total net global CO2 emissions. Tropical forests are preeminent carbon sinks, in view of their generally high volumes of biomass and soil carbon. Preserving these sinks by foregoing logging or agricultural conversion is a direct way to positively impact carbon flows, but may not be a realistic economic alternative for developing countries, local landholders or concessionaires. As a result, efforts have been made to uncover management techniques which enhance a forest's carbon fixing capacity, while still allowing for conventional economic value to be attained. Two forestry practices which have this effect are,

- Reducing collateral damage from primary forest timber extraction practices. This technique, known as Reduced Impact Logging, or RIL, lowers net greenhouse emissions in comparison to standard logging by decreasing associated necromass, lessening soil disturbance and subsequently increasing the capacity of the forest to regenerate without intervention.
- Enhancing forest regeneration, through enrichment planting, to increase biomass production in logged and degraded forests, thus increasing carbon sequestration.

There are several further biomass-based strategies which can positively affect greenhouse gas flows and thus be eligible for outside investor participation. While they do not apply to all concessions, tropical foresters should also consider these options in analyzing their own capacity to provide cost-effective carbon offset opportunities for the marketplace. They are,

- Providing sustainably produced biomass as an alternative to fossil fuel powered electricity. If a plantation is designated for providing fuel, it is assumed that an equivalent amount of CO2 is released into the atmosphere as is sequestered in the plantation, thus providing a renewable energy resource.
- Implementing conservation regimes, particularly in environmentally sensitive areas of high biodiversity under direct threat from economic conversion.
- Implementing *"carbon farm"* plantations, in which the sole purpose of the plantation is to receive carbon payments from utilities, completely in lieu of profits from wood production. At this juncture, the market for nominal carbon credits does not appear sophisticated enough to support this type of focused venture, but it remains a possibility for the future.

Examples of Successful Forestry Carbon Offsets

The Innoprise-FACE Foundation Rainforest Rehabilitation Project in Sabah, Malaysia will rehabilitate 25,000ha of logged forests over 25 years through enrichment planting with indigenous tree species, fast-growing pioneers and forest fruit trees. The Forests Absorbing CO2 Emissions (FACE) Foundation was formed by the utility trade association of the Netherlands, in order to demonstrate the economic and environmental efficiency of offsetting carbon dioxide emissions through forestry. FACE is committed to planting 150,000ha of forests globally over the coming decades. This effort is calculated to offset the lifetime emissions of one 600 MW, coal-fired power plant.

The Rakyat Berjaya-New England Electric Systems Reduced Impact Logging Project, also in Sabah, has proven that reducing the corollary damage to surface soil and residual trees through implementing improved harvesting practices has significant positive effects upon overall CO2 flows. This approach reduces re-

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lated emissions of CO2 and methane by decreasing necromass and soil disturbance, and also increases the regeneration capacity and carbon sequestration of the remaining vegetation. The combination of immediate effects and additional regeneration has been calculated to equal 344 tonnes of CO2 equivalent per ha over a projected period of forty years. The pilot project of 1400ha has been deemed successful enough to warrant a recent renegotiated contract, the intent of which is to increase the implementation of RIL on up to 9,000ha over the coming three years The ICSB-NEES initiative is of particular interest, as it pioneered the use of various business mechanisms, such as contracts, arbitration, auditing and credit re-sale clauses.

In Belize, the Nature Conservancy and the Program for Belize have solicited funding from Wisconsin Electric Power Company to implement a combination of improved forest management and conservation in the Rio Bravo region. In Costa Rica, the Foundation for the Central Volcanic Range (FUNDECOR) has developed a successful carbon offset program which includes increased management of distributed tree farms throughout that remote region. The AES Corporation, an independent power producer, financed three individual carbon offset projects; a community forestry management programme encompassing four countries in the Western Amazon. Tenaska Corporation, another independent power producer, has invested in an afforestation campaign in the Russian Republic. In the Northwest of the United States, Pacificorp (a large utility holding company) has invested in a wide range of afforestation work with the Pacific Forest Trust, while the American Electric Power Corporation of Ohio has announced a plan to plant 14 million trees on its own lands. In two unique projects, Trans-Alta Corporation of Alberta, Canada has financed projects to lower soil erosion in Canada and cattle-based methane emissions in India. Outside of the forestry/agriculture sector, utilities have invested in fuel switching projects (Czechoslovakia and Poland) as well as renewable energy projects (Costa Rica and Honduras) with carbon dioxide reduction benefits.

An important development for the field is the creation of an US-based investment pool for forestry based projects. The pool is managed by the Edison Electric Institute, the United States electric utility trade organization. Called the Utility Forest Carbon Management Program, the pool is designed as an investment vehicle for greenhouse gas offset projects in the forestry sector. Applicants develop projects for submittal to the UFCMP and, if successful, become investments for the pool. At press time, it was reported that the original applicant pool of thirty one projects had been reduced to six and that a solicitation letter of the investment prospectus was being circulated among over 200 US utilities

Designing Carbon Offset Projects

Within any carbon offset concept, forestry-based or otherwise, the related elements of *additionality* and *intent* are crucial. The additionality principal recognizes that not all actions which reduce greenhouse gases can be classified as legitimate carbon offset projects or JI. For example, a company or country electing to officially preserve a remote area, not threatened by logging or conversion, would be less likely to receive creditable recognition for their actions in the form of an offset.

A carbon offset programme is considered legitimate if it its implementors and investors can demonstrate the intent to improve greenhouse gas flows from a specific intervention. Generally, a programme must incur costs which would not otherwise have been spent under standard rate-of-return analysis. It is these additional payments which form the basis for carbon offsets and joint implementation.

Regulatory bodies, such as the USIJI, are already under development at national and international levels to monitor carbon offset projects. One of their duties will be to ensure that the dynamic of intent and additionality occurs. This does not mean that a carbon offset project is precluded from being economically profitable, rather a project's design and intent must specifically acknowledge positive greenhouse gas components from the beginning in order to be registerable as an offset. As such, a vital component of a carbon offset project is in the planning process, and in working with regulatory authorities in the development phase to the greatest extent possible.

As an example, consider that tree plantations represent investments which have positive greenhouse gas flows, but are not necessarily registerable as carbon offsets. This is because, usually, a plantation has not demonstrably *"changed"* carbon flows, since the basic economics of global fiber demand make it likely to occur somewhere. Nonetheless, it appears there are, theoretically, ways of modifying plantation design, management and investment structure in ways which pass the additionality test and achieve simultaneous economic return from both fiber and greenhouse gas sequestration. This type of re-casting represents an example of the need to demonstrate *"intent"* of a programme, through pro-active project design which incorporates the needs of carbon investors as well as standard timber economics from the outset.

In general, successful forestry-based carbon offset projects should be,

- Credible and reliable, in being able to modify carbon flows over time, judged by experience with similar projects else where;
- Able to measure and verify their claimed greenhouse gas ability;
- Cost-effective compared to alternative mechanisms; and
- Expandable and replicable elsewhere.

Carbon offset projects have been implemented by government groups, NGO's, private sector concerns and different combinations of the three. Generally, NGO's are included in the process as they add a degree of internalized monitoring as well as advice for parties not necessarily conversant with each others ways. A small number of consulting and brokerage firms have emerged, for assisting in project development according to the evolving guidelines as well as sourcing investment for project implementation.

Joint Implementation in the South Pacific

Although there has yet to be any implemented JI programs in the South Pacific, the work of a few individuals and organizations (notably SPFDP or RAS/92/361) has put the region into a position of prominence in project development and there are growing expectations for the potential of the region as an implementor of forestry-based offsets. For example, SPFDP has co-submitted four projects to Untied States Initiative on Joint Implementations in the first year of the Programme. At least one project is in investment negotiations with outside financiers, while further inquiries have come from concessionaries and governments in the region. It can be expected that a small cadre of professionals will arise to develop finance and implement such projects to regulatory specifications.

The South Pacific's high ratio of forests to population and industrialization, mean that the primary point of entry of JI investment in this region will be in forestry, rather than energy or transportation. Decisions such as Australia's to develop a pilot programme for joint implementation and New Zealand's utilization of forestry offsets to negate the greenhouse gas impacts of a proposed power plant, indicate that regional forestry offset programs can look to these countries, as well as the United States and Japan, as potential sources for investment.

However, greater familiarity with JI, garnered through forestry sector initiatives, may eventually translate into better capacity to attract financing for greenhouse friendly energy technologies to assist in small island state development. Beyond primary harvest, community forestry and plantation industries, regional forestry professionals should increasingly consider the role of biomass as an energy source. Renewable biomass energy is attractive to carbon offset financiers from the electric utility industry, as there is generally greater familiarity in power issues than in forestry regimes. It may be that in ten years, some Pacific Island Heads of Forestry will also be involved in policy decisions for biomass generation facilities and fuel supply contracts. In the meantime, there are ample opportunities to begin examining resources for applicability for joint implementation investment.

Getting involved in developing carbon offset programs is along term process. While there have been great strides in policy and programmes over the past two years, the concept remains in its infancy. Unlike some early prognostications, carbon offsets are not an immediate bounty for all foresters everywhere. However, considering the carbon implications of management decisions, it can help foresters ascertain their options in this evolving world and provide a potential low-cost path towards practicing more sustainable practices. Worldwide, well-considered programs are already reaping the rewards of this innovative source of investment and the South Pacific island states are in an excellent position to follow suit.

(by Marc Stuart and Don J. Jones, COPEC, USA)

TO:

Pacific Islands
FORESTS & TREES

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