FAO 2000 Forest Resource Assessment
Vanuatu Country Report

Department of Forests
March 2001

Introduction

The initial draft of this report was prepared by Jim Space for FAO in August 2000. It was substantially edited and maps prepared by staff of the Department of Forests following, as far as possible, the guidelines prepared by FAO for the 2000 Forest Resource Assessment. It is important to note that not all the information was available to fill in all the sections completely and there are significant gaps and uncertainties in the data (e.g. sandalwood resources and sustained yield are poorly known).

However it is fair to say that this report is a considerable improvement on the data and information available in previous summaries of Vanuatu's forest resources. The staff involved in the preparation of this report were: Adam Gerrand, Principal Forest Officer; Mandes Kilman, Inventory Officer; Phyllis Kamestia, Mapping Officer; Jonathan Love and Sebastian Buckingham, both Australian volunteers.

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Geography

Geographic description

The Republic of Vanuatu, formerly the Anglo-French Condominium of the New Hebrides, consists of the central and southern part of an archipelago which forms one of the numerous seismic arcs found in the Western Pacific. The Santa Cruz Islands, politically part of the Solomon Islands, constitute the northern part of the archipelago (UNEP/IUCN, 1988).

The archipelago forms a y-shaped chain; the larger islands are found in the west and are made up of extinct volcanoes covered with fossil or modern coral reefs. The island arc is young and associated with considerable volcanic and seismic activity (Cheney, 1987). The islands are mountainous by Pacific standards, many island interiors being uninhabited. Mt Tabwemasana Peak on Espiritu Santo is the highest point at 1,879m. Brief summaries of the physical characteristics are given by Douglas (1969) and UNEP/IUCN (1988) for most of the islands.

Vanuatu is located in the south-western Pacific Ocean about 5,600 km south west of Hawaii and about 2,400 km north east of Australia (see Map in Appendix). The country consists of 83 islands and islets with a total land area of about 12,190 km^2, extending about 800 km from north to south and about 200 km from east to west. The country's largest islands are, Espiritu Santo (39,00 km^2), Malakula (2 000 km^2), Erromango (1 000 km^2), Efate (900 km^2) and Ambrym (665 km^2). Aneityum (150 km^2) is the southernmost island in the group

Most of Vanuatu's islands are of volcanic origin and several are still active, including Mount Yasur on the island of Tanna. The highest peak, Mount Tabwemasana on Espiritu Santo, rises to an elevation of 1,879 m. Most of the islands have narrow coastal plains fringed by coral reefs.

Vanuatu has a tropical, humid oceanic climate, somewhat moderated by trade winds between May and October. Temperatures in the northern islands average about 27° C year around with an annual rainfall of about 3,000 mm. Temperatures in the southern islands range from about 19 to 31° C with a yearly rainfall of about 2,300 mm. There are occasional cyclones with a frequency of about 2.5 cyclones per year affecting some part of Vanuatu (Longworth, 1991), (Neil and Barrance, 1987).

References

Cheney, C. (1987). Geology and the environment. In: Chambers, M.R. and Bani, E., Resources development and environment. ESCAP, Port Vila, Vanuatu. Pp. 1-16.

Douglas, G. (1969). Draft checklist of Pacific Oceanic Islands. Micronesia 5: 327-463.

Longworth, W. M. (1991). Tropical cyclones in Vanuatu:1847-1991. Vila, Vanuatu Meteorological Service: 24.

Neil, P. E. and A. J. Barrance (1987). “Cyclone damage in Vanuatu.” Commonwealth Forestry Review **vol. 66(3)**: 255-264.

UNEP/IUCN (1988). *Coral reefs of the world. Volume 3: Central and Western Pacific*. UNEP Regional Seas Directories and Bibliographies. IUCN, Gland, Switzerland and Cambridge, UK/UNEP, Nairobi, Kenya. 378 pp.

Description of ecological zones

There are no formally defined or mapped ecological zones for Vanuatu. However the Vanuatu Resource Information System (VANRIS) contains vegetation and climatic data that can be used to develop maps of areas with similar vegetation and climates. It was developed by the Australian CSIRO (Bellamy, 1993) and now managed by the Vanuatu Department of Lands using the MAPINFO Geographic Information System (GIS). Maps are available for the major vegetation types for all the main islands and simplified forms of these showing main forest types are given in the Attachments.

Forest cover

Description of the natural woody vegetation

Some 9,000 sq. km, 74% of total land area, is under natural vegetation (Neill, 1987). Principal formations are tropical lowland evergreen rain forest, small areas of broad-leaved deciduous forest, closed conifer forest, montane rain forest between 1,000m and 1,500m; cloud forest above 1,500m, extensive coastal forest, swamp forest on Efate; and scattered mangrove forests covering between 2,500 and 3,500ha, of which 2,000ha occur on Malakula (Beveridge, 1975; David, 1985; Davis *et al.*, 1986).

Although lowland formations have largely been cleared and replaced by anthropogenic vegetation, forest remains the dominant landscape element on most islands. Surveys conducted in the mid-1960s indicate that some 180 sq. km of Erromango were occupied by closed climax forest, including 50 sq. km of kauri pine stands (Johnson, 1981). According to Quantin's (1976) maps, high forests are restricted on most of the islands, especially those that are densely populated (Pentecost, Aoba, Tanna and Shepherd) or have active volcanoes (Ambrym). However, the low montane forests are generally well preserved, and occupy large areas; dense, secondary woody formations, often with a thicket *Hibiscus* community, are extensive. The woody vegetation of Vanuatu includes lowland rain forest, montane cloud forest, seasonal rainshadow forest, mangrove forest, littoral forest and secondary forest. A botanical description of vegetation types is presented in Corner et al. (1975) and Mueller-Dombois and Fosberg (1998).

The vegetation and land classification system developed as part of the National Forest Inventory has been incorporated into the national Vanuatu Resource Information System (VANRIS). It is predominantly a structural classification well described by Bellamy (1993). The introduction from that report and the vegetation and forest type descriptions form the basis of the forest inventory and mapping system used today and are attached in the Attachments. Maps of the major forest vegetation types for the larger islands are attached as Attachment 2.

References

Bellamy, J. A. (1993). Vanuatu Resource Information System (VANRIS) Handbook. Brisbane, CSIRO & Qld Dept of Primary Industries.

Corner, E. J. H., F. R. S. Lee and K. E. Lee (co-ord.) (1975). A discussion on the results of the 1971 Royal Society - Percy Sladen Expedition to the New Hebrides. *Philos. Trans. Royal Soc. (London), B*, 272: 267-486.

Incoll, W. D. (1994). Re-assessment of the sustainable yield for the forests of Vanuatu. Canberra, AIDAB.

Mueller-Dombois, D. and F. R. Fosberg (1998). *Vegetation of the tropical Pacific islands*. Springer-Verlag, New York. 733 pp.

Quantin, P. (1982). Agronomic Potential and Land Use Map. Paris, ORSTOM Editions.

Queensland Department of Primary Industries (1993). Forest resources of Vanuatu. Brisbane, Qld DPI.

Wheatley, J. (1992). A Guide to the Common Trees of Vanuatu. Vila, Sun Productions.

Information on forest assessments

Area of forest cover

The major areas of commercial forest occur on the larger islands of Santo, Malakula, Erromango and Efate, with smaller areas on the islands of Gaua, Ambae, Ambrym and Tanna. The following table and information is based on the VANRIS system described by Bellamy (1993). There is a total of 205,000ha of mid height forest (20-30m tall) and 234,000ha of low forest (10-20m) throughout the country. The details of the various vegetation classes found in Vanuatu are given in the following table.

Table 1: Vegetation cover of Vanuatu.

Vegetation type	Area (ha)	Percentage of land area
Midheight forest (20-30m)	205,307	16.73
Low forest (10-20m)	234,089	19.08
Woodland (<10m)	386	0.03
Thickets (3-8mm)	433,941	35.37
Scrub (<3m)	45,018	3.67
Grassland	51,128	4.17
Swamp communities	2,261	0.18
Mangroves	2,519	0.21
Bare ground/human made	252,256	20.56
Total land area	1,226,905	100.00

Source: Vanuatu National Resource Inventory System (VANRIS).

The National Forest Inventory estimated the total forest resource at about 13 million m^3. (Baldwin et al, 1993, Incoll, 1994). However only about 20% of the total forest resource is thought to be commercially available, owing to factors such as steep slopes, dissected landform, low sawlog volumes and cultural reasons. The average commercial sawlog yield is rather low by international standards at around 15 m^3 per hectare.

References:

Baldwin, P., J. Hidson, et al. (1993). Forest Resources of Vanuatu. A summary of the forest resources of Vanuatu derived from the National Forest Inventory. Brisbane, Queensland Department of Primary Industries**:** 196pp.

Gerrand, A. M. and L. Mele (2000). Vanuatu country report to the South Pacific Heads of Forestry meeting. South Pacific Heads of Forestry meeting, Nadi, Fiji, Pacific Islands Forests and Trees Support Programme, SPC, AusAID, UNDP, FAO.

Table 2: Key bibliographic references

Country	Vanuatu
Title	Forest Resources of Vanuatu: A summary of the forest resources of Vanuatu derived from the National Forest Inventory
Author	Peter Baldwin, Japeth Hidson, Jane Siebuhr and Feke Pedro, Department of Primary Industries, Queensland and Vanuatu Department of Forestry
Year	1993
Source	Vanuatu Department of Forestry
Date of consult.	25/6/00
Location (of publication)	In FRA Pacific Islands box

Description of source
(including type of source, overall quality assessment and utility for FRA 2000)

Executive summary attached. Apparently good quality inventory but this report lacks good summaries of area and volume for the country.

Project funded by AusAID and ran from 1991 to 1994. First major National Forest Inventory for Vanuatu. Over 500 "plots" composed of Basal area sweeps over 2 strip lines m long 50 m apart.
Database developed using ARCINFO GIS on mainframe by Qld. DPI.
Later converted to PC based Foxpro and in 1997 to MS Access. Initial (VANRIS) Vanuatu Resource Info system developed and stored on GIS. Now updated and running on PC based MAPINFO (GIS)

Information content (check one or more topics as appropriate)

Natural Forest	X	Protected areas	
Plantations		Biodiversity	
Other wooded land	X	Forest ownership	
Forest area change		Wood supply potential	
Total volume	X	Non-wood forest products	some
Total biomass		Trees outside forest	
Commercial volume	X	Forest fires	

Name of reviewer: Jim Space

Country	Vanuatu
Title	Reassessment of Sustainable Yield for Vanuatu
Author	W.D Incoll
Year	1994
Source	DoF Vila
Date of consult.	
Location (of publication)	DoF Vila

Description of source
(including type of source, overall quality assessment and utility for FRA 2000)

Revised estimate of the sustainable yield based on different assumptions but using the same base data from the 1993 forest inventory.
Key changed assumptions were:

- Modified volume functions
- Assumed 10 m^3/ha rather than 15 m^3/ha as commercial threshold
- Wider list of commercial species based on those generally accepted in the Pacific (PACMERCH)

These changes resulted in an increase estimated sustained yield from 38,000 to 51,700 m^3/yr.

These estimates were later revised again for inclusion in the National Forest Policy (1997) to allow for increased resource available for community based operations using mobile sawmills and include islands with less than 5,000 m^3 commercial timber allow for island some patches below 10 m^3/ha.

Information content (check one or more topics as appropriate)

Natural Forest	X	Protected areas	
Plantations		Biodiversity	
Other wooded land	X	Forest ownership	
Forest area change		Wood supply potential	
Total volume	X	Non-wood forest products	
Total biomass		Trees outside forest	
Commercial volume		Forest fires	

Name of reviewer: Adam Gerrand, Principal Forest Officer, Vanuatu Department of Forests

Country	Vanuatu
Title	New Hebrides Condominium, Erromango Forest Inventory
Author	Land Resources Division, Overseas Development Administration, Foreign and Commonwealth Office
Year	1971
Source	See above
Date of consult.	28/6/00
Location (of publication)	In FRA Library Vanuatu box

Description of source
(including type of source, overall quality assessment and utility for FRA 2000)

Old inventory with area and volume estimates for this island. Probably pretty much state of the art for the time. Useful for historical volume comparison.

Information content (check one or more topics as appropriate)

Natural Forest	X	Protected areas	
Plantations		Biodiversity	
Other wooded land		Forest ownership	
Forest area change		Wood supply potential	
Total volume		Non-wood forest products	
Total biomass		Trees outside forest	
Commercial volume	X	Forest fires	

Name of reviewer: Jim Space

Table 3: Description of forest inventories/surveys

Country	**Vanuatu**	**Reference year**	**1993**

Title of inventory	**Forest Resources of Vanuatu (National Forest Inventory)**

Type of inventory	Aerial photography with ground plots

Field / aerial photos / satellite images / ...

Brief summary of methodologies used

Forest and vegetation type mapping from aerial photographs, stratification based on island, vegetation, altitude, and landform (225 strata), plot samples (see summary of field methods, attached). Each "plot" was horsehoe-shaped and actually made up of a 10 basal area sweep points located 30 m apart along a transect at right angels to slope then 50 m offset was another 10 BA sweeps back downslope.
This was the first National Forest Inventory (NFI) for Vanuatu and forms the baseline.

The results of the 1993 NFI should be adjusted for changed assumptions of Incoll (1994) and as stated in the National Forest Policy. These later revisions were desk operations and did not do any more field work.

Reporting level	National and sub-national	Country coverage	Complete
	National / sub-national		Complete / partial
Map output	Available – Digital (yes)	Scale of the map	1:50,000
	yes / no (also indicate format: analogue / digital)		

Vegetation types included	yes/no	Additional information included	yes/no
Natural forests	Yes	Area by forest formation	yes
Plantations	No	Volume	yes
All forests		Biomass	no
Other wooded land	Yes	Forest naturalness	no
		Forest biodiversity	no
		Forest ownership	No*
		Wood supply potential	yes

Remarks

*Note Ownership was not classified as all forests are in custom ownership.

Reliability class 1 (1=high 2=medium 3=low)

It was a substantial effort and took over 2 years of work and can be considered a reasonably good inventory for the scale and quality of the resource. In FRA terms it should be classed as "high quality".

Country	**Vanuatu**	**Reference year**	**1967**

Title of inventory **Erromango Forest Inventory**

Type of inventory: Aerial photography with ground plots
(Field / aerial photos / satellite images / ...)

Brief summary of methodologies used

Type mapping from aerial photographs, sampling with plots on transects.

Reporting level	Subnational (National / sub-national)	Country coverage	Partial (Erromango) (Complete / partial)
Map output	May be available (yes / no (also indicate format: analogue / digital))	Scale of the map	Unknown

Vegetation types included	yes/no	Additional information included	yes/no
Natural forests	yes	Area by forest formation	yes
Plantations		Volume	yes
All forests		Biomass	
Other wooded land		Forest naturalness	
		Forest biodiversity	
		Forest ownership	
		Wood supply potential	yes

Remarks

Current DoF staff have not got copy of this report so cannot evaluate / comment

Reliability class: 2 (1=high 2=medium 3=low)

Reference year: 1993 Geographic Unit: Vanuatu

Table 4: Area of woody vegetation according to national classification.

Forest and other woody vegetation types (country classification)	Area (000 ha)
1. Midheight forest (20-30 m)	205.307
2. Low forest (10-20 m)	234.089
3. Woodland (less than 10 m)	0.386
4. Thickets (3-8 mm)	433.941
5. Scrub (less than 3 m)	45.018
6. Mangroves	2.519
Subtotal of country classes corresponding with FRA 2000 forest and other wooded land	921.260
Subtotal other land	305.645*
Total land area	1,226.905**

Definitions: See VANRIS Bellamy. Above figures are from the Country Report, Vanuatu, from the 1998 Heads of Forestry meeting.

Comments: *Includes 51,128 ha grassland, 2,261 swamp communities, 252,256 ha bare ground and human made.
**Area given in geographic description above 1,219,000 ha. "Forest Resources of Vanuatu" gives total forest area (p. 89) as 418,175 ha. Note – the area given above from VANRIS is more recent and based on GIS mapping as is considered to be the more accurate total area figure.

Reference year: 1967 Geographic Unit: Erromango

Forest and other woody vegetation types (country classification)	Area (000 ha)
1. Closed forest – Merchantable timber	14.100
Subtotal of country classes corresponding with FRA 2000 forest and other wooded land	14.100
Subtotal other land	
Total land area	

Definitions: Estimated area of forests containing merchantable timber and not too steep to log.

Comments: Current DoF staff have not got copy of this report so cannot evaluate / comment in detail on this inventory. It has been superseded by the later NFI which is likely to be more consistent and reliable. However, it provides a useful historical perspective, especially for Kauri (*Agathis macrophylla*) of which there were moderate quantities on Erromango, some of which were logged in the 1970's.

Reference year: 1993

Geographic Unit: Vanuatu

Title of the inventory/survey: Summary of Vanuatu forest inventory in Country Report, Vanuatu, from 1998 Heads of Forestry meeting.

Table 5: Comparability between country classification and FRA 2000 classification.

Forest and other woody vegetation types (country classification)	Corresponding FRA 2000 classes
Midheight forest (20-30 m) Low forest (10-20 m) Thickets* (3-8 m) Mangroves	Closed Forest
Woodland (less than 10 m)?	Open Forest
Scrub (less than 3 m)	Shrub
No Equivalent VANRIS Type	Forest fallow system

Note: Open and closed forest make up "natural forest"; shrub and forest fallow make up "other wooded land"

Comments: Definitions checked and allocated correctly.
* One extra comment would be that "thickets" are not normally considered forest, let alone "closed forest" by ni-Vanuatu foresters, but they do fit the FRA definition.

Reference year: 1967

Geographic Unit: Erromango

Title of the inventory/survey: Erromango Forest Inventory

Forest and other woody vegetation types (country classification)	Corresponding FRA 2000 classes
Merchantable timber	Closed Forest
	Open Forest
	Shrub
	Forest fallow system

Note: Open and closed forest make up "natural forest"; shrub and forest fallow make up "other wooded land"

Comments:

Change in forest cover

Vanuatu currently does not have a system for regular recording of changes to forest cover and land use. We recognise the importance and need for this but it is currently beyond our resources and capacity to undertake. Some data is available (especially satellite imagery) but analysis is a specialised time consuming task. However, it may be worth FAO considering assisting with this through a specific consultancy (perhaps sensibly covering the region). A second option could be as a scholarship towards a PhD or MSc which would be possible and cost efficient as well as assisting build expertise and capacity within country to continue to monitor and report on forest cover change.

We are planning an update of the NFI within the next 2 to 3 years as we are nearing 10 years since the first one. This will provide a second snapshot of the forest cover but at considerably more expense than modelling or the approaches outlines above. This will also need donor assistance for both financial and technical resources.

[note table below may as well be deleted as no analysis has been done – left in for completeness now]

	Reference year			
Land classification	Area (1 000 ha)			
Natural forest				
Closed forest				
Open forest				
Other wooded land				
Shrub				
Forest fallow				

Plantations

Source Oliver, W. (1999) An Update of Plantation Forestry in the South Pacific

By 1986, the total plantation area had reached 1,067 ha.

Reference: Department of Forests, (2000) Vanuatu Country report. Heads of Forestry meeting, Suva, Fiji, SPC.

By mid 2000 the gross estimated plantation area is estimated to be 2,910 ha. Annual planting rate has been variable depending on funding and has been negligible in the past few years. Government policy is now clearly to facilitate private investment of plantation establishment. The National Forest Policy sets out an ambitious target of 20,000 ha over the next 25 years which averages out to 800 ha/yr.

Table 6: Plantation area by species, purpose and ownership.

Species group	Gross estimated area		Purpose	(%)	Ownership (%)		
	Ha	%			Public	Private	Others
Coniferous	890	100	Industrial	100*	100%		
	-	-	Non-Industrial	-			
Broadleaved	2,020	100	Industrial	100	100%		
	-		Non-Industrial				
Total	2,910						

* Note – The 890 ha *Pinus* plantations on Aneityum were initially planted to assist erosion control, but are now being managed by the community for timber production as well as protection services so are listed here as industrial.

Name of species group	*Species in species group (scientific names)*
Coniferous	*Pinus carribea*
Broadleaved	*Cordia alliodora*
	Endospermum medullosum
	Sweetenia macrophylla

Non-forest Species	Age	Gross estimated area (ha)	Ownership (%)		
			Public	Private	Others
Coconut, tall	1-29				
	30-59				
	60+				
	Total	96 000*			
Coconut, hybrid					
Oil palm					
Rattan*					

*Asian and Pacific Coconut Community. 1998. Coconut Statistical Yearbook 1997. Jakarta.

Although many coconut plantations in Vanuatu are senile and could be harvested for building material this has not been done on any significant industrial scale so far. Fiji has an active industry based on coconut wood but in Vanuatu this is virtually non-existent except for a several research projects.

The history of plantation establishment has seen several distinct "phases" according to identified needs. During the 1980's fuelwood was seen to be an emerging issue and Local Supply Plantations (LSP's) were established on many islands throughout the country. These were mainly *Cordia alliodora* which was found to have rapid early growth and suitable wood properties. However, it has failed to live up to its early promise and has suffered from damage through cyclones, *Phelinus* attack and general neglect. The result is that the LSP's have not contributed much to either local community or industrial use.
A later period focussed on developing industrial forest plantations (IFP's) for commercial timber production. These were mainly broad-leaved high value species such as Mahogany (*Sweetenia macrophylla*) although many other genera such as *Acacia, Eucalpyptus* and *Endospermum* were trialled as well. On Aneityum the particular problems of poor soils and high fire risk led to a program of erosion control through plantings of *Pinus carribea*. These are now managed for sawn timber by the local community.

The EU report of Groves and Fingleton (Jaako Poyry, 1997) indicated that there is significant potential for plantation establishment in Vanuatu. They note the high growth rates obtainable on fertile soils and that land is available but recognise that there are some constraints in land tenure and infrastructure.
Neil and Barrance (1987) report on cyclone damage in Vanuatu after cyclones Eric and Nigel caused extensive damage in the northern half of Vanuatu in January 1985. *Cordia alliodora*, line-planted in 1977-1984, and species trials planted between 1972 and 1978 were the plantations mainly affected. Average damage to compartments by windblow and stemsnap was 30%. Natural forest damage mainly depended on aspect; defoliation was almost complete in many areas but windblow was mainly restricted to diseased or moribund trees. Susceptibility to wind damage is tabulated for 16 planted species; *Cordia alliodora, Swietenia macrophylla and Agathis macrophylla* are recommended for growing high quality veneer timber on a short rotation. Source: CAB Abstracts

Neil (1987) reports that Cyclone Uma caused considerable damage to plantations and natural forests when it passed over the southern islands of Vanuatu in early February 1987. Surveys of the resulting damage to plantations showed that both young and old trees of *Cordia alliodora* withstood the cyclone well, while young trees of *Pinus caribaea var. hondurensis* (but not older ones) were susceptible to damage, although the plantations remained viable. Data are tabulated on the relative performance of 37 species (wind firmness, tendency to snap and leaf loss). These results confirm earlier findings on species susceptibility to cyclones showing *Agathis macrophylla* and *Swietenia macrophylla* to be very wind firm compared with faster growing (but less valuable) eucalypts and acacias. Local species were more wind firm than exotics. The natural forest was severely damaged on Efate, Erromango and Aniwa; *Endospermum medullosum* and the local kauri (*A. macrophylla*) were both very stable. Fruit trees and ornamentals were considerably damaged. Source: CAB Abstracts

Explanatory note on estimates for 2000

Oliver (1999) says that there was 1,067 ha of plantation in 1986. FAO (1998) says that there is 2,910 ha of plantation in the country as of 1996. There has been little plantation establishment since 1997, so 2000 area remains at 2,910 ha..
Oliver (1999) says that land is leased from customary landowners. Plantations are designed to achieve the governmental policy of becoming self-sufficient in meeting domestic requirement of sawn timber and forest products. This includes both industrial and non-industrial products.
Regarding non-forest species, coconut plantation are widely established. APCC (1998) gives the area by several years, total area of the year 2000 is estimated.

References

APCC. 1998. Coconut Statistical Yearbook 1997, by Asian and Pacific Coconut Community

FAO 1998: Asia and the Pacific National Forest Programmes Update 33: FAO Regional Office for Asia and the Pacific: July 1998. *[comment – this is a fairly poor source for Vanuatu and was not updated properly. Better to use the 2000 Heads of Forestry Country report]*

Groves, K. and J. Fingleton (1997). The potential for private sector investment in planted forests in Vanuatu. London, Jaakko Poyry Consulting (UK) Ltd.: 80.

Neil, P. and A. Barrance (1987). "Cyclone damage in Vanuatu." Commonwealth Forestry Review 66(3): 255-264; 18 ref.

Neil, P. (1987). Cyclone Uma and damage to southern forests, Vanuatu Department of Forests**:** 7 pp; 9 ref.

Oliver, W. (1992). Plantation Forestry in the south Pacific: A compilation and assessment of practices, FAO/UNDP, South Pacific Forestry Development Programme, Field document 8. Vila, Vanuatu.

Oliver, W. 1999. An Update of Plantation Forestry in the South Pacific, RAS/97/330 Working Paper No.7, Pacific Islands Forests & Trees Support Programme

Volume and biomass

Reference year: 1993

Table 7: Volume data (of natural forests).

Part 1: Forest Inventory Description

Name of the Inventory: Vanuatu National Forest Inventory

National Forest Inventory (Yes or No): Yes

Geographic location: Vanuatu

Total inventoried area (000 ha): 1,226.905 (effectively total land area). Only areas with significant commercial forest resources were actually sampled. This excluded inaccessible steep areas (> 30 degrees slope), non-forested areas such as thickets (3-8m tall), and intensive land use areas.

Sketch map attached (Yes or No): Yes (see Bellamy, 1993), all islands with significant forest resources inventoried.

Part 2: Inventory methodology

Stratification criteria: See NFRIS Manual for field survey methods, attached (Appendix).

Sampling design: Type mapping based on aerial photos, ground plots in selected stands for volume estimation.

Sampling intensity (%): See FRIS Summary report

Species coverage: All known species. (Identification often difficult) focussed on major known commercial species).

Minimum diameter: All trees above 10 cm DBH.

Type of volume measured: Overbark measurements converted by volume equations to underbark volume. Height estimated to crown break. Branches excluded.

Part 3: Inventory results (by reporting unit)

Reporting Unit name: Vanuatu

Area (ha): 418,175 ha (total area)

Average volume per hectare (m3/ha): 22.195 (total volume/total area)

Sampling error for average volume per hectare at 95% probability (%): 7% total volume, 8% for volume on areas excluding strata with slope greater than 30 degrees.

Stand and stock tables attached (Yes or No): Stand tables in report

Comments:

Reference year: 1967

Part 1: Forest Inventory Description

Name of the Inventory: Erromango Forest Inventory

National Forest Inventory (Yes or No): No

Geographic location: Erromango Islands

Total inventoried area (000 ha): Approximately 18,000 ha

Sketch map attached (Yes or No): No

Part 2: Inventory methodology

Stratification criteria: Type mapping and sampling by "ridges".

Sampling design: Type mapping based on aerial photos, ground plots on transects for volume estimation.

Sampling intensity (%):

Species coverage: Merchantable

Minimum diameter: 60 cm DBH

Type of volume measured: Overbark.
(including or excluding branches, underbark or overbark, etc.)

Part 3: Inventory results (by reporting unit)

Reporting Unit name: Erromango Island

Area (ha): 14,100 (accessible area)

Average volume per hectare (m3/ha): 693,800 cu m/14,100 ha = 49.2 cu m/ha

Sampling error for average volume per hectare at 95% probability (%): Given in report for each stratum.

Stand and stock tables attached (Yes or No): Stand tables in report

Comments:

Reference year: 1993? Geographic Unit: Vanuatu

Table 8: Volume of woody vegetation according to national classification

Forest and other woody vegetation types (country classification) Sub-national unit	Volume (1 000 m^3)	Biomass (1 000 m^3)
1.		*
2.Banks/Torres	1,857	*
3.Santo/Malo	5,079	*
4.Ambae/Maewo	818	*
5.Pentecost	325	*
6.Malakula	1,635	*
7.Ambrym	214	*
8.Epi	3	*
9.Efate	497	*
10.Tanna/Aneityum	337	*
11.Erromango[d]	2,455	*
Subtotal of country classes corresponding with FRA 2000 forest and other wooded land	13,220	*

Source: National Forest Policy of Vanuatu (June 1999)
* Note – Biomass is not known to have been estimated in any studies in Vanuatu. We note the method outlined in FRA Working Paper 2 but felt that it would be better for FAO experts to undertake biomass conversions than for us to apply limited knowledge.

Definitions:
[a]Figure from Appendix 2 of Incoll report using the minimum economic yield of 10 m^3/ha.
[b]'Pacmerch' species i.e.. those species generally accepted commercially in the Pacific.
[c]Adjusted figures include volumes in areas less than 10 m / ha, estimates of forest patches within agricultural areas, and a reduced allowance for loss of forest due to population growth.
[d]The figures for Erromango are unreliable and should be updated as a matter of priority. Particular attention should be paid to volume reduction for landform and slope issues.

Comments:

The most recent national forest inventory was completed in 1993. This data has been used to generate information of standing gross volume and commercial availability in several reports. The National Forest Policy (1997) states the commercially available volume to be 2.635 million m^3. This was reduced from the estimated gross volume of 13.22 million m^3. The Incoll report estimated the total gross volume in the

whole forest to be 9.35 million m^3 over an area of 4383 km^2. The available commercial volume of standing timber was estimated to be 1.89 million m^3 (area 1200 km^2).

Estimates of Sustained yield are stated in the 1997 National Forest Policy.

Sustainable yield estimates

The sustainable yield estimates for each island will form the basis for issuing Timber Licences and controlling the annual log harvest. The estimates will be refined periodically to take account of new knowledge about forest resources.

The National Forest Inventory estimated that Vanuatu's forests contain a total gross log volume of 13.22 million m^3. To estimate the available volume Incoll[1] reduced the total gross volume by 80% to account for: slopes > 30^o, strongly dissected areas; volumes < 10 m^3/ha; islands with < 5,000 m^3; and for land needed for agriculture. The estimated available volume was used to calculate the national sustainable yield of 51,700 m^3 using a 50-year cutting cycle.

A revised set of sustainable yield estimates are proposed for the various islands of Vanuatu. The proposed adjustments to Incoll's estimates have been made because many of the original assumptions about resource availability do not apply to mobile sawmills. This means that a greater proportion of the total timber resources of Vanuatu can be harvested if a combination of mobile mills and conventional logging are used.

Island	Total volume [a], Pacmerch[b] species, ('000 m^3)	Commercial Pacmerch [b] volume [a], ('000 m^3)	NFI Sustainable Yield [a] (m^3 /year)	Adjusted[c] Sustainable Yield (m^3 /year)
Banks/Torres	1,857	487	9,700	9,700
Santo/Malo	5,079	1,197	23,900	30,000
Ambae/Maewo	818	0	0	3,500
Pentecost	325	0	0	1,800
Malakula	1,635	328	6,500	6,500
Ambrym	214	0	0	1,000
Epi	3	0	0	1,000
Efate	497	271	5,400	6,500
Tanna/Aneityum	337	50	0	2,000
Erromango[d]	2,455	302	6,000	6,000
All Vanuatu	**13,220**	**2,635**	**51,700**	**68,000**

Notes:
a. Figures from Appendix 2 of Incoll report using the minimum economic yield of 10 m^3/ha.
b. 'Pacmerch' species i.e. those species generally accepted commercially in the Pacific.
c. Adjusted figures include volumes in areas less than 10m^3/ha, estimates of forest patches within agricultural areas, and a reduced allowance for loss of forest due to population growth.
d. The figures for Erromango are unreliable and should be updated as a matter of priority. Particular attention should be paid to volume reductions for landform and slope.

The proposed sustainable yield figures are a conservative estimate of the volume of timber that can be sustainably harvested from various islands. Even with these proposed adjustments, the total sustainable yield only represents about 25% of the total timber resources of Vanuatu. It should also be recognised however that in the long term the maintenance of the sustainable yield is dependent on the maintenance of the growth and regeneration capacity of the total forest estate. This may not occur for many reasons, including the wishes of landowners to convert forest to an alternative land use and failure of areas to regenerate satisfactorily.

[1] Incoll, W. D. 1994. Reassessment of Sustainable Yield for the Forests of Vanuatu. Report prepared for the Australian International Development Assistance Bureau. 14pp.

Reference year: 1967 Geographic Unit: Erromango Island

Forest and other woody vegetation types (country classification)	Volume (1 000 m^3)	Biomass (1 000 m^3)
1. Kauri	118.100	
2. Tamanu	418.100	
3. Blue wood	74.800	
4. Nemoryetu	22.400	
5.Other species	59.400	
Subtotal of country classes corresponding with FRA 2000 forest and other wooded land	693.8	

Definitions:

Comments: Merchantable volume on 14,100 ha.

Change in volume and biomass

Vanuatu currently does not have a system for regular recording of changes to forest cover and biomass. Comments here are similar to those for change in forest area.

[note table below may as well be deleted as no analysis has been done – left in for completeness now]

	Reference year							
Land classification	Volume/biomass (1 000 m^3)							
Natural forest								
Closed forest								
Open forest								
Other wooded land								
Shrub								
Forest fallow								

Forest health and protection

Fire situation in Vanuatu

Fire is not a major factor in forest health, management and/or protection in Vanuatu. Due to humid tropical conditions most of the year fires are generally small in area and intensity. For this reason we have kept our comments brief.

Fire environment, fire regimes and the ecological role of fire

Some rain shadow environment as have dryer areas that have been subject to periodic or frequent fires (usually man made) (e.g. West Coast Santo and Aneityum). Many of these have developed grassland patches (see Forest type map in Attachments).

Narrative summary of major wildfire impacts on people, property, and natural resources that occurred historically

Fire plays a role in maintaining a dynamic boundary of forest grassland in these areas.

Narrative summary of major wildfire impacts on people, property, and natural resources during the 1990's

Virtually no statistics on fires are kept and narrative summary is not available due to limited interest and impact of fires.

Fire management organization

None

Wildfire database

Non existent / Not necessary

[note table below may as well be deleted as no analysis has been done – left in for completeness now]

Year	Total No. of Fires on Forest, Other Wooded Land, & Other Land	Total Area Burned on Forest, Other Wooded Land, & Other Land	Area of Forest Burned	Area of Other Wooded Land and Other Land Burned	Human Causes	Natural Causes	Unknown Causes
	No.	ha	ha	Ha	No.	No.	No.
1990							
1999							

Record data for all wildfires, or any fire occurring on wildland except a fire under prescription.

Comments:

Definitions:

Forest: Land with tree crown cover of more than 10 percent and area of more than 0.5 hectares. The trees should be able to reach a minimum height of 5 meters at maturity.

Other wooded land: Land either with a crown cover of 5-10 percent of trees able to reach a height of 5 meters at maturity; or a crown cover of more than 10 percent of trees not able to reach a height of 5 meters at maturity; or with shrub or bush cover of more than 10 percent.

Other land: Land with less crown cover, tree height, or shrub cover than defined under "Other wooded land". Indicate under Comments section if recurring wildfires affect "Other land" by inhibiting regeneration to the "Forest" and "Other wooded land" categories.

Date: 2000
Source of information: general opinion
Country correspondent: Adam Gerrand, Principal Forest Officer
E-mail address of correspondent: forestry@vanuatu.gov.vu

Is fire database management by computer or by paper records: Not available
Address of website to access the fire database, if available N/A non-existent

Use of prescribed fire to achieve resource management objectives

Not relevant / non-existent for forest areas.

Public policies affecting wildfires and fire management

Several sections in Forestry Act restrict use of fire and allow for offences and penalties but they are seldom if ever used. Proposed new Forestry Act in 2001 has provision for requiring permits for selected areas of forest at certain times where fire is considered a risk to life or property.

Sustainable land use practices used to reduce wildfire hazards and wildfire risks

N/A

Community involvement in fire management activities

Insects and disease

Insect damage in forest areas is not well documented in Vanuatu. Similarly diseases of forest trees have received scant attention, although none of any real seriousness are considered to be causing current concern. This is clouded by lack of research capacity as there may be unknown issues out there that have not been identified or studied. One case that did receive significant attention was the attack of *Cordia* trees by the fungus *Phellinus noxious* which was investigated by several researchers as described by Barrance (1989) and the notes below.

Neil (1986) describes disease symptoms from *Phellinus* attack. All enrichment plantings over the age of 1 year of the introduced species *Cordia alliodora*, a valuable timber tree, in natural forests on the islands of Vanuatu were surveyed in 1983. The general incidence of loss from *P. noxius* rarely exceeded 5%; a slight increase with increasing crop age was found. On 1 island (Pentecost), however, losses were up to 35%, increasing rapidly in the oldest plantings (8 yr). This high level was thought to be due to the interaction of heavier rainfall and high inoculum level in the natural forest. A further survey is planned. (Source: CAB Abstracts)

Ivory and Dahrui (1993) present the results of a study of brown root rot, caused by *Phellinus noxius*, in Vanuatu during 1987-92 demonstrated that a number of species, including 13 indigenous and exotic trees were susceptible to the disease when planted in close proximity to large pieces of infected wood. Symptoms of the disease and the course of the disease are reported and lists of hosts and new hosts given. The study also established that Vanuatu whitewood (*Endospermum medullosum*) was highly resistant to the disease.

A recent proposal to ACIAR to set up a regional forest health monitoring project (Wylie and Elliot, 1999) is worthwhile and should be considered by FAO and other donors. They note several insect pests on forest trees including a whitewood leaf-eater, and shoot tip borer in mahogany that has not previously been noted in Vanuatu.

References

Barrance, A. J. (1989). *Phellinus noxius* in Vanuatu - management considerations. Department of Forests Research Report**:** 14 pp.; 5 ref.

Ivory MH, D. G., 1993. Outbreaks and new records. Vanuatu. New host records for Phellinus noxius in Vanuatu (1993). “Outbreaks and new records. Vanuatu. New host records for Phellinus noxius in Vanuatu.” FAO Plant Protection Bulletin **41**((1)): 37-38; 3 ref.

Neil, P. (1986). “A preliminary note on Phellinus noxius root rot of Cordia alliodora plantings in Vanuatu. European-Journal-of-Forest-Pathology. 1986, 16: 5-6, 274-280; 11 ref.” European-Journal-of-Forest-Pathology **16**(5-6): 274-280; 11 ref.

MH, I. and D. G (1993). “Outbreaks and new records. Vanuatu. New host records for Phellinus noxius in Vanuatu.” FAO Plant Protection Bulletin **41**(1): 37-38; 3 ref. Source: CAB Abstracts

Invasive species

Merremia peltata is a vigorous and persistent woody climbing vine and causes significant problems with regeneration of forest tree species in some areas of Vanuatu. It is particularly rampant in areas that have had large canopy disturbance due to heavy logging or cyclones and can smother young trees and prevent satisfactory regeneration. Thomson (1980) reports that *Merremia* is also a significant problem for plantation establishment in cut over forest in the Solomon Islands.

Thomson, B. (1980). Spacing strategies for plantations in the Western Solomons, Forestry-Division,-Solomon-Islands**:** 7 pp. Source: CAB Abstracts

For more information on invasive plant species reported to be present, see http://www.hear.org/pier/pacificmatrix.htm.

Weather (hurricane, tsunami, etc.)

There are occasional cyclones (hurricanes) with a frequency of about 2.5 cyclones per year affecting some part of Vanuatu (Longworth, 1991). These can cause significant damage to forests, especially plantations of exotic species (Neil and Barrance, 1987). Many native species appear to be better adapted to cyclones (e.g. Kauri, *Agathis macrophylla* and Whitewood, *Endospermum medullosum*).

Mangroves

Area

Ha	Year	Source	Remarks
	2000		
2,800	1995	Ellison, J.C. (1995) Status report on Pacific Island Mangroves. In: *Marine and Coastal Biodiversity in the Tropical Island Pacific Region. Volume 1: Population Development and Conservation Priorities*. Maragos, J.E., Peterson, M.N.A., Eldredge, L.G., Bardach, J.E. and Takeuchi, H.F. (Eds). East-West Centre, Honolulu, USA.	
2,519	1993	Department of Forests (1998) *Country Report Vanuatu*. Report presented at Heads of Forestry Meeting. Department of Forests, Port Vila, Vanuatu.	Original source: Vanuatu National Resource Inventory System (VANRIS). National forest inventory completed in 1993.
1,600	1972	Spalding, M.D., Blasco, F. and Field, C.D. (Eds) (1997) *World Mangrove Atlas*. The international Society for Mangrove Ecosystems, Okinawa, Japan. 178 pp	Extracted from vegetation maps in Quantin, P. (1972) Archipel des Nouvelles-Hébrides. Atlas des Sols et de Quelques données du Milieu Naturel. 1:100,000-1:200,000. Office de la Recherche Scientifique et Technique Outre-Mer, Paris, France.
2,500ha	1986	David, G. (1986) "Les Mangroves du Vanuatu". Naika, Centre Orstom, Port Vila Vanuatu.	
	1976	Marshal, AG (1976) "A mangrove community in the New Hebrides, South-West Pacific". Biological Journal of the Linnaen Society 8 p319-336	

Description

Mangrove tree genera found in Vanuatu include *Avicennia, Ceriops, Rhizophora, Sonneratia* and *Xylocarpus*.

Two current changes to area of mangrove are caused by geological movement as well as local use of timber. These are minimal and under current conditions overall mangrove area is fairly stable. However, a potential change in mangrove area could be caused by industrial use of timber. There was some concern of unsustainable industrial use of timber of mangroves on SE Malekula (Maskylnes islands) in 1996. This proposal did not go ahead after discussions with local people.

Several observations have been made of changes in area and composition of mangroves due to the very active geological movement affecting small but significant changes in water depth (Marshal, 1976). In addition, absence of mature mangrove surrounding some villages on east coast Malekula has been observed from the air however small localised use may be having little effect on this formation as a whole. Further survey work may be required significant change in area of mangroves could be caused by industrial use. The Forestry Policy has since included (National Forest Policy 1997) the objective of tightly controlling any utilization of mangroves as well the conservation of mangrove ecosystems as a whole. This role is planned to be included in the future Forestry Act in 2001. Current thinking in Department of Forests aims to address significant change in resource use, principally as it has done for other forested areas by control one export licences and liasing and development of management plans with landowners.

It has been estimated there is between 2,500 and 3,000ha of mangroves, areas large enough to be observed from aerial photographs include nine islands (see map in Attachments). Four of them are located in the northern region: Hiu, Ureparapara, Vanua lava and Mota lava. Central region includes Malekula, Epi, Emae and Efate and in the South, Aniwa island. The largest areas are thought to be a bit under 2,000 ha on the east and Southeast coasts of Malekula (David, 1986).

Tree genera include *Rhizophora, Bruguiera, Ceriops, Sonneratia, Xylocarpus, Heritiera, Lumnizera and Avicennia*. Most common are *Rhizophera* and *Avicennia* species. *Ceriops tagal* has been observed as popular for use as posts due to its straight form (Curry 1993).

References

Corner, E. J. H., F. R. S. Lee and K. E. Lee (co-ord.) (1975). A discussion on the results of the 1971 Royal Society - Percy Sladen Expedition to the New Hebrides. *Philos. Trans. Royal Soc. (London), B*, 272: 267-486.

Marshal AG 1976 (See copy) Curry P 1993 Internal Report for the Department of Forests. Tour Report South Santo Mangrove Sites".

Mueller-Dombois, D. and F. R. Fosberg (1998). *Vegetation of the tropical Pacific islands*. Springer-Verlag, New York. 733 pp.

Forest management

Almost 75 percent of Vanuatu is covered by natural vegetation. However, the quality of natural forests, in terms of commercial forestry, is poor. Much of the natural forest is on steep inaccessible sites and even accessible sites contain few species of commercial use. Oliver (1992) estimates the timber yield from the best 50 000 hectares of natural forest to be only 15-20 m^3 per hectare. The World Bank (1990) describes the composition of Vanuatu's natural forests as dominated by species "*with low density, little figure,...., little durability and low strength*." In the mountainous island interiors much of the natural forest has primarily a protective role.

A National Forest Inventory and related reports in 1994 estimates total merchantable volume of timber on Vanuatu at 12 883 000 m^3. If the minimum economic yield per hectare is 10 cubic metres of timber then a sustainable annual timber yield for Vanuatu is estimated at 51 700 m^3. There is, however, difficulty in relating these assessments to commercially accessible timber areas.

Vanuatu's Department of Forestry has operated two plantation forestry schemes over the past 20 years. The success of these has been limited. Local Supply Plantations (LSP's) were planted between 1975 and 1986 to meet future wood needs at village level. These plantations were established in recognition that the natural forests, because of their quality, composition and distribution will not indefinitely meet wood needs. The LSP's were planned to make Vanuatu self-sufficient in wood supply. However, funding problems, inappropriate species selection and disease have conspired to significantly limit the effectiveness of the LSP scheme. In all, around 1000 hectares (almost entirely in *Cordia alliodora*) was planted to 1986 when the scheme was put into a maintenance status awaiting review and redesign. It appears LSP's will fall far short of meeting domestic supply requirements.

A second plantation scheme, Industrial Forestry Plantations (IFP's) began in 1982 and was designed to establish larger areas of forest plantations for processing and export supply. Once again establishment targets have not been met and locations of the plantations which have been established are not favourable to transportation. It is likely these plantations will also be eventually utilised for domestic supply. In 1991 IFP's totalled 1 200 hectares of mainly *Pinus caribaea*. More recently a project to plant 525 hectares of plantation forest on Espiritu Santo has been funded by European Union ODA. Around 325 hectares have been planted on a 5 500-hectare site. This area will be maintained as a forestry research and demonstration area. The remaining area has been sub-leased to investors intending to develop hardwood species for sold wood products.

Brown, C. 1997. Regional study — the South Pacific. Asia-pacific Forestry Sector Outlook Study, Working Paper No. APFSOS/WP/01. FAO, Rome.

The forest and trees in Vanuatu are an important component of the environment in the country. They have been part of the life of the people for many generations. Products from trees and forests are not the only benefit provided, they also serve as protection, control of soil erosion, providing and purifying water systems and improving and maintaining agricultural products.

Coastal areas in the islands are protected mostly by the coastal vegetation. Trees have important roles to protection from strong wind/cyclones which affect the country on average around twice a year. Also forests and trees provide other values like habitat for the wildlife and a source of other materials like medicine and fuel wood for the locals.

Trees and the forest in catchment areas are important to maintain the water quality and quantity for local people and wildlife. In some places disturbance or removal of trees in the forest in catchment areas may

cause the water level to drop or fluctuate more widely. With the increasing need to earn cash, people go into developments ignoring the roles of trees and forests. Some villages in the country are now next to contaminated rivers. For small islands water is very essential and shortage of it is a severe problem.

Soil erosion problem is one that results from removing trees and the forests. Especially at the coast and riverbank and steep slopes. Removal of trees for timber resulting with grasslands and continues burning is a serious problem in Anietyum island in the southern part of the country. The Department of Forests has been working with the assistance of the New Zealand government have been working together to fight the erosion problem.

Forest and trees continue to be removed mostly as part of process of shifting agriculture. Land is also cleared for the establishment of the plantation of coconut, cocoa and coffee and cattle grazing. There is a need for the forest and trees in the agriculture system to improve and maintain agriculture productivity.

Source: Vanuatu country report, forest genetic resources workshop, 2000.

Forest legislation and policy

Vanuatu is less dependent on forestry export revenues than neighbouring countries such as PNG or Solomon Islands with only 14% of export value coming from forestry in 1999 (Vanuatu Department of Forests, 2000). Vanuatu has intermittently operated log export bans over the past decade. In 1995 a draft Forest Policy was released which noted the overall aim of sustainable forest management (Wyatt, Bartlett and Mathias, 1999). This policy was finalised in 1997 (and formally endorsed by the Council of Ministers in 1998. The policy recognises sustainable yield principles and notes these can be met from a declining resource area by enhancing productivity through plantation establishment. The policy specifically advocates giving firm legal effect to a continued log export ban and this was passed by Parliament in 1997. It also advocates an annual allowable cut and licences which encourage commitment to value-added processing and reforestation, including logging companies being required to lodge performance bonds with Government. The policy is to moving toward greater regulation aiming for more sustainable operations (Gerrand and Bartlett, 2001).

References

Brown, C. 1997. Regional study — the South Pacific. Asia-pacific Forestry Sector Outlook Study, Working Paper No. APFSOS/WP/01. FAO, Rome.

Gerrand, A. M. and Bartlett, A.B. (accepted + in press). *Managing change: Lessons learned from the development and implementation of Vanuatu's National Forest Policy.* 16th Commonwealth Forestry Conference, "Forests in a changing landscape", 18-25 April 2001, Fremantle, Western Australia, Commonwealth Forestry Association.

Vanuatu Government (1997). National Forest Policy. Vila, Vanuatu Ministry of Agriculture, Forestry and Fisheries.

Vanuatu Department of Forests (2000). 1999 Annual report. Port Vila, VDoF**:** 21pp.

Vanuatu Department of Forests (2001). 2000 Annual report. Port Vila, VDoF**:** 23pp.

Wyatt, S., Bartlett, A., and Mathias, A. (1999). "*Developing a forest policy in a small nation: the Vanuatu National Forest Policy*." International Forestry Review **1**(2): 102-108.

Legal

The Forestry Act, Laws of the Republic of Vanuatu [Chapter 147]: The Forestry Act was initially passed in 1982 only 2 years after independence but has undergone several major amendments up to 1997. The present Forestry Act does not reflect fully the objectives and statements of the National Forest Policy (see 3.1 below) but the Department is taking steps to address this with a current project to update the Forestry Act in line with the National Forest Policy during 2000.The current Act was completely reviewed and rewritten in 1999 under FAO TCP project 8315. A draft Bill has been prepared and is expected to go before Parliament in mid 2001.

The government demonstrated its commitment to implementing the new policy with a series of amendments to the Forestry Regulations in 1996 and Forestry Act in 1997 that enabled improved regulation of logging operations. The Regulations introduced included the management and control of mobile sawmills and sandalwood operations. Mobile sawmills were previously unregulated and the sandalwood regulations were substantially improved with incentives for domestic processing. Substantial progress has been made towards implementing these new regulations. In addition, the volume of timber licences has been dramatically reduced from almost 300,000 m^3 per year in 1997 to 112,000 in 2000 with a further reduction to about 73,000 m^3 /yr planned in 2001 (Vanuatu Department of Forests Annual Report, 2001).

The current Forestry Act is arranged into sections relating to the subject areas of forest plantations, utilisation operations, conservation, protection from fires through to administration, financial and general. Under the establishment of plantations there are provisions for protection of areas of national or cultural importance. The Minister has powers to exclude areas from logging operations in order to preserve the ecology of an area. The Code of Logging Practice, which is implemented in the Forestry Act, under Part V Conservation, relates to the protection of the environment and promotion of forest development consistent with the principles of sustainable development, and also relates to the protection of non-timber forest values, among other matters. Notable regulations/orders are outlined below.

The implementation of the *1998 Code of Logging Practice Regulations* has been a significant step for Vanuatu in terms of improved forest management and logging practices. The Code also makes requires that forest workers be individually licenced and this has been a major effort in training assessors and staff to implement the system. Vanuatu has also developed Reduced Impact Logging Guidelines and Silvicultural Prescriptions, not enforced by legislation, but if used in conjunction with the Code of Logging Practice, are excellent forest management tools to ensure the recovery of the forest post-harvest.

Following the *Amendment Order No.16 of 1994* no persons may export logs from Vanuatu. This has been modified in 1997 to allow export only under certain tight conditions. The policy has been successful in developing a domestic processing capacity and the value of forest products exported has doubled from 1995 to 1999.

Forestry Act (Control of Mobile Sawmills) Order No.9 of 1996. This outlines the registration requirements, licences, conditions and fees to regulate mobile sawmills. Notably most other neighboring countries have not addressed the issue of developing regulations to control or manage the growing mobile sawmilling sector.

Forestry Act (Management and Control of Sandalwood Trade and Exports) Order No.3 of 1997. This repeals Order No. 22 of 1995. This outlines the licence requirements, conditions and fees, the purchase register, export of Sandalwood and management charges. It gives the Minister the power to declare a Sandalwood trading season, upon advice from the Director of Forests, by specifying the period

Sandalwood can be cut and traded. Sandalwood management charge to be used to monitor Sandalwood operations and encourage replanting of Sandalwood. These new regulations have led to increased landowner interest in both harvesting and planting sandalwood (which was largely absent during a previous 10 years (SPRIG, 1998). In addition the improved sandalwood regulations have controlled the number and quality of commercial operators leading to increased commercial security and investment.

The VNFP identified that a major overhaul of the Forestry Act was needed. With the assistance of FAO, in 2000 the entire Forestry Act has been rewritten to provide a legal framework to implement the policy. The new legislation will enshrine the principles of sustainable forest management and provide for limits for operations in a Forest Sector Plan. The new Act has been circulated for public consultation leading to a national summit in late 2000 following the successful model used in the development of the policy. The new Forestry Act is expected to go to Parliament for approval in mid 2001.

Other relevant legislation

The Constitution of the Republic of Vanuatu (1979): **The Constitution of the Republic of Vanuatu must be the foundation of any Government policy. Forest policy formulation must be guided by Article 7(d), which states that every person, has the fundamental duty to *"...protect the Republic of Vanuatu and to safeguard the natural wealth, resources and environment in the interests of the present generation and of future generations."***

Article 71 of the Constitution states that *"...all land in the Republic belongs to the indigenous custom owners and to their descendants"*. Custom is the basis for land ownership and use of land in the Republic. Non-indigenous persons cannot own land. Perpetual ownership of land is only for indigenous citizens who have acquired their land in accordance with a recognised system of land tenure i.e. through custom.

International Trade (Flora and Fauna) Act (No. 56 of 1989): The International Trade (Flora and Fauna) Act (1989) regulates and monitors the exploitation and importation of species listed in the CITES appendices.

National Parks Act (No. 7 of 1993): This act provides for the declaration of national parks and nature reserve, for the protection and preservation of such areas and connected matters. It covers the declaration of national parks and reserves, the establishment of the national parks board, the constitution of the board, meetings and powers of the board, management plans, local management committee, conservation fund, accounts, annual reporting, offences and penalties. There are no National Parks in Vanuatu declared under this legislation as yet. Moves have been made to amend the legislation to allow for more customary landowner participation and active management.

Plant Protection Act (No. 14 of 1997): Provides for the exclusion and effective management of plant pests and to facilitate exports of plant produce and other related matters. The Act covers quarantine entry, standards and management of plant pests including surveying and pest management programmes. It contains the control of plant exports, movement controls, emergency orders in the event of an unexpected serious outbreak of a quarantine pest, codes of practices, powers of disposal, inspection and quarantine release, offences, and penalties. It will not limit the provision of the Animal Quarantine and Importation Act but amends this Act to exclude all mention of plants. This Act also repeals the Rhinoceros Beetle (Prevention) Act (JR 10 of 1961), the Import of Plants Act (JR 26 of 1964) and the Prevention of Spread of Noxious Weeds Act (JR 8 of 1966).

Draft Comprehensive Environmental Legislation, 1998: The purpose of this legislation is to provide for sustainable development in Vanuatu through sound environmental planning and management and the conservation, protection and environmentally sound management of all natural resources. Specifically, the

proposed legislation is intended to create a comprehensive legal and institutional framework for environmental impact assessment; disaster contingency planning; pollution control and waste management; the management of dangerous and hazardous substances; the management of natural resources and biodiversity conservation.

Treaties and Legal Instruments

Convention on International Trade of Endangered Species of Flora and Fauna (CITES) (ratified 1989): Vanuatu is a Party to CITES which controls the export and import of animals or plants, dead or alive, in whole or in part as listed under Appendices I, II and III. The International Trade of Flora and Fauna Act (1989) regulates and monitors the exploitation and importation of species listed in the CITES appendices.

Convention on Biological Diversity (ratified 1993): Convention on Biological Diversity expects, as far as possible, each contracting party to establish a system for the protection of in-situ biological diversity and complimentary ex-situ measures for the conservation and research on plants in country of origin of genetic resources.

Vanuatu Biodiversity Conservation Trust Fund (launched 1998): The Department of Forests established the Vanuatu Biodiversity Conservation Trust Fund, as it is named, to provide a continuous source of financial assistance for the retention of forests in Vanuatu and related biological conservation. A Trust Fund will be managed by a Trustee, which is Pacific International Trust Company Ltd. The Trustee will answer to a board of Appointors. A Technical Advisory Board will advise the Trustees on matters relating to the running of the Trust Fund with respect to individual projects and use of funds for the retention of forests in Vanuatu and related biological conservation.

Land in the Republic belongs to the indigenous custom owners and to their descendants, under Vanuatu Constitution land decisions rest with the custom owner. The National Forest Policy states that *"forest areas that have special ecological, scenic, historical, cultural, watershed, biodiversity or other environmental significance, shall be protected with the support of landowners. In protecting forest areas, education, motivation, and provision of benefits to the landowners will be utilised*". It is hoped that the Trust will be used to compensate landowners for the protection of these and similar areas from development activities, until such times as alternative income sources or benefits can be established.

Planning

The Government used to use a system of 5 year planning, the most recent of which is outlined below. This approach has changed over the past several years and no more 5 years plans will be developed. For Forestry we now have a comprehensive policy developed in 1997 and operational activities are set out in the DoF Business Plan (Department of Forests, 2000).

Third National Development Plan 1992-1996: As a party to Agenda 21, Vanuatu's national development goals include environmental protection as an integral part of the development process; the participation of all concerned citizens and access to information and opportunity to participate in decision making processes; enactment of effective environmental legislation and standards; and the fuller participation of women in efforts to achieve sustainable development.

The Third National Development Plan (NDP3) makes general policy statements for national environment priorities. NDP3 1993-1996 stated the Vanuatu government's commitment to economic growth and development that has minimal negative environmental impact. The Comprehensive Reform Programme

endorsed by the Council of Ministers in June 1997 has put DP4 (1997-2001) on hold. It has been explained that national development planning will continue to build on the themes of DP3 (self-reliance; balanced and sustainable development) and will incorporate the "visions" of the CRP. The foremost element of this shared vision is national cohesion and embraces a desire to build a well-governed, truly democratic nation. Other visions include the achievement of economic prosperity; the empowerment of individuals and communities; a well-educated population which has access to a quality health service; the improvement of the nation's infrastructure; the erosion of living standard disparities; the retention of traditional values and culture and the protection of our natural environment.

Vanuatu National Conservation Strategy (1993): Vanuatu National Conservation Strategy states that the highest priorities for co-ordinated national action to maintain Vanuatu's services to the environment and conserve natural resources are:

- Improve environmental education and awareness
- Improve legislation and law enforcement
- Strengthen existing environmental institutions
- Preserve natural resources and tabu places
- Use resources more efficiently

Vanuatu National Forest Policy (1997): The National Forest Policy is another major achievement for the Department of Forests. A Policy produced in participation with the staff of the Department, other Government Departments, agencies and organisations, industry, Provincial Governments and individuals. The principal national goal for the forest sector is **to ensure the sustainable management of Vanuatu's forests to achieve greater social and economic benefits for current and future generations.** All the objectives for forest management, conservation, forest development, industrial utilisation, and all research, extension, training, education and forest administration which support forestry development are directed towards that single goal.

The National Forest Policy covers forest management issues, environment and conservation, landowners and communities, forest industries, afforestation and extension, forestry research, forestry training and education, forest administration, and forest revenue. It has specific island policies and sustainable yield estimates by island.

It aims to address the absence of comprehensive national and regional land use plans, a lack of forest management plans, the gross imbalance between utilisation and reforestation/afforestation, resource security for the future, resource knowledge, lack of specific forest harvesting plans, institutional weaknesses, industry weakness, inconsistencies in bureaucratic procedures, guidelines and procedures for forest businesses to attract and secure local and international investors in the sector, and the funding and management of protected areas.

Comprehensive Reform Programme, June 1997: The Comprehensive Reform Programme (1997) has set common visions for Vanuatu in the next 20 years. One of the visions is to protect the natural environment for the sake of future generations and ourselves. The CRP has a matrix of plans of action and individual departments will each produce more detailed corporate plans. The DoF prepared its first corporate and Business Plan based on the NFP for the year 2000.

DRAFT Vanuatu National Land Use Planning Policy (1998): Under Vanuatu Constitution, land decisions rest with the custom owner. The Vanuatu National land Use Plan is a guide to sustainable land use in Vanuatu including Agriculture and Land Resources Policy Areas, Economic Forestry, Environmental Conservation and Cultural Heritage. It is meant as a guide for investors, and in evaluating development proposals and applications.

National Biodiversity Strategy and Action Plan for Vanuatu: This GEF funded project is currently being undertaken by the Environment Unit and is due for completion by 1999. The project is reviewing existing information relating to biodiversity in Vanuatu, carrying out additional surveys of priority areas and undertaking consultation with government and community representatives at a national and provincial level.

Source: 2000 Vanuatu country report, forest genetic resources workshop.

Institutions and organisations

Status and trends in forest management

Vanuatu's economy is essentially agricultural with about 80% of the population primarily engaged in subsistence farming of food crops such as taro and yams. Vanuatu's GNP in 1997 was estimated to be US$1,340 per year (Asian Development Bank, 1997). The forestry sector is usually ranked second or third of the export commodities behind copra and kava. The value of forest products exported has been increasing dramatically and has more than doubled in the past 5 years from Vt 255 million to Vt 536 million (US$4.1m) in 1999 (Vanuatu Department of Forests, 2000). This represented around 13% of the total export earnings in 1999.

Table 9 shows timber harvesting and revenue statistics for 2000. Table 10 demonstrates the growing importance of the forest sector to Vanuatu. The true contribution of the forest sector is much larger than shown here, as these figures do not include the substantial payments to workers and secondary service industries (e.g. fuel) made by the forest industry as we do not have the information for 2000.
In 1998 the forest sector contributed 14% of the total export earnings. Forestry was third behind copra and kava, which moved ahead of forestry for the first time. Reliable figures for 2000 have been hard to obtain from Customs and have not been fully assessed. In 1999, the landowners were paid about Vt 36 million (US$280,000) in royalties for 40,000 m^3 logs. It is estimated that the forestry workers were paid around Vt 120 million in wages and the government collected about Vt 35 million in fees and taxes. Over 500 people are estimated to be employed in forest operations and fixed sawmills and wood processing industries. Several hundred more are involved on full or part-time basis with mobile sawmills.

Table 9: 2000 fixed mill harvest volumes and payments to landowners and government by island.

Island	Volume of logs cut (m^3)	Royalty (Vatu)	Management charges	Total payments
Total	**35,143**	**33,067,593**	**9,873,027**	**42,940,620**

The volume of wood harvested in Vanuatu in 2000 was 39,860m^3 which is slightly down from the 40,676 m^3 harvested by fixed mills in 1999. In 2000 fixed mills harvested 35,143 m^3, and for the first time we have included an estimate for the wood cut by mobile mills to be 4,717m^3. Importantly the total harvest continues to be well below the estimated sustainable yield of 68,000 m^3 per year based on the National Forest Inventory and set in the National Forest Policy.

However, the DoF notes with continuing concern that the vast majority of logging is concentrated on the island of Santo and that there are many other areas of Vanuatu where forest resources are under-utilized. There is a need to reduce the pressure on Santo's forests and encourage operations to be more equitably distributed across other islands. This will have benefits in terms of infrastructure development, employment and income generation. However, it is recognized that a lack of infrastructure and services (especially roads, and reliable shipping) are major constraints to achieve this aim.

The Department has been making good progress in rationalizing the Timber Licences in the past few years, The total volume of licences issued has been reduced from almost 300,000 m^3 per year in 1997 to just over 73,000 m^3 in 2001. This is now only just above the estimated sustained yield of 68,000 m^3. However, there is still a problem of potential over-commitment of the resource on several islands, notably Santo and Erromango. The vast majority of forestry operations still occur on Santo and pressure on the resource meant access to the preferred species is becoming difficult.

Table 10 shows the volume production and increase in value of forestry exports over time. Notably the value of exports has more than doubled in 4 years from 233 million Vatu in 1995 to over 536 million Vatu in 1999. In 2000 there was a slight reduction in the volume harvested and also exported overseas as the largest mill in the country operated by Santo Veneers slowed its production due to financial constraints. Access to the resource of preferred species was also becoming restricted and this issue is discussed further below.

Table 10: Vanuatu's annual log production and export value from 1987 to 2000.

	Annual Log Production			**Annual Timber Products Exports**		
Year	Exports (m^3)	Domestic (m^3)	Total (m^3)	Log Exports FOB Value Vt million	Volume of Processed Exports (m^3)	Processed Exports FOB Value Vt million
1987	23,716	15521,	39,237	0.19	908	1.83
1988	5,001	17,899	22,900	47.10	1,827	59.20
1989	15,085	19,923	35,008	101.42	1,950	101.22
1990	-	19,276	19,276	-	1,939	90.06
1991	-	27,336	27,336	-	1,674	86.02
1992	-	20,355	20,355	-	2,269	146.38
1993	4,014	21,084	25,098	43.14	2,598	224.39
1994	-	43,874	43,874	-	5,107	255.43
1995	-	32,986	32,986	-	4,160	233.93
1996	-	35,854	35,854	-	7,940	362.00
1997	-	37,513	37,513	-	14,938	514.89
1998	-	36,907	36,907	-	12,917#	524.16*
1999	-	40,676	40,676	-	12,219@	536.90@
2000	**-**	**39,860**	**39,860**	**-**	**8,599****	**434.22****

Notes: * Includes 33,406 kg of Sandalwood valued at 10,962,000 Vatu
Estimated from sawmillers returns
@ Data from Santo only (vast majority) does not include Vila exports as Customs have not provided.
Year 2000 total of 39,860 m^3 includes 35,143 m^3 from fixed mills and 4,717 m^3 from mobile mills. Previous years did not include mobile mills, as data was not available.
** Export value data from Customs for forestry is considered to not cover all forest products correctly and is likely to be an underestimate.

Forestry is an important sector to rural communities, as in many cases it is one of their main sources of cash income. There is pressure to convert forests for cash or other land uses. Landowners are often not interested in maintaining forest unless it provides an income or other services they see as valuable. In 1999, landowners were paid about Vt 36 million (US$280,000) in royalties for 40,000 m^3 logs. In addition to commercial forestry operations, forests provide a wide range of products into the subsistence lifestyle of most Vanuatu people. The Vanuatu National Forest Policy (VNFP) (Department of Forests, 1997) recognizes that *"the importance of Vanuatu's forests can not be judged only from an economic perspective. Forests, land and people in Vanuatu are inseparably linked. The forests are a vital part of the country's cultural heritage and contribute to the welfare and economic development of the people"*.

The Government of Vanuatu has been very active in moving towards sustainable forest management policies and practices. The development of the National Forest Policy in 1997 was a major achievement and raised awareness of the importance of the forestry sector with many stakeholders. The Department of Forests has been assisted by an AusAID funded project from 1995 to 2000 aiming to improve the capacity of the staff and forest industry workers to be able to implement sustainable forest management practices. A draft Code of Logging Practice was developed in 1995 and then formally given legal backing with regulations in 1998 with a phase in time aimed at having all operations comply with the Code by end of the year 2000. At the time of writing (March 2001) most operations do not fully comply with the Code but there has been substantial progress towards SFM and improvement through training of staff and forestry workers.

Prior to the development of the VNFP the forestry sector was constrained below its full potential development due to a number of complex reasons. There was little consideration of long term sustainability of the operations and Timber Licences were approved politically without consideration of the technical constraints such as the size or accessibility of the resource. This led to many poor decisions and gross over-commitment of the resources. For example, at one stage, the total Timber Licences issued was almost 300,000 m^3 per year when the estimated sustainable yield later adopted in the policy was 68,000 m^3 per year. The resource was simply not there for some companies to operate profitably. A number of these inappropriate licences have never operated viably and several have gone bankrupt or left the country leaving a trail of debts and disappointments. Thus the uncontrolled issuing of licences was counterproductive to getting a long-term viable industry in the country.

Additional technical guidelines such as the *Vanuatu Reduced Impact Logging Guidelines,* and the *Vanuatu Silvicultural Forest Harvesting Types,* have been prepared by consultants and DoF and some industry staff trained in their implementation through a RIL demonstration forest area. The regulatory and technical framework has been basically set up. However, operations in the field still do not meet these standards in most cases and substantial ongoing effort will be needed to train operators and enforce the new rules.

Vanuatu has established very little in the way of plantation forests. However, the 1997 National Forest Policy for Vanuatu notes a target of 20,000 hectares of plantations which, (if predominantly whitewood), would provide a conservative volume of 5 million cubic metres on a 25 year rotation – a sustainable yield of 160 000 cubic metres per annum. Planting is recommended to be carried out at 800 hectares per annum. The National Policy recommends the Government will require the evergreen timber licenses to establish and maintain at least 5 hectares of commercial plantations each year for every 1000 ³ of logs harvesting, in addition to natural forest management requirements

References:

Brown, C. 1997. Regional study — the South Pacific. Asia-pacific Forestry Sector Outlook Study, Working Paper No. APFSOS/WP/01. FAO, Rome.

Vanuatu Department of Forests (1998). *Vanuatu Code of Logging Practice.* Department of Forests, Port Vila, 83pp.

Vanuatu Department of Forests (1997). *Vanuatu Reduced Impact Logging Guidelines.* Department of Forests, Port Vila.

Vanuatu Department of Forests (2000). *Vanuatu Department of Forests 1999 Annual Report.* Department of Forests, 19pp.

Vanuatu Department of Forests (2000). *A strategy for conserving, managing and better utilizing the genetic resources of Santalum austro-caledonicum in Vanuatu.* Port Vila, Canberra, CSIRO and Department of Forests**:** 21pp.

Criteria and indicators for sustainable forest management

Sustainable Forest Management (SFM) is the clearly stated aim of the 1997 Vanuatu National Forest Policy. We want to know how to measure it and if we are achieving it. We have reasonable estimates of simple indicators such as volumes harvested to compare with estimated sustainable yield from the National Forest Inventory. Currently around 35,000 m^3 logs are harvested for timber by the large commercial mills each year with a further 5,000 m^3 estimated to be cut by mobile mills. On this simplistic basis operations appear sustainable as this is well below the estimated sustainable yield of 68,000 m^3/yr. However, operational standards need to improve to ensure regeneration and maintain residual stand density and quality. Reduced Impact Logging Guidelines produced and demonstration area developed in 1997 will assist implementation.

No current indicators for biodiversity have been developed in Vanuatu. Although we have basic species lists there has been little thorough evaluation of many habitats. The endangered or threatened status of many plants or animals has not been determined. Work is currently being done to improve this with UNDP funds to develop a Biodiversity Strategy. There is currently no measure of how well Vanuatu would perform against proposed indicators as no assessment has been done. Vanuatu would likely perform well against many indicators but as there have been no detailed baseline studies it is not possible to determine. Just because we cannot *prove* that we are managing sustainably with measured indicators does not mean that operations are unsustainable. It may well be that operations *are* sustainable, its just that we cannot prove it!

The challenge is to develop indicators that are relatively simple and cheap so that they are applied at the appropriate scale and intensity to match small operations in a developing country context. Developing countries have special conditions and needs and this is important to consider when developing any system of indicators. Indicators are being developed with a strong push from rich developed nations. In many small developing nations such as Vanuatu, the current level of understanding and ability to implement SFM, let alone the indicators is low. SFM is constrained by many factors including limited funds, institutional capacity landowner and political will.

Indicators for sustainability should be appropriate to the scale and intensity of the operations. They should consider the country context including the following - land tenure (in Vanuatu all land is custom-owned), funds, education levels, social aspirations and development opportunities, infrastructure, political stability and commitment. Measurement of sophisticated technical indicators may not be currently achievable in many countries and the technical capacity to undertake such a programme over a long time frame is often lacking or needs support. There is a risk that the very countries that are most in need of improved forest management, especially tropical developing countries, will be unable to participate in a highly technical and expensive system of monitoring indicators.

There are ways we can avoid some of these potential problems. There is an urgent need for technical assistance and capacity building for small developing countries to be able to effectively develop and implement appropriate indicators for SFM. Firstly, technical assistance and support for improved research and maintenance of structures needed to ensure the work continues are needed. A regional approach or co-operative research networks can assist develop the skills. These have significant advantages as many of the issues and constraints identified here that apply in Vanuatu also apply in other countries. Similar models have been successfully used for regional codes of logging practice, and also genetics research in the South Pacific through the South Pacific Regional Initiative on forest Genetic Resources project (SPRIG).

Natural forests and woodlands

Management objectives

Table 16 - Forest area by wood supply potential

Reference year:

The National Forest Policy sets out the concept of zoning forests into 4 categories, as follows:

1. **protection forests** where the forests' biological diversity and ecological integrity together with values such as water supply, soil conservation, cultural or historical significance, or scenic appeal can be protected,

2. **production forests** for which the main management emphasis will be on long term timber production, further classified into-
    - natural forest management areas
    - land suitable for plantation reforestation
    - cleared land suitable for afforestation

3. **conversion forests** where forests are suitable to be cleared for alternative land uses,

4. **uncommitted forests** where a use classification has not yet been determined,

This process is a substantial task and will take several years and likely to require technical and financial assistance. This is planned to be considered with a proposal for updating the National Forest inventory and a project to prepare regional forest management plans that has been developed and submitted to several donors.

Natural forest type (country classification)	Forests available for wood supply (000 ha)	Forests not available for wood supply (000 ha)
1. possibly could do forest types (e.g. mid height, low etc.) by slope category > 30 at this stage only		
2. later work is intended to refine this to consider the classifications outlined in the policy		
All forest types		

References:

Comments:

Forest management plans

No forest management plans are current in Vanuatu. A project proposal to develop these on a regional (provincial) basis has been prepared and submitted to several donors in 2000. If FAO or other organisation is interested in funding or otherwise assisting this work please contact the DoF.

Table 18 - Area of forest under management

Reference year:
[note table below may as well be deleted as no analysis has been done – left in for completeness now]

Forest type (using country classification)	Total area (000 ha)	Area under management[1] (000 ha)			
		Production	Conservation	Other purpose (pls specify)	**Total**
1.					
2.					
etc.					
All forest types (Total Forest)					

[1]: Area under management is defined here as the forest which is managed fore various purposes (conservation, production, other) in accordance with a formal, nationally approved, management plan over a sufficiently long period (five years or more)

References:

Comments:

Silviculture

Silvicultural prescriptions have only recently been developed by consultants working on the AusAID VSFUP Project (Applegate and Andrewartha, 1999). These are appropriately basic prescriptions for variable cutting diameters for the main commercial species for six identified forest types. They aim to widen the species selected and reduce the overall intensity of harvesting resulting in minimised canopy openings to reduce the infestation of vines such as *Merramia* and allow for natural regeneration.

The Department of Forests has endorsed these but they have met with stiff industry opposition due to the introduction of variable cutting diameters that increase the minimum size of several of the most popular commercial species. It is fair to say these have yet to be effectively implemented but are part of the ongoing process of moving towards SFM.

Applegate, G. B. and R. K. Andrewartha (1999). Vanuatu Silvicultural Prescriptions. Port Vila, Vanuatu Department of Forests**:** 29pp.

Forest protection practices

The Code of Logging Practice sets out several procedures for protecting forest areas, especially around waterways and village or tambu (cultural taboo) sites. Landowners are encouraged to become involved in marking out boundaries and identifying protection areas. These are new concepts and are still being developed.

Forest harvesting practices

Vanuatu has taken an active role in developing practical guidelines and procedures for improving forest harvesting practices in recent years. The Code has been endorsed at the highest level of government and is backed up by legal regulations with penalties for breaches.

The Vanuatu Code of Logging Practices (1998) and Reduced Impact Logging guidelines (RIL) (1997) have been developed recently to improve forest practices and enhance protection of forest with special values and also to residual growing trees. The Code has been developed and substantial training undertaken with Department staff, forest workers and landowners. In addition a Forest Operators Licencing system has been set up and is being implemented.

It is fair to say that the field implementation of these still has a long way to go but the framework is in place. A program of operator training and the development of an Operators Licence system is also being actively pursued.

Special programmes and incentives to promote sustainable forest management

A number of projects have been actively working to help Vanuatu move towards sustainable forest management. The information below was taken from the 2000 Annual report for the Department of Forests and summarises the considerable work and benefits provided to Vanuatu by international donors.

Table 19: Donor funded projects active in DoF during 2000

Description	Donor	Funded in 2000? Yes/no	1999 revenue US1$=140Vatu
Legislation review	FAO	Yes	23,270,000
GTZ Forest Management Project	GTZ	Yes	9,322,500
Biodiversity Mapping and Training Project	AusAID	Yes	8,400,000
Kauri Reserve	NZ	Yes	3,570,000
Aneityum Erosion Control Project	NZ	Yes	2,314,600
Clean Development Mechanism consultancy	AusAID	Yes	2,000,000
Mangaliliu Community Forestry Project	NZ	Yes	214,550
SPRIG Phase 1 Genetic Conservation Project	AusAID	Yes	10,000,000
SPRIG Phase 2 Genetic Conservation Project (See note 1)	AusAID	2001*	21,250,000
Post Logging Reforestation (LEARN) (see note 2)	EU	2001*	12,948,600
Donor projects funded during 2000 (=Yes)		**8 projects**	**59,091,650**
Donor projects agreed but funded from 2001 (=2001*)		**2 projects**	**34,198,600**

Notes: 1. SPRIG project design approved by AusAID with funds of approx 20m/yr x 3 yrs but delayed until 2001. 2. EU LEARN project funds available during 2000 but delayed until 2001 for VSO Project Manager.

During 2000, donors include projects funded by AusAID, FAO, German Technical Cooperation (GTZ), the European Union, and New Zealand ODA (Table 19). Eight projects worth Vt59 million were active in the DoF during 2000, with a further Vt34m in 2 new projects starting 2001.

In addition to the above, the Department of Forests makes good use and gets excellent value from our membership of several international organizations that do not directly involve projects. Summary of these costs and benefits for 2000 are given in Table 20.

Table 20: Summary of costs and benefits of Vanuatu's international forestry organizations for 2000.

Organization	Benefits (Vatu)	Costs (Vatu)	Balance (Vatu)	Other benefits
1. ITTO	2,968,000	-4,900,000	-1,932,000	Good technical assistance and future large project support
2. IUFRO	0	-32,000	-32,000	Excellent research + networking
3. FAO + APFC	26,400,000	Nil (staff time only)	26,400,000	Good technical, training, networking and project support
Total net benefit	29,368,000	-4,932,000	**+24,436,000**	

We also have a close working relationship with other organizations in the region. These include The South Pacific Community's Forests and Trees Support Program, based in Fiji. Vanuatu obtains substantial benefits from the membership of these forestry organizations that justify our continued involvement.

It is clear that the Department of Forests secures a large part of its operational costs from donor sources outside the Government recurrent budget (Tables 19 and 20). It would not be possible for the DoF to carry out its activities under the Government recurrent budget of only Vatu 50 million. Donors contributed an additional Vt59 million in 2000, which was Vt9 million more than the government. Some of this is one off or occasional projects (e.g. the major forestry legislation review supported by FAO in 2000) but a substantial part assists us to move towards our goal of sustainable forest management. We are grateful for donor support. In future we are working towards a combination of increased revenue and increased recurrent budget allocation from Government so that the DoF will be able to reduce reliance on donors.

In addition to the financial benefits it is very important for networking and capacity building that we maintain good relations with a range of international organizations. Through networking we are able to obtain training and other funding opportunities that help us improve the staff capacity and technical standards of the Department and improve forest management.

A summary of the projects active in the DoF during 2000 is given below.

Forestry Legislation review Project (FAO)
Purpose of the project / Objectives: Design legislation for sustainable development of Vanuatu's forests, generation and equitable distribution of forest revenues, and for the effective implementation of forestry programmes consistent with the 1997 National Forest Policy.
Beneficiaries of the project: Directly to DoF staff, State Law Office staff, indirectly to forest industry and stakeholders including all landowners with forest resources.
Means of service delivery: Consultation meetings and national summit, Draft new Forestry Act, reports, training.
Resources available through the project: Estimated 2000 donor contribution Vt23,270,000, incl. 1 computer
Duration: 1 year ends early 2001.
Number of staff: 2 ni-Vanuatu consultants, expatriate legal expert consultants as required, FAO staff Samoa, Rome.

GTZ Sustainable Forestry Project (German Aid)
Purpose of the project / Objectives: Develop appropriate methodologies of sustainable indigenous forest management and experimentally implement at Butmas, Santo. Carry out awareness measures.
Beneficiaries of the project: Initially landowners at Butmas, with flow on effects through training and demonstration.
Means of service delivery: Reports, training, certified trainers, staff appointed, COLP, inventory
Resources available through the project: Estimated 2000 donor contribution Vt9,322,500, 1x4WD truck,
Duration: 3 years ends 2000.
Number of staff: 1 ni-Vanuatu Project Manager based in Luganville, expatriate staff in Fiji, consultants as required.

Aneityum Erosion Control Project Vt2,314,600
Objectives: To control the soil erosion on up to 300 ha and to commence control measures on a further 170 ha.
To train local staff and trial a range of techniques.
To carry out awareness programs aimed at the local population.
To try to perpetuate funding of the Program in some form at the community level.

Kauri Reserve *(Note – funding for this project was withdrawn by the New Zealand government during 2000).*
Purpose of the project / Objectives: To assist the villagers in the management of the Kauri Reserve and therefore provide alternative income generating projects to the people of Umpon Yelongi
Beneficiaries of the project: People of Umpon Yelongi, Erromango.
Resources available through the project: Estimated 2000 donor contribution Vt3,570,000
Duration: 2 years ends 2000.
Number of staff: 2 expatriate volunteers based on Erromango.

South Pacific Regional Initiative on Genetic Resources (SPRIG) Project
(Note: Phase 1 ended mid 2000 with Phase 2 delayed until early 2001)
Purpose of the project / Objectives: To make selection, improvement and supply of quality seeds of indigenous and exotic species. To set up conservation strategies and actions for indigenous species, gender component included and institutional strengthening.
Beneficiaries of the project: People throughout the South Pacific.
Resources available through the project: Estimated donor contribution Vt21,250,000 per year for 3 years
Duration: 3 years pilot project ends mid 2000. AusAID has agreed to a second 5-year phase starting 2001.
Number of staff: 1 expatriate Team Leader, 1 Project Manager in Canberra, consultants as required.

Mangaliliu Community Forestry Project Vt214,550
Objective: To utilise Mangaliliu LSP to reduce environmental impact of *Cordia alliodora* regeneration and for job creation and sustainable livelihoods for both men and women at the community level

Vanuatu Biodiversity Mapping and Training Project
Purpose of the project / Objectives: To improve the knowledge of Vanuatu's biodiversity and the capacity to effectively manage it for the benefit for current and future generations.
1. To build the capacity of DoF and Environment Unit staff and build skills in biodiversity assessment
2. To develop flora and fauna databases for Vanuatu
3. Development and refinement of species maps and identification of species conservation requirements
4. To identify preliminary potential biodiversity conservation areas

Beneficiaries: By improving the capacity of staff from the DoF, Environment Unit and LUPO the Project beneficiaries will include people throughout Vanuatu with areas of land containing conservation values.
Resources available through the project: Estimated 2000 donor contribution Vt8,400,000
Duration: 1 year ends 2000.
Number of staff: Environment Australia staff in Canberra and consultants as required.

Key issues and concerns

Future outlook for the forestry sector

Brown (1997) states that it is evident that Vanuatu has the potential to be self sufficient in solidwood products and to develop a modest export industry. However, it is equally evident that achieving this goal requires better organisation and management of forestry programmes than occurred in the earlier LSP and ISP programmes. The future will probably see Vanuatu continuing to supply the majority of its sawn timber needs but importing panels, paper and speciality sawn timber.

The DoF Annual report for 2000 notes the following positive developments (highlights) and also issues and concerns for the future.

Highlights

- Most of the **Forestry Legislation Review** consultation work was completed in 2000 and a draft bill is ready for tabling in the next 2001 parliament sitting
- Work on the new **Forest Operator Licensing** scheme is progressing well and most of the operators assessed should be licensed before end of first quarter 2001.
- **Code of Logging Practice training** and some enforcement to improve logging standards

- Vanuatu was accepted as **a member of the International Tropical Timber Organisation** in May 2000. This will lead to international recognition and support for Vanuatu's forestry sector through future benefits of staff training, technical and project assistance.
- A second **sandalwood oil-processing factory** was established by a new licensee involving substantial investments of around Vt40 million.

Issues and concerns

- **Industry non-compliance with Code of Logging Practice** still a concern
- **Lack of industry interest in training** their own staff to meet the new standards
- **Industry reliance (97%) on two species** Whitewood and Melektree is unsustainable and should include a wider range of species representative of the forest composition
- **Political interference** especially pressure to issue log export and sandalwood licences

References:

Brown, C. 1997. *Regional study — the South Pacific*. Asia-pacific Forestry Sector Outlook Study, Working Paper No. APFSOS/WP/01. FAO, Rome.

Government of Vanuatu (1997). *National Forest Policy*. Vila, Vanuatu Ministry of Agriculture, Forestry and Fisheries**:** 42pp.

Land ownership

Land tenure system in the country appears simple as virtually all land is owned by Custom landowners. However things are actually more complex than this first appears because the boundaries are not defined, nor is ownership recorded in a formal government sense. There is a national council of Custom Chiefs of the republic called Malvatumauri. One of the important roles of this council is to look after the customary landownership system, making it effective and resolving disputes. The entire land in the country is owned by the customary landowners. A man who is a true custom landowner is one whose blood originates directly from the *nakamal* (men's house), *varea* (village), or *nasara* (dancing grounds, public square, ritual clearing or place) associated with that land. If a man's heritage traces to that place, he may resume the titles and ownership of its lands. In parts of the country the right to own the land is through women but the majority is by the men. Depending on the size of a family each individual has a right to a piece of land allocated by the head of the family.

References

Vanuatu Country report, 2000 SPRIG project forest genetic resources workshop, Apia.

Alatoa, H., T. Bakeo, et al. (1984). Land Tenure in Vanuatu. Port Vila, University of South Pacific.

Forest land in public ownership (000 ha)			Forest land owned by indigenous/tribal peoples (000 ha)	Forest land in private ownership (000 ha)
State	Other[1]	**Total**		
			All land is custom owned	

[1] Other: Forest land belonging to cities, municipalities, villages and communes. Also includes any publicly owned forest and other wooded land not elsewhere specified.

References: Constitution of Vanuatu

Comments:

Protected areas

Area Name	Subclass	Type of area	IUCN Cat.	Total Area	Reference
1. Wiawi (Lasenwei)	NATIONAL	Protected area	VI	1,411	Luca Tacconi (1997)
2. Erromango	NATIONAL	Reserve	VI	3,205	Luca Tacconi (1997), Land Lease Act Cap 163
3. Vatthe	NATIONAL	National Park	VI	3,144	
4. Loru	NATIONAL	Protected Area	VI	306	

Policy and legislation

The post-independence Constitution devotes a chapter to land issues, and provides the basis upon which all legislation and policy concerning land tenure in Vanuatu rests. The salient points are that: all land in the Republic belongs to the indigenous custom owners and their descendants; the rules of custom form the basis of ownership and use of land; only indigenous citizens who have acquired land in accordance with a recognised system of land tenure may have perpetual land ownership; and government may own land in the public interest (Nalo *et al*., 1987). Most land is thus in customary ownership and there is little likelihood of Government acquiring land for protected areas. Such areas would have to be leased or managed jointly by the government and custom owners (M.R. Chambers, pers. comm., 1989). Declaration of a site as public land could well meet with opposition from custom owners, and could involve expensive compensation (Nalo *et al*., 1987).

The issue of land tenure must be seen in the light of customary practice, or strong traditions concerning land. Although there are certain nationwide principles, such as the important distinction between use rights and ownership rights, the system is highly fragmented and different practices may apply amongst the over a hundred languages in the country. Land tenure, customary tenure, protected areas and conservation are discussed further by Nalo *et al*. (1987) and with particular reference to the establishment of Erromango Kauri Reserve (Barrance, 1989).

The current approach being taken in Vanuatu is the development of Protected Areas under the IUCN category VI. Even though a National Parks Act was gazetted in 1998, it has been found that effective approach for conserving biodiversity has simply been for custom owners to declare an area as protected. Along with this declaration a collaborative agreement is made with government on the rules or form of management to be carried out by the owners. This has been done to varying degrees for four forested PA areas (listed above), though more work is required in the development of management for biodiversity and cultural values. Further work is also required to review whether any legislation is required that will assist in maintaining these values (Department of Forests, 2000)

Legislation for the establishment of national parks and reserves and the protection of land and water is generally lacking (Nalo *et al*., 1987). Laws on Vanuatu which were enacted prior to independence were made by the Resident Commissioners under the provisions of the Anglo-French Protocol of 1914. Some of these are still in force and several include conservation measures. The Forestry Joint Regulation (No.

30 of 1964) provides for the establishment of forest areas, forest lands, and forest reserves (although none have been established), and is incidentally also used for the protection of wrecks. The intention of this legislation is to ensure that forest resources are protected and developed in accordance with good forestry principles.

Under Forestry Act No. 14 (1982), the Director of Forests is authorised to enter into forest plantation agreements with owners to assist reafforestation or to protect threatened forests. Such areas are subject to state control, and clearance without a permit is prohibited. Agreements may be formulated in order to prevent soil erosion, preserve the ecology of an area, conserve land of particular scenic, cultural, historic or national interest, or for recreational use by the public (Sloth, 1988).

Other environmental legislation includes the Fisheries Act No. 37 (1982) which provides for the declaration of marine reserves (Section 20) within which no living organism, sand, coral or part of a wreck may be taken or removed.

Improved legislation for national parks and reserves was under consideration in 1989 (Leaver and Spriggs, 1989) and a number of potential protected areas have been identified. The National Conservation Strategy prospectus (IUCN, 1988) states that a project to review the legislation concerning conservation and environment has been implemented, with the object of making recommendations for modifications or additions to existing laws. One major piece of legislation needed is a heritage conservation act that would provide for both cultural and natural conservation. The Act should provide mechanisms whereby custom leaders and landowners could have sites and objects of special importance registered for protection under the act. Ownership and management would rest with the custom owners, but with the additional support of the law for their protection and specified penalties for the violation of that protection.

The contribution made by traditional custom and practice towards protected areas and resource conservation is significant. For example, seasonal custom taboos are applied in certain coastal waters for the conservation of dugong, fish and turtle (SPREP, 1989). During colonial times land in Vanuatu was registered under freehold titles and were mainly held by non-indigenous interests. Land held by the French, British and Condominium governments prior to independence was vested in the Vanuatu government for the benefit of the Republic, under Land Reform Regulation No. 31 of 1980. A significant number of these land parcels comprised long distances of coastal land about 100m wide. Much of this land has been returned to customary owners, but some has been retained for the establishment of protected areas. The Land Reform Regulation also empowers the Minister responsible for lands to declare any land to be public. This is only done on the advice of the Council of Ministers and after consultation with customary owners. Following requests by the Local Government Council, proposals to declare parts of Espiritu Santo as public land for recreational purposes have been made.

International activities

Vanuatu is party to the International Convention on Biodiversity as well as Convention of International Threatened and Endangered Species and the Vanuatu government is working to address these commitments (Department of Forestry, 2000).

The Convention on the Conservation of Nature in the South Pacific (1976) has been neither signed nor ratified. Known as the Apia Convention, it entered into force during 1990. The Convention is coordinated by the South Pacific Commission and represents the first attempt within the region to cooperate on environmental matters. Among other measures, it encourages the creation of protected areas to preserve indigenous flora and fauna.

Although Vanuatu is party to the South Pacific Regional Environment Programme (SPREP), the 1986 Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention) has not yet been signed or ratified. The Convention entered into force during August 1990. Article 14 calls upon the parties to take all appropriate measures to protect rare or fragile ecosystems and threatened or endangered flora and fauna through the establishment of protected areas and the regulation of activities likely to have an adverse effect on the species, ecosystems and biological processes being protected. However, as this provision only applies to the Convention area, which by definition is open ocean, it is most likely to assist with the establishment of marine reserves and the conservation of marine species.

Other international and regional conventions concerning environmental protection to which Vanuatu is party are reviewed by Venkatesh *et al*. (1983).

Administration and management

The Department of Forestry of the Ministry of Agriculture, Forestry and Fisheries is responsible for the implementation of the Forestry Act No. 14 of 1982. The Department of Fisheries of the same Ministry is responsible for the Fisheries Act No. 37 of 1982, and is consequently responsible for marine reserves, whilst the Ministry is charged with generally overseeing issues concerned with environment and conservation. The administrative status of currently gazetted recreational reserves rests with a local government council, although the legal basis for this is not clear.

In September 1986 an Environment Unit was established in the Ministry of Lands, Geology and Rural Water Supply, with responsibility for coordinating environmental and conservation issues. The Environment Unit essentially has a single objective: to develop policies and programmes such that natural resources are managed so that they are not severely degraded by development activities. Major projects include preparation of a national conservation strategy and comprehensive environmental legislation; resource surveys of fringing reefs, freshwaters, Espiritu Santo Island and biological, geological, scenic and cultural heritage sites; dugong surveys; and surveys of estuarine crocodiles of Vanua Lava (Chambers and Bani, 1987, 1989). The Environment Unit will also be made responsible for the management of any parks and reserves gazetted in the future (SPREP, 1989). The Environment Unit is severely challenged in fulfilling its duties as it only has 3 permanent full time staff, all of whom are based in Port Vila. Even the Department of Forests is understaffed with 38 staff spread throughout 4 of the 5 Provinces.

Systems review

In general, Vanuatu's environment is relatively undisturbed (Chambers and Bani, 1987), due to low population densities (about 10 per sq. km in rural areas), and the limited degree of development (M.R. Chambers, pers. comm., 1989). Nevertheless, this could change due to the high rate of human population increase and the high proportion (85%) of the population engaged in slash-and-burn agriculture and subsistence reef fishing. A broad-ranging discussion of environment, resources and development is given by Baines (1981), covering topics such as tenure, population, administration, financial costs and aspects of natural resources including forests, mangroves, reefs, minerals, wildlife etc. Large-scale agricultural developments are leading to environmental problems, principally accelerated by forest clearance and soil erosion through poor pasture management (IUCN, 1988).

An Action Strategy for Protected Areas in the South Pacific Region (SPREP, 1985) has been prepared. The principal goals of the strategy cover conservation education, conservation policy development, establishment of protected areas, effective protected area management and regional and international

cooperation. Priority recommendations for Vanuatu are as follows: develop a national conservation strategy; establish a kauri reserve on Erromango Island; establish recreational reserves on Espiritu Santo. The development of a national conservation strategy was delayed by a lack of funds, but has since been financed with funds from Australia, channelled through SPREP. SPREP has funded an inter-departmental team to carry out a survey of three potential protected areas on Ambrym, Efate and Malakula and it is hoped that these, along with the proposed site on Erromango, will form the nucleus of a protected areas system (Anon., 1989). Protected Areas either exist or are proposed for these islands (refer to map *Vanuatu Protected Areas*) (Department of Forestry, 2000).

Dahl (1980) has recommended that the protected areas network be consolidated through the establishment of reserves to protect examples of major forest types, grasslands, swamps, lakes and marine habitats; forest reserves on each of the main islands for vegetation and birds, such as 2,000ha of forest in southern Erromango and 2,000-3,000ha in central Efate; a cloud forest reserve on Espiritu Santo, which would be of value for the conservation of Santo mountain starling (Hay, 1986); and reserves along the north-west coast of Malekula or Santo, where reefs were elevated over 6m in 1965. Less specific recommendations are made by Dahl (1986) and include establishing a major protected area on Espiritu Santo, smaller reserves at least on Tanna, Aneityum and Erromango, a recreation and tourism reserve on Efate, and protection of saltwater crocodiles on Vanua Lava (Dahl, 1986).

From recent surveys carried out by Department of Forestry it is thought higher levels of plant biodiversity are found in mountainous area and yet generally threat to these areas are relatively low. Though it is the lowland forests that are clearly under threat from various kinds of industrial land use. There is still poor understanding of the different vegetation types/alliances found in these higher risk areas and survey work is planned to assist government on where it should concentrate its efforts. This includes awareness programs and development of management plans where landowner commitment for maintaining biodiversity and cultural values is strong. This strategy maybe effective in the long term particularly with on going government support (Department of Forestry, 2000). However where commitment is not strong by custom owners maintenance of Protected Area and its values in the long term may not be certain. The Erromango Kauri Reserve is an example of this, both leasing the protected area and development of ecotourism are being trialled as solutions to this problem. (Tacconi, 1997)

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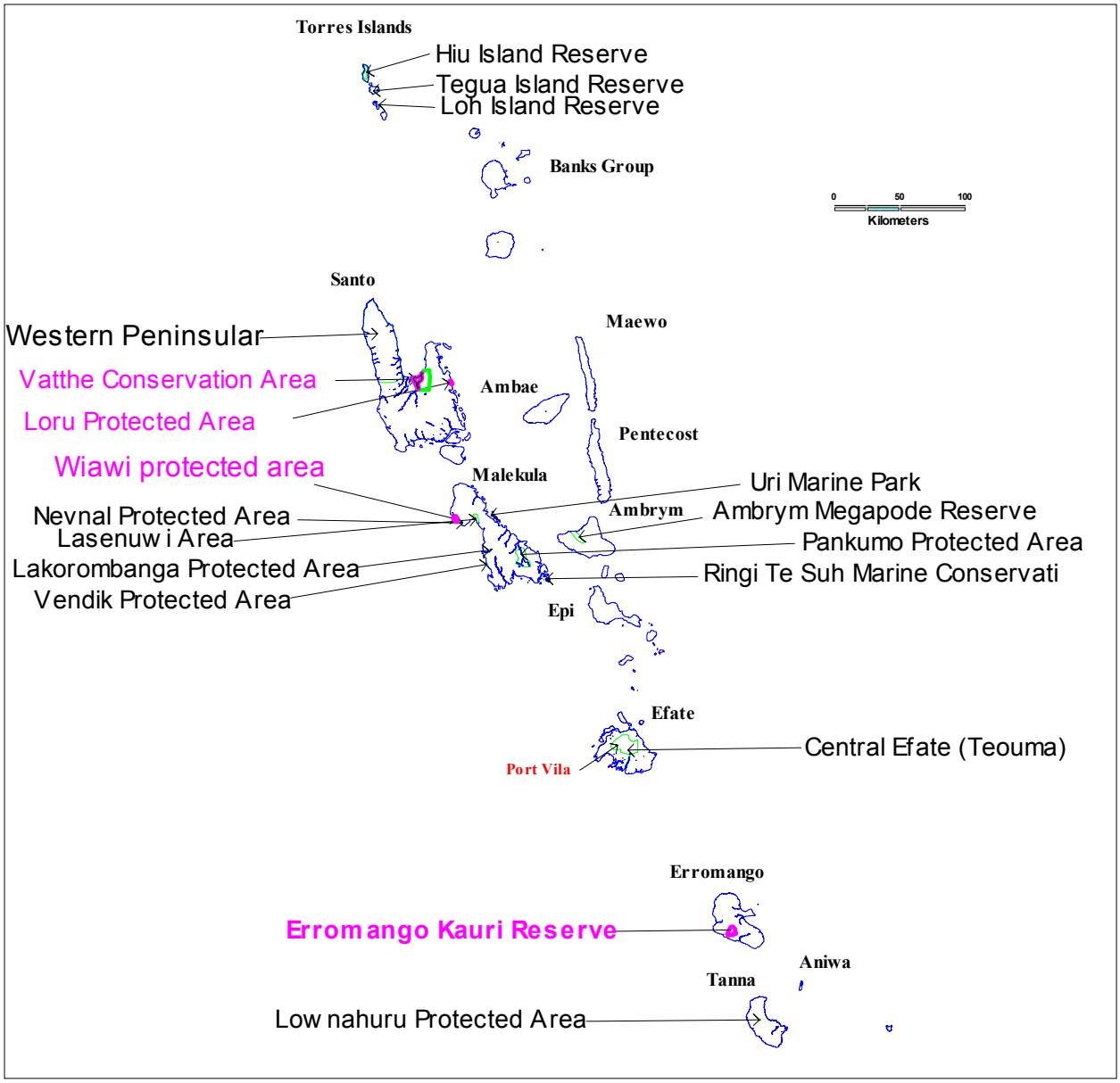
Figure 1: Map of existing and proposed conservation areas in Vanuatu.



Watershed management

Not completed due to insufficient information.

Watershed characteristics (altitudinal gradients, slope, rainfall, river systems, vegetation)

Hydrological infrastructure related to water flow and torrent control

Approaches to soil and water conservation

Land use systems

Institutional mechanisms and structures for planning, decision making, local participation, etc. (e. g. watershed management groups)

Physical infrastructure in the watersheds

Social services within the watersheds

Economic and commercial activities

Major gaps and needs in terms of watershed management

Forest products production, trade and consumption

Contribution of the forestry sector to the country's economy

The main benefits of the commercial forestry operations in Vanuatu are spread between the landowners, the people who work for the timber companies, the timber companies and the government. In1999, the landowners were paid about Vt 36 million (US$275,000) in royalties for 40,000m^3 logs, the forestry workers were paid an estimated Vt 120 million in wages and the government collected about Vt 27 million in fees and taxes.

The 1999 Vanuatu National Census presents employment information that provides some facts on forestry employment (Government of Vanuatu, 2000). The breakdown by industry reports 263 people being formally employed in forestry and logging. A further 131 were employed in wood or wood processing This is considered to be an underestimate of the total as it does not include additional employees in government (e.g. 38 DoF staff), or part-time workers in forestry operations in the field. The unofficial estimate by the Department of Forests is that over 500 people were employed in 1999 in forest operations and fixed sawmills and wood processing industries. Several hundred more are estimated to be involved on full or part-time basis with mobile sawmills and turnover of village workers in larger logging operations.

The wood processing industry on Vanuatu is not well developed. The sawmilling industry comprises three significant fixed site mills and several smaller mills plus around 80 portable sawmills which operate sporadically and produce relatively low quality timber. The fixed site mills generally have some form of pressure treatment facilities. There is one plant producing low-grade veneer, and a small furniture manufacturing industry producing for the domestic market. The Government of Vanuatu has intermittently operated a log export ban to assist in developing a domestic processing industry. A notable Vanuatuan forestry export is sandalwood. This has been Vanuatu's most famous forestry export for upwards of a century. Tonga and New Caledonia also have sandalwood although Tonga's is virtually non-existent.

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Products

The sawnwood (NC) figures added from 1991 to 1999 are considered reasonably accurate. Figures concerning other wood products from 1992 to 1998 are thought to be unreliable or the information is not available to be proofed.

	Units x1000	1991	1992	1993	1994	1995	1996	1997	1998	1999
Roundwood	Cum	**63**		**4**						
Industrial Roundwood	Cum	**39**								
Sawlogs+Veneer Logs	Cum	39								
Wood Fuel	Cum	**24**								
Sawnwood	Cum	**13**	**10**	**10**	**21**	**16**	**19**	**21**	**20**	22
Sawnwood (C)	Cum	0								
Sawnwood (NC)	Cum	13	10	10	21	16	19	21	20	22

1998 Trade Figures from FAO

		Import		Export		Production	Consumption
	Units	Quantity	$US (x1000)	Quantity	$US (x1000)	Quantity	Quantity
Sawnwood	Cum kg?	**722**	**141**	**6317**	**3647**	**7000**	**1405**
Sawnwood (C)	Cum	721	140	47	12	0	674
Sawnwood (NC)	Cum	1	1	6270	3635	7000	731
Wood-Based Panels	Cum	**428**	**182**	**131**	**62**	0	**297**
Veneer Sheets	Cum	3	1	131	62	0	-128
Plywood	Cum	322	143	0	0	0	322
Particle Board	Cum	42	13	0	0	0	42
Fibreboard	Cum	61	25	0	0	0	61
Paper+Paperboard	Mt	**213**	**245**	**0**	**0**	**0**	**213**
Newsprint	Mt	25	16	0	0	0	25
Printing+Writing Paper	Mt	72	97	0	0	0	72
Other Paper+Paperboard	Mt	116	132	0	0	0	116
Roundwood	Cum	**23**	**2**	**349**	**58**	**63200**	**62874**
Industrial Roundwood	Cum	**23**	**2**	**349**	**58**	**39200**	**38874**
Sawlogs+Veneer Logs	Cum	0	0	0	0	39200	39200
Wood Fuel	Cum	**0**	**0**	**0**	**0**	**24000**	**24000**
Recovered Paper	Mt	**3**	**0**	**0**	**0**	**0**	**3**

1999 Trade figures from Vanuatu Departments of Statistics and Forests

		Import		Export		Production	Consumption
	Units	Quantity	$US (x1000)	Quantity	$US (x1000)	Quantity	Quantity
Sawnwood	kg	**159534**	**316**	**1079519 (12,219 m³)**	**271**	**13702m3**	**1663**
Sawnwood (C)	Cum						
Sawnwood (NC)	Cum						
Wood-Based Panels	Cum	**2100369**	**501**	**0**	**0**		2100369
Veneer Sheets	Cum	12116	14	0	0	0	12116
Plywood	Cum	2006685	261	0	0	0	2006685
Particle Board	Cum	51631	63	0	0	0	51631
Fibreboard	Cum	29937	98	0	0	0	29937
Paper+Paperboard	Mt	**485917**	**505**	**0**	**0**	**0**	**485917**
Newsprint	Mt	16000	9	0	0	0	16000
Printing+Writing Paper	Mt	82535	426	0	0	0	82535
Other Paper+Paperboard	Mt	76351	697	0	0	0	76351
Roundwood	Cum	**311000**	**82**	**243510**	**108**	**0**	**67490**
Industrial Roundwood	Cum	0	**0**	**0**	**0**	**0**	**0**
Sawlogs+Veneer Logs	Cum	0	0	0	0	0	0
Wood Fuel	Cum	**31**	**.053**	**0**	**0**	**0**	**31**
Recovered Paper	Mt	**0**	**0**	**0**	**0**	**0**	**0**

Notes: Import and export figures have come from the Department of statistics and are base on customs records. These do not match with the production records which come from department of forest from

sawmillers returns. Some figures are in cubic meters some in kilograms some round log some sawn timber. We have presented the Import Export in kg as this is how they are reported by Statistics Dept. Production figures held by DoF are in m³ round log but these have been converted to sawn timber by assuming a recovery rate of 30%.
Domestic consumption figures are not known and have been estimated by calculating from the remaining figures (Consumption = (production - export) + import.
Any advice and guidelines from FAO would be appreciated to help resolve these difficulties. E.g. comparison with export records from the country importing to Vanuatu (e.g. Fiji pine), or some standard estimates for timber consumption (e.g. 0.05 m³ per person (wild guess for example only!) to give a reality check to the numbers before final publication. If we can get some assistance on this from the workshop or through FAO later we can set up better procedures to record the numbers better in the future.

Fuelwood and wood energy

No information is formally recorded on fuelwood production and consumption. Wood is used mainly for cooking as there is little requirement for heating due to the tropical climate. There are few industrial uses for fuelwood although the second largest sawmill, Melcoffee sawmills, uses sawdust and off-cuts to produce steam to run their kiln driers to reduce high costs of fossil fuels or electricity.

The 1999 Vanuatu National Census collected information on cooking fuel type used by households (Government of Vanuatu, 2000). Results from this show that wood or coconut is still the main cooking fuel in 83% of the 36,415 households overall, with gas making up 15% and others the remaining 2%. These proportions have stayed the same since 1989. However it is important to note that the reports states that the percentage of houses in urban areas using wood has risen from 26% in 1989 to 43% in 1999. This is a reflection of the increase in families living in temporary houses (squatter settlements) in urban areas of Port Vila and Luganville. There is no formal charcoal production in Vanuatu and thus no exports. Imports of charcoal (if any) would be insignificantly small.

The South Pacific Regional study done for the FAO Asia-Pacific Forestry Outlook Study (Brown, 1997) gives estimates for fuelwood production and consumption for Vanuatu to be between 73,500 and 207,000 tonnes in 1994 (see Table 21). Brown (1997) states: "*the Melanesian and Polynesian countries' estimates are derived from the average fuelwood per capita reported for these countries in the FAO 1994 Yearbook (0.49 cubic metres), and also using the maximum per capita consumption (Papua New Guinea; 1.38 cubic metres)*". Data from Brown (1997) on fuelwood is given below for countries incl. Vanuatu.

Table 21: Scenarios for Fuelwood Removals (Cubic metres) – selected data from Brown (1997)

Country	1994 FAO Fuelwood Production[2]	Population	Fuelwood Consumpt'n per capita 1994	Estimated Fuelwood Production (Average) 1994	Estimated Fuelwood Production (Maximum) 1994	Estimated Fuelwood Production (Average) 2010	Estimated Fuelwood Production (Maximum) 2010
Papua New Guinea	5 533 000	4 011 000	1.38	5 533 000	5 533 000	8 253 000	8 253 000
Solomon Is.	138 000	320 000	0.43	156 800	441 600	262 600	740 000
Fiji	37 000	726 000	.05	355 700	1 001 900	438 000	1 233 000
Vanuatu	24 000	150 000	.16	73 500	207 000	107 800	303 600

The figures given by Brown (1997) above are likely to be more realistic than the previous estimate by FAO of only 24,000m^3 for Vanuatu fuelwood consumption. However, as we have no hard information nor expertise in this area, we recommend that FAO consider these above and choose an appropriate amount based on knowledge of fuelwood consumption patterns elsewhere. Note that the population has increased to 186,000 people in 1999 and so Browns figure of 150,000 people needs to be revised and the fuelwood increased accordingly. Population growth rates have increased, and fuelwood use is increasing in urban areas, contrary to some expectations. All these factors mean that it is likely that fuelwood will become an increasingly important issue for forests, especially around urban areas.

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[2] Source FAO Forest Products Yearbook 1993

Species used for fuelwood

Virtually all Vanuatu tree species can be used for fuelwood (Wheatley, 1993) however some are clearly better than others. Most fuelwood is cut locally by rural people but there increasing amounts are being carted into the two main urban areas of Port Vila and Luganville.

Neil (1987) summarizes information on fuelwood trials in Vanuatu. Growth and survival data at 30-31 months are reported for 5 species (*Acacia cincinnata, Albizia falcataria, Casuarina cunninghamiana*, 2 provenances of *Gmelina arborea* and 6 provenances of *Leucaena leucocephala*) planted on a site at 120 m alt. at Efate, Vanuatu, in 1984. *Albizia falcataria* grew very much better than the other species tested (although it was considerably damaged by cyclone Uma in 1987), and produced appropriate sized fuelwood for use in a small-scale gasifier at 18 month old. *G. arborea* performed next best but is considered less suitable as it is not a nitrogen fixer. *L. leucocephala* performed quite poorly and was attacked by the psyllid *Heteropsylla cubana* in 1985, which caused severe defoliation and dieback.

References:

Neil, P. (1987). Fuelwood trials, Vanuatu Department of Forests**:** No. 2-87, 8 + iii pp.; 14 ref. SOURCE: CAB ABSTRACTS

Non-wood forest products

INTRODUCTION

Main Non-Wood Forest Products

General information

PLANTS AND PLANT PRODUCTS

Food

Wheatley's (1992) *Guide to the common trees of Vanuatu* lists their traditional uses and ni-Vanuatu names. This guide contains much new information while also drawing on an earlier work (Gowers, S. Some common trees of the New Hebrides and their vernacular names. New Hebrides; Forest Section, Department of Agriculture, 1976) which it replaces. The guide is in 4 parts: I, Introduction - how to use the guide, and information on the Port Vila Herbarium, the flora of Vanuatu and its forest types; II, The field guide - an explanation of the format and botanical terms used, guide to use of the key, lists of families of trees and shrubs known from Vanuatu, island area codes and languages, a short account of distinctive features by which taxa may be identified, a field key to genera and species, and (the main part of the guide) descriptions of families, genera and species; III, The ni-Vanuatu names - spelling, pronunciation, notes on the lists of names given, and lists of ni-Vanuatu names with their scientific equivalents; and IV, The use class and species check lists. Species descriptions give details of common, ni-Vanuatu and scientific names, habit, bark and twig characteristics, wood colour, botanical characteristics of leaves, flowers and fruits (and details of flowering and fruiting periods), dispersal method, habitat and ecology, distribution and uses. The use check lists categorize species by major use, and give codes for minor use/s and brief notes on use. The uses are: edible (any part); edible fruits (planted or wild); edible nuts (planted or wild); edible leaves (planted or wild); edible (other parts); any building construction use; ground posts for building; aerial parts for building; canoes and outriggers; weapons and utensils; rope, twine and cordage; fuelwood (ordinary or hot); live fence posts; ornamental and shade; custom (medicine, poison, carving etc., tamtams, drums, standing figures, flas (decorations), dyes and paints, scents, resins and glues, boundary markers); and commercial timber. Source: CAB abstracts.

Indigenous fruits and nuts

Walter et. al. (1995) present information on the fruit and nut trees of Vanuatu. They note that there are some 40 fruit and nut tree species grown in Vanuatu, a few of which are endemic and the rest of which were introduced by early settlers. Only 7 species are traditionally cultivated: breadfruit, *Barringtonia* spp., *Canarium* spp., golden apple (*Spondias cytherea* [S. dulcis]), Polynesian chestnut (*Inocarpus fagifer*), *Pometia pinnata* and *Syzygium malaccense*. Fruit of wild species such as *Dracontomelon vitiense* and *Terminalia catappa* are eaten. A programme on the island's fruit and nut trees between April 1991 and December 1994 produced an inventory of the trees and their vernacular names, updated botanical descriptions, analysed fruit composition and conducted a socio-economic survey to identify which fruit could be processed and marketed. CIRAD established agronomic trials on *Canarium* and *Barringtonia* spp. in Vanuatu. SOURCE: CAB ABSTRACTS

Walter, Sam, et al. (1996) discuss the indigenous nut trees in Vanuatu with particular reference to their ethnobotany and variability. They note that Vanuatu has one of the largest gene pools of oceanic fruit and nut species: many have been grown and eaten since prehistoric times. Twenty-one nut tree species have been identified in Vanuatu, excluding palm trees, shrubs, lianas and breadfruit (which is used mainly for

its pulp and only very occasionally for its nuts in Vanuatu). Many indigenous nut species in Vanuatu have a wide geographical distribution on all oceanic islands from Indo-Malesia towards the Marquises. Some are known to have been introduced by aborigines into the central Pacific, and others have been distributed by sea currents. Among these widely distributed species are *Adenanthera pavonina, Aleurites moluccana, Cordia subcordata, Neisosperma oppositifolia, Inocarpus fagifer [I. fagiferus] and Terminalia catappa.* A few edible species, namely *Barringtonia, Canarium and Finschia chloroxantha*, have a narrower distribution and do not occur east of Vanuatu and Fiji. Only seven species in Vanuatu are commonly cultivated around villages or gardens, or are protected and tended. These are *Barringtonia edulis, B. novae-hiberniae, B. procera, Canarium harveyi, C. indicum, Inocarpus fagifer and Terminalia catappa.* They all play an important part in the diet and all show wide variability within and between species. This paper focuses on these seven species because they represent potential economic resources for Vanuatu. Besides these species, there are minor nuts that are occasionally eaten, mostly by children or in famine time. They may be tended by local communities for another use, such as cordage, basketry, rattles, house construction or light. This paper briefly reviews these minor species as well. From 1991 to 1994 ORSTOM (the French Institute of Scientific Research for Development in Cooperation) studied indigenous fruit and nuts in Vanuatu for the Vanuatu Department of Agriculture. Information collected will allow future development of the species and the simultaneous conservation of the environment. All the results presented here were collected during a two-year survey of 20 areas in Vanuatu. A list of vernacular names for practically all the kinds (morphotypes) of *Barringtonia, Canarium, Inocarpus* and *Terminalia* present in each area was established first with the local community, then trees were found. A total of 346 trees was tagged. The figures given do not represent the real genetic diversity or even the true numbers of botanical varieties. They give the number of morphotypes recognised in a given area by the local people. The names of the morphotypes in each area are either a real local name or a descriptive one (for example, green fruit, small fruit). Names tend to be consistent in an area for the most common morphotypes but not for the rarest ones. SOURCE: CAB ABSTRACTS

Tree nuts are an important land use in Vanuatu, which offer outstanding prospects for expansion. Recent economic analyses have indicated very positive returns from the three main indigenous nuts called nangai (*Canarium* spp.), navele (*Barringtonia* spp.), natapoa (*Terminalia catappa*) (Anon, 1999). Small but growing commercial quantities of these nuts are now being collected in the outer islands and transported to Vila for sale in shops. There is huge export market potential but this has not bee tapped due to small and irregular harvesting despite the substantial existing natural resource.

It is estimated 300,000 ha of forest land contained nangai trees at a density of 1 bearing tree per ha (Anon, 1999). These 300,000 trees were estimated to produce 15,000 tonnes nut in shell (NIS) or 2,250 kernel in testa (KIT) in a year. Commercially available nangai is expected to be considerably less than the estimated total resource.

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Fodder

Medicines

Common trees of Vanuatu (Wheately, 1993) has a useful collection of uses of plants for traditional (kastom) uses, although it notes that many medicinal uses are kept secret and therefore not made widely available.

Perfumes & cosmetics

Sandalwood is an important forest product in Vanuatu and is used for many cosmetic and perfumery uses as well as carving. The main sandalwood species in Vanuatu is *Santalum austrocaledonicum*, which is found on the west coast of Santo and small areas on Malakula and the islands from Efate southwards. It is a parasitic tree and its most common host species appears to be *Acacia spirorbis* in many areas.

Exact resources are not known but control of exploitation is necessary. Neil (1986) noted that about 55 t of wood are exported annually, although this has varied widely. Natural regeneration is poor, probably mainly because of damage by feral animals. Investigations into artificial regeneration have met with varying degrees of success, and further work on regeneration is recommended.

Sandalwood represents a very important forest industry for Vanuatu, and in 2000 the amount paid to landowners for sandalwood (Vt31,727,850) was only slightly less than that paid for all the logging royalties (Vt**33,067,593**). Sandalwood is particularly important for small farmers in remote areas where little other income earning opportunities exist such as on Erromango. In 2000 the DoF recorded over 1,000 separate purchase transactions averaging around 70kg per sale. Some of these people would sell several lots but it indicates the large number of people involved at the grass-roots village level.

A highlight of 2000 was the setting up of the second sandalwood oil distillery in Vila by a new company that aims to increase production during 2000 and beyond. This has the potential to create jobs and to add more value to the product while still in Vanuatu.

Table 22: Sandalwood harvesting summary for 2000.

Island	Quantity harvested (Kg)	Royalty to landowners (Vt)	Government Management charge	Total value (Royalty + GoV charges)
Malakula	0	0	0	**0**
Santo	0	0	0	**0**
Erromango	57,638	25,540,250	1,729,140	**27,269,390**
Tanna	15,469	6,187,600	464,070	**6,651,670**
Grand total	73,107	31,727,850	2,193,210	**33,921,060**

Note: Figures presented as at 29/3/01 – but not all Licensees had presented their returns, so this represents an underestimate of the actual amount harvested.

Table 22 shows a summary of the 2000 sandalwood harvesting in Vanuatu. Licence fees earned the government Vt4 million. Production was more than double 1999 with a total production in 2000 of over 73 tonnes.

References:

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Dying & Tanning

Utensils, handicrafts & construction materials

Wheatley (1993) lists many traditional uses for forest products. This guide contains much new information while also drawing on an earlier work [Gowers, S. Some common trees of the New Hebrides and their vernacular names. New Hebrides; Forest Section, Department of Agriculture, 1976] which it replaces. The guide is in 4 parts: I, Introduction - how to use the guide, and information on the Port Vila Herbarium, the flora of Vanuatu and its forest types; II, The field guide - an explanation of the format and botanical terms used, guide to use of the key, lists of families of trees and shrubs known from Vanuatu, island area codes and languages, a short account of distinctive features by which taxa may be identified, a field key to genera and species, and (the main part of the guide) descriptions of families, genera and species; III, The ni-Vanuatu names - spelling, pronunciation, notes on the lists of names given, and lists of ni-Vanuatu names with their scientific equivalents; and IV, The use class and species check lists. Species descriptions give details of common, ni-Vanuatu and scientific names, habit, bark and twig characteristics, wood colour, botanical characteristics of leaves, flowers and fruits (and details of flowering and fruiting periods), dispersal method, habitat and ecology, distribution and uses. The use check lists categorize species by major use, and give codes for minor use/s and brief notes on use. The uses are: edible (any part); edible fruits (planted or wild); edible nuts (planted or wild); edible leaves (planted or wild); edible (other parts); any building construction use; ground posts for building; aerial parts for building; canoes and outriggers; weapons and utensils; rope, twine and cordage; fuelwood (ordinary or hot); live fence posts; ornamental and shade; custom (medicine, poison, carving etc., tamtams, drums, standing figures, flas (decorations), dyes and paints, scents, resins and glues, boundary markers); and commercial timber. SOURCE: CAB ABSTRACTS

Ornamentals

Exudates

Others

ANIMALS AND ANIMAL PRODUCTS

Living animals

Honey and beeswax

Bushmeat

Other edible animal products

Hides and skins

Medicines

Colorants

Other non-edible animal products

REFERENCES

Wheatley, J. (1992). A guide to the common trees of Vanuatu with lists of their traditional uses & ni-Vanuatu names, Sun Productions.

QUANTITATIVE DATA ON NWFP

[note table below may as well be deleted as no analysis has been done – left in for completeness now]

Product			Resource				Economic value			
Category	Impor-tance	Trade name Generic term	Species	Part used	Habitat	Source	Desti-nation	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food				fr, nu, se, le, pl, ro, fl, st, ju, oi						
Fodder				le, fl, fr						
Medicines										
Perfumes, cosmetics				oi						
Dying, Tanning				ba, fl						
Utensils, handicrafts, construction materials				st, ba, fi						
Ornamentals				pl						
Exudates				gu, re, la, ta						
OTHERS										

[note table below may as well be deleted as no analysis has been done – left in for completeness now]

Product			Resource				Economic value			
Category	Impor-tance	Trade name Generic term	Species	Part used	Habitat	Source	Desti-nation	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Living animals				an						
Honey, beeswax				ho, bw						
Bushmeat										
Other edible animal products										
Hides, skins										
Medicines										
Colorants										
Other non-edible animal products										

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance
Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)
Source: W - wild, C - cultivated
Destination: N - national; I – international

Forest services

Recreation and tourism

Carbon sequestration

Wildlife habitat and biodiversity

Other services

Appendix

1. Additional references

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2. Population and trends

The Vanuatu National Population and Housing Census for 1999 (Government of Vanuatu, 2000) estimates the total population of Vanuatu to be 186,678 people. It is estimated to be growing fast at 2.6% per annum which gives a doubling time of around 25 years. Almost 80% of the people lived in rural areas although there is an increasing drift to the two main urban areas of Luganville and the capital Port Vila. Urban growth rate was 4.2% but the rural growth rate was considerably lower at 2.2%. The crude birth rate is 33 per 1,000 people, which has declined from 37 in 1989. The 1999 fertility rate was 4.5, which is also down from 5.3 in 1989.

Trends in population growth over time

Year	Vanuatu's population
1967	77,988
1979	111,251
1989	142,419
1999	186,678

The working age population was 97,642 people. Of these 76,370 (78% were "economically active". Of the economically active, 51,309 were susbsistence farmers (ie about 66% of economically active people were subsistence farmers). The usual quoted figure is that 80% of ni-Vanuatu are subsistence farmers which equates to the 80% living in rural areas.

Source: Government of Vanuatu (2000). Vanuatu National Population and Housing Census, 1999, Main report. Port Vila, National Statistics Office**:** 231.

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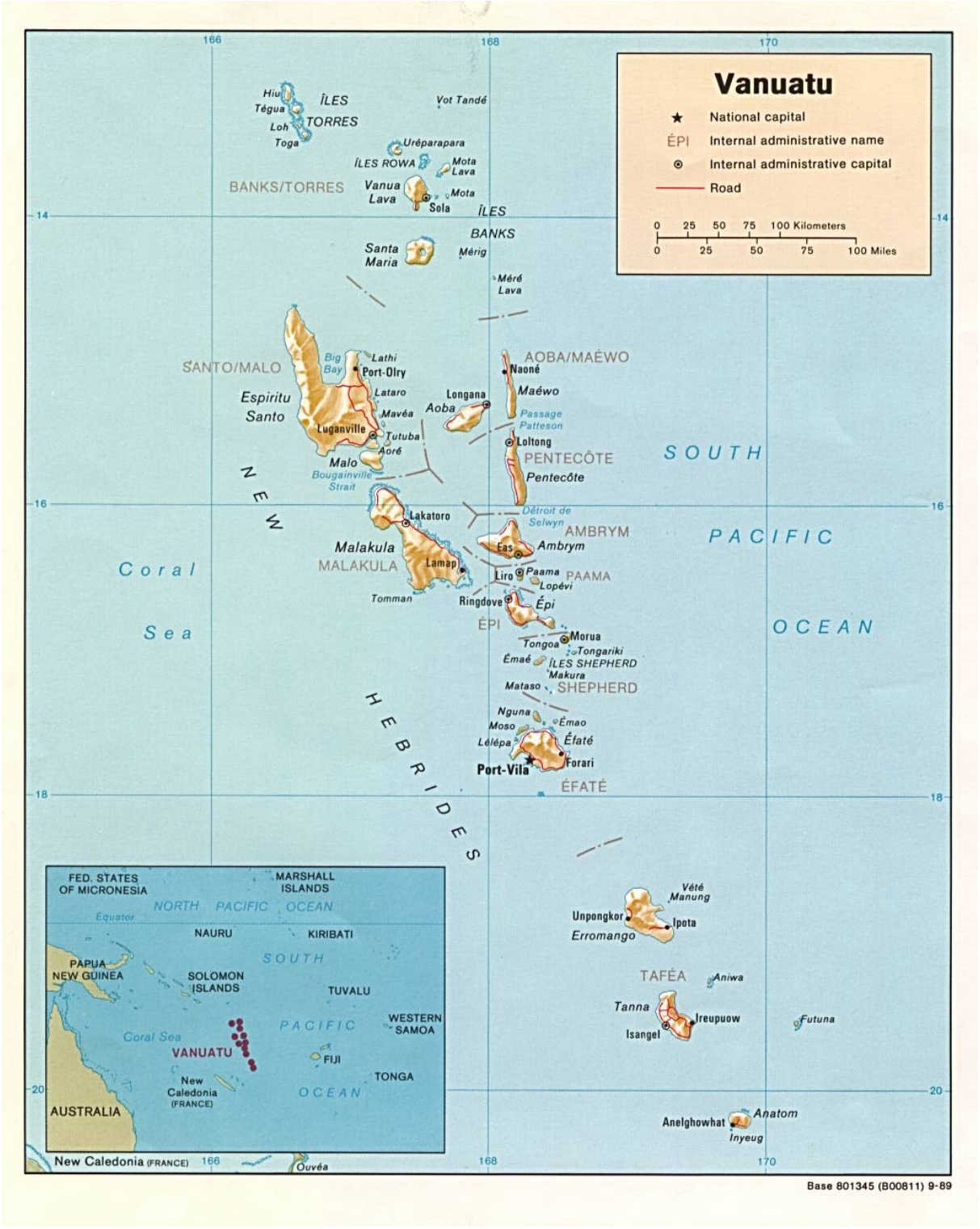
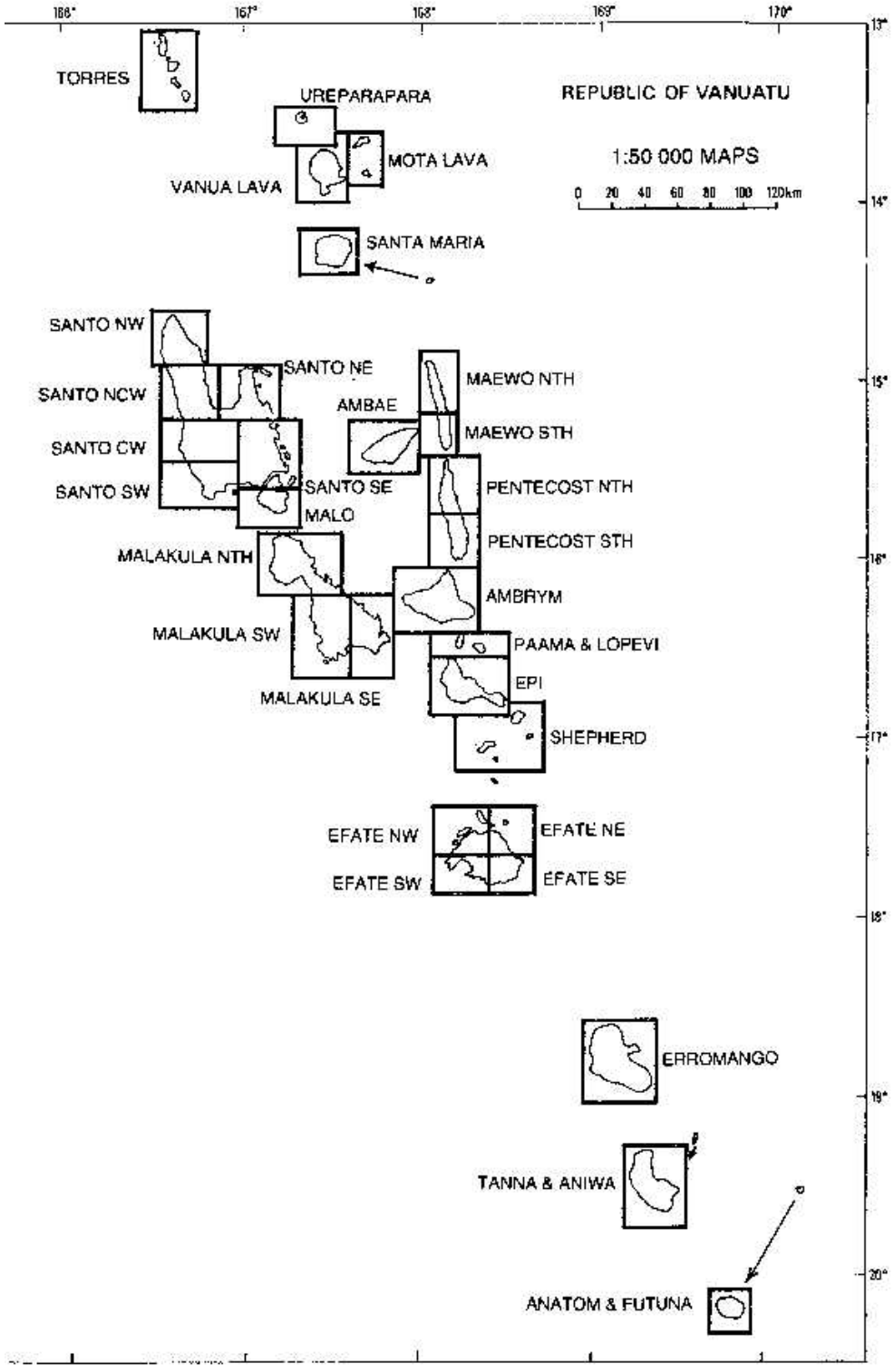
Attachments

1. Map of Vanuatu



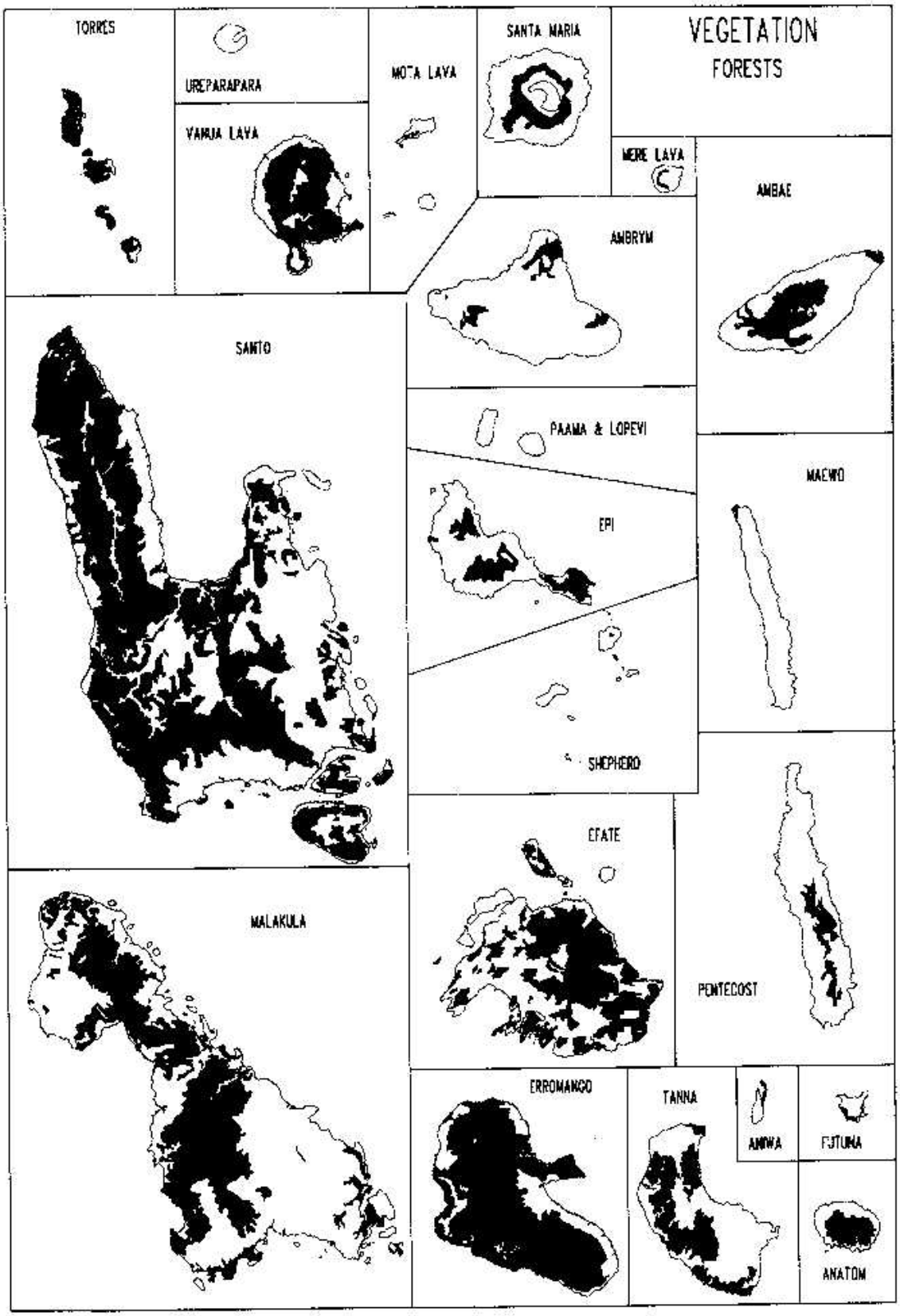
2. Key to VANRIS Resource Mapping Unit (RMU) 1:50,000 maps

APPENDIX 2



A2.1 Key to 1:50,000 Resource Mapping Unit and Vegetation and Land Use Intensity maps.

3. Map showing forest > 10m tall from VANRIS for main islands of Vanuatu



4. VANRIS Vegetation and forest types (Tables from Bellamy, 1993)

Alpha Code	Code	Vegetation Type
Forests		
Fme	100	Midheight forest with emergents
FmeAgCI	110	Midheight forest with *Agathis-Calophyllum*
FmeCI	120	Midheight forest with *Calophyllum*
FmeCIAg	130	Midheight forest with *Calophyllum-Agathis*
FmKh	140	Midheight forest with *Kleinhovia hospita*
Fmm	150	Midheight forest with small to medium crowns
Fmml	160	Midheight forest with small to medium crowns; dense remnants
Fmm2	170	Midheight forest with small to medium crowns; medium-dense remnants
Fmm3	180	Midheight forest with small to medium crowns; sparse remnants
Fmo	200	Midheight forest with an open canopy
Fmol	210	Midheight forest with an open canopy; dense remnants
Fmo2	220	Midheight forest with an open canopy; medium-dense remnants
Fmo3	230	Midheight forest with an open canopy; sparse remnants
FmoCI	240	Midheight forest, open canopy, with *Calophyllum;* local *Agathis*
Fmoe	250	Midheight forest, moderately open canopy, with emergents
Fms	260	Midheight forest with small crowns
FmW	270	Midheight forest with *Metrosideros-Weinmannia*
Fl	300	Low forest
FlAs	310	Low forest with *Acacia spirorbis*
FlBa	320	Low forest with *Barringtonia asiatica*
FlCe	330	Low forest dominated by *Casuarina equisetifolia*
FlCI	340	Low forest with *Calophyllum neo-ebudicum*
FlM	350	Low forest with *Metrosideros*
FlMW	360	Low forest with *Metrosideros-Weinmannia*
FlMx	370	Low forest of mixed species composition
Fld	380	Low forest with a high proportion of deciduous trees
Fle	390	Low forest with emergents
FlKh	400	Low forest with *Kleinhovia hospita*
Flm	410	Low forest with medium crowns
Flme	420	Low forest with medium crowns and emergents
Flo	430	Low forest with an open canopy
Flo2	440	Low forest with an open canopy; medium dense remnants
FloAs	450	Low forest, open canopy, dominated by *Acacia spirorbis*
Fls	460	Low forest with small crowns
Flsw	470	Low forest; swampy
Woodland		
Was	500	Woodland dominated by Acacia spirorbis

Thickets		
T	*550*	Thicket of unspecified composition
TAg	560	Thicket with *Agathis-Calophyllum*
TAs	570	Thicket dominated by *Acacia spirorbis*
TAsCe	580	Thicket dominated by *Acacia spirorbis* and *Casuarina equisetifolia*
TB	590	Thicket dominated by *Hibiscus tiliaceus*
TBPI	600	Thicket containing *Hibiscus tiliaceus* and palms
TCe	610	Thicket dominated by *Casuarina equisetifolia*
TF	620	Thicket dominated by tree ferns
TFCe	630	Thicket dominated by tree ferns and *Casuarina equisetifolia*
TFPI	640	Thicket dominated by tree ferns and palms
TL	650	Thicket dominated by *Leucaena*
TLAs	660	Thicket dominated by *Leucaena* and *Acacia spirorbis*
TLMx	670	Thicket dominated by *Leucaena* and mixed species
TMW	680	Thicket with *Metrosideros-Weinmannia*
TMP	690	Thicket with *Metrosideros and Pandanus*
TMx	700	Thicket of mixed species
TmxPI	710	Thicket of mixed species and palms
TPF	720	Thicket dominated by *Pandanus* and tree ferns
TP	730	Thicket dominated by *Pandanus*
TPg	740	Thicket dominated by *Psidium gayova*
TPICe		Thicket donated by palms and *Casuarina equisetifoRa*
Scrub		
S	800	Scrub of unspecified composition
SV	810	Low scrub of *Vaccinium-Cyperaceae*
Grassland		
G	850	Grassland and/or herbaceous communities
Gt	860	Tall grassland
Swamp Communities		
Sw	900	Swamp community complex
Swg	910	Herbaceous swamp
Sww	920	Woody swamp
SwMs	930	Sago swamp
Mangrove Communities		
M	950	Mangrove communities
Other		
N/A	999	Bare ground or man-made (see Land Use)

5. Appendix: Description of forest types from VANRIS Handbook. (Note: only forest types shown – other types excluded)

Code	Name	Description	Occurrence
Fme	Mid height forest emergents (Figs 6.1, 6.2, 6.3)	An even, moderately dense canopy with large-crowned emergent probably banyans *(Ficus spp.)*. The main species recorded for the canopy are *Dysoxylum confertiflorum, Myristica fatua, Syzygium sp., Buchanania cf.macrocarpa, Calophyllum neo-ebudicum, Hernandia moerenhoutiana, Elaeocarpus angustiflolius Syzygium nutans, Burckealla obovata Pterocarpus indicus, Terminalia catappa, Endospermum medullosum, Canarium indicum and Ficus spp.*	From almost sea-level to approximately 1000m, generally over a wide range of land forms and rock types. On the drier western sides of islands, it is generally confined to the moister areas in the higher part of its range of altitude. It is found in the Banks group, and on Santo and Efate islands.
FmeAgCL	Mid height forest with *Agathis-Calophyllum*	An even moderately dense canopy with small to medium-crowned emergents – probably *Agathis* and *Calophyllum*. Recorded species for canopy include include *Agathis macrophylla, Calophyllum neo-ebudicum, C inophyllum Hernandia moerenhoutiana, H. peltata, Weinmannia denhamii, spp., Terminalia sepicana, Bischofia javanica, Dysoxylum amooroides, D gaudichaudianum, Burckella obovata, Planchonella linggensis, Dillenia biflora, Mangifera minor, Elattostachys falcata, Serianthes vitiensis, Metrosideros collina, Acacia spirorbis* and *Ficus spp.*	Mainly on volcanic cones, hills and footslopes below 100m. A. Spirorbis is occasionally present on the drier sides of Erromango, Tanna and Aneityum islands.
FmeCI	Mid height forest with *Calophyllum*	Identical to FmeAgCI except that *Agathis* is not present.	On Erromango island
FmeCIAg	Mid height forest with *Calophyllum-Agathis*	Identical to FmeAgCI except that *Agathis* occurs in scattered stands.	On Erromango island
FmKh	Mid height forest with *Kleinhovia hospita*	A relatively even canopy without obvious emergents and characterized by a high proportion of *Kleinhovia hospita* and other semi-deciduous species. Canopy species recorded include a high proportion of *Veitchia* palms with *Kleinhovia hospita, Castanospermum australe, Dracontomelon vitiense, Pterocarpus indicus, Pisonia umbellifera, Antiaris toxicaria, dysozylum amooroides, D.gillespianum, Garuga floribunda, Endospermum medullosum, Terminalia catappa, Dendrocnide latifolia, Inocarpus fagiferus, Adenantherra pavonina, Gyrocarpus americanus, Elattostachys falcata, Sterculia vitiense, Intsia bijuga and Pleiogynium timorense*.	The drier western side of Malekula on recent alluvium, calcareous terraces and planteaux, and volcanic mountains and hills at altitudes below 300m.
Fmm	Midheight forest with small to medium-diameter crowns	More or less even closed canopy with occasional banyans emerging from it. Of the canopy trees *Antiaris toxicaria* and *E.medullosum* are the most common. Other species include *Pisonia umbrellifera, Sterculia vitense, Dendrocnide latifolia, Bishofia javanica, Ficus spp., Terminalia catappa, Evodia bonwickki, H. moerenhoutiana. P.indicus* and *M. fatua*	On a range of landforms and rock types on Efate in areas below 300 m with a wet climate.

Code	Name	Description	Occurrence
Fmm1	Mid-height forest with small to medium-diameter crows; dense remnants	Similar to Fmm except that the canopy is even more open and irregular due to removal of trees for selective logging or clearing for agriculture.	As for Fmm
Fmm2	Mid-height forest with small to medium-diameter crowns; medium-dense remnants	Similar to Fmm1 except that the canopy is even more open and irregular.	As for Fmm
Fmm3	Mid-height forest with small to medium-diameter crowns; sparse remnants.	Similar to Fmm2 except that the canopy is represented by only occasional trees	As for Fmm
Fmo	Mid-height forest with an open canopy (fig.7.2)	The lower tree stratum is visible on the air photographs. Occasional banyans are present. Common canopy species include *Antiaris toxicaria E.medullosum, Dendrocnide latifolia, B.obvata, Pometia pinnata, Ficus spp., Terminalia catappa, Evodia bonwickki, H. moerenhoutiana. P.indicus* and *M. fatua.*	On a wide range of landforms and rock types throughout Vanuatu, but largely confined to lower slopes below 300m altitude. Although principally a forest of wet climates, it does occur on dry to intermediate climates, where soil moisture conditions are favourable. In these conditions, the proportion of deciduous and semi-deciduous species is significantly higher.
Fmo1	Mid-height forest with an open canopy; dense remnants (Fig.6.1).	Similar to Fmo but the canopy is more open as a result of selective logging or partial clearing for agriculture.	On Efate and Santo
Fmo2	Mid-height forest with an open canopy; medium-dense remnants	Similar to Fmo1 but it is more disturbed.	On Efate and Santo
Fmo3	Mid-height forest with an open canopy; sparse remnants.	Similar to Fmo1 except that disturbance is so severe that only vestiges of the original forest remain.	On Efate and Santo where logging or grazing operations are present.

Code	Name	Description	Occurrence
FmoCI	Mid-height forest, open canopy, with *Calophyllum;* local *Agathis.*	Similar in canopy characteristics and species composition to Fmo forest except that it has a high proportion of *Calophyllum neo-ebudicum* in the canopy. *Veitchia* palms are also common.	On mountains and hills of calcareous and pyroclastic parent material on Efate, generally between 300 m and 1000m in altitude in areas with a wet climate.
Fmoe	Mid-height forest, moderately open canopy with emergents Figs 6.1, 7.1)	Similar to Fmo forest except that it has a significant number of emergent banyans. Canopy species recorded include *Ficus spp., Dysoxylum amooroides, D. gillespieanus, Bischofia javanica, Elaeocarpus chelonimorphus, Myristica fatua, Pisonia umbellifer, Syzygium nutans, Burckella oborvata, elattostachys falcata, Macaranga dioica, Planchonella linggensis, Alphitonia zizyphodes* and *Veitchia palms*	On Tanna on volcanic plateaux below 300 m in areas with either a wet or dry climate.
Fms	Mid-height forest with small crowns .	Relatively even canopy with occasional large-crowned emergent banyans. Canopy species recorded are *D.amooroides, M.fatua, Garcinia vitensis, C.neo-ebudicum, D.latifolia, M.collinia, B.javanica, P.indicus, Ficus spp.*	On mountains and hills of calcareous and pyroclastic parent material on Efate, generally between 300 m and 1000 m in altitude in areas with a wet climate.
FmW	Mid-height forest with *Metrosideros-Weinmannia*		On lower volcanic footslopes from 200 m to 300 m altitude in areas of south-east Tanna with a wet climate.
FI	Low forest	A canopy of small to medium crowned trees with occasional banyan emergents. The most commonly occurring species of the canopy are *Kleinhovia hospita* and *Veitchia* palms. Other recorded species include *I. bijuga, P. indicus, C. australe, G. floribunda, G. americanus, D. latifolia, A. toxicaria, D. vitense, P.costata, P. pinnata,* and *A. spirorbis*	
FIAs	Low forest with *Acacia spirorbis* (Fig 6.3)	Structure and floristic composition similar to that of the FI forests. However *A. spirorbis* and *Gyrocarpus americanus* form a significant part of the canopy with other deciduous and semi-deciduous species.	Confined to dry area below 100m altitude on a wide range of landforms on Santo and Efate islands.
FIBa	Low forest with *Barringtonia asiatica*	A significant proportion of *Barrintonia asiatica* and *B. edulis* amongst the canopy trees. Other recored species are M*acaranga megacarpa, Syzygium nutans, Instia bijuga, Gyrocarpus americanus, Burckella obovata, Casuarina equistifolia, Garuga floribunda, Diospyros samoensis, Bischofia javanica, Dysoxylum amooroides, Hernandia peltata and Pometia pinnata.*	Confined to the coastal plan and low raised coral terraces in the perhumid climates of the Torres Islands.
FICe	Low forest dominated by *Casuarina equisetifolia*	Pioneer community, which may occur in three different environments in Vanuatu; on coastal plains and recent limestone terraces as a fringe community along the coast; as riverine pioneer (as in Santo); or as a pioneering community on recent volcanic plains. In all cases FlCe begins as a pure colonising stand. Over time, as site conditions change, other species invade the community and its character slowly changes.	On most islands of Vanuatu.

Code	Name	Description	Occurrence
FICI	Low forest with *Calophyllum neo-ebudicum*	Similar in structure to the FI vegetation type but appears to be very poor in species. Canopy species recorded include *Syzygium sp. Calophyllum neo-ebudicum, Antiaris toxicaria, Instia bijuga, Bischofia javanica, Planchonella linggensis, Dysoxylum amoorroides, Pisonia umbellifera nad Acacia spirorbis.* The paucity of species and the relatively common occurrence of secondary species point to a past history of cultivation.	On calcareous and volcanic planteaux and terrrances and hill slopes below 300 m in area of south-east Erromango with an intermediate to wet climate.
FIM	Low forest with *Metrosideros.*	Similar structure to FI forests and probably a similar floristic composition to FmW forests with *Metrosideros* and *Weinmannia* commonly occurring in the canopy.	On Epi and Pentecost islands on calcareous plateaux and volcanic hills or plateaux with wet climates and generally between 300 m and 1000 m.
FIMW	Low forest with Metrosieros-Weinmannia	Similar to FIM forests.	In wet volcanic mountains on Erromango above 300 m.
FIMx	Low forest of mixed species composition	Similar to the FI forests and occasionally has a locally high proportion of secondary garden regrowth species. Canopy species recorded include *Pterocarpus indicus, Biischofia javanica, Ficus spp, Elattostachys falcata, Pisonia umbellifera, Pometia pinnata, Artocarpus communis, Dendrocnide latifolia, Syzygium sp., Myristica fatua* and *Inocarpus fagiferus*.	On limestone terraces and plateaux below 300 m in dry climates of both Erromango and Epi islands.
Fld	Low forest with a high proportion of deciduous trees	Very similar to Fl forests except for the presence of semi-deciduous trees in the canopy. The most common species is *Kleinhovia hospita* and *Pterocarpus indicus* but includes Veitchia palms on Malakula. Other recorded species include *I. bijuga, P. indicus, C. australe, G. floribunda, G. americanus, D. latifolia, A. toxicaria, D. vitense, P.costata, P. pinnata, Macaranga dioica , D. amooroides* and *A. spirobis.* Associated species include *A. spirobis, Ficus spp., P.umbrellifera, B. javanica, P. pinnata. T. catappa & Syzygium spp.*	
Fle	Low forest with emergents	The emergents are mainly large crowed banyans. in other respects it is similar to Fl forests but with a higher proportion of deciduous and semi-deciduous species present in intermediate and drier climate zones.	On alluvium, calcareous plateaux & terraces& volcanic hills and mountains generally below 500 m altitude. The forest is found in dry, intermediate and wet climates of Malakula and Ambrym
Fis	Low forest with small crowns	A relatively even canopy with the main species most probably being *Metrosideros collina, Weimannia denhamii, Gacinia vitensis, Syzygium spp., Astronidium sp* and *Lauraceae*	

6. Appendix: Common and scientific names of commercial trees in Vanuatu.

Agathis macrophylla	Kauri, (Vanikoro kauri or Kauri pine)	*Hernandia moerenhoutinana*	Bluewood
Alphitonia zizyphoides	Huremi or waetwud	*Instia bijuga*	Natora (Kwila, merbau)
Antiaris toxicaria	Milktree or melektri	*Myristica fatua & M.fatua var papuana*	Nandai, wild nutmeg
Bischofia javanica	Nakoka or Javanese cedar	*Palaquium neo-ebudicum*	
Burckella obovata	Naduledule	*Pometia pinnata*	Nandao, (PNG taun)
Calophyllum neo-budicum	Tamanu	*Pouteria costata*	
Castanospermum australe	Bean tree or back bean	*Pterocarpus indicus*	Bluewater, bluwota, New Guinea rosewood,
Dracontomelon vetiense	Nakatambol	*Samanea saman*	Raintree
Dysoxylum gaudichaudianum	Stinkwood or stingwood	*Santalum austro-caledonicum*	Sandalwood, santal
Elaeocarpus floridanus		*Serianthes spp*	White cedar
Endospermum medullosum	Whitewood (PNG basswood)	*Syzygium malaccense*	Nakavika
Garuga floribunda	Namalaus	*Terminalia catappa*	Natapoa, (Indian almond)