

Management and Utilization of Forest Resources in Papua New Guinea¹

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Abstract: Papua New Guinea, with an area of about 46.7 million ha and a population of 3.7 million, is blessed with a large natural forest resource. Over 80 percent of the land is covered with forests of various types, ranging from swamp and lowland rain forests in coastal plains to alpine vegetation and moss forests in the highlands, most of which are owned by the people. About 15 million ha are considered commercial, with about 400-500 million cubic meters of high value timber. Current logging concessions are spread over 3.1 million ha. All the projects except one are based on selective cutting with a minimum cutting limit of 50 cm d.b.h. The current system of resources acquisition and allocation, extraction of timber, and its effect on the environment, including biodiversity is described. Possibilities of management options of these heterogenous forests on a sustainable basis are discussed.

During the last 5,000 years, people of Papua New Guinea have lived within numerous tribes and clans with diverse customs and languages that shared one invaluable friend—the natural forest. Despite centuries of subsistence gardening, today about 80 percent of 467,500 sq km is covered by forests, varying in types from the swamps and lowland forests of coastal plains to alpine vegetation and moss forests in the highlands. The forests have provided the basic needs of the people and are still an integral part of their social and cultural heritage. It is estimated that 15 million hectares can be developed into log exports and onshore processing. These forests contain about 400 wood species of varying properties, of which about 40 are commercially accepted. The forestry sector has contributed significantly to the development of the country in terms of employment (about 11,000) and foreign exchange earnings (*table 1*).

However, management of forest resources in Papua New Guinea is at a crossroads today. If, on the one hand, politicians and planners view this renewable resource as a major means of export earnings and income to landowners, generations of employment opportunities, and infrastructure development in the

hinterlands, then the vital question before foresters is whether the resource can be managed on sustainable basis. Conservationists and environmentalists, on the other hand, worry about irreversible ecological changes in these fragile ecosystems if the forest cannot be regenerated.

Resource Acquisition

The land and all the resources with it—whether forests, minerals or oil—are the most valuable possessions of a Papua New Guinea clan. Apart from town sites and a few other larger areas, the government owns only about 3 percent of total land. The rest of the land ownership and land rights are vested in 700 ethnic groups. Individuals have rights of usufruct, but guardianship is vested in patrilineage. When land is under such a closely interlocking system of rights and obligations, transfer of land to individuals or groups outside these relationships is difficult and rare. It also makes it difficult to obtain general agreement for a long-term land use, which may have no immediate benefits, e.g., reforestation.

The current Forestry Act. (Anon. 1976) provides for exploitation and development of forest resources mainly through Timber Right Purchase (TRP) Agreements. Under this Agreement, the government acquires rights of felling, removing and disposing of timber from customary landowners. Normally, a down payment is made on the basis of volume of timber which is recouped when royalty starts flowing.

The two other ways to develop timber projects, Local Forest Area (LFA) under Private Dealing Act and through Timber Authority (TA), are generally used for smaller operations. Currently, 3.1 million ha are covered by TRPs and LFAs (Anon. 1990b).

Table 1—Exports of forest products ('000 cubic meters and millions of kina¹)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Logs	743	1063	1019	1284	1158	1314	1442	1361	1279	1084
Sawntimber	24	21	20	18	15	7	4	3	3	4.5
Plywood	8	6	6	5	1	.2	.02	0	0	0
Woodchips ²	103	148	100	103	82	61	66	67	53	68
Value	45	53	56	82	67	77	113	100	91	83

¹1 kina = 1.04 U.S.\$

²Woodchips in '000 bone dry units.

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Resource Allocation

Following a TRP Agreement, a Timber Permit (TP) is issued to a registered timber company by tendering on agreed terms and conditions, including payment of royalties, (the major portion of which—75 percent—goes to the resource owners and the remainder—25 percent—goes to the respective Provincial Government), and other levies, such as reforestation levy, agriculture development levy, Forest Industries Council (FIC) levy, etc. The main conditions of a Timber Permit are:

- Log harvest and export at a pre-determined rate, processing and follow-up land use;
- Construction of roads and bridges and their maintenance during the life of the project;
- Infrastructure development, which may include construction of airstrips, school buildings, community hall, health posts, houses, new townships, churches, etc.;
- Environmental protection measures; an approved Environmental Plan is a prerequisite for starting the project;
- Submission of a Forest Working Plan which includes details of forest surveys, roads and bridges, production schedule, reforestation, environmental protection measures, fire control and preventive measures, control of insects and pests; and
- Listing of species which are not allowed to be cut, removed, or damaged. Normally this includes trees with edible fruit or of economic use other than timber.

Environmental Safeguards

Considerable efforts are made to minimize the deleterious effects of logging operations on forest ecosystems. Under the Environment Planning Act Chapter 370, each Permit Holder (Timber Company) is to submit an Environmental Plan for the project area. It is a comprehensive document which includes information on the purpose of development, socio-economic benefits to the resource owners, viability of the project, infrastructure development, resource harvesting and replacement practices, climate-edaphic environment, flora and fauna, and environmental impact safeguards, including existing and proposed conservation areas which include preservation of cultural and historic sites. The Environmental Plan is approved by the Minister in charge of the Department of Environment and Conservation after it has been evaluated by a number of experts and presented to the people of the project area.

The Timber Permit includes the following conditions to minimize adverse environmental impacts of logging operations:

1. No clearfelling is allowed on slopes up to 20 degrees.
2. Selective logging is allowed on slopes up to 30 degrees.
3. No logging is allowed on slopes greater than 30 degrees.
4. A 50 m buffer must be observed along rivers, streams, and creeks.

5. No logging is allowed (a) within 100 m of any garden (field), burial ground or area of cultural importance, or (b) within 500 m of any inhabited village.
6. Measures to minimize soil erosion must be taken.
7. Precautions must be taken to ensure that banks of any river or stream are not damaged, and that the course of any river or stream is not altered by logging operations.
8. No hauling or snagging of logs, timber or other forest produce through any flowing river or stream is allowed.
9. No obstruction of rivers or streams by logs, timber, other forest produce, debris, or other materials from its operations is allowed.
10. No pollution of rivers or streams by sawdust, oil, waste, debris, or other materials is allowed.
11. Should logging activities adversely affect community or domestic water quality or quantity or both, the permit holder shall provide an alternative water supply.

A number of the above conditions are flouted by timber companies due to poor control. The Department of Environment and Conservation does not have resources to monitor the situation. Generally it is the forest inspectors who report matters concerning adverse environmental impacts. In the majority of cases, loggers do not maintain 50 m buffers along rivers, often log above 30 degree slopes, damage river and creek banks, and block and pollute rivers and creeks with debris. Cases have been reported where companies have hauled logs through flowing rivers.

Resource Management

Logging Operations

Out of the three major phases in timber harvesting—felling and bucking, minor transportation, and major transportation—it is the second phases which causes the highest damage to the forest and site and determines the success or failure of selective logging. There is no clear cut provision in the Permit with regard to area control. Although submission of a 5-year Forest Working Plan (FWP) within 60 days of the issue of the Permit is a prerequisite for starting logging operations, very few timber companies follow it. Generally, the annual coupe is altered and no pre-planning is carried out for roading, snag tracks, and bush ramps. Very few companies conduct pre- and post-logging inventories. Even those who do so do not have any follow-up plan to use post-logging data to manage the residual stands. The standard of forest roads is generally poor, usually evidencing excessive clearing from 40 m to as much as 70 m wide. Crawler tractors and wheeled tracked skidders are the common types of equipment used in skidding. Some loggers occasionally use huge tractors for skidding, which not only have a high cost of operation but also cause much more damage to the forest cover. An articulated wheeled or tracked front-end loader is the common type of equipment used in loading. For hauling logs, two types of trucks are used in PNG: long chassis truck, and logging trucks with trailer or jinker, the latter being more common. *Table 2* shows an estimate of logging cost in PNG. Safety standards in logging in PNG are very low compared with those of other

Table 2—An estimate of logging costs in Papua New Guinea

	Managed by company or contractor cost/cu.m.		Managed by individual contractor cost/cu.m.	
	(Kina)	Percent	(Kina)	Percent
1. Forest planning and engineering	1.40	3.49	0.80	3.29
2. Road construction and maintenance	8.35	20.80	4.40	18.11
3. Felling and bucking	5.20	12.95	3.30	13.58
4. Bunching and skidding	11.65	29.01	7.60	31.27
5. Loading, hauling and unloading	9.05	22.54	3.70	15.23
6. Royalty	4.50	11.21	4.50	18.52
Total:	40.50	100.00	24.30	100.00

countries. It is evident that the present system of log harvesting in PNG is not compatible with sound forest management practices. Improvement of the system is imperative for sustained management of the resource (Buenaflor 1988a,b).

Yield

The minimum cutting limit, irrespective of stand composition and size class distribution, is 50 cm d.b.h. Adhering to this limit is known as selective cutting. Except in one project (Japan and New Guinea Timbers in Madang), which is based on clearfelling (using hardwood mixture for pulpwood chips), the rest of the projects in the country to-date are based on selective cutting. So far, however, it has not been obligatory for timber companies to mark trees, to conduct pre- and post-logging inventories and to follow directional felling to minimize damage to the residuals. There are no penalties in the Forestry Act for excessive damage to the residual crop or for cutting under size trees. In particular, yield regulations based on stand characteristics and sustained yield principles are not observed, and virtually no attention has been paid to manage the logged-over forests. As a result, there are no predictions for the next cut. Information on growth and yield is almost completely lacking. In certain situations, where the majority of the trees of a commercial species are above 50 cm d.b.h., almost a clearfelling situation may prevail though the company may have followed selective logging within the TP conditions.

Because of the very selective nature of logging, a so-called "creaming" of the forest, yield may vary from as low as 12 m³/ha in a highly mixed forest to over 100 m³/ha in areas where a single or a couple of commercially important species (*Calophyllum*, *Intsia*, *Nothofagus*, *Anisoptera*) become dominant. The average yield is estimated to be about 30 m³/ha.

The important commercial species being harvested currently are: *Eucalyptus deglupta*, *Intsia bijuga*, *Araucaria* spp., *Terminalia* spp., *Calophyllum* spp., *Pometia* spp., *Syzygium* spp., *Endospermum* spp., *Celtis* spp., *Vitex cafessus*, *Pterocarpus indicus*, *Anthocephalus chinensis*, *Palaqui* spp., *Castanopsis*

spp., *Lithocarpus* spp., *Nothofagus* spp., *Podocarpus* spp., *Homalium* spp., *Diospyrus* spp., *Anisoptera thruifera*, *Hopea* spp., etc. For export purposes, a MEP (Minimum Export Price) system is in operation. The MEP is revised periodically on the basis of international price. Certain species are banned from export in log form.

Biodiversity

Earlier studies on heterogeneity of flora in PNG were confined to commercial species. Pajmans (1970) recorded 122, 147, 145, and 116 species of trees above 10 cm d.b.h. in four 0.8-ha plots. However, in a recent study of total species count, as many as 363 species were recorded in a 0.64 ha plot in a lowland tropical rainforest. The species comprised of trees (49 percent), shrubs (18 percent), vines and climbers (15 percent), herbs (9 percent), vegetative clumps (8 percent), epiphytes (7 percent) and palms (3 percent). More studies are planned, especially to study the effect of logging operations on biodiversity in both lowland and hill forests (Kiapranis 1990).

Constraints for Sustained Yield Management of Natural Forests

There are a number of constraints, socio-political and economic on the one hand, and technical and logistical on the other, which have not allowed the management of forest resources on sustained yield principle so far in PNG. These include:

1. *Policies*: The 1979 Forest Policy (Anon. 1979) did not have strong emphasis on the management of natural forests for sustained yield in spite of the fact that it allowed increased log harvest and export to generate revenue.
2. *Landownership*: Since TRP Agreement allows removal of only the standing crop, it is not possible to manage the logged over forests unless the TRP and TP conditions are revised.
3. *Limited resources*: Inadequate financial resources and trained staff, both at the national and provincial levels, have resulted in poor control of harvesting operations resulting in excessive damage to the site and potential tree crops (PTC), overcutting, and wastage.
4. *Attitudes of Timber Companies*: There has been, in general, a lack of interest and commitment in proper management by timber companies, the majority of which are transnational either as Permit Holder or as logging and marketing contractor to the landowners companies, for proper management. This is partly due to the short period of the contract (normally a TP is issued for 10 years), weak conditions of the TP, landownership problems, and the absence of proper guidelines and suitable penalties in the Forestry Act for undersize cutting, excessive damage to residuals, and wastage.
5. Inadequate knowledge of silvics of even the prime timber species.

6. A belief that plantation forestry (reforestation) could meet the demands of timber more economically and efficiently. Hence every TP has a clause on reforestation which was not fulfilled by the majority of timber companies. Even companies that carried out reforestation planted areas that fell far short of the volume of the timber harvested or area logged. According to Gane (1985), there was an imbalance of 8:1 between harvesting and resource replacement. Besides, there are other problems such as availability of land, (landownership), sub-optimal growth of planted species, high initial investment, insect pests and fire risks, quality of wood of planted species vis-a-vis high value timber species (choice of species), end-use, marketability and post-planting management practices which have to be considered in order to make reforestation an economically viable post-logging land-use in the country.
7. *Shifting Cultivation*: The majority of the rural population in PNG depends on subsistence agriculture. It has been frequently observed, especially in comparatively highly populated areas, that people immediately establish "gardens" in logged areas which are made accessible by logging roads. This results in the destruction of natural regeneration and advance growth by slash and burn.
8. A post-logging land-use pattern for concession area is not worked out before issuing the timber permits.

Factors Favoring Sustained Yield Management

The following factors would, however, favor sustained yield management of natural forests in PNG so as to perpetuate high-value timber species over large areas of TRPs:

Selective Logging

The majority of the timber products are (and will continue to be) based on selective logging. This would mean that if timber companies follow carefully planned harvesting techniques, leaving behind adequate number of undamaged residuals in the range of 20-50 cm d.b.h., it would be possible to have next economic cuts after a predetermined period following a polycyclic felling system. It would also ensure a heterogeneous character of forest with comparatively less damage to the site and loss of gene pool.

Presence of Natural Regeneration

It has been observed that a number of commercial timber species such as *Anisoptera*, *Hopea*, *Pometia*, *Calophyllum*, *Anthocephalus* flower and fruit regularly and regenerate profusely on certain sites presumably because of regular climatic pattern and seasonal changes. Other species such as *Pterocarpus*, *Nothofagus*, *Intsia* regenerate by coppice and root suckers (Saulei 1985). Howcroft and Nir (1986) recorded an average of over

7,000 plants between 50 cm height and 45 cm d.b.h of *Anisoptera* in 4 one-hectare plots in a logged-over forest in Morobe Province. Another study from the same area (Kingston and Nir 1988) showed 6 trees/ha of leading desirables over 50 cm d.b.h. with an estimated volume of 20 m³/ha and 19 trees/ha over 30 cm d.b.h. In *Calophyllum* dominated forests in Manus, over 11,000 seedlings below 1 meter ht were recorded under the canopy of unlogged forests. However, there were very few trees between 20-50 cm d.b.h. Other observations of interest from the management viewpoint were that: (a) *Calophyllum* spp. flower and fruit regularly; (b) dispersal of seeds of both the species of *Calophyllum* was poor as indicated by a large number of seedlings under the mother trees; (c) seedlings remain suppressed under heavy canopy shade, most of which perish with time, and (d) with disturbance and opening, *Calophyllum* seedlings respond to light (Srivastava and others 1986).

Ecological Status of Forests

Observations indicate that in PNG, the forest over large tracts is "young" at a pre-climax stage. Due to frequent activities of volcanoes, earthquakes, fires, and the movement of riverbeds, the forest is "rolled-over" periodically. From an ecological viewpoint, it is easier to regenerate a forest at a pre-climax stage dominated by light demanders than the one at climax stage, which is in equilibrium with site conditions.

Reforestation

Plantation forestry due to problems mentioned earlier has yet to develop its full potential in PNG.

Marketability

Native high value species such as Kwila, Rosewood, Taun, Mersawa, Pencil Cedar, and Planchonella will not lose their importance in the export oriented market in future. There will be no problem in selling these timbers either as primary products (logs) or as value-added secondary and tertiary products (sawn timber, furniture, etc.), even in a highly competitive and volatile international market.

Future Trends

During the last 3 to 4 years, especially after the Forest Inquiry Commission Report, a number of developments have taken place which, if successful, will ensure management of forest resources on a sustainable basis.

Forest Inquiry Commission

The Commission of Inquiry in forestry matters, which was set up in 1985, submitted its final report in 1988. It identified a number of weaknesses in the present system of management and utilization of forest resources in the country such as a weak

Forestry Act and other policies, inadequate knowledge of the resource base, poor monitoring of timber projects, prevalence of transfer pricing, and a lack of trained staff and other resources (financial, transportation, etc.) (Anon. 1988). All efforts are being made by the Government to implement the recommendations of the Commission.

Tropical Forestry Action Plan (TFAP)

In order to solve some of the problems highlighted by the Inquiry Commission, the government requested the UNDP/World Bank in 1989 to launch the Tropical Forestry Action Plan. The World Bank took the role of lead agency and fielded a team of experts, which submitted its final report in February 1990. The report came up with 14 priority projects covering wide areas such as resources appraisal, monitoring, agroforestry, human resource development, strengthening State Purchase Option, forest industry development, landowner awareness, rehabilitation of existing National Parks, and declaration of World Heritage Areas (Anon. 1990c). It sought cooperation of non-government organizations (NGOs) in forest resource management. In subsequent reviews, the project on rapid resource survey, revenue studies, and some aspects of research on forest management have been given priority.

New Forest Policy and Legislation

A new Forest Policy has been in place since April 1990. Some of the most important ingredients of this policy are (i) sustained yield management as the guiding principle for production forests, including non-timber products; (ii) management practices compatible with the environment, (iii) increase in on-shore processing to add value to the product to generate more employment opportunities and increase in investment, (iv) resource acquisition in the form of Forest Management Agreement (FMA) instead of TRP, which would include post-logging management of the area (Anon. 1990a). Currently, the Forest Act is being revised to implement the new policy.

Institutional Changes

In line with the new policy, institutional changes are being made. A PNG Forest Authority will be established (replacing the present Department of Forests) as a statutory corporation for the management of forestry sub-sector. The Authority will be made of a National Forestry Board and a unified National Forest Service.

Research and Development

In 1989 the PNG Forest Research Institute was established in Lae with generous funds from the Japanese government. The institute is well equipped with laboratory facilities, including a

scanning electron microscope, National Herbarium, a botanic garden, National Insect Collection, National Seed Centre, and two field stations at Bulolo and Madang. Four main areas of research are covered: forest botany, forest management, forest protection, and forest products. It has over 60 professional and supporting staff with an allocation of K1.2 million in 1991. Some of the priority areas in research are (i) productivity and silviculture of residual stands; (ii) genetics and tree improvement of reforestation species; (iii) biodiversity; (iv) flora exploration for completing flora of PNG; (v) agroforestry; (vi) environmental impact assessment; (vii) utilization of timber species, especially the lesser known with suitable techniques of processing, seasoning, grading, and preservation; (viii) minor forest products (rattan, orchids); and (ix) insect and pest diseases of timber trees.

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