

**PROFITABLE ENVIRONMENTAL  
PROTECTION (PEP) PROJECT**

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*QUARTERLY REPORT*  
October, November, December, 1994

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Report for the Quarter October, November, December, 1994

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# QUARTERLY REPORT

October, November, December, 1994

Written By  
Profitable Environmental Protection (PEP) Project Staff

## I SUMMARY

PEP made very satisfactory progress this last quarter as several of the project's activities became better developed and consolidated. These included the ecotourism enterprise and site stable agriculture in Lolihor, as well as the Carboxylon and waste oil activities. The project was challenged by the outcome of the PRA exercise in Hog Harbour, and we continue into the next quarter in uncharted waters as we try to follow this community development process through, with no experience in other Pacific communities to provide guidance.

### **Programme activities:**

PEP ran another cooking workshop at the Lolihor community's request during this quarter. This emphasised hygiene and nutrition along with menu planning for tourists. Arrangements were made for two people involved with the ecotourism enterprise to undertake educational tours in the next quarter. This arose out of repeated feedback from tourists that the facilities and tour could be more attractive if the special needs of overseas tourists were better understood and catered for.

The intervention to introduce techniques of site stable agriculture was slightly delayed by the long drought but has begun to progress better with the onset of rains. The wuhuran (demonstration) farm plots have been fenced and planted with glyricidia and acid-tolerant yams. Other planting materials could not be collected because the drought had reduced planting supplies.

The results of the garden clearing survey and the wuhuran farmers KAP survey were translated to Bislama for distribution to LDC and teachers. PEP awaits discussion of the results and agreement of the process for future monitoring by the community.

The Environment Education officer ran a two day workshop for trainers. This created much interest in both environment issues and the effects of tourism on culture. More village workshops were requested. These are planned to be run by the village trainers with support from PEP's Education and Enterprise Development Officers.

Wuhuran Theatre has been weaned from PEP support. It is now an independent body which PEP contracted last quarter to stage performances of the play "Jealous Heart" in individual villages in Lolihor. This play created much discussion by the audiences.

In Santo, we took some time to assess what the outcome of the PRA held last quarter, in Hog Harbour village, meant for PEP. The PRA process changes our role from an outside development agency coming in to introduce activities into the village for fulfillment of objectives set by us, to an agency coming in to facilitate planning by the village to meet objectives set by them. While both we and the village took time to sort out what this meant to our relationships, our staff in Santo continued with environmental educational activities for the wider Santo community.

PEP engaged two overseas and two local consultants to conduct a five-week survey of population numbers, distribution, ecology, ethnobotany and gross morphological variability of Vanuatu's threatened endemic palm, **Carpoxyton macrospermum**. Discussions were also held with the Farm Support Association to conduct germination trials when necessary, and for seedlings in PEP's nursery to be sold or distributed for observation of the palm's horticultural characteristics. PEP consulted with government authorities over the possibility of exporting **Carpoxyton** seeds and received welcome approval and support. Plans for formulating a species recovery and conservation plan were also discussed with government.

Information and data gathering on waste oil was completed satisfactorily. Several alternative treatments were considered, and assessed for technical and financial viability. Only one alternative was considered both technically and financially viable for possible adoption in Vanuatu at this time. This is to burn it as a boiler fuel. The team decided to go ahead and find a suitable institution to trial the technology here. An IEE was prepared for approval. Negotiations began with several likely candidate institutions and we finally settled with a local hotel as the most appropriate for the demonstration boiler. Negotiations are continuing.

We gained another staff member this last quarter. We now have a total complement of nine full time staff and one advisor. Three of our staff members attended a regional meeting on indigenous nuts of the South Pacific held in Vila, while Kathy Fry, FSP's Regional Manager, was one of the few NGO representatives invited to attend a UNDP meeting in Port Moresby..

**Note to readers:** Each PEP Quarterly Report contains the entire history of each project or intervention. New material for each reporting period is added under the heading of "**Current Situation**", and organized by intervention. If you do not wish to review material previously presented, look for the "**Current Situation**" heading under each active intervention (North Ambrym, Santo, Carboxylon, and Waste Oil) - all new material is inserted thereafter.

## II PROGRAM ACTIVITIES

The following sites have been adopted or considered for PEP intervention:

### I. NORTH AMBRYM

**Initial Situation:** Gardens in the Lolihor EMU are expanding at the expense of forest, largely because inhabitants are expanding cash cropping. Traditional slash and burn practices necessitate site rotation every year.

**Conservation Objective:** To reduce loss of forest cover occurring as a consequence of expanding gardens.

**Enterprise Interventions:** Enterprises that provide an alternative source of cash income, give new or added value to natural resources, or that substitute destructive gardening for more sustainable exploitation will be expanded or developed, thus reducing dependence on cash cropping (cocoa, copra, cattle, peanuts) or market gardens (mostly taro and sweet potatoes) for income.

Enterprises selected for advancement were (1) a tourism project, (2) cultivation of wild yams, and (3) site stable agriculture.

### Project History

**March 1993:** PEP Team recommends adoption of this EMU, with further investigation of specific interventions.

**September 1993:** Profiling completed, active EMU, Initial Environmental Examination submitted and approved for wild yam enterprise, IEE in progress for tourism project, handicrafts under investigation, shark fin enterprise dropped. Monitoring and evaluation and environmental education programs are active.

PEP team recommends continuing advance in tourism, handicraft, and yam initiatives.

## **December 1993:**

### Tourism

Consultant Jeremy Challacombe visited the Lolihor EMU during the previous quarter to prepare an IEE for the tourism project. Traditionally, access to the volcanoes has been denied during the yam planting season, November through February. It is believed that persons visiting the volcanoes disturb them, bringing volcanic dust and acid rain that destroys the newly planted crops. Villagers favoring the tourism project wanted this prohibition lifted. In May of 1993, following presentations by representatives from Ranvetlam, the District Council of Chiefs agreed that tourists could visit the volcanoes at any time of the year. Although this issue has been the subject of continuing debate, the decision of the District Council was reaffirmed in August 1993. In a cultural context, this represents a major deviation, and is an indication of the level of interest in increasing tourism.

### Site-Stable Agriculture

Boosting production from areas already under cultivation is one forest conservation strategy that PEP proposed for Lolihor but has not yet attempted. Following from several discussions with Charles Rogers of the Farm Support Association (FSA), Devoe drafted terms of reference for Rogers and FSA to begin this work, assessing existing farming systems, and recommending practices to boost production in terms of either food or cash. This consultancy is scheduled for February.

### Equitable and Sustainable Human Development Program (ESHDP)

On November 6th, Pestelos travelled to Lolihor. Working with the PEP Liaison Officer, the following four days were devoted to community relations activities that culminated in the formal endorsement of the ESHDP Workshop by the Ambrym Island Councilors. The program and subsequent profiling activities began on November 11th, and continued intermittently through November 29th. Following a discussion with all participants at the onset of the training, it was agreed that participants would not be compensated for their work with the project. This issue was again raised by the local trainers on November 29th, when they presented a petition calling for a sitting fee to be paid, retroactive to the first day of the workshop. Pestellos and Salong responded, saying that among other considerations, this demand was in violation of a previous commitment, and that there was no money available to pay such fees. The workshop was declared closed, and Pestelos and Salong returned to Port Vila.

It should be noted that the work of the ESHDP was virtually completed by November 29th. The sudden closing of the program and subsequent discussions within the EMU brought to the surface long standing conflicts relating to ESHDP, the PEP Project, and Salong's work within the community. It is Salong's view that these conflicts are being successfully resolved, and that here is now "incredible support" for the ESHDP.

## Waste Oil:

In Vanuatu, as in all the small island nations of the South Pacific, there is no mandate requiring that waste lubricating oil be disposed in an environmentally responsible manner. As a result, all waste oil eventually finds its way into the ground. The PEP waste oil initiative will determine the amount of waste oil available for recovery, and to investigate various alternatives for the recycling or disposal of this oil. If feasible, an enterprise is to be planned to undertake the waste oil collection and reuse.

Estimates have been made of the amount of waste oil available for recovery, and of volumes that realistically might be recovered. Various options for recycling or disposal have been investigated, with two scenarios indicated. Destruction of Vanuatu's waste oil in an environmentally sound way could be accomplished through incineration employing off-the-shelf equipment available in the United States. From a business standpoint, an enterprise based upon waste oil incineration would be viable only if waste oil collection was mandated by government, and if users of lubricating oil were charged for waste oil collection.

A second solution to the disposal problem is to use waste oil "as found" as a source of supplemental energy. Either of Port Vila's two largest hotels could use all the oil that could be collected at this time to meet their hot water heating needs. A report is under preparation summarizing this project; this will be reviewed with stakeholders both within and without government prior to developing a plan for subsequent action.

recruited in Port Vila as a test group. Unfortunately, at the time for this tour, two cyclones passed through Vanuatu, straddling Ambrym. Flights to, and local transport in, Ambrym were suspended, and the trial tour was canceled. Upon his return to Port Vila, the consultant met with locally-based tour operators to acquaint them with the PEP tourism project. Their reaction was favorable, and they evidenced interest in marketing the tour once it was fully developed.

### Lolihor Development Council

Of ongoing concern are the issues of management and sustainability for the tourism project and other interventions. An expected product of the PEP/ESHDP participatory profiling and planning exercise was the selection of a Lolihor Development Council to provide guidance and management for development activities in Lolihor. As related in above report of the ESHDP activity, this did not eventuate. The tourism project involves a number of stakeholders whose record of cooperation is clouded; it was felt to be essential that a locally chosen body be constituted to assume management responsibility for the enterprise.

In an attempt to bring together the Lolihor community, and to facilitate the selection of a development council, Neil Netaf Stevens, a member of FSP's ni-Vanuatu staff and a Community Development Specialist, was recruited to work within the EMU.

Following background meetings with PEP staff and Jimmy Nipo of the Department of Local Government in Port Vila, Stevens travelled to Lolihor in March for ten days of consultations with community members. At meetings in six villages, the purpose of both PEP and ESHDP projects was discussed, and support and commitment for each project solicited. Next, an area leaders' meeting was convened, which resulted in the election of the Lolihor Development Council, Chairman, and Executive Committee. The Council agreed that they would support all PEP/ESHDP initiatives, and that responsibility for community participation would be lodged with the Executive Committee. If the Committee functions and accepts these responsibilities, it will follow that leadership and management roles now in the hands of on-site PEP staff will be transferred to local leaders. PEP staff will assume their more appropriate roles as advisors and facilitators, and the project will have achieved a significant milestone.

### Site-Stable Agriculture

PEP began work with the national NGO Farm Support Association (FSA), negotiations for which were begun last quarter. PEP Local facilitator George Bumseng visited FSA personnel and the farm, and alley cropping demonstrations at Montmartre just outside Port Vila at the end of January.

Charles Rogers of the FSA assessed existing farming systems in Lolihor during February 19-March 1. He reported considerable potential for improving agricultural practices by: 1) introducing alley cropping to contribute to site-stabilization of cash cropping; 2) enriching fallows with legumes to speed restoration of soil fertility; and 3) increasing production from coconut plantations by suitable under plantings. Additionally, Rogers recommended a program of farm forestry to further stabilize agriculture, diversify woody biomass, and produce fuel wood and building materials. Contouring and other techniques to reduce erosion were also suggested. During his visit, Rogers established a contour planting trial. Cuttings of Gliricidia sepium sent by Rogers were outplanted in Lolihor in March. Rogers raised the interest of local farmers and predicts excellent participation in activities aimed at enhancing agricultural production.

## Equitable and Sustainable Human Development Program (ESHDP)

PEP continued coordination and planning with NPSO, Department of Local Government, and ESHDP personnel in Suva for the rescheduling of the aborted Lolihor Development Congress. Target date is now June. A United Nations Volunteer is expected to be posted to Lolihor in June, too.

### Popular Theater in Lolihor

During the last two weeks in January, the Wuhuran Theater Group was in Port Vila for a training workshop with Vanuatu's national troupe, Wan Smol Bag. Wuhuran began work on a new play written by them, "Nabanga", about themes of cooperation in village life. Cooperation is shown to enhance environmental management and quality of life, while greed and self-interest lead to environmental degradation and social problems. "Nabanga" was performed for PEP and other FSP staff during the training.

Cyclones prevented the Wuhuran Theatre group from returning to Ambrym until early February. Wan Smol Bag continued to coach them, and they worked on the play "Tourists and Toilets", which Wan Smol Bag had originally written and produced upon commission from World Wide Fund for Nature (WWF). PEP selected this play for the Wuhuran Theatre's repertoire because it raises many of the environmental and social issues surrounding outer-island tourism and serves as an excellent platform for launching discussion of these issues. Wuhuran Theatre presented "Tourists and Toilets" in Vila for PEP, the larger FSP, and collaborators from Department of Local Government, Environment, Forestry, and National Planning Office. We were joined by Sally Montgomery Brumbaugh, new FSP Vice President, on her first visit to Vanuatu. The theatre group presented "Tourists and Toilets" in Fanrereo and Ranon following the Port Vila workshop.

### **June 1994:**

- 1 a. Equitable and Sustainable Human Development Program (ESHDP) and Lolihor Development Council (LDC).

ESHDP developments include the following:

- the first draft report on the ESHDP Participatory Planning Process in Lolihor called, "Community Aspirations for Human Security in the Lolihor Watershed Area: their implications to strengthening local capacities for project development and implementation", was produced;
- National Planning Office (NPO) re-affirmed commitment to being the coordinating center for ESHDP,
- new national committee has been set up. (The sacking of striking civil servants had left vacant positions.)
- a work plan produced,
- and the decision made for the United Nations Volunteer (UNV) to reside in Port Vila instead of North Ambrym.

### Lolihor development:

The L.D.C. has written letters to:

- all NGOs, introducing itself and requesting training support;
- Telecom Vanuatu Ltd. (TVL) to request the installation of a single line telephone in Lolihor, with facsimile capacity.

Initial preparations with Nasonal Komuniti Development Trust (NKDT) to run a workshop with the LDC were canceled after scheduling difficulties. Neil Stevens Netaf, FSP Community Development Specialist substituted to facilitate the drafting of LDC's constitution. The week long process generated further excitement and cemented commitment to the PEP project activities in Lolihor. Neil officially opened a temporary office at the Lonbato co-operative store room at Ranon village.

The L.D.C. and the Lolihor community are:

- prepared for the Lolihor Development Congress on August 17th; and
- eager to have assistance from the U.N.V. to develop and implement working policies based on community aspirations for human security.

Having received drafts of the constitution, delegates of the L.D.C executive will be travelling to all villages to discuss the draft constitution, address questions, and allow further input towards the final draft for ratification at the Second Annual L.D.C. Meeting.

Based on the constitution, the LDC will proceed to develop:

- Lolihor Conservation Policy;
- Lolihor Tourism Plan;
- Lolihor Cultural Revitalization Policy;
- Lolihor Non-formal Education Policy;
- Lolihor Sustainable Development Plan;
- and a framework for partnership with other organizations.

After clarification of these policies, delegates of LDC will embark on an awareness mission to Port Vila to inform potential partners of how they can participate in the implementation of LDC policies in Lolihor. The partnership framework will guide negotiations with all organizations including local groups such as Wuhuran Theater Group.

The LDC executive met with the PEP coordinator and:

- agreed to hiring an environment educator for Lolihor;
- endorsed Marina Jones as the part time female Local Facilitator;
- agreed on first aid, tour guide and cooking workshops and a schedule for these;
- submitted a budget for a building for the LDC;
- and endorsed ten names as Wuhuran farmers to work with FSA on site stable agriculture.

#### 1 b. Wild Yams

Three thousand seven hundred and sixty two kilograms of wild yams have been bought from the villages of Wilit and Konkon by PEP and distributed since November 1993. The total number of farmers that have received wild yams is ninety four.

Volcanic activity temporarily affected some of the growing plants but they have since recovered. More and more farmers are interested in participating in wild yam planting. Those who have already planted want to plant more.

Time constraints have resulted in a weakness in wild yam monitoring. But the proposed wild yam farmers workshop will be conducted to:

- reinforce PEP's goals in Lolihor;
- allow farmers to exchange ideas on the best ways to plant and harvest wild yams, monitor growths, monitor production, identify a marketing channel, and agree on a beach selling price.

The L.D.C. is committed to:

- administer the purchase of another 7,000 kg of wild yams from Wilit, Konkon, and S.E. Ambrym;
- transport, store, and distribute wild yams to farmers after briefing them.

#### 1 c. Wuhuran Theatre Group

Developments with Wuhuran Theater Group include the following:

- hiring of two new members, John Nabong and Shelly Sali, - two performances of "Tourists and Toilets" play at Ranon Junior Secondary School and Fanla village;
- production of "Jealous Heart," - a new play about root causes inhibiting advancement of PEP activities in Lolihor, ready to be performed;
- a two day on-site training at Henyal-Orkon by Charleon Falao of Wan Smol Bag Theater; and
- and the decision by the group members to establish Wuhuran Theater Group as a separate entity from PEP to facilitate involvement in non-formal education on all issues including, but not limited to, environmental awareness.

#### 1 d. Tourism

From May 3 - 7, two tourists embarked on parts of Ambrym Adventure Tour. Four days notice was too short to get everything organized, and the two tourists could not afford a cultural dance display at Fanla. A village tour outside of Lolihor was quickly organized. The tourists did not want to go to the hot springs, having just travelled in New Zealand. Their travel on Sunday resulted in some guides not turning up. Consequently, packs were too heavy for just one guide and the PEP local facilitator. Luckily, the tourists were fit and experienced, so they carried some of their own packs. The guides did not know the right path at that time because they had not surveyed the paths as planned due to other commitments. A report submitted by the two tourists has proven valuable to the tour guides and the cooks.

May 17 - May 26 saw consultant Jeremy Challacombe's return to Lolihor. He was joined by four tourists from May 19 - 24. The whole tour program was conducted. Everything went smoothly and everyone was relatively happy, except for some people at Emiotungan in West Ambrym who were expecting the tourists to stop at their village. A meeting called by the chiefs of West Ambrym on July 28th will discuss Ambrym Adventure Tours and listen to their concerns.

Work on brochures for Rossolo Bungalows and Ambrym Adventure Tours has started but is yet to be completed. The in-house brochures will be produced and distributed to the tour operators in Vila.

Meetings have been held with tour operators in Vila to inform them of Ambrym Adventure Tours. Mike Van Helsing of South Pacific Travels and Gilbert Ambroggani of Surata Tamaso may be coming on an awareness tour of the Ambrym Adventure Tours in August. They will try to bring some paying tourists to cover their costs. Jeremy Challacombe is also trying to organize a commercial tour from Australia in the next quarter.

It is recognized that some work needs to be done to inform yachtsmen of the Ambrym Adventure Tours. Educational pamphlets, brochures, posters and videos must be produced to provide a guide for tourists on what to expect and how to behave. Evaluation questions in self-addressed envelopes will be provided to tourists for feed back. This will help the stakeholders in improving the tour.

Douglas Solomon, (bungalow owner and operator) and Isaiah Bongnaim, (tour guide leader to west Ambrym.) should be taken on a study tour to see eco-tourist operations either in New Zealand or Fiji. A tour will enable them to substantially improve their practices on the ground.

Planned training workshops include:

- a first aid course for tour guides scheduled for July;
- the second tour guide training course (to increase the pool of tour guides) in August;
- and another cooking workshop is scheduled for September.

1 e. Site-Stable Agriculture

Arrangements between three individual farmers, the Ranon Junior Secondary School Agriculture Teacher, and Charles Rogers, led to the shipment from Vila of some 450 glyricidia cuttings for alley cropping. Because of packing and transportation complications, only 30 per cent of the planted cuttings have sprouted. Glyricidia plants, however, already exist at Ranon. These can be used to start other alley cropping plots.

George Bumseng, has planted out:

- Dendrolobium umbellatum or "limlalau," 100 per cent of which are growing;
- pigeon peas - already germinated;
- and flamengia, for the purpose of collecting seeds. It remains to be seen how flamengia will resist volcanic activity.

George has also set out markers to monitor soil erosion on:

- a contour planted garden plot;
- and a plot without contour planting.

Nine Wuhuran farmers, besides George, have been identified to serve as key farmers in demonstrating:

- fallow enrichment;
- contour planting and alley cropping;
- and cultivating under coconut trees.

### **September 1994:**

#### 1 a. Wild Yams

Wild yams continue to grow but some will be affected by the current drought in Lolihor. One plot was trampled by cattle looking for water and better pasture.

Another six hundred and ninety (690) kilograms of tubers has been distributed for planting by twenty five farmers. Other farmers are requesting planting material and the LDC is waiting for approval for funds by PEP to purchase another (7) seven tonnes from South East Ambrym.

#### 1 b. Site-Stable Agriculture

Under contract to PEP, the Farm Support Association established 6 demonstration plots with wuhuran farmers. Meetings held with different community members revealed the existence of other acid-rain resistance yam varieties. Some of these were collected for trial in the wuhuran plots. Planting of cuttings and seeds for alley cropping and for fallow enhancing was delayed due to a long period of drought.

PEP agreed to meet the cost of fencing the demonstration plots to keep pigs and cattle out. These destroy gardens close to the village and discourage people from farming land in proximity to settlements. The problem has to be addressed if the remaining forest, which is being encroached by gardens, is to be saved. The LDC agrees that the issue requires attention.

#### 1 c. Wuhuran Theatre Group

George Bumseng's absence from Lolihor on an Asia Environment Program (AEP) Scholarship illuminated the great need for guitar lessons for all the theatre group members. In his absence, only two performances were made on the occasion of the Lolihor Development Congress.

A funding proposal has been submitted to PEP for the performance of "Jealous Heart" in 8 Lolihor communities. PEP and the Wuhuran Theatre Group have agreed that any future plays would be developed and performed on a contract basis and at the request of PEP. PEP has encouraged the theatre group to seek other opportunities to perform as an independent theatre group, and has provided support for core activities.

#### 1 d. Tourism

Under the sponsorship of PEP, a successful first Aid Training Workshop for the Tour Guides of Lolihor was conducted by Mr. Solomon of the Red Cross Society, Port Vila.

Six tourists including three members of the National Tourism Master Plan Consulting Team embarked on part of the Lolihor Ambrym Adventure Tours. The feedback provided was valuable in planning the second Tour Guide Training Workshop to be conducted Eileen Ligo.

Tour Guide Training Workshop, Conducted by Eileen Ligo:

- gave theoretical and practical experience to the tour guides of Lolihor,
- finalized agreement on package tour with the LDC, people of Emiotogone and Sanesup,
- orientated potential tour guides of West Ambrym and recommended urgent action to market the tour package before end of October 1994.

The National Tourism Master Plan Consulting team sent another mission to Lolihor to discuss the Lolihor, Ambrym Adventure Tours.

Individual tourists have continued to drift to Lolihor. Travel Agents in Port Vila have not taken advantage of the opportunity offered by PEP to familiarize themselves with the Lolihor Ambrym Adventure Tours. The Lolihor Development Council is interested in exploring linkages with tour operators in Santo, pending the opening of the New International Airport in Luganville.

## 1 e. Monitoring Forest Clearing Practices

Concern that PEP has no clear means of monitoring the effect of its interventions on the rate of forest clearing resulted in the decision to conduct a survey to investigate the current practices of clearing bush and forest in Lolihor. The survey had several objectives;

- to establish baseline information on forest clearing practices in Lolihor,

- to train local people in the conduct of such a survey,

- to begin a process of monitoring forest clearing that the LDC can take over and continue after PEP closes.

A simple questionnaire of 12 questions was designed, and translated to Bislama. Discussions were held with the principal and staff of the local Junior Secondary School for students to be trained and to conduct the survey, under staff supervision during the August holidays. This coincided with the commencement of the traditional period for clearing land for new gardens. Three hundred nineteen questionnaires were completed. It is the intention to do only sample surveys in future so that the school can process the data itself by hand.

The results of the survey in brief they show that each household averaging 6.2 persons, has at least 2 farmers and often 3. The majority of farmers (over 52%) were females. Of farmers of both sexes, about 25% were farming for the first time this year. Of the rest, total number of years they had been gardening ranged from 1 to 62 years. On average, each farmer has three gardens, using the same piece of land for some two to three years, and leaving it fallow for some three to four years before farming it again. About 42% males and 38% females cleared virgin forest each year for new gardens. By far the most frequent reason for clearing virgin forest (83%) is to make gardens for subsistence crops. Favoured crops for resistance to volcanic damage are manioc and fiji taro, while crops considered good for planting under bush are wild yams and fiji taro. Some 71% of forest clearing is for mixes of subsistence and cash cropping, 52% is for cash crops only, 29.8% is for planting coconuts. The survey did not attempt to measure the average area of forest cleared each year. Only 12 of the 319 farmers had no more virgin forest on their land. The majority of farmers (97%) considered it important to conserve virgin forest while 94% think it good to leave some virgin forest uncleared. These results show that with careful planning and encouragement of well managed utilisation of the virgin forest, the Lolihor community may be able to sustain the integrity of their environment in the long run.

1 f. Monitoring changes in Knowledge, Attitudes and Practices (KAP) of the wuhuran farmers and a control group.

A total of 23 farmers, comprising all the wuhuran farmers and a control group, were subjected to a KAP survey. As these were specially selected farmers, they averaged a higher number of gardens (4.8) than the community average (3.1). Almost all of the gardens have some cash crop. The most frequent cash crops are coconuts and kava, while peanuts is also less frequently planted. Bananas, manioc, fiji taro and water taro are usually planted with cash crops. Sixteen of the 23 farmers still have about half or more than half of their land in virgin forest, while 4 of them have none left. Of those with virgin forest, 15 said they plan to keep some of it untouched for various reasons including that -

they thought it is important to preserve the environment, to keep trees, and to provide fruits for birds,  
the bush provides nutrients, and helps regeneration of abandoned gardens,  
forest is necessary to plant wild yams in, or,  
it is too much work to clear.

The average fallow time for these farmers was just over 3 years. While 20 of the 23 considered the current fallow period long enough, 2 thought they were coming back to the same garden site too soon and not giving enough time for the land to recover. Ideas for improving the situation, included planting with legumes, alley cropping, longer fallow, mulching, and planting with big trees. All except one, garden on sloping land while all except three, claim they lose soil through erosion. The majority are using wood to stop erosion and consider this satisfactory. Suggestions for improvement include planting trees including glyricidia, hibiscus, limlalau, and alley cropping. All burn rubbish after clearing the land for new gardens because burning kills tree roots, weed seeds, pests, drives away rats, helps crops grow better, and is custom practice. Only three farmers state that burning is not good for the garden, because they had obtained new ideas from the FSA agents and because the rubbish burnt could be spread to fertilize the garden. About half the farmers interviewed are now farming the same garden plot longer than they did 5 years ago through mulching with crop rotation, and through decreasing fallow period. Fifteen of the farmers think that farming the same piece of land for many more years than currently practiced is not good, the reason being that such practice depletes soil nutrients too much. The majority favor mixed cropping and a list of crops thought to benefit each other as well as those thought to be detrimental to each other was obtained. The survey data is tabulated in Appendix VI.

This questionnaire was administered a few months after the FSA team had made visits to Lolihor, so that it already detected the influence of the FSA programme on site-stable agriculture.

Another KAP survey is to be conducted towards the end of PEP life to see how much effect the FSA intervention has had. Responses of wuhuran and control farmers for both surveys will be analyzed separately then.

- 1 g. Vanuatu Equitable and Sustainable Human Development Program (VESHDP) and Lolihor Development Council (LDC).

VESHDP is advocating the participatory development process and facilitating participation in Lolihor with the following activities:

- official launching of VESHDP and the signing of the Suva Declaration by Vanuatu's Prime Minister and UNDP's Resident Representative on July 27, 1994, as part of the 14th Independence Anniversary Celebrations,
- orientation of Directors of Government Departments and Political Secretaries,
- orientation of Vanuatu NGOs,
- and close partnership with the National Planning Office staff and the Department of Local Government.

The facilitation of local participation in Lolihor included:

- support to the Lolihor Development Congress on August 17, 1994, and swearing in of the Lolihor Development Council,
- video documentation of the Lolihor Development Congress,
- introduction of Alan Morales, the UN volunteer to work with the LDC, the Lolihor Development Team (formerly known as Local Trainers) and the people of Lolihor to prepare project documents, find donors, implement, monitor and evaluate the projects.

LDC has;

- taken on responsibility of organizing all workshops conducted in Lolihor and funded by outside groups including PEP,
- held wide consultation with the Lolihor population concerning
  - Wuhuran education program,
  - LDC constitution prior to the Annual General Meeting of the LDC on October 15th 1994,
- submitted a report on wild yams to PEP and requested funding for another (7) seven tonnes of wild yams to be planted,
- a grant of Vt 200.000 from PEP to the LDC to partially cover start-up expenses for the organization. Funds are to be used for construction of office space and purchase of office furniture and supplies (subject to approval by PEP staff),
- mandated the Lolihor Development Team to document project ideas, implement, monitor and evaluate the projects,
- undergone a three day Basic Bookkeeping and Business Management Workshop conducted by Hanson Kalo of Community and Environmental Forestry Project and sponsored by PEP.
- and reviewed and finalized package rates for the Lolihor Ambrym Adventure Tours to begin on April 1st 1995.

## 1 h. Educational Activities

The work of Stanley Womack (PEP Environment Educator) and Matu Bongranli (PEP Women Local Facilitator) in conducting the KAP survey has been discussed previously.

Jacque Yakan of CEF conducted a very successful tree planting workshop with 10 farmers of Lolihor complete with;

- theory,
- tree planting along the coast line,
- video show, and
- and establishment of a nursery.

Peter Kaoh of FSA has been responsible for the site stable agricultural project in Lolihor. His work with the team Wuhuran farmers has been hindered by the dry season and the prevalence of volcanic activity.

## **Current Situation**

### **December 1994:**

#### **1 a. Wild Yams**

Wild yams continue to grow despite the long period of drought which caused minimal effects. Monitoring of the plantings and their growth is planned for the next quarter to be undertaken by the Lolihor PEP staff with the assistance of the PEP coordinator.

#### **1 b. Site-Stable Agriculture**

The officers of Farm Support Association (FSA) have been to Lolihor several times, working with the wuhuran farmers to;

- fence their demonstration plots to keep out roaming pigs and cattle,
- purchase and distribute 300kg. of acid tolerant yams to four farmers to multiply as seed material. This will be distributed to more farmers for the next growing season.

A shipment of over 1,000 glyricidia cuttings was sent from Vila and distributed to the wuhuran farmers. They have been planted in the alley cropping plots. Their growth is being monitored by the Lolihor PEP Staff and the few that have not sprouted are being replanted from a nursery "bank".

50kg. of laplap beans were distributed to interested farmers, most of whom had whole pieces of their land destroyed by bush fire during the long period of drought. Another 50kg. will be used by the Holiness Community to demonstrate the beans a smother crop under old coconut plantations. Farmers were informed of the value of the bean which:

- enriches fallows,
- speedily restores fertility, and
- is a smother crop.

A flamengia nursery was set up at the Ranon Junior Secondary School. The seedlings which have germinated and are growing well will be used to establish a demonstration plot at the school.

The FSA officer's report is detailed in Appendix I.

#### **1 c. Wuhuran Theatre Group**

The Wuhuran Theatre Group was contracted by PEP to perform the play "Jealous Heart" in the eight settlements in Lolihor. The theme of the play is cooperation which is shown to enhance environmental management and quality of life, while self-interest and greed lead to social problems and environmental degradations. Interactive discussions with the audiences after the play were based on these two questions: 1) How would you avoid these problems when and if it does happen?, 2) How would you resolve them? This report is detailed in Appendix II.

#### **1 d. Tourism**

A second cooking workshop, sponsored by PEP was conducted by Kelma Sope. See Appendix III for Kelma's report.

The LDC and Douglas Solomon, proprietor of the bungalows at Ranon, have agreed to host a team of tour operators from Vila on a tour of the Lolihor Adventure Tour free of charge. The operators will be paying their own air fares and PEP will account for the boat and truck transports. Hopefully, this will get their interest to market the package tour.

Arrangements have been made for Douglas to spend a week at Nagar Bungalow Resort, North Efate, to gain experience from the operation there. Also, arrangements are being made for Isaiah Bong, chief guide, to go to New Zealand for training in tour guiding.

#### **1 e. Vanuatu Equitable and Sustainable Human Development Program (ESHDP) and Lolihor Development Council (LDC).**

Events over the last quarter included the introduction of Allan Morales, a UN Volunteer, to work with the LDC and the Lolihor Development Team to prepare project documents, find donors, implement, monitor and evaluate the projects.

## **1 f. Educational Activities**

PEP's Environmental Education Officer Stanley Womack visited Lolihor twice to:

- gather appropriate information to be used by tour guides and wuhuran farmers (see Appendix IV).
- conduct a 2 day environmental workshop (see Appendix V for Stanley's report).

Information collected will be put in pamphlets for farmers and tour guides.

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## 2. SANTO

Initial Situation: The Australian Institute for Marine Sciences completed a Vanuatu Marine Resources survey in 1988. The Survey identified Hog Harbour and Elephant Island as one of four exceptional coral reef systems in Vanuatu and recommended Elephant Island as a national conservation priority. The area was noted for its rich marine biodiversity and unique conservation potential. Some suggestion of over fishing exists, turtles are occasionally hunted. Local tourist attractions, including Lonnoc Beach Resort and Champagne Beach, would benefit from protection of reef quality at Elephant Island. Potential exists for enhancing snorkeling and diving enterprises in exchange for cooperation in site protection.

Conservation Objective: To institute a private, protected area to safeguard the exceptional marine biodiversity of Elephant Island, threatened by uncontrolled exploitation and large-scale tourism (Fairstar cruise ship shipboard diving).

Enterprise Intervention: Lonnoc Beach Resort, Elephant Island, and Champagne Beach would all benefit from maintenance of reef quality at Elephant Island. We propose to investigate the enhancement of existing tour/snorkeling/diving enterprises to support a protected area, and to improve tourist services in exchange for cooperation in management of Elephant Island. The appeal for working with an established business (Lonnoc) is very high. Some baseline data is available and conventional business indicators can be employed to demonstrate progress (or lack thereof).

### Project History

**September 1993:** This project is highly recommended for continued investigation. Land disputes are rumoured for Elephant Island. The relationship between Lonnoc Beach and Elephant Island is unclear (Does Lonnoc share Elephant-Island-derived revenues with Elephant Island owners?). We would like to investigate these issues before approaching the principals at Lonnoc and Elephant Island to seek their cooperation in developing pro-conservation enterprises.

**December 1993:** Stead travelled to Santo October 28 to prepare for the visit of USAID's Larry Armstrong and Toni Ferrara. Prior to their arrival, he met with John Mooney, Santo's Municipal Planner, to develop a strategy for introducing PEP into the Elephant Island community. It was decided to work through the Santo Tourism Industry Development Association (STIDA), as virtually all stake holders are represented in this organization.

Devoe and AEP Fellow Milika Naqasima travelled to Santo December 14-16, so Naqasima could see the site and better detail her work plan for January and February. Devoe and Naqasima met with Local Government Council (LGC) Secretary Havo Moli to discuss plans for work at Elephant Island and in the surrounding communities of Hog Harbor and Port Olry. Moli

pledged LGC support for the PEP effort. He suggested that he accompany PEP staff to the site and villages to present them to the area chiefs upon Naqasima's return. He seemed acquainted with the environmental issues in the North Santo area and genuinely interested in protecting resources and tourist income there.

Naqasima and Devoe also met with Luganville Municipal Planner John Mooney, who as a member of the STIDA, had first approached PEP with regard to environmental management in North Santo. Mooney's concern, like PEP's, is in preventing damage to the marine resources which could result from uncontrolled tourist traffic, and thus undercut tourist revenues. Mooney was briefed on the discussion with Moli and PEP work plans.

Kalmer Vocor, owner of the Lonnoc Beach Resort, met with Devoe and Naqasima to discuss his questions about development in the area. Lonnoc Beach Resort will be the base for much of the PEP field work, so Devoe wanted to discuss longer-term rates for accommodation and boat rental. Vocor is very knowledgeable about local issues and politics, and is an important stakeholder in the project.

Ranked fourth in importance by the PEP Advisory Committee, it was recommended that this intervention is to be the site of heightened activity. Anita van Breda, PEP's Marine Conservation Specialist, will assume her duties on January 31st, and will be stationed in Santo to undertake day-to-day direction of this project.

**March 1994:** Van Breda arrived in Vanuatu the end of January and prepared a Project History and overview of PEP activity at Elephant Island. This includes statements of goals and objectives, activities and expected outcomes. She travelled to Santo to assist AEP fellow Milika Naqasima with field work and report writing. Debriefing meetings at the close of the fellowship were held with the Local Government Council Secretary Havo Moli, STIDA's Chairman Kalraer Vocor, Fisheries Department Francis Hickey, Devoe and van Breda. Naqasima gave a brief presentation of her findings. Devoe and van Breda reaffirmed commitment to follow up the initial findings with additional research. Fisheries agreed to target Hog Harbour community for traditional marine management education workshops.

Van Breda returned to Vila for PEP staff meetings, and to discuss PEP marine projects individually with PEP staff. Ten working days in Vila were devoted to research and networking for two marine projects as well as FSP computer and video training.

Devoe and van Breda defined terms of employment for a ni-Vanuatu environmental education assistant to work with van Breda in Santo. In March, van Breda established day-to-day management of the Santo project with the establishment of a PEP Santo office. Management is defined as "integrator, coordinator, communications center, tactician, and consensus-maker". Van Breda recruited environmental education assistant Donna Kalfatak, who will be based in the Santo office.

#### Extension Activities

To introduce PEP's marine projects to the South Pacific environment community, van Breda drafted and mailed a letter of introduction to PEP collaborators, supporters, and colleagues in the region.

The Great Barrier Reef Marine Park Authority requested PEP's review of a report on a global representative system of marine protected areas for IUCN and the World Bank.

The Australian High Commission - Vanuatu, requested PEP's review of a marine reserve project in Malekula.

Development of local contacts for further involvement with this project are underway. Van Breda and Kalfatak met with STIDA's acting manager Eileen Ligo to communicate PEP research findings thus far, and to review plans for future activities. Ms. Ligo reaffirmed STIDA's interest in this project and agreed to participate in village workshops. Van Breda and Kalfatak also volunteered to formally introduce this project to the members of STIDA at their next general meeting.

Van Breda and Kalfatak participated in the Environment Unit's Big Bay national park community workshops.

Field activities are based from Lonnoc Beach Resort (LBR). LBR continues to update and improve services including construction of a larger bar and restaurant and running water, toilet, and shower facilities. Owner Kalmer Vocor would like to encourage landings of cruise ship visitors to Lonnoc Beach and has requested PEP's assistance in choosing a location and recommending construction design of a jetty.

We will continue to lend technical assistance and support for community-generated marine conservation projects where feasible and appropriate (such as the Maskelyn Island giant clam project). Our association with these projects enhances PEP's visibility and furthers our knowledge of, and experience with, community driven conservation projects which will ultimately enhance our effectiveness with our community education activities.

## Research

Van Breda edited Milika Naqasima's Santo report, and composed a two page summary for distribution to PEP collaborators.

Documentation of existing literature and information relative to development of a management plan for this site is an ongoing project.

Ecological data gathering continues with a third round of water quality testing to be completed in April. A fisheries biologist consultant will be contracted to assist with further development and refinement of the coral and reef fish biological monitoring program. Future work plans will identify additional research needs for economic, cultural and social data necessary for management of the area. The environmental education assistant will lead development of environmental education community workshops and will continue with the Woman's Fisheries Network Survey which seeks to evaluate the role of woman in community fisheries.

PEP recommended continued efforts to further develop this project including commissioning a participatory rapid appraisal of Hog Harbour and Port Olry. Long-term partners and funding agents should be sought to ensure continuance of PEP's efforts and goals.

**June 1994:** Van Breda travelled to Port Vila April 18 and 19, for a two day staff meeting with USAID officials. A Santo-Project summary was prepared and future work plans discussed. With the project's ecological work under way, planning emphasis was given to social and economic data gathering relative to community dynamics and development. The group agreed to search for a social scientist consultant to perform a Participatory Rural Appraisal for Hog Harbour and Port Olry villages. The consultant will be required to train PEP ni-Vanuatu staff in the principles and methodology of PRA in order to develop in-country skills. Other plans include regional recruitment for institutional partners to assist with continuation of project beyond the close of PEP.

U.S. A.I.D. staff members John Grayzel and Chuck Howell, travelled to Santo with van Breda and Devoe for a one day tour of Hog Harbour, Lonnoc Beach Résort, Champagne Beach, and Port Olry.

The Santo-PEP office was moved to the Local Government Council building. The new office space increases accessibility of the PEP project to local community.

Van Breda and Kalfatak travelled to Vila in April for an introduction to the new PEP project coordinator and project review meetings.

#### Extension Activities

With the addition of Kalfatak to PEP staff, introductory meetings with the President and Secretary of Local Government Council were arranged. Kalfatak and van Breda requested continued assistance with facilitation of community relations. Additional meetings were arranged with two Hog Harbour village chiefs to remind the villagers that the project was still on-going, to share results of Naqasima's report, and to inform them of the pending visit of a fisheries biologist. It was agreed to arrange a meeting with all village leaders: chiefs, pastors, womens' group, youth group, and key landowners (Mr. Obed; Champagne Beach and Mr. John Wus; Elephant Island) for June to discuss the project's objectives, findings to date, and village involvement and participation.

Kalfatak and van Breda consulted with Neil Stevens, FSP Community Development Specialist, regarding future plans for Hog Harbour community relations and development activities. Meetings were also held with William Naviti, Fisheries Research, and Ernest Bani, Environment Unit, to update status of project and seek support and involvement.

Individual meetings were also held with custom landowners of Elephant Island and Champagne Beach to discuss the project and extend an invitation to the village leaders meeting.

#### Research

Previous fish census dive sites were relocated and coordinates recorded. Mapping of dive sites was completed to facilitate work of contracted fisheries biologist consultant Dr. Allen Friedlander/ Hawaii Cooperative Fisheries Research Unit.

Dr. Friedlander conducted a census of reef fish of Elephant Island and Hog Harbour, Champagne Beach patch reefs. The work was designed to augment previous preliminary work completed last January and included recommendations for further investigation regarding subsistence and commercial fishing efforts, and their possible impacts for future management of the site. Preliminary analysis indicates a diverse and healthy fish population. However the full analysis and report is not yet available.

We are also in the process of conducting shoreline transects to characterize invertebrate populations, the primary target of women who fish.

Water quality monitoring continues. The Matevulu College blue hole will be included in the monitoring program at the request of the Department of Geology, Mines and Water Resources.

June 14 the Fairstar cruise ship visit to Champagne Beach was documented. The findings were reported to the Fisheries Research and the Environment Unit. A meeting was held with STIDA officials to discuss the Fairstar and cruise ship visits in general. We agreed to work together on the design of improved snorkel and dive regulations for all tour operators and to design an education program for tourists based on environmental considerations.

Kalfatak completed a report of the Women's and Fisheries Survey of 15 women in Hog Harbour, January 1994. An English and Bislama version of the results are available for distribution.

#### Other

Kalfatak completed an open water diver certification program.

van Breda participated in PEP's eco-tourist trek to Ambrym.

#### Participatory Rural Appraisal (PRA).

The staff planning meeting in June decided that any resource management plan for the Santo EMU would be formulated by the resource owners themselves, facilitated by PEP through a PRA exercise. On the advice of the USAID Manila office, contact was made with Dr. Richard Ford of Clark University. Negotiations are now well underway for the latter's assistance to PEP with training and with the conduct of the PRA exercise in Santo.

The proposal to facilitate community resource management planning through a PRA exercise has created interest in a few other bodies, including the Government Environment Unit. Discussions were held with the latter, which has a proposal for a PEP-type project in Matantas area contingent to the PEP Santo EMU. It was agreed that training associated with PEP's PRA exercise would also be made available to some of the government officers involved in Matantas. These will, in the main, be those that normally service PEP's EMU communities, and would therefore be required by PEP for the PRA anyway.

The PEP Coordinator held a briefing meeting with the outgoing Regional Development Planner attached to Luganville Municipality. He provided useful insight into current development of small indigenous business enterprises in Santo, particularly those involved in tourism.

**September 1994:** PEP/Santo work this quarter focused on social data gathering and increasing community participation in the PEP project. A Participatory Rural Appraisal (PRA) exercise was completed which yielded much information about the resources and social structure of the community as well as information on needs and issues of importance to the community. PRA techniques learned can be applied to specific areas of natural resource management of interest to PEP. Anticipated follow up will include continuing support of the momentum in community mobilization generated by the PRA, as well as addressing natural resource, agricultural and cultural problems identified in the PRA.

Environmental education and extension activities continue to grow. PEP/Santo receives many requests to provide or assist with environmental education from a range of individuals and institutions including local tour operators, government offices, individuals, and communities concerned with protecting resources. Kalfatak has translated posters, comics and booklets into Bislama for use in education workshops.

A PEP house was rented in Hog Harbour to serve as a field-site base of operations. Located within a short distance of the village "nakamal" (meeting house) and cooperative store, the house allows greater access by the community to the PEP project.

#### Extension Activities

1. van Breda and Kalfatak toured the PEP project site with Mr. Richard Teare, American Ambassador to Vanuatu, and his wife during their visit to Santo in July, 1994.
2. Stead and van Breda met with dive and tour operators in Santo during Stead's enterprise research trip to Santo, July 1994.
3. Kalfatak and van Breda met with approximately 20 women of Hog Harbour to review and discuss the findings of Kalfatak's survey work completed in January. Information about membership in the Fiji based Women and Fisheries Network was provided and the women were encouraged to share information about their fishing activities and problems.
4. An environmental education and safe boating workshop was held for the staff and families of Lonnoc Beach Resort. The PEP project was explained, and general issues of coral reef and coastal conservation discussed. Specific information on anchoring was targeted to LBR boat captains in an attempt to minimise anchor damage to reefs. Boat captains were enlisted to assist with data gathering in terms of SCUBA and snorkeling activities of guests. A diver survey at LBR is now in place.

Posters on Vanuatu government fisheries regulations were distributed. Kalmer Vocor, proprietor of LBR, asked advice on what activities within the resort potentially damage coastal resources. As a result, taboos were placed on throwing rubbish in the sea, walking on reef flats at low tide, and putting wash water in the sea.

5. At the request of Chief Lulu Vatu, South Santo, and Chief Moli, Malo, an informational meeting was held with Mr. Peter Morris, lease holder in South Santo. Together, these gentlemen would like to establish a marine reserve in South Santo. We spent several hours discussing the history of the area and past attempts to protect resources. We agreed to assist with

environmental education and surveying of the site which contains marshes, mangroves, mullet breeding grounds, and areas where coconut crabs were formally found in abundance. Land disputes and disagreements on land use are evident. Additional information will be needed for any future PEP involvement with this activity.

6. Kalfatak represented PEP/FSP at the opening ceremony of Ringi Te Suh Marine Reserve/Malekula at the request of Mr. Jack Enrel.

7. Kalfatak and van Breda provided assistance to Dr. Ken Zimmerman of Southern Cross University, Australia with research on marine snakes in Vanuatu. Dr. Zimmerman requested information on local beaches with appropriate habitat for marine snakes; collections were made at Elephant Island and Champagne Beach of Laticauda frontalis (thought to be found only in Vanuatu) and L. colubrina.

7. Several meetings and field trips were made with Jeremy Challacombe and Charles Darby, environmental consultants to the Vanuatu National Tourism Master Plan. These meetings allowed PEP staff to learn about tourism development planning in Vanuatu and express issues of concern regarding marine based tourism.

8. van Breda and Kalfatak attended the Save the Children Fund (SCF) "South Santo Bush Community Resource Management Project" first quarterly meeting in Vimele village. The project coordinator presented his report; guests were invited to make introductions to their projects. PEP was asked to present information to SCF "resource tour" for select village members.

9. Received request to make education presentation to Woman's Affairs Department workshop in October 1994.

#### Research

1. Report received regarding fisheries census and monitoring completed by Allen Friedlander.

2. Visit to sea mount north of Elephant Island discovered by Yang Yako, commercial fisherman in Hog Harbour. Due to its proximity, this area may be included in Hog Harbour resource management plan.

3. With assistance from Dr. Richard Ford and John Bronson/Clark University/USA, a three week Participatory Rural Appraisal exercise was completed in Hog Harbour from September 11 to October 1, 1994. The PRA trained 14 village members and 12 individuals from PEP, FSP, and the Environment Unit, Fisheries, and Forestry government departments. A community action plan resulted from the PRA exercise, which PEP will use as a foundation for creating a village resource management plan. Abbreviated versions of PRA techniques will be used by PEP staff to address specific issues (such as fisheries and tourism) not covered in detail in the initial PRA.

## Continuing Education

van Breda and Kalfatak travelled to Suva, Fiji to attend the International Workshop on Traditional Marine Tenure and the Sustainable Management of Marine Resources in Asia and the South Pacific. Kalfatak made a brief report on her survey work for the Women and Fisheries Network and van Breda presented information on the PEP/Santo project. The workshop proved useful for exchange of information between research and conservation projects in the region; many requests for additional information on PEP were received.

## **Current Situation**

### **December 1994:**

PEP/Santo work this quarter involved follow-up discussion and planning to the Participatory Rural Appraisal (PRA), expansion of environmental education programs, and continued ecological monitoring.

Staff met with Hog Harbour PRA participants to discuss the outcome of the PRA, and the community's plan of action for specific tasks. Government elections and the holiday season seems to have limited community response to the PRA.

Two workshops were planned for 1995 to address natural resource issues. A Land Use and Management workshop will follow up on PRA Community Action Plan concerns for improved gardening and agriculture practices. Expanding on the concerns raised in the PRA, the workshop is designed to present an holistic approach to land use planning and will address various agricultural techniques, forestry practices, livestock production, and tourism.

A marine and coastal resources workshop was also planned for 1995, with assistance from the Fisheries Department. The purpose of the workshop is to involve active participation of Hog Harbour community members in evaluation of, and management planning for, sustainable use of these resources. The information gathered in the process will supplement scientific studies made thus far.

Extension activities continued with production of environmental education workshops and seminars at the request of local government departments, tour operators, and individuals.

Water quality testing is ongoing. Shoreline surveys of use of marine and coastal resources continue to document Hog Harbour's use of coastal natural resources.

### **Extension Activities**

1. Meet with Chief Lulu Vatu/South Santo, and Fisheries, regarding reserve for Sarakata river.
2. Provide environmental education seminar for Woman's Affairs Department vocational training course.
3. Meet with two members of the Melanesian Forestry Expedition to discuss their protected area initiatives.
4. Provide environmental conservation workshop for the Youth and Sports Department in Cassevia (see Appendix VI).
5. Explore conservation/enterprise potential of Lope-Lope Resort and adjacent mangroves with Eileen Ligo, Espiritu Santo Tours.
6. Plan and develop workshop on mangrove conservation and tourism for Lope-Lope resort; discuss with family owners of resort.
7. Discuss artificial reef construction and marine based tourism planning involving Lonnoc Beach Resort with commercial tour operator.
8. Meet with individuals from South Santo and Fisheries department regarding advice for marine conservation planning.
9. Meet with FAO Forestry representative regarding extension practices with indigenous owners for management of forests.

### **Research**

1. Review the Vanuatu Tourism Master Plan; The Natural Resource Base.
2. Investigate design and development of mangrove boardwalk.
3. Meet with Cassevia villagers regarding Carpoxyton macrospermum research with John Dowe.
4. Participate in Carpoxyton survey work, Cassevia, and west coast Santo.
5. Continue water quality testing.
6. Continue coastal survey work.

### **Community Action Planning**

1. Plan Land Use and Management workshop involving Agriculture, Livestock, Farm Support Association, Forestry.
  2. Plan Marine and Coastal Resources workshop with Fisheries.
  3. Hold meetings with PRA participants to follow up and assist with Community Action Plan.
  4. Explore possibility of enterprise survey in Hog Harbour.
  5. Inform Vanuatu Cultural Centre of Hog Harbour PRA regarding community concerns for custom and culture; seek assistance.
  6. Meet with Wan Smol Bag Theatre to discuss forming a theatre group in Hog Harbour.
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### 3. CARPOXYLON MACROSPERMUM PROJECT

**Initial Situation:** Carpoxylon macrospermum, a palm in what is described as probably the only endemic plant genus in Vanuatu, is botanically important as a very distinctive genus with few close relatives, and clearly endangered. The palm was apparently an important food for coconut crabs, flying foxes, and to a lesser extent, people (edible kernel) before its population declined. Thought to be extinct prior to rediscovery in 1987, Carpoxylon was known from at least one site on Santo (four plants), and suspected from sites on Erromango, Tanna, and Ambae (20 individuals total). Without conservation measures, this species is likely to become extinct

**Conservation Objectives:** Multiplication of the remaining palms and protection of the full range of the plant's genetic diversity to ensure the survival of the species, assessment of the existing population and development of a formal species recovery plan, protection of wild palms and habitat.

**Enterprise Intervention:** A village-based and/or Port Vila- based nursery to produce and sell the palm to Vanuatu collectors and landscapers. Providing there are no legal restrictions, seeds or seedlings could be sold to the lucrative international palm trade, with sales initially directed to palmeta and research institutions. Money is to be returned to village projects and further conservation efforts.

#### Project History

**September 1993:** The enterprise has excellent conservation value. The village of Casaveia, where four adult palms grow, has one extended family, very much interested in working with PEP. The enterprise potential of a palm nursery is to be evaluated. Success may hinge on the ability to access the international market; this situation will be clarified.

**December 1993:** A terms of reference for forester Joanna Walker's assistance with the search for Carpoxylon at sites outside of Casaveia, South Santo, was drawn up following preliminary discussions. The initial plan was to follow leads of informants on palm location. When this method turned up a number of palms, Devoe conjectured that the population might in fact be large enough to merit a more generalizable sample. Accordingly, in November, Devoe and Walker walked a four-day transect in West Santo, where no palms had been reported, to effectively take a random sample of the palm population.

Upon the request of the editor of "Naika", the newsletter of the Vanuatu Natural Science Society, Devoe prepared a report of the findings and sent it to two palm taxonomists, John Dransfield and John Dowe, who are kept abreast of the Carpoxylon project. Both asked to forward the report to scientific journals for possible publication. As the request from Dowe was received first, it was sent by Dowe to "Palms and Cycads".

Also in November, Devoe and Stead met with forest botanist Pat Curry and horticulturist Sandy Lawson. Stead had arranged a meeting with Lawson, a local landscaper, to discuss the potential market for Carpoxyton. Lawson suggested that all rare endemic plants would be of some interest to collectors, but that the landscaping market is confined to plants with specific qualities. Lawson has a personal interest in rare native species, and believes the sale of materials from these plants could be a profitable one on a small scale. Curry suggested that determining handling methods for seeds of indigenous plants is a big task, and if started now, would assist the work of a proposed national botanical garden. Devoe and Curry believe that seed collection and sale could both raise conservation awareness and return income to rural communities. Curry urged the others to consider organizing a native plant enterprise that would market a broad range of rare and unusual plants.

Walker sent to Devoe Carpoxyton seed collected during her consultancy. Devoe sowed the seed in small-scale germination tests similar to those reported earlier, except that seed was sown in germination trays rather than directly into plastic pots. The first germination tests sown in July, 1993, yielded 89% germination, confined to a one-month period. It took more than two months from germination for the seedlings to reach the stage where the fronds became bifid. From these first tests and subsequent growth of the seedlings, we learned that in a wet medium, degree of insolation has little effect upon the rate or percentage of germination over the range tested (full sun, direct sun limited to three hours per day), but that where the potting medium is maintained moist, greater insolation produces faster seedling growth. These seedlings were held at Devoe's home for three months following sowing, and then transferred in November to the care of Mele family living in Port Vila.

Upon learning that the first batch of Walker's seed had been refrigerated, Devoe conjectured that it was unlikely to germinate. However, chilling may not have killed the embryos, in which case induced dormancy would likely delay germination. None of this seed has germinated to date, but neither is it obviously deteriorated.

The next lot of seed collected by Walker from two areas on Santo was sown November 18 with 23 out of 30 seeds (77%) germinated to date. Seed subsequently collected by Devoe and Walker sown November 27 has reached only 27% germination. Upon germination, seedlings are removed from germination trays and planted into poly planting bags.

Devoe is seeking a collaborator or contractor to assess the amount and distribution of genetic variation among the subpopulations of Carpoxyton spread over Santo and perhaps Ambae, Erromango, Tanna and other islands in the Vanuatu archipelago. The information is needed for the species recovery plan, which will aim to protect the whole genetic base.

The Enterprise Specialist prepared a report "Strategy for Carpoxyton Enterprise Development". The report notes that the domestic market for Carpoxyton plant materials is insignificant, but that there is a high probability that a substantial export market exists. Initially, export sales would be to collectors. If the species proves to have value as a landscaping or ornamental plant, this market should be developed as well.

With the existing prohibition against the export of Carpoxylon materials, it is not possible to capitalize on this market. If it is possible to document the income-generating potential of this enterprise and concurrently present a conservation plan that confirms that there is plant material available that is excess to the needs of the conservation plan, export sales may be approved. To this end, a market study to determine potential sales of Carpoxylon plant materials will be commissioned. A TOR has been prepared, and a consultant is sought to undertake this work.

**Recommendation, December 1993:** PEP's Carpoxylon intervention has attracted the interest of internationally recognized palm experts; without exception, they support the project. Development of a conservation plan and enterprise activity should continue unabated.

**Status, March 1994:** On the enterprise side, a consultant was employed to conduct a study to quantify the market for Carpoxylon plant materials in the United States. This was limited to the U.S. for two reasons, 1) the U.S. represents by far the greatest single market for these products, and 2) initially offering the products exclusively in the U.S. greatly simplifies administration and distribution problems. The consultant employed had formerly been associated with Cultural Survival Enterprises as a market researcher, and was intimately familiar with research of this nature. The consultant concluded that there was a viable market for Carpoxylon plant materials in the United States, and suggested approaches to access this market.

On the conservation side, a short-term technical assistance contract "Information Support for Horticultural Production of Carpoxylon macrospermum, Veitchia montgomervana, and V. spiralis" was fulfilled by Dr. Dennis Johnson, Deputy Chairman of the Palm Specialist Group of the IUCN Species Survival Commission. Dr. Johnson was asked to assist with a literature review to determine restrictions under CITES and plant quarantine to shipping seeds and seedlings of these species internationally. He further supplied background information related to palm biology and to the handling of seeds and seedlings as commodities and an Initial Environmental Examination for the proposed PEP palm seed enterprise.

During the quarter, Devoe corresponded with Johnson, Dransfield (Royal Botanic Gardens, Kew, UK), Dowe (Townsville Palmetum) and others regarding the species recovery plan for Carpoxylon. She met with Dowe and Dransfield while in Australia. Expressions of interest in conducting the molecular analysis were received from staff at the Bailey Hortatorium at Cornell University and the US Forest Service National Forest Genetic Electrophoresis Lab.

PEP resolved to draft a plan to pursue Carpoxylon recovery. This draft, with a discussion of the enterprise aspects of the project, should be presented to Vanuatu's Environmental Unit. A goal of this activity would be to have the Environmental Unit rescind its prohibition against the export of Carpoxylon plant materials. If the Government of Vanuatu agrees that Carpoxylon seed can be exported in conformance with a sound conservation plan, PEP should assemble all data necessary to the plan, which will be subject to scientific peer review.

**June 1994:** PEP held a meeting with the head of the Vanuatu Government's Environment Unit to brief him on the status of the project to date. Discussions ensued on the need to conduct a comprehensive population survey of the palm in order to formulate a strategy for conserving the species. PEP's conditionality for developing a profitable enterprise as part of the conservation strategy was explained and accepted. It was agreed that a palm expert be engaged

to conduct the population study which is to include an ethnobotanical component. It was also agreed that the opportunity would be utilised for training some ni-Vanuatu persons in the process of population survey of a threatened or vulnerable plant species. Both the Environment Unit and the Forestry Department agreed to send up to two persons each to participate for part of the time during the six-week field work for this palm.

Contact was renewed with the palm expert, Dr. John Dowe, who has agreed to come in November/December for a period of six weeks. Dr. Dowe will conduct the population survey and include ethnobotanical information in his investigation. He will also supervise any laboratory analysis necessary for establishing genetic variation. The PEP Coordinator will assist Dr. Dowe for part of the survey.

Contact was also renewed with Mr. Dick Phillips, a commercial nurseryman who exports palm seeds from Fiji, and a member of the International Palm Society. He confirmed his interest in assisting with collection, germination, packaging, and export of palm seeds if needed. He also expressed interest in re-establishment of the palm in Aneityum - the location of the type species. Our last quarterly report made an error about a *Carpoxyton* palm being at the University gardens in Suva. The palm, one of two representatives in Fiji, is growing in Mr. Phillips' garden.

**September 1994:** PEP continued negotiations and concluded contracts for the services of John Dowe and Dick Phillips as reported for the last quarter.

### **Current Situation**

#### **December 1994:**

During the month of November, PEP mounted a nation-wide survey of Carpoxyton. This survey set out to investigate the approximate number of trees, their distribution, ecology, obvious morphological variation and ethnobotany. Most importantly it intended to identify the existence and extent of natural populations, if any. To this end, the field work began in Aneityum, the island from which the palm was first collected and described scientifically.

The survey covered ten islands finding *Carpoxyton* in all but two. It was led by the South Pacific palm expert, John Dowe, with assistance from well known Fiji nurseryman, Dick Phillips; three local contractors, Japeth Hidson, Chanel Sam and Harry Bule; and four staff members from PEP and FSP - Suliana Siwatibau, Stanley Womack, and Fcke Pedro. The reports from Dowe, Phillips, Hidson, Sam, Kalfatak and Siwatibau are attached as Appendices VII, VIII IX, X, XI & XII.

endangered.

As part of the population survey, PEP has contracted the Australian Institute of Marine Science to do a DNA analysis of the palm's genetic material to supplement field information on species variation. This will contribute towards the formulation of a species recovery and conservation plan. During the survey, seeds were collected for laboratory analysis to establish procedures and identify DNA markers.

The survey also collected much interesting information on the different uses of the palm. Its sweet green fruits make popular snacks with children - similarly its germinating seed, popularly called "navara". The leaf top, and old infructescence are used as broom. The leaf sheath may be used as a kava bowl, baby bath, sleeping mat, or shovel for hot charcoal. The spathe for the inflorescence is used to form a drinking bowl. Many of those who planted the palm also valued it for its beauty and its rarity.

Dick Phillip's role was to advise on germination methods. He talked to several nurserymen in Vila, after having observed growth characteristics of the palm in the field. He was very enthusiastic about the potential of the palm as a horticultural plant. On his advice, PEP approached the Farm Support Association and arranged to have them conduct germination trials as and when PEP requires these. These trials will be to test batches of seeds for export sales.

PEP's Enterprise Specialist, Jim Stead, continued investigations into overseas markets for Carpoxyton seeds. In discussions following John Dowe's population survey field work, it was decided that an enterprise based upon export of Carpoxyton seeds could be developed now - harvesting only from those trees that are cultivated or clearly regenerated from cultivated trees.

PEP staff met with Ernest Bani, Director of Vanuatu's Environmental Unit, to discuss plans for marketing Carpoxyton seeds. Mr. Bani's reaction to the plan was positive: the Environmental Unit will support the enterprise and issue required export licenses.

PEP will proceed with plans to market Carpoxyton seeds maturing during March, April, and May 1995. Initially, the business will be conducted under the PEP/FSP umbrella as a separate entity having a board of overseers including members from the private sector, Government, and FSP. This organization will be sufficiently autonomous so that it can continue to function

successfully following the close-out of the PEP project in September 1995. The intention is to first establish accurate costs with this trial run, and then to use this information in establishing the ongoing seed export enterprise. Proceeds from the first year's sales will generate sufficient surplus funds to provide capital for the succeeding years's operation.

Marketing Carpoxyton plant materials will be done through the seed banks of The International Palm Society, headquartered in the United States, and the Palm and Cycad Societies of Australia. In preliminary discussions, these organizations have indicated enthusiastic support of the seed marketing program.

The results of the DNA analysis will not be ready until April, 1995, at which time PEP will approach government in order to put together a species recovery and conservation plan.

#### 4. WASTE-OIL

**Situation:** There is no program in Port Vila (or Vanuatu) providing for the disposal of used lubricating oil (waste oil) in an environmentally acceptable way. It is believed that a local utility uses 60,000 liters of lubricating oil per year. In addition, unknown amounts of lubricating oil are imported to service motor vehicles, construction equipment, and the like. Disposal of this waste oil is by dumping onto the earth.

Vanuatu's Energy Unit is enthusiastic about this project, and has offered to undertake a preliminary survey of waste-oil "producers" and potential purchasers.

**Conservation Objective:** To prevent the waste oil from being dumped improperly.

**Enterprise Intervention:** Working with the utility and other producers of waste oil, PEP proposes to develop an enterprise that would collect and market the used oil.

#### Project History

**March 1993:** The recommendation was to continue to evaluate feasibility of this project.

**September 1993:** During the RDO/SP-FSP meetings of March and April, 1993, the then RDO/SP Science Advisor declined to approve continued activity in this area. PEP staff feel that this project has considerable enterprise and conservation merit and would contribute to the range of linkages addressed by PEP. In August, the Enterprise Specialist again discussed this proposed project with the RDO/SP Project Officer, and asked for approval to continue to study the recovery and sale of waste oil. This approval was granted. Preliminary discussions have been held with Vanuatu's Energy Unit; they enthusiastically support the concept.

PEP resolved to continue to advance this initiative, further define the project, and seek information regarding waste oil "producers" and potential customers.

**December 1993:** Efforts during this period were focused upon accurately determining the amount of lubricating oil imported into Vanuatu, and in ascertaining the size of the local market for waste oil.

Meetings were held with the managers of the three firms that import lubricating oil into Vanuatu to explain the project and to query them regarding the amount of product entering the country. The total amount of lubricating oil imported into Vanuatu in the last 12 months was 468,000 liters; this represents an average year. After subtracting the amount of oil sent to outer islands and estimated amounts consumed during use, it is estimated that 200,000 liters are available for recovery in Vila.

It may be possible to market some recovered oil in Vanuatu, although initial discussions with potential users have not been encouraging. Therefore, it is necessary to develop an economically viable export scheme that would provide for local storage, economical transportation, and the identification of an overseas purchaser. The local Shell Oil bulk plant has 800,000 liters of unused bulk storage that might be made available at some unknown cost. An arrangement to use this capacity would have to be negotiated with the parent company in New Caledonia.

With the exception of a small, specialized facility in New Zealand, there is no known re-refiner of used lubricating oil in the South Pacific. In Australia, used oil from metropolitan areas is customarily collected and sold as fuel oil. Although this oil may be filtered or cleansed in some way, it is not re-refined. The selling price is not sufficient to cover the cost of collection, processing, storage, and delivery; producers pay oil collectors for their services.

It was thought that oil tankers departing Vanuatu with empty bunkers would accept waste oil at very favorable rates. This is not the case. No bulk oil is shipped to Vanuatu from nations that are potential users (Australia and New Zealand). Oil imported into Vanuatu comes from Fiji and New Caledonia; neither of these nations represents a market for used oil.

It was recommended that efforts be continued to find a market for Vanuatu's waste oil. Market prices for waste oil in New Zealand and Australia should be determined, and cost of transport to those countries should be ascertained.

**March 1994:** The possibility of disposing of Vanuatu's waste oil to an overseas market was investigated. Because of depressed world oil prices, there is virtually no market for waste oil in the South Pacific. Because of these depressed prices, the operation of Australian re-refineries became uneconomical in 1991, and these facilities were shut down. Commercial businesses collect waste oil for a fee of two to six cents per litre. This product is sold as a source of heat in a very soft market at prices that often fail to cover "production" costs. Much of the waste oil collected is being stored. The situation is much the same in New Zealand; however, there is one re-refinery in operation. The bottom line is that even if waste oil could be delivered free to Australia or New Zealand, it would find no market.

In Suva, Fiji, a foundry uses waste oil as a source of heat. It has not been possible to determine what, if anything, they pay for this oil. It is known that they are able to meet all their needs from local sources, and that there is no possibility that Fiji will accept waste oil from Vanuatu. In 1993, a re-refinery commenced operations in W. Samoa. At present, this facility is able to meet all requirements for raw product from domestic sources. Realistically, transportation costs preclude Western Samoa as a market for Vanuatu's waste oil in any foreseeable scenario.

The cost of shipping oil from Vanuatu to typical destinations such as Australia and New Zealand was investigated. No tank ships regularly operate between Vanuatu and these countries, and in view of the small amount of product to be transported (200,000 liters per year, maximum), no ship would call to pick up this cargo. The alternative is to place the waste oil in 205 litre drums and ship them in containers. The bare cost of this, exclusive of local handling and delivery in Vanuatu and the delivery point, is approximately VT 136,000 per container, which translates to A\$.83 per litre.

Lack of a market and prohibitive cost of transportation preclude any possibility of exporting waste oil from Vanuatu. Any scheme for collecting waste oil must be predicated upon the assumption that the oil will be disposed of within the country. There are three broad possibilities:

1. Destroy the oil in an environmentally acceptable way.
2. Use it as a source of heat with little or no processing.
3. Process the waste oil so that it can compete in the marketplace with "new" product.
4. Ship the oil out of the country.

PEP resolved to continue to investigate the four alternatives indicated above.

**June 1994:** Approximately 30 manufacturers were contacted to determine if their technology and equipment capabilities could meet the need for waste oil incineration, re-refining, or burning without processing as a source of heat. With one possible exception, no practical small-scale incinerating equipment is available. One manufacturer makes off-the-shelf waste-oil reprocessing equipment with capacities appropriate to the needs of small island nations (SINS) and at a reasonable price. A standard commercial hot water heater was located that will burn crankcase oil, transmission fluid and No. 2 oil "as received" from service stations, utilities, and other "producers" of waste oil.

Potential suppliers have been provided with specific parameters for equipment suitable for use in Vanuatu, and proposals solicited. These proposals will be evaluated during the current reporting period.

The Energy Division of the Forum Secretariat in Suva, Fiji, was contacted for information on a UNDP funded waste oil study. This information was provided by Mr. Park Yuen, Project officer at the Forum Secretariat. Information regarding waste oil recycling was requested from the UNDP in Suva, Fiji. Mr. Somsey Norindr, Resident Representative, responded with an overview of the situation in Australia and articles describing a small-scale re-refinery in W. Samoa. We will continue to liaise with these two organizations.

**September 1994:** The Enterprise Specialist visited W. Samoa to meet with Mr. Tony Hill, Managing Director of Aegis Oil Samoa Ltd., a small-scale waste oil re-refining facility. The purpose of the meeting was to evaluate the technical and financial viability of this facility, and to determine if such re-refineries represent a practical solution to the disposal of waste oil in Vanuatu and other small nations of the S. Pacific. The following observations derive from a day-long meeting:

1. The facility is efficiently laid out and fabricated to high standards (largely by Mr. Hill). With minimal start-up difficulties and few subsequent maintenance problems, the facility produces re-refined base stock to acceptable standards.
2. From a production standpoint, the art, science and major cost is in the additive selection and blending to produce various end products.
3. Public acceptance of products has been high, and these demand retail prices comparable to brand name products produced from virgin base stock.
4. The major problem is the inability to secure enough waste oil to keep the facility operating efficiently. Hill has initiated a program to import waste oil from American Samoa, although he does not know the cost of such a scheme. (Experience in New Zealand, and an analysis of the situation in Vanuatu indicates that the cost of handling and transport preclude any possibility that importing waste oil is financially viable.)
5. No useful business plan was prepared prior to initiating the project. Accurate cost data was not accumulated during the construction of the facility. There are no drawings or specifications to document construction of the facility.
6. Although the plant has operated intermittently for several months, no useful product cost data has been accumulated.

Hill believes that, at best, to break even a small-scale facility such as this would have to produce 200-300,000 liters per year. This is two to four times the total amount of waste oil available in Vanuatu. Although data is not available, it is evident that construction of a small-scale refinery is capital and technology intensive. Elimination of waste oil by re-refining and blending to produce a marketable end product is not considered a viable alternative.

Several manufacturers of oil equipment capable of filtering and purifying waste oil have responded to inquiries by PEP. Equipment of an appropriate scale and reasonable cost is available "off the shelf". The product produced by this equipment will vary in viscosity and chemical composition. It is not known if this product can be burned in conventional atomizing burners; this is under investigation. Manufacturers of chemical incinerators have also be queried. "Off the shelf" equipment is available, although initial cost is high, approximately US\$ 260,000 and operating costs are substantial. To achieve necessary high combustion temperatures, incinerators employ powerful blowers. These blowers consume large amounts of electrical energy, and are expensive to operate. In addition, a pre-heater employed by these incinerators requires a source of energy, usually diesel fuel or LPG.

Returning to Suva, the Enterprise Specialist met with Suresh Raj, Sustainable Development Advisor, UNDP, and following with Brian Dawson, Director of the Forum Secretariat's Energy Division and Mike Lawrence and Park W. Yuen of his staff. Funded by the UNDP, the South Pacific Forum is managing the S. Pacific Regional Energy Project. A study of waste oil issues is a component of this project. Both parties were briefed on the PEP's waste oil work and it was agreed to continue to exchange information. As neither representatives of the UNDP nor the Forum had visited Aegis Oil (Samoa) Ltd., the Enterprise Specialist offered his observations on the appropriateness of small-scale re-refineries as a potential solution to the regions waste oil disposal problem.

### **Current Situation**

#### **December 1994:**

An assessment of the amount of waste oil available for collection in the Port Vila area, and an evaluation of alternatives for disposal of this waste oil was completed and a report prepared (Appendix XIII). This report indicates that the only potentially viable way of disposing of Vanuatu's waste oil would be to burn it as a source supplemental heat.

A project has been proposed to demonstrate that: 1) employing off-the-shelf technology and equipment, a waste oil fired boiler could be installed in a local resort to provide supplementary hot water heating capacity, and 2) a small business could be established to collect waste oil and sell it to the user. An IEE for the project has been prepared and forwarded for approval.

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## 5. MALEKULA CLAM PROJECT

Situation: A small marine conservation area was established by community members with no outside prompting or support. A community representative requested PEP's assistance with information and further project development. The Maskelynes area is noted for over-exploitation of near-shore resources due to population pressure and absence of management. Because of rough seas and scarcity of deep-water boats, villagers are heavily dependent on near-shore resources for protein. The conservation area is a privately owned reef-flat that has been restocked with giant clams.

Conservation Objectives: To protect the initial efforts of villagers, encourage continued protection of the area, improve efficacy of the reserve to restock other areas, add additional organisms to those protected and produced in the reserve, assist with reserve management.

Enterprise Intervention: This is a subsistence-economy effort. The villagers would like eventually to have enough marine produce to sell, but that is a long-term endeavor. No PEP enterprise activity is proposed.

### Project History

**September 1993:** PEP should provide technical assistance to support and encourage this meritorious community initiative. A partnership with the Environment Unit has been discussed and seems a promising approach that may ensure continued attention to the area. Because of limited enterprise potential, this area has not been chosen by PEP staff as a full-blown EMU.

**December 1993:** Devoe twice met with Peace Corps volunteer Charles Allen to develop a program for the AEP Fellow's technical assistance visit to Ringi Te Suh. Local Government and traditional leaders were contacted for approval and to secure their input to the plan. Devoe reviewed and selected environmental videos for use in environmental education workshops planned for the three villages on Uliveo Island, where Ringi Te Suh is located. Jack Enrel, initiator of the Ringi Te Suh project, was asked to join the AEP Fellow during her visit to the project and assisted the Project Manager in developing the work program.

With Fisheries Department Fisheries Biologist Moses Amos, AEP Fellow Milika Naqasima travelled to Malekula December 2-7th. Naqasima and Amos conducted three environmental workshops and surveyed the reefs surrounding Uliveo. During their visit to Ringi Te Suh, they made several recommendations for enhancing giant clam reproduction and growth. PEP will follow-up on these recommendations subject to the availability of staff and resources.

The recommendation was that this low priority intervention would be advanced as resources allow.

**March 1994:** During this reporting period, no activity relating to this intervention took place and there was no change in the status.

Therefore no activity is planned for the forthcoming quarter.

**June 1994:** Jack Enrel, Project Initiator of Ringi Te Suh Marine Conservation, privately owned marine protected area in South Maskelynes, Malekula met with van Breda and Kalfatak to report on the progress of the conservation area. Mr. Enrel requested PEP's financial assistance with the purchase of clam shells to stock the reef flat, and for funds to travel to giant clam mariculture centres in the region for practical learning experience. This assistance was not granted as it had previously determined that PEP input would be limited to technical assistance. Mr. Enrel requested we review a contract written for formal recognition of the protected site by adjacent landowners and local chiefs, as well as the village and national governments. We reviewed the contract and recommended adding a map of the site.

**September 1994:** Kalfatak travelled to the Maskelynes Islands off the south coast of Malekula to attend the Declaration and Opening Ceremony of the Ringi Te Suh Marine Conservation Project on behalf of PEP.

### **Current Situation**

#### **December 1994:**

There was no PEP activity during this reporting period. If there is no activity during the next reporting period, reference to the Malekula Clam Project will be deleted from the next Quarterly Report.

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## **III ADMINISTRATION**

Wycliff Bakeo was recruited this quarter to work closely with Jim Stead, with the intention of taking over as PEP's enterprise specialist when Jim leaves next quarter.

Our planning improved considerably during the quarter as we organised ourselves to tie each activity more closely with an estimated budget, and formulated work plans for the rest of PEP time.

Liaison with other organisations outside the activities of the project continued with CUSO/Vanuatu, WWF South Pacific Program, FAO Regional Forestry Project and USAID office in Manilla.

## IV TRAVEL AND TRAINING

Kathy Fry, the FSP Regional Director travelled to Papua New Guinea in December at the invitation of UNDP to attend their *Mid-term Review of the Pacific Sub-Regional Programme*. UNDP's Pacific Subregional programme is focused in four areas: human development; environment and natural resources management; economic and financial management; and intra-regional co-operation. FSP regional activity has linkages to three of the eleven projects discussed. The UNDP Equitable and Sustainable Human Development Project (ESHDP) collaborates with the PEP project at the North Ambrym project site, focusing on participatory social and human development, while PEP focuses on the profitable management of human interaction with environmental conservation. The South Pacific Biodiversity Conservation Programme (SPBCP), implemented by the South Pacific Regional Environmental Programme (SPREP) with UNDP administered GEF funds, is also working on a conservation project in Big Bay National Park, close to the PEP Hog Harbour project site on the island of Espiritu Santo. Project staff consult and assist each other regularly, and some of the Big Bay staff joined in the Participatory Rural Appraisal (PRA) training organized by PEP. Finally, the FAO implemented South Pacific Forestry Development Programme has close liaison with the FSP regional Melanesian EcoForestry Programme in PNG, Solomon Islands, and Vanuatu, funded by a USAID Matching Grant. The UNDP invitation to FSP was a new initiative by UNDP to collaborate more closely with non-government organizations.

Suliana, Jim, and Stanley attended a regional workshop on indigenous nuts. This was held here in Port Vila from 31 October to 4 November. It covered biology, ecology, horticulture, processing, and marketing of selected indigenous nuts - particularly, species of **Canarium** and **Inocarpus**.

PEP was happy to receive Rodger Garner, Chief, Agricultural and Planning Division, USAID/Manilla, and Andrew MacGregor, Project Officer of USAID's Commercial Agriculture Development Project, as visitors. The former travelled to Lolihor to observe the project's activities there first hand.

## **APPENDIX I**

### **LOLIHOR PHASE THREE (3) TOUR REPORT**

Date: 6th - 13th December 1994  
By: KAOH Peter Naput, FSA  
Due: 15th December 1994

The three main purpose of this tour are:

- i). to set up a garden site to demonstrate the following:
  - thinning of unproductive coconuts/palms
  - introduction of pigeon pea and Cow peas
  - planting of 600 mounds of sweet potatoes, 1000 shoots of xanthosoma taro, 1000 plants of "ash fire" plantain bananas under well spaced coconut.
- ii). to make a follow up visit to all the Wuhuran farmers with demonstration plots and to the school farm. Replace any cuttings that have died.
- iii). to establish with one farmer, a garden plot of at least 500 msq. With this farmer work out the optimum mix and distribution of crops including coconut in this given area of garden. The mix of crops for this farm will include gliricidia as nitrogen fixer and potassium pump.

#### **Introduction:**

This report written for the USAID - funded Profitable Environmental Protection Project (PEP) consists of two (2) parts. The first part of this report is the actual phase III report. It presents mainly what has been done concerning activities 8 and 10 under this phase and the reasons why these two activities were not completed.

The second part of this report presents overall progressive outcomes or the results for our work under this contract for the period beginning August to December 1994 (5 months).

Part I: Phase III Report.

**Achievements:**

- i) have identified the two sites for demonstration gardens involved in activities 8 and 10 of this contract.
  - i.e. one for garden under thinned out coconuts
  - one to find optimum crop mix under coconuts.
- ii) Visited and talked to the farmers with demonstration gardens.

Even though there are some problems and or reasons (discussed further down) that have stopped me from completing the activities required, I had tried my best to make a start. We have identified two sites for demonstration gardens that are stated under Phase III of this contract.

The two sites are identified in Jessie Nabong's land in Fanto. It is possible that one of this demonstration garden site reconsidered later on if George finds another interested farmer besides Nabong. This is just to distribute the work fairly over Lolihor farmers because Jessie has already been involved in 3 demonstration gardens ie: alley cropping, lablab and the up coming demonstration garden involve in activity No. 8. I have also urged few villagers to get ready to supply us the planting materials such as sweet potato tops (2400), xanthosoma taro shoots (1000) and ash fire shoots (1000) for the above demonstration gardens during the beginning of next year 1995. I have visited the farmers with various demonstration gardens and the results are given in part II of this report.

The two major problems/reasons that has held us back from completing the two demonstration gardens that should be established during this phase are:

- ii) The first problem was a death. While I was in Lolihor, an old man from Fanto village, the father of Jessie Nambong died. According to North Ambrym custom, death must be respected which means no working (gardening, fishing, playing, etc) is to be done except gathering of villagers to mourn. The mourning goes on for many days. So because Fanto village or Jessie Nabong is the targeted farmer to take on these demo gardens I didn't want to work further on because I don't want to be considered negatively by the villagers.

- ii) As a result of the long drought that had remained up to until November 94, it makes it impossible for us to get planting materials (600 mounds of sweet potato, 1000 shoots of xanthosoma, 1000 shoots of ash fire) that are required easily out from Lolihor for the two demonstration gardens.

Because of the two above reasons, the two demonstration garden for this phase (phase III) is now delayed until early next year in a sense that between now and then when the rain comes (which now has already began) we will be able to find and have the required planting materials (stated above) for these demonstration gardens around early next year.

#### **Recommendations:**

This is the same recommendation that I made in my phase II report but I would like to bring it up again. Because of the death in Fanto that we didn't make it at this time, I still recommend that FSA, LDC and PEP Local Staff go meet all the Fanto Holiness Community and explain to them clearly what we are doing and the benefits that they could get out from it.

Part II: Over all five (5) months progressive outcomes of our work.

Within the first five (5) months of this contract beginning August and ending December 1994, FSA staff working together with LDC, PEP Local Staff and Wuhuran farmers have gone through some difficult time when trying to carry out various activities that are needed to be done during that period of time. Due to some problems and or reasons we weren't able to carry out all the required activities but working together as a Lolihor development team I am glad that we have done most of phase I and phase II activities. Because of everyone's contribution putted together we achieved the following progressive outcomes of our work:

1. Acid tolerant yams for seed materials are now all planted. Most of them have grown out vines that are being staked (Activity #4).
2. Lablab demonstration as smother crop is now completed, lablab seedlings/young plants are now about an average height of 11cm (Activity #7).
3. A total of 13 farmers (over Lolihor area) + Ranon Secondary School are supplied with up to 25 kgs lablab seeds. Some of these farmers have already planted part of their shares which are now at their early growing stages (Activity #7). The distribution of these lablab seeds is still going on.

4. Flemingia seeds for alley cropping trial garden for Ranon Junior Secondary School are being sown in nurseries and are now about an average height of 8cms. These will be ready to be planted out in the garden during the next phase (phase IV).
5. Three alley cropping demo gardens out of five are complete planted with gliricidia cuttings. Shoots are already beginning to emerged from the sides of these cuttings. The other two alley cropping gardens have also been planted but were planted all over the demo garden plot with out control. So George Bumseng and Matu will make sure that this is done correctly before the year ends.
6. Some of the acid tolerant yams (those to multiply for seed materials) such as sweet yam (Remkonkon) and Naf (Waeu) that were planted in alley cropping demo garden established under the old coconut plantation in Fanto village have turned out to grow very good. The vines are healthy and are green in colour. As I had mentioned earlier in my phase II report under the heading "Problems faced" #(i)..... they (Fanto Holiness community) don't trust in what we are doing (Alley Demo Garden)... so this will be a very good progressive result of our work for them to see.
7. Dedrolobium or locally known as Limlalao hedge row to demonstrate its usefulness for erosion control, was done in advance as it suppose to be done later in phase IV. The plants are strong and healthy and now about an average height of 180 cm. When we (Charles Rogers and I) first talked to George about this he was abit scared having in his mind that Limlalao may become a major weed in his garden plot. But when the cuttings planted earlier, around March 1994, grew out to be beautiful and effective, George increased planting of Limlalao cuttings again.

### **Discussions:**

Even though I had explained earlier clearly and had marked the hedge row lines in alley cropping demonstration gardens belonging to Willie. T. of Ranvetlam and P. Ravo of R.J.S.S., during this phase, I found that they had planted the gliricidia cuttings at right spacings except that they have planted the whole demo site which means there will be no control plot. Asking them, they told me that after the project finished/end of contract they will still need to plant out these hedge rows (gliricidia) on to the control plot as well. (This a very good feed back that I will bear in my mind). Still we urged them to replant the cuttings again the way we want them to do, that is have one treated and one control plot for each demo garden.

**Conclusion:**

To conclude I would like to say that, I am glad that our work has shown some progress so far in Lolihor therefore I like to thank LDC, PEP local staff, Wuhuran farmers and everyone in Lolihor that has contributed to make this year 1994 the beginning of "site-stable agriculture development year" for Lolihor. I look forward to carrying on the good work with my Lolihor development team in the approaching new year, 1995.

## APPENDIX II

### RIPOT BLONG PERFORMANCE BLONG 'JEALOUS HEART' WE WUHURAN THEATRE IMEKEM LONG LOLIHOR, NORTH AMBRYM

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George Bumseng mo Emma Wendy

#### PURPOSE

PEP project hemi bin contractem Wuhuran Theatre Group blong mekem plei 'Jealous Heart' long eight settlements long Lolihor, North Ambrym.

Reason blong mekem pleiplei ia i blong fanemaot ol problem we i save affectem ol wok blong PEP long Lolihor mo hao nao oli save solvem ol problem ia.

#### STORIAN BLONG PLEIPLEI

Pleiplei i soem wan devel we i stap long wan olfala nabanga tree. Wok blong hem i blong mekem trick mo spoilem wok mo plan blong ol man long velij.

Fes trick blong hem i mekem long tufala yangfala boe blong fight ova long wan woman we tufala everiwan i wandem maretem.

Second trick blong hem, hemi spoilem plan blong man long velij blong buildem wan resthaos blong pulum ol tourist i kam.

Next wok blong devel, hemi mekem tufala man i fight from graon we oli planem wild yam long hem.

Last samting we devel i mekem, hemi influencem jif blong velij blong ronemaot wan grup blong pleiplei we i kam blong mekem wan plei long velij.

Afta long pleiplei, i gat tufala question we ol man i storian raon long hem:

- 1) Ol problem we pleiplei i soem, i save hapen long Lolihor?;
- 2) Wanem nao yumi save mekem blong solvem ol problem ia?

**OL PROBLEM WE GRUP I FINEM**

1. From we hemi taem blong rainy season, samtaem mifala i posponem ol performance taem rain i foldaon long evening.
2. Taem mifala i stap go raon blong mekem performance i bin gat wan ded long Holiness Community we i mekem mifala i mas stop until ol man oli finis mourning.
3. Tufala velij, Ranvetlam mo Faramsu oli no bin agri blong letem mifala i perform long hem. Hemi i folem sam bad feeling we i stap long taem finis taem John Salong i wok yet long PEP.

**SCHEDULE BLONG PERFORMANCE**

DDAT	VELIJ	TIME
03.11.94	Ranon	7:00 pm
30.11.94	Fanrereo	7:00 pm
05.12.94	Fanla	7:00 pm
07.12.94	Ranbe	7:00 pm
08.12.94	Fanto	7:00 pm
15.12.94	Lonbe	7:00 pm

**OUTCOME BLONG OL DISCUSSIONS**

Ranon

No. blong audience: 140

Ol man Ranon oli ting se ol problem we pleiplei i soem, everiwan i save hapen long Lolihor. Ol woman oli expresse strong se i mas gat tangtitian (lukaotem gud) mo rongtafanan (blong harem save mo acceptem) bageken olsem bifo. Hemi stap long ol family blong teachem ol pikinini abaot tufala concept ia.

Sipos i gat eni problem i kamaot blong affectem ol wok blong PEP, oli talem se hemi role blong LDC blong storian mo solvem problem ia.

Fanrereo

No. blong audience: 131

Long Fanrereo oli talem se everi lida mo memba blong LDC oli mas luksave se olgeta nao oli responsible blong mekem sua se ol man Lolihor oli wok tugeta oltaem blong leftemap laef i kam antap. Bifo wan community i electem wan lida, ol man i mas lukluk mo save gud backgraon mo fasin blong lida ia.

Hemi shud be wan role blong LDC blong preachem 'tangtiti oman kukun' (safeguardem working together). Everi man i shud luksave se devel hemi stampa blong everi faet mo raorao.

Sipos i gat wan problem we i stap affectem ol wok blong PEP, LDC wetem jif mo ol lida oli mas sitdaon blong solvem problem ia. One man we i strong hed tumas hemi shud mekem wan promis long fes blong God mo man.

### Fanla

No. blong audience: 146

Blong avoidem ol problem, man i mas humble mo respect. Ol man i lanem samting ia through long family blong olgeta. Everi family i shud teachem ol boundary blong graon long pikinini blong olgeta.

I gat ol 'yafu nyer' long ol velij blong tokbaot mo solvem eni problem we i girap. I gat ol fasin blong solvem ol problem peacefully.

### Ranbe

No. blong audience: 75

Oli talem se man i mas:

- acceptem God long laef blong olgeta
- respectem each other
- teachem pikinini fasin blong 'rongtafanan'
- teachem pikinini ol boundary blong graon blong olgeta
- hemi role blong LDC blong solvem ol problem we i affectem wok blong PEP.

### Fanto

No. blong audience: 69

Oli expresse strong se everi memba blong LDC i shud avoidem party politics from hemi wan factor we i stap spolem 'omankukur'. Oli mas acceptem God long laef blong olgeta.

LDC hemi responsible blong solvem ol problem we i affectem wok blong ol project long Lolihor.

### Lonbe

No. blong audience: 36

Eni man we hemi stumbling block blong 'omankukur' LDC i shud putum hem long hand blong police. Hemi no shud benefit long eni project we i stap long Lolihor. Ol lida i shud tokbaot 'omankukur' long everi Monday meeting.

## SUMMARY

Bifo each performance George Bumseng i stap mekem introductgion blong tokbaot from wanem PEP i kam long Lolihor mo ol activities blong hem we i stap mekem blong achievem goal blong hem. Fulap man oli interest blong luk pleiplei mo sharem tingting blong olgeta after long performance. Plei hemi twenty five minutes mo hemi wan stret plei blong project blong PEP long Lolihor.

## CONCLUSION

Wuhuran theatre grup i gainem more popularity, long Lolihor taem hemi performem 'Jealous Heart'. I gat more understanding se i no wan grup blong concert nomo be hemi soem pleiplei long ol man mo traem mekem ol man i tokbaot ol issues we i save affectem community.

Tru long plei ia ol man i save mo goal mo ol activities blong PEP long Lolihor mo thru long ol discussions oli luksave LDC olsem wan local governing body we istap lukaotem ol project long Lolihor mo hemi responsibility blong hem blong mekem sua se everi project i go hed mo ol community i benefit long hem.

## APPENDIX III

### REPORT ON MEAL AND MENU PLANNING AND FOOD PREPARATION COURSE

PLACE: RANVETLAM VILLAGE  
ISLAND: NORTH AMBRYM  
DATE: 12th - 14th October 1994  
PARTICIPANT: 13  
COORDINATOR: KELMA SOPE

#### ACTIVITIES:

WEDNESDAY.

8.00 AM Morning course began with Word of Welcome by the men leader, followed by a devotion led by Mr Isaiah. Official Opening declaration led by Mrs Nelly Bill. Once the declaration finished handed over to Mrs. Kelma Sope.

Firstly explain the importance of running No.2 course, then continued personal cleanliness and hygiene, especially handling of food. Kelma also mentioned the little children should keep them away when preparation of tourist meal prepared.

Also mentioned camp area at valcano need two toilet one for ladies/men. Rubbish should put on a proper place or keep away from trek road. Also encouraged them, they should build one shelter up on the top of the hill were the valcano is.

Mrs Sope explained the importance of handling utensil and tea towel, food cover. Must take with them to the camp.

FIVE MINUTES BREAK

Mrs Sope continued explain clear four (4) main cooking method people used them today.

- a. Boiling - cook with water
- b. Frying - cook with oil
- c. Grilling - cook food on top of the stone or charcoal
- d. Baking - cook with oven or stone

After, telling them every single rule cooks or guides should follow while food preparation take place. Straight after giving them rules go on to three balance meal. Very very important to understand good three food groups before preparation of tourist food take place.

12.00

BREAK FOR LUNCH

1.30 PM Begin work with writing all MENUS for seven (7) meals and the costing of each meal. Once finished every MENU, did explain single Menu then go on to prepare it.

First meal been prepared sandwiches, tin fish, butter, lemon with salades and tomatoes. When finished made the sandwiches rolled up with gloss paper also show ripe pawpaw and fresh water as a balance meal.

4.30

AFTERNOON BREAK

THURSDAY

8.00 PM One Thursday morning devotion led by Mrs Mabir. Mrs Sope move on straight to cooking demonstration. Before cooking took place, review on costing of meal and again deep mention Menu because she belived it a new word to the participants.

The first menu been taught was, Taro slice chips and sweet potatoe chips. The next chips been taught is a square long chips the one that every body or tourist could have it for lunch. The next teaching is base on coconut cookies. Every cooking comes out very good and left to cool so can seal it or closed firm. Plastic wrap was very good and hygine for the tourist. Also prepared balance of food and covered up with silver paper.

12.00

BREAK FOR LUNCH

1.00 PM Continued prepared balance meal. It was grilled on the open fire with silver paper included ripe banana with coconut cream was also grilled on a open fire for desert. The balance meals been prepared just used beef. Handly, one of member participant could give a chicken free for cooking or even George could buy one chicken for my cooking demonstration. Mrs Sope keep on repeating protein especially fish or chicken. The second last teaching base on handmade peanut butter. Once peanut butter completed mixed, fill on to a clean bottle now become a full peanut butter.

4.45 PM

AFTERNOON BREAK

Closing Prayer was offered by Mr Isaiah. Once closing prayer finished every participants dicuss menu bring for next day.

FRIDAY 8.00 AM

On Friday morning devotion led by Malibu Job. The first lesson to be taught based on how to use pig bought for 3,000 Vt. Also base on eight tourist at 400 Vt each meal. Mrs Sope explained clear how to use one pig for a day. First, pig cooked with tomato base and vegetable will give you a name of meal called Pudding.

9.00 AM

Every participants put hands together and prepared every meal been taught by Mrs Sope during two day course. The three (3) different kind of chips, cookies, once completed cook they closed firm ready for afternoon practice Tour with Guide. Also prepared balance meal in a silver papper include ripe banana grill with coconut cream on open fire. Every meals prepared fresh coconut, water, cups, tea towels, food cover, tin opener, knife and mats ready for afternoon tour. Mrs Sope taught how to cook stew.

12.00 BREAK FOR LUNCH

1.30 PM Continue to organized four tourists to go out with four tour guides for practice. The tour guide carry everything include meals then they all move out for trail.

During practice, every meal prepared. Morning snack, midday meal, afternoon snack, evening meal of dinner in the village. Once a guide and tourist finished eating they should evaluate the practice themself and found out one (1) or two (2) mistakes, otherwise everything fine.

The last and final session is evaluation. Mr Isaiah close with Prayer.

#### WEAKNESS:

Three day course in Ranvetlam George never present. Mrs Sope point of view he should be there. One day meal not really please her eyes according balance meals for all participants, example two tin meat enough for ten participants. The participants handly get free protein.

Mrs Sope tried her best to teach some Jam Recipies. Its hard to see any fruit around. Pawpaw giving to pigs because no food for the pig. Lots of Tour Guide don't want to join cooking workshop. Hope no mistake after course.

REMARK:

The participant put hand together and co-operate with bringing Menus form their village to teach. During evaluation Mrs Sope found out they like three days course but it's to short. People are very kind and look after Mrs Sope very well. Lots of photos been taken by Mrs Sope.

MEMBERS

COMMENTS:

Member need another course three days course too short. Member need another course on costing and planning.

TEACHER'S

COMMENT:

Participants need another cooking course, but Mrs Sope need to see first action. She been asked a question to few ladies been attended last course. They are not sure and forget some of the teaching. Sope found out that they never make it into practice. The only meal been prepared was sandwiches. Mrs Sope sure after these course tourist meal will improve. Need some kind training course aply to West of Ambrym and could promote tourists to the Island of Ambrym.

Course Participant. Ranvetlam Village N. Ambrym

<u>Names</u>	<u>Village</u>
Mabir Bong	FP. Ranvetlam
Imkon	FP. Ranvetlam
Lesbeth	TG. Ranvetlam
Isaiah	TG. Ranvetlam
Wingibal	FP. Ranveltam
Anna Willie	FP. Ranvetlam
Kelven	TG. Faramsu
Emma	TG. Faramsu
Lolonruth	TG. Faramsu
Jowet Bong	Ranvetlam
Lesale	Faramsu
Maven	Faramsu
Malibu	Faramsu
Ruth Luke	Faramsu

Ranvetlam

Costing of Meals = 4 People, each paying 400 vt each meal.

Trek

Midday Snacks

Food Items	Costing Items
Chips 2 pk @ 180	360
Cookies 2 flour	50
Sugar ½ cup	30
Butter 4 sp butter	30
Fresh coconut 4 @ 20 vt	80
Milk 4 tsp	20
	<hr/>
	570
	_____ profit = 1030 vt

Midday

Sandwiches

Bread 1 loaf @ 40 vt	140
Tin fish 1 @ 120 vt	120
Butter 1 tbsp	20
Shallots	50
Onion 1 @ 20 vt	20
Lemon 1 @ 20 vt	20
Pinch of salt	10
Fresh coconut 4 @ 20 vt	80
	<hr/>
	460
	_____ profit = 1140 vt

Afternoon Snacks

Roasted local peanut 4 @ 20vt	80
Chicken bean bake 1 @ 500vt	500
Cucumber 1 @ 20 vt	20
Fresh tomatoes 2 @ 20vt	40
Pinch of salt	20
Cooking oil ½ cup	20
Clean water	
Hot drinks	
Coffee, Tea, Milo	500
Sugar & Milk powder	
Peanut biscuit 2 cup flour	50
Butter 4 tbsp	20
Sugar 4 tbsp	20
	<hr/>
	970
	_____ profit 630 vt

Breakfast

Pawpaw 1 @ 30	30	
Bread 1 loaf @ 40 vt	140	
Peanut butter	80	
Jam	80	
Hot drinks		
Coffee tea milo	200	
Sugar Milk powder	<u>530 vt</u>	
		Profit 1070 vt

Morning Snack

Clean water		
Chips @ 2 pkts - 180	360	
Local Peanut 20x4	80	
	<u>440</u>	

Lunch

Gan meat	250	
Grill Roast yam	200	
Cucumber	20	
Tomatoes	50	
Fruits available	50	
Drinks clean water		
Fresh coconut @ 4x20 vt	80	
	<u>650 vt</u>	
		Profit 510 vt

Evening Meal

Bunia with root crops, vegetables and pork

Rest of the pork	2,000	
Root crops	500	
Vegetables	100	
Spring onion	50	
Coconut cream 6 @ 20 vt	120	
Salt	20	
Fruits	200	
Coconut drink or lemon juice	120	
Hot drinks	400	
	<u>3,510</u>	

Meals for 8 x 400 vt = Vt 3,600  
Profit 90 vt

Sipos yu usum pig long wan dei.

Midday Meal

Pork space ribs in tomato and vegetables

Space ribs	1,000
Tomatoes	50
Vegetables	100
Root crops	300
Spring onions	100
Salt	10
Lemon juice 4 limes @ 10 vt	40
Sugar	40
	<hr/>
	1,640 vt
	<hr/>

Meals for 8 x 400 vt = 3,600

Profit = 1,960 vt

REPORT ON MEAL AND MENU PLANING  
AND FOOD PREPARATION COURSE

PLACE: RANON  
ISLAND: N. AMBRYM  
DATE: 15TH, 17TH October 1994  
PARTICIPANT: 10  
COORDINATOR: KELMA SOPE

ACTIVITIES:

SATURDAY

Nine o'clock morning course began with word of welcome by George, followed by devotion led by Mrs Nelly, Women Leader. Once the devotion end, Mr George hand over to Mrs Sope.

Firstly Mrs Sope thank George for his hard work been made. Continued explain the importance of coming back to North of Ambrym. Also mention the importance of have every kitchen utensil must keep in the Bungalow itself, can't used as home utensil. Must prepare food on a clean table, wash hands before handling tourist food. Mrs Sope explain clear purpose of the second course and what is going to happen in the two (2) courses, keep on repeat to them never forget to make three (3) balance meals. Continued designing a menu for meals when the planning of menu completed go on straight the four method of cooking just like what happen in Ranvetlam.

When everythings been explain all participants collecting food for menu together then go into action. First meal prepared is balance meal of sandwiches, it was good. After participants been prepare and wrap it up with plastic food wrap. Also wrap ripe clean pawpaw ready to serve. Go ahead of baking cookies for afternoon snack, and also banana cake been baked. Once the two (2) recipes cooked left it for a while to be cool, and once it cool then seal the cookies, and gives them a packet of cookies. Also wrap pieces of cakes into clean and nice parcel. Mrs Sope explain clear the two (2) different meal cookies. One for afternoon snack and banana cake for supper and hot drink after tourist having evening meal.

12.00 PM

BREAK FOR LUNCH

01.00 PM: Begin collecting menu for evening meal. Participants begin with peeling of pumkin, grating coconut for coconut cream, cutting onion, and lighting earth oven. Everybody put hands together and make pumkin pie with tin meat. Serve with baked kumala and fruits one coconut drink and pawpaw. Mrs Sope can do more cooking or baking but depend on what foods been brought forth. Mrs Sope stress out the importance of collect of menu ready for Monday cooking. Every participants glad to bring food for Monday cooking.

430 PM

BREAK

MONDAY

8.00 AM: On Monday morning prayer was offered by Awanith. The first lesson is to teach mainly on slice chips and square long chips, this are for two (2) types of meal. Slice chips it for snack and square long chips for midday meal. Mrs Sope taught them how to use chips cutter.

When they finished frying chips, they go ahead with frying chicken. One of the small group go cleaning of vegetable ready for shallot dressing. Mrs Sope teach them how to prepare every plate as a balance meal. Also a balance meal been parceled it into a package made out of Aluminium foil. Also explain the importance of using aluminuim foil and also stress local leaves can be use but take care that leaves no poision food. Mrs Sope encourage them to use aluminium foil and plastic food wrap. It also very very hygine to the tourist and any one.

10:00 AM: Continue prepare pudding mix with chicken to replace pig. Group move to a banana pie. Once it finish cook or bake, it was sucess.

12:00 PM: Last new recipies been try is egg curry. The new recipes was very delicious. Mrs Sope told them to cut ripe pawpaw and bring every food been cook and bake. Put it up on the table for everybody can have a taste. It was very nice looking to food been prepared and cooked on the table by the participant.

1:00 PM: Break for lunch and everybody have eaten food been prepare by course participants. The food was very good.

2:00 PM: The group comes back to a classroom for final evaluation.

3:00 PM: Closing of two (2) days course been taken place in a bungalows.

During closing of the workshop Mrs Linda said a word of thanks on behalf of the participants. Chief Job offered a thanks giving prayer. Mrs Sope give encouragement word to the Course Participants, also stress out problem of some previous course participants been mention that they have been forget or never practicing what have been taught. From now on, do every cooking as practice in action other wise teaching is wasting of time and wasting of money.

Mr Tokon chairman of Lolihor community also give heavy encouragement words to the course participants same time declared the course been close.

WEAKNESS: DRY SEASON  
NOT ENOUGH FRUITS.

REMARKS: The members co-operated together with the teacher. Members were very happy about the course and every teaching was very clear.

MEMBERS/  
COMMENTS: Two days course was very short, it should be five days.

TEACHER: Ladies from Ranon are keen to do cooking better than Ranvetlam ladies. The ladies from Ranon do lot more of practice than other ladies. Need another course on cooking in the Western of Ambrym were the bungalow is. Mrs Sope likes to teach how to make local jam but problems of don't having good fruit jam.

Course participants Ranon village, North Ambrym

Names	Village
Douglas	Ranon
Linda	Ranon
Elsie	Ranon
Matu	Ranon
Nelly	Ranon
Winny	Ranon
Awaneth	Ranon
Mothy	Fanrereo
Gena	Fanrereo
Rose	Ranon

Ranon Bungalows - cost of food for four(4) tourists

Morning Breakfast

1 pawpaw @ 50vt	50
Bread	140
Peanut butter & jam	50
Coffee	20
Tea	20
Milo	20
Sugar & milk powder	50
	-----
Sub-total	,350 Vt
	-----

Mid-morning snack in bungalows - 4 tourists @ 400 Vt = 1,600 =  
Profit 1,250

Type 1

Chips x 2 @ 180	360
Local peanut x 4 @ 30	120
Banana cake - 2 bananas @ 20	40 } 240 Vt
- 2 eggs @ 30	60 }
- Butter	20 }
- Flour	50 }
- Sugar	20 }
Tea, coffee	200
	-----
Sub-total	870 Vt
	-----

Type 2 - Out Snack.

Chips x 2 @ 180 Vt	360
Cookies	210
Fruits	100
Fresh coconut drinks @ 20 x 4	80
	-----
Sub-total	750 Vt
	-----

Midday Meal

Curry tomato with	50
chicken & vegetable	500
Boiled yam	500
Fresh fruits	100
Lemon drink @ 10Vt x 4	40
	-----
Sub-total	1,190
	-----

4 tourists @ 400 Vt  
= 1,600 Vt  
profit = 410 Vt.

Evening Meal

Local chicken with island	500
cabbage & coconut cream, 6 @ 20	100
Baked yams and sweet potatoes	120
Mixed fruit salad	100
Fresh coconut drink	80
Coffee, tea 50 Vt @ 4	200
	-----
Sub-total	1,800 Vt
	-----
	= 1,600 - 1,800 Vt
	Loss = 200

Morning Snacks

Banana cake or banana scone	240
Coffee, ta 50 @ 4	200
Fruit juice drink	40
Sugar	40
Pawpaw fruit	100
	-----
Sub-total	620
	-----
	Profit = 980 Vt

Midday Meal

10 eggs @ 30 Vt	300
Egg served with	200
soft yam	100
Fried island cabbage	100
Fresh fruit - grape fruit	40
Tomatoes and cucumber	50
Fresh lemon drink	40
	-----
Sub-total	830
	-----
	Profit = 770 Vt

Evening Meal

Pumpkin meat pie	100
served with sweet potatoes 2 @ 150 Vt	300
and soft yam	300
Fresh tomatoes cucumber	40
Fresh lemon drink	50
	40
Dessert - Sweet ripe banana 4 @ 20 Vt	80
baked with coconut	
Cream 4 @ 20 Vt	80
Hot drink - Coffee, tea, milo	200
	-----
	1,190
	-----
	Profit = 410 Vt

USING ONE PIG FOR A DAY - 6-8 PEOPLE

Small pig cost = 3,000 Vt

Midday Meal

Pork ribs tomato and vegetables

ribs	=	1,000
Tomatoes	=	50
Vegetables	=	100
Rootcrops	=	300
Spring onion	=	100
Salt	=	10
Lemon juice	=	40
Sugar	=	40

-----  
1,640  
-----

Meals for 8 x 400 = 3,600 Vt

Profit = 1,960 Vt.

Evening Meal

Pudding with rootcrops, vegetables & pork

Rest of the pork	=	2,000
Rootcrops	=	500
Vegetables	=	100
Spring onion	=	50
Coconut cream 6 @ 20 Vt	=	120
Salt	=	20
Fruit	=	200
Coconut drink	=	120
Hot drinks	=	400

-----  
3,510 Vt  
-----

Meals for 8 x 400 3,600 Vt = 3,600 Vt.

Profit = 90 Vt.

## APPENDIX IV

### TOUR REPORT

Place: Lolihor, North Ambrym  
Date: 20th - 27th of November, 1994.  
Officer: Stanley Womack.  
Purpose: To gather information about Lolihor EMU.

#### Introduction:

This report is made available by the author after a week long tour in Lolihor EMU area in North Ambrym. This report specifically aimed at the PEP activities, vegetations, marine life in the EMU. It also present a custom story about the volcano in the traditional belief, the problems and constraints encountered and some possible solutions.

#### Achievements:

##### 1.0. Site Stable Agriculture

A visit was made to the identified plots belonging to John Rawo, Holiness Community and Willie to assess the progress of the work being done in the plots. In the team were Peter Kaoh, Dominique (Kaohs' assistant field officer) and myself. Kaoh and Dominique already spent 2 weeks in Lolihor expecting rain drops for the cultivation of gliricidia. Their expectation was a failure therefore, they assist in the planting of wild yams.

##### 1.2. Results:

###### a) John Rawo of Ranon

A size plot of about 100m<sup>2</sup> erected with eight strand of barbed wire. The plot is located on a slope of approximately 10%. The bush are cleared ready to plant gliricidia. At the bottom of the plot Rawo started to plant the yams (sweet yam & waiuten bulbil). I wonder how this works because I think they should establish the tree legume first before cultivation. However, a long drought in the area made it impossible to establish the tree legume. The fence erected at the incentives of Peter Kaoh and Dominique his assistant field officer.

b) Holiness Community of Fanto

This is the plot with the area of 200m<sup>2</sup>. This plot is located under old coconut plantation. Flat area. This plot will be demonstrating the use of tree legume as alleys and lablab bean (Tolothros lablab) as a cover crop. Both are a source of nitrogen fixing plants. However, a major problem arises with the leadership of Pastor Jessie land owner who is unable to get his community together to do the job allocated to them. Kaoh and Dominique did all the work by themselves. They cut the posts dig the holes, plant posts and erect the barbed wire. We must not promote this type of approach because it enable the community to sit back and watch. We should be demonstrating an approach whereby the community participating in the activity to learn and to adopt the technologies applied for their future benefits. We should be working WITH the community not FOR the community.

c) Willie of Ranvetlam

This is a plot where we would like to apply the use of aluminium can to form a fence to scared the pigs. Willie is a hard working man. He follows the instructions. The main problem to this method was that the local pigs are too tame, therefore does not scared by the voice of the aluminium can. This technology would work with the wild pigs. However, the area is 100m<sup>2</sup>, flat about 20 meters from the house. The area cleared ready for the establishment of gliricidia.

d) George Bumseng's pigeon peas and limlalau (*Dendrolobium umbellatum*) plot.

The Limlalau is a language name of a tree legume identified by Charles Rogers during his visit in the Lolihor this year. The scientific name is known as *Dendrolobium umbellatum*. A trial was set up in Bumseng's land as an experimental trial. The condition of the limlalau was good. The growth was vigorous, healthy and forming a dense canopy. There is a need to assess the different nutrient composition deposited to the soil, its effectiveness on the crop and the length of time it takes for the continuous crop cultivation. Despite all the above three plots are ready to be cultivated. He is planning to plant peanuts to help the soil fertility before planting non-legumenous crop. The limlalau is planted in three rows of 30m in length. The limlalau is planted at 2m in the rows. The gliricidia is planted between the limlalau. With the vigorous growth of the limlalau Bumseng decided to replace the gliricidia with the limlalau. With the help of Kaoh and Dominique we planted the limlalau to replace the gliricidia. We planted close together to improve soil deposits. The area is approximately 600m<sup>2</sup>. The pigeon peas (*Cajanus cajan*) with the height of 1.5m covering an area of about 750m<sup>2</sup> was growing very healthy. The pods are ready to be harvested. Bumseng is planning to cultivate his land after harvest. The seeds will be dried and stored for the next fallow.

## 2.0 Culture and Tradition

How do we advertise tradition and culture for tourist market? There is a need to investigate more on the above question. The community needs to be consulted to find out which of their traditions and cultures would be best to expose to the tourist. Speaking to some of the leaders in Lolihor they seem to comment that the handicraft have exposed some of the taboo carvings and also every one is doing the carving of any kind even though they are not entitled to. This however, has gone out of hand. Therefore, we need to be careful in our introduction of new development that it does not have too much effect on the culture and traditional values of Lolihor. This would be another task that needs to be followed up. I have recorded a full custom story about the volcano with a written document of the same story by Sali Atel of Fanrereo. This story will be presented separately.

## 3.0 Environment Education Workshop

The above workshop was discussed with the LDC and scheduled for 23rd to 25th of November. Matu to be responsible for the over all organisation of this workshop.

## 4.0 Meeting

Held a meeting with Matu to help her with the planning of the daily and monthly activities and draw up her work plan for the month of November. I also point out the PEP priorities in Lolihor. Matu needed a lot of help from Bumseng as well as their supervisors.

## 5.0 Problems and constraints

- a) Drought affected the PEP activities in Lolihor.
- b) Community participation in site stable agriculture.
- c) Monitoring of PEP activities have not been properly carried out by the PEP staff in Lolihor.
- d) Aluminium can proved unsuccessful.
- e) Doing the work for the community rather than working with them.

## 6.0 Some suggested solutions

1) George and Matu with the help of FSA, PEP staff in Vila and LDC to conduct meetings in all the villages to explain the followings:

- a) What is PEP?
- b) Why PEP is carrying out such activities in Lolihor?
- c) Community participation.
- d) Importance of these activities.

### **Comment:**

All the community must understand the reasons behind these activities. In this manner the communities will participate actively.

- 2) To assist George and Matu in planning, organising, monitoring and to understand the PEP priorities.
- 3) More information to be obtained from Peter and Roger about planting of crops before establishment of tree legumes.
- 4) To discourage the approach of working for the people by applying the first suggested measure.
- 5) Aluminium cans should be replaced by the barbed wire.

### **Conclusions:**

This report should be submitted in November, but due to work load and travelling that makes it impossible. However, I hope this report will assist PEP in its future assistance in Lolihor. Maybe some of the suggestion above have already been carried out.

## **APPENDIX V**

### **REPORT ON THE ENVIRONMENT EDUCATION WORKSHOP**

Place: Lolihor North Ambrym.  
Date: 23rd to 25th of November 1994.  
Officer: Stanley Womack

#### **Purpose:**

- a) To educate the community about environment.
- b) For the community to have a clear understanding of their environment and the related problems affecting their environment.
- c) For the participants to act as resource persons in disseminating environmental information and awareness in Lolihor.

#### **Introduction:**

The environment education workshop was carried out as an educational tool for the participants to use in formulating general environmental awareness in Lolihor. The workshop aims at the above objectives. This report presents the performances of the workshop and the problems encountered.

#### **Achievements:**

The environment education workshop (EEW) was carried out as planned. 15 participants attended the workshop. Some of the original nominees doesn't turn up due to other commitments. However, the LDC managed to make up the required number, but it is not well represented. The host village was Fanla. It was a successful workshop in a sense that we have covered all the topic required. The paramount chief, chief Tofor was also a participant.

This workshop is different of all the workshop held in Lolihor. This is because the location is in the custom village of Lolihor which also was a constraint to some of the original nominees. Not all the participants can read nor write, but they all listen with interest and discuss among themselves successfully in their own language.

The materials used are markers and plain papers. Mostly talking and discussions are used (theory type). The approach was to open up the discussions and let them discuss and solve their own problems.

**The topics covered are:**

1. What is PEP?
2. Why PEP chose Lolihor to work with?
3. What is environment?
4. Why is environment important?
5. Why we should know more about environment?
6. Problems affecting their environment.
7. Why they are planting wild yam?
8. What is alley cropping and why it has been introduced?
9. Why we are encouraging tree planting?
10. Why we introduced tourism?

The information about each of these topics will be documented for future use.

**Problems and constraints:**

- a) Most participants can't read and write.
- b) Maybe wrong location for some original nominees.
- c) Some participants have to walk every day from their respective villages to Fanla to attend the workshop.

**Recommendation:**

A follow up of this workshop is essential through meeting approach in all villages addressing the same issues as above.

**Conclusion:**

The participants have expressed their concern about the environment, that they never realised that they are destroying their environment when they are doing certain developments. Now that they have heard and learnt the advantages of the environment in relation to their lives, they have confidence in addressing the issues to others.

## APPENDIX VI

### CASAVEIA YOUTH LEADERSHIP WORKSHOP REPORT November 22, 1994

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Donna Kalfatak

The Santo Youth Centre asked PEP to give a talk on the marine environment at a workshop held at Casaveia on the 22nd of November, 1994. The youth at the workshop varied in age from 16 to 40. There were 21 participants including three women.

The organisers did not chose a topic for us to give a talk on, so my talk was on marine environment in general. Prior to the main part of the talk, the PEP project was introduced. These are the areas I based my talk on:

- human coastal activities and their impact on the marine resources
- human marine activities and their impacts
- marine environment (what is a coral reef and its relationship to other marine animals, plants and man).
- the use of traditional marine conservation
- the depletion of turtles and coconut crabs
- Jack Enrel's giant clam reserve

The main method of conveying this environment education awareness is through talking using posters made with crayons and markers as guides.

At the end of the talk some questions were asked:

1. Traditional marine conservation techniques can be done, for example the use of placing taboo on a reef from fishing for some period of time but there are some times when the taboo was disobeyed. Therefore, the question is; do you think the taboo breakers should be taken to court?
2. Can you tell us what happens to the rubbish especially empty cans and plastic bags that are dumped in the waters?
3. You told us that PEP project based in Hog Harbor will last in September 1995, What will happen from then on?
4. Could you please tell us how PEP project chose to work in Hog Harbor and not any other place?

5. From your experience can you tell us which islands in Vanuatu have conserved most of their natural resources?
6. Can you help us to deal with the mining group in South Santo?
7. Can you indicate to us an example of how development is carried out without causing too much damage to the environment or the marine environment?
8. Now you told us that local people should say yes or no to development coming to their lands/areas, what will happen if one of our areas is declared public land?
9. To take care of our environment means that we will not be able to carry out any development like we are planning to. What should we do because development will affect our environment. How will we go about it?
10. How big does a coral grow per year?

It was conveyed to them that this environment awareness does not mean that there will be no development at all. Development can take place but it should be carried out in a sustainable manner.

The local people are the key people in their rural areas. They have the rightful decision to their land. Whenever development comes into your area, take time to think of it very carefully before allowing or not allowing it to develop in your place.

In conclusion I see that the rural communities need environmental education. They are hidden in the rural areas and are not exposed to what unsustainable development had done to other countries environment. From this talk, I see that they were not aware of what the end results of development would be to their environments. This talk taught me that the rural people need to be aware of development impacts if they allow it to come into their areas. Local people need to know that they are the ones that would be affected if development are carelessly done in their lands.

The best way for environment education to reach the rural areas is to include it in every workshop that goes to the villages. It would be best for workshop organisers to include environment education in their programs.

## APPENDIX VII

# PRELIMINARY REPORT ON A POPULATION SURVEY OF THE RARE AND ENDANGERED ENDEMIC PALM *Carpoxyton macrospermum* H.WENDL. & DRUDE IN VANUATU

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### SUMMARY

A population survey of the endemic Vanuatu palm *Carpoxyton macrospermum* H.Wendl. & Drude, undertaken by the Foundation for the Peoples of the South Pacific as a component of a PEP (Profitable Environmental Protection) Project between 2 November and 3 December 1994, revealed that the palm occurs sporadically throughout most of Vanuatu, primarily cultivated as a food plant in village gardens. On the islands of Aneityum, Futuna and Tanna, small, actively regenerating populations were found in primary forest, thus suggesting that the palm is indigenous to these islands. The palm is, as far as could be determined, absent from some islands (eg. Pentecost and Ambae). During the survey, 139 mature fruiting individuals, over 90 juveniles and over 400 seedlings were observed. Of this total, only 26 mature fruiting individuals were observed in primary or late-secondary forest. This situation supports the proposition that the conservation status of the palm is Rare and Endangered. Notes on traditional uses and a custom story were gathered, as were preliminary accounts of the palm's ecology, habitat preferences and morphological variation. Recommendations for continuing conservation action are given.

## RECOMMENDATIONS

1. TO DEVELOP A SPECIES' RECOVERY PLAN FOR *CARPOXYLON MACROSPERMUM* TO INCLUDE A COMPREHENSIVE BIOLOGICAL STUDY OF THE PALM AT A NATURAL POPULATION
2. TO ESTABLISH AT THE APPROPRIATE LOCATION(S) WHERE *CARPOXYLON* OCCURS NATURALLY, CONTROLLED AREAS TO CONSERVE THE SPECIES
3. TO INVESTIGATE THE FEASIBILITY OF MARKETING THE SEEDS OF *CARPOXYLON* WITHIN THE INTERNATIONAL HORTICULTURE TRADE, THE PROCEEDS (OR PORTION THEREOF) TO GO TOWARD CONSERVATION OF THE SPECIES

## Introduction

The monotypic palm genus *Carpoxylon* (Car'pocks'ee'lon), with its only species *C. macrospermum* H.Wendl. & Drude, is endemic to Vanuatu, and indeed is suspected to be the only genus of plants endemic to the archipelago. The palm was first described in 1875 by the German botanists Hermann Wendland and Oscar Drude from fruit collected by the English naturalist John MacGillivray during one of his two voyages on the H.M.S. Herald which passed through the southern islands of Vanuatu first in 1853 and again in 1859. The type specimen for the species (ie. the plant sample from which the species was originally described) is conserved in the British Museum with the following notation on the outside of the box: "Isle of Aneiteum [Nohoich. *Areca!*] 1860". MacGillivray (1853) in his journal of the first voyage referred to an *Areca* which he collected from Aneityum, but the lack of any descriptive details prevents positive confirmation that he was mentioning *Carpoxylon*. The journal of the second voyage has not been located by this author.

As the palm was described from only the fruit, its general appearance and other details were not known to following botanists. This situation prompted speculation about the palm, and a number of researchers interpreted the available materials in various ways (Burret 1932; Moore 1957; Langlois 1976). Not surprisingly, the palm's existence was questioned by some researchers (Chew 1975) whilst others, who visited the type locality of Aneityum, were unable to locate the palm (Hodel 1982).

Following the palm's 'rediscovery' in 1987 (Dowe 1989) in south Espiritu Santo, a full description of the species (Dowe & Uhl 1989) was available to botanists. The palm's position within the classification system of the family was also clarified, it being placed in the subtribe Iguanurinae (Arecoideae) with relatives being *Clinostigma* and *Neoveitchia*. Despite this clarification of placement, *Carpoxylon* has no true close relatives. This places the palm in an unique position in the evolution of the family in the south-west Pacific, and particularly in the Vanuatu context considering the very limited degree to which generic and specific endemism has developed within the archipelago.

*Carpoxylon* is listed as Rare and Endangered (Dowe 1991) using criteria established in the International Union for the Conservation of Nature's **Red Data Book**, and has received a high priority rating in the Species' Survival Commission's **Global Action Plan for Palm Conservation** (Dowe in press). Fearful that such an important example of the diversity of palm evolution in the south-west Pacific may become extinct if action was not taken to conserve it, *Carpoxylon*'s threatened status was brought to the attention of the Vanuatu Department of Forestry's Forest Botanist Ms Patricia Curry who subsequently proposed to the Foundation for the Peoples of the South Pacific that they initiate a program to determine the palm's population and distribution, in anticipation of developing a species' recovery plan. Within the FSP's Profitable Environmental Protection projects, the palm is being examined as a potential horticultural subject with international sales. The results of the feasibility study ± will be published in a separate report.

## **Population and Distribution Survey**

### **Materials and methods**

Previous recordings and surveys of *Carpoxylon* had revealed and confirmed that the palm grew on Espiritu Santo and Tanna. On Santo it was reported to occur as a cultivated plant (Dowe 1989; Devoe 1994) whilst on Tanna its status was not determined (Gage & Gage 1989). A list of uninvestigated reports had been gathered informally since 1989 by some researchers, in particular Dowe and Devoe. The itinerary for the current population survey was designed around the information available in the previously collected reports. The field-work component of the survey was undertaken between 2 November and 3 December 1994 by a team, comprising the author, Suliana Siwatibau, Japheth Hidson, Chanel Sam (Vanuatu) and Dick Phillips (Fiji), supplemented with FSP field workers. Members of the survey team visited nine islands, including Aneityum, Futuna, Tanna, Tongoa, Malakula, Ambrym, Pentecost, Ambae and Espiritu Santo.

The procedure was to approach potential informants at as many villages as possible during the allocated time. Airports and other points of congregation proved to be good sources of information. Additional reports were investigated where possible. To enhance communication, samples of the fruit and photos of the palm were carried by each team.

At each site where *Carpoxylon* was found, the village or place name was noted, as were the number and heights of adults (fruit producing palms), juveniles (non-fruit producing palms above 1 m tall) and seedlings (palms below 1 m tall) (Fig. 1). Location details, such as altitude, soil, habitat type and vegetational associations were recorded. In addition, details of ecology, condition of palm, local names and uses were noted (Fig. 2). Photographs were taken at most locations whilst a number of voucher specimens were collected for deposit in the Port Vila (PVV) and Queensland (BRI) herbaria. Fruits were collected to establish morphological variation (if any), whilst mature endosperms were collected for DNA analysis to

determine genetic variation within the total population (Fig.2). The results of the DNA analysis, being conducted by the Australian Institute of Marine Science, Townsville, will be published in the final report.

As well as verifying previously gathered reports, a number of new reports were presented to the team as more contacts were made during the course of the survey. These reports shall have to await future investigation, though a preliminary estimate indicates that only a small number of additional palms may be involved.

## Findings

### Population distribution and structure

The known population of *Carpoxydon*, as determined by the survey, comprises 139 mature fruiting individuals,  $\pm 90$  juveniles and  $\pm 400$  seedlings. Of the mature fruiting palms, 113 are cultivated specimens and 26 occur naturally in primary or late secondary forest. Only on Aneityum, Tanna and Futuna were populations found in primary or late secondary forests (Fig.1). The populations in these forests are small though there is active regeneration. The populations generally comprise a small number of mature palms surrounded by proportionately greater numbers of juveniles and seedlings. These populations appear to be remnants of a former more widespread natural distribution. Removal of forest for agriculture has dramatically changed the floristic and vegetational character of Vanuatu, particularly on well-populated islands such as Tanna. Aneityum has comparatively more primary and late-secondary forest remaining than Tanna, though in real terms the area covered is not significant.

Where *Carpoxydon* occurs in primary or late secondary forest; it always grows in association with other palm species; on Aneityum with *Veitchia spiralis* H.Wendl. (Naquoy) and *Caryota* sp. nov. (Inrejay) and on Tanna with *Veitchia arecina* Becc. (Niue) and *Caryota* sp. nov. Floristic associates include *Inocarpus fagiferus* (Park.) Fosb. (Nanambe), *Neisosperma oppositifolia* (Lamk.) Forst. & Sach., *Syzygium malaccense* (L.) Merr. & Perry (Nakavika), *Fagraea berterana* A. Gray & Benth. (Nopou), *Dysoxylon gaudichaudianum* (Juss.) Miq. (Stinkwood), *Pouteria linggensis* (Burch.) Pierre (Comb Tree), *Hernandia moerenhoutiana* Guillaumin var. *samoensis* (Hoscht.) Kubitzki (Bluewood) and *Dendrocnide latifolia* (Gand.) Chew (Nangalat).

Altitudinal range of palms on Aneityum is 10-100 m and the soils are eroded ferralitic clays with moderate humus content. On Tanna altitudinal range is 200-250 m and soils are volcanic in origin with associated alluviums with high humus content.

## Ecology

Given the time constraints and other limitations imposed on the survey, only brief and preliminary observations on the ecology of *Carpoxylon* were possible. The palm is most often a sub-canopy element with optimal habitat appearing to be moist lowland forest on high fertility soils, in microclimates where drainage may be impeded or where excessive moisture levels are maintained by permanent streams, soaks or springs. Litter and humus in these situations is developed to a greater depth than nearby areas.

Regeneration occurs predominantly below or close to the parent palm(s). Little regeneration was seen away from the parent palms. At the sites where *Carpoxylon* is found in primary and late secondary forest on Tanna and Aneityum, the ratio of mature plants to juveniles and to seedlings was 2:4:13. This ratio is similar to the age/class recruitment levels recorded for other rainforest palm species, and represents a moderately successful degree of regeneration. Dispersal of fruit appears to be gravity driven, though at one location on Tanna (Yaohanen) a cache of fruits in a rodent burrow some distance from the parent palms was observed. Informants often told how they have seen rodents climb palms to retrieve fruit, while land crabs (*Cardisoma* sp.) have been seen transporting both intact and partially decayed fruit into their burrows (pers. obs.). Flying fox have been known to alight on the infructescence when fruit is mature. They feed on the thin mesocarp, though without removing the fruit from the palm.

## Floral phenology

Casual observations suggest that, at least on an individual inflorescence, the pollen shedding phase (staminate anthesis), which begins immediately following the fall of the subtending inflorescence bracts, may last for a number of weeks. This is followed by a short period of quiescence, followed by female flower receptivity which may last a few days. Potential pollinators are bees, wasps and flies as they were present in swarms during the pollen shedding phase. Although a number of apparently receptive female phase inflorescences were seen, no pollinators were observed in attendance.

Variation in the timing of floral maturity was observed between palms in the south and those in the north. In November, many of those in the south were displaying newly opened inflorescences with male flowers shedding pollen, whilst, at the same time, those in the north were displaying inflorescences with receptive or recently pollinated female flowers. This suggests that floral maturity and possibly also fruit maturity occurs slightly earlier in the north than in the south.

## **Fruit maturation**

Fruit maturation appears to be seasonal with the period of February to April being when the greatest number of palms will be carrying mature red fruit. During the survey (November), only one palm of the 139 observed was carrying mature red fruit. Most palms (> 95%) were carrying full-size but green fruits which would be expected to begin to mature within two to three months. A number of infructescences appear to mature concurrently.

## **Morphological variation in *Carpoxylon***

To determine if there was any morphological variation in *Carpoxylon*, plant height and DBH (diameter at breast height) were recorded, and mature fruit collected and measured. Average maximum plant height shows significant variation only between those on Tanna and all other islands. On Tanna, average maximum plant height is 21 m compared to 8.8 m for all other islands. Only three of the 17 palms observed on Tanna are cultivated, the majority occur in primary forest or remnant forest patches. The soils on Tanna, particularly at the *Carpoxylon* sites, are exceptionally rich and deep. No significant variation was observed in trunk diameter.

Variation in fruit and endosperm measurements between locations was insignificant. Variation from the mean and average measurements was no greater than 14% which was about equal to the overall variation in size range for all fruits and endosperms measured.

Full details of morphological variation will be presented in the final report.

## **Regeneration of cultivated palms**

Regeneration in the vicinity of most cultivated palms was absent or severely limited due to many restricting factors. Foremost among these includes removal of fruit for consumption, removal of seedlings - also for food, but mainly as a garden-weeding exercise - and the trampling of seedlings by humans and animals. Most cultivated palms occur in open situations which inhibits germination and seedling establishment due to intense radiation and harsh conditions. Most sites have soils which may become periodically dry. Despite the poor regeneration of cultivated palms, three locations exhibited active and successful regeneration. At Casaveia in south Santo and at Palanua in east Malakula, the palms had been planted in riverine situations where there is permanently moist, deep alluvial soils and where land crabs (*Cardisoma* sp.) are active. The crabs assist in improving levels of regeneration by taking fruit into their burrows where the seeds are able to germinate and become readily established. Populations at these two sites exhibit an age/class recruitment ratio similar to that of populations in

primary and late secondary forest as occurs on Tanna and Aneityum. A third site of active regeneration was noted by Devoe (1994) during her survey of *Carpoxylon* at Vevol on Santo. She reported a group of ten juveniles and seedlings growing in an abandoned village, at ca. 1000 m altitude, which had reverted to secondary forest.

The life histories (ie. when and who planted the cultivated specimens of *Carpoxylon*) was known to informants at most locations. Invariably, all cultivated palms were generated from seedlings removed from below the parent tree(s) and transported some distance to the new site. The collection of fruit specifically for propagation was rarely considered. The removal of seedlings from the ground was most often done with a sharp object such as a bush knife or similar implement. Seedlings were usually carried to the new site wrapped in leaf packages and planted soon after arrival. Many more seedlings were transplanted than have survived. Following transplantation, the only special procedures employed to ensure survival was the infrequent clearing of encroaching vegetation or the placing of a stake enclosure around those seedlings planted in high traffic areas such as near houses or pathways.

### Uses of *Carpoxylon*

The primary reason for planting *Carpoxylon* is for a food source. The thick glutinous endosperm of the full-size but immature fruit is consumed. The endosperm is extracted by biting into the fruit, lengthwise, to penetrate the fibrous mesocarp and woody endocarp and to expose the edible portion which is then removed intact with the fingers. Some consumers further remove the thin, still soft inner endocarp which has a tart, dry flavour, by deftly peeling it with a sharp knife. Children are the main consumers in villages, though gardeners and hunters consume the fruit when visiting remote areas or abandoned gardens. The navara (germinated fruit) is sought after by children as a sweet, and apparently nutritious delicacy.

Secondary uses include the making of brooms from the leaves as seen most often on Malakula. Naturally shed dried leaves are collected from below the palm. The leafsheath is removed by cutting through the lower portion of the petiole, whilst the rachis is cut through about mid-leaf leaving about one metre of leaf intact. The leaflets, which are rigid and leathery, are then trimmed near their apices to form a long-lasting broom.

Bowls are fabricated from the peduncular bracts (of which there are two of similar shape and size) and the leafsheath. The bowls from the peduncular bracts are created by merely holding the boat shaped bract by both ends and drinking. Prepared food is occasionally placed in the bowls. A thin rope may be pulled tight between each end to make a handle. Bowls made from the leafsheath are also multi-functional. Their fabrication is more complex. A recently fallen though still soft leafsheath is collected from below the palm. The rachis and adjacent distal portion of the petiole are discarded, leaving the leafsheath and the lower half of the petiole intact. The sheath is then turned inside out. The remaining portion of petiole is turned backward and the auricles of the upper leafsheath folded behind the petiole and

secured with a small stake, usually a tough root or twig. The resulting pressure of the inserted stake on the petiole ensures that the leafsheath is held taut. The lower portion of the leafsheath is then cut away at such an angle as to create a moderately deep bowl with a rounded end. The petiole functions as the handle. In the village of Brenwei, west Malakula, bowls made from *Carpoxyton* (local language is Parkel) are used exclusively for the consumption of kava at special ceremonies, whilst bowls created from the leafsheath of the common palm *Veitchia winin* H.E. Moore (Ndidi) are used for more frequent (daily?) consumption. The newly fabricated kava bowls are smeared with oils and resins and placed above stoves for curing, which turns them a glossy black in the process. They are stored in the rafters of the nakamal. When in use, the bowl is placed on a stand made of a number of y-shaped branches pushed into the ground. Kava is prepared traditionally. The chewed portions are placed directly in the bowl and mixed with water. Fibres are removed by sieving through coconut fibre or muslin. These communal bowls are reported to contain enough kava for about 100 servings. Informants reported that some bowls made from *Carpoxyton* leafsheaths have been in continuous use for over 30 years.

A use for *Carpoxyton* in custom medicine as a contraceptive was recorded at Elia, west Santo. A small portion of 'bark' is removed from the palm at about breast height. With a sharp knife, the exposed fibrous pith is scraped to form a cottonwool-like pulp which is mixed with water and the juice squeezed into a drinking vessel. The woman seeking contraception drinks the mixture, at least one cupful for four consecutive days to ensure that a 'permanent' infertility ensues. An antidote to induce fertility is as follows: The bulb of *Proiphys amboinensis* L. (Tapon-lapa) is dug up and the inner portions removed or loosened to develop space into which 150 seeds of *Coix lacryma-jobi* L. (Wasil or Jacob's tears) are placed. This is buried under the path which the woman most frequently uses to visit the toilet. After some time, fertility should return.

One custom story about the origin of *Carpoxyton* was recorded from Aneityum:- A long time ago, a tribe of tall, light-skinned, and wise people came to Aneityum from the east and settled on the south of the island near Umetch. They brought with them the palm which is now known as Nohoich (*Carpoxyton*). From the palm they made a stringed musical instrument - from which part of the palm it was made and its appearance are now forgotten. The instrument made a very loud sound which soon began to irritate the local people. Eventually the local people became so annoyed by the continuous sound that they drove the newcomers from the island. All that they left behind were the palm and some stones with carvings on them.

A novel means of catching flying-fox using *Carpoxyton* fruit as bait was observed in the village of Lalep, east Malakula. A rope is strung between two poles across the approach path which the flying-fox must take to reach the fruit. From the rope are suspended fishing hooks on short strings. These catch in the wings of the flying-fox as they attempt to alight on the palm's infructescence.

On Futuna, the dried endosperm of the fruit is used in the making of tobacco pipes. The endosperm, which naturally has a central cavity, is further hollowed-out to form the bole of the pipe. A hole is drilled just above the base of the endosperm into which is inserted a thin section of bamboo, which acts as the mouth piece.

## Conclusion

The estimated success or failure of a population of a species to regenerate in its natural environment is one criteria which may be used to determine a species' ecological status and long-term biological viability. If the size of the area in which regeneration is to occur is exceedingly small, there may be inhibition of successful overall regeneration even if it is locally active. In depauperate or remnant forest patches, regeneration, although locally active, may not be sufficient to maintain viable populations of an individual species over long periods. The smaller a population becomes, the more vulnerable and negatively receptive it is to climate and ecological changes, and the higher degree of endangerment it faces. In the case of *Carpoxyton*, the exceedingly small and fractured natural population places the palm in an extremely vulnerable position, and indeed using even the most conservative criteria for determining degrees of endangerment, the palm must be placed in the highly vulnerable/approaching extinction category.

Although many hitherto unknown cultivated specimens of *Carpoxyton* were located during the survey, the fact that the palm is in extreme endangerment has not diminished. Conservation through cultivation is not a sustainable or realistic choice for any species of endangered plant - it is merely prolonging the inevitable. Conservation and continued vigilant protection of natural populations are indeed the only sure and biologically valid method of ensuring the survival of a species.

The locating of extant natural populations in primary forest during the survey offers an unprecedented opportunity for a complete biological study of *Carpoxyton* to be undertaken as a prerequisite for a species' recovery plan. Of all the environmental issues which Vanuatu is presently faced, the conservation and protection of this unique Vanuatu palm should receive immediate attention and be given the highest priority.

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Figure 1. Distribution and population details of *Carpoxyton macrospermum* H.Wendl. & Drude at locations visited during the FSP 1994 survey: Adults = fruiting palms; Max.height = height of tallest individual if more than one was present at location; Juveniles = non-fruiting palms > 1 m tall; Seedlings = non-fruiting palms < 1 m tall; Status = whether planted or natural; Collection # = for DNA analysis records and herbarium vouchers.

LOCATION	ADULTS	MAX.HEIGHT	JUVENILES	SEEDLINGS	STATUS	COLLECTION#
<b>ANEITYUM</b>						
Annunapoth	1	7 m	0	< 10	planted	Dowe 0120
Unuhuc	2	8 m	1	1	planted	Dowe 0121
Anatawai	2	10 m	0	0	planted	-
Umetch	2	7 m	0	0	planted	Dowe 0124a
Umetch Hill	7	7 m	0	< 50	planted	Dowe 0124b
Umetch Valley	3	5 m	0	> 10	planted	-
Anouyac	1	6 m	0	1	planted	-
Itchapthev	1	7 m	0	> 10	planted	Dowe 0126
Ametchinibeke	7	12 m	> 10	> 50	natural	Dowe 0129
Inwan Leleghei	1	12 m	10	> 50	planted	Dowe 0132
<b>FUTUNA</b>						
Yulantufu	5	12 m	0	0	natural	-
<b>TANNA</b>						
Yaohanen	3	15 m	< 10	> 20	natural	Dowe 0134
Green Hill Creek	5	27 m	0	< 10	natural	Dowe 0135
Green Hill area	2	27 m	0	0	natural	-
Lownakiam Apen	4	27 m	> 10	> 50	natural	Dowe 0137
Korembenken	1	15 m	1	0	planted	Dowe 0138
Yanemarei	2	15 m	1	0	planted	-
Manuapen	0		1	0	planted	-

EFATE						
Eton	0			1	0	planted -
MALAKULA						
Toutu	1	6 m		0	0	planted Dowe 0139
Small Toutu (site 1)	4	8 m		3	< 5	planted -
Small Toutu (site 2)	5	22 m		0	0	planted -
Lalep	1	8 m		0	0	planted -
Rana Amelvet	2	9 m		0	0	planted -
Orap	1	4 m		0	0	planted Dowe 0140
Wormet	4	12 m		2	2	planted -
Amelvet Vitan	2	6 m		0	0	planted -
Lotopo	1	5 m		0	0	planted Dowe 0142
Sanwir (village)	0	-		1	0	planted -
Lavasal	1	14 m		0	0	planted -
Lilrang	0	-		1	0	planted -
Monambour	4	25 m		0	0	planted -
Palanua	4	16 m		> 10	> 20	planted -
Atchin Island	1	7 m		2	0	planted -
Lawor	1	6 m		0	> 50	planted Dowe 0150
Unmet	1	4 m		0	0	planted Dowe 0143
Lambubu	0	-		1	0	planted -
Mbwitin	1	18 m		0	0	planted Dowe 0144
Penamur	1	8 m		3	0	planted -
Vetkar	1	14 m		0	1	planted Dowe 0145
Penghetabul	0	-		1	0	planted -
Rupo (Unua 4)	1	6 m		0	0	planted -
Penamur (Unua 3)	1	20 m		0	0	planted -
Novor	1	25 m		0	0	planted -
Benbaur	1	22 m		0	1	planted -
Mbatambong	1	6 m		0	0	planted -
Remet (Unua 1)	2	13 m		0	6	planted Dowe 0147
Taremp			1			10 m 0 9 planted -
Taremp (village)	3	10 m		0	0	planted -
Potinder	1	18 m		0	0	planted -
Patne/Lichlich	1	18 m		0	1	planted -

Burbar	1	12 m	0	30	planted	-
Rapersivir	1	2 m	0	0	planted	-
Rapekteur	2	2 m	1	0	planted	-
Lanvitvit	2	6 m	0	0	planted	-
Mbangir	1	7 m	1	0	planted	-
Pandehur	1	5 m	0	0	planted	-
<b>ESPIRITU SANTO</b>						
Vasalea	1	6 m	0	0	planted	Dowe 0153
Elia 2	3	6 m	0	0	planted	Dowe 0155
Wusi	0	-	1	0	planted	-
Vunavusi	1	9 m	0	0	planted	-
Narango	1	15 m	0	0	planted	-
Veleuro	1	12 m	0	0	planted	-
Hog Harbour	1	10 m	0	0	planted	-
Nambank	2	2 m	2	0	planted	-
Tabotalo	1	9 m	0	0	planted	-
Narago	2	10 m	0	0	planted	-
(Devoe 1994 Survey)	14	-	14	14	planted	-
<b>TONGOA</b>						
Su.navorari	2	9 m	0	0	planted	Sam FSP
Lolaki	2	9 m	0	0	planted	-
Navasan	0	-	1	0	planted	-
Kamalamba	0	-	2	0	planted	-
Tavotalo	0	-	1	0	planted	-
Tabale	0	-	3	0	planted	-
<b>AMBRYM</b>						
Sanesup	0	-	3	0	planted	-

Figure 2. Local names and uses of *Carpoxydon macrospermum* H.Wendl. & Drude recorded during the FSP 1994 survey.

LOCATION	NAME	UTILISATION	
Aneityum vessels; ornamental.	Noho'ich	fruit and navara as food; inflorescence bracts and leafsheath as bowls and	carrying
Futuna	Napuansavi	fruit and navara as food; endosperm for tobacco pipe (see text).	
South Tanna	Nikora	fruit and navara as food.	
North Tanna	Niue	fruit as food.	
Central Tanna	Nar'pwock	fruit as food.	
East Malakula	Bunglu	fruit and navara as food; leaf as broom; fruit as flying-fox bait (see text).	
North Malakula	Bungool	fruit and navara as food; leaf as broom.	
West Malakula	Parkel	fruit and navara as food; leaf as broom; leafsheath as ceremonial kava	bowl
South Malakula	Bungool buat	fruit as food; leaf as broom	
North-west Santo	Wollal	fruit as food; leaves for sleeping mat.	
West Santo	Olo-olul	fruit as food; contraceptive potion from trunk pith (see text).	
South Santo	Vininu-vusa	fruit as food; ornamental.	
North Santo	Ollal	fruit as food; leaf as thatch.	
East Santo	Niniu	fruit as food; leaf as broom; leaf as thatch.	
South-east Santo	Valala	Navara as food; leaf for broom	
Tongoa	Nabupua kaimasi	fruit and navara as food; also as pig food; leafsheath as bowl for laplap from	breadfruit

## APPENDIX VIII

COLLECTION, CLEANING, PACKING, AND GERMINATION OF CARPOXYLON SEEDS - A REPORT TO PEP - by Dick Phillips - NOVEMBER, 1994.

### SUMMARY

Although *Carpoxylon macrospermum* has been located "in the wild" on Anietyum and Tanna and is now known from much larger numbers of mature trees on a number of other islands of Vanuatu - especially Malekula - it is still endangered and, following DNA study, a species recovery programme is obviously the top priority.

It is my belief that chemical study of the green and germinating fruit should be undertaken to discover the nutritional and medicinal properties. The lack of regeneration under cultivated trees has been explained by the popularity of the fruit as a food both in the green and germinating stages.

Horticulturally I believe that the palm has great possibilities in tropical countries. Nothing is known of its tolerance of cold but if trials show such tolerance, the horticultural markets would be very much greater.

Trials in Vila to test the speed of germination of mature seed are suggested together with trials for the continuing viability of stored seed. While not vital, such trials should enhance the commercial potential of the seed.

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Introduction.

The original terms of reference called for visits to Malekula and Santo in the company of the palm taxonomist and a forester. In villages specific people were to be identified and trained in the identification of the palm, the correct method of collection, cleaning and drying and packing of the seeds for sending to Vila.

From experience gained by the palm taxonomist on Anietyum and Tanna it was realised that no mature seed would be found. Certain changes were agreed.

Please refer to the minutes of the meeting of 18/11/94 - File Ref P7/3.

The objectives of this report are, therefore -

1. To advise on the collection of seeds in gardens and villages.
2. To advise on the cleaning of seeds for growing locally in villages or for sending to Vila.
3. To suggest methods of growing of seeds in villages.
4. To suggest improved ways of transplanting seedlings in villages and gardens and their continued maintenance.
5. To recommend methods of storage of seed in Vila.
6. To recommend methods for germination trials in Vila.
7. To comment on germination trials in Townsville
8. To comment on the horticultural possibilities of *Carpoxylon macrospermum* both in Vanuatu and overseas.

#### 1. COLLECTION OF SEEDS IN VILLAGES AND GARDENS.

- a. Some palms flower all the year and produce fruit continually. It is believed that *Carpoxylon macrospermum* begins to flower about September and sends out a number of inflorescences over a period of several months. Despite this spread in the time of flowering, it is believed that seeds on all inflorescences will ripen in quite a short period - maybe from mid-February to mid-April.
- b. Environmental and climatic conditions may cause some variation
  1. Plants in Anietyum and southern areas of Vanuatu may produce ripe seeds later than those further north due to the later onset of hot weather.
  2. Cyclones may damage palms and affect the whole cycle of reproduction.
  3. Drought or excessive rain may affect cycle of reproduction.
  4. Heavy rain at time of flowering may affect pollination of flowers.
  5. Predation by coconut crabs, rats, flying foxes, etc. may seriously affect the numbers of fruit maturing.
  6. Use of green fruit for food will seriously reduce numbers of fruit maturing.
  7. Use of ripe and germinating fruit (navara) for food will seriously reduce the numbers of fruit available for propagation.

N.B. The planting and growing of this palm in villages for food and other uses (brooms, etc.) would be a perfectly legitimate project in itself and should, I believe, be encouraged in addition to species regeneration and the possible development of commercial sales of seed overseas. It could well be worth undertaking chemical investigation of the fruit to ascertain nutritional and medicinal values.

8. In some palms, the seed on an individual infructescence does not necessarily ripen at the same time - it is usual to find mature and slightly immature seeds on the same infructescence. There does not appear to be any set pattern to the ripening of seeds and the two may be mixed on the infructescence. Some mature seeds may drop before the remainder ripen - others may remain on the infructescence until all are ripe.
  9. In some palms, so long as there are a few mature and fully ripe seeds on an infructescence and the endocarp on the remaining seeds is hard, seed can be picked and reasonable percentage germination can be expected. However, in some other palms, only fully mature seeds will germinate - in some cases seeds must actually fall from the tree to be viable. My feeling is that Carpoxylon falls into this latter category - or, if not fully so, the riper the seeds the higher the germination rate that can be expected.
- c. 1. Once seeds fall on the ground attack by insects, fungi, rats, etc. becomes a serious problem, so it is preferable to try to catch the seeds as they fall by enclosing the maturing infructescence in a cage of small mesh wire netting. Similarly it would be desirable to band trees (as is done in some coconut plantations) to prevent rats and coconut crabs climbing the palms. It is appreciated that, at village level, this banding of the trunks and caging of the infructescences may not be a practical proposition. The caging of the infructescences is, I believe, the more important as this both protects against predation from crabs, rats, etc. while allowing all the ripe fruit to fall from the tree at full maturity.. Chicken wire mesh about 1 cm. is the best to use if available.
2. If caging is impracticable, some methods need to be developed to catch seed so that it does not fall to the ground and become the target of predators.

## 2. CLEANING OF SEEDS FOR GROWING LOCALLY AND FOR SENDING TO VILA.

- a. The mesocarp (outer layer of the fruit) of the Carpoxylon is relatively dry or dries fairly quickly after seeds fall from the tree. It is, therefore, desirable, though not vital, that seeds be collected and cleaned as soon as possible after maturing and falling.
- b. If mature seed is collected quickly it is a relatively easy matter to clean them. It may be possible to rub some of the soft and moist mesocarp from the seed by rubbing with the fingers. A sharp knife will generally be needed to complete the cleaning.

c. If the mesocarp has dried the seed should be soaked in water for several days. Fermentation may begin and, if this occurs, it is my practice to change the water every two days. (I must admit that I have no technical reason for doing this). Once the mesocarp has softened and has started to rot, cleaning is a simple process although a knife may be needed to complete the job. Generally speaking, the cleaning of large palm seeds with a smooth endocarp is not too difficult. It is very important however, to remove all traces of the mesocarp as they may become centres for fungus attack. Perhaps a final cleaning by rubbing the seeds with coarse sand and then washing them with clean water would complete the process.

d. Clean seed should be dried as quickly as possible. While it might be in order to dry seeds of some palms (*Acrocomia* sp.) in the sun, I do not recommend this for *Carpoxyton* as I do not believe that it would occur naturally. It may occur where a palm is growing (planted) in a village in the open but I doubt that it would happen in natural stands in the forest. Leaving *Carpoxyton* seeds in the sun to dry could result, I believe, in damage to or the death of the embryo. Drying should take place in the shade and it can be accelerated by the movement of air. The optimum would be to spread the seeds on a tray of wire mesh so that the seeds are fully exposed to the wind. Should the seeds have to be piled up more than one layer, they should be stirred from time to time so that drying is fairly quick and even.

N.B. If seeds are to be grown at the village, this drying process is not imperative.

e. Once seeds are clean and dry they should be sent to Vila as quickly as possible though I do not believe that storage for a week or two would be all that harmful - however, the less delay the better.

f. The mesocarp of some palms may contain stinging crystals (*Ptychosperma* spp) and care is needed (rubber gloves) while cleaning. This does not appear to be the case with *Carpoxyton* - the usual method of opening green seeds to eat is by biting them and this indicates the absence of stinging crystals.

### 3. TRANSPLANTING OF SEEDLINGS IN VILLAGES AND GARDENS.

a. In our travels on Malekula and Santo it soon became clear that all attempts to replant has been undertaken using naturally grown seedlings from around the base of old trees. Where eating of the green and mature nuts is common there are seldom any seedlings available and this would account for the apparent lack of regeneration mentioned in early reports.

b. The method of obtaining these seedlings gives a very clear reason why there is a very high percentage of failure in the establishment of these replanted seedlings. Seedlings are simply pulled from the ground with serious damage to the developing root system. The old seed could also be broken away from the seedling and this would result in the almost certain death of the seedling which was still feeding from the endosperm.

c. No attempt was made to protect the roots from drying out. It is on record in palm literature that some delicate palm roots can dry and die in fifteen minutes. It was observed that there was a delay of many hours before the seedlings were planted again.

d. Once planted no attempt seems to have been made to water or otherwise care for the small plants. In one case a farmer had provided good protection for a seedling against attack from land crabs which were plentiful. I hope I am not appearing critical as I believe farmers would not normally provide such care for any of the plants which they grow.

e. Successful transplanting of seedlings can be undertaken if the following procedures are followed -

1. Have some sort of container available in which to hold the seedling plus soil. This can be a plastic bag, a sheet of plastic, a piece of cloth or sacking, a banana or heliconia leaf, the fibre from the base of the coconut leaf or any similar available material.
2. Make sure the soil around the seedling is damp - water if possible or dig up in wet weather. Do not dig up the seedling in dry weather.
3. Dig up as large a lump of soil as possible around the roots of the seedling - try not to disturb this soil so that it falls off the roots and exposes them to the air. If the seed is still attached to the seedling make sure that it is not broken off.
4. Place this lump of soil and the seedling in the plastic bag or wrap in the material suggested above, tie firmly and securely with string or any suitable vines which are available.
5. Keep in the shade especially if enclosed in plastic - anything inside plastic heats up a lot.
6. In the event that roots are exposed it is very important that they be covered as soon as possible with damp material - wet grass, leaves, etc. and wrapped as in (4) above.

7. Do not cut back the two newest leaves. This can cause stress to the one growing point deep at the base of the leaves. A single trunked palm has only one growing point and, if this is damaged to the extent that it dies, the plant will die. Even slight damage can seriously affect growth.
8. Speedy transport to the new planting site and speedy planting will increase chances of survival.
9. Time spent on the preparation of the planting hole is not wasted. There is a saying that a 100 vatu plant should be planted in a 500 vatu hole.
10. Choose a site with good moist soil, good drainage and some shade - in nature small palm seedlings are usually in the shade. Dig a hole much larger than the lump of soil surrounding the palm seedling. Dig deep and put a layer of chopped up leaves and some soil at the bottom of the hole. (Putting a few empty tin cans in this part of the hole is a good way of disposing of tin cans and supplying certain minerals for the plant in the future). Cover the leaves with some more soil.
11. When planted, the new seedling should be at a slightly lower level than the surrounding soil so add or take away soil in the hole so that the seedling in its lump of soil will sit just below the level of the surrounding soil. Fill in around the seedling with soil, firm down and water. If water is not available, this process would best be done in wet weather. Cover the soil with leaves to stop it drying out too quickly.
12. If any cow or horse manure is available this could go with the chopped up dry leaves at the bottom of the hole and in the other soil around the seedling. I do not recommend the use of chicken manure unless the grower is experienced - new, fresh chicken manure is very hot and strong and can kill. Old chicken manure is quite good but it must be old. Regular watering, if possible, will help with the establishment of the new plant but overwatering, if drainage is not very good, is worse than underwatering.
13. Put some sort of guard around the seedling to prevent damage from crabs, chickens, dogs, children, etc. Shade will be needed for quite a long time after planting.
14. If leaves of the seedling are long and the plant tends to fall over, do not cut the leaves but put in a stake alongside the plant (taking care not to damage the roots) and tie the leaves loosely to the stake.

15. The chances of the seedling being watered regularly are probably poor so planting out of seedlings should be undertaken during the wet season or preferably, soon after the onset of the wet season so that the new plant will have the whole of the wet season to become established.

I have gone into considerable detail knowing that much of what I have suggested is unlikely to happen. However, the more that can be done, the more chance the seedling has of survival.

#### 4 GROWING OF SEEDS IN THE VILLAGE.

a. In the village of Narango in south Santo an attempt has been made to grow seeds in plastic bags. The success obtained gives me hope that the growing of seeds under relatively primitive conditions will be a success. Old plastic bags in which rice is sold had been used, they had been filled with the soil that was available, they had not been given any special treatment and I doubt that they had been kept properly watered. However, 14 of 20 seeds had germinated. It appears they were in full sun and, when it was seen that the plants were not doing all that well, they were brought (to the other extreme) in to a very dark kitchen. While I believe that many of the seedlings will die, this experience shows that, with a little more knowledge and care, seeds could be grown successfully in villages.

b. It is believed that these plants came from seed collected about March/April 1994 but that they were not planted until August 1994. The photo was taken on 25/11/94. This indicates a delay of about four months in planting and the germination rate indicates that this delay did not seriously affect the viability of the seeds. It also indicates fairly fast growth - the plants which I have seen in Vila grown from seed grown by Nora Devoe also indicate fast growth.

c. In villages it would be unrealistic to expect that anything but a fairly simple procedure will be followed in the growing of the seeds. I would suggest the following -

- in containers
- in simple seed beds.

The containers should have the following properties -

- at least 10/15 cms across
- at least 25/30 cms deep
- of material in which holes can be made to allow water to drain away
- capable of being removed easily without breaking up the soil inside
- be flat on the bottom so that they are stable when full.

The seed beds could be any area, lined with logs, which can then be filled with suitable soil.

- d. Soil for use in containers should be open and free draining, not sticky, heavy clay. Coarse sand is a good additive if available. If beach sand is used, it should be washed to remove salt. If horse or cow manure is available, it could be mixed in. Do not use fresh chicken manure as it is far too hot and strong and will kill the new roots of seedlings.
- e. Water must be available. At Narango Village on Santo water had to be brought from a pool a long way away and up a very steep hill some 100 metres high - it was a major problem.
- f. The container should be filled with soil (not packed down hard) and the cleaned seed should be planted sideways across the container and covered with about 2cms of soil. It should be watered.
- g. All the containers should be stored in an area which is shaded but has strong light (i.e. under a shady tree but not inside a house). They should be protected so that they do not fall over, be knocked over or damaged by animals, chickens, etc.
- h. The soil in the containers should be kept moist. Too much water is bad, not enough water is bad. If the surface of the soil is moist, the soil towards the bottom of the container will be much moister and no additional water is needed; if the surface of the soil is dry, water is needed.
- i. In containers over 300 cms across, covering the surface of the soil with a shallow layer of chopped up leaves or grass will reduce the surface evaporation and so reduce the need for watering.
- j. The sides of the containers should not be exposed to the sun or the soil inside will get very hot and growth will be affected.
- k. Once growth has started, containers should be lifted from time to time to prevent roots growing through the holes and into the soil.
- l. Provided that they have had reasonable care, seed sown in April/May should be ready for planting out early in the following wet season.
- m. The most important item in all of the above is correct watering. Underwatering is preferable to overwatering but the plants must never be allowed to dry out or serious setback to growth will be caused.
- n. The size of the seedbeds will depend on the numbers of seed available and the numbers of trees which the villagers need. I would suggest a bed about 1 metre by 2 metres surrounded by logs about 200/300mms deep. The raising of the beds will help to ensure good drainage. The seedbeds should be filled with a mixture of good soil, chopped up dry leaves and coarse sand (if available or necessary because of the heavy sticky nature of the soil). The seeds should be planted lengthwise across the soil 20cms apart and 20cms between the rows and covered with about 2cms of soil. The top of the soil should be mulched with chopped up leaves to reduce

the evaporation and slow drying out. This would reduce the need for watering. However, as this planting may coincide with the end of the wet season some consideration may have to be given to watering during the dry season. The seed bed should be in the shade which may reduce the need for regular watering.

o. The seedbeds would be open to predation from rats, crabs etc. and a high surround may be beneficial. There would also be some damage to roots when plants were being taken out of the seedbed for later planting out.

## 5 RECLEANING AND STORAGE OF SEEDS IN VILA.

a. On receipt in Vila all seed should be inspected carefully.

b. If seed has not been cleaned properly, it should be soaked in water, cleaned properly and dried in a cool shady place.

c. When fully dry, seeds should be dusted with a fungicide and stored in a cool, airy place. Use paper bags, not plastic.

d. If the use of a fungicide is unacceptable, seed could be soaked in a 10 % bleach solution and dried before storage.

e. 'Safe' insecticides - pyrethrum and derris - and fungicide - lime sulphur - may be alternatives if other pesticides are not acceptable. However, I have had no experience with them and cannot make recommendations as to use.

f. Personally, I like to dust seeds (or soak them) with both a fungicide and an insecticide. If nothing is used, the possibility of fungus and/or insect attack must be accepted with the possibility of loss of viability and value of seeds. For personal reasons, I do not use the fungicide Benlate.

## 6. GERMINATION TRIALS IN VILA.

a. As seed will not be available until March/April 1995 and the Project is expected to finish some six months later, long time germination trials are not possible unless some person or organisation can be found to continue them.

o. Before proceeding with germination trials a number of facts need to be made clear.

1. In very, very few cases can you expect 100% germination even when the seed is fully mature and has been cleaned and planted without any delay.

2. Seed may not germinate evenly. Some seed in any batch may germinate within a month or two; other seed in the same batch may germinate haphazardly over many months.

3. Seed from some palms may not begin to germinate for many months and may continue haphazard germination over a period of years.
4. To give some examples from my own experience -
  - seed of *Chrysalidocarpus lutescens* (the Golden Cane Palm) usually begins to germinate after 6 weeks to 2 months and seed ungerminated after 4 months will usually never germinate.
  - Seed of *Pelagodoxa henryana* usually had a germination rate of about 30% but, when subjected to a constant temperature of 30 degrees celsius 100% germination was achieved over a 1 month to 10 month period.
  - Seed of *Acrocomia* sp. did not begin to germinate for 24 months and then had a 20% rate.
  - Seed of *Raphia* sp. germinated over a period of 1 month to 24 months with a 75% germination rate.

The last two examples are extreme cases but show the enormous variation which must be accepted.

5. Every batch of seeds will vary considerably for reasons which may be difficult to ascertain. Seed collected early in the season may give better results than that collected later - or vice versa ! It is my belief (educated guess ?) that *Carpoxylon* seed will prove relatively easy and fast to germinate.

d. I believe that there is likely to be considerable advantage to be gained by the use of constant heat in the germination of most tropical palm seeds. This might appear at variance with the belief that *Carpoxylon* seed is believed to mature at the end of the summer (wet season) and, presumably, germinate during the cooler months.

- e. The germination trials in Vila are intended to show -
  - the results which can be expected from different methods of germination so as to recommend the most successful method to growers and/or purchasers of seed.
  - the effects of delays in the planting of seed and to establish the viable life of seeds.
  - if a commercial export is set up, to check the germination rate of each batch exported.

- f. I would recommend testing germination in the following ways
  - in soil, 1 seed per bag (PB 6 1/2 available in Vila) with seed half buried lengthwise across the bag.
  - in soil, 1 seed per bag (PB 6 1/2 available in Vila) with seed buried to a depth of 2 cms lengthwise across the bag.
  - In sealed clear plastic bags, 10/25 seeds per bag depending on size of bag, no soil, but a wad of damp absorbent paper, cardboard or other similar material.

1. PB 6 1/2 black plastic plant bags should be filled with an open, freedraining soil mixture. The addition of coarse sand would be helpful. Horse and/or cow manure could be added although this will probably introduce a lot of weed seeds. Water and leave overnight, the soil will settle slightly. Press seeds into the soil with the seed length wise across the bag with both ends slightly buried and humped side of the seed open to the air. Place the bags in a shaded area (approx 50% shade) and protect from damage by chickens, animals, children etc. Soil should be kept moist but not too wet - water only when the surface of the soil begins to dry. The sides of the black bags should be protected from the sun as otherwise the soil will heat up too much and affect germination and growth.
2. As for 1. above but seeds are planted and covered with 2 cms of soil.
3. Some moist absorbent material is placed in a clear plastic bag. I use spaghnum moss which is readily available in Fiji but any other suitable material can be used as its purpose is to keep the air in the bag at maximum humidity. Seeds are added, the bag sealed and then hung up in strong light but not in direct sun. Temperatures rise inside the bag but fall again at night. Hang the bags so that one bottom corner is lower than the other. If free water accumulates in the lower corner the absorbent material is too wet. Open the bag and drain away the free water then close the bag again and hang it up. Repeat the process until no free water accumulates in the low corner.

I much prefer this method of germinating seeds because

- germinating seeds are clearly visible through the clear plastic.
- as seeds germinate, they can be removed and planted in the black plastic plant bags and so reduce work.
- fungus attack can be seen and seeds can be taken out and recleaned.
- seeds are not subject to attack from insects and other pathogens usually present in soil.
- germinated seeds can be left in the bags for some weeks and planted out in less busy periods in the nursery.

g. I believe that most growers overseas would use a sterile medium when germinating palm seeds - spaghnum moss, perlite, vermiculite, etc. If it was decided to sterilise the soil in which tests in Vila are undertaken, the best method would probably be heat. However, it is important not to add any fertilizer to soils being sterilised by heat as toxic levels of salt can build up which will severely damage the roots of newly germinated seeds.

h. The number of seeds in each of the above trials will depend on the numbers which may become available. If a large quantity of seeds is available it would be good to use 100 seeds in each trial; if smaller numbers are available, not less than 25 seeds should be used for each trial.

i. To extend the trials and to test the continued viability of seed the following action should be taken -

1. Repeat each of the three tests using a minimum of 10 seeds and 25 if possible, at monthly intervals for a period of at least six months, longer if enough seeds are available.

Assuming the first tests were done in May, further tests would be done in June, July, August, September, October, and November - longer if seeds are available. The information obtained from these continuing tests would be valuable for the agents in Australia and the USA who will be handling the seeds there.

j. Further information which might be useful would be to compare germination rates of seeds from different areas. On Malekula, some palms were much more vigorous than others - are better results obtained from more vigorous trees? Is there a difference between young and old trees? Generally the trees I saw on Santo were not as vigorous as many of those on Malekula. Is there a difference between cultivated trees and those growing in primary forest? Do seeds from Tanna (good soils) give better results than those from Aneityum (poorer soils)? These are supplementary tests which could be carried out if sufficient seeds become available from different areas.

k. careful records need to be kept. These include

- date seeds received in Vila and numbers
- area, village from which received. Wild or cultivated.
- condition on arrival - seeds which arrive poorly cleaned may have a different germination rate due to fungus or insect attack.
- dates the seeds are laid down in all trials
- dates first seeds germinate - in seeds planted in soil this will have to be the date the first shoot appears through the soil. Seeds in plastic bags may appear to germinate

more quickly but I believe that would only be because new growth is more easily seen through clear plastic.

As experience has shown that fully mature seed will probably germinate in about a month, I think a record should be kept of the number germinating each week. After two months I would lengthen the checking period to monthly.

Seed not germinated after six months (four months if germination has been good and rapid) should be dug up and checked to see if it is still heavy. If still O.K. it should be replanted and left for a further few months.

l. Seeds in plastic bags should be removed as soon as it is clear that they have germinated and planted in soil in P.B. 6.5 bags.

m. Having met a number of people in Vila, I would strongly recommend that Mr. Charles Rodgers is the one who should be asked to carry out the trials. In discussions he showed understanding of the need for the trials. He is technically competent to carry them out

and, best of all in my view, he is keenly interested. He is keen to grow seeds of a *Veitchia* spp. which is on the property where he lives and which is used for building - much of it has been cut out and he appreciates the need to farm it for future use. He could possibly also germinate seeds of *Veitchia montgomeryana* for ensuring the future of that palm. I have left various plastic bags, etc. with him but he will need to see my notes on the germination trials.

n. A number of palms have been sold - including some after my talk at the university. I hope that John Dowe's seminar will also add to the interest in getting the palm into gardens around Vila. I believe that it is important to generate, through publicity, a lot of interest so that as plants become available, there will be gardeners waiting for them. I shall also encourage Elsa Miller (who is doing the landscaping at the Royal Palms) to include them in her plans.

o. If and when a commercial operation begins, I would strongly recommend that a small percentage of each shipment be retained and tested, using the most successful method found in the first trials. Although overseas buyers take the risk of the viability of the seed they purchase, I believe it is valuable to have some evidence of viability if complaints of non-germination are received. Germinating some seeds locally would also keep a steady stream of plants available for use in Vanuatu.

p. It is relatively simple to send palm seeds to Australia. No permit is necessary to import. Seeds must be clean and dry and I understand that a dusting with a fungicide is preferred. No phytosanitary certificate is needed. Any further treatment necessary is done in Australia.

q. Importers in America get a permit and a batch of green and yellow stickers with the permit number on them. This sticker must go on the outside of all shipments - the shipment is intercepted by the quarantine authorities and, after inspection, passed on to the addressee. A phytosanitary certificate is needed by the U.S. Authorities prefer no treatment as chemicals which are banned in America may be used by other countries. This is where soaking in a bleach solution can give a measure of protection.

These requirements may change and can be checked when a commercial operation is planned later.

## 7. Germination trials in Townsville

a. It was agreed that no trials would be undertaken in Townsville.

b. However, if it could be shown that *Carpoxydon macrospermum* were tolerant to the lower temperatures in less tropical climates, it would very greatly enhance the horticultural value of the palm. This tolerance to cold is one of the major factors in the world-wide popularity of the *Howea* spp.

Could I suggest that some thought be given to giving some seeds to Townsville with a view to germinating them for distribution to selected growers for testing of cold tolerance.

8. Horticultural possibilities of Carpoxyton macrospermum

a. Having seen more than 50 of these palms on Malekula, Santo and Efate and from my personal experience of the two specimens that I have in Fiji, there is absolutely no doubt in my mind that this will prove to be an excellent palm for horticultural purposes. Well grown palms have good colour, a strong, quite stately appearance and the arching of the leaves is also an attractive feature. Old leaves fall away leaving a clean fairly smooth green trunk. The crownshaft is clean and striking. I have only seen infructescences with green fruit but as the fruit ripens bright red, this should be a striking feature. There seems to be a tendency for the old infructescences to remain on the tree - rather untidy - but, in a garden, these could be easily cleared away. In most cases, the palms were erect and straight.

b. When young the palm leaves recurve to the extent that they touch the ground so the palm will take up a fair bit of space and this might not be too good in a small garden. The specimen I have planted in the Thurston gardens in Suva in 1989 ( it came from Vanuatu as a seedling in 1987) is a very attractive tree and the leaves are now lifting above the ground - you have a photo of this. It has had no supplementary watering or fertilising since it was planted and the soil in the gardens could not be described as good. It was not damaged greatly in the cyclone of January 1993 and withstood a period of very dry weather (for Suva) in mid 1994.

c. My other specimen is in a Cotta pot (similar to those available in Vila) some 600mm across. It is growing extremely well, slightly smaller than the specimen in the ground in Thurston Gardens, but it has had regular watering, fertilising and good general care. Some palms will not accept the constriction of the roots when growing in a pot - Carpoxyton macrospermum is very happy and this is a very great horticultural plus for the palm. The palm is over three metres high and four metres across. It had pride of place in my display of palms at the September Flower Show in Suva and was much admired.

d. If trials could prove that this palm had some tolerance of cold the potential for sale of seed could be increased very greatly.

## **APPENDIX IX**

### Field Report

#### **The Palm Carpoxyton macrospermum Population Survey.**

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**Japheth Hidson**

The Profitable Environment Protection (PEP) Project engaged the services of a palm taxonomist, Mr John Dowe to conduct the survey in order to understand better the nature of the existing population, distribution and available resource to provide where possible guidelines for regulations covering population, production, harvest and export of seed/seedlings. Mr Japeth Hidson (reporter) is contracted to act as a guide, assistant, and interpreter for the palm taxonomist through out his field work in Vanuatu.

This report covers mainly of the contractor's work and impressions about the distribution, vigour and quantity of the palm Carpoxyton on the islands visited. The field survey starts on the 2nd November 1994 and ends on the 7th of December the following month, with a seminar by John on the 6th, December.

#### **1. EFATE**

The palm taxonomist arrived on the 2nd november 1994. Picked up at the airport by Mrs Suliana Siwatibau (Vanuatu PEP Coordinator). I met John in the afternoon, when he was officially introduced to the FSP staff by Suliana. We collected some contour maps from the Land Survey Department for the survey. Later, John did some briefings the palms generally in the Pacific and particularly the palms of Vanuatu, especially the endemic Carpoxyton. He had some slides and photos illustrations.

3/11/94. Working on the reconfirmations and arrangements of work following the scheduled work programme.

4/11/94. Our last preparations, shopping and getting necessities for the survey.

## 2. ANEITYUM

The field survey team comprising of 2, John and I arrived there by plane at about 10.30am. The Chief was not at the airport to meet us, however we got a taxi boat that transport us across the passage to the main island taking roughly 15 minutes. We got off the boat with our gears and things and walked up to the forestry staff vacant house and this would be our home for a week. The message of our presence quickly got to the Forest Supervisor and in few minutes he was with us Mr Titiya Kelly with another islander Mr Serel who were our guides for the rest of the week.

After short briefing on the survey, we showed them some photos of the Carpoxyton and the name 'NAHOICH'. To this they said the name is referring to palm tree they have. We know they are talking about the Carpoxyton, so we asked them to outline the areas they know off that are having this palm that we may visited.

Our first site was at Anunapoth about 1 km walk from Analcauhat. There is a single plant about 8 metres tall with 10 or more seedlings growing amongst coconut palms, altitude 5 m above sea level with soil alluvial over coral. This was reported to be planted. Francais Wanieg's father. We collected some specimen from this, flowers and fruits.

We located others, 2 adults 8 metres, 2 juveniles and 1 seedling. These were also reported to be planted (adults) amongst coconut palms with some secondary forest surroundings, Ficus. spp Inocarpus fagiferus and Barringtonia edulis. Altitude about 10 m, growing on alluvial soil. The area is known as unuhuc.

We found another 2 adults plants at Anatawei in Jimmy Yaheng's coconut plantation. These were reported to be planted by Mr Yaheng's uncle. The two are about 9 metres height, growing at an altitude of 5 m in alluvial over coral. The surroundings are coconut palms and a few secondary bushes. Mr Yaheng mentioned that people planted them, because long ago, the sheath is used as dish and flowering pod for drinking kava or water, but didn't know where they got them.

That afternoon we walked up about 10 m passed Yatalao, close to the river, we located some Veitchia spiralis (Noquoy) they were growing in groups (7) with many seedlings. We collected some flowers, ripe fruit and leaves samples. These are at an altitude of 70m and average height of 18m tall. The soil is probably alluvial on river banks amongst some secondary bush. These are reported growing naturally.

On the 7th of November, the boat took us to Umetch, with our Guide Serel and Boatman Titya Kelly. On the river side in the coconut plantation we found 2 adults, no seedlings. They are about 7 metres tall growing at 10 m altitude on alluvial soil. These are reported to be planted. There are on juveniles or seedlings counted though we collected some fruits.

The next were seven (7) adults planted by Chief David Yutaea of Umetch in advance. The appears to be shorter, 7m tall, and looks healthier, with big long fruits. There are no juveniles but quite a small population of seedlings maybe fifty or more. These however were planted, as the chief is thinking of building a house there. There are also some Caryota planted. The altitude is about 50 m and growing on partly clay loam.

There are three (3) adults in the Umetch valley, no juveniles but less than 10 seedlings. The vegetation is secondary forest, where gardening has been done. Soil, alluvial river deposits, at 10m altitude.

On our way back to Analcauhat, we stopped at Anoyac to see another reported planted adult by Serel's father up the valley. This is shorter, about 6m at 10m altitude growing on alluvial soil. Surrounding forest is secondary, comprising of *Inocarpus fagiferus* *Pometia pinnata*, *Ficus* spp and some coconut palms.

On the 8th, we tried Port Patrick area, but unfortunately we were unlucky not to find any. This was unfortunate because here was the first collection made a century ago. However we stopped at Itchapthau to see one only plant with about 10+ seedlings in a garden area, reported also to be planted. It is about 7m tall growing on alluvial soil over rock.

The next day, which is the 9th of November, we managed to get to Anetchininbeke on the South Eastern side of the island. We walked up creek about 1½ km about 200m altitude, there are big population of *Vietchia spiralis*, (Nakou), *Caryota* spp (naprei) and amongst them are *Carpoxyton* stands (Nohoich) of Natural stand growing in Primary forest, on alluvial rich soil vigorously, and are well protected by the surrounding vegetation. Here there are about 7 adults, average 12m, 10+ juveniles and numerous seedlings.

This indicates that *Carpoxyton* should grow best where other palm species are growing, ecologically, and naturally. But can always grow well if planted in the right area that it is well adapted to. On Aneityum we were told, that this palm appears to grow faster than else where and much healthier. These seen around are flowering and having some fruits but not yet mature.

Joh and Richard walked up the Lawan Lelegher to find only 1 adult, 10 juveniles and 50+ seedlings. This is reported to be planted, but growing in rich soil in valley and well protected.

Our last visit on Aneityum to Anwatch, where we climbed the steep hill up to about 400m altitude to see a small population of *Clinostigma harlandi*. The palm spp is known on Aneityum as sacred tree for various reasons. It customarily used for burning around garden with coconut flowers/leaves or fruits in villages or homes. They believe it can cause marriage break ups and people leaving villages, infact its a devils tree (Paralegei).

There is a story of *Carpoxydon* spp on Aneityum told by Philip Tepahae. Long ago there were some very tall wise light skin tribes coming from the south in canoes and settled in the south of Aneityum (Umetch) bringing with them this palm. They used the trunk as some musical string instrument. They caused too loud noises with this, that annoyed the people of Aneityum, so they drove them away leaving the *Carpoxydon* and some paintings.

The main uses of *Carpoxydon* on Aneityum are sheath for washing babies, keeping water, and mats. The inflorescence sheath is used for drinking kava.

### 3. TANNA

On the 12th November we flew to Tanna by plane. Arriving on Tanna about 10.00 am we got down to Tafea Coop Rest House booked in, and immediately took off to Yaohnanen area. There about 250 m altitude, there's a natural population of 3 adults, 15m tall, less 10 juveniles and 20+ seedlings, growing very healthy, protected by this huge strangler ficus sp (Banyan Tree) and primary forest, though there is gardening going on around there now. The soil is rich alluvial, looks fairly wet under shade in creek.

At 1.30 pm, we tried Green Hill area and we found another natural population of 5 adults, 27m, no juveniles, less than 10 seedlings. This is in primary forest, down in creek nambinaming. Chief Nakapwe Jimmy is of this area, and their main uses of this Nuokor (*Carpoxydon*) is eating fruits and seedlings (Navara) soil here is rich alluvial volcanic, and very wet, cause it's close to small spring water, well protected by surrounding vegetations at an altitude of 300 m. Two others located in the distance 27m tall.

Afternoon Stanley Womack joined in the team of survey, just arriving from Vila. Sunday rest no work had a walk to Tanna Beach Resort, have lunch and back. Rain starts in the afternoon.

Monday 14th November, Stanley, John and I drove past the Isangel Junior Secondary School to Lownakiamapen area. We stopped at village asked for a guide, who took us to this beautiful site of natural population, well protected from the surrounding forest, that looks wet and maybe becomes flooded during heavy storms. There are 4 adults (healthy) fruiting very heavily, about 27m tall average, 10+ juveniles and 50+ seedlings growing very well under this open canopy, but damp rich alluvial volcanic soil. The area is also full of *Veitchia spiralis*. Lownakiamapen is at about 300m altitude. They have no special uses, and called it Niue (Carpoxyton).

In the afternoon, rain didn't stop, but we had to get to south, because of the tight programme. However the skilful driver, who was also our guide, successfully drove us to Korembenken, where there's one adult planted in garden with one juvenile but not seedlings, children use seedlings for playing games. This is about 15m tall, growing healthy. There is another 2 adults, about 15m tall at Yanemarei, no seedlings or juveniles, also reported to be planted. In the Southern part of Tanna they also called this palm Niuekor. Yanemarei is at 500m altitude and is wet area. There's report that some are around in valleys and creeks around the area. There's another juvenile at Manuapen, planted in garden.

#### 4. MALEKULA

On the 19th November, we flew down to Norsup by plane at 10.35 am arrival, took a bus to Norsup, checking rest house, but found no one waiting, so we went straight on to Lakatoro, found a dormitory type house, although the care taker is not available, we dropped in our gears. On our way to Lakatoro, we saw 1 *Carpoxyton* in the coconut plantation (fruits not mature) about 6m tall. Flowers beginning to come out again, 2 fruits collected. About 10m altitude, no seedlings. Local man told of people, mainly children eat the Navara (young seedlings), 2nd stop was near the first opposite side, there are 4 *Carpoxyton* adults, 2 at 5m and 5 at 8m tall. Seedlings 25 and 1 juvenile. Other vegetation in the "wildpatch" 2 *Veitchia*, *Inocarpus*, *Ochrosia*, *Rhus taitensis*, *Canarium*, and *Psychotria*. A man tending his cattle near by said the tall palms were planted and the leaves were used for broom. We saw another *Carpoxyton* at Lalep village, which was also planted. 1 palm to 8m tall, large green fruit and other in various stages. Name for the palm here is Nibanglu. Spoke to an old lady of 70 years, who planted the palm in her teens i.e the palm was 50-60 years. Fruit is eaten by children and occasionally adults.

2 palms at Rano Amelvet, one 5m and one 9m tall. No fruit collected, have full size green fruit and inflorescence with newly pistillate flowers we saw along road market tables made of split palms (*Veitchia*).

Orap village, one palm, at 4m tall planted in centre of village compound. Man who planted it said the plant is about 13-17 years. Inflorescence clasping scars indicate that it had been flowering for an estimated 6 years. Planted primarily for brooms, and secondary for edible nuts. Man's name was Kinomer Atoari. The name for the palm at this village was Nanimbangal. The dried inflorescence was used as broom for sweeping heavy dirt, and leaves for lighter dirt.

At Wormet village, after a small walk, saw 2 palms, about 12m tall each and 2 juveniles, on slope in coconut plantation under planted Metroxylon. About 100 altitude, no fruits. About 200m away slightly up hill and walking through a village, saw 2 more, 1 about 6m and 1 about 8 m tall, with one seedling. No fruits.

Return to Guest House at about 6.30 pm. Some kava at local Nakamal, to bed 10.30 pm. On the 21st of November we travelled West of Malekula. We stopped at Anwatah, no reports. A Amok area there are 6 reports planted (report from Uri people) the main use is broom and edible nuts.

At Unmet, there is 1 adult Carpoxyton planted by Dirovic Tusai, near water tap. Looks very healthy, only one of those we collected mature fruits. This was planted in 1983. He uses the tree for broom and children eating green pre-mature fruits. Brenwei, across the river from Unmet, we met Chief Kalman Hapsou. He said there is a small population around 10 trees are some where up the bush, at their old village site. He showed some dishes or bowls made from Carpoxyton sheath and brooms that are from those reported above. The bowls can last for 1 to 3 years. The children also eat the Narava. the language name here is Pakel. The same bowl can also be made from Vietchia sheath, but are smaller. The name of the area chief Kalman was referring to is Udualu.

We tried to look at the hydro scheme site at Brenwei, but the road was too wet for the bus to go down the river.

Afternoon after having lunch back at Lakatoro, we went back to Laravet, but couldn't find any. At Lambubu, there is one 1 juvenile planted in 1983, 50m altitude. Its planted in front of the house as an ornamental.

On this same day Suliana and Dick saw 17 Carpoxyton 2 Pelagedoxa. Pelagedoxa endosper, is eaten by children. Carpoxyton called, Nini in Unua (5 villages) other villages on east coast in Nanimbangul.

Reported palms not seen at Uri, includes 6 at Amok. Returned to Lakatoro at 3.30 pm. Changed Guest house to Norsup. Dinner at M. Restaurant and Kava. To bed about 10.00 pm.

On the 22nd of November, starts at 8.30 am, to further north Potovro. We asked the villagers and they told us, one around there. Back towards Norsup stopped at Vao, reported dead one, no seedlings or juveniles probably because of the long draught soil also is very poor and shallow coral over alluvial. Other trees Acacia spirobis and scrubs.

Nawor, 1 adult 6m tall planted 1977 in the village 75m altitude looks healthy, 50+ seedlings gathered in piles and nurseried, some looks weak because of the sand heat and chicken digging them up. Owner of these is Renso Belbong. The adult is the offspring of an original mother planted but dead a few years ago. The Primary use is broom and eating fruits. The fruits looks mature.

Our next stopped was paddling across on a canoe to Atchin Island (small island offshore) Lavalsal. Walking across the island, we came to Chenard village. One (1) adult looking unhealthy on poor shallow coral soil. No fruits collected. Place looks dry, in coconut plantation close to houses. Owner of palm is Tamat Pechou going on further, we came to another small village, where one 1 juvenile (planted) is growing very close to a house. It is 50 cm tall and could be around 20 years old as reported. This although growing probably on alluvial over coral and shallow soil pretty healthy, but slower in growth, soil is drier. Around the same area another juvenile, probably dying soon, growing next to a toilet, coral stones around.

We had lunch at the coast of this village, bread and pork. Straight after lunch we walked back taking the truck around the island through the S.D.A. mission didn't find any carboxylon on way back.

Getting across the passage by canoe, we drove to Belanua, took some reports of 4 adults and 2 juveniles, in the bush, we couldn't see. Walking across the river mouth, in the coconut plantation there's 1 Carboxylon of very poor looking, no seedlings and juveniles. Altitude 5m soil alluvial mixed with coral. Went further up the river, about 20m from the river, amongst Metroxylon (population large) 3 adults between 10 to 12 m tall. They are all growing healthy having numerous seedlings plus 10 or more juveniles. Alluvial soil, river sediments and debts wet, this is the best site visited so far on Malekula.

At Monamboker, in the coconut plantation, there's 4 adults planted 1 25m and 3 7-8m tall, maybe offsprings of the adult. They are all healthy and strong, fruits not mature. About 10m altitude on alluvial wet so close to river (same river mentioned above). Quite population of Metroxylon warburgil. Uses, probably for the same purpose as else where on Malekula. Wormet (Lilrang) 1 juvenile, 2m tall, healthy. Growing in rich alluvial soil near huge Dracontomelon vitiense.

Back to Lakatoro, visited cultural centre, talked with Viani (person in charge) he tried to raise some *Pelagedoxa*, but they all died, presumably they were not well looked after and the soil is very poor, or not suited for the species.

From there, head straight to Norsup, had kava at local Nakamal. Bed time 10.00 pm. Suliana and Dick report 22nd November, Burbar, 1 adult 12m tall, 30+ seedlings, stream inland village, other trees *Inocarpus*, healthy, large green fruits.

Raparinou 1 adult 14m planted 1982 internodes close, 85cm ddh, collected samples 20m altitude, flowering in the 4th year. Rapekteur, 2 adults, about 5.5m, juvenile 1 planted in 1982 by house.

Sunday afternoon 1.30 pm, we drove North East Malekula covering Walarano area. Here their language name for *Carpoxyton* is Nibanglu. The primary uses are edible pre-mature fruits and end of leave for broom. Also children especially eat navara. Every palm seen were planted, and fruits were collected from mother trees located else where from planted ones, but some were planted about 60 to 70 years ago. No one knows where they come from.

At Vitan, 2 adults, planted in coconut plantation, and were reported to be over 70 years. There about 6m tall, no juvenile or seedlings. Fruits looks green but not mature.

Latopo, 1 adult about 5m tall at an altitude of approximately 50m. No seedlings and juvenile, fruits, looks green but not mature yet.

Santa-Maria, old one died because of drought, the owner tried to plant some seedlings again but they died maybe due to lack of water.

Waka are at Samwir village, 13 years juvenile planted by Sam Samuel's mother, about 2m tall. Soil coastal alluvial, 20m altitude.

Navakal, 7 adults, 35 years (was planted) about 14m tall. No seedlings, alluvial volcanic soil at 10m altitude.

Almost every *Carpoxyton* palm seen on Malekula, were cultivated around village gardens or coconut plantation between 10 to 100 m altitude, primarily for the uses of edible green pre-mature fruits, leaves for broom, sheath (kava bowl or dish), and children eating Navara. They appear to be growing very slow and even some replanting dies indicating that *Carpoxyton* will grow better in rich soil that is wet. None has been found in the higher altitudes up to 300m, though Nora has recorded 1 adult planted at 1000m on Santo. The difficulty of raising seedlings and children eating fruits and Navara indicates this species is dying out.

## 5. SANTO

Wednesday 23rd November the survey team travelled to Santo by plane. We stayed at the Unity Park Motel. After booking in at the Motel, it was decided, we split up in two teams again, and we made some changes to our survey programme on Santo. John and I are to have two days on the West Coast, and another two on Ambae, then return to Santo and then have an extra day on Malekula before returning to Vila. Suliana and Dick to do East Santo, and Big Bay area and check on Pentecost.

Afternoon 23rd John, Donna and I went to Casavea, South Santo, where we held a meeting to discuss some differences and complaints from the locals and the FSP/PEP's work on this Carpoxyton project.

The meeting was open by the Chairman, who welcomed us to join them again and they were looking forward to this meeting to clear out some of the misunderstanding amongst themselves and this work on Carpoxyton, referring to discussions Nora Devoe and Livo Mele had left to them.

On behalf of the FSP/PEP, I stood up to firstly thanked the chief, chairman and people for welcoming us. We were late, for this meeting so, I apologized for being late and introduced us and the purpose of the survey team coming to South Santo, explaining why doing the population survey for Carpoxyton palm.

I finished, when the chairman asked about the seedlings collected by Nora and Livo, (Forestry Officer) 6 seedlings for the Parliament House and 130 seedlings for nursery. They said they haven't received any money, or wanted to know what had been done to this seedlings. They generally have the impression that they are the only ones who have these species in Vanuatu.

I told them, I don't know much about what Nora and Livo and their plans on the seedlings collected for them, that will have to be settled by talking with Livo and find out what actually they were proposing to these people, and agreements in terms of money. However, PEP through FSP has no market programmes for Carpoxyton yet. This is research work, but will take necessary steps to investigate marketing possibilities internally and outside Vanuatu. The work so far is to do some research study, that may help towards market establishment, which is very important in this survey.

After some brief explanation, they seemed to be in a position to understand better the work on the Carpoxyton. Then we closed the meeting with small summarized and off the field, looking at some nurseries and juveniles planted. The nursery holds about 100 seedlings of which about 60% dead. The cause of the deaths probably due to lack of water.

24th November, morning at Casavea again looking at 4 adults, close to the river, ranging height 12m to 20m tall wet alluvial river soil, they look very healthy and fruits beginning to mature. No seedlings were recorded, we were told river crabs taking down fallen mature fruits into holes. And there's a deal juvenile standing, plant chewed by thirsty cattles.

Leaving Casavea, to Vunavosi, 1 adult planted in coconut plantation. Height about 9m tall. No seedlings and juveniles. The language name of Carpoxyton around this area is Vininiu Vusa, their main uses is eating fruits and Navara. We also got reports of wild stand at Funavusi. At Veleuro 1 adult about 12 m tall again planted very close to the river. Alluvial river sand, we couldn't collect any fruits or seen any seedlings regeneration, all fruits fell into water. Narango, another adult about 15m tall, right in village.

Afternoon about 12.00 pm, John Dowe, Donna and I flew by plane from Pekoa airport to Lajmoli West Coast Santo. Reached Lajmoli 12.20 pm, met local guide sent by chief of Olpoi. He then directed us to Olpoi about 1.5 km walk.

Reaching Olpoi 1.30 pm, rest 30 minutes, then had a small meeting on the Carpoxyton Population Survey. The chief of village Tavue Malal.

## APPENDIX X

Port-Vila 6 Decemba 1994

Report blong field trip long Tongoa long namba 28 go kasem 30 Novemba mo long Ambrym long namba 1 go kasem namba 3 Decemba 1994

### Inventory blong Carpoxyton macrospermum

Long Tongoa we emi wan volcanic aeland, i gat 5 stamba Carpoxyton we oli young mo 5 stamba we oli mature. olgeta everiwan oli planem long vilej except 1 nomo we oli planem long plantation.

#### OI ples we mifala i faenem.

Long south west long aeland long Lubukuti vilej long wan ples oli kolem shumavarao, sam ples long 40 to 50 m alt., i gat 2 mature stamba we Charley sandri hemi planem long 1974 kolosap long haos blong hem. Tufala stamba oli sem mak nomo kolosap long 9 m high. Long lanwis oli kolem se "nambupu kaimas"(kaimas=ghost). Charley emi bringim frut from Bongabonga vilej.

Long tufala stamba i gat green frut be oli no mature. I gat sam tu we cyclone Vanea i mekem oli foldaon long graon be i no gat mature frut o frut we emi germinate. Oli usum green frut blong kaikai taem emi redi mo navara blong em tu.

Long Lubukuti vilej iet long wan ples oli kolem "Lolaki", Taribua Rubea emi planem 2 stamba; wan emi young, emi kolosap 5 to 6 m high mo narawan emi mature kolosap bae emi kasem 9 m high. Hemi karem flaoa (inflorescence male mo female) mo frut tu. Oli kolem tri ia long lanwis "Nabupuakaimas" (kaimas=ghost). Taribua hemi bringim frut from Bongabonga be hemi no save wanem taem hemi planem. I gat sam green frut tu we cyclone Vanea i mekem oli foldaon. I no gat mature frut o frut we emi germinate long graon. Taribua emi watchem se palm tri ia emi resist long cyclone. Hemi usum gaine (petiolole) blong leaf blong bakem bredfrut long em.

Long mature stamba Stanley hemi kolectem wan inflorescence mo long youngfala stamba wan gaine sample.

I gat wan smol stamba tu long wan ples oli kolem Nasavan long Lubukuti vilej iet we olfala Tomsen hemi planem. Emi kolosap 2 m high be mifala i no gat any infomesem long em from olfala hemi ded finis, be ol man blong vilej oli tink se olfala hemi karem frut from tri blong Taribua nomo.

Mifala i kolectem wan lif sample long smol stamba ia

Long south blong Tongoa long vilej blong Bongabonga long wan ples we oli kolem Kamalamba bitwin 100 to 200 m alt., i gat 2 young stamba we Abed Mosis hemi planem long bitwin 1980 mo 1984. wan emi kolosap 3 m high mo narawan 5m. Oli kolem "Nambupuakaimas"

Abed emi bringim frut from wan stamba mama we papa blong hem i planem bifo be tri ia emi ded finis. Hemi tink se papa blong hem i karem from Epi O Malekula.

Oli no usum tri ia.

Long sem vilej long wan ples oli kolem Tavotalu. Charley Rarua hemi planem wan stamba we hemi young tu, kolosap emi 5m high. Rarua emi karem frut ia from mama stamba long Kamalamba be oli tink se hemi planem long sem ya olsem Abed Mosis

Oli no usum palm tri ia.

Long south Tongoa iet long 100 to 200 m alt. long vilej long Meriu long wan ples we oli kolem Tabale, i gat 2 adult stamba we David Satei i planem long 1975. Hemi brigim frut from mama stamba long Bongabonga long Tabale.

Tree namba 1 emi 4 to 5 m high, emi gat 1 inflorescence we i close (emi covered yet), 1 inflorescence wetem male mo female flowers, 2 infructescence wetem green frut mo 1 dry infructescence without frut. I no gat mature frut long satamba, sam green frut oli foldaon from wind nomo

Tree namba 2 emi 5 to 6 m high, emi gat wan inflorescence wetem male mo female flowers, wan infrutescence we i gat green frut long em mo 3 dry infrutescence without frut. I no gat mature frut be i gat sam green frut we cyclone i mekem i foldaon.

David i talem tufala tri ia oli resist long strong wind mo hemi luk se taem yumi planem tri long shadow o kolosap wota, hemi grow quick.

Long south Tongoa iet long 10 m alt. long wan plantation blong kokonas kolosap vilej blong Panita, Charley Rarua hemi planem wan stamba we hemi young iet. Tri emi kolosap 5 m high. Hemi brigim frut ia long mama stamba long Bongabonga. Mifala i no gat chance blong luk olfala charley blong kasem mo information.

Long West Ambrym we emi wan volcanic soil, i gat nomo 3 young stamba.

#### Ples we mifala i faenem.

Long vilej blong Sanesup (SDA Mission) long sam ples long 10 m alt, olfala Falao Paul i planem kolosap long haos blong hem, bitwin 1980 mo 1990, 2 stamba we oli young iet. wan emi kolosap 2m high mo narawan kolosap 2m50. Falao i brigim frut ia from Epi long wan vilej we oli kolem Campani behind Valesdir plantation.

I gat wan smol stamba mo we Gevin hemi planem kolosap haos blong hem long Sanesup iet. Tri emi kolosap 2m50 high. Frut blong em emi kam from Campani vilej behind Valesdir plantation long Epi. Gevin hemi planem tri ia sem taem wetem Papa blong em Falao. Oli no usum.

Prepared by: Chanel Sam

## APPENDIX XI

### TRIP REPORT

November 23 - 26, 1994

#### WEST COAST SANTO CARPOXYLON POPULATION SURVEY

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Donna Kalfatak

During each meeting with the various villages visited, the purpose of the meeting was introduced by Hidson. He explained the purpose was to carry out a population census of Carpoxylon through out Vanuatu. This special palm is endemic to Vanuatu. The census is to see how much resources of this palm species exist in Vanuatu. The research team also noted the environment these palms occupy, and observed its health. Some of the seeds were collected for DNA analysis to determine genetic variation throughout Vanuatu.

#### Wednesday, 23rd of November 1994

At 3.40pm, Dowe, Hidson and Kalfatak arrived at Casaveia and were met by Toa Vari. The village men were waiting for the team since 1.30pm but due to the teams late arrival they went away. They were later called back by bubu shell. The meeting started at 4.00pm. Toa Vari gave the welcome comments and Hidson chaired the meeting. The meeting was introduced as stated above. It was made clear to them that Carpoxylon is also found in the other islands such as Aneityum, Tanna and Malekula. Also there are some villages in West Coast Santo that have this palm.

Hidson mentioned that Devoe in one of her visits to this village stated that Casaveia would be the centre where Carpoxylon will be distributed to. Again, Hidson indicated to the village men that Dowe's research will determine which areas yielded the best varieties, the best particular area will serve the market if there is one. It was mentioned that at this stage no market is available. Work is still on the way to find a market but the palms should be in a healthy condition to assure best interest from the market we will be selling to.

The villagers have some questions which Dowe and Hidson avoided as they refer to Devoe. I offered to collect the questions at the conclusion of the meeting for the main office in Vila to deal with. Here are the questions:

1. The villagers would like to know how to use the 5000 vatu given to the community? I told them they can use it in anyway they want because it is now their money. However, they would like to know if they could use it to buy more Carpoxyton from their neighbour villages and sell them to PEP?
2. I was told that 100 seedlings and 30 seeds were brought out from Casaveia by Livo, Devoe and another white lady who visited the village 14th of October, 1993. The village showed me their record book where all Carpoxyton transactions and notes are recorded. They would like to know how much were sold out of 130 seedlings and seeds? How much sold per seedling/seed?
3. They are planning to buy seedlings and seeds from their neighbour villages but would like to know how much to pay for a seedling/seed? They would keep these seedlings/seeds in their nursery and later sell them to PEP or a market.
4. There were rumours that someone in the village had sold some seedlings/seeds to a person in town. They would like to know who the seller and buyer were? They thought PEP might know who these people were.
5. They were once told that a net would be used to trap the palm seeds. The question is who will buy the net?

They have a Carpoxyton committee. They are as follows:  
Toa Vari Mele  
Esther Toa  
Susan Henle  
Porucu Tinesi

After the meeting, the team visited the village nursery and later visited a juvenile one that was planted in 1982. The juvenile is doing very well compared to one that is now twenty years old and was surveyed by Dowe and Hidson in Malekula.

Thursday, 24th of November 1994

At 7.00am the team met two guides from Casaveia, Lui Mele and Porucu Tinesi at Casaveia. We visited palms at Narango and one at a nearby garden. One 15m adult palm was observed in a coconut plantation at Narango village. It was reported that this palm has grown wild at Vunavusi. We could not make it up there because it's too far.

On our way back to Luganville, one adult palm was observed at Veleuro, between Talua and Tangoa. It is about 12m tall and grows very close to river on alluvial soil. The seeds dropped straight into the river, therefore there is no chance of regeneration.

Afternoon on the 24th of November, 1994

At noon we left Luganville for the West Coast. Upon arrival at 12.30pm we were met by Lizer Malal, chief Tavue Malal's brother. Tavue is the chief of Ulpoi village, the first village we visited. It took us about 20 to 25 minutes walking to Ulpoi. The chief was not available due to attending a wedding in a nearby village. Most of the villagers also attended the wedding. The remaining villagers gathered in the meeting shelter.

At 1.30pm Hidson explained the purpose of us visiting Ulpoi. The villagers responded that there are Carpoxylon growing in the mountains. It would take a whole day to visit the site. We were taken to a palm nearby the village which they thought was Carpoxylon. Devoe and Walker were shown this palm, making the first recording of this palm. Dowe continued to ask villagers about other palm species.

The fisheries boat arrived about 8.30pm. We had dinner with Lizer and spend the night in his house. We got to the boat in the next morning.

Friday 25th of November, 1995

We left Ulpoi at 6.30am for Nokuku. No one knew of our visit when we first talked to some villagers on the beach. We then introduced ourselves to a guy who claimed to be the chief of Lajmoli area. He led us to the chief's house where we were told to wait at the Nakamal. The villagers were called by the bubu shell. When we got some attendance, Hidson once again introduced the reason why we went to Nokuku. We were told there is no evidence of Carpoxylon at Nokuku. As usual, Dowe got some information from the villagers on other palm species. We left the village about 8.30am and departed for Penauro.

10.30am at Penauro

At 10.30am we arrived at Penauro and were greeted by a family. Penauro was not on the survey list. However, we were told at Nokuku that a palm was planted in this area. We did not meet the chief but talked with a man who used to be this village chief some few years ago. Two people volunteered to guide us to the Carpoxylon. It took us about 40 minutes to get to the site. When we arrived at the spot we found out that the palm was not Carpoxylon but a Veitchia species.

#### 4.00pm at Vasalea

It took us about two and a half hours to get to Vasalea. This day was Sulesai primary school's break up, so few people were in the village. (Sulesai is the nearest school for this village). A husband of a couple who seemed to be the only people in the village decided to take us to the palm. It took us about 15 to 20 minutes to the site. The palm was planted by a man who is now dead. It was a 6m palm, planted among some sago palms. It was shaded by the sago leaves. The name of this site is Peapole. There is a creek nearby and the soil type is alluvial. The local name of this palm is olo-olon. The fruits were not healthy. We spend the night at Vasalea anchorage.

#### Saturday 26th of November, 1994

We left Vasalea at 7.30am and arrived at Elia at 8.10am. We were greeted by the villagers and later met the chief. It was the chief that planted this palm in his garden so he offered to guide us to the area. It took us about two and half hours to reach the palm site. The name of the palm site is Usia which means water sand. The language name of the palm is olo-olon, the same as Vasalea.

There were three adult palms about 6m tall planted among sago and coconut palms. They looked healthier than the previous one we observed. The soil is rich alluvial soil. There is plenty water available in this area. There are more fruits and seeds compared to those in Vasalea and Casaviea. No seedlings were observed due to children eating the endosperm of seedlings. It was reported that upland from this area there is another adult palm.

#### 3.30pm at Wusi

We were greeted by some villagers and explained to the chief the purpose of our visitation. One juvenile palm was planted in 1992 in the village. It was planted on a sandy beach and wet soil close to a running tap. This seedling was brought from an adult palm planted at a river creek up hill from Wusi.

We left Wusi at 4.30pm and arrived in Luganville at 1.30am. It was a good trip except for some big waves on our way back. Unfortunately I got seasick the next day.

In conclusion, the villagers in the villages visited were happy in receiving us. Though some did not hear any radio messages, they were happy to know why we suddenly appeared in their villages.

It seemed that the first three or four villages such as Ulpoi to Penauro were confused of the exact palm we were looking for. Two of the confusion evidence was when we were led to different palm species in both Ulpoi and Penauro.

The last three villages led us to Carpoxyton. They could tell the exact palm when we first showed them Carpoxyton pictures. Two days survey was too short. It was reported that there were some Carpoxyton sites in areas that are remote. Therefore, the survey should have taken three to four days.

## APPENDIX XII

### PARTICIPATION IN A SURVEY OF CARPOXYLON POPULATION IN VANUATU - A field trip report -

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by Suliana Siwatibau

#### Purpose

The trip was undertaken as part of a nationwide survey of the population of the rare palm, *Carpoxylon macrospermum*. PEP had engaged a palm expert, Mr. John Dowe to do the survey. I joined him with two others to cover the two largest islands of Vanuatu - Santo and Malekula.

#### Itinerary

The survey of Malekula and Santo took place from Saturday 19/11 to Saturday 26/11. The team worked in Malekula during the period Saturday 19/11 to Wednesday 23/11 then moved to Santo for the remainder of the period to 26/11.

#### Team Members

The survey team for Malekula comprised - John Dowe, Dick Phillips, Japheth Hidson, Chanel Sam (2 days only), and myself.

#### Method of survey

After the first two days working together in Malekula we split into two teams so that we could cover as much of the island as possible. It was necessary to work together the first two days so that we could standardise information gathered. We travelled north of Norsup on the first two days. When we split, John and Japheth continued to work in the north and went west. Dick and I worked southward from Lakatoro reaching as far south as Ronovie village, which was at the end of the road.

We carried photographs and fruits with us to show the people as we went around the island. We stopped at every other village, asked people if they had seen the palm and showed them the photographs and samples. At each village people knew whether the palm would be found in the neighbouring villages. Therefore we in effect covered all the villages. Information on each village was provided from at least two other villages.

Every reported palm close to the village was visited. We counted the number of adults (either has or is now fruiting or flowering); juveniles, (never produced fruit or flower, but has a distinct trunk); and seedlings (young ones without a clear

trunk). We recorded general health of plants, species associated with them, ecological conditions, age if available, height, diameter of trunk at breast height, number of inflorescences and infructescences, and presence of any pollinators. Mature fruits if found, were collected for despatch to AIMS for DNA analysis and the rest were kept for herbarium specimens. There were very few of these.

We also collected information on the local language names, the reasons for planting, the cultivators, and the uses made of the various palm parts.

## RESULTS

Information gathered by Dick and me was transferred to John Dowe for the final report. The information Dick and I gathered are summarised here for each village visited.

### I. MALEKULA VILLAGES:

#### NORTH OF LAKATORA CENTRE

##### 1. Tautu

(Small and Big Tautu) Between the airport and Norsup

Six adult trees and 13 juveniles and 5 seedlings were sighted. The tallest of the adults was 6m. The adult trees all had fruits at different stages of development up to almost mature green ones. No ripe ones were sighted. Two of the trees also had inflorescences where the male flowers had died and the female ones appeared to have been recently pollinated. Four of the trees were close together within 5 to 10 meters of each other, while the other two were solitary. One was in a village while the rest were amongst coconuts.

The juveniles were growing very well in small thickets amongst coconuts.

Tautu people call this palm NIMBANGLU which means small coconut. They eat the green fruit when the flesh turns jelly-like, and the germinating seed - called navara is supposed to be very popular with children because of its sweetness. This term navara is generic for germinating palm seeds. The top third or so of the large pinnate leaf is cut off when the leaf dies, and is used as a broom called - NOROK NE NIMBANGUL.

Components of thickets associated with the palm in this area include, *Inocarpus fagiferus*, *Rhus taitensis*, *Pometia pinnata*. and *Croton* spp. These are common secondary bush trees that usually grow in fairly fertile, well drained areas but with ample supply of moisture. The soil in the area is mainly sandy loam.

People told us that the palm is cultivated in their area from seedlings collected from other parts of Malekula. They could not recall the origin of the palms but remember them only as having been part of the local cultivated vegetation. The main purposes for its cultivation here are for the valued broom and for the edible fruit and navara.

## 2. Rano Amelvet North of Norsup

We saw on the land belonging to this village a total of 5 adult trees and no juveniles. The tallest of the adults was 10m. All trees were planted, the oldest being estimated at over 70 years of age. Trees ranged in height from 5m. to 10m. All had fruits at different stages of development but with none close to ripening. We were informed that the trees usually take about six months from flower to ripe fruits and take a six months rest before the next flowers are produced.

No seedlings or juveniles were found either close to the adult trees or anywhere else on the areas visited that belonged to this village.

The people in this area call the palm NIMBANGLU and cultivate it for its edible fruit and navara, its leaf top for broom, and its leaf sheath used as kava bowl and as baby bath.

Two trees were growing in grassland by the roadside, while the others were found in abandoned garden sites well outside of the village. Associated vegetation was dominated by grasses with a few scattered coconuts, low trees and shrubs of secondary vegetation. The soil in the area appeared to be loamy clay with some sandy loam and of varying depths in top soil. The long dry weather had not affected these trees as adversely as it had affected others further north.

People in this area do not recall any stories about the origin of the palm either inside or outside Malekula. They remember it only in cultivation.

## 3. Sanwir Village North of Norsup

Here we sighted one juvenile of 13 years of age, and a trunk less than 1m. growing in a valley on sandy soil. This was planted by Chanel's mother, so that the age was fairly accurate. It is in a shady grassy area. It does not appear ready to produce flowers yet which was a little surprising when compared to other trees of similar age in other parts of Malekula.

We did not have time to visit the sites of 7 adult trees reported to be growing in the general area surrounding this village. The people here also use the leaf broom and consume the fruits. They call the palm NANIMBANGUL.

4. Orap Village  
North of Norsup

Here we were delighted to find a very healthy and heavily fruiting palm of only 4m high, inside the village by the house of Kinomer Atuan. The ground was covered with a thick layer of crushed coral. The owner believes that the palm is growing over a drainage channel enabling it to survive the long drought so well and to fruit so profusely. We were informed that the tree was up to 17 years old having been planted from a seedling carried in from the bush, and that it had begun fruiting at about 8 years old. The bush trees were in abandoned gardens and were reported to number 7 to 15. We counted at least 10 infructescences with fruits at different stages of development and 2 young inflorescences. There were about 250 fruits on each infructescence.

The village name for the palm is NANIMBANGUL. They cultivate it for the leaf broom, and the edible young fruit and navara.

5. Wormet Village/Achin  
North of Norsup

Here Eribert's father planted two trees close together in amongst coconuts about 50 to 60 years ago. They were 10m and 12m high. The trees were on a hill at about 100m elevation growing on steep slope with clayey exhausted soil, and rather dry conditions. Both had no fruits or inflorescences and did not appear healthy at all.

There were 2 juveniles both over 1m high.

6. Wormet/ Potnevul  
North of Norsup

Here Mathison Jacob had planted two palm trees in amongst coconuts just outside the boundary of the family settlement. They were 8m and 10m high. Again because of the long dry weather, there were no fruits or flowers on either tree.

We found 2 seedlings of less than 1m high.

In Wormet the palm is called NIMBANGUL.

7. Lavalsal Village  
North of Norsup

Here we found an adult tree about 36 years old 14m high, growing in a coastal grove of coconuts about 50m from the beach. The tree was on sandy loam and doing moderately well. It was planted from a seedling collected from an older tree in abandoned gardens in the bush, where at least 10 trees were reported to occur. The parent tree was estimated to be over 50 years old.

The people of Lavalsal village call the palm NANIMBANGUL and cultivate it for the leaf broom and for the edible green fruit and navara.

REPORTED tress in the villages north of Norsup all appear to be in abandoned garden sites, while those we sighted were definitely planted. We did not gather any evidence of a natural stand in the area of Malekula north of Norsup.

#### MALEKULA VILLAGES - SOUTH OF LAKATORA CENTRE

##### 8. Patne in Lichlich Village land.

Tonel Malingmen showed us two palms he planted 34 years ago in a coconut grove on a flat high area close to the sea. He had obtained the seedling from his father's tree which had since died. The trees were 18m and 8m high and appeared to be relatively fast growing from the width of their internodes. These were 10cm to 13cm wide. They had a lot of fruit which unfortunately been badly shaken by the recent cyclone. Tonel informed us that the trees took about 10 to 15 years before fruiting, and that ripening of fruits coincided with the growth period of the yam vine.

One seedling of less than 1m height was carefully protected from damage by land crabs with a sheet of corrugated iron.

These trees were growing in rich, well-drained, sandy loam soil, aerated by numerous land crab activities, and a moist environment with closely spaced coconuts and native coastal species. The ground was relatively bare with scattered small shrubs including clumps of heliconia.

Lichlich villagers call the palm NIMBANGUL. The leaf tip is much valued as a broom while the fruits are popular items of consumption as in other parts of Malekula.

##### 9. Potindir Village

Here we found an old tree of 18m height but having no fruit or flowers at all. We were informed that it may be at least 80 if not more years of age. No one had seen any fruit on it for at least two years. It was growing in a cocoa and banana plantation with Inocarpus, Macaranga and thick grass. The trunk was very thin and the internodes narrow (2cm - 5cm) indicating poor growth.

The local people reported one healthy adult in the garden area. They call the palm NIMBANGUL. The valued leaf broom is called NURUK NIMBANGUL. The slow growing trunk is much stronger than that of the fast growing Veitchia (Nini), and is used here for house building and for pig sty posts.

#### 10. Louni and Limap Villages

These two villages had no Carpoxyton close to the settlements and therefore we recorded none, although they reported the presence of the palm in the bush where they were planted by the ancestors. They also reported existence of planted trees in the offshore islands of Uri and Uribiv. The palm is known as NIMBANGUL in these two villages.

#### 11. Taremp Village

This village is situated by the sea some short distance from the main road. Here Rion showed us 4 adult trees close to the village in his land. We were particularly impressed by one, about 10m high, growing at the edge of the coconut grove, on the bank of a small stream. The internodes ranged from 10cm to 15cm wide indicating rapid growth. The trunk was a robust 23cm dbh (diameter at breast height). The tree had fruits but there were so many inflorescences closely arranged and very heavily fruiting, it was impossible to count from the ground. There also were 2 inflorescences with pollinators active on the re male flowers.

This tree had 9 seedlings less than 1m. and 1 seedling over 1m.

The additional 3 adult trees were planted by Rion's bubu in amongst the coconuts in the same grove. They looked healthy, with fruits of a range of sizes, and no flowers. Internodes ranged from 7cm to 10cm wide.

The local name for the palm here is BANGUL. Flying foxes as well as humans consume the fruits.

#### 12. Unua No.1/ Remet Village

Here we sighted 2 adults very heavily fruiting with probably 10 to 12 infructescences from recently fertilised female flowers to large almost mature fruits. One was 7m while the other was 13m high.

#### 13. Unua No.2/ Mbatambong Village

We found 1 adult of 6m height and about 16 years old. The owner reported that it began fruiting at 15 years of age. The tree was planted in 1977 beside the owner's kitchen surrounded by thick growth of Sida scrub and amongst a stand of Pandanus, Citrus, and Hibiscus tiliaceous. It appeared relatively healthy with 6 infructescences, bearing a range of fruit sizes, and one inflorescence with ripe male flowers heavily swarmed with flies.

#### 14. Novor Village

Here we found one very tall slim adult, of about 25m height, estimated at over 60 years old, on the top of the hill by the village border and amongst coconuts, and another adult down in the valley by a dried stream bed amongst lush stand of palms and tall trees including; Kleinhovia, Barringtonia, Heliconia, Veitchia, and Licuala grandis. The hilltop tree had not fruited well this year, with 5 infructescences and rather small fruits. The valley tree was very healthy, and heavily laden with large fruits. There were so many infructescences, it was difficult to count. Definitely over 10 of them. Children savour the navara so that despite the favourable ecological conditions for regeneration, only 1 seedling of less than 1m. high was found in the area.

The villagers reported another tree in the bush with many seedlings.

#### 15. Unua No. 4 /Rupo Village

One adult tree, about 20 to 25 years old, growing in exposed dry area by the toilet in amongst grass. It was about 6m high. The fruits were rather small and infructescences light. Trunk internodes ranged from 2.5 to 4.5cm showing slow growth.

#### 16. Unua No. 3/Penamor Village

One adult 20m tree over 60 years old with very few fruits because of the drought, was found in amongst cocoa and coconuts. No fruits or seedlings were found on the ground due to heavy harvesting of the navara by children.

Villagers reported 4 more adults in the bush.

#### 17. Unua - Blacksand area

Here we found 3 adults, 3 juveniles, and 3 seedlings. The tallest adult was 14m high. One of the adults was very old. It had 2 newly opened inflorescences, and 3 infructescences with a range of immature fruits sizes. The other two adults were both growing in damp well drained situations inside a cocoa plantation. Both fruited heavily with large green fruits. These were expected to be ripe by February/ March. One of these two was planted while the other had regenerated naturally from a planted tree that had since died. There were 3 other healthy juveniles of up to 4m. high growing in a clump with it, and amongst a tall (30m) thicket of Semecarpus, Inocarpus, Bischofia, and

In all of the UNUA area the palm is called NINI which is also the name for Veitchia. In all the area too the leaf is used for broom while the fruits are consumed both in the green stage and as navara.

18. Mbwitin Village.

This village had no Carpoxyton within the village area, but reported extensive stands at least half day's walk into the mountainous interior, in the Small Nambas land. Also called NINI in that land it is reported to grow in the:

MANDU area - Londobue, Kamalvir, Yapkalas

BOTKOT area - Lemanrobun, Malbow, Vetmumb

TENMAS area

The above areas are reported to have large stands of Carpoxyton with *Pelagodoxa henryana*, *Veitchia*, and other palms, in or near old settlements/schools run by French missionaries. We deduced from the descriptions of the stands, and from the presence of the non-native palm *Pelagodoxa*, that the Carpoxyton was probably not in a native stand in the Small Nambas area. However this needs to be confirmed.

19. Pangumur Village

This had a 5m tree beside a grave in front of a bathing shed inside the village. It showed signs of wind damage from the last hurricane. We noted 5 infructescences with damaged fruits and 2 inflorescences with mature male flowers swarmed with flies. The tree was slow growing in the exposed situation with internodes ranging from 2.5cm to 5cm.

The local name for the palm here is NINI. The leaf is used for broom and called NESIR NINI. Only the green fruit is consumed. Consumption of navara was unknown.

20. Bangir Village

This village had one 7m adult tree of poor growth and one juvenile of robust growth. The adult showed wind damage from the recent hurricane and stress from the long dry season. It was in exposed situation beside a kitchen. It had 5 infructescences and 2 inflorescences with ripe male flowers.

The leaf is valued for broom known as NESIR NINI.

The villagers reported others in Rerep village.

#### 21. Lanvitvit Village

Here we found 2 adult trees of 5m and 5.5m height, planted about 70 years ago, by Andrew's brother. They were on the hill slope on fertile well drained soil at about 20m altitude and about 100m from the sea. They were amongst bananas, breadfruit, macaranga and native hibiscus. They each had about 8 to 10 inflorescences and infructescences with a range of fruit sizes.

Here the palm is called BANGUL. The leaf broom is called NISAR BANGUL. The edible green fruit is called MELLAKAS, while the navara is called MABUKULA.

#### 22. Rapaksir Village

We found here an adult of only 1.25m height, planted after independence (1982) and in its 4th year of flowering. It had only 3 inflorescences but was robust although evidently slow growing. Its internodes were very narrow ranging from less than 1cm. to 2.5cm. This tree was planted beside a home in the village.

The local people call the palm BANGUL, and use the leaf top as a broom known as BANGUL NESAR.

#### 23. Rapakteur Village

Close to Rapaksir village, this village had 3 trees only about 1.5m high, all planted together about 1982, by Samson, around his dwelling place. Interestingly, two plants that were in more sunny location had begun to flower. The third, in the shade of coconuts, was still a juvenile.

The trees were planted because of their decorative value. The local name is BANGUL, while the useful leaf broom is BANGUL NESAR.

People of these two villages reported the occurrence of "plenty" Carpoxyton trees in the bush where the wild bullocks graze. These stands were the sources of their seedlings.

#### 24. Bonbur Village

This village had one adult 12m tree planted behind the village in amongst a moist thicket of Pisonia, breadfruit, Aleurites, native hibiscus, and native shrubbery. Its undergrowth was largely of grass and ferns preventing easy collection of navara. Thus it had at least 31 seedlings thriving around its base. It was difficult to detect all the seedlings due to the presence of tall grass.

The people here use the trunk of Carpoxyton for house construction as it is very strong.

## 25. Ronovie Village

This was the southernmost village visited. It had no Carpoxyton cree in the village grounds, but the people knew it well and reported its occurrence in the high plateau behind the village. The local name for the palm here is BANGUL BUAT, while Veitchia is called Bangul Vavin. The only use reported to us from this village is that of the navara which is consumed by children. Women do not use the leaves for broom. This is surprising given the high demand for this use in the villages north of this location. It is likely that the palm they refer to could be a large fruited Veitchia. This needs to be verified.

## II. SANTO VILLAGES

The survey team again split into two groups in Santo. Donna joined Dowe and Japeth who surveyed part of South Santo including Casavea, and the rugged west coast. They travelled most of the way by boat. Phillips and I travelled north-east to Hog Harbour and Big Bay then made our way southward as far as Narango village.

We planned to complete our survey in one and a half days then fly on to Pentecost where the palm was reported by a local informer to occur. Unfortunately we could not get seats on the plane so had to engage a forester, Mr. Harry Bule, to survey Pentecost for us.

We travelled extensively in the Big Bay/ Jordan River area, Hog Harbour/Sara/Shark Bay area and went across to the interior where we drove southward through Butmas village to Tanafo and on south to Luganville. We were surprised at the absence of natural stands of palms in the interior. The only palm found wild was the native Calamus. Stands of Metroxylon were found cultivated near settlements. Along the coast and up to the fringing coastal ridge, there were frequent stands of Veitchia.

We found Carpoxyton only in cultivation in the following villages:

### 1. Hog Harbour Village

One 10m adult tree of about 60 years of age with 5 infructescences bearing fruits at all stages of development before maturity. This was growing in the mission compound by the rubbish dump where they burn rubbish. The tree showed stress from exposure to fire and from the dry exposed location.

The green fruits and the navara are both consumed by children. Our guide recalled how he himself used to pick the green fruits from the same tree during his childhood days. The custom name for the palm here is LOLAL, which is the same name applied to Veitchia.

## 2. Nambank Village

Here in South Santo we found 3 adults and 2 juveniles. The adults, with maximum height of only 1.5m, were only in their second year of fruiting and had just begun to produce flower buds. These trees were planted for their attractive form and because they were disappearing from the area. The people claimed that the palm was more widely cultivated by their ancestors, but it had disappeared from their area for a long time.

The people call the palm NINIU, which means that its fruit can be drunk like a coconut. The green fruit is consumed, the leaf top is used as a broom, the leaf sheath is used as a sleeping mat, and as a shovel for hot charcoal.

## 3. Tabotalo Village

This small settlement had an adult 9m palm close to the road on a shady slope. It was planted by the head of the household, Joseph, from a seedling he obtained from the old village site. The tree had 2 heavily bearing infructescences, and 2 inflorescences.

At least 11 seedlings were counted under the tree in amongst the grass.

The custom name here is VALALA, meaning tall palm tree. The leaf top is used for broom while the navara is consumed.

## 4. Narango Village

Here we found 2 adults with fruits and ripe male flowers swarmed with flies and wasps. The taller of the two trees was 10m high. One of the trees was claimed to be about 100 years old. Each had 1 inflorescence and 4 infructescences.

We found a man in this village with 20 seedlings in small empty 1kg plastic rice bags. He planted them in August, 1994 from seeds that ripened about March, 1994. We found 14 seedlings surviving. They were in need of water and light.

The local name for Carpoxyton here is NINIU while that for coconut is niu, and Veitchia is falal. The leaf top is used for broom known as ATVIAS. The reason given for its cultivation is because it is rare. The green fruits and navara are consumed.

## PENTECOST

Harry Bule's survey of Pentecost revealed the absence of Carpoxyton from that island.

## APPENDIX XIII

# WASTE LUBRICATING OIL: RECOVERY AND DISPOSAL IN VANUATU

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James L. Stead  
PEP Enterprise Specialist

### BACKGROUND

Vanuatu and the other small island nations (SINs) of the South Pacific import a variety of lubricating, hydraulic, transmission, and transformer oils. In Vanuatu, there are no regulations providing for the collection and/or disposal of these products following use, nor is there any program, formal or informal, to recover and dispose of waste oils. Much of this waste oil is used again for various purposes, ultimately however, it all finds its way into the soil.

This study of waste oil is limited to Port Vila, as this is the only area in Vanuatu where, at this time, use of lubricating oil is sufficiently concentrated to make its collection and disposal practical.

### PURPOSE

The purpose of this report is to provide an estimate of the amount of waste oil available for recovery in Vanuatu, the amount that might actually be recovered, and an evaluation of various methods of disposal. The report will consider the sources of waste oil, present methods of disposal, and the desirability of addressing the problem through legislation or regulation. Opportunities for enterprise activity associated with the collection and disposal of waste oil are to be investigated.

### SUMMARY

At this time, Vanuatu imports 468,000L of lubricating oils per year, of which 154,000L is available for recovery. Initially, it is estimated that 27,000 to 46,000L would be recovered. The only viable method of disposing of this waste product in

Vanuatu is to burn it as a supplemental source of heat. A voluntary, rather than mandatory, waste oil collection program is recommended, accompanied with a program of environmental education. The establishment of an enterprise undertaking the collection, storage, and delivery of waste oil to users has commercial potential.

#### WASTE OIL AVAILABLE FOR RECOVERY IN THE PORT VILA AREA

Virtually all non-fuel oil is imported into Vanuatu by 3 bulk oil terminal operators: Societe Shell Pacifique, British Petroleum South West Pacific Ltd., and Mobil Ballande. Lubricating oil is imported in 200L drums or 1 and 5L retail packaging.

The total volume of lubricating oil entering a country should be easily determined through customs records. In fact, this information may or may not be available on a timely basis, and often includes hydrocarbons such as grease or industrial chemicals that will not find their way into the waste oil stream.

Vanuatu's oil terminal managers have been helpful in providing data; reporting that 468,000L of lubricating oil was imported in the 12 months ending September 1993. This volume is exclusive of grease, but includes transmission and hydraulic oils.

Efforts to identify individual sources or "producers" of waste oil by both Vanuatu's Energy Unit and the PEP Project were at best, moderately successful. The largest single purchaser of lubricating oil in Vanuatu is the country's electric utility, UNELCO, consuming 48,000L per year, or 10.3% of total imports. Seven of 14 vehicle service facilities (including the two largest new vehicle dealerships) report that they consume an aggregate of 12,840L per year, or 2.7% of total imports. Less than half of service facilities contacted responded, and data provided appears to be estimates. These estimates are considered to be only marginally reliable, and low. Some suspected large users, such as the Department of Public Works and construction firms, failed to provide any information.

To arrive at the amount of waste oil available for recovery in the Port Vila area, it is necessary to subtract from total imports oil shipped to outlying islands and oil lost to the environment during use. In the 12 months ending September 1993, 168,000L, of lubricating oil (36% of all imports) were distributed to the northern islands through Santo, with small additional volumes sent to southern islands. Port Vila and surrounds are generally assumed to represent 60% of the total market for all goods, with the remaining 40% being dispersed throughout the rest of the country. This convention has been used in this study.

In attempting to estimate the amount of lubricating oil lost to the environment and/or consumed during use, experience in New Zealand and Australia was relied upon. New Zealand's Ministry of the Environment states that 43-50% of lubricating oil is lost

during use (see Exhibit I for a list of persons contacted during the course of this investigation). The Environmental Protection Agency of N.S.W., Australia, estimates that 50% of the volume of new lubricating oils are consumed in use or otherwise lost to the environment. In Vanuatu, the country's largest single user of lubricating oil is the electric utility, UNELCO. UNELCO reports that 55% of all lubricating oil purchased is "burned" during use. For purposes of this study, it is assumed that 55% of lubricating oil is lost, and that the remaining 45% is available for recovery.

No known data exists regarding the annual rate of increase of consumption of lubricating oil. As an indicator, the total amounts of gasoline and diesel oil imported into Vanuatu in the period 1988-1993 have been used to predict the volume of lubricating oil imported. Annual increases during that period have averaged 4.5% per annum with each year exhibiting a slightly greater percentage increase.

Summary:

Total amount imported (12 months ending September 1993)	468,000L
Less shipments to other islands @ 40%	(187,200)
Sub total	280,800
Less losses to the environment @ 55%	(154,440)
	<hr/>
Total available for recovery in 1993	126,360L

Assuming a constant 4.5% rate of annual increase, in the 2003 total imports of lubricating oils reach 726,000L, with 240,000L being available for recovery.

AMOUNT OF WASTE OIL ACTUALLY RECOVERABLE

The question of the amount of waste oil that can actually be recovered is difficult. The fact is, in the eyes of the local population, much of this oil is not wasted - it finds many uses in the everyday activities of both the commercial and non-commercial communities. Examples of these uses are:

- dust suppressant on non-surfaced roads.
- relatively clean used lubricating oil (from new vehicle dealer service shops) is reused in older vehicles. Oil in older vehicles may never be changed, but rather topped up with "quality" used oil.
- release agent for concrete forms. Forms are liberally painted with oil so that the concrete does not adhere to the forms and forms may be easily stripped.
- wood preservative for fence posts and structural timber.

There is no reported experience in the S. Pacific that assists in forecasting the amount of waste oil that could be expected to be recovered in the small island nations. New Zealand has a target of "95% recovery and recycling of available used oil by the year 2000". In N.S.W., 27 percent of available waste oil is collected. Neither New Zealand nor N.S.W. have enacted legislation requiring mandatory collection of waste oil, however, both consider it a hazardous substance under certain legislation.

For the purposes of this study, it has been assumed that 25% waste oil available for recovery would actually be recovered in the first year. Complicating the situation is the fact that one single producer, UNELCO, could contribute 19,400, or more than 10% of all available waste oil. It is probable that UNELCO would either cooperate fully and make available all their waste oil, or fail to cooperate and contribute nothing. Because of this, two scenarios will be described, the first in which all of UNELCO's waste oil is recovered, and the second in which none is recovered.

All UNELCO oil recovered:

Total available for recovery	126,360L	
Less UNELCO	(19,400)	
Total less UNELCO	<u>106,960</u>	
At 25% recovery factor		26,740L
Plus 100% of UNELCO		19,400
Total, including UNELCO		<u>46,140L</u>

No UNELCO oil recovered:

Total, less UNELCO, available for recovery	106,960L	
At 25% recovery factory		26,740L

A recovery factor of 25% in the first year may be optimistic, however, this relatively high value has been selected because it is believed that virtually all waste oil can be collected from a limited number of large producers.

Should Vanuatu embark on a program to recover waste oil, it is estimated that by the year 2003, 60% or 144,000 L of available product will be recovered per year.

#### OPTIONS FOR DISPOSAL

There are 4 broad options for disposal of waste oil in Vanuatu: 1) exportation, 2) incineration, 3) use "as found" as a supplementary heat source and, 4) re-refining. In larger developed nations, use of a combination of these options provides

for disposal of waste oil in economically viable ways that are responsive to variations in supply and to changing market conditions. In Vanuatu and the other small island nations of the Pacific, because of their remoteness and small scale of operations, options within these 4 categories may be limited or non-existent.

#### EXPORTATION:

Exporting Vanuatu's waste oil to an overseas buyer is an appealing option as it removes from the country many of the technical and environmental problems attendant to waste oil processing. A simple enterprise requiring minimal investment and modest management expertise would suffice to provide for the collection, storage, shipment, and marketing of the product.

The business of disposing of waste oil is in many aspects governed by conditions in the international oil market. The spot market price for crude oil early in 1994 was US\$ 10-11, half of prices prevailing 2 years previously. As the price of virgin crude drops, so does the value of waste oil. Given present market conditions, Caltex Oil (Australia) states "Waste oil is not a resource that has a significant value".

In both Australia and New Zealand, waste oil users do not pay for the product, to the contrary, producers pay collectors to pick up the product. Given today's market conditions it is likely that oil delivered to the dock in either Australia or New Zealand would find no customer even if it was offered at no charge. With the possible exception of W. Samoa, none of the small island nations of the South Pacific have facilities that could use or dispose of waste oil.

Even in the event that the price of crude rises, and that subsequently waste oil acquires some value, the cost of handling and transport is prohibitive in any realistic scenario. There are no tank ships plying routes between Vanuatu and Australia, New Zealand or any other potential waste oil market. Vanuatu's bulk oil is imported from New Caledonia in the case of Shell and Mobil; BP is supplied from Fiji. If it is assumed that 100% of one year's recoverable waste oil, a maximum of 46,000L in the first year, was to be exported in one shipment, no tank ship would make the voyage for that small amount of oil (typical of the tank ships serving Vanuatu is the MS Konemu, a small inter-island vessel with a capacity of 1100 tonnes).

Vila Agents, a leading shipping agent in Port Vila, state that the only shipping method available for the export of waste oil would be to containerize 200L drums. The per liter cost of transport to Australia using this method is AU\$ 0.83, roughly 50% of the retail selling price of a liter of lubricating oil in that country. This figure does not include the cost of collection, storage, local transport, container handling fees, 200L drums, or handling costs at the receiving end.

In addition to financial considerations, there is a potential legal obstacle to the inter-island transport of waste oil. Within 2 years, the South Pacific Forum, acting under provisions of the Basil Convention, will likely propose that movement of waste oil between S. Pacific Islands be restricted or prohibited.

Neither at the present time, nor in the foreseeable future, does it seem likely that exportation will be a viable alternative for disposing of the Vanuatu's waste oil. Only a combination of greatly elevated world oil prices and order of magnitude increases in local use of lubricating oil would create a situation that could possibly make exportation feasible. Furthermore, if and when such conditions exist, it is likely that a domestic market for waste oil will have emerged.

#### INCINERATION:

Destruction of waste oil by burning in free air is relatively inexpensive, and is presently practiced in at least one of the S. Pacific Islands. With combustion taking place at temperatures of a few hundred degrees, the volume and range of products of incomplete combustion is substantial, and the process is environmentally unacceptable.

Controlled incineration of fuels, waste vapors and liquids is a widely employed technology. Combustion takes place at temperatures as high as 2000 F with destruction efficiencies greater than 99.9%. Incinerator exhaust gases may contain heavy metals such as lead and mercury in the form of fly ash. If exhaust gasses are processed through a scrubber, this ash is captured as an easily removed solid waste. Incinerator/scrubber installations meet U.S. Environmental Protection Agency standards in a wide variety of applications.

Both initial and operating costs of these technologically advanced incinerators is high. Typical of the better equipment available is the KM Sue Incinerator manufactured by Kaiser Marquardt of Van Nuys, CA. The cost of a unit having a throughput of 380 to 560 liters per day, including a scrubber and installation and check out services, but excluding shipping, is US\$ 263,000. Operating costs for electrical power and LPG (to fuel a preheater) would be approximately US\$ 21.00 per hour at current rates. As with any waste oil collection and disposal process, the cost of collection, transport, and storage must also be considered. (A copy of the Kaiser Marquardt proposal is on file in the PEP office in Port Vila.) A list of all manufacturers contacted during the course of this study is found in Exhibit II.

From a business standpoint, disposal of waste oil through incineration is a dead loss proposition. Whether incineration services are supplied by government or the private sector, the cost would have to be borne by waste oil generators or directly or indirectly, by government. As a practical matter, such a scenario is highly unlikely in the S. Pacific Islands.

## BURN AS SUPPLEMENTAL SOURCE OF ENERGY:

There are a number of options for burning waste oil as a source of energy; some permit the oil to be used virtually "as found", while others require minimal processing, usually limited to the removal of water and particulate matter. Water settles out of the oil in storage, and particulate matter is removed by centrifuging or filtration. Off-the-shelf equipment is available in a wide range of capacities and to meet various filtration requirements. Typical suppliers of this equipment are noted in Exhibit II.

In the simplest scenario, waste oil is simply dripped into the firebox of a low technology kiln or boiler as a supplement to the primary energy source. No oil processing is required, and gravity feed system using a small stainless steel tube supplying oil at atmospheric pressures directly to the firebox is all that is required. Combustion may or may not be closely controlled, and the amount and type of emissions varies considerably. Such systems frequently fail to meet developed world emission standards.

In Vanuatu, wood kilns and the abattoirs might be expected to burn waste oil in this way. They do not, however. Saw mill waste fires kilns with satisfactory results, and the Vila abattoir has recently installed a system using tallow as an energy source.

In industries requiring large amounts of process heat such as glass or brick making, cement manufacturing, sugar refining, and the like, boilers or kilns may be fired with oil, coal, or biomass. Unprocessed waste oil can be injected into the firebox as a supplement to the primary energy source. High temperature, forced draft burning processes are used, and scrubbers are routinely employed in such installations. The waste oil is consumed as found, and in an environmentally acceptable manner.

This is the primary means of waste oil disposal found in Australia, with ever increasing numbers of furnaces being modified to burn waste oil as a supplemental fuel. Unfortunately, with the possible exceptions of Fiji and Papua New Guinea, Vanuatu and the other SINS do not have industries such as those enumerated above. As these nations continue to develop and basic industries are established, they should be encouraged to utilize this technology.

Diesel engines, in sizes ranging from those installed in heavy duty over-the-road trucks to very large stationary and marine installations, may be fueled with a small admixture of processed used lubricating oil. This is usually a highly efficient closed loop system, with the engine's lubricating oil being drawn off and replaced with new oil at a prescribed rate, filtered, and fed back into the fuel system.

Inherent in a closed loop system is the fact that characteristics of feed oil vary little, and efficient filtration systems can be designed to meet specific requirements. As the number of sources contributing to the feed stock increases, so does the cost and complexity of the filtering process. Diesel engine manufacturers in the United States do not recommend that filtered waste oil be used to fuel their engines, and without exception, state that using this as a fuel admixture would jeopardize the engine warranty. Closed loop systems, often designed by or with the cooperation of the engine manufacturers, are the exception to this. In Vanuatu, the electric utility, UNELCO, is the largest single "producer" of waste lubricating oil. It is likely that this oil could be burned as fuel in a closed loop system.

Specialized atomizing oil burners have been designed to burn waste oil in smaller installations. The oil is mechanically filtered and injection is augmented with compressed air to assure optimum atomization. These oil burners are efficient and relatively easy to maintain, usually requiring a brief once-a-month shut-down. The burners are acceptable to the EPA, but size is limited to 500,000 BTU by the Agency. They have been designed into both hot air furnaces and hot water boilers in standard "off the shelf" models of varying sizes. Clean Burn Inc, Leola, PA, manufactures the most comprehensive line of small waste oil fired furnaces and boilers.

Vanuatu's two largest hotels supply hot water for guest rooms, kitchens and laundries in centrally located LPG fueled boilers. Either of these hotels could use all the waste oil that could reasonably be expected to be collected in the Port Vila area to heat hot water. If waste oil was available for the cost of collection, transport, and storage, and LPG fired boilers were replaced with waste oil fired boilers, it is possible that an enterprise could be established to supply waste oil to these hotels at a price that would motivate them to replace their burners.

#### RE-REFINING:

Re-refining of waste oil in-country is an appealing concept. A small re-refinery affords a means of recycling varying amounts of incoming product, provides employment, and yields a high value product. In Western Samoa, a small-scale re-refinery has been constructed, operates on an intermittent basis, and produces fully acceptable product.

To determine if this enterprise represented a solution to disposal of waste oil in Vanuatu, the W. Samoan facility was visited and its operations reviewed. Unfortunately, the owner of the re-refinery has no accounting of the cost of construction of the facility, nor does he maintain useful manufacturing cost data. There is insufficient data to determine whether this (or any) small-scale re-refinery has potential as a solution for the utilization of waste in the small island nations. Having said this, there are good reasons to believe the approach is unsatisfactory:

1. Construction of a small-scale re-refinery is both technologically and capital intensive. A rough estimate of the cost to replicate the facility is US\$ 320,000, exclusive of design costs. This figure assumes the use of much "found" equipment - used storage tanks, pumps, etc. - and does not include the cost of land and buildings.

2. Although only limited cost data is available, the operator is confident that the facility is operating at a substantial loss.

3. The operator believes that the break even point will occur at production level of 200-300,000L per year. This is many times the amount of waste oil available in Vanuatu.

4. The capacity of the existing facility is 600,000L + per year; this is 5 times that required for current production in W. Samoa and totally beyond the scale of a facility suitable for Vanuatu.

5. There are no drawings or specifications defining the W. Samoan refinery.

Disposal of waste oil in Vanuatu or other small island nations by re-refining is not considered a viable alternative at this time, nor is it likely to be in the near term future.

#### MANDATORY VERSUS VOLUNTARY RECYCLING

At first glance, the enactment of legislation requiring mandatory recycling of waste oil would appear to be the most effective approach to ensuring widespread participation in a recycling program. However, experience in both developed and developing nations has shown that this is not necessarily true, and that a voluntary recycling program may be the more practical strategy. The following issues must be considered:

1. The enactment of environmental (or any other) legislation without the means of supporting it with consistent, equitable enforcement will not result in a positive outcome.
2. Where legislation runs counter to ongoing custom practice, legislation is not effective. Thus regulations prohibiting taking turtles or certain birds has been largely ineffectual in a society where these animals are traditionally valued as food.

3. Vanuatu is an archipelago of more than 80 islands stretching over 1300 kilometers of the South Pacific with a widely dispersed population. Wide dispersion of waste oil sources, irregular and expensive inter-island shipping service, and lack of availability of drums or other suitable containers precludes, as a practical matter, the successful imposition of mandatory waste oil collection and disposal at this time.

4. Mandatory recycling implies that some entity will accept all waste oil offered at any time and in any quantity. In a situation where options for disposal are limited and both capital and ongoing costs of storage are substantial, it may not always be possible to receive, store and subsequently dispose of all waste oil offered.

.. It is recommended that at the onset, a voluntary waste oil collection and disposal program be considered.

Whether voluntary or mandatory, success of the program will largely hinge on a comprehensive conservation education program. Such a program must be multi-faceted, with relevant messages directed to the oil companies, their principal customers, consumers, and schools.

#### ENTERPRISE OPPORTUNITIES

It has been proposed that waste oil be disposed of by burning it as a supplemental source of energy. Waste oil collection, storage, and delivery to consumers has potential as viable enterprise. With cooperation of government, waste oil "producers" would be encouraged to accumulate oil in 200L drums. The entrepreneur would pick up this oil, and store it or deliver the oil directly to users.

The prospective business would require two pieces of capital equipment: 1) a truck, ideally equipped with a hydraulic lift tail gate, and 2) an oil storage facility. Because the level of business activity would be low, say one day a week at the onset, an enterprise established solely to provide waste oil collection would be difficult to sustain. Therefore, an existing business owning a suitable vehicle should be encouraged to undertake the activity.

#### RECOMMENDATIONS

1. A project to demonstrate the feasibility of employing a waste oil fired boiler should be established at a business or institution using large volumes of hot water.

2. The Government's Energy and/or Environmental Units should be asked to cooperate in establishing a voluntary waste oil collection program. This program should be supported by an environmental education program directed to waste oil producers and the public.

3. The establishment of a private enterprise to undertake collection, interim storage, and delivery of waste oil should be fostered.

#### COMMENTS

1. Waste oil can not be collected and stored unless a user or method of disposal has been established with absolute certainty. Long term storage of waste oil presents substantial financial and environmental risk. Any program to collect and dispose of waste oil must be in equilibrium at its inception; both the facility burning waste oil as supplemental fuel and the waste oil collection service must come on line at approximately the same time.

2. Collection of data regarding waste oil from "producers" has proven to be very difficult. In most cases, information is not available as oil is casually given to anyone requesting it, dumped on site, or sent to a landfill. Producers often refuse to divulge the information, this probably reflecting concern regarding subsequent use of the data.

3. The situation in Vanuatu is typical of that found throughout the region (and in developing countries throughout the world), and the program suggested may have wide application. The ongoing UNDP/SPF Regional Energy Program is, among other issues, considering the collection and disposal of waste lubricating oil throughout the South Pacific. It is suggested that FSP/PEP continue to liaise with the UNDP/SPF to determine if there is an opportunity for future collaboration.

Exhibit II

Address List:

EQUIPMENT MANUFACTURERS

Australia

Hamworthy Engineering Australia (PTY.) Ltd.  
Unit 3, 43 Carrington Rd. Tel: (02) 680 4388  
Castle Hill, NSW 2154 Fax: (02)6804358  
Hugh Wilson, Engineer  
(Manufacturers of commercial boilers.)

Mat Hand Pty. Ltd. Tel: 07 375 5000  
P.O. Box 385 Fax: 07 274 0034  
Corinda, QLD 4075  
(Distributor of material handling equipment.)

Hurl Nu-Way Tel: 02 609 3366  
Sydney, NSW Fax: 02 609 3388  
Eric Batey, Engineering  
(Manufacturers of heavy oil & waste oil atomizing oil burners. Recommended  
by Hamworthy Engineering.)

Reflex Handling & Storage Equipment Tel: 02 525 9644  
Cnr The Boulevard & Kareena Rd. Fax: 02 525 3891  
Caringbah, NSW  
(Distributor of materials handling equipment.)

United States

Allen Filters Incorporated Tel: (417) 865 2844  
522 North Fremont Fax: (417) 865 2469  
P.O. Box 747  
Springfield, MO 65801  
Katherine A. Allen  
(Manufacturers of oil reconditioning systems.)

Black Gold Corporation Tel: (615) 251 0680  
24 Great Circle Road, Suite 334 Fax: (615) 251 0682  
Nashville, TN 27228  
(Manufacturers of waste oil fired hot air furnaces.)

Centrico, Inc. Tel: (201) 767 3900  
100 Fairway Court  
Northvale, NJ 07647  
(Manufacturers of centrifuges for purifying lube oils.)

Clean Burn Inc. Tel: 800 331 0183  
83 South Groffdale road Fax: (717) 656 0952  
Leola, PA 17540  
(Manufacturers of waste oil fired boilers and hot air heating systems.)

Clean Burn International (Export agent for above)  
615 Dandenog Drive Tel: (302) 998 6650  
Wilmington, DE 19808 Fax: (302) 998 7206  
Barrett E. Kidner  
Director International Sales

Kaiser Marquardt  
16555 Saticoy Street  
Van Nuys, CA 91406-1739  
Robert Huebner, Director  
Aero Propulsion and Turbo Products  
(Manufacturers of chemical incineration equipment.)  
Tel: (818) 989 6400  
Fax: (818) 989 6447

Lenan Corporation  
2347 Kettering Street  
Janesville, WI 53546-1028  
Charles Johnson  
(Manufacturers of waste oil fired hot air furnaces.)  
Tel: (608) 752 1601  
Fax: (608) 757 7878

NAO Inc.  
L Street & Sedgley Ave.  
Philadelphia, PA 19134  
Theo Powell  
(Manufacturers of chemical and gasoline disposal incinerators.)  
Tel: 1 800 523 3495  
Fax: (215) 743 3018

Petronics, Inc.  
86 Bridge Road  
Islandia, NY 11722  
W. Christopher LieBau, Chief Engineer  
(Manufacturers of oil reclamation equipment.)  
Tel: (516) 454 7600  
Fax: (516) 528 2133

EXHIBIT 2

Address List:

PERSONS CONTACTED

Following is a list of persons contacted during the course of the waste oil study:

Australia

Mark Gorta, Manager  
Hazardous Chemicals and Wastes  
Environment Protection Agency (NSW)  
P.O. Box 1135  
Chatswood, NSW 057  
Tel: 02 295 5000  
Fax: 02 325 5678

Jeevan Jacob, Specialist  
Hazardous Substances  
Environment Protection Agency (NSW)  
P.O.Box 1135  
Chatswood,NSW 057  
Tel: 02 295 5000  
Fax: 02 325 5678

Herb Parker  
Caltex Oil (Australia) Pty., Ltd.  
c/- Australian Lubricatin Oil Refinery Ltd.  
Sir Joseph Banks Drive  
Jurnell, NSW  
Tel: 02 876 7391  
Fax: 02 868 4335

Fiji

June Buhoodram, Consultant  
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Fax: (678) 302 213

Brian Dawson, Director  
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Mike Lawrence, Petroleum Advisor  
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Suresh Raj  
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UNDP  
PMB  
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Fax: (679) 302 203

Guam

Francis Damian  
U.S. Environmental Protection Agency  
Guam

Tel: (671) 646 8863

Kim Flores, Manager of Engineering  
Guam Power Authority  
Guam

Tel: (671) 649 6942

New Caledonia

French Chamber of Commerce & Industry  
BP m#  
Noumea Cedex

Tel: (687) 272 551  
Fax: (678) 278 114

Papua New Guinea

Beatrice Soila, Commercial Officer  
Embassy of the United States  
P.O. Box 1492  
Port Morsby

Tel: (675) 211 455  
Fax: (675) 213 423

New Zealand

Tui Gilling  
Hazards and Waste Policy Directorate  
Ministry for the Environment  
P.O.Box 10362  
Wellington

Tel: (644) 473 4090  
Fax: (644) 471 0195

Frank Radisich  
Aegis Oil of New Zealand  
P.O. Box 20  
Auckland

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