Vanuatu Department of Forests / SPC / GTZ Pacific German Regional Forestry Project

Management Plan for the Model Area for Community-based Sustainable Forest Management in Butmas, Vanuatu

Final version [10 August 2004]

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LIST OF ACRONYMS USED

AAC	Annual Allowable Cut
AWA	Annual Working Area
AWP	Annual Working Plan
BNFPC	Butmas Natural Forest Products Co-operative Ltd
DFS	German Forest Service Ltd.
DLT	Diameter Limit Table
DoF	(Vanuatu) Department of Forests
EDP	Enterprise Development Plan
FAO	(UN) Food and Agriculture Organization
FMP	Forest Management Plan
FMU	Forest Management Unit
GOPA	Gesellschaft für Organisation, Planung und Ausbildung Ltd.
GSV	Gross Standing Volume (m^3 / ha)
GTZ	German Agency for Technical Co-operation
LEARN	Landowners Education and Awareness on Regenerating Naturally
MAD	Maximum Attainable Diameter
NCOLP	National Code of Logging Practice
NFI	National Forest Inventory
NFMPP	Natural Forest Management Pilot Project (Nakavu, Fiji)
NFPF	National Forestry Programme Facility
NTFP	Non Timber Forest Product
PGRFP	Pacific German Regional Forestry Project
PHI	Pre-Harvest Inventory
PNG	Papua New Guinea
PWD	Public Works Department
PSP	Permanent Sample Plot
RAP	(FAO) Regional Office for Asia and the Pacific
RFO	Regional Forest Officer
RMU	Resource Management Unit
SFM	Sustainable Forest Management
SFO	Senior Forest Officer
SPC	Secretariat of the Pacific Community
SPRIG	South Pacific Regional Initiative on Forest Genetic Resources
SVT	Santo Veneer & Timbers Ltd
SSS-CITY	Sanma Small Sawmillers Central Indigenous Timber Yard
UN	United Nations
UNCBD	UN Convention for Conservation of Biological Diversity
UNCCC	UN Convention for Control of Climatic Change
UNCCD	UN Convention for Combat of Desertification
USDA	United States Department of Agriculture
VANRIS	Vanuatu Resource Information System
VT	Vatu (1 euro equals around 130 vatu – 21st of June 2004)

1. CONTEXT

Since 1994 the Pacific German Regional Forestry Project (PGRFP) and the Vanuatu Department of Forests (DoF) are co-operating with a primary focus on sustainable (natural) forest management. The PGRFP's **project purpose** is that resource-users (such as landowners or concession-holders) increasingly apply sustainable land and forest management systems. Beyond this, the experiences made should be used for the updating and improvement of national and regional policies and legislation[1].

One major project output revolves around the development of a **Sustainable Forest Management** (SFM) model that shall be applied by landowners in a model area and that shall be used as an example for application at the national and regional levels.

Already as early as 1996, landowners from **Butmas village** in the centre of the island of Espiritu Santo, had made available a 403 ha forest area[2] suitable for the establishment of a natural forest management demonstration site. A co-operation with Butmas village was attractive for the PGRFP and the DoF, because the already existing **Vanmolmol Landowner Association** shared the project's ideas about responsible natural forest management. At the same time the proposed area seemed relatively easily accessible, and conflicts about ownership boundaries did not exist.

At the operational level, the PGRFP subsequently supported a range of preparatory activities. The demonstration area was demarcated and subdivided into so-called coupes. Following an inventory and tree spotters training (in November 96 and March 97 respectively), a Pre-Harvest Inventory (PHI) was implemented in 5 coupes, whereas a 6th coupe was set aside as watershed protection area. During 6 months of field work, a total of 2437 plots (of 200 m^2 each) was established, covering an area inventoried of 48.74 ha, which means a sampling intensity of around 14% (in relation to the total area of 340 ha). The results of the PHI were analyzed and evaluated by Prof. Mussong in March 1998.

The results of the PHI were also used to further improve the silvicultural model based on the application of species-specific diameter limits for felling, whereby the selection / marking of trees for logging occurs with the aid of easily understandable Diameter Limit Tables (DLT). This concept basically follows the lines of work done in the NFMPP pilot project in Fiji (Nakavu) and had already been proposed by Prof. Mussong in 1996, using data from the 1990-1992 national forest inventory.

More surveys and assessments followed. In November 1997, DoF's Forest Conservation Unit carried out a botanical survey of the Butmas project area in order to determine the exact relation between botanical and local tree names. In total, 6 plots of 50 x 50 m and 7 pairs of 15x15 m plots were established for the botanical identification and measurement of trees. The results of this survey have been analyzed by Helen Corrigan and Chanel Sam [1999]. Late in 1999, 12 so-called Permanent Sample Plots [PSP] were established and measured in order to be able to monitor the impacts of the various intensities of logging to be implemented later. These PSP had the same lay-out as the plots established for the botanical survey. No analysis of these plots has been published so far, amongst other reasons because of the frequent shifts in the local PGRFP's staff in the period before 2003.

[1] Edited formulation, based on the PGRFP's presently valid Project Planning Matrix (phase May 2004 – September 2006).

[2] This figure includes the 340 ha (as determined after GPS survey) of the demarcated 6 coupes plus a so-called water catchment protection area north of coupes 1 and 2 of 63.6 ha.

In 1999, the trees qualifying for harvesting according to the model developed by Prof. Mussong were selected and marked in the field. The results of this tree selection have been analyzed during a training course on data processing in November 1999 [De Vletter, 1999].

At that time, the idea was to contract a commercial logging company to carry out the logging according to the project's strict rules and guidelines. The next step was – therefore - that a coupe harvesting plan plus accompanying maps was drawn up (1999). A tender document was prepared, but the attempts to attract a local logging company to fell the marked trees (according to detailed technical conditions set by the project) failed. This was mainly because local companies felt unable to market certain frequently occurring, and – at that time - lesser used species (Dysoxylum, Palaquium and Myristica), but also because the companies were simply not able to meet the high standards of logging that co-operation with the PGRFP would require. A solution was not easy to find and by the end of 2001 project activities virtually had come to a standstill.

The turning point came when the idea to contract a local logger was finally dropped and the fundamental shift to a **community forestry approach** was made. Early 2004, the landowners established a co-operative (the Butmas Natural Forest Products Co-operative Ltd, BNFPC) and an enterprise development plan was prepared [Anonymous, 2004]. The PGRFP purchased an 8" blade all-terrain mobile sawmill and a lease purchase agreement between PGRFP and BNFPC was concluded [in May 2004]. This agreement regulates the use and ownership of the equipment provided by the project, sets the conditions related to the expected development of landowners skills and competences, and provides the lease purchase payment scheme in terms of annual / monthly rates to be paid back to the project.

To increase their capacity, various training courses directed to landowners have been implemented. Training events included a training on mini-sawmill operation (June 2003), a 3-weeks attachment of a clan-representative to Agriculture Suppliers for chainsaw maintenance and repairs (June 2003), a business planning course followed by the application for registration of BNFPC by the Registrar of Co-operative Societies (Oct. 2003) and a 2 weeks training on the Peterson minimill operation (May 2004).

Parallel to these developments the Sanma Small Sawmiller Central Timber Yard (SSS-CTY) has been established recently. This yard is managed by the Association of Small Sawmillers (of which BNFPC is a member) and will play a role in the seasoning, storage, grading, treatment and marketing of the lumber produced by the co-operative, but the exact procedures of operation and management still have to be developed.

The elaboration of a **Forest Management Plan** (FMP) for the model area is seen as the final step in all preparations needed on the way to the implementation of the identified SFM prescriptions. The present document is the final version of the FMP. A draft version was prepared after a first multi-stakeholder consultation held in Luganville on 18 June 2004 (De Vletter and Arudovo, 2004 a) and was presented to – and discussed with - the major national stakeholders in a second workshop in Luganville on 13 July 2004 (De Vletter and Arudovo, 2004 b).

2. INTRODUCTION AND PURPOSE

A **forest management plan** is a written document that bases on some form of previous forest inventory, that presents relevant information about the resource to be managed, that states the objectives of the forest management and that outlines the various steps and activities needed to realize these objectives.

All measures proposed should be in accordance with principles of sound forest management and sustainability (ecological, social-cultural and financial).

Normally, a forest management plan is supported by more detailed **annual working plans**. This will also be the case in Butmas [reference is further made to section 12].

Forest Management Plans are normally required under the prevailing national forest policy statement / legislation, but are only rarely made – even in the case of large scale logging by companies with other wise good track-records. This is also the case in Vanuatu. It must be noted that, if certification is wanted, a forest management plan is a must.

Development and application of a SFM-**model** is important with regard to the implementation of National Forest Policy of Vanuatu (from May 1997), which notes the lack of adequate management plans as a serious constraint. The policy calls (amongst others) for the establishment of forest inventory standards, the development of selection systems for natural forests based on minimum cutting diameters and the formulation of standards for management planning. The plan - as outlined in the following sections - will be fully in line with these requirements.

The development of a SFM-model is further of significance in view of the following developments:

- The process of formulation of forest certification standards in Vanuatu. Although the forest management in Butmas will not yet be targeting export markets, the forest management standard should be such that the road to certification remains open at all times. The Vanuatu National Working Group on Forest Management Certification – in a series of workshops – is still working on local (FSC-oriented) standards and criteria for certification. As long as this process is not concluded, the existing standards for PNG will be used as yardstick in the case of Butmas [see appendix 8].
- Of importance is also the (FAO hosted) National Forest Programme process (NFP) – to which Vanuatu has now become partner. The NPF facility supports partner countries to further the process of National Forest Programme development and the SFM-model could be used as inspiration for project proposals submitted to the facility.
- The SFM-model will also provide inputs to the FAO-funded Forestry Sector Plan. After the endorsement of the forest policy and the new forestry act, the next step will be a 5-year forest sector plan – as the executive arm of the policy.

At a lower level – finally – there is also a relation with the 3 Forest Management Units (FMUs) that have been established on Santo, each with its specific Annual Allowable Cut (AAC) as determined on the basis of the results of the last national forest inventory.

Under conditions of community forestry (as in the case of Butmas) forest management plans are also needed, but taking into account the following rules:

- The plan should not be too “scientific” and complex.
- The plan must be transparent and easy to understand, also for the landowners.
- On the other hand, the plan should fulfill some minimum requirements of DoF – if the plan is accepted to serve as a “model” for application outside Butmas.

GENERAL PART

3. AREA TO BE MANAGED AND LEGAL FRAME

3.1. General area description

Location: The Butmas-block is located in the center of the island of Espiritu Santo [**map reference in annex**], east of the Jordan river (which flows into Big Bay) and the so-called Tanakar ridge. As the crow flies, the distance between Luganville and Butmas is only around 30 km, by car it takes around 1 hour to reach the village. The altitude of the area is roughly 550 m a.s.l. (Butmas village) and increases to 600 – 750 m.a.s.l. going to the west.

Size and subdivision:

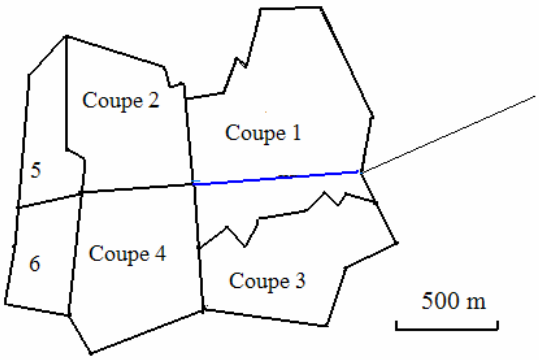
The total land area covered by the Butmas clan is around 1675 ha. It covers the entire Tanakar plateau, plus the very steep slopes to the west and north as well as the more gentle slopes to the east. On the southern side the boundary with the Dragbo and Sorowa clans follows the ridge rather than the foot of the slope. The model area itself is located on the plateau, covers **340.6 ha** and is divided into 6 so-called coupes [demarcated by lines cut through the forest], as follows.

Figure [1]

Subdivision of the model area[3]:

Coupe 1: 108.1 ha
Coupe 2: 56.1 ha
Coupe 3: 64.0 ha
Coupe 4: 57.8 ha
Coupe 5: 31.5 ha
Coupe 6: 23.1 ha

TOTAL: 340.6 ha



Note: the black lines indicate the coupe boundaries, whereas the blue line represents the central base line. Coupe 1 extends to the south of this baseline.

Landform and soils: The largest part of the area lies within Resource Management Unit (RMU) 30779 of the Vanuatu Resource Information Systems (VANRIS). VANRIS describes the landform as a moderately dissected inclined plateau. The rock type is reef limestone in which – as major soil type – **hapludalfs** have developed. These soils belong to the Order of the **alfisols** [according to the USDA soil taxonomy system], which generally develop in humid climates under forest cover and are characterized by clay accumulation in the B-horizon, a thick E-horizon, a high base saturation and much available water. The Great Group hapludalfs belong to the Sub-Order udalfs (alfisols of the humid climates), characterized by a haplic diagnostic horizon (which has – in fact - minimum diagnostic properties). These soils are (excessively) well to locally imperfectly

[3] The surface areas (in hectare) deviate considerably from the figures mentioned in various earlier reports. It was the introduction of the GPS in 2003 which made an exact survey of the coupe boundaries – and thus area calculations - possible (Schweter, 2003)

drained, moderately weathered, where the land is flat deep with finer textured calcareous subsoils under dark topsoils. Cation exchange capacity, base saturation and availability of N and P are all high, which makes these soils fertile and suitable for gardening.

There are no permanently running creeks on the plateau, but only so-called waterways (gullies with locally very steep slopes) in which only during periods of prolonged heavy rainfall surface water is flowing.

Climate: The annual rainfall is around 2500 – 3000 mm, which is higher than the figures found in the coastal areas of the island. Rainfall is fairly evenly distributed over the year, although the period June – September tends to be relatively dry. The average maximum temperature in February is 27^0 C, in August 23^0 C. The average minimum temperatures in the same months are 20^0 C and 18^0 C respectively.

Forest and vegetation: Sanma (Espiritu Santo and Mala) is the province with the most extensive forest resources in Vanuatu. The total forest area for the .province is estimated at around 162.000 ha (source: VANRIS). Of this total, only around 30.000 ha would be suitable for commercial logging (25% of the total commercial forest area of Vanuatu). The major commercial species occurring on the island are Agathis macrophylla (“kauri”), Endospermum medullosum (“whitewood”), Antiaris toxicaria (“melek tri”), Castanospermum australe (“bin tri”), Dracontomelon vitiense (“nakatambol”) and various other species.

In central and eastern Santo forest types are found with species such as Endospermum, Antiaris and Elaeocarpus dominating. The forests on the westcoast are dominated – on the other hand – by species such as Intsia, or, at higher altitudes (ridges), Agathis, Palaquium and Podocarpus.

It seems – however – that the forest around Butmas differs quite much from most other forest types described for Santo. The Butmas area is **unique** in that it is dominated by the species Dysoxylum aneityense, Palaquium neo-ebudicum, Myristica fatua, Terminalia sepicana, Dendrocnide moroides and Elaeocarpus chelonimorphus. The relative importance of these species may differ strongly from place to place and within short distances. In a part of coupe 6 – for example – Dysoxylum was found to be absent, although it occurs everywhere else (Corrigan and Chanel Sam ,1999). The exposed position on a plateau makes the forest susceptible to hurricane damage. Also gardening activities in the past must have influenced the forest to a considerable degree, demonstrated by the frequent presence of the secondary Myristica fatua. Wherever the soil is shallow (on steep slopes along gullies), the forest has a stunted appearance. The result of all this is that the forest does not reach impressive top-heights (the crown canopy is usually around 20 m) and that the commercial log lengths (on average 8.5 m) are below what is normal for other parts of Vanuatu. Big diameters (over 75 cm) are relatively rare, whereas the majority of trees are in the smaller diameter classes.

Wildlife: So far, special studies on the wildlife occurring in the Butmas demonstration area have not been conducted. On the basis of extensive discussions with villagers, own observations and literature study (Bregulla, 1992), a preliminary list of bird species occurring in Butmas could be drafted. This list is included in appendix [6]. It was found that of the 57 landbirds occurring in Vanuatu, 35 species could be confirmed for Butmas (60%). This percentage will rise soon, since a number of relatively common species could not be confirmed immediately. Interesting to note is that of the species confirmed, 5 are considered globally endangered, whereas 1 species was listed in Appendix II of CITES. The globally endangered bird species found are the incubator bird (Megapodius freycinet layardi), the imperial pigeon (Ducula pacifica), the palm lorikeet (Charmosyna palmarum), the chestnut bellied kingfisher (Halcyon farquhari) and the tanna fruit dove (Ptilinopus tannensis). The rainbow lorikeet (Trichoglossus haematodus) is listed in CITES appendix II.

The only naturally occurring mammals are bats. There are 12 species, comprising four fruit-eating flying foxes and eight small insectivorous species. At least all flying-fox species are said to occur in Butmas. In addition to feral domestic animals (wild pigs, wild dogs and wild cattle), the only other mammals found in or near the bush are rats (3 species) and the house mouse – all introduced.

The villagers report that only one snake species occurs in Butmas, which is the Pacific Boa (Candoia bibroni). There are various species of lizard (mainly skinks or geckos), but which of the 19 species recorded for Vanuatu occur in Butmas still has to be investigated.

Present and future land use:

Participatory land use plans on the community level have not yet been developed for Butmas. In a first discussion between the landowners and the PGRFP-team (held on 8 July 2004) the following preliminary decisions on land use planning were taken:

- The major sites for gardens and other agricultural areas will – in the future – be concentrated in a 300 ha area east of the model area and south-east of the village (“Faluifun” – which is part of the Falambil and Butvi clan lands).
- A restricted number of houses and gardens will be tolerated within a 100 m wide strip along the existing logging road built by Santo Veneer & Timbers (SVT) encircling the Butmas land. House building will be reserved for families with ties to the Butmas clan only.
- The land where the Butmas chief is presently undertaking some agricultural activities will remain restricted to the mound located to the north-west of the village.
- The plateau itself where the model area is located will remain reserved for sustainable forestry exclusively.
- Particular care shall be taken to avoid the overlapping of gardens with production forest in the eastern and south-eastern corners of coupe 3. No further expansion of gardens shall be undertaken in this area.

It was further decided to have follow-up sessions with the landowners (including members of neighbouring clans) on land use planning and to develop a community level map showing the boundaries of present and future land use types. This map will be attached to the FMP when revision is due.

3.2. International setting, national policy and legislation

Vanuatu is signatory of the major international treaties, agreements and conventions [UNCCBD, UNCCC, UNCCD etc.] and is, therefore, committed to sustainable development, responsible natural resource use and conservation of nature, conservation of biodiversity and endangered species. It is noted that these commitments overrule the national legislation.

The National Forest Policy of Vanuatu [of May 1997, printed in 1999] provides the guiding framework for all forestry activities. The document presents major constraints and issues [such as the lack of management plans] and then sets out the general objectives, policies and strategies to be pursued. More specifically, there are objectives and policies for environment and conservation, landowners and communities, forest industries, extension, research, training, administration and forest revenue.

In addition, a regional forest policy is formulated for the major islands of Vanuatu. The focus of the forestry sector in Vanuatu will be on Santo. A sustained yield of 30.000 m^3 annually is determined, including 6000 m^3 sourced from agricultural areas that were not included in the NFI and 5000 m^3 set aside for mobile sawmills. This means that the actual annual cut has to be reduced to sustainable levels. Whereas the focus for West Santo is on small scale operations and sandalwood collection, the emphasis for the rest of the island will be on logging of natural forests in 50-years cycles, forest industry development, plantation forestry and village based timber production. Butmas falls under the last category.

The Forestry Act No. 26 (2001) is the major law relating to forests and forestry. It consists of parts about administration, forestry sector planning, agreements, licenses, protection of the environment, reforestation and miscellaneous matters. Each part is split up in more detailed divisions. Generally spoken there are 2 major requirements for any commercial forestry operation – an agreement and a license. There are 3 kinds of agreements and 4 kinds of licenses (including a mobile sawmill license applying the case of Butmas).

The Forestry Act stipulates that the Vanuatu Code of Logging Practice (COLP) applies to all commercial forestry operations and such operations are to be conducted in accordance with the Code. The Code is also legally binding for mobile sawmill license holders, unless specifically exempted by the Director of Forests [which is not the case in Butmas]. The Code contains sections on forest use planning, silvicultural prescriptions, areas excluded from logging [bufferstrips along watercourses and on steep slopes], coupe harvesting planning details, construction works [road specifications, watercourse crossings, log landings, skid tracks], logging operations [felling, skidding, loading, hauling], weather limitations, safety requirements, training, supervision and evaluation. A special simplified code for small sawmill operations has been developed [stret fasin blong katem ol wud long Vanuatu blong ol smol somils, DoF, 1998].

A fact that must be taken into account when practicing forest and land management is the predominantly communal landownership in Vanuatu. The landowners have the sole ownership of their land and are in the first place responsible for management decisions. In the field natural features such as creeks and ridges normally mark traditional land boundaries of the various clan lots. These boundaries have not always been mapped adequately, so that land disputes are common and often are an obstacle to sound long-term land / forest use planning.

Finally it has already been noted that the Department of Forests intends to introduce internationally recognised forest certification standards. After having discussed this issue in various mainly regional fora (Heads of Forestry meetings, workshops) a working group has been established in order to prepare the development of national standards and criteria. As long as this process is not yet concluded, the best option seems to temporarily adopt standards and criteria from other countries with comparable conditions (PNG or Solomon islands).

3.3. Hierarchy of planning

To identify the position of a FMP in the hierarchy of planning, between various levels must be differentiated. At the national level, broad strategic planning occurs through the national policy statement and the forestry act. National objectives, policies and strategies are formulated for the entire spectrum of possible forest functions and services, the involvement of communities, forest industries, training and forestry research. These objectives, policies and strategies can be translated into a concrete and consistent action program through a Sector Plan. In Vanuatu, the updated policy and the revised act provide this framework, whereas the Sector Plan will be drawn-up (with FAO support).

At a lower level, sustainable forest management planning should be embedded in systematic land use planning and broad forest classification. It is useful to quote the COLP on this issue (section 2.1): “ecologically sustainable forest management is one of a range of land uses. Ideally forest use should be determined within an integrated approach to land use planning. An integrated approach to land use planning will recognize and provide for the multiple values of forests, the sensitivity of land to degradation, the desired outputs from the forest and land, and the management requirements which are necessary to achieve sustainable use”.

In practice this is not yet the case in Vanuatu. Under the National Land Use Planning Policy, agriculture clearly has priority over forestry and natural forest management would be restricted to the resource zone National Marginal Agricultural Land (MAL).

The focus of planning subsequently narrows to the regional and local levels. At the regional level, the Vanuatu Silvicultural Prescriptions provide general management instructions for 6 forest types (which are an amalgamation of the 35 VANRIS forest types). These forest types and the corresponding management instructions coincide with the major islands within Vanuatu. The prescriptions are general and include activities such as the definition of minimum cutting diameters following a pre-harvest inventory, a post-logging damage assessment and a residual stand treatment (such as the liberation of potential crop trees or forest enrichment). At the present moment, these prescriptions are not implemented in any logging operation.

Below this level site-specific forest management plans (FMPs) have to be prepared. Such plans provide the management guidelines for clearly defined units, such as concession areas or forest under community management. The area size may vary between several hundred to a few thousand hectares. FMPs provide an avenue for informed sustainable use and management for a defined period (10 years). Annual Work Plans (coupe harvesting plans or operational plans) – finally – provide the details of the management activities to be carried out in defined sub-units of the management area (concession or community forest) within a one-year period. These activities are designed in such a way that they fit-in with the concept, objectives and broad guidelines provided by the FMP.

3.4. Administration

Forestry Administration: The Department of Forests (DoF) – as set out in the 1997 National Forest Policy – co-operates with landowners as well with forest industries in order to fulfill its mission: "to ensure the sustainable management of Vanuatu's forests to achieve greater social and economic benefits for current and future generations" (DoF Annual Report 2003).

In order to achieve this mission, the DoF:

- Provides technical advice to clients such as landowners (using field inspections, reports, meetings, workshops and training as major instruments),
- Monitors all operations going on in the forest to achieve compliance with various acts and regulations (including the Code of Logging Practice), and
- Collects information for sharing with other clients (statistics, knowledge, etc.)

The DoF is organised along technical lines (with SFO's for extension, utilization, research, planning and conservation) and along regional lines. Vanuatu is subdivided into 3 Regions, whereby Butmas falls under the Northern Region (covering the provinces of Sanma and Torba). The Regional Forest Officer North (RFO-N) is based in Luganville. Although Santo is further subdivided (Central, East, West and South), there are no field stations outside Luganville. The Forest Officers responsible for each of these sub-regions are all based in Luganville.

Provincial Administration: Sanma province is administratively divided into 10 so-called Area Councils (ACs). Butmas village falls under AC 3, Fanafo – Canal, with Fanafao as "capital village". The Area Councils have a councillor (who is based in Luganville) and a Secretary, who is based at the capital village. The lowest level of administration are the village councils, led by the village chiefs, who – at least in administrative matters – report back to the Area Council secretaries.

4. DESCRIPTION OF THE VILLAGE

4.1. General

The forest managers are based in Butmas village. Butmas was established in 1975, and has grown steadily in size in the past 30 years. At the time of the first baseline study (Corrigan, 1998) there were 33 houses (of which 20 empty) in the village. At that time, the population was between 72 – 84, the fluctuations being caused by people moving in an unpredictable way between villages. Presently, the village has 109 inhabitants (50 women and 59 men, including children). The village is located on the land of the Butmas-clan, but the inhabitants also belong to other clans from the vicinity. Apart from Butmas, there are family groups from Velié, Retelen, Butvi, Sorowa, Dragbo, Falambil, Makvi and Fabon.

Butmas has an elementary school (French speaking) and prior to 1986 there was even a clinic. The closest clinic is now in Stone Hill. There is not yet a church building in the village. The villagers belong to 2 different churches, praying and bible-study sessions are often led by visitors from other villages.

4.2. History

Corrigan (1998) uses so-called timelines to describe the big historical events in selected years. In the old times, there have been incidents of black magic diseases and associated deaths, also earthquakes, the arrival of the Americans during world war II, the work that came because of bridge and airport building and the various other jobs people did for the Americans (washing and cooking). In 1968 many people from Butmas moved to Fanafo, for school, medical services, but also to join the newly created Nakriamel group which attempted to achieve independence of Santo from Vanuatu. In 1992 the road came finally through to Butmas, which greatly improved the contacts with the outside world. In 1995 a man from Butmas contested in the election but he lost. In 1996 contacts with GTZ were made which led to the establishment of the model area for sustainable forest management and – ultimately – to the creation of the Butmas Natural Forest Products Co-operative and the start of community forest management using a portable sawmill.

4.3. Leadership and organizations

Since there are people from various clans living in Butmas, there is – in theory – more than one chief. The chief of Butmas (Chief Lolos) is – however – presently acknowledged as the traditional village leader. The Butmas chief and his assistant have many responsibilities and duties, ranging from marriages, land disputes and custom ceremonies to school or health issues and the functioning of other organizations (such as the BNFPC). Decisions are always taken jointly with the 5-members of the chief's committee, whereby – as a rule - it is tried to achieve consensus. Two days per week are set aside for the chief and for community work (usually Monday and Friday). On those days the community works during half a day for the chief and for a community member during the other half of the day. Money is paid in the last case, set aside by the chief, so that it can be spent on community development (Corrigan, 1998).

The first organization established in the village was the **Vanmolmol Association (“**we go together**”)**. It was established in 1993, mainly in order to close ranks for having forest resources exploited by Santo Veneer & Timbers. A deal made with the company appeared to be bad and the emphasis shifted to the risks of unsustainable forest management through external logging companies. The association comprises landowners from Butmas, Fanafo, Palon and Nambauk village, who belong to the same family groups as those mentioned in section [4.1].

As outlined in the introductory sections of this plan, the attempts to contract a conventional commercial logging company for the implementation of the logging in Butmas had failed. This led to the gradual adoption of a community forestry concept and this – in turn - led to the establishment of the Butmas **Natural Forest Products Co-operative Marketing & Consumer Society Limited** (short: BNFPC). The co-operative's objectives include the production and sale of treated sawn timber according to Vanutatu National Standards, to ensure that the timber harvest and lumber production shall occur without negative environmental impacts, the provision of training or education to its members and to provide at least 6 full-time jobs. The co-operative was officially registered on the 27th of April 2004.

4.4. Means of existence

Agriculture and gardening are at the basis of the existence of the people of Butmas. The gardens are found just outside the village, and serve subsistence needs as well as the generation of cash income (especially kava and peanuts). Their size is normally between 0.3 – 0.5 ha.

The major crops are yam, taro, cabbage, sugar cane, kava, banana, corn, pumpkin, kumala (=sweet potatoe). The crops differ in getting ready to harvest or sell: taro needs one year, kumala / peanuts only 3 months, kava even 3-4 years.

Apart from gardening, hunting is also very important. Flying fox, pigs, wild cattle are hunted throughout the year. No guns are used, but only simple equipment such as spears.

Increasingly the people seek paid jobs. Some men found work with logging companies operating in the area. Both men and women find occasional employment with large-scale kava planters down in the lowlands. In former times people used to participate in the coffee harvest and would stay away from the village for a period of up to 3 months. But the coffee-plantation is closed now.

Further traditional forest uses – apart from gardening and hunting - include firewood collection, water gathering, collection of traditional medicines, building materials and wild fruit (Barringtonia, Syzygium).

5. REVIEW OF FOREST INVENTORY DATA

In 1997, a comprehensive Pre-Harvest Inventory was carried out in the Butmas block. After the implementation of a training course directed at DoF staff and landowners in November 1996, preparations started early 1997 with the cutting of outer boundaries and baselines. A tree spotters course was conducted in March 1997. The field work of the PHI started on 14 April 1997 and was completed around mid October of that year.

In addition to the PHI, surveys and measurements have been carried out in various types of sample plots. In November 1997, DoF's Forest Conservation Unit carried out a botanical survey of the Butmas project area. In total, 6 plots of 50 x 50 m and 7 pairs of 15x15 m plots were established for the botanical identification and measurement of trees and other plants. Furthermore, between October and December 1999, 12 so-called Permanent Sample Plots [PSP] were established and measured in order to be able to monitor the impacts of the various intensities of logging to be implemented later. These PSP had the same lay-out as the plots established for the botanical survey.

In the following sections a summary of the results of these various assessments is presented.

5.1. Pre-Harvest Inventory (PHI)

5.1.1. Purpose and method

The purpose of the Pre-Harvest Inventory (PHI) was to enable the precise estimation of the numbers of trees, basal areas and standing volumes, per species and for all diameter classes, within the respective coupes before the logging is carried out. This in order to be able to take sound decisions on the intervention levels applied (various degrees of selective logging) and as a general basis for management planning. The second objective was to provide more data needed for the further development of species-specific diameter limits to be used for the selection of trees for logging.

A strip sampling system was used, whereby at right angles to a baseline following the contour, at 65 m intervals lines were cut until reaching the coupe boundary. Along these lines, continuous sample plots of 20 m long and 10 m wide (200 m^2 per plot) were established. Within these plots all trees (>=35 cm) were measured (dbh, height) and assessed for quality. In every fifth plot, also all trees >=10 cm dbh (and < 35 cm) were measured (dbh only).

In this way, a total of 2437 plots was established, covering an area inventoried of 48.74 ha, which means a sampling intensity of around 14% (in relation to the total area of 340 ha). The total amount of plots where also the trees >= 10 and < 35 cm dbh were measured was 480 (covering 9.60 ha or almost 3% sampling intensity).

The descriptive details of the PHI are summarized in the following table [1]:

Table [1]: Descriptive details of the Butmas Pre-Harvest Inventory (1997)

	COUPE						
	1	**2**	**3**	**4**	**5-6**	**6[4]**	**TOT**
Area (ha)	108.1	56.1	64	57.8	54.6	23.1	340.6
Strips	18	10	20	11	27		
Plots [number]	549	370	698	402	418		2437
SI (%)	10%	13%	22%	14%	15%		14%
Subplots [number]	103	75	139	80	83		480
SI (%)	1.9%	2.7%	4.3%	2.8%	3.0%	0.0%	2.8%
Trees>= 35 cm [N]	459	298	550	216	298		1821
BA>=35 cm [m^2]	87.71	58.97	108.07	42.13	55.11		351.98
Volume>=35 cm [m^3]	543.56	365.50	647.83	263.15	323.18		2143.22
Trees>=10,<35cm [N]	896	724	1373	1008	936		4937
BA>=10,<35 [m^2]	23.22	17.31	35.66	22.43	24.36		122.98

Notes to the table:

- The presented figures differ slightly from the figures mentioned in Mussong (1998) – mainly due to coupe area re-measurements, compartment reshuffling and – also – some corrections in the data files, leading – for example – to slightly different numbers of subplots.
- Subplots – where trees >= 10 , < 35 cm have been assessed additionally
- SI – sampling intensity; BA – basal area

5.1.2. PHI Results

Average stand characteristics whole area

The species found and the major stand characteristics for the **trees >= 35 cm** are summarized in the following table [2]:

Table [2]: Species composition and stand characteristics for trees >= 35 cm

	SPECIES	Number of Trees / ha	Basal Area (m^2/ha)	Volume (m^3/ha)	% (on BA)
1	Dysoxylum aneityense	14.69	3.10	17.64	43.0%
2	Palaquium neo-ebudicum	5.99	1.41	9.59	19.5%
3	Myristica fatua	5.42	0.64	3.98	8.9%
4	Terminalia sepicana	2.44	0.42	2.62	5.8%
5	Dendrocnide moroides	0.35	0.27	1.79	3.7%
6	Elaeocarpus chelonimorphus	0.92	0.18	1.00	2.4%
7	Endospermum medulosum	0.72	0.16	1.63	2.2%
8	Evodia spp.	0.74	0.15	0.84	2.1%
9	Semecarpus vitiensis	0.74	0.09	0.52	1.2%
10	Syzygium spp.	0.57	0.09	0.46	1.2%
	Plus 42 other species:	4.78	0.73	3.91	10.2%
	TOTAL:	**37.36**	**7.22**	**43.97**	**100.0%**

[4] New compartment – part of old compartment 5.

Comments:

- The dominating species are all commercial, with the exception of Dendrocnide (no. 5). Some frequent species are less easily marketable (Dysoxylum, Myristica). Species no. 2 (Palaquium) has a good market in the meantime.
- The numbers of stems, basal areas and standing volumes are lower than those of "normal" tropical forests in the Pacific region, also lower than undisturbed stands elsewhere in Vanuatu.

The species found and the major stand characteristics for the **trees >= 10 cm, < 35 cm** are summarized in the following table [3]:

Table [3]: Species composition and stand characteristics for trees >=10, <35cm.

	SPECIES	Number of Trees / ha	Basal Area (m^2/ha)	% (on BA)
1	Myristica fatua	164.0	4.9	38.1%
2	Semecarpus vitiensis	45.7	1.1	8.9%
3	Macaranga dioica	37.8	0.8	6.5%
4	Dysoxylum aneityense	21.7	0.7	5.3%
5	Streblus pendulinus	24.8	0.6	4.5%
6	Neuburgia corynocarpa	19.9	0.5	3.8%
7	Melicytus ramiflorus	29.9	0.5	3.8%
8	Ficus wasa	23.4	0.4	3.5%
9	Ficus adenospermum	11.8	0.4	2.7%
10	Palaquium neo-ebudicum	12.4	0.3	2.6%
	Plus 69 other species:	122.9	2.6	20.2%
	TOTAL:	**514.3**	**12.8**	**100.0%**

Comments:

- The major species of the upper canopy are found back in the lower stories, regeneration does not seem to be a problem.
- There are also a number of typical secondary species (Macaranga, Ficus spp.), which point to forest disturbance in the past (hurricanes and gardening).

Stand characteristics per coupe

The major stand characteristics for the **trees >= 35 cm** are presented for the coupes separately in the following table [4]:

Table [4]: Stand characteristics per coupe (trees >= 35 cm)

COMP	Plots (number)	Area (ha)	Number of Trees / ha	Basal Area (m^2/ha)	Volume (m^3/ha)
1	549	10.98	41.80	7.99	49.50
2	370	7.4	40.27	7.97	49.39
3	698	13.96	39.40	7.74	46.41
4	402	8.04	26.87	5.24	32.73
5-6	418	8.36	35.65	6.59	38.66
AV			37.40	7.22	43.97

Comments:

- The stand characteristics do not differ much between the coupes. Coupe 1 is the best coupe, coupe 4 the worst.
- The tendency is that the stand quality seems to decrease from the north-east to the south-west [see figure 2].

The major stand characteristics for the **trees >= 10 cm, < 35 cm** are presented for the coupes separately in the following table [5]:

Table [5]: Stand characteristics per coupe (trees >= 10, <35 cm)

COMP	Plots (number)	Area (ha)	Number of Trees / ha	Basal Area (m^2/ha)
1	103	2.06	434.95	11.27
2	75	1.44	482.67	11.54
3	139	2.78	493.88	12.83
4	80	1.66	630.00	14.02
5-6	83	1.72	563.86	14.68
AV			514.27	12.81

Comments:

- Again, the stand characteristics do not seem to differ much between the coupes.
- Remarkable is that the trend in this diameter class is opposite to what was observed for the trees >= 35 cm: the numbers of trees and basal areas increase from the north-east to the south-west [see figures 2 and 3].

Figure [2]: Forest quality in terms of Gross Standing Volume (GSV, m^3 /ha);

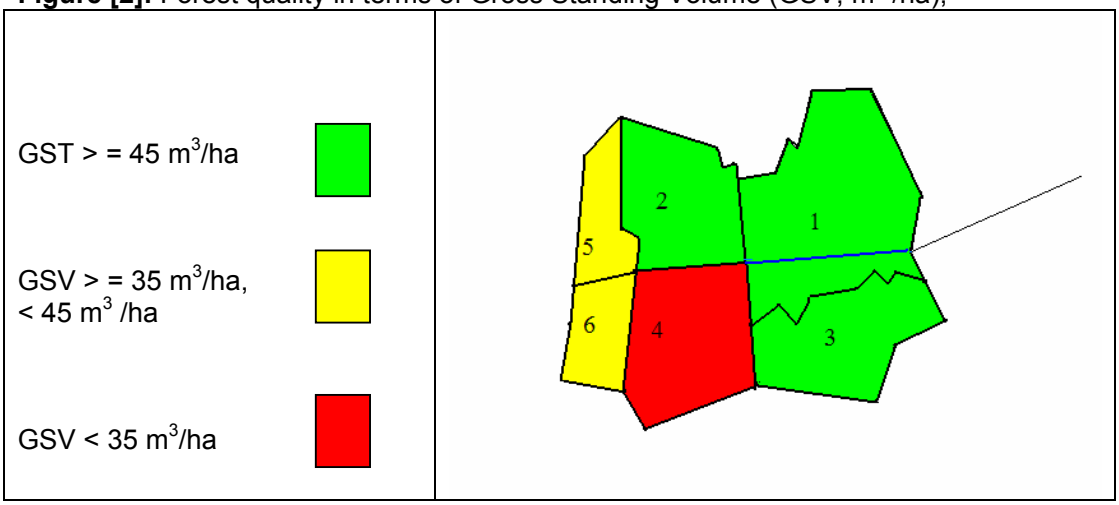
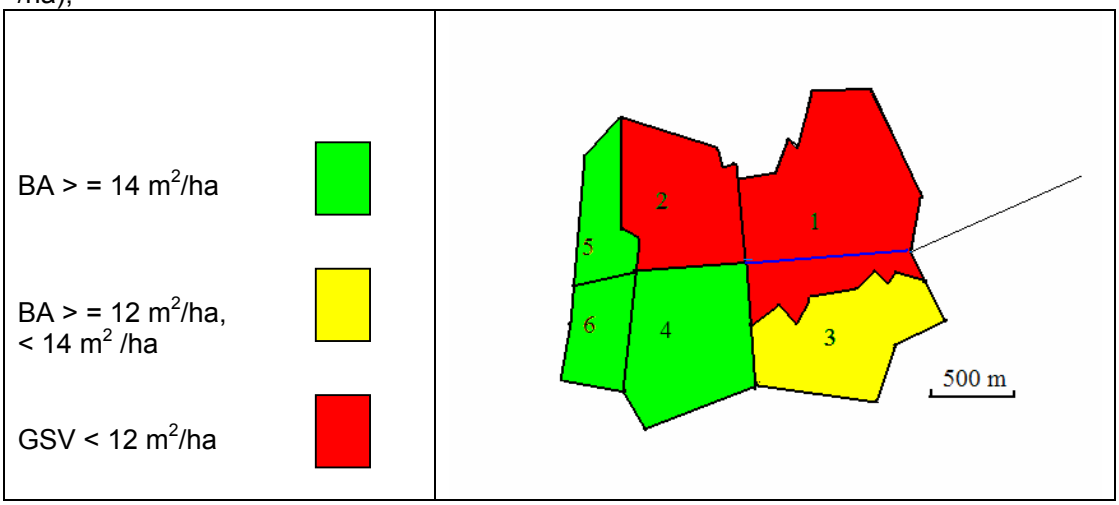


Figure [3]: Forest quality in terms of Basal Area of trees >= 10 cm and < 35 cm (BA, m^2 /ha);



Frequency distribution over DBH-classes

Table [6]: Distribution of N, BA and Volume over DBH classes

CLASS (10 cm)	N/ha	BA/ha	Vol/ha
20	446.6	8.5	0.0
30	67.7	4.3	0.0
40	18.7	2.1	12.7
50	9.6	1.8	11.1
60	5.0	1.3	8.3
70	2.4	0.9	5.3
80	0.9	0.4	2.5
90	0.8	0.6	4.1
TOT	**551.6**	**20.0**	**44.0**
>=10,<35	514.3	12.8	0.0
>=35	37.4	7.2	44.0

Comments:

- There seems to be a discrepancy in the relation volume / basal area (the quotient is normally around 8-10). In this case the quotient is much lower (2.2), because the volume in the 2 lowest diameter classes was not calculated and also because of the generally low tree heights and volumes per tree.
- There is a nice “positive” stem-frequency distribution – i.e. high numbers of trees in the lower diameter classes, low numbers in the higher diameter classes.
- The amounts of small trees are very high – the bigger trees are comparatively rare – pointing to the influence man or hurricanes in the past.
- One essential condition for sustainable natural forest management based on selective logging is fulfilled.

Summarizing conclusions

The following summarizing conclusions can be drawn:

- The major stand characteristics (such as numbers of stems, basal areas and volumes) are lower than what is normal in tropical forests, they are also lower than what is normal in Vanuatu production forest.
- The species composition in Butmas is quite unique – the forest does not fall into any category described for Santo.
- The classical highly valued commercial species are either absent or not frequent.
- On the other hand, the proportion commercial or at least potentially commercial trees is quite high.
- There is a marked decrease in quality of the forest from the east towards the west and south-west [trees >= 35 cm]. Stems numbers and Basal Areas of the diameter classes >= 10, < 35 cm show exactly the opposite trend.
- The stem-frequency distribution is strongly positive – there is an exponential increase of stem numbers with decreasing diameter class. An essential condition for sustainable forest management, therefore, fulfilled.
- All in all, the forest is suitable for sustainable management based on selection logging using the Vanuatu Diameter Limit Tables as major instrument [see further section 6.3].

5.1.3. Summary of the botanical survey (1997)

In November 1997, DoF's Forest Conservation Unit carried out a botanical survey of the Butmas project area. In total, 6 plots of 50 x 50 m and 7 pairs of 15x15 m plots were established for the botanical identification and measurement of trees. In the 50x50 m "main plots" all trees >= 30 cm[5] were measured, whereas in the 15x15 m sub-plots all trees >=10 and <30 cm were assessed. The results of this survey have been analyzed and presented by Helen Corrigan and Chanel Sam [1999]. Appendix [3] attached to this report contains the major results of this survey. A brief summary of the major results will be given here:

Trees >= 30 cm: 25 species were found in total, of which Dysoxylum aneityense, Palaquium neo-ebudicum, Myristica fatua, Endospermum medullosum and Elaeocarpus floridanus were the most frequent. The Number of Stems, the Basal Area and the Volume were 84 (N/ha), 14.95 m^2/ha and 103.9 m^3 / ha respectively.

Comments:

- Terminalia sepicana (no 4 in the PHI) was – surprisingly - not found in the botanical survey. The species composition can apparently differ very much over short distances.
- The stand characteristics found (N, BA, Volume) are very high compared with the PHI results. Partly this is because of the lower diameter limit used (30 instead of 35 cm), partly also because the very different way of sampling [a Botanical Plot will not be established in substandard forest].
- The volume is astronomical [in comparison with the one found in the PHI] because the top-height was taken for its calculation – not the merchantable height [as in the PHI].

Trees >= 10 cm, < 30: in total, 36 species were found of which Myristica fatua, Macaranga dioica, Streblus pendulinus, Ficus adenosperma and Melicytus ramiflorus were the most frequent ones. The Number of Stems and the Basal Area in this diameter class were 549 (N/ha) and 14.5 m^2/ha respectively.

The stem-frequency distribution [i.e. the distribution of stem over the diameter classes] was strongly positive, meaning that high numbers of stems are found in the lower diameter classes, but only low numbers of stems in the higher diameter classes. The low diameter classes have the trees for future harvests in store, an important condition for sustainable natural forest management on the basis of selective logging is fulfilled.

The number of trees per hectare above 60 cm dbh was 15.4.

[5] Unfortunately, different dbh-limits have been used in various assessments: 35 cm in the PHI, 30 cm in the botanical survey and 25 cm in the DoF's Permanent Sample Plots. This may lead to difficulties when comparing data from different sources. In future, one single lower DBH-limit is recommended (30 cm).

5.1.4. Summary of data collected in Permanent Sample Plots (PSP –1999)

Late in 1999, 12 so-called Permanent Sample Plots [PSP] were established and measured in order to be able to monitor the impacts of the various intensities of logging to be implemented later. These PSP had the same lay-out as the plots established for the botanical survey. A difference was that in the 50x50 m "main plots" all trees >=25 cm were measured (30 cm in the botanical survey), while in the 15x15 m "sub-plots" the trees >=10 cm and < 25 cm were assessed (>= 10, <30 cm in the botanical survey). No analysis of these plots has been published so far. Appendix [4] attached to this plan contains the major results of this survey. A summary of the most important results will be given here:

Trees >= 25 cm: a total of 44 species was found, of which Dysoxylum aneityense, Myristica fatua, Streblus pendulinus, Elaeocarpus chelonimorphus, Semecarpus, Palaquium neo-ebudicum, Terminalia sepicana, Weinmannia denhamii and Evodia spp.were the most frequent. The Number of Stems, the Basal Area and the Volume were 123 (N/ha), 13.88 m^2/ha and 55.33 m^3 / ha respectively (using 25 cm as limit) and 71 (N/ha), 10.95 m^2/ha and 43.73 m^3 / ha (using 30 cm as limit – for the purpose of comparison with the results of the botanical survey).

Comments:

- The species found are basically the same as in all other surveys, although their relative importance may differ.
- The stand characteristics found (N, BA) are slightly higher compared with the PHI results. Partly this is because of the lower diameter limit used (30 instead of 35 cm), partly also because the different way of sampling. Although PSPs should be established in "average" forest, highly disturbed places will be avoided.
- The volume – on the other hand - is lower than expected. It was found that the reason for this is the low average height of the trees [5.8 m in the PSP, against more than 8 meters in the PHI]. This must be traced back to differences in surveying criteria applied by the field teams, not in real differences in tree heights.

Trees >= 10 cm, < 25: in total, 54 species were found of which Myristica fatua, Semecarpus spp., Streblus pendulinus, Melicytus ramiflorus and Ficus spp. were the most common. The Number of Stems and the Basal Area in this diameter class were 565 (N/ha) and 11.64 m^2/ha respectively.

The stem-frequency distribution [i.e. the distribution of stem over the diameter classes] was again strongly positive. The number of trees per hectare above 60 cm dbh was only 7.8, much less than in the botanical survey.

6. GENERAL DESCRIPTION OF THE MANAGEMENT SYSTEM

6.1. Background and method of development

The forest management system which will be applied in the Butmas demonstration area is described in detail in Mussong (1996) and Mussong (1998). The system is basically a system of controlled selective logging. It has been designed in such a way that – on the one hand – only the oldest and strongest trees of all tree species are removed, whereas – on the other hand – it is simple and straightforward to apply. In this way the system fulfills the silvicultural requirement of maintaining the **ecosystem's structural and species diversity** to a large degree, as well as the social requirement of **easy field applicability** by the landowners themselves.

The selection of trees for harvesting is based on sets of **species-specific diameter limits**, according to the method originally developed for the NFMPP project in Nakavu, Fiji (Mussong, 1992) and adapted to the specific conditions of Vanuatu.

For the first development of diameter limits with the computer, the data sets collected in the National Forest Inventory (NFI) were used. Later, data from the Pre-Harvest Inventory (PHI) in Butmas were used for the further improvement and refinement of the then existing preliminary limits. The development process can be divided in a number of different major stages: the creation of a species frequency list, the computation of the limits, the testing of the limits and – if necessary – their modification. Each of these stages can be further sub-divided in various steps.

As a first step, the so-called Maximum Attainable Diameter (MAD) is computed per species, as the average diameter of the 3 – 5 largest diameters of each species. Subsequently a factor for over-maturity is deducted from this Maximum Attainable Diameter, based on the idea that trees should be harvested just before they begin to lose their vitality, not thereafter (10% reduction). Then increment values have to be deducted, because trees will grow during the felling cycle. Arbitrarily determined values of 3, 5 and 10 cm are deducted for the light, medium and heavy logging varieties respectively. Presently, reliable data about increment under various management regimes are still lacking in Vanuatu. For the time being – therefore - use shall be made of rough assumptions, until more accurate data become available (for example, through regular observations and data analysis in the Permanent Sample Plots established in Butmas – see also section [13]).

The final stages of the process comprise a sorting of the tree-species according to their corrected diameters and a grouping of tree-species in distinct **diameter limit classes**. There is no rule on the amount of classes to be built, but generally there are less the more intensive the logging becomes. For Vanuatu, between the following limit classes could be distinguished:

S1: 120, 100, 80, 60, 50 and 35 cm
S2: 100, 80, 50 and 35 cm.
S3: 75, 50 and 35 cm

Species within a certain limit class may only be cut if their diameter is equal to, or more than, the limit.

In addition, there is a category NOT QUALIFIED. This category contains all unknown species, species with important non-wood products (such as fruit-trees etc.), species useless for timber and – finally – species that may have special value for wildlife (such as Ficus species, which are important for various threatened doves or pigeon species).

The last steps of the development process consist of testing the limits and – if necessary – further modification of the tables. The testing can occur in the form of a computer simulation, whereby the developed limits are applied on – for example – the PHI data and the removal percentages are calculated. In case the simulation results clearly deviate from the target removal percentages (S1=20%, S2=30%, S3=40%) it should be checked for each tree species whether classifying in another diameter-limit group is necessary. Indicators are – for example – the results of other inventories, the diameter-frequency distribution, regeneration behavior and expected increment rate of the species concerned (if known).

6.2. Logging intensity options and felling cycles

To satisfy the needs of the forest owners, three different intervention levels are available:

- Logging intensity S1 (light logging option, in which only 20% of the standing volume >= 35 cm dbh is removed),
- Logging intensity S2 (medium logging option, in which 30% of the standing volume >= 35 cm dbh is removed),
- Logging intensity S3 (heavy logging option, in which 40% of the standing volume >= 35 cm dbh is removed).

Each of this logging intensity is coupled with a certain felling cycle:

- Logging intensity S1 (light logging option) – 10 years
- Logging intensity S2 (medium logging option) – 20 years
- Logging intensity S3 (heavy logging option) – 40 years

In principle, a choice between any of these options can be made on ecological or practical grounds. However, to achieve an optimal increment as well as for economic reasons, the **medium intensity intervention level** (30%) is recommended as a rule.

Long felling cycles (of around 50 years) are avoided by not removing all the commercial timber. By only removing a portion of the total volume available, an earlier return to the forest treated in this was becomes possible. This is particularly attractive for logging undertaken by landowners themselves. Their community forestry operations are often not very capital-intensive, so that even with lower harvesting volumes per unit of area still a profit can be made. In addition, the management system fits in very well with the small scale of most community forestry operations and their spatial restrictions (operations are often bound to the land of one or a few clans).

6.3. The Diameter Limit Table (DLT)

In the field, the selection of trees for logging occurs with the **Diameter Limit Table** (DLT). This table is the major instrument for the application of the management system in the forest. The DLT which is used in Butmas is shown in the table [7] on the next page.

S1		S2		S3	
>= 120 cm:		**>=100 cm:**		**>= 75 cm:**	
An-nts	CASAUS	An-nts	CASAUS	An-nts	CASAUS
Foabuk	DYSAMO	Atapol	DRAVIT	Aokora	ANTTOX
	AGAMAC	Fafla	PTEIND	Atapol	DRAVIT
	GARFLO	Foabuk	DYSAMO	Benuar	SAMSAM
> = 100 cm:		Ngasi	STEVIT	Ep	GYRAME
Aokora	ANTTOX	Pakoar	PANEDU	Fafla	PTEIND
Atapol	DRAVIT	Saken	CHISPP	Fdurusul	ERYFUS
Fafla	PTEIND	Wi	SPODUL	Fmbas	ENDMED
Fdurusul	ERYFUS		AGAMAC	Foabuk	DYSAMO
Fmbas	ENDMED		GARFLO	Foalol	DYSANE
Foas	TURLUT		INTBIJ	Foas	TURLUT
Nga	CANIND	**>=80 cm:**		Foar	CASEQU
Ngasi	STEVIT	Aokora	ANTTOX	Fruki	PALNEO
Pakoar	PANEDU	Benuar	SAMSAM	Nga	CANIND
Saken	CHISPP	Ep	GYRAME	Ngasi	STEVIT
Wi	SPODUL	Fdurusul	ERYFUS	Pakoar	PANEDU
	INTBIJ	Fmbas	ENDMED	Saken	CHISPP
>=80 cm:		Foalol	DYSANE	Wi	SPODUL
Benuar	SAMSAM	Foas	TURLUT		AGAMAC
Ep	GYRAME	Foar	CASEQU		GARFLO
Foalol	DYSANE	Fruki	PALNEO		INTBIJ
Foar	CASEQU	Nga	CANIND	**>= 50 cm:**	
Fruki	PALNEO	Ora	BISJAV	Fdiskar	ADEPAV
Ora	BISJAV		SYZNUT	Foabonsat	DYSGAU
	SYZNUT			Foamasine	PLALIG
>= 60 cm:		**>= 50 cm:**		Nat	BUROBO
Fdiskar	ADEPAV	Fbati	GLOSPA	Ora	BISJAV
Foabonsat	DYSGAU	Fbe	SYZBUE	Pa	ALEMOL
Foamasine	PLALIG	Fdendtaf	DILBIF	Siri	POMPIN
Nat	BUROBO	Fdiskar	ADEPAV	Tavo	TERCAT
Pa	ALEMOL	Foabonsat	DYSGAU		SYZNUT
Siri	POMPIN	Foamasine	PLALIG		SYZVAT
Tavo	TERCAT	Foatne	CRYTUR		
	STETAN	Fsambek	EVOLAT		
	SYZVAT	Ftanto	ELAANG		
>= 50 cm:		Nat	BUROBO		
Anbutalse	DYSARB	Pa	ALEMOL		
Farei	ALPZIZ	Sendro-of	ELACHE		
Fbati	GLOSPA	Sipte	EVOSPP		
Fbe	SYZBUE	Siri	POMPIN		
Fdendtaf	DILBIF	Tafola-ang	TERSEP		
Fdrend	MYRFAT	Tavo	TERCAT		
Fnduru	CALNEO		HERMOE		
Foalai fo-ok	SEMVIT		MIMELE		
Foatne	CRYTUR		PONPIN		
Fsambek	EVOLAT		STETAN		
Ftanto	ELAANG		SYZVAT		
Mariu	ACASPI				
Sendro-of	ELACHE				
Sipte	EVOSPP				
Tafola-ang	TERSEP				
	CELPAN				
FICUSA	DYSGIL				
HERMOE	DYSSPP				
MIMELE	PONPIN				

>= 35	**OTHERS**	**> = 35 cm**	**OTHERS**	**> = 35 cm**	**OTHERS**

NOT QUALIFIED:

Table [7]: The Butmas Diameter Limit Table

FRUITTREES	Nde (ARTALT, ARTCOM), Ro-ot (BAREDU), Talse (INOFAG), MANIND
OTHERS	Foa natafok (BACSTY), Faep (BARASI), Fases (CALINO), Fgolat (DENLAT), Fgolat bu (DENMOR), Fere (FICUSB), Riva (HIBTIL), Fnatal (KLEHOS), Foarumb (OSMNEO), Fomdok (PISGRA, PISUMB)
ALL NOT IDENTIFIED TREES	

SPECIFIC PART

7. OBJECTIVES OF THE FOREST MANAGEMENT

The major objective of the forest management is to contribute essentially to the achievement of the purpose of the development project undertaken by the villagers from Butmas through the recently established Butmas Natural Forest Products Co-operative (BNFPC). This purpose could read: "**Organized inhabitants of Butmas village receive a sustainable income on the basis of sale of forest products obtained through sustainable forest management practices**".

In addition to the major objective, the Forest Management Plan has a number of goals:

General goals:

- The implementation of adapted guidelines of sustainable forest management in order to demonstrate the financial, ecological and social feasibility of such undertaking for villagers.
- To demonstrate the feasibility of sustainable forest management by forest communities in order to provide inputs to the national and regional policies in this respect.
- To ensure that future generations will benefit from forest products and services at least to the same extent as the present generation.
- To ensure that the road to forest management certification remains open, even if certification will / can not be a priority at the present moment.
- To harmonize the social-cultural, economic and ecological interests of all stakeholders involved in forest management.

Economic goals:

- To implement guidelines for sustainable forest management with a minimum of costs (in terms of labour and finances) in relation to the expected outputs (material and non-material).
- To optimize the forest management in such a way that all groups present in the village / clan benefit in a fair / equitable way from forest products and services as well as from associated job opportunities.
- To contribute to the generation of income for the state in the form of various fees and taxes.
- To provide the local market with high quality lumber according to the Vanuatu National Standard (grading rules).

Social and social-cultural goals:

- To realize participation by the village inhabitants in all [planning, implementation, and monitoring / evaluation] stages of the forest management.
- To achieve that the forest management – apart from promoting the productive and protective forest functions – also guarantees the social and social-cultural forest functions. This entails that the collection of important Non-Timber Forest Products (NTFP) shall remain possible at all times and that culturally or religiously important places shall be protected.
- To achieve that hunting for subsistence purposes remains possible, within the strict regulations set in the Game Act.
- Hunting for commercial purposes or the collection of living wild animals shall not be in line with the concept of this management plan.

Ecological goals:

- To ensure that the plant and animal biodiversity of the managed ecosystems is maintained or even increases.
- To ensure that the existing complex forest structure and heterogeneous tree species composition are conserved.
- To achieve that the water catchment function of the managed area is protected and that the water quality is maintained.
- To prevent soil erosion and degradation of soil structure and fertility.

Scientific goals:

- To contribute to the building up of scientific knowledge about forest dynamics [regeneration, growth and increment, mortality, etc.] under different management regimes [intervention levels, techniques and methods].
- To contribute to the evaluation and dissemination of such knowledge in order to promote sustainable forest management elsewhere in Vanuatu and in the Pacific region.

8. IMPLEMENTATION OF THE MANAGEMENT SYSTEM

8.1. General

Already in 1999, the trees qualifying for harvesting according to the management model [described in detail in section 6 of this plan] have been selected and marked in the field. At that time, the idea was to contract a commercial logging company to carry out the logging according to the project's rules and guidelines. The next step was – therefore - that a coupe harvesting plan plus accompanying maps was drawn up (in 1999). A tender document was prepared, but the attempts to attract a local logging company to fell the marked trees failed for reasons that have been outlined earlier in this plan. Finally, no logging did take place and gradually the painted marks on the selected trees were no longer visible.

This means that for the implementation of the community forestry operations by the BNFP Co-operative, the tree selection operations have to be redone completely. Under conditions of community forestry – with its small annual harvesting areas – it is not practical to select trees for logging in the entire area in one operation. Instead, this will be done annually, in one annual working area at a time, as part of the obligatory annual working plan (AWP). A start with this has already been made in a 35.7 ha first annual working area inside coupe 1 [in February 2004]. The field data of the 1999 tree selection – however - have not been lost and are available in the form of computer files. These data can be still be used here for the broad planning in terms of timing and locality of all further field operations (felling, extraction, processing and transport).

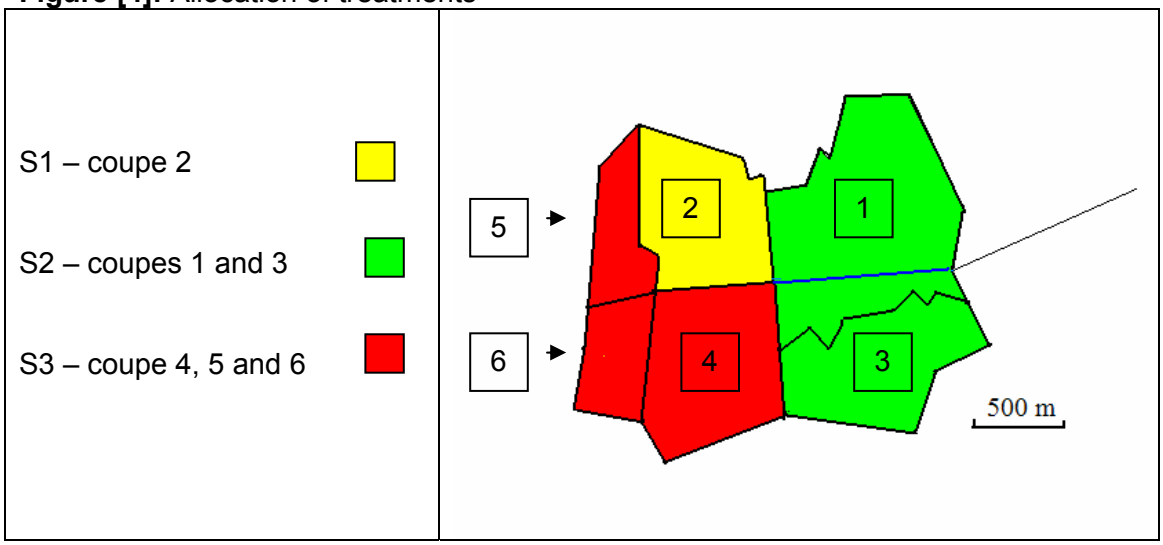
8.2. Decision on treatments

The idea launched in the Coupe Harvesting Plan (drafted in November 1999) to maintain 2 whole coupes as "control" (= no logging, the coupes 3 and 6) will have to be dropped. With the decision to adopt a community forestry approach, it will be necessary to restrict the logging operations as long as possible to the land owned and controlled by the Butmas community itself. Maintaining very large blocks of unlogged [production] forest must be regarded as uneconomical. The original recommendations made by Prof. Mussong (1998) shall be adopted instead.

The treatments – then - will be allocated to the various coupes as follows:

- Light logging (S1) – coupe 2,
- Medium logging (S2) – coupes 1 and 3
- Heavy logging (S3) – coupes 4, 5 and 6

Figure [4]: Allocation of treatments



8.3. Results of the tree selection operation

8.3.1. General results

A detailed overview of all tree selection results in terms of total numbers of stems, basal areas and volumes selected / marked in each coupe, is presented in the table [8] below. Also the original PHI results have been included in the table, in order to make a comparison with the tree selection results possible [with regard to the removal targets set for the different treatments].

Table [8]: Comparison of tree selection results and PHI results

PRE-HARVEST INVENTORY RESULTS:							
COUPE	AREA (ha)	N/ha	BA/ha (m^2/ha)	Vol/ha (m^3/ha)	N tot	BA tot (m^2)	VOL tot (m^3)
1	108.1	41.8	7.99	49.50	4519	864	5351
2	56.1	40.27	7.97	49.39	2259	447	2771
3	64	39.4	7.74	46.41	2522	495	2970
4	57.8	26.87	5.24	32.73	1553	303	1892
5	31.5	35.65	6.59	38.66	1123	208	1218
6	23.1	35.65	6.59	38.66	824	152	893
TOTAL	340.6				**12799**	**2469**	**15095**
NET:							**10566**
TREE SELECTION RESULTS:							
1 (M)	108.1	16.64	3.08	12.90	1799	333	1394
2 (L)	56.1	5.76	1.47	6.15	323	83	345
3 (M)	64	12.09	2.33	13.44	774	149	860
4 (H)	57.8	11.44	2.02	8.71	661	117	504
5 (H)	31.5	14.57	3.12	13.35	459	98	421
6 (H)	23.1	13.16	2.19	12.90	304	51	298
TOTAL	340.6				**4320**	**831**	**3822**
NET:							**2675**

Notes to table [8]:

(1). The tree selection figure are the results of the first tree selection carried out in 1999. Since most tree marks have disappeared in the meantime, tree selection / marking will have to be redone [as preparation for the establishment of each annual working area]. The results of these [future] operations will most probably differ slightly from the ones presented here.
(2) In the coupes 3 and 6 no tree selection was done, because these coupes were – at that time – set aside as "control" coupes. The figures in the table for these coupes have been calculated on the basis of simulations using the PHI-data.

Table [8] shows that of the [roughly] available 15.000 m^3 gross standing volume, around 3800 m^3 gross volume has been selected for logging. Converted to net volumes (using a factor 0.7) these figures are 10.600 m^3 and 2675 m^3 respectively, or 25%. On average, around a quarter of the available volume has been selected, which corresponds with the target removal of the "average" logging intensity S2 (medium). Around 4300 trees have been selected, which have – on average – a basal area of 0.19 m^2 and a volume of 0.88 m^3 gross (0.62 m^3 net). The average selected tree – in other words – does not have impressive dimensions in Butmas.

In the following table [9] the realized removal percentages for the numbers of stems, basal areas and the volumes are presented for the coupes separately:

Table [9]: Tree selection: removal percentages per coupe

TREAT-MENT	COUPE	N	BA	VOL Realized	VOL Target
M	1	40%	39%	26%	30%
L	2	14%	18%	**12%**	**20%**
M	3	31%	30%	29%	30%
H	4	43%	39%	**27%**	**40%**
H	5	41%	47%	35%	40%
H	6	37%	33%	33%	40%

It is shown that – in most cases – the realized removal percentages [based on volume] are quite close to the targets set. There is a slight tendency to under-realization, whereby the coupes 2 and 4 show the most pronounced differences from the targets (12% resp. 27% realized instead of 20% resp. 40% targeted).

The table also shows that the removal percentages in terms of number of trees [N] and basal area [BA] have a tendency to be higher than the percentages based on volume. This may be attributed to the relatively high proportion of trees selected in the lower diameter classes.

8.3.2. Expected production per species

In the following sections on expected production per species, the species names in Butmas language will be used. The following table [10] gives - for the 10 most common tree species - the relation between the scientific species names, the common names and the names in Butmas language.

Table [10]: Names of the 10 most common tree species in Butmas

	Scientific name	Common name	Butmas name
1	Dysoxylum aneityense	Red Stinkwood	Foalol
2	Palaquium neo-ebudicum	Palaquium	Fruki
3	Myristica fatua	Nandae	Fdrend
4	Terminalia sepicana	Wael Natapoa	Tafola-ang
5	Elaeocarpus chelonimorphus	Waet Elaeocarp	Sendro-of
6	Endospermum medulosum	Waet Wud	Fmbas
7	Evodia spp.	Evodia	Sipte
8	Semecarpus vitiensis	Waet Nawalas	Folae
9	Syzygium spp.	Nakavika	Fbatur / Fdroposer
10	Cupaniopsis leptobotrys	Nakatambol	Jaeran

The expected production **per species** for the entire area is presented in table [11].

Table [11]: Expected production per species for the entire 340 ha area

Nr	Species	VOL Gross M^3	VOL Net M^3
1	Fdrend	1101	771
2	Foalol	591	414
3	Fruki	448	314
4	Tafola-ang	388	272
5	Sipte	157	110
6	Sendro-of	144	101
7	Foalae	144	101
8	Fbatur	106	74
9	Fmbas	97	68
10	Jaeran	70	49
	+ 69 other species	576	403
	TOTAL	3823	2676

In the meantime, most of these species have an established market and there is considerable local knowledge and experience on the species properties and their uses. Only Fdrend (Myristica) is still considered as a lesser known species and special efforts will have to be undertaken to expand the market for this timber.

The species Fruki (Palaquium), Foalol (Dysoxylum) and Tafola-ang (Terminalia) also have an established export market.

In the large group “other species” both established commercial species and lesser used species occur. The management system requires that also the lesser-known species will be felled and processed and that markets are disclosed.

The distribution of the selected volumes over the various species is certainly not uniform over the entire area and considerable differences between the 6 coupes may be expected. The between-coupes differences in this respect are illustrated in the following table [12].

The table shows that Fdrend (Myristica) is the number 1 selected species in 4 out of 6 coupes. The positions of the other species are different in each coupe. Sometimes unexpected species show up in the top 5. An example is Fmbas (Waet Wud), which is on the 4^{th} position in coupe 1, whereas this species is otherwise not particularly common. Other examples are Tamanu (Calophyllum neo-ebudicum) and Fbe (Syzygium buettnerianum), occupying the 4^{th} and the 5^{th} position in coupe 2.

Table [12]: Species composition of the selected volumes for coupes separately

C-1	Species	N	VOL	**C-2**	Species	N	VOL
1	Fdrend	1001	507	1	Sendro-of	71	81
2	Fruki	95	220	2	Fruki	23	71
3	Tafola-ang	127	156	3	Tafola-ang	20	25
4	Fmbas	22	90	4	Tamanu	15	21
5	Foalol	25	68	5	Fbe	18	20
	34 other spp	529	353		33 other spp	176	127
		1799	1394			323	345
C-3	Species	N	VOL	**C-4**	Species	N	VOL
1	Fdrend	435	323	1	Fdrend	197	104
2	Foalol	60	223	2	Tafola-ang	129	103
3	Fruki	28	101	3	Foalol	37	64
4	Tafola-ang	32	54	4	Fruki	10	24
5	Foalae	73	47	5	Fbatur	37	24
	14 other spp	147	113		42 other spp	251	185
		775	861			661	504
C-5	Species	N	VOL	**C-6**	Species	N	VOL
1	Foalol	92	192	1	Fdrend	94	68
2	Fdrend	186	94	2	Sipte	39	46
3	Sipte	18	23	3	Tafola-ang	36	38
4	Sendro-of	23	17	4	Foalol	8	25
5	Fruki	5	13	5	Fruki	5	19
	30 other spp	135	82		17 other spp	121	102
		459	421			303	298

8.3.3. Results of tree selection in the first annual working area

As stated in section [8.1], tree selection has already been carried out in the first annual working area in February 2004. This is a **35.7 ha** big sub-coupe of coupe 1, located south of the baseline and north of a deep, east-west running gully. The treatment in this sub-coupe will be S2 (medium logging intervention). The results of the tree selection are shown in the table [13] below.

Table [13]: Results of tree selection in **35.7 ha** of forest (first annual working area)

SPECIES	Nr of stems	Basal Area (m^2)	Volume (m^3)
Fruki	37	26.2	99.2
Fdrend	182	19.4	79.3
Foalol	14	12.1	51.6
Tafola-ang	20	5.0	22.5
Nat	1	1.3	6.5
Fmandran	3	1.3	3.8
Sipte	3	0.7	3.1
Jaeran	3	0.7	2.5
Foalae	2	0.4	1.1
Fbatur	1	0.2	0.7
Sendro-of	1	0.2	0.6
TOTAL	267	67.6	270.8
PER HA:	**7.48**	**1.9**	**7.6**

The table shows that the species selected do not differ fundamentally from those selected in the coupe areas as a whole. The fact that Fruki is the number one species must be seen as favorable, in view of the present high demand and good price for that species.

The percentages selected in terms of numbers of stems [N], basal area [BA] and volume [VOL] are 17%, 24% and 15% respectively, when comparing the selection results with the PHI results. Since the target removal percentage for S2 [medium logging] is 30%, there seems to be a pronounced under-realization of the tree selection in this case. Whether this is caused by wrong interpretation of the diameter limit tables in the field or because the figures of the PHI (which refer to the coupe as a whole and not specifically to sub-coupe 1) give a too optimistic picture of sub-coupe 1, will be investigated[6].

[6] According to the PGRFP's staff in Luganville, obviously unusable (hollow / rot / bent) logs have been excluded from the tree selection. This may also have contributed to the low selection percentage.

9. PLANNING OF THE HARVESTING

9.1. General

The planning of the harvesting will be determined in the first place by the capacity of the sawmill operated by the Butmas Natural Forest Products Co-operative and its development planning over time within the limits of sustainability. The basic figures in this respect are provided by BNFPC's Enterprise Development Plan (from February 2004).

For this management plan it will be assumed that the BNFPC will produce 100 m^3 of lumber during the first years and then gradually increase to around 150 m^3 of lumber annually. Furthermore it is assumed that the recovery rate will gradually improve from the presently realized 46% to around 50% from year 5 onward.

All this means that the annual sawmill input needed [m^3 round-wood] will initially be around 220 m^3, then stabilize at around 300 m^3. Taking the figures for the selected gross volumes per hectare into account [table 8 in section 8.3.1] and considering that the gross standing volumes still have to be converted to net volumes (with a factor of 0.7), the size of the average annual working areas can be computed. These are on average around 35 ha, but the area may vary between 25 and 50 hectare, depending on the treatment and the stocking of the coupe concerned. Only in the case of light logging in coupe 2, an annual working area of larger size would be needed (> 60 ha).

The most practical subdivision in **sub-coupes** would be as follows:

Coupe 1 – S2 [medium] – subdivide in 3 sub-coupes
Coupe 2 – S1 [light] – no further sub division
Coupe 3 – S2 [medium] – subdivide in 2 sub coupes
Coupe 4 – S3 [heavy] – subdivide in 2 sub coupes (1 production / 1 protection)
Coupe 5 – S4 [heavy] – no further sub division
Coupe 6 – S4 [heavy] – no further sub division.

The most practical **sequence of operation** would be to start with the already established annual working area in coupe no. 1, move from there to coupe 3 and then go westward (coupes 4, 6 and 5), and from there back to the east (coupes 2 and the remaining 2 sub coupes of coupe 1).

9.2. Annual harvesting planning

The detailed harvesting planning per year in terms of roundwood input (net volume in m^3), recovery rate of the sawmill, lumber output (m^3) and size / location of the Annual Working Area is presented in the table [14] below.

Table [14]: Detailed annual harvesting planning.

YR	Lumber Output (m^3)	Recovery Rate (%)	Round-wood Input (m^3 net)	AWA Area (ha)	Roundwood Available (m^3 NET)
1	100	46	217	Coupe 1 – 1 35.7 ha	217
2	125	47	266	Coupe 3 –1 28 ha	266
3	135	48	281	Coupe 3 – 2 30 ha	281
4	145	49	296	Coupe 3 – 2 6 ha Coupe 4 39.3 ha	56 240
5	150	50	300	Coupe 4 18.5 ha Coupe 6 23.1	113 187 (22 kept reserve)
6	150	50	300	Coupe 5 31.5 ha	295
7	150	50	300	Coupe 2 56.1 ha Coupe 1 – 2 6.5 ha	241.5 58.5
8	150	50	300	Coupe 1 – 2 33.2 ha	300
9	150	50	300	Coupe 1 - 3 33.2 ha	300
10			**Reserve:**	Coupe 6 Coupe 1-2/3	22 54

Note to table [14]:
(1) Year 1 – if the standard conversion factor from gross to net standing volume (0.7) would be applied on the selected volume in coupe 1 – sub coupe one, the result would be 271 * 0.7 = 190 m^3. Since it appears that selection criteria applied in the field have been very strict w.r.t. stem quality, a higher conversion factor will be assumed in this case (0.8). On this ground it is assumed that the volume selected in this sub coupe is **sufficient** to feed the sawmill in year 1.
(2) Calculation of reserve: of the net available volume in coupe 6 (209 m^3), only 187 m^3 is used (22 m^3 kept as reserve); sub-coupes 1-2 and 1-3 have an area of 108.1-35.7 = 72.4 ha, with a total net available volume of 72.4*12.9*0.7 = 654 m^3. Of this volume, only 600 m^3 is used (54 m^3 kept in reserve).

The table shows that even under the rather conservative assumptions made with regard to the sawmill production, the Butmas area is too small to enable a sustainable operation. The light logging (S1) option is coupled with an estimated felling cycle of around 10 years, so the quickest return would be possible – at least in theory – to coupe 2 (planned to be exploited in year 7 – second cycle possibly in year 17). The S2 (medium) coupes would have to wait 20 – 25 years, the S3 (heavy) coupes even 40 years.

9.3. Planning of roads and trails

The planning of roads and trails is determined by the following major considerations:

- Log processing with the mobile sawmill will be carried out “on site” close to the felled trees. In order to find the optimum balance between labour inputs needed for setting-up the mill and labour inputs needed to haul the felled logs towards the mill and in order to reduce damage to soil, natural regeneration and advance growth as much as possible, around 2 sawmill set-ups per hectare are needed.
- Felled logs will be extracted manually (using a 6-ton manual winch) towards the sawmill over a distance of not more than 25 – 30 meters.
- Transport of the processed lumber towards the storage shed (provided with an anti-blue stain diptank) will be done manually.
- The storage shed is now located at around 1 km outside the model area, but will be relocated inside the area (to the point where the baseline intersects with the boundary line between the coupes 1 and 2).
- The treated lumber will be transported by truck or pick-up from the treatment/ storage shed to the markets.

The broad planning of roads and trails will then be as follows:

- 1 km of existing truck road connecting the SVT logging road close to the village with the start of the baseline on the east boundary of the model area will be upgraded (construction of a graveled surface of 3 m wide).
- 2 km of new truck road will be constructed parallel to the baseline from the east to the west boundary of the model area.
- Around 50 km of 1-2 m wide trails will be constructed for manual transport of lumber.

The truck road will have a density of 3000 / 340 = 9 m per hectare.

The planning of roads and trails is shown on the map included in appendix [1].

9.4. Planning of extraction and transport

The same basic considerations that have been outlined in the previous section [9.3] apply here.

Since costs involved are prohibitive for mechanised extraction, log hauling will be done using a manual winch (6 ton pulling capacity), in combination with manual lifting of logs using crowbars in order to avoid obstacles and in order to manoeuvre the logs in the right position with regard to the sawmill location. Where possible use will be made of the

presence of slopes – the sawmill location will, therefore, be selected in such a way that uphill log hauling is prevented.

Lumber transport (from the mill to the shed where the diptank is located) will be done manually. The maximum transport distance is around 1 km when the shed is relocated to the centre of the model area (average transport distance 500 m). It is assumed that 1 man can carry around 25 kg of lumber per trip and that 10 trips per day are possible (1 km per roundtrip on average).

It will be investigated if the introduction of a manual low-cost cable system for the transport of lumber is technically and financially feasible. Such systems have a potential in community logging as the hard work of path clearing can be avoided while the technology is simple enough to be handled by landowners. Another option to decrease the walking distances would be the introduction of a trailer on the main road (pulled either by a horse or by a so-called farm-tractor), so that the lumber can be brought in a straight line to the central access road instead of to the diptank-shed. The disadvantage would be the extra handling (loading / unloading of the trailer).

After treatment and storage of the lumber at the diptank shed, further transport to the market outlet will be done by truck or pick up. A truck can carry around 4 m^3 of lumber per trip, a pick-up 1 m^3.

9.5. Options for achieving sustainability

It follows from the planning presented in section 9.2 that the demonstration area will be logged in 9 years and that a second harvesting will only be possible in year 17 at the earliest (in the coupe with a light-logging treatment). In view of the required institutional sustainability of the BNFP Co-operative, it is – therefore - necessary to look into options for area extension beyond the present model-area.

Using the figures from table [8], it can be calculated that on average around 8-10 m^3 roundwood is selected for logging per hectare (gross value). This would mean an average annual cutting area of 35 ha (based on an annual sawmill intake of 300 m^3 gross volume). If the average felling cycle is set at 25 years, a minimum area of 875 ha would needed to achieve sustainability (say **1000 ha** when making allowances for bufferstrips on steep parts and along water courses, in-site conservation areas and reserves).

Extra compartments could be created to the west of the present area, where around 380 ha – now called temporary forest reserve is available. It is recommended to carry out a forest inventory there to investigate the suitability of the forest for community logging[7].

The other option would be to seek expansion in the forests belonging to other clans. In the following table [15] an overview is given of the forest areas owned by clans surrounding Butmas.

[7] Landowners state that the forest in the area on the western half of the plateau is of relatively low quality (stunted appearance due to hurricane damage). This will be checked.

Table [15]: Tentative areas of clan forest lands surrounding Butmas

Clan name	Area (ha)
Fabon	3350
Makvi	2692
Butmas	1675
Dragbo	488
Sorowa	1740
Velié	858
Retelen	233
Butvi	325
Falambil	399
TOTAL	**11760**

The shaded areas in table [15] show clan lands which are not yet committed to logging by SVT. In principle these clans are willing to participate in the BNFPC. A plan will be drawn-up in order to formalize the participation of these clans in community logging together with the BNFPC and to initiate the implementation of pre-harvest inventories in selected forest areas.

9.6. Wet weather provisions

Section 7 of the COLP requires that during wet weather conditions logging shall cease in those areas where risk of damage to soil and water exists. If possible logging can continue in specially designated coupes where such risks are less. It has been decided to keep the relatively flat and (from the SVT circular road) easily accessible coupe 1 [sub coupe 3] open during the whole year as special "**wet weather coupe**".

9.7. Environmental provisions

The management system proposed in this plan has been designed in such a way that the forest's multi-storied structure and species composition largely remain in tact (see also section 6). This in itself is already a major environmental provision, since it secures the adequate natural regeneration of the forest, the continuation of habitat functions for wildlife and the continuing availability of important NTFP for subsistence collection by landowners.

Furthermore all major stipulations of the COLP will be complied with, as far as relevant under the conditions of small scale, only partly mechanized community logging:

- Demarcation of bufferstrips along designated watercourses and on steep slopes (>30^0) where no tree selection for logging shall occur.
- Protection of areas with special environmental values to be excluded from logging.
- Ceasing of harvesting activities under very wet conditions and shifting to the wet-weather coupe under such conditions (see section 9.6).

10. IMPLEMENTATION OF HARVESTING

The methods and techniques applied when implementing the harvesting shall follow all rules and guidelines as stipulated in the COLP, as far as these are applicable to small-scale community logging.

10.1 Construction of roads and trails

The clearing width of the central access road will be around 10 m, whereas the graveled surface width will be 3 m only (based on the assumption that there will never be more than 1 vehicle on the road at the same time). Other specifications will follow the COLP. The costs of construction for the new road will be around 1.5 million VT per kilometer (verbal communication, Rodney Aru, Melcoffee sawmill), whereas the costs of upgrading the existing road are estimated at around 1 million VT per kilometer[8].

The trails for manual transport of lumber will be cleared over a width of 1 – 2 m, using the caneknife and the chainsaw. Small trees will be removed only in those places where the risk of the lumber load hitting tree trunks exists (in curves). On steep spots some additional groundwork will be necessary such as construction of stable steps when waterways have to be crossed. A balance must be found between minimizing costs and environmental disturbance on the one hand, and safety and speed of transport on the other hand.

10.2. Reduced impact felling

The selected and marked trees will be identified by the felling-team (consisting of 2 - 3 men). When the trees are felled, felling damage to standing trees and regeneration will be minimized (reduced impact felling), while keeping the amounts of waste remaining in the forest as small as possible. Stumps shall not exceed 30 cm in height, whereas a maximum of the felled timber shall be used for further processing. By applying directional felling techniques (using winches), the trees will fall in a certain prede-termined direction. The required felling direction is determined by a number of considerations:

- The location of the sawmill and the direction of extraction to the mill. Cumbersome log manoeuvring shall be avoided in order to save time and costs and to reduce damage to regeneration.
- The position of remaining trees and advance growth not to be damaged.
- The location of water courses. Logs shall not fall across water courses.
- Safety aspects, in particular the direction of the safest escape route.
- The form of the tree and – in particular – its crown. Often, trees will have heavy branches on one side, which will limit the possibilities for directional felling.

[8] It is extremely difficult to obtain realistic estimates of road construction in Vanuatu. The PGRFP's staff in Luganville received a quotation from PWD for the construction of 3.2 km of road according to "national road standards" of around 2.5 million VT per km (letter from PWD to PGRFP of 16.06.04). Since the national road standards are too generous for the purposes of this management plan, the lower figure assumed here seems justified.

10.3. Reduced impact extraction

When the tree is on the ground, the log must be prepared for extraction and further processing ("bucking", cross cutting). Large buttresses and branches are removed, always in such a way that maximum recovery can be achieved. Subdivision in blocks to be handled separately by the sawmill is determined by the log's diameter (the larger the diameter, the shorter the block), by the principle to optimize output and by market requirements. It will be investigated in how far big branches and other waste that normally would be left in the forest, can be used for e.g. charcoal production (using mobile kilns) in an attempt to leave a relatively clean forest floor behind where natural regeneration can more easily establish.

The manual moving of logs towards the sawmill will be done in such a way that damage to soil and natural regeneration is minimized. This is achieved by the original position of the logs on the ground (influenced by directional felling) with regard to the sawmill location and by lifting the logs when using the crowbars.

10.4. Sawmill operation

Sawmill operation shall occur by a trained and experienced team, following the guidelines and instructions provided by the manufacturer (Peterson Ltd.).

The sawmill shall be maintained on a daily basis. The machine will be cleaned and greased, oil and fluid levels will be checked. The blade shall be inspected and sharpened frequently.

The set-up of the mill should be on level, permanently dry ground, in such a way that log extraction towards the mill can occur downhill. After relocating the mill lumber waste shall be removed from the site and the sawdust shall be spread evenly across the ground.

10.5. Safety requirements

In all operations, strict safety rules shall be in force. This means that:

- The operations (particularly the felling, extraction and sawmilling) shall only occur by properly trained crews who are aware of safe working methods and techniques.
- Supervisors are assigned for the various operations who have the responsibility for making sure that the safety rules are followed, that safety equipment is available and used and that people breaking the rules are addressed.
- The working places are kept tidy to avoid people from falling or tripping.
- The chainsaw, the sawmill and all other equipment are properly maintained and serviced on a daily basis.
- Workers are using the safety equipment such as safety boots, helmets, ear protectors, eye protectors, gloves, overalls, etc.
- A good first aid kit is present on-site and is checked (and – if necessary – replenished) on a daily basis.

11. COSTS AND BENEFITS

11.1 Costs

A preliminary cost benefit comparison is part of the management plan. The calculation is made for an average year, based on the following input parameters:

- Annual Working Area (AWA) 35 ha
- Lumber production 125 m^3.
- This means 300 m^3 intake.
- For which 428 m^3 Gross Standing Volume is required (0.7 factor).
- A total of 475 trees to be felled (0.9 m3 / tree).
- 1 labour day costs 800 VT.

The expected annual costs are presented in the following table [16]:

Table [16]: Costs of the various operations in forest management planning

ITEM	DETAIL	COST (VT)
Annual working area	Labor demarcation, tree selection / map	28,000
	Materials (paint, ribbon)	25,000
	Depreciation instruments	10,833
Road / trail construction	2 km new truck road / 1 km upgrade truck road	463,500
	Trails 150 m /ha	25,200
Felling	2 p do 5 trees / day	152,000
	Chainsaw depreciation	43,000
	Fuel / maintenance / repair	40,000
Extraction to mill	Winch (incl. In felling)	
Sawmilling	Set-Up	140,000
	Milling	500,000
	Transport to shed	400,000
	Mill depreciation	120,000
	Fuel / maintenance / repair	160,000
Shed – storage / treatment	Treatment chemicals	137,500
	Labor (2 p – when milling)	200,000
Transport	Lorry / 4 m3 trip	437,500
GENERAL	GTZ LOAN (agreement)	600,000
	Annual license	Exempted
	REGISTRATION	10,000
	Management fee	Exempted
	SSS-CITY charges	Not known
	Transport to LG – marketing	60,000
	COMMUNICATION	30,000
	Stationary	32,500
TOTAL COSTS		**3,615,033**

Notes to the table [16] above:

(1) Annual Working Area preparation:
- a team of 3 persons can demarcate / carry out tree selection / prepare a tree location map on 3 ha per day.
- Depreciation instruments includes compass, clinometers and various tapes worth around 450 euro, written-off in 5 years

(2) Road and trail construction:
- Of the major truck road there is around 309 m needed (3000/340)*35 at an average cost of 1500 VT per meter (being the average between 2000 VT / m for the new road and 1000 VT / m for the upgrading of the already existing road).
- Of the trails (suitable for manual lumber transport) there is around 150 m / ha needed. A 3 men team can construct 500 m of such trail per day.

(3) Felling:
- A team of 2 persons fells 5 trees / day.
- Chainsaw depreciation: the new price is set at 200.000 VT, writing-off is in 7 years. A rest value at the end of this period of 25% is assumed, so that the depreciation becomes (200.000-50.000)/7 = 21.500 for one saw. A total of 2 saws is needed.
- Fuel and maintenance is taken as 10% of the purchase price.

(4) Sawmilling:
- A 5-men team sets up the mill in half a day. Per hectare about 2 set-ups are necessary.
- The mill produces 1 m^3 of lumber per day – operated by a team of 5 people.
- The transport of the lumber to the shed occurs manually. The average trip distance is 500 m, one person can make 10 such trips per day with around 25 kg on his shoulders. One person – therefore – carries 250 kg per day. For the removal of 1 m^3 (weighing around 1000 kg) 4 person days are needed. The removal the annual production is 125 * 4 = 500 person days.
- The mill depreciation is based on a new price of 1.6 million VT (including optionals), a rest value of 25% and a write-off period of 10 years.
- Fuel, maintenance and repair is taken as 10% of the purchase value.

(5) Storage and treatment at the shed:
- During milling days there will be a team of 2 people needed for stacking and dipping.
- Chemical consumption (vacsol and anti-blue) is estimated at 0.55 l per 1.5 m^3 of lumber and a sales price of 3000 VT per liter chemical.

11.2. Benefits

A comparison of possible costs and benefits is presented in the following table [17]:

Table [17]: Comparison of possible annual costs and benefits in VT

BENEFITS:	125 m^3 lumber	40% first grade – 45.000 VT / m^3	2,250,000
		60% second grade – 25.000 VT / m^3	1,875,000
		TOTAL:	4,125,000
COSTS:			3,615,033
NET SURPLUS:			**509,967**

The figure of a possible annual net surplus of around 0.5 million VT should be considered indicative. The calculation is based on many assumed values which will have to be verified in the course of management plan implementation. Of special importance in this respect is the development of the prices, for which the cost – benefit ratio has a high sensitivity.

11.3. Need for manpower

In the table [18] below the manpower need is calculated for the various management operations. The calculation is – as in the case of the cost calculation in section 11.1 – based on the following input parameters:

- Annual Working Area (AWA) 35 ha
- Lumber production 125 m^3.
- This means 300 m^3 intake.
- For which 428 m^3 Gross Standing Volume is required (0.7 factor).
- A total of 475 trees to be felled (0.9 m3 / tree).

Table [18]: Annual need for manpower

Item	Detail	Person Days
Annual Working Area	Demarcation, tree marking, tree location map	35
Trail construction	For manual lumber transport	32
Felling	+ extraction	190
Sawmilling	Set up	175
	Milling	625
	Manual lumber transport	500
Shed	Stacking – dipping	250
	Pick-up / lorry (un) loading	250
General	Trips to LG – marketing	90
TOTAL		**2147**

The total need for person-days is 2147, or – if the year would have around 200 potential working days – around 11 permanent jobs.

The conclusion is that the BNFPC will have to recruit additional labour beyond the 5 persons who are presently implementing the test operations. In particular, additional labour is needed for manual lumber transport, stacking and dipping at shed-site and pick up or lorry loading and unloading.

12. THE ANNUAL WORKING PLAN (AWP)

This management plan only provides the broad lines of forest management planning for a 10-year's period. It presents the general concepts and a framework within which the field activities have to take place, but it does not provide the instructions needed for day-to-day operations. It is – therefore – necessary that each year a separate so-called **Annual Working Plan** (AWP) is prepared that presents the practical details of the forest management activities to be undertaken in the year and the working area concerned.

Under the conditions of community forestry such AWP shall remain **as simple as possible**, but at the same time fulfill the minimum standards the DoF requires.

The AWP bases on the preceding tree-selection and tree-marking operation carried out the (sub) coupe that will be exploited subsequently. It is here proposed that the AWP shall contain short sections on the following issues:

- General concept of management system, treatment chosen (S1, S2 or S3).
- (Sub) – coupe to be exploited – location, area (ha).
- Summary of method and results of the preceding forest inventory [if inventory has taken place].
- Results of tree selection operation
    - List of selected trees, with species names, dbh, basal area, stem length and estimated gross volumes.
    - Expected production in m^3 net (net volume on the ground and net volume lumber).
- Detailed harvesting planning.
    - Method and organization of felling and extraction.
    - Locations of the sawmill.
    - Road and trails, densities, specifications and location.
    - Transport of lumber, methods and organization (from mill to treatment plant).
    - Activities at the treatment plant.
    - Transport of lumber, methods and organization (from treatment plant to market).
    - **Manpower** needed per operation.
    - **Materials and equipment** needed per operation.
- Preparation of the next (sub) coupe.
    - Tree selection / tree marking / **tree location map**.
- Measures other than selective logging in native forest (tree planting, AF, NTFP, etc – if applicable).
- Expected costs and benefits.
- Maps:
    - (Sub) coupe – showing roads / trails / **tree locations** / gullies / creeks and other natural features / steep slopes / buffer-zones / tabu-sites / conservation or protection zones, etc.

13. MONITORING AND RESEARCH

13.1. Background

The reaction of the forest to the different types of treatment will be studied in **Permanent Sample Plots**. Permanent Sample Plots (PSP) are permanently demarcated plots where recurrent observations [with regard to tree species, dbh and height] on permanently marked trees are made. These observations are needed in order to monitor the impacts of logging [in various degrees, S1, S2 and S3] and to compare these impacts between each other and with untreated [unlogged] forest.

According to its mandate, it is the responsibility of the **DoF's Research Unit** to establish, monitor and manage PSPs, always in co-operation with the landowners who shall be invited to participate in field activities [such as line clearing, tree measurements or maintenance of plot or tree marks].

The DoF's Research Unit is interested in the development of calculated stand characteristics [such as increment in diameter / basal area / height / volume, ingrowth, mortality etc], the differences in these respects between the treatments themselves and the differences between treated on the one hand and non-treated forest on the other hand. Information on all these issues will provide a better understanding of the behaviour [growth and regeneration] of the forest under different management regimes and is – therefore – of great importance for the further updating of the nation's forest policy and the guidelines for sustainable natural forest management.

PSPs have been established already in the Butmas area on previous occasions:

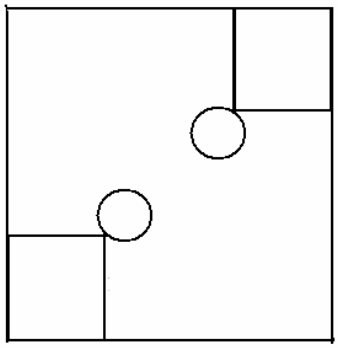
- In 1997 in the form of a "botanical survey" (six main plots of 50x50m and seven pairs of 15x15 m "subplots"). These data have been conserved and analyzed (see report Corrigan / Chanel Sam, 1998).
- In 1999 in the form of official DoF Permanent Sample Plots. A total of twelve 50x50m plots has been established, following a design prepared by Tevita Evo (Forest Research, Colo-i-Suva, Fiji). The design was the same as for the botanical plots. The data collected during the first assessment made at the time of plot establishment, are conserved[9], but have not yet been analyzed.

[9] Original e-files lost, data keyed-in once again in June 2004.

The established plots have a lay-out as illustrated in figure [5]:

Figure [5]: Lay-out of a PSP

- 50 x 50 m Main Plot (trees >= 30 cm)
- 15 x 15 m Sub Plots (2 – trees >= 10cm, <30 cm)
- 3 m radius SubSubPlots (2 – trees >2 cm, <10cm)



Unfortunately, the established plots cannot be traced back exactly in the field anymore – the location descriptions made at the time of establishment were not precise enough and non-durable corner posts had been used.

In view of this and considering that no treatments had been carried out yet, it was decided to establish new PSPs once more. This would make no difference in terms of labour input needed when compared with re-measuring existing plots. This time more attention shall be given to a proper marking of the exact positions of the plots [both on the map and in the field, also making use of newly introduced GPS technology], in order to avoid the described problems of the past. The present situation is that a total of 6 PSPs has been marked and assessed in the field [3 plots in compartment 1, 3 plots in compartment 3].

According to the PGRFP staff in Santo, it is the intention to establish three plots [of 50x50 m each, plus two pairs of 15x15 m subplots and two pairs of 3x3 m subsubplots within each 50x50m plot] within **each coupe**. As there are six coupes, a total of 18 PSP would have to be established.

13.2. Recommendations for PSP-establishment

The establishment of PSP in such a way that meaningful information can be derived from their regular re-measurement is a complicated affair where many statistical and practical considerations play a role. Normally, the variability of tropical forests is very high, which would require very big areas under PSP in order to be able to attribute differences in forest development to the treatments applied [logging] with a statistically acceptable level of confidence.

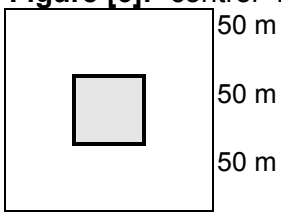
But this requirement conflicts with the limited capacity of the Department of Forests to make manpower and funds available for measurement, management / maintenance, data input and data analysis – as the history in the case of Butmas has already shown.

Since the Butmas block is a demonstration area[10], after all and considering the importance to be able to make statements on the impacts of various degrees of logging as a basis for further policy development, it is absolutely necessary that PSPs are established. It should – nevertheless – be attempted to **simplify things as much as possible** and to try to minimize the workload associated with PSP establishment and management as well as with data input / analysis.

Therefore the following can be recommended:

- The basic design and lay-out of the individual plots should remain unchanged [as illustrated in figure 5].
- However, Instead of establishing 3 plots per **coupe**, it is better to establish 3 plots per **treatment** (**12 plots in total**).
- Considering the fact that the Butmas area itself is too small for sustainable community logging, the idea launched in the Coupe Harvesting Plan (drafted in November 1999) to maintain 2 whole coupes as "control" (= no logging, the coupes 3 and 6) is dropped as uneconomical. The original recommendations made by Prof. Mussong (1998) shall be adopted instead. The treatments – then - will be light logging (S1 – coupe 2), medium logging (S2 – coupes 1 and 3) and heavy logging (S3 – coupes 4, 5 and 6).
- This means that for the "control" plots smaller areas inside otherwise treated coupes have to be demarcated where no logging shall take place. It is proposed to do this in coupe 1 with the already established PSP 1 and in coupe 3 with the already established plot 3. In both cases there should be a buffer of exactly 50 m around the outer boundary of the plot where no logging shall be permitted – so that unlogged enclaves of 150 x 150 m are created [with the untreated "zero" plot in the center]. The third "zero" plot will be established in **coupe 6**, also surrounded by a bufferstrip where no logging is allowed.

Figure [6]: "control" PSP with bufferstrip (in treated coupe)



- The 3 plots needed in medium logging shall be the PSPs no 2 and 3 [in coupe 1] and PSP no 2 [in coupe 3]. PSP 1 [in coupe 1] and PSP 3 [in coupe 3] will become "zero" plots [see above], whereas PSP 1 [coupe 3] shall be dropped.
- In compartment 2 (light logging) three (3) PSPs will be established.

[10] The decision to adopt a community forestry approach does not mean a change in this respect.

- In the compartments 4, 5 and 6 (all heavy logging) there will be one PSP in each compartment.

Recommendations with regard to practical aspects of PSP establishment are:

- While GPS can help identifying the plot locations, there is still a need to demarcate the boundaries precisely and – above all – sustainably. After all, even under the best circumstances the GPS has an accuracy of + / - 10 m.
- One plot corner should be tied-in from a known point, for example the start of the baseline. Descriptions on how the PSP **corner** was reached shall be made and stored: for example, follow base line under course 270 degrees for 253 m, then turn exactly south, follow line for 182 m, meet NW corner of plot. Here it is important that distances recorded are horizontal distances (i.e. corrected for slope) and that the compass-bearings are corrected for declination [so that bearings on the map are the same as bearings in the field].
- Plot corners shall be marked permanently with strong, rot-resistant coloured pegs. For example, yellow pegs at the corners of the main 50 x 50 plot, red pegs at the corners of the two subplots of 15x15 m and blue pegs in the center of the two 3 x 3 m subsubplots.
- When the logging takes place according to the schedule proposed in this plan, the logging crews shall receive the instruction that they are to treat the PSP in exactly the same way as the rest of the forest (with the exception of the “zero” plots, which shall be left untouched). If pegs fall down, the will have to be put again into the right position afterwards.
- It will be made sure that the outer boundaries of the plots follow a standardized direction (e.g. exactly NW / EW – corrected for declination[11]). In that way there is an additional help in re-locating the plots from one of its corners. A sketch map of each PSP will be made.
- The numbering of the trees will be done with aluminum tags. Regular checks shall have to be made whether the tags are still there [have not fallen out or “eaten-up” by the tree].
- It is of utmost importance that the diameter of the tree is always measured at exactly the same spot. Normally, this is at breast height (at 1.30 m, taken on the uphill side of the tree). Sometimes special cases apply, such as buttresses, forks, irregularities etc, for which special rules apply [see for further details the PHI inventory manual for Vanuatu, De Vletter, 1997]. Marking the measurement place is necessary. This will be done by putting the nail in exactly at breast height or at one hand-width above buttresses.
- The bufferstrips around zero-plots [in treated compartments] shall also be clearly marked. Best is to select the plot location so that use can be made of clear, existing boundaries – such as the steep waterway in the case of PSP 3 in compartment 3 or the baseline and the [planned] central road in the case of PSP 1 in compartment 1.

[11] The difference between the magnetic North (as shown in the field by the unadjusted compass) and the true North (as used for map orientation).

Recommendations with regard to the frequency of assessments and data management are:

- In each plot, complete surveys will be made at the time of establishment [before logging] and immediately after the implementation of the treatments.
- During the first 3 years after completion of the treatments the plots shall be surveyed bi-annually, thereafter the frequency of surveys can be reduced to every 3 to 5 years.
- All data shall be entered into computer files immediately, following the file structure as recommended in the paper “file descriptions” (De Vletter, 2004).
- Back-up copies of the files created shall be made and be present at the DoF offices in Luganville and Port Vila, as well as at the PGRFP office in Suva, Fiji.
- The DoF’s Research Unit shall prepare reports on the results of the surveys annually. Every 3 years a full-scale evaluation report shall be prepared.

14. TRAINING AND CAPACITY BUILDING

This Forest Management Plan will – ultimately – be implemented by the landowners of Butmas village. In spite of a considerable number of training events in the past, the development of a special capacity building program targeting landowners remains a must, also in view of the fact that positions change, people move away and refresher courses are needed.

This training program on Sustainable Forest Management should directly contribute to the purpose of the PGRFP: “Resource-users (such as landowners) increasingly apply sustainable land and forest management systems”. .

Priority themes: For the training of landowners the emphasis will be on the pure implementation aspects of sustainable forest management.

The following topics seem the most important now:

Training related to management plan / annual work plan preparation:

- General awareness of forest dynamics and sustainable forest management.
- Tree spotting.
- Forest inventory – field work.
- Tree selection and marking for community logging.
- Preparation of Annual Working Plans
- Preparation of Annual Working Area maps – tree locations, steep slopes, gullies, etc.

Training related to technical aspects of timber harvesting:

- Reduced impact felling.
- Chainsaw maintenance and repair.
- Safety in felling / extraction.
- Reduced impact log extraction (winching).
- Waste reduction in logging.
- Optimum log preparation.
- Reduced impact road and trail construction / maintenance.

Training related to the timber processing aspects:

- [Refresher] sawmill operation.
- Product quality improvement.
- Safety in milling.
- Waste reduction.
- Timber treatment and pollution prevention.

Training related to the running of a co-operative:

- Promotion of business management skills – time management, administration, accounting, communication, reporting, personnel management, conflict prevention.
- Decision making, meeting techniques, networking, information collection.
- Marketing, negotiation techniques.

It is further recommended that also a special training program will be developed directed at villagers who do not directly participate in the community logging activities (in particular women). Such training events could include reading / writing courses, development of other income generating measures, agroforestry techniques, keeping of poultry or small lifestock, etc.

Further details of the capacity building program, also with regard to other target groups than villagers, are presented in Appendix [8].

15. MANAGEMENT OPTIONS OTHER THAN SELECTIVE LOGGING

Apart from selective logging of indigenous forests, there are a number of other management options that can be implemented by landowners. Not all of these options are relevant for the model area itself, but can be important in the surrounding forests. Examples of such options are:

- Collection and management of Non-Timber Forest Products (NTFP), as already practiced by the villagers. Systems for the sustainable management of NTFP will be developed further.
- The establishment of plantations (in the form of small village woodlots) on old garden sites.
- The cultivation of valuable trees (such as white wood) on the basis of natural regeneration as part of agroforestry systems.
- The establishment of small enrichment plantations inside degraded forest spots.

16. FOREST PROTECTION, COUPE CLOSURE

Forest protection against – for example – illegal logging or hunting by outsiders shall occur on the basis of regular patrolling by the villagers, supported by DoF forest guards. Fire is no problem in Butmas.

Immediately after completion of the harvesting operations coupes shall be closed once an inspection (carried out with support from DoF) has shown that the operations have been carried out according to the guidelines set in the plan.

17. NETWORKING WITH INSTITUTIONS AND OTHER STAKEHOLDERS

Community forestry in the form proposed under this plan is a relatively new approach in Vanuatu, the success of which will depend to a large degree on constructive networking, communication and information exchange between the BNPC / PGRFP and a variety of other stakeholders. The most important parties in this respect are:

- The DoF, which will have to provide services to the landowners and which will have to provide an enabling environment for community forestry (in terms of adapted policies and legislation),
- Other relevant government bodies.
- The private sector, such as logging companies, wood markets and furniture shops.
- Other projects active in (community) forestry in the widest sense (such as LEARN or SPRIG).
- Institutions of training and research, in Vanuatu as well in the Pacific region.
- Donor organizations and international organizations (FAO, SPC,etc).

It is further planned that the existing contacts between communities involved in small-scale forestry shall be structurally strengthened. Ultimately, a federation of small-scale timber producers may emerge, that can act as partner in discussions with all stake-holders and that can meaningfully influence the further development of an enabling environment for community forestry.

18. EVALUATION AND REVISION

18.1 Evaluation

Registration and subsequent evaluation of all relevant data with regard to the operations carried out and their impacts created, is necessary to ensure that the performance standards required under this management plan are met. Compliance with the rules and guidelines set (as stated in the management plan or annual work plan) is verified, while indicating where the adjustment of management approach or actions may be necessary.

Therefore, **detailed records** will be kept of all activities carried out during the entire planning cycle, starting with the terrain and coupe demarcation, the tree selection, the timber harvesting and processing, transport, storage and treatment until and through the selling and marketing of the produced lumber.

These records are administered on specially designed field forms and have later to be entered into EXCEL spreadsheets, with the support from the PGRFP and DoF

Administration is particularly useful to have data available for **cost – benefit analysis**. If adequately recorded information is available, such as labour (or material) inputs for the various management activities, it is possible to calculate the profit the BNFPC has made in the end. Without such information the co-operative would not be able to learn whether a loss or profit has been made. Also it becomes easier to indicate where can be economized, or, the other way around, where more inputs have to made.

Administration is further needed to test whether various assumptions made under this plan (such as production targets and recovery rates) are realistic or have to be adjusted.

Monitoring is also necessary to follow the development of the treated forest over time. Information about diameter development, height development and stocking (numbers of stems per unit area) gives the technical basis for professional decisions on management activities. Such monitoring is done in the Permanent sample Plots [see further section 13].

18.2 Revision

This plan is designed for a 10-year's period. In view of the many unknown factors at the time of writing and the many assumptions made, a revision and updating will be needed after 5 years at the latest, using the information obtained through monitoring and evaluation (as outlined in section 19.1).

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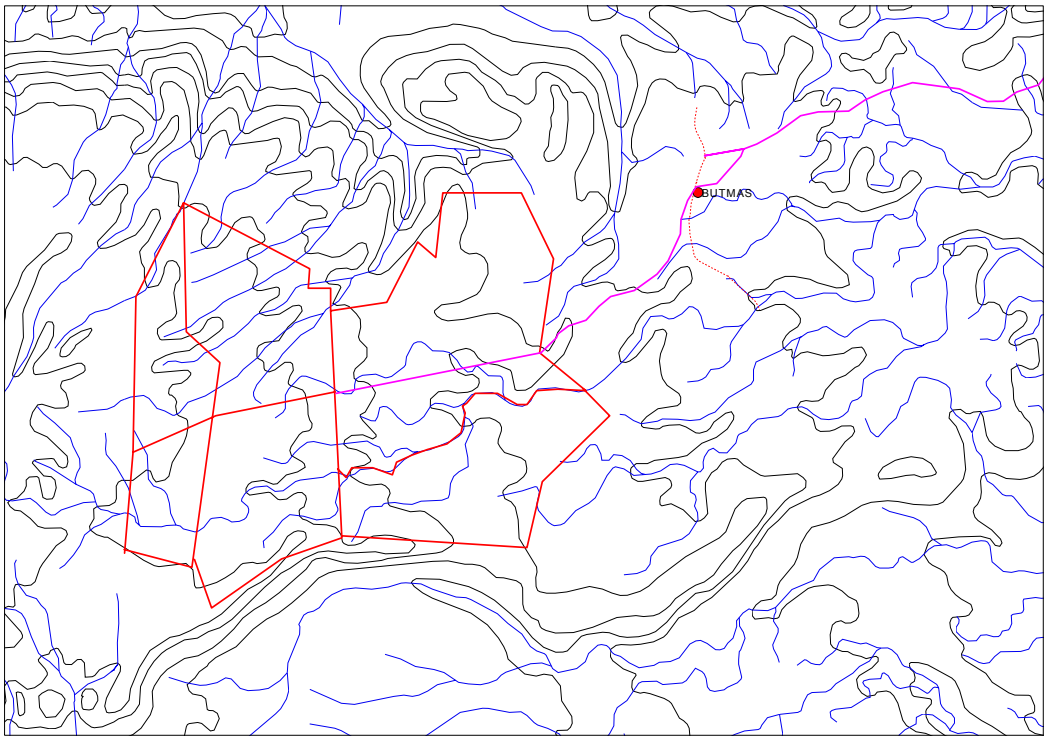
APPENDIX

1. Maps
2. List of tree species for Butmas
3. Summary of results of the botanical survey (1997)
4. Summary of results of the Permanent Sample Plots (1999)
5. Results of tree selection in 1999
6. List of land bird species of Vanuatu – status in Butmas
7. Test against National Forest Management Standards (PNG)
8. Training and capacity building program

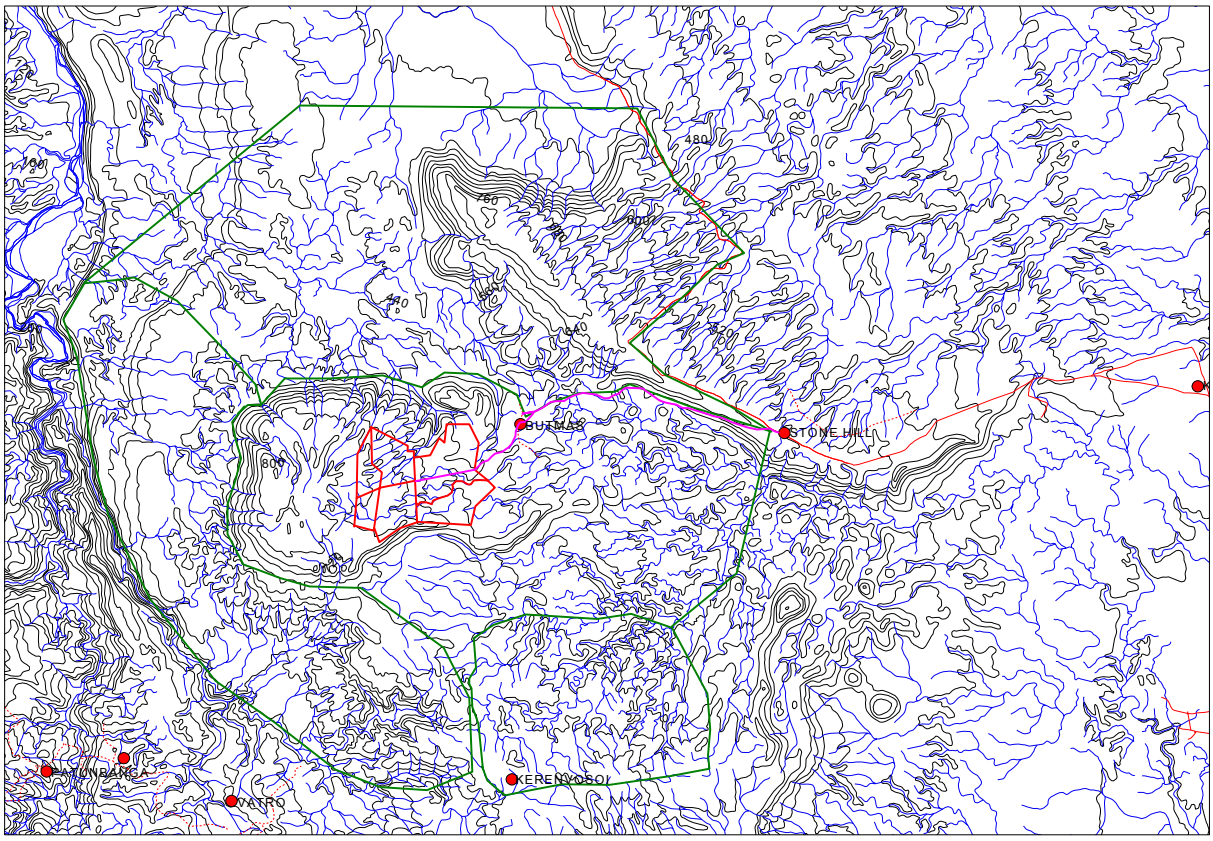
APPENDIX TO FOREST MANAGEMENT PLAN BUTMAS

Appendix [1]: Maps

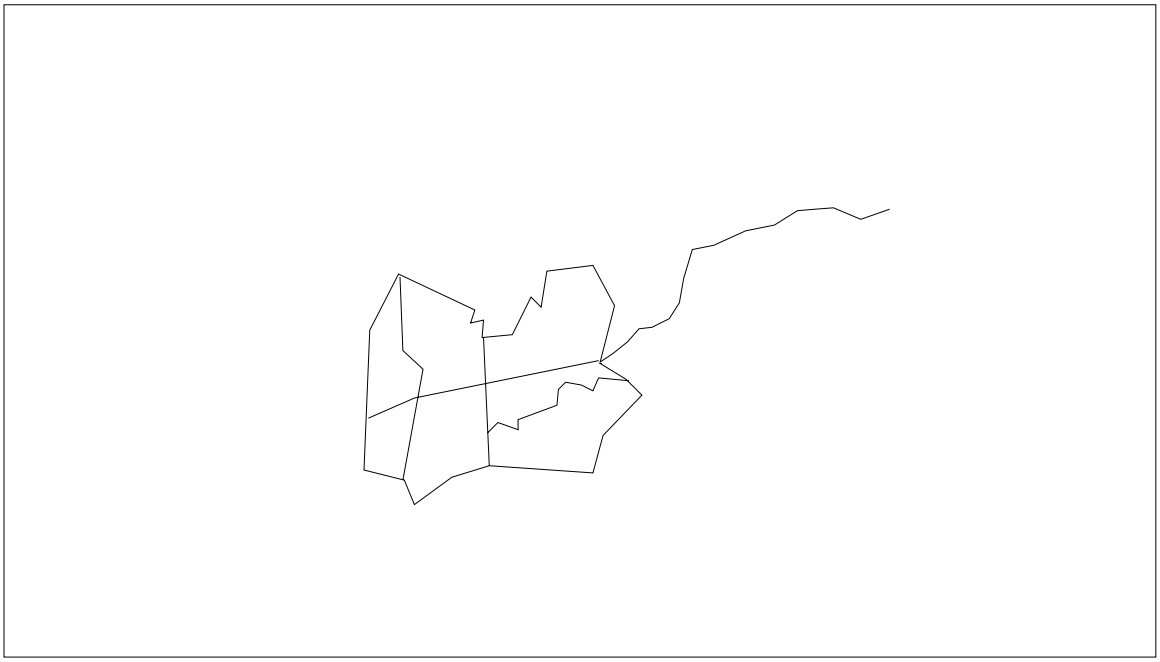
Coupe-Boundaries A



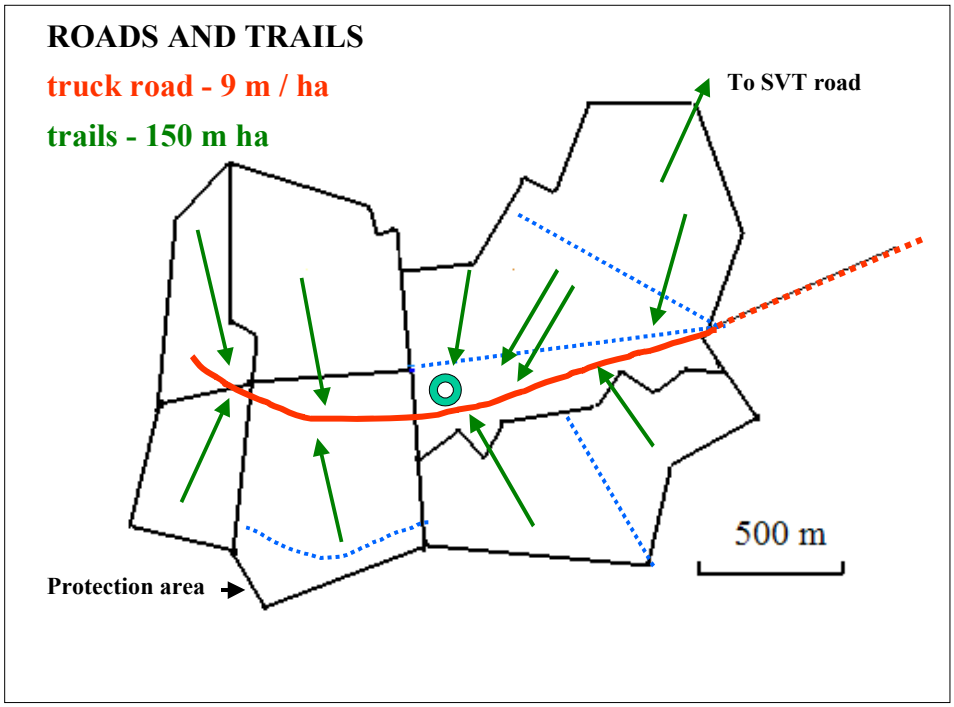
Butmas 1



Plain map



Road and trail planning



Appendix [2]: List of tree species for Vanuatu

Annex 2: Tree List Vanuatu					
Scientific name	**Family**	**Code**	**Bislama**	**Use**	**Language**
Acacia simplex	Mimosaceae	ACASIM	Namaliu blong solwara	FU	
Acacia spirorbis	Mimosaceae	ACASPI	Namaliu	V	Mariu
Acacia spirorbis	Mimosaceae	ACASPI	Gaiac	V	
Acalypha caturus	Euphorbiaceae	ACACAT	Waet namatal		Fmangelef
Acalypha grandis	Euphorbiaceae	ACAGRA			Foarbi
Aceratium oppositifolium	Elaeocarpaceae	ACEOPP	Jeri tri		Faflumburu
Acronychia simplicifolia	Rutace	ACRSIM			
Adenanthera pavonina	Mimosaceae	ADEPAV	Bisa	V	Fdiskar
Agathis macrophylla	Araucariaceae	AGAMAC	Kaori	T	
Albizia lebbek	Mimosaceae	ALBLEB	Albizia	V	
Albizia minahasse	Mimosaceae	ALBMIN		V	
Albizia saman	Mimosaceae	SAMSAM	Rentri	PT	
Aleurites moluccana	Euphorbiaceae	ALEMOL	Aleurites	PT	Pa
Alphitonia zizyphoides	Rhamnaceae	ALPZIZ	Huremi	PT	Farei
Alphitonia zizyphoides	Rhamnaceae	ALPZIZ	Alphitonia	V	Farei
Alstonia vitiensis	Apocynaceae	ALSVIT		V	
Anthocarapa nitidula	Meliaceae	ANTNIT		PT	Fmorkar
Antiaris toxicaria	Moraceae	ANTTOX	Milikwud	T	Raas / Aokara
Antidesma messianum	Euphorbiaceae	ANTMES			
Artocarpus altilis	Moraceae	ARTALT	Breadfruit		Nde
Artocarpus communis	Moraceae	ARTCOM	Breadfruit	FR	
Astronidium aneityense	Melastomataceae	ASTANE			Foase
Baccaurea stylosa		BACSTY			Foa natafok
Barringtonia asiatica	Barringtoniaceae	BARASI	Fis Poison Tri	V	Faep
Barringtonia edulis	Barringtoniaceae	BAREDU	Navel wud	FR	Ro-ot
Barringtonia racemosa	Barringtoniaceae	BARRAC		V	
Bischofia javanica	Euphorbiaceae	BISJAV	Nakoka	T	Ora

Boehmeria macrophylla	Urticaceae	BOEMAC			
Burckella obovata	Sapotaceae	BUROBO	Naduledule	FR	Nat
Burckella spp	Sapotaceae	SAPSPA	Inyetupon		
Calophyllum inophyllum	Clusiaceae	CALINO	Nabakura	V	Fases
Calophyllum neo-ebudicum	Clusiaceae	CALNEO	Tamanu	T	Fnduru
Cananga odorata	Annonaceae	CANODO	Nidigoro	V	
Canarium indicum	Burseraceae	CANIND	Nangai	FR	Nga
Canarium spp.	Burseraceae	CANSPA		PT	
Castanospermum australe	Papilionaceae	CASAUS	Bintri	T	An-nts
Casuarina equisetifolia	Casuarinaceae	CASEQU	Sheoak	FU	Foar
Celtis paniculata	Ulmaceae	CELPAN	Celtis		
Cerbera spp.	Apocynaceae	CERSPP	Red / Waet Cerbera	V	Blut
Chisocheton spp.	Meliaceae	CHISPP		V	Mondo-ol / Saken
Claoxylon fallax		CLAFAL			Fpaoa
Commersomia bartramia	Sterculiaceae	COMBAR		V	
Cordia dichotoma	Boraginaceae	CORDIC	Kerosinwud	FU/V	Fbaetop
Cordia dichotoma	Boraginaceae	CORDIG	Glutri	FU/V	Fbaetop
Cordia subcordata	Boraginaceae	CORSUB	Burao blong solwara	V	Fbaetop
Cordiaeum variegatum	Euphorbiaceae	CORVAR	Croton	V	
Corynocarpus similis	Corynocarpaceae	CORSIM	Nakavika blong tevel	FR	Fptumbo
Croton insulare	Euphorbiaceae	CROINS		V	
Cryptocarya hornei	Lauraceae	CRYHOR		V	
Cryptocarya turbinata	Lauraceae	CRYTUR		V	Foatne
Cupaniopsis lebtobotrys	Sapindaceae	CUPLEP	Black nakatambol		Jaeran
Decaspermum neo-ebudicum	Myrtaceae	DECNEO			
Delonix regia	Caesalpiniaceae	DELREG	Krismastri	V	
Dendrocnide latifolia	Urticaceae	DENLAT	Nagalat	X	Fgolat
Dendrocnide moroides	Urticaceae	DENMOR	Big Nangalat	X	Fgolat bu
Dillenia biflora	Dilleniaceae	DILBIF	Dillenia	T	Fdendtaf
Dillenia ingens	Dilleniaceae	DILING	Dillenia	V	Fdendtaf
Diospyros samoensis	Ebenaceae	DIOSAM	Blakwud	V	

Dolichandrone spathacea	Bignoniaceae	DOLSPA			
Dracantomelon vitiense	Anacardiaceae	DRAVIT	Nakatambul	FR	Atapol
Dysoxylum amooroides	Meliaceae	DYSAMO	Stinkwud	T	Foabuk
Dysoxylum aneityense	Meliaceae	DYSANE	Red stinkwud	T	Foalol
Dysoxylum arborescens	Meliaceae	DYSARB	Stinkwud	PT	Ambutalse
Dysoxylum bijugum	Meliaceae	DYSBIJ	Stinkwud	V	Vua Puk
Dysoxylum gillespianum	Meliaceae	DYSGIL	Stinkwud	PT	
Dysoxylum grandichaudianum	Meliaceae	DYSGRA	Stinkwud		Fmondol / Foabonsat
Elaeocarpus angustifolius	Elaeocarpaceae	ELEANG	Birimo	T	Fmbili / Ftanto
Elaeocarpus chelonimorphus	Elaeocarpaceae	ELECHE	Waet elaeocarp	PT	Sendro-of
Elaeocarpus floridanus	Elaeocarpaceae	ELEFLO		PT	
Elattostachys falcata	Sapindaceae	ELAFAL	Inwonapag	T	Sairang
Endospermum medullosum	Euphorbiaceae	ENDMED	Weatwud	T	Fmbas
Erythrina fusca	Papilionaceae	ERYFUS		V	Fdurusul
Erythrina indica	Papilionaceae	ERYIND		V	
Erythrina variegata	Papilionaceae	ARYVAR	Narara	V	
Evodia bonwicki	Rutaceae	EVOBON	Karipu	V	
Evodia latifolia	Rutaceae	EVOLAT	Smol Evodia		Fsambek
Evodia spp	Rutaceae	EVOSPP	Bigfala evodia		Sipte
Excoecaria agallocha	Euphorbiaceae	EXCAGA		V	
Fagraea berterana	Loganiaceae	FAGBER		V	
Ficus adenosperma	Moraceae	FICADE	Gud faewud nabalango	FU	Fnum
Ficus aspera	Moraceae	FICASP	Big lif nabalango	V	Fto-tong
Ficus septica	Moraceae	FICSEP	Nabalango		Forfor
Ficus smithii	Moraceae	FICSMI	Bifala nabalango		Fdraber
Ficus spp (stranglers)	Moraceae	FICUSB	Nabanga	V	Fere
Ficus spp. (non stranglers)	Moraceae	FICUSA	Fig / Nabalango	V	Siboi
Ficus wasa	Moraceae	FICWAS	Stret nabalango	V	Fdralak
Finschia chloroxantha	Proteaceae	FINCHL		FR	
Flueggia flexuosa		FLUFLE			

Garcinia pseudoguttifera	Clusiaceae	GARPSE	False Tamanu	FR	Asiafmala
Garcinia vitiensis	Clusiaceae	GARVIT	False Tamanu	T	Fmamlo
Gardenia tannaensis	Rubiaceae	GARTAN		V	
Garuga floribunda	Burseraceae	GARFLO	Namalaus	T	Niliwi
Geissois denhamii	Cunoniaceae	GEIDEN		V	Topnman
Geniostoma rupestre	Loganiaceae	GENRUP		FU	Nornortefsel
Glochidion ramiflorum	Euphorbiaceae	GLORAM	Namamau / Namlau	V	Fbati
Gnetum gnemon	Gnetaceae	GNEGNE		FR	
Guettarda speciosa	Rubiaceae	GUESPE		V	
Gyrocarpus americanus	Hernandiaceae	GYRAME	Kenutri	V	Ep
Harpullia arborea	Sapindaceae	HARARB		FU	
Hedycarya dorstenoides	Monimi?	HEDDOR	False kofi	V	Boniki-is
Heritiera littoralis	Sterculiaceae	HERLIT		V	
Hernandia morenhoutiana	Hernandiaceae	HERMOR	Bluwud	PT	
Hernandia nymphaeifolia	Hernandiaceae	HERNYM	Nabiribiri	V	
Hernandia peltata	Hernandiaceae	HERPEL	Wisiltri	V	
Hibiscus tiliaceus	Malvaceae	HIBTIL	Burao	V	Riva
Homalium aneityense	Flacourtiaceae	HOMANE		V	Foafok
Homolanthus nutans	Euphorbiaceae	HOMNUT	Homolanthus	V	Fsal
Inocarpus fagiferus	Papilionaceae	NOFAG	Namambe	FR	Talse
Intsia bijuga	Caesalpiniaceae	INTBIJ	Natora	T	
Ixora asme	Rubiaceae	IXOASM			Fu-uk
Kleinhovia hospita	Sterculiaceae	KLEHOS	Namatal	V	Fmatal
Leea indica	Leeaceae	LEEIND	Wael natontong		Fsasar
Leucaena leucocephala	Mimosaceae	LEULEU	Kasis	FU	
Leucosyke australis		LEUAUS			Foi
Lisea aneityensis	Lauraceae	LITANE			Papae
Litsea imthurnii	Lauraceae	LITIMT			Frimisim
Litsea spp	Lauraceae	LITSPP			Papae fo-ok
Macaranga dioica	Euphorbiaceae	MACDIO	Navinue	V	Rifnu
Macaranga megacarpa	Euphorbiaceae	MACMEG	Macaranga	V	
Maesa ambrymensis	Myrsinaceae	MAEAMB		FU	

Mangifera minor	Anacardiaceae	MANMIN	Mango	FR	
Manilkara dissecta	Sapotaceae	MANDIS			
Melastoma malabathricum	Melastomataceae	MELMAL			Fsasaben
Melia azaderach	Meliaceae	MELAZE	Melia	V	
Melicope bonwickii	Rutace	MELBON		PT	
Melochia odorata	Sterculiaceae	MELODO	Red namatal	V	Fbaerer
Melicytus ramiflorus		MELRAM	Smol lif false kofi		Fabrefo-ok
Meryta neo-ebudicum	Araliaceae	MERNEO	Meryta	V	Fdambal
Metrosideros collina	Myrtaceae	METCOL	Metrosideros	V	
Micromelium minutum	Rubiaceae	MICMIN		V	Fla-ang
Mimusops elengi	Sapotaceae	MIMELE	Mimusops	V	
Morinda citrifolia	Rubiaceae	MORCIT	Yelotri	V	
Myristica fatua	Myristicaceae	MYRFAT	Nandai	FU/PT	Fdrend
Neiosperma oppositifolia	Apocynaceae	NEIOPP		V	
Neonauclea forsteri	Rubiaceae	NEOFOR		T	
Neuburgia corynocarpa	Loganiaceae	NEUCOR	Waet bak	V	Fmandran
Osmoxylon neo-ebudicum	Araliaceae	OSMNEO	Ambrela tri		Foarumb
Osmoxylon occidentale	Araliaceae	OSMOCC	Osmoxylon	V	Darum
Palaquium neo-ebudicum	Sapotaceae	PALNEO		T	Fruki
Pangium edule	Flacourtiaceae	PANEDU	Navangi	V	Pakoar
Phaleria spp		PHASPP			Foamarae
Phyllanthus ciccoides	Euphorbiaceae	PHICIC			Fdam
Pipturus argenteus	Urticaceae	PIPARG		V	
Pisonia grandis	Nyctaginaceae	PISGRA	Pisonia / Nambuka	V	Fmondok
Pisonia umbellifera	Nyctaginaceae	PISUMB	Nampik / Nambuka	V	Fmondok
Pittosporum campbelli	Pittosporaceae	PITCAM			Fsoflo
Planchonella linggensis	Sapotaceae	PLALIN	Comtri	PT	Foamasine
Podocarpus imbricatus	Podocarpaceae	PODIMB		T	
Podocarpus neriifolius	Podocarpaceae	PODNER		T	
Polyscias scuttellaria	Araliaceae	POLSCU	Nanalas	V	
Pometia pinnata	Sapindaceae	POMPIN	Nandau	FR	Siri
Pongamia pinnata	Papilionaceae	PONPIN	Pongamia	FU	

Pouteria costata	Sapotaceae	POUCOS		PT	
Pouteria linggensis	Sapotaceae	POULIN		PT	
Premna corymbosa	Verbenaceae	PRECOR		V	
Psychotria trichostoma	Rubiaceae	PSYTRI			
Pterocarpus indicus	Papilionaceae	PTEIND	Bluwota	T	Fifla / Fafla
Rhus taitensis	Anacardiaceae	RHUTAI	Rhus	V	
Samanea saman	Mimosaceae	SAMSAM	Ren tri		Benuar
Santalum austro-caledonicum	Santalaceae	SANAUS	Sandalwud	moratoriu m	
Securinega flexulosa	Euphorbiaceae	SECFLE	Namamau	V	
Semecarpus forsteri	Anacardiaceae	SEMFOR	Nawalas	PT	Folai
Semecarpus vitiensis	Anacardiaceae	SEMVIT	Poisontri / Waet nawalas	PT	Foalae fo-ok
Serianthes spp	Mimosaceae	SERSPP	Waetsida	T	
Schefflera cabalionii	Araliaceae	SCHCAB			Foabru
Schefflera neo-ebudicum	Araliaceae	SCHNEO	Pijin leg		Pedetel kap
Spiraethemum spp		SPISPP			Sisiof
Spondias dulcis	Anacardiaceae	SPODUL	Naus	FR	Wi
Sterculia banksiana	Sterculiaceae	STEBAN		X	
Sterculia tannaensis	Sterculiaceae	STETAN			Ngasi
Sterculia vitiensis	Sterculiaceae	STEVIT		PT	Nangasié
Sterculia vitiensis	Sterculiaceae	STEVIT	Nawaswas	PT	Ngasi
Streblus pendulinus		STRPEN	Smol lif nabalango		Rinaisil
Syzygium spp	Myrtaceae	SYZSPP	Big lif wael nakavika	PT	Fmbatur
Syzygium spp	Myrtaceae	SYZSPP	Wael samblong		Fdroposer
Syzygium buettnerianum	Myrtaceae	SYZBUE	Wael nakavika	PT	Fbe
Syzygium clusiaefolium	Myrtaceae	SYZCLU		PT	
Syzygium malaccense	Myrtaceae	SYZMAL	Nakavika	FR	
Syzygium nidiae	Myrtaceae	SYZNID	Long lif wael nakavika		
Syzygium nutans	Myrtaceae	SYZNUT	Wael nakavika	V	
Tapeinosperma srobiculatum		TAPSRO			Fdaldu

Terminalia catappa	Combretaceae	TERCAT	Natapoa	FR	Tavo
Terminalia sepicana	Combretaceae	TERSEP	Wild Natapoa	PT	Tafola-ang
Thespesia populnea	Malvaceae	THEPOP		V	
Trema orientalis	Ulmaceae	TREORI		V	Ftor
Trichospermum inmac	Tiliaceae	TRIINM		V	Fla-sara
Turrillia lutea	Proteaceae	TURLUT	Woman kauri	PT	Foas
Weinmannia denhamii	Cunoniaceae	WEIDEN	Weinmannia	FU	Foasesa
				FR	fruit, nuts
				FU	fuelwood
				T	timber tree
				PT	potential timber
				V	village uses
				X	no known use

Appendix [3]: Summary of results Botanical Suvey-1997

- 6 plots of 50x50 m – i.e. 1.5 ha area inventoried
- Distribution of the plots over coupes: coupe 1 (2 plots), coupe 4 (1 plot), coupe 5 (2 plots) and coupe 6 (1 plot).

Trees >= 30 cm:

NR	Species	N/ha	BA/ha	Vol/ha	% (on BA)
1	Dysoxylum aneityensis	31.33	7.50	49.90	50.2%
2	Palaquium neo-ebudicum	7.33	1.96	15.24	13.1%
3	Myristica fatua	14.00	1.31	11.68	8.8%
4	Endospermum medullosum	3.33	0.78	7.29	5.2%
5	Elaeocarpus floridanus	2.67	0.49	3.62	3.3%
6	Evodia spp.	2.00	0.45	2.79	3.0%
7	Semecarpus vitiensis	3.33	0.32	1.95	2.1%
8	Barringtonia edulis	2.67	0.22	0.99	1.5%
9	Semecarpus tannaensis	2.00	0.21	1.44	1.4%
10	Streblus pendulinus	2.00	0.19	0.62	1.3%
	plus 15 other species	13.33	1.53	8.34	10.2%
		84.00	**14.95**	**103.88**	**100.0%**

Note: Terminalia sepicana (nr 4 in the PHI) not found in botanical survey. Species composition may differ very much over short distances.

Different lower dbh limit compared to other assessments (30 cm – compared to 35 cm PHI and 25 cm DoF Permanent Sample Plots)
Explains partly the higher figures (compared to PHI)
Volume very high because top-height taken – not merchantable height

Trees >= 10 cm, < 30

	Species	NS/ha	BAS/ha
1	Myristica fatua	161.90	5.28
2	Macaranga dioica	50.79	0.94
3	Streblus pendulinus	41.27	0.81
4	Ficus adenosperma	25.40	0.74
5	Melicytus ramiflorus	34.92	0.68
6	Semecarpus vitiensis	28.57	0.67
7	Neuburgia cylindrocarpa	12.70	0.62
8	Ficus wassa	19.05	0.47
9	Dysoxylum aneityensis	12.70	0.40
10	Calophyllum neo-ebudicum	12.70	0.37
	Plus 26 other species	149.21	3.51
	Total	**549.21**	**14.49**

S / D distribution

CLASS	N/ha	BA/ha	Vol/ha
15	380.95	6.23	
25	168.25	8.26	
35	43.33	4.05	26.24
45	16.00	2.55	15.15
55	8.67	1.97	14.25
65	7.33	2.57	19.38
75	6.00	2.51	18.83
85	2.00	1.26	9.67
TOTAL	**632.54**	**29.39**	**103.52**

Nice “positive” distribution
Amounts of small trees very high – bigger trees comparatively rare – influence man / hurricanes visible.

Appendix [4]: Summary of results Permanent Sample Plots (PSP) – DoF 1999

Trees >= 25 cm:

	Species	N/ha	Ba/ha	Vol/ha	
1	Foalol	39.33	6.28	23.71	Dysane
2	Fdrend	36.33	2.68	12.41	Myristica
3	Rinae asil	7.67	0.58	1.73	Streblus
4	Sendro-of	1.67	0.42	1.60	Elache
5	Foalae	5.00	0.36	1.78	Seme
6	Fruki	3.00	0.33	1.79	Palaq
7	Tafola-ang	1.67	0.32	1.04	TermiSep
8	Foasesa	0.33	0.31	0.88	Weinm
9	Evodia	1.00	0.31	1.60	
10	Jipte	1.33	0.26	1.12	?
	34 other sp:	25.67	2.02	7.87	
	TOTAL	**123.00**	**13.88**	**55.53**	

Trees >= 10 and < 25 cm:

(12 pairs of 15x15m sub plots = 0.54 ha)

	Species	NS/ha	BAS/ha
1	Nandae	138.89	3.68
2	Foalae	50.00	1.10
3	Rinae asil	51.85	0.81
4	Fabrefo-ok	48.15	0.73
5	Nambalango	25.93	0.50
6	Waet back	16.67	0.43
7	Rifnu	24.07	0.41
8	Fdrend	22.22	0.40
9	Foalol	12.96	0.35
10	Poniki-is	12.96	0.29
	44 other sp	161.11	2.93
	TOTAL	**564.81**	**11.64**

Diameter distribution:

Class (cm)	N	BA	VOl
12.5	300.00	3.60	
20	264.81	8.03	
30	80.33	5.26	21.22
40	22.00	2.63	11.08
50	8.33	1.60	6.81
60	6.33	1.74	6.83
70	4.00	1.48	5.65
80	2.00	1.17	3.94
>=25	123.00	13.88	55.53
>=10	687.81	25.51	55.53

Note: class 12.5 between 10 and 15, 20 between 15 and 25, 30 between 25 and 35 etc.

Appendix [5]: Results of Tree selection 1999 – overview of species, N, BA and VOL per coupe

C-1	Species	N	BA	VOL
1	Fdrend	1001	116.71	507.34
2	Fruki	95	55.07	220.08
3	Tafola-ang	127	37.12	156.21
4	Fmbas	22	12.78	89.88
5	Foalol	25	18.45	68.15
	34 other spp	529	92.58	352.54
		1799	332.71	1394.20

C-2	Species	N	BA	VOl
1	Sendro-of	71	19.88	80.55
2	Fruki	23	15.29	71.19
3	Tafola-ang	20	5.84	25.16
4	Tamanu	15	3.95	20.70
5	Fbe	18	4.69	20.18
	33 spp	176	32.94	127.19
		323	82.59	344.98

C-3	SPEC	N	BA	VOL
1	MYRFAT	435.1	54.5	322.8
2	DYSANE	59.5	38.8	223.1
3	PALNEO	27.5	17.3	101.0
4	TERSEP	32.1	9.5	54.3
5	SEMVIT	73.3	8.0	46.5
	14 other spp	146.6	20.8	112.7
		774.0	148.9	860.3

C-4	Species	N	BA	VOL
1	Nandae	197	23.64	103.54
2	Tafola-ang	129	21.25	102.82
3	Foalol	37	18.14	64.14
4	Fruki	10	5.59	24.27
5	Fbatur	37	5.28	24.14
	42 other spp	251	42.85	184.75
		661	116.76	503.66

C-5	Species	N	BA	VOL
1	Foalol	92	47.31	192.17
2	Nandae	186	20.77	94.17
3	Sipte	18	5.21	23.42
4	Sendro-of	23	4.02	17.29
5	Fruki	5	2.26	12.63
	30 other spp	135	18.69	80.89
		459	98.26	420.57

C-6	Species	N	BA	VOL
1	MYRFAT	93.95	10.81	68.02
2	EUOSPP	38.68	7.13	46.18
3	TERSEP	35.92	5.53	37.68
4	DYSANE	8.29	4.99	25.27
5	PALNEO	5.53	2.58	18.79
	17 other spp	121.58	19.46	102.05
		303.95	50.50	297.98

	COMP 1		COMP 2		COMP 3		COMP 4		COMP 5		COMP 6	
	Species	VOL	Species	VOL	SPECIES	VOL	Species	VOL	Species	VOL	SPECIES	VOL
1	Nandae	507.3	sendro-of	80.5	Nandae	323.1	nandae	103.5	foalol	192.2	nandae	68.0
2	Fruki	220.1	fruki	71.2	Foalol	223.3	tafola-ang	102.8	nandae	94.2	sipte	46.2
3	Tafola-ang	156.2	tafola-ang	25.2	Fruki	101.1	foalol	64.1	sipte	23.4	tafola-ang	37.7
4	Fmbas	89.9	tamanu	20.7	tafola-ang	54.3	fruki	24.3	sendro-of	17.3	foalol	25.3
5	Foalol	68.1	fbe	20.2	Foalae	46.5	fbatur	24.1	fruki	12.6	fruki	18.8
6	Foalae	59.9	sipte	17.5	Fbatur	30.1	tamanu	23.7	rinae-asil	12.0	foalae	17.4
7	Jaeran	44.7	jaeran	17.0	Siri	17.0	sendro-of	23.5	tafola-ang	12.0	sendro-of	15.0
8	Sipte	40.7	rinae-asil	14.4	Fmandra	15.1	fbe	20.9	foalae	9.0	nat	12.3
9	Fbatur	28.4	fbatur	8.4	Sipte	13.7	nat	17.7	nat	7.2	fbatur	11.7
10	Nat	20.7	sisiof	7.6	Fmondol	7.0	sipte	15.3	rifnu	5.9	tamanu	8.5
11	Foabuk	19.5	fmbas	7.1	Osmoxylum	6.2	rinae-asil	15.2	fmondol	4.7	rinae-asil	8.4
12	Fnum	18.4	topnam	6.7	Papae	4.9	faolol	13.3	fsaeran	3.7	fbe	7.6
13	Rinae-asil	16.0	nat	6.7	Aseopp	4.7	foalae fo-of	6.0	nawalas	3.0	aseopp(?)	4.2
14	Fmondol	15.6	fmondol	5.3	Jaeran	3.4	topnam	5.4	jaeran	2.8	fsoflo	4.1
15	Siri	14.8	fnum	5.1	Topnam	3.2	foalae	4.7	sisiof	2.8	fmandran	2.7
16	Fmorkar	11.3	nandae	4.9	elispp(?)	2.9	nawalas	3.4	fbatur	2.6	topnan	2.2
17	Sendro-of	8.0	foalol	4.8	Fbati	1.6	fnum	3.4	fsataran	2.2	Syz nidiae	2.2
18	Tamanu	7.2	rifnu	2.3	Fpaoa	1.5	fmorkar	3.3	fablumburu	2.2	DYSBIJ	1.7
19	Rifnu	7.0	foaruk	2.2	Fbaerer	1.2	fbili foof	3.1	ambutalse	2.0	Ora	1.5
20	Blut	6.2	blut	1.9		861.2	fwadiarae	2.4	nakavika	1.0	Foabru	1.3
21	Sisiof	5.2	forfor	1.8			rifnu	2.3	tamanu	0.8	fabrefo-ok	0.6
22	Ora	4.4	fablumburu	1.5			fmondol	1.9	W samblong	0.8	Fmorkar	0.6
23	Papae	4.1	foarbu	1.4			jaeran	1.6	nandao	0.7		298.0
24	Fbili	2.9	fuarbu	1.0			fbili	1.6	fbili fo-or	0.6		
25	Fablumburu	2.8	foalae fo-of	1.0			ambutalse	1.3	foalae fo-of	0.6		
26	Foabru	2.7	jamun	0.9			fablumburu	1.3	foase	0.6		
27	Ambutalse	2.5	topnave	0.8			foarbu	1.1	fnum	0.6		
28	Fbe	2.2	fmasasa	0.8			foamesine	1.1	fbe	0.5		
29	Fsoflo	1.4	fmorkar	0.8			fwarbu	1.1	foarbu	0.5		
30	Fpaoa	1.3	fuanutu	0.8			foarkar	1.0	fmbati	0.5		
31	Fdroposer	1.1	poe	0.7			fouru	1.0	fbawa	0.4		
32	Topnam	0.7	ambutalse	0.7			sisiof	0.9	fba-ang	0.4		

33	Frimisim	0.6	fuawutu	0.6		faflumburu	0.8	fwase	0.4		
34	Forfor	0.4	fwase	0.6		papae	0.8	soflo	0.3		
35	Foarumb	0.4	navonia	0.5		fwasasa	0.7	fmorkar	0.1		
36	Paoa	0.4	faun	0.5		fmbetur	0.7		420.6		
37	Fdralak	0.3	papae	0.5		fbawa	0.6				
38	Foase	0.3	fto-tong	0.3		foalae sem	0.6				
39	Fasfas	0.2		345.0		Unknown	0.5				
		1394.2				Soflo	0.5				
						Naolas	0.5				
						w samblong	0.5				
						fuase	0.4				
						semvit	0.3				
						foalarae	0.3				
						fdroposer	0.3				
						fbaoa	0.3				
	TOTAL	1394.2		345.0	861.2		503.7		420.6		298.0

Appendix [6]: List of (land) bird species of Vanuatu - status in Butmas

Excluded are birds of the open sea (albatrosses, petrels), coastal birds (boobies, cormorants, frigatebirds, gulls, terns, plovers, thick-knees, oystercatchers, god-wits,sandpipers, etc.), birds of wet inland ecosystems (herons, geese, ducks) and some rare vagrants.

Based on literature study (**Birds of Vanuatu, Heinrich L. Bregulla, 1992**) and discussions with Ms Rolenas – Dept of the Environment and with Johnny Lolos on 4th of July 2004.

English	**Scientific / common / butmas name**	**Status in Butmas – remarks**
(1) Brown Goshawk	Accipiter fasciatus vigilax / / Dropsi (?)	**Confirmed** sighting coupe 1
(2) Swamp harrier	Circis approximans / / Fnalfu	**Confirmed** sighting SVT road
(3) Perigrine falcon	Falco peregrinus / / Fnalkar	**NOT** CONFIRMED
(4) Incubator bird	Megapodius freycinet layardi / Nameko / Nasem-butuli	**Said to be present**. Manage-ment measures needed. **Endangered**.
(5) Red Jungle Fowl	Gallus gallus	Occurs on Santo – not con-firmed Butmas Only moderate altitudes
(6) (Buff) Banded rail	Gallirallus philippensis sethsmithii / / Nambilak	**Confirmed.**
(7) Spotless crake	Porzana tabuensis tabuensis	Occurs on Santo – not confirmed Butmas
(8) White browed crake	Poliolimnas cinereus tannensis	Nothing known. Check.
(9) Purple swamphen	Porphyrio porphyrio samoensis / Redhead / Fndrai	**Confirmed.** Plague to gardens (banana eater).
(10) Red-bellied fruit dove	Ptilinopus greyii / small green pigeon / Be-ebum	**Confirmed.**
(11) Vanuatu [yellow headed] fruit dove / Tanna fruit dove	Ptilinopus tannensis / large green pigen / Fuari	**Confirmed.** Lowland to moderate height. Canopy feeder. **Endangered.**
(12) Pacific imperial pigeon	Ducula pacfica pacifica / Nawimba / Fue-eend	**Confirmed.** Lowland to around 800 m. Feeds on figs and other **large** fruiting trees. **Endangered**.
(13) Vanuatu mountain pigeon	Ducula bakeri / Natutu / Neit	**Confirmed.** From 600 m and up. Mix in Butmas with Pac. Imperial pigeon?

(14) White-throated pigeon	Columba vitiensis leopoldii / Natarua / Fmbatior	**Confirmed.** Feeds more in understorey.
(15) Rufous-brown pheasant dove	Macropygia mackinlayi mackinlayi / long tail / Fndrabokare	**Confirmed.**
(16) Green-winged ground dove	Chalcophaps indica sandwichensis / short leg / Fomak	**Confirmed**
(17) Santa Cruz ground dove	Gallicolumba sanctaecrucis	Occurs in mountain rainforest of West Santo. Could occasionally occur in Butmas – check needed.
(18) Rainbow lorikeet	Trichoglossus haematodus / Nasiviru / Fsip	**Confirmed. Listed appendix II CITES.**
(19) Green palm lorikeet	Charmosyna palmarum / Denga / Ndringis	**Confirmed.** Mountain species**. Endangered.**
(20) Fan-tailed cuckoo	Cacomantis pyrrophanus schistaceigularis	**Not** confirmed. Uncommon in lowland forest on Santo.
(21) Shining Bronze cuckoo	Chrysococcyx lucidus layardi / Koran	**Confirmed**.
(22) Long-tailed New Zealand cuckoo	Eudynamis taitensis	**Not** confrmed. Occasional migrator from NZ.
(23) Barn owl	Tyto alba / Fmbeik	**Confirmed.**
(24) White-bellied swiftlet	Collocalia esculenta uropygialis	**Confirmed.**
(25) White-rumped swiflet	Aerodramus spodiopygius	**Confirmed.**
(26) Uniform swiflet	Aerodramus vanikorensis vanikorensis	**Confirmed.**
(27) White-collared kingfisher	Halcyon chloris / Nasigo / Sindrar	**Confirmed –** common.
(28) Vanuatu [chesnut bellied] kingfisher	Halcyon farquhari / Red Nasigo / Sitaetae	**Confirmed. Endangered.**
(29) Pacific Swallow	Hirunda tahitica subfusca	Occurs on Santo (Luganville wharf) – not confirmed Butmas.
(30) Melanesian cuckoo shrike	Coracina caledonica / Big head / Fmbaesap	**Confirmed.**
(31) Polynesian triller	Lalage maculosa	Occurs on Santo, not confirmed Butmas.
(32) Long-tailed triller	Lalage leucopyga	Occurs on Santo, not confirmed Butmas.
(33) Island thrush	Turdus poliocephalus	Occurs on Santo, not confirmed Butmas.
(34) Scarlet robin	Petroica multicolor	Occurs on Santo, not confirmed Butmas.

(35) Golden whistler	Pachycephala pectoralis / / Basei	**Confirmed.**
(36) Southern shrikebill	Clytorhynchus pachyce-phaloides / / Pokogod	**Confirmed.**
(37) Broad-billed flycatcher	Myiagra caledonica / Fmos	**Confirmed**
(38) Vanuatu flycatcher	Neolage banksiana / / Sosondr	**Confirmed.**
(39) Grey fantail	Rhipidura fuliginosa brenchleyi / Nasiksik / Najikjiki / Sarkel	**Confirmed.**
(40) Spotted fantail	Rhipidura spilodera spilodera	Occurs on Santo, not confirmed Butmas.
(41) Fantail warbler	Gerygone flavolateralis correiae	Occurs on Santo, not confirmed Butmas.
(42) Thicket warbler	Cichlornis whitneyi / / Flili	**Confirmed. Should be checked, since this seems to be a high-altitude species!**
(43) Vanuatu mountain honeyeater	Phylidonyris notabilis / / Fndroul	**Confirmed.**
(44) Silver eared honeyeater	Lichmera incana / long fala mouth / faelakar	**Confirmed.**
(45) Cardinal honeyeater	Myzomela cardinalis / / Faela Lambutukar	**Confirmed.**
(46) Vanuatu white-eye	Zosterops flavifrons / Nalaklak / Fafaela	**Confirmed.**
(47) Grey-backed white-eye	Zosterops lateralis	**Confirmed**
(48) Common waxbill	Estrilda astrild	Once introduced to Santo, but now extinct (?).
(49) Chesnut-breasted mannikin	Lonchura castaneothorax	Introduced to Santo, not confirmed for Butmas.
(50) Black-headed mannikin	Lonchura malacca / / Fafaela rice	**Confirmed**. Introduced bird.
(51) Red-throated parrotfinch	Erythrura psittacea	Not found on Santo
(52) Blue-faced parrotfinch	Erythrura trichroa cyaneifrons	Apparently not found on Santo, although suitable habitat exists.
(53) Royal parrotfinch	Erythrura cyaneaovirens	Occurs on Santo, but not confirmed for Butmas. Endangered.
(54) Santo Mountain Starling	Aplonis santovestris	Small population on peak Santo. **Not confirmed.** Endangered.
(55) Rusty-winged starling	Aplonis zelandicus rufipennis	Occurs in the mountains of Santo. **Not confirmed** for Butmas. Endangered.
(56) Indian mynah	Acridotheres tristis / / wako	**Confirmed**. Not yet pest

		proportion.
(57) White-breasted woodswallow	Artamus leucorhynchus tenuis / / rarad	**Confirmed.**

Appendix [7]: Test against National Forest Management Standards (PNG)

In the absence of standards for natural forest management in Vanuatu, the standards developed in PNG can be used as a yardstick.

Principle 7 (management plan) stipulates that a management plan, appropriate to scale and intensity of the operations shall be written, implemented and kept up to date. The long-term objectives of management and the means achieving them, shall be clearly stated.

Comment: with the preparation of the present forest management plan this requirement is partly fulfilled. It is **planned** to implement it and keep it up to date, which shall be monitored as part of the follow-up process.

Principle 7.1 specifies that the management plan should derive from an overall land use plan that has been completed with genuine community participation. Under this principle it is further required that a Participatory Land Use Plan has been completed and recorded on maps, showing various land use types.

Comment: overall land use plans that have been completed with genuine community participation do not yet exist in Vanuatu. The present plan is based on preliminary participatory land use planning that shall further be carried out at the level of the land belonging to the Butmas community and the neighbouring clans (see section 3.4 of the plan). The plan further intends to give incentives to the development of the land use planning process at higher levels.

Principle 7.1.2. lays down that forest conservation areas shall be established and indicated on the map (at least 10% of the accessible forest production area in the case of portable sawmilling operations).

Comment: this requirement is fulfilled with the designation of one catchment-protection area of 63.3 ha (north of coupes 1 and 2) and one forest reserve of 380 ha west of the production forest. The total reserved area of more than 464 ha even exceeds the 340 ha production forest.

Principle 7.2 provides the minimum contents of the management plan in broad lines.

Comment:

- Management objectives: presented in section 7.
- Description of forest resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions and a profile of adjacent lands: presented in section 3.
- Description of the silviculture and management system based on information gathered through forest inventory: presented in sections 5 and 6.
- Rationale for rate of annual harvesting and species selection: presented in sections 6 and 9.
- Provisions for monitoring of forest growth and dynamics: presented in section 13.

- Environmental safeguards based on environmental assessments: the management system as such (described in section 6) provides environmental safeguards by concentrating the timber harvesting on the largest trees of most species; apart from a preliminary survey of birds, no special environmental assessments have been carried out yet, but are recommended for the future.
- Plans for identification and protection of rare or endangered species have not yet been specifically drawn up, but it is assumed that the management system – by keeping the natural forest structure and species composition largely in tact – will provide the basis for habitat conservation for such species.
- Maps describing the forest resource base etc.: are presented in annex 1.
- Description and justification of harvesting techniques and equipment to be used: presented in the sections 9 and 10.

Principle 7.2.1. provides further details to the required minimum contents of the plan.

Comment:

- Resource inventories including minimum output: are described in section 5.
- Operational guidelines for layout, design and maintenance of roads and trails: are provided by the obligatory COLP en presented in detail in the sections 9.4 and 10.
- Operational guidelines for harvesting and extraction: are provided by the obligatory COLP and presented in sections 9 and 10.
- Environmental safeguards: see principle 7.2.
- Maps: see principle 7.2.
- Extraction and harvesting techniques: see principle 7.2.
- Records of village meetings: will be kept, but are not taken up in the plan.
- Health and safety provisions: presented in section 10.
- Rules for hunting, fishing etc.: presented in section 7.

Principle 7.2.2. lays down requirements for annual harvesting levels, species selection, minimum felling diameters, regeneration strategies and felling cycles, all based on forest inventory and knowledge about growth and yield.

Comment: this requirement is covered by the use of the diameter limit tables developed by prof. Mussong (1996). These are based on preliminary (conservative) estimations of growth and yield. The proposed system of Permanent Sample Plots (presented in section 13) will make it possible to further update and refine these estimations.

Principle 7.2.3. stipulates that field level topographic maps are prepared showing road / trail locations, areas suitable for all-weather harvesting, log yards, drainage structure, buffer zones, etc.

Comment: these maps (scale 1:2000) are part of the Annual Work Plan as proposed in section 12.

Principle 7.2.4, inventory and management of NTFP.

Comment: inventory of NTFP is not proposed, as the management system will allow the continuing sustainable harvesting of NTFP. Development of management systems will take place later.

Principle 7.2.5., fire management and control.

Comment: not relevant in Butmas.

Principle 7.2.6., plans for enforcement of hunting rules.

Comment: hunting rules are laid down as part of the participatory planning process, no special “enforcement” plans are needed in the case of Butmas.

Principle 7.3., periodical revision of the plan to incorporate monitoring results, new information and changing frame conditions.

Comment: dealt with in section 18. Initially, the revision shall take place every 2 years (instead of the required 5 years) since the plan is new for Vanuatu and uncertainties still exist in a considerable number of fields. Ongoing studies in the PSP, further collection of socio-economic information, further collection of cost-benefit information and ongoing environmental monitoring will provide the inputs to the revision and updating process.

Principle 7.4. adequate training and supervision of forest workers.

Comment: the plan proposes a well-structured training and capacity building program (section 14 and annex 8).

Principle 7.5., while respecting the confidentiality of information, forest managers shall make publicly available a summary of the primary elements of the plan.

Comment: the plan is intended as a model for Vanuatu and – even – the Pacific region. Through the PGRFP and SPC, the primary elements of the plan shall be accessible to all relevant stakeholders.

Conclusion:

The plan is largely in line with the national forest management standards (of PNG). In a number of areas follow-up processes have to provide improvements, notably:

- The development of systematic land use planning procedures (with genuine community participation) at all levels and the embedding of the plan into these
- The further identification plant and animal species occurring in the area, including rare, threatened or endangered species and the development of special protection measures.
- Ongoing growth and yield studies in the established Permanent Sample Plots, further collection of socio-economic information, further collection of cost-benefit information and ongoing environmental monitoring that will provide the inputs to the revision and updating process.

Appendix 8: Training and capacity building program

Purpose: A training program on Sustainable Forest Management should directly contribute to the purpose of the PGRFP: "Resource-users (such as landowners or concession-holders) increasingly apply sustainable land and forest management systems". Beyond this, the experiences made should be used for the updating and improvement of national and regional policies and legislation.

Target groups: This Forest Management Plan will – ultimately – be implemented by the landowners of Butmas village. In spite of a considerable number of training events in the past, the development of a special Human Resource Development Program targeting landowners remains a must, also in view of the fact that positions change, people move away and refresher courses are needed. Over the years, the project's strategy has shifted to institutionalization and advice rendering to the process of sustainable forest management policy development at all levels (national and regional), while maintaining a firm basis ("testing ground") in the field.

This means that, ultimately, the DoF should be in a position to provide quality services to target groups. Besides landowners, the DoF should be a **key-target group** of any training program. A third important target group will be staff from the NGO's which are also supporting various sustainable forest management / community forestry initiatives in Vanuatu.

Priority themes will vary depending on the target groups. Whereas for landowners the emphasis will be on the pure implementation aspects of sustainable forest management, the emphasis for technicians of the DoF should be more on promoting their competence and ability [and attitudes] to render quality extension services. For NGO-staff the emphasis will be similar as in the case of DoF technicians.

The following topics seem the most important now:

Training related to general aspects of forest management planning:

- Principles of forest dynamics and sustainable forest management.
- Procedures of forest inventory.
- Forest inventory data analysis and evaluation.
- Preparation of Forest Management Plans
- Preparation of Annual Working Plans

Training related to the forest-ecological aspects of management implementation:

- Tree spotting.
- Forest inventory – field work.
- Tree selection and marking.
- Preparation of Annual Working Area maps – tree locations, steep slopes, gullies, etc.

Training related to technical aspects of forest exploitation

- Reduced impact felling.

- Chainsaw maintenance and repair.
- Safety in felling / extraction.
- Reduced impact log extraction (winching).
- Waste reduction in logging.
- Optimum log preparation.
- Reduced impact road and trail construction / maintenance.

Training related to the timber processing aspects:

- [Refresher] sawmill operation.
- Product quality improvement.
- Safety in milling.
- Waste reduction.
- Timber treatment and pollution prevention.

Training related to the running of a co-operative:

- Promotion of business management skills – time management, administration, accounting, communication, reporting, personnel management, conflict prevention.
- Decision making, meeting techniques, networking, information collection.
- Marketing, negotiation techniques.

Form and duration of the training: normally the training shall be in the form of short courses of 1 – 2 weeks duration.

Training methods and materials: directed at developing “competences” and abilities; training events will be given –where possible – “on the job”, sometimes preceded by short class-room explanations; support in the form of manuals and hand-outs [to be developed in a number of cases].