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THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA

THE FOREST RESOURCES

OF THE

TERRITORIES OF PAPUA AND NEW GUINEA.

REPORT

BY

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PREFACE.

My original commission was to report on the forest resources of Papua, and when that work was completed I was asked by the Administrator of the Territory of New Guinea to undertake a similar forest survey of that country. My report had already been furnished to the Papuan Administration, but was not in a condition for printing, as a number of botanical determinations were unavoidably held over by Mr. White (Government Botanist, Brisbane), who desired to examine them more critically. Subsequently, when my field work in the Mandated Territory was finished, it was decided to print both the report on Papua and the one on the Territory of New Guinea in one volume. There is no botanical boundary between the two Territories and the nature of the forests is alike in both, and it was, therefore, considered more satisfactory to combine the two reports, so that, while the description of the forests of each Territory will be found separated, the technical description of the species met with in both will be found amalgamated, and the index embraces the whole volume.

The twelve months spent in the forests of Papua made the field work in the Territory of New Guinea much easier botanically. Also types of forest were met with which correspond with others I had made surveys of in Papua, and required only inspection. It was possible to push on, passing over large areas of typical jungle of low grade in the search for areas of profitable commercial forest.

I had found no areas of immediately exploitable forests in Papua, but I had high hopes of discovering some in the sister Territory. I thought that plains such as occur in the Northern Division would be found in the great valleys of the Markham, Ramu and Sepik, and that possibly, unlike the Dobadura area, the natives would not have destroyed the forests. My hopes were not realized, for the natives of the Markham and Upper Ramu have converted what must have once been high rain forest into savannah forest and pure savannah. On the lower Ramu and throughout the plains of the Sepik River, the conditions are so swampy as to preclude the growth of high forest. The lower south-east end of Bismarck Range yielded no forests of commercial interest, but it is possible that between the Hagen, the Bismarcks and the Central Range, valuable coniferous forests exist. The area is a wide one and, except for my climb up Mount Otto, which is, as it were, only the first step, has not been penetrated and is well worth thorough exploration. Equipped as I was with a knowledge of the Papuan silva, my progress in the Mandated Territory was much more rapid in those parts where the King's writ ran; beyond that area, however, and unfortunately one has not to penetrate far to leave it behind, progress was hampered by the necessity of reassuring and making friends with the native population. Where no white man had been before, the task was easy, but in that intermediate belt which has not come under Government control, but where some years back well-armed native labour "recruiting" parties operated, the position is very difficult. It is unfortunate that, through the action of some of the natives who accompanied me in one area where I had partially restored the confidence of the native in the white man, the good work was not only undone, but the population, justifiably incensed at the offence committed, wreaked their vengeance by looting and destroying my base camp. The loss of botanical material and notes was very serious, for they were irreplaceable; the loss of gear was only monetary, but the most serious loss was my native herbarium assistant, who, though getting clear of camp when the attack came, did not succeed in reaching the coast. In the broken mountainous country between the Ramu and the sea, he came to grief, but whether by the hands of hostile natives or through an accident, will probably never be known. The delays caused through the need of pacification before food or carriers could be obtained were a nuisance, and I was, in consequence, unable to penetrate as far as I should have liked nor to make as many traverses as I had hoped.

The possibility of commercial forests on the smaller islands seemed less than on the main island, but on New Britain there are still small areas of profitable forests of Eucalyptus Naudiniana, the tree that for many years has yielded the best general building timber for Rabaul and outlying stations. Otherwise the islands were disappointing.

Australia's tropical dependencies, while offering no prospects of immediate gain to large saw-milling interests, possess forest potentialities of a high order. The range of forest regions extends from the Mangrove swamp at sea level through the rain forests of the low-lands on to the oak of the hills and the pine forests of the mountains. It is nature's very abundance that has made the forests of these Territories unprofitable.

Less species and some pure stands are what are wanted and here is where the forester can assist nature. In that splendid growing climate there is no reason why Australia should not establish forests to supply a large part of her timber requirements.

Both in Papua and the Mandated Territory it was only possible for me in the time allotted to burrow holes from sea to mountain in as many places as practicable to record all information obtainable concerning the trees on either land. I have only made a small beginning of the Forest Survey and of Botany I have only touched the fringes of the vast field. This report must be regarded merely as a skeleton on which some other forester will, I hope, lay the flesh.

The botanical identification of the large quantity of material collected was kindly undertaken by Mr. C. T. White, Government Botanist of Queensland, and the thanks are due to him and to his assistant, Mr. W. D. Francis, for the excellent work they have done.

I am much indebted to the Magistrates, District Officers, Missionaries and planters for the assistance given me in carrying out the work I had in hand.

C. E. LANE-POOLE.

10th January, 1925.

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THE FORESTS OF PAPUA.

1. GENERAL.

The Territory of Papua lies between the 5th and 12th degrees south latitude, and the 141st and 155th degrees east longitude. It has an area of 87,786 square miles, and is therefore about the same size as the State of Victoria. In addition, 2,754 square miles are comprised in numerous islands, the most distant being Rossel, which lies about 250 miles from the eastern point of the mainland. Papua forms the south and south-eastern portion of the large island of New Guinea. To the north lies the Territory of New Guinea (late German New Guinea), and to the west, Dutch New Guinea. It juts out into the Pacific Ocean, and is separated from the mainland of Australia by Torres Straits.

A chain of mountains trending N.E. and S.W. divides the eastern half of Papua. This is the Owen Stanley Range, which, at Mount Victoria, attains a height of 13,150 feet. High subsidiary groups of mountains occur on either side of this backbone. Of them, the Hydrographer's Range (6,000 feet), behind Dyke Ackland Bay, is a conspicuous landmark; also the distant peaks of Mount Lamington, to the west. Lower ranges occur frequently, and of these the Astrolabe Range to the east of Port Moresby is a prominent one. Mount Victoria (13,150 feet) is regarded as the N.W. limit of the Owen Stanley Range, which runs from there to the S.E. point of the Territory, with an average altitude of 9,000 feet, with here and there peaks raising their heads to greater heights. Beyond Mount Simpson the height of the range decreases rapidly to the sea coast. The Owen Stanley Range is also called the "Main Range," but this name is a loose one, for it is applied also to the central mountains, which run from Mount Victoria along the Wharton Range to Mount Albert Edward, 13,000 feet, and on to Mount Chapman, on the angle of the neighbouring Mandated Territory, and thence through that Territory to join the Victor Emanuel Range, where the Fly River is supposed to have its source. The eastern half of the Territory is exceedingly mountainous, but as one travels westward the distance between the "Main Range" and the sea becomes greater, and the intervening land is low-lying, and, in certain parts, very swampy. Even in the Western Division, however, the distance that must be traversed before mountains are met with is not very great.

From the nature of the country and its tropical situation, and consequently heavy rainfall, rivers, great and small, are plentiful, while countless streams are met with everywhere. Owing to the configuration of the country, the largest rivers are to be met with in the Western Division, and of these the Fly River is the most important. This great waterway is navigable by launch for 500 miles, and has been explored for 620 miles. The Purari River comes next to it in importance, with 120 miles navigable by launch. The size of the rivers diminishes as the Territory narrows towards the eastern end, but, even so, large rivers empty into the ocean on both the N.E. and S.W. freeboard, and many of these are navigable by small craft and launches for many miles, and are serviceable for floating timber for still greater distances.

The total run-off of the Territory has been calculated to be 100,000 cubic feet a minute [1], and in many parts the conditions are very favorable for developing power. The Water Power Committee of the conjoint Boards of Scientific Societies estimated the available horse-power of the waters of the Territory at 8,500,000, and this estimate was based on half the run-off, and a head of only 500 feet.

Mr. Stanley discusses at length the probable connexion of New Guinea with other lands, and shows that in early geological times it was related to Australia on one side, and Sula, Celebes, and probably Borneo on the other. This would seem to be borne out by the fauna and flora. The "Main Range" is of the Cambrian formation, consisting mainly of gneisses and schists, while the great delta of the Purari, the plains behind Buna, the coral formations, and the active volcano, Mount Victory, at Cape Nelson, represent the more recent formations. Large areas of mud-stones and shales occur between the Vailala and Era Rivers, while in the west, between the Kikori and the Strickland Rivers limestone or raised coral reefs occur. The best forest soils are to be found in the plains behind Buna, between the Kumusi and the Hydrographer's Range; but throughout the Territory, except where limestone predominates, or the land is so low-lying as to be swampy, or so steep as to be precipitous, the soil derived from the weathering of the "Main Range" rocks would appear to be all that is necessary to assure the growth of forests of tall timber trees. Indeed, it is one of the remarkable features of the forests that large trees with clear boles of 80 and 100 feet are to be met with at elevations of 6,000 to 8,000 feet, and these are not always confined to cups, pockets, or gullies, but are frequently on the exposed, rock-strewn spurs of the "Main Range." Mr. E. R. Stanley[2], Government Geologist, who has a very wide experience of all parts of Papua, has found the soils derived from basaltic rocks are those that carry the largest timber, and this is particularly the case when the basalt overlies limestone. I was unfortunate in not meeting such formations, so have no data as to the difference in cubic contents between forests growing on this and other formations.

The climate of Papua is influenced by the usual monsoonal or trade wind effects which are common to tropical countries. There are two main seasons—the north-west and the south-east monsoon. The north-west monsoon blows from about November to March, and the south-east monsoon from April to October. There is a period of variable winds and unsettled weather at the two changes of the seasons. The north-west monsoon, blowing as it does from the warmer equatorial seas, carries more water vapour than the south-east monsoon, which reaches Papua after passing over the colder ocean to the south. So, one would expect the north-west season to be wetter than the south-east; and this, generally speaking, is the case. The south-east is usually known as the "dry season," and the north-west the "wet season." Owing, however, to the configuration of the coast, topography of the country, and the angle of incidence of the winds

(1) and (2) E. R. Stanley: Contribution to the Geology of Papua. Bulletin No. 7, 1921, p. 6. Home and Territories Department, Melbourne.

on the coast line, this cannot be taken as a fixed rule. At Kikori the seasons are reversed, and the months of May, June, and September are the wettest in the year. From the present available data the region around the head of the Gulf of Papua would appear to receive a larger fall of rain than any other part of Papua.

The following are the average rainfall returns at various stations, taken over several years[1]:—

Period.	Station.	Division.
8 years	Kikori, 230 inches ..	Delta
11 years	Lakekamu, 197 inches	Delta
11 years	Ioma, 161 inches ..	Northern
12 years	Cape Nelson, 135 inches	North-East
12 years	Kokoda, 131 inches ..	Northern
13 years	Kerema, 123 inches ..	Gulf
11 years	Samarai, 117 inches ..	Eastern
12 years	Buna, 113 inches ..	Northern
15 years	Daru, 90 inches ..	Western
5 years	Kairuku, 61 inches ..	Central
5 years	Rigo, 48 inches ..	Central
15 years	Port Moresby, 38 inches	Central

Two points of interest arise from these rainfall figures. In the first place it will be noticed that the stations along the coast of the Central Division receive a very low rainfall for the tropics, and as would be expected, this is reflected in the silva, which is decidedly sclerophyllous. This is known as the dry belt, and here the south-east season is a period of partial drought. The averages for the last fifteen years are as follow:—

North-west season, 29 inches.
South-east season, 9 inches.

The length of the belt is roughly 250 miles, stretching from Hula, to the east of Port Moresby, to Maiva, west of Yule Island. Its depth is not known, but it is generally considered not to extend more than 20 or 30 miles inland. Its land boundary must be very irregular, depending on the topography of the country. Sclerophyllous floral regions, differing only in the composition of the savannah forests from the grass and eucalyptus belt on the coast, are to be found up to 4,500, and even 5,000 feet, on the S.E. flanks of the Owen Stanley Range, between Mount Obree and Kagi. While this dry belt is the largest in the Territory, it is probable that others exist which are quite large enough to form separate climatic districts. The one lying between Goodenough Bay and Emurimuri Point, on the east coast, probably ranks second in importance.

The usual explanation for the presence of these dry belts is that the coast-line lies more or less N.W. and S.E., but this does not appear to be wholly adequate. The Commonwealth Meteorologist[2], while pointing out the insufficiency of the data, and the consequent impossibility of making a detailed analysis of any of the climatic factors affecting the Territory, or coming to final conclusions on the matter, explains the Central Division dry belt as follows:—

> "The dry belt from Yule Island to Rigo is partly due to the approximately N.W. to S.E. direction of the coast-line in that region, but an at least equally important influence is the interference of the MacGuillivry Range and other mountains near the south-east end of that belt, these mountains intercepting or deflecting portion of the rain-bearing south-easterly winds. Though wind direction data is, unfortunately, incomplete, there is reason to believe that the north-west monsoon includes a considerable portion of the W.N.W. to W. winds, and a Dutch East Indies meteorological publication indicates that W.N.W. to W. is the prevailing wind direction in latitudes 9 deg. to 11 deg. during the months of January, February and March. This slight increase in the angle of incidence of the wind-flow against the coast-line would account for the occurence of the maximum rainfall in the Yule Island to Rigo region in the first three months of the year, when the N.W. winds are prevalent, and they strike the coast at least as directly as the south-easterlies in the winter months."

In regard to the second dry belt that I have referred to, the Commonwealth Meteorologist writes:—

> "The Territory between Taupoto and the junction of the Eastern and North-eastern Divisions is also relatively dry, and this effect is also partly due to the direction of the coast-line. In addition, the dry belt is screened to the S.E. by the Stirling Range, and to the N.E. by the Territory between Goodenough Bay and Collingwood Bay."

The floral composition of these dry belts is dealt with later, in the section "Forest Regions."

The second interesting point arising from the average rainfall returns given on page 4 is the very marked difference of rainfall between Kikori and Daru stations. These are the administrative centres of the Gulf and Western Divisions, respectively, and are about 140 miles apart, yet Kikori receives 230 inches and Daru only 90 inches. Further, at Kikori the wet season is the period of the south-east monsoon, while the north-west is what the Magistrate stationed there humorously calls "the rainy season." The actual monthly figures for the two stations are as follows. Those for Kikori are the average for eight, and those for Daru for fifteen years[1]:—

	—	KIKORI.	DARU.
N.W.	November	13·52 inches	4·73 inches
	December . ..	11·70 ,,	7·98 ,,
	January	14·21 ..	15·77 ,,
	February	13·39 ,,	9·78 ,,
	March	14·34 ,,	13·25 ,,
S.E.	April	17·70 ,,	12·67 ,,
	May	32·57 ,,	10·88 ,,
	June	28·15 ,,	4·39 ,,
	July	19·26 ,,	2·61 ,,
	August	18·22 ,,	3·16 ,,
	September	26·99 ,,	2·02 ,,
	October	20·07 ,,	2·51 ,,
		230 inches	90 inches

It will be seen that the wet seasons are reversed at these two stations. Daru's wettest months are January, March and April, and Kikori's May, June and September. Commenting on this remarkable difference in climate, the Government Meteorologist writes:—

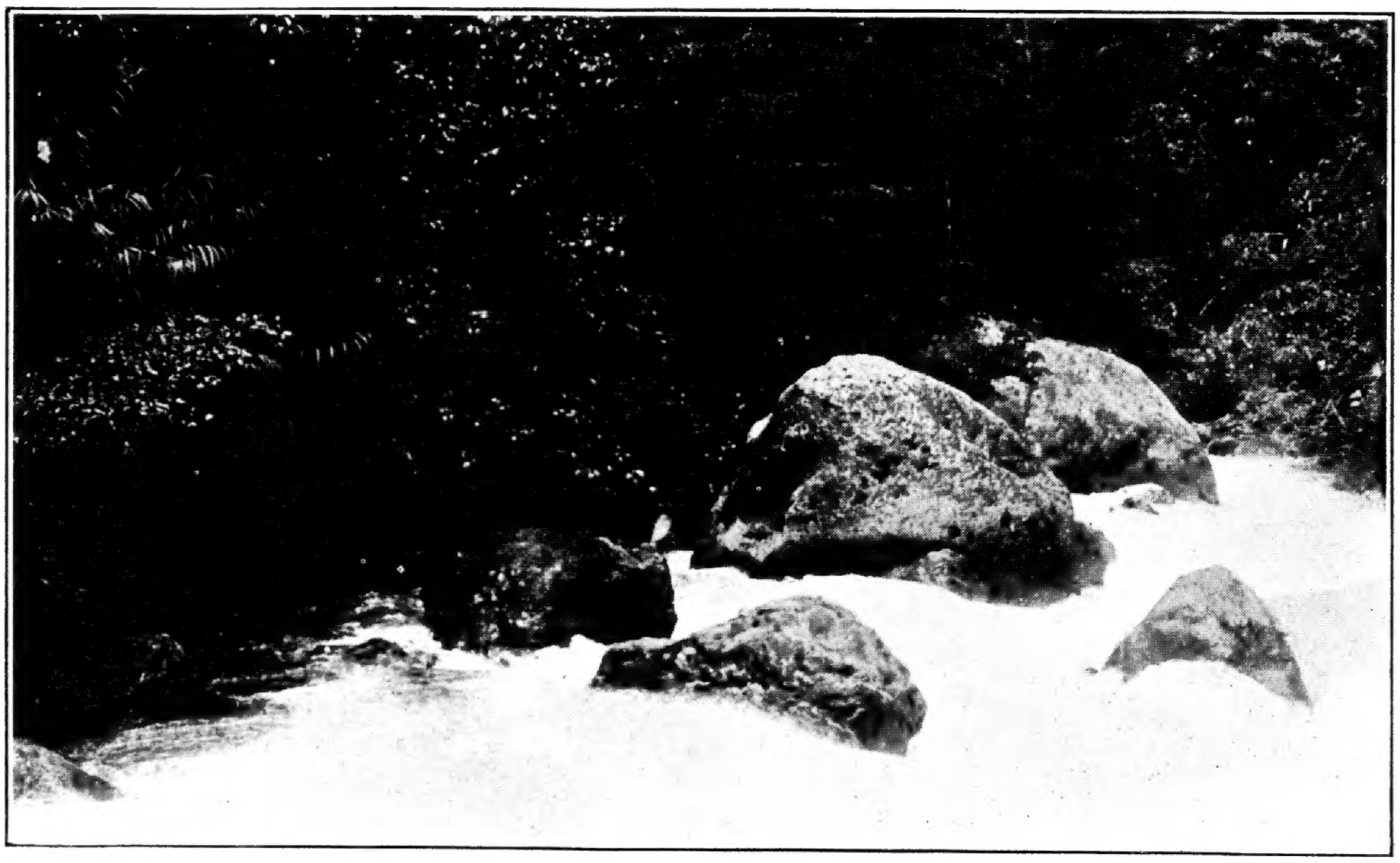
> "The marked contrast between the two low-level stations, Kikori and Daru, at once arrests attention, especially as both stations are apparently fully exposed to the south-east winds, during the prevalence of which all the disparity accrues. In this instance, configuration of the coast-line is the principal influence responsible for the irregularity of the rainfall, the converging shores of the Gulf of Papua producing a convergence of the winds entering the Gulf from the south-east and south. It will be apparent that the south-easterly winds passing between Daru and Redscar Head will be restricted to less than half as much sea-way when they reach the latitude of Kerema. The effect of this convergence and of the friction with the land mass on either side of the Gulf, is to cause a certain amount of "bunkering up" of the air in the region near the head of the Gulf, and

(1) Annual Report Papua, 1922–3.

(2) Department of Lands and Agriculture, Port Moresby. File: Meteorology. 11th January, 1923.

(1) Annual Report. Papua, 1921–22. Agricultural Department.

Mt. Obree, 10,200 feet.



Mimai River. A source of power.

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the continuance of the south-east winds results in the great masses of air being forced to rise considerably in process of relieving the congestion. This uplift strongly reinforces the influence favouring condensation, and fully accounts for the relatively heavy rainfall near the head of the gulf."

In a country of the latitude of Papua when the rain falls below 70 inches, the rain forests composed of hygrophyllous trees carrying their aerial gardens of epiphytes and tangled with lianas may be expected to give way to the more drought-resisting formations—the savannah forest. This type is composed of sclerophyllous trees which are not in close forest formation, but are scattered like parkland trees, and where the ground in between the trees is covered with grasses and other xerophytes. This general rule does not apply to high mountainous country where other factors come into operation, and where a tropical latitude is to some extent compensated by altitude. Taking the lower lands of Papua, from the coast-line inwards to the foothills of the "Main Range," the rainfall is everywhere, except in the dry belts, ample for the production of tall timber trees in rain forest formation. While no data are available as to the area of the dry belts and patches, this must be small when compared with the total area receiving 70 inches of rain and over.

From the map it will be seen that of the stations on page 4 only one, Kokoda, is a hill station, its altitude is 1,200 feet, and it is situated some 60 miles from the north-east coast. It is unfortunate that there are not more inland stations, particularly on the high mountains, for with the present state of our knowledge it is not possible to come to any definite conclusions as to the climate at altitudes of between 2,000 feet and the top of the "Main Range."

The belt included between these heights is of considerable area and is likely to prove of particular interest to foresters. It carries, in places, between 5,500 and 7,500 feet, good stands of hoop pine, while other sound conifers are to be found at even higher altitudes in sufficient quantities to repay further investigation. From a plant geographical, and from a purely meteorological point of view, the study of the rainfall and other climatic factors at different altitudes would be particularly valuable. With the latest self-recording instruments, such stations should not prove very expensive. The trail from Kokoda to Port Moresby offers excellent sites for a series of stations, and these would have the advantage of being visited at comparatively short intervals by the overland mail escort.

While nothing definite can be stated about the climate inland, it is generally thought that more rain falls on the mountains than on the lowlands. From an examination of the vegetation at altitudes up to 10,200 feet, I am inclined to believe that less rain falls on the mossy forests—whose lower limit varies between 7,000 and 8,000 feet, and whose upper is around 11,000 feet—than in the regions lying between the foothills and 7,000 feet; what I have called the mid-mountain region. Whether more rain falls on the mossy forests than on the lowlands, viz., the belt between the sea and 1,500 feet, remains to be proved.

I have not been fortunate enough to visit any of the very high mountains, so am not in a position to discuss from my own observation the climate above 10,200 feet. (1)That Schimpers "alpine grass land" conditions predominate above 11,000 feet is made clear in (1)Sir William McGregor's vivid account of the ascent of Mount Victoria in 1889, and Mount Scratchly and Mount Victoria in 1897. Sir William estimated that there are 100 square miles of grassy country on the top of the Owen Stanley Range, Mount Scratchly, of the Wharton Range, and Mount Albert Edward. Such œcological conditions point to periods of great dryness. Sir William found Mount Victoria in June, 1889, very dry indeed—his supplies narrowly escaped disaster when a grass signal fire was lit, and the fire got away. There did not appear to have been rain for weeks. On his second visit in 1897(2), the conditions were quite the opposite—it rained all day and every day, and the greatest difficulty was experienced in making observations for latitude during the night, while the bearing of Mount Albert Edward, which was of particular importance for fixing the position of the peaks in longitude, was not taken owing to the ceaseless fogs and mists during the day time. Under the section "Forest Regions" will be found the description of the flora on the topmost mountains of Papua. Made by so careful an observer as Sir William McGregor, it is of particular interest to foresters and œcologists.

There seems little doubt that the rainfall decreases once the mid-mountain region is passed. This is probably the wettest belt, and the rainfall diminished in the mossy forests, and may fall below that of the coastal dry belts in the alpine grass land regions—11,000 feet and over.

While the two great trade winds at times are strong enough to be termed gales, hurricanes, which are so common throughout the tropics, do not occur. From a forestry stand-point the winds are never strong enough to cause damage on any large scale. The strongest gales are experienced in the north-west season, and they are generally short-lived. Nowhere have I noticed any distortion of trees, any fixed lean, or flat-topped habit, due to the force of a prevailing wind.

The temperature, as is generally the case in tropical countries, is not excessive. Taking the annual meteorological return for 1919-20, the mean maximum lies around 85 deg. Fahr. for all coastal stations, and the mean temperature around 70 deg. Fahr. Kokoda, the highest station (1,200 feet), shows a mean maximum of 89.4 deg. Fahr., and a mean minimum temperature of 71 deg. Fahr. The maximum is only beaten by Kairuku—90 deg. Fahr., while the minimum, though the lowest mean recorded, is only separated from Cape Nelson by 0.1 deg. Fahr. There seems little difference between sea level and elevations of 2,000 feet. Nights, however, are cooler, and there is less light intensity at the higher elevations. Omitting Kikori, whose maximum and minimum thermometers that year would seem to have been out of adjustment, the mean for 20 stations was 76 deg. The humidity, as is to be expected, is very high; at no station did it fall below 70 per cent. in 1919-20, and at Kikori it was 88.9 per cent. As in the case of rainfall, no data are available as to the temperatures over periods of time in the mid-mountain belt and at high elevations. Isolated temperatures have been taken by most explorers. Sir William McGregor records a temperature at night of $40\frac{3}{4}$ deg. at 10,200 feet, while at the top of Mount Scratchly the thermometer stood at 55 deg. Fahr. in the shade at noon, and, although there was ice on the water, at 38 deg. Fahr. at daylight. All these were recorded in the month of September, during his ascent of Mount Scratchly. In June, when ascending Mount Victoria, he found a temperature of 59 deg. at 9 a.m. at 10,130 feet. On Dickson's Pass at about the same level he records 44 deg. before sunrise, and 55 deg. at 8 a.m. Referring to the temperature on the peaks of Mount Victoria, he writes(1):—

> "The temperature rose in the middle of the day to 70 deg.; in the morning the grass was all quite white with frost. Icicles were brought into camp."

Mr. Monckton records a minimum temperature of 26 deg. Fahr. at night on the summit of Mount Albert Edward, while the temperature of the air when he took the boiling point height of Mount Albert Edward, presumably in the day time, was 48 deg. Fahr.

(1) Since writing the above I visited high mountains in the Territory of New Guinea and came to different conclusions as to these so called alpine grass lands. See page 68.

(1) Annual Report, British New Guinea, 1888–9, pp. 43–44; (2) Annual Report British New Guinea, 1896–7, App. C.

Mr. E. R. Stanley, Government Geologist, in his report on his "Geological Expedition across the Owen Stanley Range"[1], records a number of temperatures. At 4,428 feet the thermometer stood at 70 deg. at noon and at 66 deg. at 6 p.m. At 5,344 feet the temperatures were 63.5 deg. at noon and 61 deg. at 6 p.m. On the Owen Stanley Divide the highest point reached, 9,110 feet, the temperature on the 11th June, on a misty day, was 51.8 deg., and on returning on the 4th July the temperature at 10.25 a.m., when the weather conditions were foggy, 52 deg. was recorded. On the slopes of Mount Obree, at an altitude of 8,200 feet, on the 2nd February, 1923, I experienced a cheerfully warm day. At 11 a.m. it was 72 deg. Fahr.; everything was quite dry; the moss on the trees—for at that altitude the forest is all of the mossy type—looked as though it had not seen rain for some time: it had poured the previous day. By 2.30 the clouds had enveloped the mountains and everything was dripping wet, while the temperature had dropped to 58 deg.

On the long ridge dividing the Kemp Welch and Brown headwaters, which Mr. Stanley and I traversed in February, the following temperatures were recorded by him:—

Date.	Hour.	Altitude.	Temperature.
		Feet.	Degrees.
10th February, 1923..	9 a.m. ..	6,500	56
,, ,, ..	11.45 a.m. ..	7,520	61.5
,, ,, ..	2.30 p.m. ..	8,000	59
,, ,, ..	4.20 p.m. ..	6,750	68
11th February, 1923..	6.45 p.m. ..	6,750	62
,, ,, ..	9 p.m. ..	6,018	63
,, ,, ..	12.30 p.m. ..	6,976	64.5
,, ,, ..	2.15 p.m. ..	7,340	63

The humidity in the mid-mountain forests would appear to be higher than in the lowlands and foothills, while in the mossy forests there must be long periods when the whole belt is saturated. Yet traces of fires show that there are times of drought in the mossy forests, and at such times the forest becomes quite inflammable. To any one who has attempted the exasperating task of trying to light a fire in the mossy forests in what I regard as its normal condition of soppiness, will find it difficult to believe that there are times when it becomes quite dry. Certainly my experience on the slopes of Mount Obree came as a revelation to me, and made it much easier to account for comparatively large patches of burnt mossy forest. Such burnt patches are absent from the mid-mountain forests, showing that while the mossy forests are more often in a condition of saturation, they must dry up very rapidly and become more inflammable than the comparatively speaking drier mid-mountain neighbouring formations. When "Alpine grass lands" are reached, the humidity probably drops considerably more, and fires should become extensive wherever there are natives to light them. Mr. Monckton [2], in his report of his ascent of Mount Albert Edward, says: "The whole of the forest on the summit (of the Wharton Range) has been killed by extensive fires, and for miles, wherever the eye rests, it meets a spectacle of gaunt dead trees." The altitude of this burnt country is about 11,000 feet.

2. FOREST REGIONS.

The forest regions, except for the dry belts, may be divided according to altitude as follows:—

Lowland forests	..	0	—	1,000	feet	above sea.
Foothill forests	..	1,000	—	5,500	,,	,, ,,
Mid-mountain forests	..	5,500	—	7,500	,,	,, ,,
Mossy forests	..	7,500	—	11,000	,,	,, ,,
Alpine forests	..	over		11,000	,,	,, ,,

(1) Annual Report, 1917–18.
(2) Annual Report, British New Guinea, 1905–6, App. p. 89, para. 66.

These main divisions overlap in many places, and the least satisfactorily delineated type is the lowland forest. This is the mixed rain forest, and while it is found at its best between 0 and 1,000 feet, it also intrudes into the foothill forests wherever there is a good sheltered pocket of aluvium or rich soil. Mid-mountain forests are sometimes met with at 4,000 feet, and I have seen the oaks and hoop pines at an altitude of 8,000 feet. The mossy forest is also of rather uncertain limits, especially where exposure to high winds occurs. I have seen a patch of it as low as 5,500 feet. The altitudes given above must therefore be taken as indicating the type of forest that is predominant between the altitudes mentioned, but not as a definite or precise limitation of each type.

In addition to the above, which, except for the higher belt, are all composed of hygrophyllous tree vegetation, there are the savannah forests of the dry belts, which are sclerophyllous types; but even then we find intermediate types and belts of mixed rain forest, hard to distinguish from the typical form.

In the tidal estuaries of rivers and in all places along the coast-line where there is a sheltered inlet or cove, or a harbour with a flat shore, another formation is met with, consisting of halophyllous trees. These are the mangrove associations—forests of the sea.

I will begin by describing the savannah forests:

Savannah Forests.

The savannah forests are confined to the dry belts, which, as has already been explained (p. 2), occur here and there throughout the Territory. These are open forests, similar to the large areas that occur in Australia. They are not forests in the generally accepted sense of the word, for the trees are too scattered and too small to yield a profit to a sawmiller, or to give one used to temperate dense forests the idea of a forest. Yet the savannah forests yield useful fence post wood and other timbers required by the plantation manager, not to speak of firewood for Port Moresby. So they are not to be entirely despised from an economic stand-point. From the scientific aspect they are of particular interest. As has been pointed out under the section dealing with climate, such dry belts can be expected when the rain fall decreases below 70 inches. Much more data, however, is required regarding the rainfall of the interior, and environmental factors governing the growth of trees, before an explanation can be found for the patches of savannah forest that are to be found at various altitudes in the mid-mountain region.

The composition of these areas is sclerophyllous in character. In the dry belt of the Central Division the trees consist of eucalypts of the following species: *Eucalyptus alba* Reinw., the poplar or white box of Queensland—it is easily recognizable by its large leaves; *Eucalyptus papuana* A. Cunn., the common small gum around Port Moresby—it has not a persistent bark; *Eucalyptus clavigera* F. Muell., almost as common as *E. papuana*—it has a persistent bark half-way up the bole which makes it quite distinctive.

These three eucalypts rarely exceed 50 feet in height, but as one goes inland *Eucalyptus tereticornis* Sm. dominates the formation. This is the New South Wales forest gum, and is known in Queensland as the forest red gum, while here it is known as the narrow-leafed gum.

In addition to the eucalypts other trees of the myrtle family occur.

Melaleuca sp. (aff. *M. leucadendron* Linn) a small tree on Hombron Bluff, and recorded by Mr. White from the Astrolabe Range, where he found it quite common.

Melaleuca sp. (near *M. leucadendron* Linn), a large paper-bark tree, found in damp ground.

From an altitude of 1,500 feet upwards a tall Casuarina is common. This is *C. nodiflora* G. Forst., but must not be confounded with *C. equisetifolia*, which is a purely beach forest species.

Another large tree is *Diplanthera tetraphylla*. This is a handsome wide-crowned tree with showy yellow flowers in terminal panicles.

A number of small trees and shrubs make up the woody plant formation, and among them is a sandalwood, *Santalum* sp., at the lower levels. *Morinda citrifolia* is common, but this at Hombron Bluff and Warirata is replaced by *Timonius rumphii*. Some pretty flowering verbena trees or shrubs of the *Clerodendron* genus occur near the coast.

Between these trees and shrubs, which are scattered at some distance from each other, the ground is covered with grasses, of which the two largest, if not the most common, are Kurakura (*Imperata arundinacea* Cyr., and *Saccharum spontaneum* Linn). These two tall grasses appear to take possession of the ground wherever it is open enough, and of the two *Saccharum* requires rather moister land. These grasses are conspicuous, but the many others—43 gramineæ are enumerated by Mr. White[1]—are more numerous, particularly at higher altitudes. Here and there in the grass a cycad (*Cycas media*) is to be found, and this gymnosperm is so numerous as to give character to the landscape. Throughout the savannah forest of the dry belt, gullies and ravines exist which are clothed with a type of forest intermediate between the rain and the savannah forests. It carries a certain number of deciduous trees, of which the kapok or cotton tree (*Bombax malabaracum* Dc.) is perhaps the best example —a very large thick-barked deciduous tree which is a beautiful sight when in flower, the large red blossoms in the leafless branches making it very conspicuous. Other deciduous trees also occur, and one—uri of the Motuans, close to the Melias—grows both in the rain forest and the gullies of the dry belt. Another tree which is found in both formations is devoru (*Alstonia scholaris*), the Queensland milk wood, milky pine, or white pine; a large asymmetrically-boled tree. Albizzias occur also, and one, mokeke (*A. procera*) is confined to the damper places of the dry belt. The others seem to grow as well as in the rain forest. These gully forests seem to occur wherever the subsoil moisture is sufficient to support hygrophyllous trees, and these make up the greater part of the species of such associations. Wherever a gully forest is destroyed by natives for farming purposes the original growth is replaced by grasses, and little by little the eucalypts and other savannah forest trees become established. This is not, I am confident, a natural succession, but is due to the fires that the natives light in the grass lands in the dry season for hunting purposes The young regrowth species of the gully forests are killed at once by fire, and grass is in consequence established. Only fire-resisting species, like the eucalypts and certain other thick-barked trees—clerodendrons, for instance—can then establish themselves in open forest formation. Were it not for these fires the regrowth would be very similar, if not the same, as the gully forest before the natives cleared it for farming. There are certain areas in this dry belt about which it is difficult to decide whether they are artificial savannah forests, caused through the natives' farming and burning proclivities, or the real savannah forests. This is accentuated when the site is not a gully or depression, and does not appear to be particularly damp. In such cases I have come to regard the presence of old devoru and other trees that thrive best in the rain forests, but grow well also in the gully forests, as a proof that the country in question was once covered with the latter intermediate formation.

As the ground rises from the coast inland, the areas of gully forest extend more and more, and begin to assume more of the rain forest characteristics. Aerial gardens of epiphytes clothe the branches of the larger trees, many more rain forest types have intruded, large lianas begin to be a striking character, and scitaminous plants now form an undergrowth. Further inland the savannah forests become mere islands in the ocean of forest, which now assumes the definite rain forest formation. But—and here I think is a subject of sufficient interest for careful œcological investigation—the dry sclerophyllous savannah forest of the Central Division does not cease until the lower limit of the mist belt—5,500 feet—is reached. *Eucalyptus papuana*, *E. clavigera*, and *E. alba* do not occur, but *E. tereticornis* grows in a closer formation at 4,500 feet than at Bisiataba—1,700 feet. *Casuarina nodiflora* is very common, and the same cycad sprinkles the grass. When the eucalypts have been cut down for firewood or other purposes, the regeneration is thick and vigorous. While neither at low or mid-mountain altitudes do the gums find their way into the heavier forests at 5,000 feet, *Casuarina nodiflora* grows also in the rain forest, and it is a remarkable sight to see this species rearing its trunk alongside hoop pines, podocarps, and oaks. So is it curious to see in the grass lands on the edge of a rain forest the cycad growing, and close to it, perhaps not 20 yards away, the tree fern in the shade of the heavy timber. Were it not for the presence of large and obviously very aged eucalypts, and the entire absence of all rain-forest or gully-forest species on these highland dry-forest patches, I would feel some hesitancy about calling them real savannah forests, and might ascribe their origin to artificial causes. While artificial savannahs are created by natives in the mid-mountain forest regions, these areas do not carry eucalypts or casuarinas, and are only kept from reverting to high forest by the annual fires of the hunters. When the population has left a hill-top village, and moved down to the valley—a procedure which is happening everywhere that the Government's influence has been felt sufficiently to stop inter-tribal warfare—the abandoned farm lands which were in the high forest show a good regrowth of those light-demanding weed species which I shall have occasion to refer to later, and which are the forerunners, if not the nurses, of the true forest species. Gully forests occur at 5,000 feet, which, while differing in composition, are of the same type as those that occur at 400 feet behind Port Moresby.

Economically the only species of outstanding value in the Savannah Forests of the dry belt of the Central Division is the sandalwood. I deal with this source of wealth in the section headed "Minor forest produce." To the baker, user of producer gas-plants and householders, the eucalypts of the Port Moresby hills are of great value as a source of fuel and power. The plantation manager is glad to make use of the round logs of the narrow-leafed gum (E. tereticornis) for his fence posts and house props, though he prefers melila (Afzelia bijuga) if he can get it. Where the soil is sufficiently deep and moist no doubt it would be practicable to make plantations of more valuable species, but on such sites species yielding fruit, rubber or other tropical comparatively short rotation crops should prove nationally more economical than timber producing species. In the porous Port Moresby bed soils it is doubtful whether any better species could be induced to grow than the eucalypts now occupying the ground. The gullies must certainly remain the garden plots of the natives, and, if the population increases, more and more of such, or similar profitable, farming land must be thrown open to them.

Within the long strip known as the dry belt several areas of high rain forest occur. These are formations which owe their existence to the presence of ample supplies of water in the soil. They occur along the big and small rivers and extend inland on either side for a distance which depends purely on the width of alluvial soil the river has made. Such formations only

(1) C. T. White, F.L.S.: "A contribution to our knowledge of the flora of Papua," pp. 14–16.

occur in the lowlands; higher up a river where it becomes torrential the rain forests or savannah forests come down to the stream's edge, according as the conditions are favourable for one or the other formation. It is in the comparatively speaking flat country between the foothills and the sea, that these forests occur. In some cases the strip of alluvial ground is narrow, and the ground then slopes rapidly up to the tops of little hills. Here the rain forest gradually alters in composition, becomes more open and finally on the top carries a larger proportion of deciduous than evergreen trees. The composition of these riverside forests is very complex for, while they include all the characteristic rain forest species, they also shelter a number of intermediate forms—types one might expect to find in the gullies of the savannah forests.

I made an inspection of the forests bordering the Veimauri, Vanapa, Veiya, and Brown. A saw-milling company holds them under lease from the Government, and has spent some capital on a mill and on opening up the forests for timber purposes; the areas in consequence seemed to be worth investigating carefully.

As will be seen from the portion of the Central Division map, which is on a scale of 4 inches to the mile, these rivers all fall into an estuary known as Galley Reach. The Venapa and Laloki are big rivers, and they together form a large part of the low-lying tidal delta country which lies between the Galley Reach and high ground.

All this delta country consists of mangrove swamp. A description of this typical mangrove forest will be found on page 47. The rivers Veiya and Veimauri rise comparatively close, and are small in comparison with the first two-mentioned waterways.

No forest proper is met with until one has left the tidal salt water, or the land begins to rise sufficiently to drain, and so carry an association of tall hygrophilous trees. The dividing line between the mangrove and the fresh-water swamp formation is the limit reached by the salt water. Then come low-lying swamp lands, mainly covered with sago palm (*Metroxylon rumphii*), with here and there a sabi (*Sarcocephalus cordatus*), the Queensland yellow or Leichhardt's pine, and *Myristica* sp. The latter is a big tree, which has the same prop-rooted arrangement as the mangrove, looks like a Sonneratia, but has no pneumatophores. As soon as the land rises above the level of the swamp are to be found the rain forests, broken here and there by depressions which are swampy, and limited inland by the rise of the rocky hills. The rain forest at its best is on the alluvium of the flats.

Rain Forests.

A description of this type of forest is not easy. The large buttresses that certain trees have at the base of the boles, the hanging lianas, the aerial gardens that cover the upper branches of the tall trees, all tend to distract and make a comprehensive view or description difficult. Add to these the thick stand of young trees which make it hard to see stems of the trees more than half a chain away, and some idea of my difficulty in giving a general view of this type of forest may be obtained. How does such a forest differ from the wet eucalypt forests of the extreme south-west of Western Australia, of parts of Victoria, and of Tasmania? In the first place, in the extraordinary mixture of species. On 108 acres on the right bank of Veimauri Creek, I measured 69 different species of trees of 5-ft. girth and over. The height of the top story is not as great as that of the Australian wet eucalypt forest; 100 to 120 feet would be the limit of height of the canopy, except for one species—Ilimo—which I shall refer to later. In the absence of heavy undergrowth, except for the lawyer canes (*Calamus sp.*), there is no difficulty in walking through such a forest. This rattan, with its hooking spines, makes a scrub-knife a necessity. Here and there a thick growth of *Scitaminæ*, with large green paddle-like leaves, makes a dense covering. There is a definite third story in this forest some 30 feet high. The first and second stories are there, too, but are hard to distinguish at first, but not so the third. The great difference is, however, caused by the wealth of climbers, lianas, Freycinetias, and as one's eye follows these up the trunks, by the festoons of hanging ferns (*Asplenium*) and other epiphytes in the branches, by the presence of tuft upon tuft of young calamus palms which star the ground; by the long, slender, cylindrical stems of the larger-growing palms.

Here, then, are some of the striking differences that an Australian from the southern States would see at once. A North Queenslander would find a great similarity between this forest and the one he is accustomed to in his own country and calls "scrub." He would probably feel quite at home once he recognized a few of his Queensland friends—such as milkwood, Leichhardt's pine, cedar and beech, stinging trees, and scrub itch.

The complexity of the forest is much reduced when it comes to examining it from a purely forestry standpoint. The often very beautiful excrescences of the scene must be overlooked while the main thing—timber—is examined. Once this is determined on, the forest becomes a simple matter to describe, for it now consists of three storeys of trees—the top one, about 100-120 feet high, is composed of trees from 7-ft. girth upwards; the second of trees 5 feet in girth, 50 to 75 feet high; and the third of trees 30 feet high. Its composition is very varied—the number of species on 1 acre being very great. Its density is very high, the shade is as complete as possible, the young trees are very crowded, and their leaves are, as a rule, very large—much larger than their parents, to enable them to catch what little light filters through from above. While some of the largest trees have clear boles from the ground, others are buttressed, the buttresses in some cases stretching out 3 yards from the butt.

If, on this skeleton of our forest, you, in imagination, throw a covering of climbers of all sizes, with all manner of leaves, from the huge cut up leaf of a Freycinetia to the delicate palm fronds of the lawyer canes; if you cover the upper branches with ferns and orchids and strew the ground with small herbaceous plants and the tufts of the young calamus before it puts out its climbing shoot; if you sow here and there a large strangling fig, grotesquely monstrous, you will have some idea of the appearance of a tropical rain forest of this type.

Unlike the temperate climates, there is no spring in the tropics, when masses of flowers come into bloom. The ground is never covered with showy blossoms of wild flowers, and, except for third story trees, and those that have their blossoms low down on their trunks (cauliflory), the flowering of the trees takes place unseen. There is too much intervening greenery, and the branches are too high for the passing traveller to see the flowers unless they are very large and showy. It is hard to collect botanical material in these forests for, apart from the trouble of finding out whether the tree is in flower, there is the task of getting the material down, and matters cannot wait for many of the species have but brief flowering periods.

In the same way the epiphytes that make up the aerial gardens on the branches are so high up that they only appear as tufts of greenery, and the flowers of the orchids, which are never large or showy in Papua, are not seen at all. Now and then a third story tree, such as maita-maita (*Eugenia sp.*) or a bio bio (*Garcinia*) in full flower or fruit, or a Baccauria with its trunk a mass of pendant racemes of cream flowers, add a colour to the greenery. These sights are, however, comparatively rare, and one, for the most part, only sees flowers when they have dropped to the ground, or when a native has laboriously climbed up and brought them down.

This description of the forests at the head of the Gallery Reach would apply to all other rain forests in the Territory. Others have a greater height growth; in no two localities is the composition the same, while the quality of the stand of timber varies everywhere; but while all these differences are there, and may be ascertained by careful inspection, measurement and the counting of trees, to the eye the general view which I have attempted to give is the same.

There is another type of forest along the banks of most large rivers in the Territory which consists principally of ilimo (*Octomeles sumatrana*), a magnificent tree which yields a timber which has much to recommend it for all indoor work. It reaches a height of 180 feet and sometimes 200 feet in favorable localities, and has a girth above the buttresses of about 15 feet. The buttresses are heavy and spread out 8 feet from the bole, and rise to 10 or 15 feet up it. The bole is generally clear and straight for 100 feet. It is found in two formations:—(i) scattered singly or in groups of two or three in the damper places along the river and creek banks of the rain forests; (ii) in dense formation along the banks of large waterways. It is the second formation that I am about to describe, as it differs very much from any other in the Territory.

Ilimo is a social species and anywhere that a large river, such as the Vanapa or the Brown, has deposited a mass of alluvium and made new ground, it comes up in a dense mass. All who have travelled up the large rivers of the Territory will have noticed these patches of young trees. They are most conspicuous, not only because with them is associated no other species, but because they are of even age; they have all grown up together. The young ilimo is a remarkably attractive tree with its symmetrical arrangement of branches, its large green, heart-shaped, drooping leaves, and its freedom from creepers and epiphytes, so that one instinctively remarks on the healthy appearance of the clump one passes. Very few of these clumps of ilimo reach maturity; a river, as a rule, in the flat country where alone such tree formations are possible, is continually changing its course; where one year it may be depositing alluvium on one side, another year it may have ceased to do so, and the new ground is now being made on the other bank; and later a great flood comes and bends are washed away and the new ground so lately made, with its fine growth of young ilimo, is swept down to the sea. Wherever the ilimo has succeeded in establishing itself and growing for a generation, it stands a good chance of reaching maturity. It has by this time bound the ground together with a network of roots, and it takes a very great flood indeed to tear the soil away; only an entire alteration in the course of the river can destroy the young forest now. The ground which, when the ilimos were quite young, was covered with rushes is now covered with much the same growth as the rain forests; here and there a few third story trees have found their way in, but they are not numerous. The same may be said of lianas, creepers and epiphyts, which are only met with in small quantities. The first story is no longer all ilimo—a number of top story rain forest trees have come in and are competing with the original trees, and these have not quite finished making their height growth. One second story tree—tatoa of the Benendele people (*Vitex cofassus.*)—is found here and there. All these intruders do not, when counted up, exceed the number of ilimo even in second quality stands, while in the best the ilimos exceed them by 50 per cent. The mature forest does not differ very much from the ilimo stand of middle age, except that the top story is now quite distinct and is all ilimo; the intruding species are now in the second story, and being much more slow-growing, have not yet reached maturity, and seem very small compared to the ilimo that are now up to 15 feet in girth and have buttresses standing out all round, making them look still bigger.

Here are the figures relating to an 8-acre patch of over-mature ilimo on the Vanapa. It is sufficiently aged for the intruding species to be for the most part mature. It will be seen that there are only ten species and that there are 62 individuals in all, of which there are 39 ilimo, or 64 per cent. of the stocking, and these cubed 14,130 feet. The largest girth was 15 feet, and the highest clear bole 120 feet. It is very unfortunate that these heavy stands of ilimo are not more numerous, for there is no doubt that the timber is sufficiently useful to command a good price, the extraction offers no difficulty, its transport down stream is simple, and it mills very well indeed. I have not, however, found any but small patches of such forests in the parts of the Territory I have visited.

[*Description of Timber on an area of 8 acres—Vanapa.*]

Herbarium No.	Native Name.	Botanical Name.	Number of Individuals.	Cubic Contents.			Percentages of—	
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number of Trees.
							%	%
1	Damoni	*Dracontomelum mangiferum*	6	526	66	88	3·1	9·7
2	Kaeda	*Planchonia timorensis*	1	128	16	64	0·75	1·6
4	Nara*	*Pterocarpus indicus*	2	403	50	201	2·4	3·3
5	Okamu	*Pometia pinnata*	1	205	15	205	1·2	1·6
13	Sihu	*Pterocymbium* sp.	1	259	32	259	1·5	1·6
20	Uri	*Garuga* sp.	4	610	76	152	3·6	6·4
34	Ilimo	*Octomeles sumatrana*	39	14,130	1,766	362	82·7	62·9
36	Okaka	*Terminalia catappoides*	1	118	15	118	0·7	1·6
51	Habere	*Dractomelum* sp.	6	456	57	76	2·7	9·7
106	Atuiabiahuna ..	Indt.	1	242	30	242	1·4	1·6
			62	17,077	2,259	565	100·0	100.0

* One of the Naras had a girth of 15½ feet—the largest I have seen.

The timber from these forest is supposed by white people to be less valuable than that which is obtained from the few scattered ilimo that are to be found in the mixed forests further from the bank of the river. Some long residents in Papua affirm that there are two species of ilimo—a large-leafed and a narrow-leafed, and that it is the timber from the latter that is the better. I was unable to find any difference between the timber of the trees inland and on the banks, nor have I been able to find different varieties of ilimo. The tree is diœcious, and that may have given rise to the theory of two varieties. There are differences in the quality of the timber, but these arise from usual causes, and of them over-maturity and consequent decrepitude of the wood is one, though perhaps the attacks of borers, followed by fungous disease and rot of the wood is more common.

The natural succession to these even-aged forests of ilimo is the mixed rain forest. As the ilimos begin to die their place is taken by the intruding rain forest

species, and gradually the number of them increases until the stand becomes the mixed rain forest type. The new forest thus established will have a few scattered ilimo through it, but this species cannot again regenerate itself on the same ground, as a pure stand, until the forest is destroyed. In nature this occurs only when the river, through some devastating flood or some large block, alters its course so as to carry away the forest and the soil; then it may happen that in years to come the river again begins to find its way back to its old course, and lays down alluvium on the old site till a bank is formed, which is sufficiently drained to allow ilimo to spring up.

This type of forest may, I think, be termed edaptic. Chary as I am of using so overworked a word, this seems a case where it may be said to apply rather well. The question of plantations is dealt with under separate section and on page 51 I discuss the planting of ilimo. It is a social species, and grows very quickly, and yields a very good soft wood. It should be planted wherever conditions are favourable to it. It has the further advantage that it has already been successfully planted by natives in the Delta division for several generations. Instead of the slow agency of the river—first a destroying and then a building one—we find human agency at work. It is in the cleared patches of the river forest, after he has established his gardens, that the Delta "boy" plants ilimo, that his son may find canoe logs when his turn comes to clear land for gardens on the banks of the huge waterways of his country.

The description I have given of an ilimo forest of the Vanapa applies, within the limits of its inadequacy, to all such edaphic ilimo patches in the Territory, and they occur to a greater or less extent on the banks of all the great rivers. Those on the Vanapa are the best I have seen, but there is no reason for supposing that there are not as fine or finer stands on the many rivers I was unable to visit.

Veimauri Forests.

These forests are situated on the right bank of the Veimauri. The ground is generally high, and is only inundated by high floods where flats occur. The hills come down close to the banks, and these are cut up into gullies in which alluvial land has been deposited. Some areas of sago swamp are to be found here and there, but taken on the whole the topography is decidedly hilly. The geological formation is basalt, and the soil on the flats and in the hollows appears to be rich in all the necessary plant foods. There is a plantation at Veimauri of coco-nuts in full bearing. The lie of the hills here is about N.W., and the gullies run S.W. to the river, which makes many twists and bends through the flatter country. Two sets of traverses were cut; one parallel with the lie of the hills, intersecting every creek and gully, and the other parallel with the gullies and ridges. In this way it was thought that a fair average of the timber on all parts would be obtained. It is not easy to estimate the total area of this type of forest, but assuming that it does not go further than the crest of the hills, and neglecting the small areas of plantations, the total area would be about 1,500 acres. The total area embraced within the strips was 108 acres, or 7.1 per cent. Table I. hereunder gives all the data worked from the field books. It will be seen that 69 different species of trees were met with, and while many of them were only seen once, some were more heavily represented. None was, however, so markedly in the majority as to give the forest a distinctive character. No tree could be said to dominate the association enough to enable the forest to be called by its name, as one talks of an iron bark or a jarrah forest. The largest number was No. 1—Damoni—with 42 species, but No. 2—Kaeda—was only one behind it, and it makes a large tree in this locality, a somewhat unusual thing; in fact, on the Veimauri are the best I have seen. The total number of millable-sized trees over

No. 1.—VEIMAURI FOREST SURVEY.

Details of results of the measurements of timber on 108 acres of strips, 7 per cent. of whole.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
1	Damoni	*Dracontomelum mangiferum* ..	42	2,957	27·3	70	8·39	9·6	2·5
2	Kaeda	*Planchonia timorensis* ..	41	2,545	42·0	110	12·91	9·3	2·5
3	Medobi	Indt.	13	1,704	15·9	131	4·83	2·8	8·0
4	Nara	*Pterocarpus indicus* ..	3	136	1·2	45	0·38	0·7	36·0
5	Okamu	*Pometia pinnata*	14	1,168	10·8	83	3·31	3·1	7·7
6	Monoia	*Artocarpus* sp.	1	90	0·8	90	0·25	0·2	108·0
7	Okoia	Indt.	25	1,774	16·4	71	4·99	5·6	4·3
9	Eti	*Cedrela toona, var. australis* ..	1	99	0·9	99	0·27	0·2	108·0
10	Melila	*Afzelia bijuga*	34	1,829	16·9	54	5·18	7·7	3·0
11	Manoi	Indt. *Aglaea elaeanoidea* ..	3	222	2·0	74	0·57	0·7	36·0
12	Hodava	*Terminalia* sp.	14	636	5·9	45	1·80	3·1	7·7
13	Sihu	*Pterocymbium* sp.	29	2,739	25·3	91	7·77	6·6	3·7
17	Marabo	Indt. *Sterculaceae*	1	59	0·5	59	0·17	0·2	108·0
18	Kava	Indt.	1	196	1·8	196	0·55	0·2	108·0
19	Sabi	*Sarcocephalus cordatus* ..	11	1,023	9·4	93	2·90	2·5	9·8
20	Uri	*Garuga* sp.	29	2,611	24·0	90	7·41	6·6	3·7
21	Kerea	*Endospermum formicarum* ..	1	79	0·7	79	0·22	0·2	108·0
22	Arimore	*Horsfieldia silvestris* ..	5	285	2·6	57	0·81	1·1	21·6
24	Kobura ..	*Pterygota forbesii Fv.M.* ..	8	417	3·8	52	1·18	1·8	13·5
25	Homuda	Indt.	6	365	3·3	61	1·03	1·3	18·0
26	Mokeke	*Albizzia* sp.	2	120	1·1	60	0·34	0·4	54·0
27	Uri	*Garuga* sp.	22	1,160	10·8	53	3·32	5·0	4·9
28	Variva	*Hibiscus* sp.	1	86	0·3	86	0·24	0·2	108·0
29	Devoru	*Alstonia scholaris*	14	2,297	21·7	164	6·51	3·1	7·7
31	Toto	*Thespesia populnea* ..	1	64	0·6	64	0·18	0·2	108·0
32	Kia	Indt.	12	723	6·7	60	2·06	2·7	9·0
33	Bara	*Diospyros* sp.	13	811	7·5	62	2·30	2·8	8·0
34	Ilimo	*Octomeles sumatrana* ..	2	288	2·6	144	0·82	0·4	54.0
35	Kuwe	Indt.	1	30	0·3	30	0·08	0·2	108·0
36	Okaka	*Terminalia cattapoides* ..	4	484	4·3	121	1·37	0·9	27·0

No. 1.—Veimauri Forest Survey—*continued.*

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
37	Kibore	Indt.	1	59	0·5	59	0·17	0·2	108·0
38	Hode	Indt.	2	223	2·0	111	0·57	0·4	54·0
39	Pede	Indt.	1	64	0·6	64	0·18	0·2	108·0
40	Huroro	Indt.	1	51	0·4	51	0·14	0·2	108·0
41	Ihara	*Mangifera minor*	8	500	4·6	62	1·42	1·8	14·0
42	Mohu	*Ficus* sp.	3	221	2·0	74	0·37	0·7	36·0
43	Kwara	*Myristica* sp.	4	142	1·3	35	0·40	0·9	27·0
44	Horoko	Indt.	3	266	2·4	89	0·75	0·7	36·0
45	Barikaba ..	Indt.	1	97	0·9	97	0·27	0·2	108·0
46	Haki	Indt.	1	100	0·9	100	0·28	0·2	108·0
47	Waiamahasi ..	*Celtis philippinensis* ..	2	236	2·1	118	0·66	0·4	54·0
48	Fishua	Indt.	1	115	1·0	115	0·35	0·2	108·0
49	Dekona	Indt.	1	36	0·3	36	0·09	0·2	108·0
50	Uva	*Aglaia elæagnoidea* ..	1	59	0·5	39	0·17	0·2	108·0
51	Habere	*Dracontomelum* sp.	3	264	2·4	88	0·75	0·7	36·0
52	.. .. ..	Indt.	2	168	1·5	84	0·48	0·4	54·0
53	Minhihi	*Sterculaceae*	1	59	0·5	59	0·17	0·2	108·0
54	Hoiata	Indt.	1	69	0·7	69	0·19	0·2	108·0
55	Veriveri	*Baccaurea* sp.	1	51	0·4	51	0·14	0·2	108·0
56	.. .. ..	Indt.	2	66	0·6	33	0·18	0·4	54·0
57	Asiru	*Cinnamomum massoia* ..	1	180	1·6	180	0·51	0·2	108·0
58	Biobio	*Garcinia assuga*	1	25	0·2	25	0·06	0·2	108·0
61	.. .. ..	Indt.	1	97	0·9	97	0·27	0·2	108·0
62	Manato	Indt.	8	509	4·7	63	1·44	1·8	14·0
64	Yata-ata ..	Indt.	4	362	3·3	90	1·03	0·9	27·0
66	Hawaranavea ..	*Dysoxylon* sp.	7	361	3·3	51	1·03	1·5	15·0
67	Bakua	*Sterculia affin S. edelfeltia* ..	3	177	1·6	59	0·50	0·7	36·0
68	Bado	*Eugenia* sp.	2	80	0·8	40	0·24	0·4	54·0
69	.. .. ..	Indt.	1	77	0·7	77	0·22	0·2	108·0
70	Agadava ..	Indt.	1	49	0·4	51	0·14	0·2	108·0
71	Motulu	Indt.	1	36	0·3	36	0·09	0·2	108·0
72	Kebo	Indt.	2	147	1·4	74	0·41	0·4	54·0
73	Moso	Indt.	1	64	0·6	64	0·18	0·2	108·0
75	Kabo	*Urticaceae*	1	69	0·7	69	0·19	0·2	108·0
77	.. .. ..	Indt.	2	80	0·8	40	0·24	0·4	54·0
78	.. .. ..	Indt.	2	152	1·4	76	0·43	0·4	54·0
79	Tokobio	*Cryptocarya* sp.	3	179	1·6	59	0·51	0·7	36·0
80	Tua	*Gnetum gnemon affin* ..	1	59	0·5	59	0·17	0·2	108·0
		Total	437	35,209	325·0	80	100·	100·	..

the 108 acres was only 437, which makes a little over four trees to the acre. Turning to the three columns of cubic contents it will be seen that the total is 35,209, which gives us an average of 325 cubic feet to the acre and 80 cubic feet per tree. Excluding species represented by too small a number of trees to make the figure a fair one, the cubic content of all the trees is low. This was to be expected for the height growth of the forest was low. Devoru—No. 29—shows an average of 164 cubic feet, but this is not high; for this species in better localities, grows bigger. The next two columns show the comparison between the species, and the whole stand on the 180 acres. It will be seen that only six species out of the 69 carry 5 per cent. or over of the total volume. while in number no species has more than 9.6 of the total stocking. The mixture in the Veimauri Forest is greater than in any I have surveyed. I ascribe it to the influence of the dry belt; penetrate a very short distance east and west, and savannah forest covers the land. It has a marked dry season, and a number of dry land and gully species have established themselves in the rain forests. Mokeke (*Albizzia*) is a good case; Vari (*Bombax malabaricum*) occurs in this forest, but did not fall within any of the strips. A number of species appear to be confined to this district, for I failed to find them elsewhere. Uri (*Garuga* sp.)—becomes a very common tree on the higher rocky hills, and though this species occurs even in the Delta division, I nowhere found it growing under the same semi-savannah forest conditions as in the dry belt. When the timber of these hilly parts, and they form the larger portion of the forests in this locality, is compared with that on the alluvial ground, we find the comparison is much against the hill timber. which goes as low as 114 cubic feet to the acre at the worst, and only averages 230, while the timber on the flat runs at its best 835 cubic feet to the acre, and averages 420 cubic feet.

I am afraid that, from a commercial stand-point, the whole area is of little value, except for local requirements, when the timber could be pit sawn Tables 2 and 3 show the data regarding the better represented species, and the more valuable species respectively. For information as to the qualities of the timbers, see section VI. No. 9—the toon cedar of India or red cedar of Queensland—is doubtless a valuable wood; but, is it worth considering here, where it only runs a little over a quarter of one cubic foot per acre? No. 1—damoni—is a good walnut substitute, and No. 10—melila—has probably the best reputation of any New Guinea wood, because it is durable in the ground. No. 13—sihu—might prove useful for match making; No. 20—uri—has a good brown heart, and would make good furniture. Kaeda is a sound hard wood, useful for structural work, but othewise not remarkable. No. 29—devoru—is a useful inside lining wood.

Of the valuable species that come under the 5 per cent. line, No. 4—nara—is the most beautiful timber; then comes No. 3—medobi—the silky teak, as it has been named in the trade. This is a particularly pleasing timber, and would, I am confident, find a

ready market in Europe. No. 5—okamu—comes next in order of merit; it has proved a useful timber for boat planking. No. 36—okaka—is a general purpose wood that works easily.

Table II.

Veimauri Forest—108 acres of strips.

Predominant Species, viz: 5% or over of total cubic contents.

No.	Local Name.	Scientific Name.	No. of Trees.	Cubic Contents.	Volume per Acre.	Percentages of Total Cubic Contents.
						%
1	Damoni	*Dracontomelum mangiferum*	42	2,957	27	8·39
2	Kaeda	*Planchonia timorensis*	41	4,545	42	12·91
13	Sihu ..	*Pterocymbium* sp.	29	2,739	25	7·77
20	Huri ..	*Garuga* sp. ..	29	2,611	24	7·41
29	Devoru	*Alstonia scholaris* ..	14	2,297	21	6·51
10	Melila	*Afzelia bijuga* ..	34	1,829	17	5·81
			199	16,978	157	45·00

Table III.

Valuable species not included above.

No.	Local Name.	Scientific Name.	No. of Trees.	Cubic Contents	Volume per Acre.	Percentages of Total Cubic Contents.
						%
3	Medobi	Indt.	13	1,704	15·0	4·83
9	Epi ..	*Cedrela toona* var. *australia*	1	99	0·9	0·27
4	Nara ..	*Pterocarpus indicus*	3	136	1·2	0·38
5	Okamu	*Pometia pinnata* ..	14	1,168	10·8	3·31
36	Okaka	*Terminalia catappoides*	4	484	4·3	1·37

It is interesting to note that in these Veimauri strips only two ilimos were met with. In surveys of other rain forests this tree is generally better represented.

Forest between Veimauri and Veiya Rivers.

A small patch of timber remains between these two rivers. It is a tract of level alluvial country, which, at the lower end is swampy, but at the upper it is well enough drained to carry big timber. Four hundred acres of it are under coco-nuts; the remainder is forest. No. 1—damoni—is the most common tree—no less than 36 per cent. of the stocking belonging to this species. In other respects it is very similar forest to that found on the Veimauri, wherever flat country is met with. I found five fresh timber trees, of which No. 84—otuni *Sloanea paradisiarum*—is a hardwood tree with a wide range.

Forests of the Vanapa.

Taking the track from Veiya Village to Doura, one passes alongside the Vanapa River, but the timber on the banks has mostly been cleared for farming purposes, and now, where there are not gardens and crops, there are heavy stands of those weed trees that spring up once such country is left fallow. A description of these re-growth forests is given later, when dealing with the Northern Division. On the Vanapa the areas are small, owing, doubtless, to the sparseness of the population. Between the patches of re-growth, there are remnants of the rain forest and patches of ilimo; but it is not till Doura Village is passed that the areas of forest become large, and the garden lands altogether insignificant. The river is navigable by launch for 6 miles above the village, and here was situated the upper camp of the hands employed felling for the mill. Above this camp the river becomes too shallow for a launch, but it is still floatable for logs in the north-west season. The forest on the left bank was first examined. A preliminary inspection showed that the timber in rain forest formation did not extend far from the river. At a depth of three-quarters of a mile the trees become stunted, and degenerated gradually into light pole woods; at 1½ miles the savannah forest appeared, and this stretched across with islands of swamp land to within 1½ miles of the Brown River, where timber was again met with, gradually improving to the bank of the river, where there are some good stands of ilimo. The left bank of the Vanapa at this point is only clothed with a narrow strip of timber. The summary of data computed from the field books is given in Tables IV., V. and VI. I estimate the area of forest that is of this type, and therefore represented by the strips measured, at 2,500 acres, and the area of the strips was 67 acres, or 2.6 per cent. It will be seen that out of a total stand of 308 mill logs, cubing 35,873 feet on the 67 acres, 59 per cent. of the trees and 64 per cent. of the volume are represented by and contained in seven species; and each of them contains more than 5 per cent. of the total cubic contents. Of the more valuable species below the 5 per cent. line nara is most numerous, but the cubic contents per tree is low. It will be seen that two cedars were met with, and two silky teaks. Twelve new species were found here, but a number of the Veimauri trees were missing; the distribution of ilimo was in patches. In one strip of 3 acres, I found fourteen ilimo and four other species. In another of 8 acres I found eleven ilimo and fourteen other species. These two patches of ilimo represent over 4,000 cubic feet of timber, and therefore had a very marked effect on the total figures. By taking a strip along the river within 5 chains of the bank, a stand of 950 cubic feet can be measured. With a strip parallel to the first, and 25 chains deep, the stand falls to about one half, while, 45 chains back from the bank, the stand is barely 100 cubic feet to the acre.

The configuration of the country on the right bank is more hilly, and a camp was selected 5 miles higher up to enable a strip survey to be made of this type. A preliminary inspection showed this country to consist of a narrow strip of alluvial ground made by the river, and behind this, exceedingly rocky hills, rising to 400 and 500 feet at first, and then, as one ascended the river, to 1,000 and 1,500 feet. The alluvial strip, at every convex bend, was cut in two by a spur of a hill.

TABLE IV.

SURVEY OF THE FORESTS ON THE LEFT BANK OF THE VANAPA RIVER.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
1	Damoni	*Dracontomelum mangiferum* ..	37	2,610	39·0	70·5	7·26	12·00	2·0
2	Kaeda	*Planchonia timorensis* ..	10	672	10·0	67·5	1·88	3·24	7·0
3	Medobi	Indt.	2	157	2·5	78·5	0·43	0·65	33·0
4	Nara	*Pterocarpus indicus* ..	13	927	14·0	71·0	2·60	4·21	5·0
5	Okamu	*Pometia pinnata*	21	2,576	38·0	123·0	7·20	6·80	3·5
6	Memenia ..	*Artocarpus* sp.	1	90	1·5	90·0	0·25	0·32	67·0
7	Okoia	Indt.	1	160	2·5	160·0	0·44	0·32	67·0
9	Eti	*Cedrelia toona var australis* ..	2	274	4·0	137·0	0·75	0·65	33·0
11	Manoi	Indt.	5	584	8·5	117·0	1·63	1·60	13·0
13	Sihu	*Pterocymbium* sp.	23	4,008	60·0	174·0	11·19	7·45	3·0
15	Pidina	*Flindersia* sp.	2	315	4·5	157·0	0·88	0·65	33·0
19	Sabi	*Sarcocephalus cordatus* ..	7	581	8·5	83·0	1·62	2·26	10·0
20	Uri	*Garuga* sp.	31	3,422	51·0	110·0	9·51	10·05	2·0
24	Kobura	*Pterygota forbesii Fv.M.* ..	4	323	5·0	81·0	0·88	1·29	17·0
27	Uri	*Garuga* sp.	2	117	1·5	58·0	0·31	0·65	33·0
29	Devoru	*Alstonia scholaris*	21	3,293	49·0	157·0	8·92	6·81	3·5
31	Toto	*Thespesia populnea* ..	8	707	10·5	88·0	1·98	2·59	8·0
33	Bara	*Diospyros* sp.	3	163	2·5	54·0	0·45	0·97	22·0
34	Ilimo	*Octomeles sumatrana* ..	34	4,974	74·0	146·0	13·90	11·10	2·0
36	Okaka	*Terminalia catappoides* ..	13	2,212	33·0	170·0	6·20	4·21	5·0
43	Kwara	*Myristica* sp.	2	190	3·0	95·0	0·54	0·65	33·0
47	Waiamahasi ..	*Celtis philippinensis* ..	11	409	6·0	82·0	1·20	3·52	13·0
48	Fishua	Indt.	1	20	0·33	20·0	0·05	0·32	67·0
49	Dekona	Indt.	3	230	3·5	77·0	0·64	0·97	22·0
51	Habere	*Dractomelum* sp.	11	833	12·5	76·0	2·33	3·52	6·0
57	Asiru	*Cinamomum massoia* ..	2	171	2·5	85·0	0·48	0·65	33·0
59	Waranoka ..	Indt.	1	78	1·0	78·0	0·21	0·32	67·0
63	Amausi	*Cordia* sp.	3	269	4·0	89·0	0·75	0·97	22·0
71	Motulu	Indt.	1	240	4·0	240·0	0·66	0·32	67·0
82	Agi	*Vitex* sp.	1	29	0·5	29·0	0·08	0·32	67·0
83	Oi	Indt.	1	57	0·66	57·0	0·15	0·32	67·0
84	Otuni	*Sloanea paradisiarum* ..	6	453	7·0	75·0	1·24	1·95	11·0
85	Napera	*Heritiera littoralis*	1	98	1·5	98·0	0·27	0·32	67·0
86	Bovida	Indt.	5	507	1·5	101·0	1·42	1·62	13·0
88	Tumuna	Indt.	2	281	4·0	140·0	0·78	0·65	33·0
89	Maita-Maita ..	*Eugenia* sp.	2	108	1·5	54·0	0·28	0·65	33·0
90	Kiloe	*Meliaceae*	3	546	8·0	182·0	1·52	0·95	22·0
91	Ano-Ano ..	Indt.	4	170	2·5	42·0	0·47	1·29	17·0
92	Bisi-Bisi	*Eugenia* sp.	1	98	1·5	98·0	0·27	0·32	67·0
94	Arupi	Indt.	6	547	8·0	91·0	1·52	1·95	11·0
96	Sekeri	*Artocarpus incisa*	2	75	1·0	37·0	0·21	0·62	33·0
97	Yuwa	*Ficus* sp.	2	218	3·0	109·0	0·58	0·62	33·0
99	Keroni	Indt.	1	110	1·5	110·0	0·30	0·32	67·0
100	Asimagani ..	Indt.	1	115	1·5	115·0	0·30	0·32	67·0
101	Wasina	Indt.	1	141	2·0	141·0	0·39	0·32	67·0
		Total	308	35,873	577·0	125·0	100·00	100·00	..

TABLE V.

FORESTS ON LEFT BANK OF VANAPA.

Predominant Species, viz., 5 per cent. and over of the Total Volume.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
34	Ilimo	*Octomeles sumatrana* ..	34	4,974	74	146·0	13·90	11·10	2·0
13	Sihu	*Pterocymbium* sp.	23	4,008	60	174·0	11·19	7·45	3·0
20	Uri	*Garuga*	31	3,422	51	110·0	9·51	10·05	2·0
29	Devoru	*Alstonia scholaris*	21	3,293	49	157·0	8·92	6·81	3·5
1	Damoni	*Dracontomelum mangiferum* ..	37	2,610	39	70·5	7·26	12·00	2·0
5	Okamu	*Pometia pinnata*	21	2,576	38	123·0	7·20	6·80	3·5
36	Okaka	*Terminalia catappoides* ..	13	2,212	33	170·0	6·20	4·21	5·0
		Total	180	23,095	344	128	64·00	59·00	..

TABLE VI.

FORESTS ON LEFT BANK OF VENAPA.

Valuable Species not included in Table V.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
4	Nara	*Pterocarpus indicus* ..	13	927	14·0	71·0	2·60	4·21	5
9	Eti	*Cedrela toona var. australis* ..	2	274	4·0	137·0	0·75	0·65	33
3	Medobi	Indt.	2	157	2·5	78·5	0·43	0·65	33
		Total	17	1,358	20·5	79·5	..	..	..

In other parts it was traversed by little and big streams, confluents of the main river, and now and then by small swamps. When well drained, and not too rocky, fair stands of timber were met with. Here it was I encountered heavy ilimo stands, and the one I have summarized on page 7 occurred near my second camp. Rising from the alluvial country up the hills, the timber gets smaller and more scattered; at 1,500 feet a number of new species are met with, and the forest, while still of a rain forest type, now contains a fewer number of species, and here acorns begin to be seen scattered on the ground; this is the beginning of the oak forests.

The close proximity of the hills makes the area of typical alluvial-soil-rain-forest small. The strip survey was carried out in such a way as to take in all the alluvial flat, and a long narrow strip up the hill slopes. The survey, which covered an area of 104 acres, may be taken as representing 2,000 acres of the same type of forest. The data will be found in Tables VII., VIII., and IX. It will be seen that the strips contained 55 different species, of which seventeen had not been met with before. There were 268 trees, 6 feet girth and over, in all; and these contained 45,326 cubic feet of timber, which works out at an average of 435 cubic feet per acre, and 169 cubic feet per tree. Turning to Table VIII. we find that, of the species each representing more than 5 per cent of the total cubic contents, ilimo comes first with 41 trees, cubing 14,245; medobi second; sihu third, and okaka fourth. Together these four species, though only represented by 84 trees—or 31 per cent. of the growing stock—contain over 50 per cent. of the total cubic contents of the stand. Of valuable species, nara and ete are of special interest, though the former is small in volume per tree, and the latter comparatively rare.

How are the various species that make up the growing stock of the forest divided between the alluvial land by the river banks and the hills? The answer to this question, unfortunately, reveals a state of affairs which makes the commercial working of the forests on this part of the Vanapa a precarious venture.

TABLE VII.

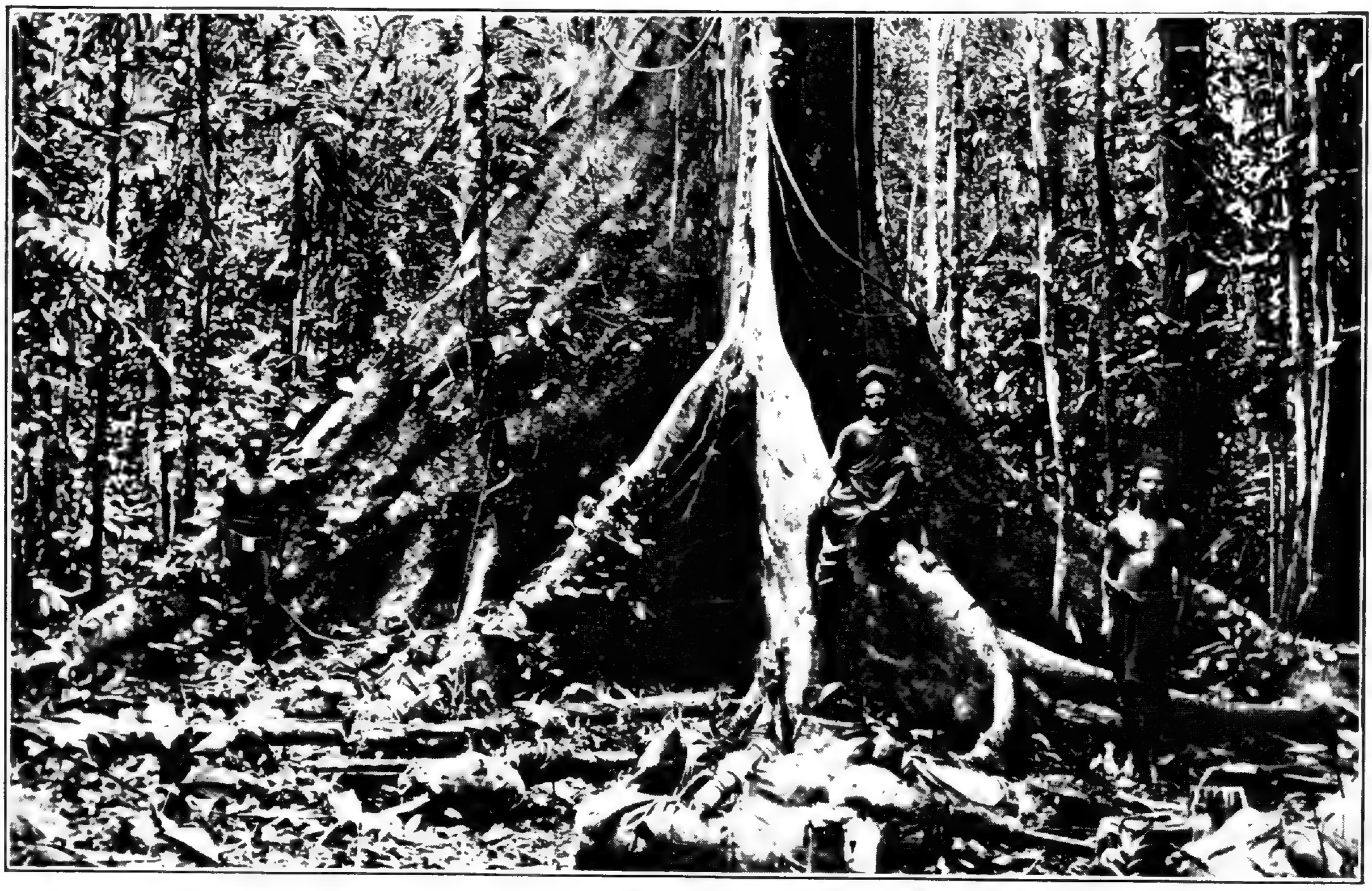
SURVEY OF FORESTS ON RIGHT BANK OF VANAPA.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
1	Damoni	*Dracontomelum mangiferum* ..	10	810	7·7	81	1·76	3·73	11·5
2	Kaeda	*Planchonia timorensis* ..	11	843	8·0	76	1·87	4·10	10·4
3	Medobi	Indt.	19	3,574	34·3	183	7·87	7·09	5·5
4	Nara	*Pterocarpus indicus* ..	17	1,216	11·7	71	2·69	5·34	6·1
5	Okamu	*Pometia pinnata*	2	263	2·5	131	0·50	0·74	52·0
6	Meneia	*Artocarpus* sp.	6	936	9·0	156	2·00	2·23	17·3
7	Okoia	Indt.	1	110	1·0	110	0·25	0·37	104·0
9	Eti	*Cedrela toona var australis* ..	6	752	7·2	126	1·59	2·23	17·3
13	Sihu	*Pterocymbium* sp.	14	3,112	29·8	222	6·84	5·22	10·0
15	Pidina	*Flindersia* sp.	1	157	1·5	157	0·33	0·37	104·0
19	Sabi	*Sarcocephalus cordatus* ..	6	1,261	12·0	210	2·77	2·23	17·3
20	Uri	*Garuga* sp.	13	1,800	18·2	139	3·96	4·75	40·2
22	Animore	*Horsfieldia silvestris* ..	1	57	0·5	57	0·11	0·37	104·0
24	Kobura	*Pterygota forbesii Fv.M.* ..	6	658	6·3	109	1·37	2·23	17·0
25	Homeda	Indt.	3	493	4·7	164	1·00	1·12	34·0
26	Mokeke	*Albizzia* sp.	4	486	4·6	121	1·06	1·49	26·0
27	Uri	*Garuga* sp.	2	162	1·5	81	0·34	0·74	52·0
29	Devoru	*Alstonia scholaris*	5	883	8·5	166	1·93	1·86	21·0
31	Toto	*Thespesia populnea*	3	619	5·9	206	1·37	1·12	34·0
32	Kia	Indt.	3	158	1·5	52	0·33	1·12	34·0
34	Ilimo	*Octomeles sumatrana* ..	41	14,246	136·9	347	31·43	15·29	2·5
35	Kue	Indt.	1	50	0·5	50	0·11	0·37	104·0
36	Okaka	*Terminalia affin T. okari* ..	10	2,586	25·0	258	5·69	3·73	10·0
37	Kibore	Indt.	1	154	1·5	154	0·33	0·37	104·0
42	Mohu	*Ficus* sp.	1	54	0·5	54	0·11	0·37	104·0
51	Habere	*Dracontomalum* sp.	24	1,853	1·8	77	4·07	8·95	4·3
54	Hoiata	Indt.	1	200	1·6	200	0·44	0·37	104·0
57	Asiru	*Cinamomum massoia* ..	2	159	1·5	79	0·33	0·74	52·0
64	Yata-Yata ..	Indt.	1	43	0·4	43	0·04	0·37	104·0
67	Bakua	*Sterculia affin. S. edelfeltia* ..	1	84	0·8	84	0·18	0·37	104·0
72	Kebo	Indt.	1	157	1·5	157	0·33	0·37	104·0
74	Vanea	*Sterculaceæ* Indt.	1	101	1·0	101	0·22	0·37	104·0
76	Tavili	Indt.	3	662	6·3	221	1·38	1·12	34.0
82	Agi	*Vitex* sp.	3	315	3·0	105	0·68	1·12	34·0
85	Napera	*Heritiera littoralis*	2	218	2·0	109	0·48	0·74	52·0
86	Bovida	Indt.	3	422	4·0	107	0·92	1·12	34·0
91	Ano-Ano ..	Indt.	2	119	1·1	59	0·25	0·74	52·0
94	Arubi	Indt.	1	102	1·0	102	0·22	0·37	104·0
104	Kevao	*Ficus* sp.	1	392	3·7	392	0·87	0·37	104·0
105	.. .. ..	*Lagerstroemia* sp.	3	312	3·0	104	1·38	1·12	34·0
106	Otuiabiahuna ..	Indt.	2	362	3·8	181	0·78	0·74	52·0
107	.. .. ..	Indt.	1	121	1·1	121	0·26	0·37	104·0
108	Fitogo	Indt.	4	487	4·6	122	1·06	1·49	26·0
109	Nomutu	Indt.	1	179	1·7	179	0·38	0·37	104·0
110	Namoa	*Celtis* sp.	1	900	8·6	900	1·98	0·37	104·0
112	Demo	*Dipterocarpaceæ* Indt. ..	6	952	9·1	109	2·09	2·23	17·0
113	Kokaka-pilopilo ..	*Affin. Hopea papuana* ..	2	125	1·2	62	0·27	0·74	52·0
114	Godita	Indt.	1	227	2·1	227	0·49	0·37	104·0
115	Moka	*Garcinia Hollrungii* ..	1	73	0·7	73	0·16	0·37	104·0
116	Neru	*Guttiferae*	1	58	0·5	58	0·12	0·37	104·0
117	Koroba	*Quercus pseudo-molucca* ..	1	30	0·3	37	0·07	0·37	104·0
118	Supu	Indt.	2	157	1·5	78	0·33	0·74	52·0
119	Tikona	Indt.	2	213	2·0	106	0·46	0·74	52·0
120	Ooka	*Sapotaceae*	4	467	4·5	117	1·00	1·49	26·0
121	.. .. ..	*Eugenia* sp.	1	154	1·5	154	0·33	0·37	104·0
		Total	268	45,326	435·0	169	100·00	100·00	

A young Ilimo (*Octomeles sumatrana*). (See page 7.)

[*To face page* 12.]

Eugenia syzygium. (See page 32.)



[*Photo by E. R. Stanley.*

Ilimo Butt, showing wide buttresses. Ilimo (*Octomeles sumatrana*).

[*Photo by J. Burdon.*

Cutting out a canoe from a log of Ilimo.

[*To face page* 13.]

TABLE VIII.

FORESTS ON RIGHT BANK OF VANAPA RIVER.

Predominant Species, viz., over 5 per cent. of the Total Volume.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
34	Ilimo	*Octomeles sumatrana* ..	41	14,246	137	347	31·43	15·29	2·5
3	Medobi	Indt.	19	3,574	34	183	7·87	7·09	5·5
13	Sihu	*Pterocymbium* sp.	14	3,112	30	222	6·84	5·22	7·5
36	Okaka	*Terminalia catappoides* ..	10	2,586	25	258	5·69	3·73	10·0
		Total	84	23,518	226	280	52·00	31·00	..

TABLE IX.

VALUABLE SPECIES NOT INCLUDED IN TABLE VIII.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	Total Cubic Contents.	Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
4	Nara	*Pterocarpus indicus* ..	17	1,216	12	71	2·69	5·34	6·1
9	Eti	*Cedrela toona var. australis* ..	6	752	7	126	1·59	2·23	17·3
		Total .. :	23	1,968	19	197	..	..	

Traverse A was taken parallel to the bank of the river going up stream, and mainly on flat country. The strip covered 30 acres, carrying 94 trees, cubing 14,792 feet.

Traverse B was taken in the same type of country as A, but going down stream. The strip covered 8 acres and contained 62 trees, cubing 17,077 feet.

Traverse C was taken up a ridge over the top and down to the Toiva River—a confluent of the Vanapa. The strip covered 66 acres, contained 112 trees, cubing 13,457 feet.

Summarizing the above three strips, we have—

—	Acres.	Trees.	Cubic Feet.
Forests on alluvial	38	156	31,869
Forests on hills	66	112	14,457
Total	104	268	45,326

—	Contents.		Trees. Per Acre.	Percentages.	
	Per Acre.	Per Tree.		Contents.	Trees.
				%	%
Forests on alluvial ..	839	204	4·1	70·0	58·0
Forests on hills ..	204	120	1·7	30·0	42·0

These figures speak for themselves, and should any more evidence be desired regarding the very unequal distribution throughout this area, I would point to the fact that Traverse B is our sample ilimo stand already summarized in table on page 7. Setting out the ilimo alone, we have:—34 ilimo, 14,130 cubic feet. 1,766 cubic feet per acre; 31 per cent. of the total cubic content, and 12½ per cent. of the total number of trees; 4¼ trees to the acre, and 415 cubic feet per tree.

Without this 8 acres of ilimo the strip survey would have shown a forest of doubtful commercial value, and this is, I am afraid, the estimate we must accept.

FORESTS ON THE BANKS OF THE AROA RIVER.

The Aroa River runs more or less parallel with the Vanapa River, but some 10 miles to the westward. It is in comparison a small river, and its grade is such that it is shallow, and cannot be used for floating logs, except when in high flood. An inspection was made of the timber growing along both banks for a distance of 8½ miles. The forest proved uninteresting both from a commercial and sylvicultural standpoint. There were not the same deposits of alluvium, while the little hills lower down and the bigger ones higher up, were as disappointing as those on the Vanapa. The following new trees were met with:—

122, Meia (*Barringtonia Forbessi*, Bak. fil.)
123, Yokokoro (*Lucuma* sp.).
124, Ivina (Indt.).
125, Vasapa (*Pleiogynium solandri*).
126, Ono (*Aleurites moluccana*).
127, ? (*Dysoxylum* sp.).
128, Kuve (*Pisonia Brunonia*).
129, Koka (Indt.).
130, Bio Bio, No. 2 (*Garcinia* sp.).
131, Maita-maita (*Eugenia* sp.).
132, ? (*Aglaia obliqua*).

From a hill between Lolorua and Rorona Plantations an excellent view of the district is obtained. The hill itself and the plain to the sea is all savannah forest, and it is only with difficulty that you can place the flora in New Guinea, so much does it resemble that of Australia. It is only along the alluvial banks of the rivers, and in the hollows, that rain forest occurs. Behind to the north-east rise hill after hill, up and up to the mountains that form the Owen Stanley Range, and all these hills are clothed with woody growth, which, at this distance, appears as large as the tall trees of the rain forests of the river banks. The hollows and creek banks carry some good stands of No. 3—medobi—which is probably commoner here than

in any part of the Central Division; it does not occur in other parts of Papua; otherwise these patches have little interest economically, except for the supply of timber to the plantations for building and other purposes.

Forests of the Northern Division.

Between the sea coast on the east, the Kumusi River on the north and west, and Mount Lamington and the Hydrographer's Range on the south, lies a large area of alluvial land. It is intersected by several rivers and numerous creeks, and near the sea coast many low-lying areas occur, which, if within reach of the tidal waters, carry mangrove associations, and, if more inland, carry the usual fresh water swamp flora. The soil is a deep rich sandy loam of great depth, and is very satisfactory agricultural land. From sea level it rises very gently to between 600 and 800 feet at its inland boundary. It is well drained or easily drainable. The rainfall is very satisfactory—an average of 113 inches a year—and the climate, from the point of view of equable temperatures and absence of desiccating winds, is all that could be desired for the growth of tall timber trees in rain forest formation.

At one time the whole of this area was covered with such a forest, but to-day there are but a few islands left in a sea of grass lands. The little patches of virgin forest give one some idea of the magnificence of the original stand everywhere. From what Whitford,(1) Brown,(2) and Matthews have written on the subject of the Philippine dipterocarp forests, the Buna plain forests must have approached nearer to that type than to the forest of the western side of Papua, which probably approach more closely to the Queensland type of forest. While Papua never boasted the assortment of dipterocarps that the Philippines possess, one tree of this family is so common as to vie with *Pometia pinnata* for supremacy in numbers, while in cubic contents to the acre it easily stands first.

It is inevitable that so rich an agricultural area in the tropics should be converted from forest into grass lands by the natives. These have but one system of agriculture, which is by no means restricted to Papua, but prevails right throughout the tropics wherever the native has not yet learned the use of the plough to cultivate his land to a depth. His system is to cut down the timber, and burn it, and on the land thus cleared his wife plants his crops of taro, sweet potatoes, and yams, with here and there a paper mulberry to yield the family a wardrobe; a few bananas and some pawpaws complete the picture. When he has reaped his tuber crop, he will replant the area, and this he may repeat four times, by which time he finds the soil no longer yields the same return. His lightly-scratched garden is exhausted. He must now find new ground for his farming operations, and so he lets his first garden go fallow, and picks out another patch of forest not too far away, and this he treats like the first. So, little by little, patch by patch, he turns the forest into food crops. The land left fallow does not become grass land at once, nor does it grow a crop of rain forest trees. Just as in Australia, an abandoned vegetable bed grows, first of all, a crop of weeds, so the fallow garden land of the Buna plains, and for that matter all other alluvial lands, grows a crop of weed trees. Like your southern garden weed, they are all strong light-demanders, they grow extraordinarily quickly and thickly, covering up the land in a very short time with an almost inpenetrable thicket of saplings. The natives call these "light woods"; they use lengths of them as shoulder poles, under which the cheerful Orokaivas sing their way along the trail, bearing a two men's load. The decking of canoes is made of it, and it supplies the bulk of the domestic fuel used. If you are baking bread, it is advisable not to use this weed timber, for there is no heat in it, and half the quantity of No. 5 (okamu or koiawo) will go a great deal further. All the rafters of houses are made of "lightwood," and most of the joists, but the native likes to see some stronger poles for his floor supports. The rafters are soon honeycombed with the galleries of the carpenter bee, who rivals the great mason wasps as an indefatigable worker. For all these uses the weed trees serve excellently, for the shoulder pole has only to last its journey; the canoe decking is always being renewed, and lightness is a much more important factor than durability here; the native fire is either a quick-cooking one or a smouldering mosquito smudge; while the rafters always outlast the underposts of his home. So these regrowth forests must not be written down as worthless. It will be interesting to test the wood of the varius species that make up these formations to see if any have a long enough fibre for the manufacture of such low grade material as news print. Many of them grow so fast that poles 25 feet long and 4-5 inches in diameter could be supplied in six years. Here are the names(1) of some of the commonest of these weed trees and some shrubs and climbers that come up with them:—

No. 164	Gibore ..	Tree ..	*Macaranga riparia.*
165	Ose ..	Shrubby Tree	*Saurauja schumanniana.*
166A	Gega ..	Tree ..	*Macaranga* sp.
167	Ongesa ..	Shrubby Tree	*Geunsia farinosa.*
168	Gurega ..	Tree ..	*Pipurus incanus.*
169	Oiela ..	Tree ..	*Alphitonia moluccana.*
171	Penbagi ..	Shrubby Tree	*Clerodendron tracyanum.*
177	Kureri ..	Climber ..	*Rubus moluacanus.*
179	Tutura Tatara	Climber ..	*Clematis Pickeringii.*
182	Ombara ..	Tree ..	*Kleinhovia hospita.*

In addition there are several species of the genus *Ficus*

This regrowth forest of weed trees is the natural succession to the destroyed forest, and its life is comparatively short, its place being taken by a number of more permanent species which gradually make themselves conspicuous. They are probably there all the time, but are lost in a thicket of Alphitonia and other weed trees. Of these the Evodias, certain figs, terminalia, and the long follicled Alstonia are well to the fore These overtop the weed trees, rob them of light, and kill them. Beyond that, the sylviculture of the forest is difficult to follow, but eventually it returns to mixed rain forest, probably not with the same association of trees, possibly with some pure stands of heavily seeding varieties, and without several of the light seeding species, or those whose seed is neither borne by the wind nor carried by animals. Thus nature, in perhaps two or three centuries, re-establishes the forest conditions which the native has destroyed in a year. That nature does not achieve this object in all cases, however, is shown by the grass lands of the Buna plains. Here the native has beaten nature, and at the same time beaten himself.

Going back to our native who has made gardens all over the virgin forest in his locality: By this time seven to ten years have elapsed, and on his first garden is a fine stand of weed trees. So back he goes to where he first grew his crops, and he cuts down the weeds, and burns them. If he finds—as he generally does— specimens of either No. 36 (kauouia, as the Buna people call okaka), *Terminalia catappoides* or *Terminalia okari*, its cousin, that bears a better eating nut, he reserves them. He does the same for the bread fruit trees he finds, and genda, the cabbage tree (*Gnetum gnemon*). In all these cases he piles the brushwood away from their trunks, so as to give them a better chance of coming through the fire. Quite a number survive. The second rotation our native does not get quite what he got from his first crop off the virgin forest, but it is as good or better than the second; but he finds he cannot get the same number of crops from the soil this time. The weed trees have given him something but not all that

(1) Whitford, H. N.: Forest types and Products.
(2) Brown, W. H., and Matthews, D. N.: Philippine dipterocarp forests.

(1) The local names are those commonly used in Buna district; the language is a slightly corrupted Binandeli.

he took out in his first four crops, which owed their plentifulness to generations of humus. When he again abandons the area, a crop of weed trees springs up as before. There is no reason why he should not continue this process of a few crops, and letting the land lie fallow to grow a re-growth forest for seven years before he recrops it. Unfortunately, he finds he cannot get enough land—he is back at his first plot in a much shorter period than seven years. He has no alternative; the land no longer yields him the same number of successive crops; he has either to shift his village to new country, or work the old ground over at shorter intervals. Latterly, the Government itself, in its anxiety to see settled communal life, has placed obstacles in the path of the natives who wish to found a new village. The population grows; the land yields less, and the village must remain a fixed centre. When the native reduces the interval between his crops sufficiently to give the regrowth too little time to restore the plant foods to grow a crop of potatoes or taro, grass comes in. Grass in ordinary competition with weed trees would stand no chance at all, but the native uses an agent which gives the grass a tremendous advantage over the tree—that is, fire. After the native has farmed a piece of soil worn out by the process I have described, he finds that his poor crop is replaced by weed trees and grasses. When dry weather sets in during the S.E. season, he fires this to drive out the wallaby, and the baby weed trees are killed. The grass is burnt, but its roots are untouched, and it comes up again, to be burnt once more. Year by year the area of this grass land increases; it takes up a few yards of regrowth each burn, and, once gained, the grass land maintains its hold. In a little while large numbers of such patches of grass become linked up, and there remain only thin chains of rain forest, either too narrow to farm, or along some water-course, and too wet to burn, or reserved by the community for tribal ceremonial, or for superstitious reasons. Were the native to forego burning the grass lands for a few years, the weed trees would doubtless re-establish themselves, for in such soil, and with such excellent climatic conditions of environment, woodlands have a decided advantage over grass lands. As it is, the Buna Plains to-day consist of artificially created grass lands, with narrow belts, fringes, and chains of rain forest. These are either naturally protected through their situation or artificially protected by man. From an agricultural point of view, the native with his present primitive farming implements and notions cannot cultivate the grass country; so that, even without any great increase in the population, there is the making of a serious land problem for the Orokaiva people. The cessation under British Government of all inter-tribal warfare has accentuated the difficulty, for the native's mind is no longer anxious as to whether he or another will reap the crop he sows, or as to whether the village will exist in a year's time. There are in all probability also more mouths to feed than in the old days. This disappearance of rain forest conditions, and the establishment of grass lands, occurs throughout the tropics where shifting cultivation by natives is resorted to, and fire is the agent used to clear up the brush and slash, and to drive out game.

In the Philippines such artificial grass lands and re-growth woodland is known as "Parang." (1) Brown describes the final conditions there as follows:—

> "When an area is burnt over regularly, the grasses form almost pure stands. With primitive methods of agriculture, the grasses get a good start even without fires, as their rhizomes are much harder to erradicate than are dicotyledonous plants; but it is only where other plants are destroyed by fire that the grasses form extensive pure stands. If the grass is not burned, it is quickly invaded by second-growth trees. If no fire has occurred in an area for two or three years, small patches of trees may appear; but an area is rarely kept free from fire for a period sufficiently long to allow trees to cover it. The part left in grass is usually burnt over with fair regularity. The fires may kill the trees at the edges of the forest, or the occasional absence of fires may cause the trees to encroach upon the grass. Thus the parang persists for years—the trees at times gaining, at others losing ground. When they form a continuous forest, the land is frequently cleared again and cultivated, as such areas are much more easily put under cultivation than is grassland.
>
> When ground is cultivated intensively, or with modern methods, the grass does not take possession of it, but the shifting system of cultivation has been so widespread in the Philippines that, according to Whitford, 40 per cent. of the land area of the Archipelago is occupied by grass; $16\frac{2}{3}$ per cent. by second-growth forest; while only 10 per cent. is cultivated."

It will be a long time before the Papuan native develops better methods of agriculture, and in the meantime the utilization of the large areas of artifically created grass land is a serious problem. In the section dealing with plantations I have ventured to put forward a solution.

The Forests near Soputa.

While it is not possible to create in one's mind a precise idea of the nature of the forests which once spread over the whole of this flat area, an examination of the fringes of forest that still remain enables us to get a general impression of the silva of the district. Immediately behind Buna, along the Kokoda track, lies the hamlet of Soputa. Close to the Giruwa River, and about this part are a number of small areas of forest—some fringing the river, others around swampy ground. A strip survey embracing an area of 3 miles by 2 miles was carried out, and the summarized results will be found in Tables X., XI., and XII. The area included in the strips was—

(1) W. H. Brown: Vegetation of Philippine Mountains, pp. 18–19.

TABLE X.

Survey of Forests near Soputa in Northern Division.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	Total Cubic Contents.	Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
133	Digisi	*Aaglaia sapindina*	5	842	11·0	168	3·11	2·24	15·0
136	Karawa	*Anisoptera polyandra* ..	55	8,607	110·0	156	31·84	24·60	1·4
137	Dandike	*Rubiaceae*	22	2,965	38·0	135	10·97	9·80	3·6
138	Pegamba	*Couthovia brachyura* ..	7	1,039	13·0	148	3·84	3·10	32·0
140	Gnambo	Indt.	3	395	5·0	132	1·48	1·30	26·0
141	Konina	*Elaeocarpus novo-guiniensis* ..	1	460	6·0	460	1·71	0·44	78·0
142	Sisira	*Canarium lineistipula* ..	6	554	71·0	92	2·05	2·70	13·0
143	Dibaba	Indt.	2	258	3·0	129	0·95	0·90	39·0
144	Duduye	*Semecarpus* sp.	1	141	2·0	141	0·52	0·44	78·0

TABLE X.—*continued.*

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
145	Tato-o	*Vitex cofassus*	8	640	82·0	80	2·37	3·50	8·0
147	Sauma	*Endiandra* sp.	2	186	2·0	93	0·69	0·90	39·0
148	Susa	*Dysoxylon* sp.	4	388	5·0	97	1·43	1·80	19·0
149	Boan	Indt.	2	171	2·0	85	0·63	0·90	39·0
150	Koare	*Myristica* sp.	1	88	1·0	88	0·32	0·44	78·0
151	Lala	Indt.	3	343	4·5	114	1·27	1·30	26·0
152	Borua	Indt.	1	154	2·0	154	0·57	0·44	78·0
153	Bara	*Myristica* sp.	4	371	4·5	93	1·37	1·80	19·0
154	Akoua	Indt.	1	124	1·5	124	0·46	0·44	78·0
155	Bouye	Indt.	2	105	1·0	52	0·39	0·90	39·0
156	Tongoli	Indt.	2	149	2·0	74	0·53	0·90	39·0
157	Goro	Indt.	1	172	2·0	172	0·64	0·44	78·0
158	Aruru	*Sarcocephalus cordatus* ..	1	118	1·5	118	0·45	0·44	78·0
159	Moi-i	Indt.	1	128	1·5	128	0·47	0·44	78·0
160	Bakuma	Indt.	1	179	2·0	179	0·64	0·44	78·0
1	Damoni	*Dractomelum mangiferum* ..	14	1,108	14·0	79	4·09	6·30	16·0
2	Kaeda	*Planchonia timorensis* ..	3	101	1·0	34	0·37	1·30	26·0
4	Nara	*Pterocarpus indicus* ..	4	331	4·5	83	1·36	1·80	19·0
5	Okamu	*Pometia pinnata*	34	2,499	32·0	73	7·95	15·20	2·3
6	Meneia	*Artocarpus* sp.	2	492	6·0	246	1·84	0·90	39·0
10	Melila	*Afzelia bijuga*	2	147	2·0	73	0·43	0·90	39·0
13	Sihu	*Pterocymbium* sp.	3	446	6·0	155	1·65	1·30	26·0
19	Sabi	*Sarcocephalus cordatus* ..	2	345	4·5	177	1·31	0·90	39·0
29	Devoru	*Alstonia scholaris*	10	1,175	15·0	117	4·35	4·30	8·0
36	Okaka	*Terminalia catappoides* ..	4	497	6·0	124	1·85	1·80	19·0
47	Waiamahasi ..	*Celtis philippinensis* ..	9	1,018	13·0	113	3·76	4·00	9·0
		Total	223	26,826	344·0	120	100·00	100·00	0·35

TABLE XI.

Predominant Species, viz., 5 per cent. or over of the Total Volume.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
136	Karawa	*Anisoptera polyandra* ..	55	8,607	110	156	31·84	24·60	1·4
137	Dandike	*Rubiaceae*	22	2,965	38	135	10·97	9·80	3·6
5	Okamu	*Pometia pinnata*	34	2,499	32	73	7·95	15·20	2·3
		Total	111	14,071	180	..	50·76	49·60	0·7

TABLE XII.

Valuable Species not Included in XI.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
4	Nara	*Pterocarpus indicus* ..	4	331	4·5	83	1·36	1·80	19
10	Melila	*Afzelia bijuga*	2	147	2·0	73	0·43	0·90	39
		Total	6	478	6·5	..	..	..	..

Local Names—Galley Reach and Buna Equivalents.

No.	Galley Reach.	Buna.	No.	Galley Reach.	Buna.
1	Damoni ..	Onomba	13	Sihu	Husisi
2	Kaeda ..	Bibira	19	Sabi	Tiga
4	Nara ..	Taoro	29	Devoru ..	Didima
5	Okamu ..	Koiawo	36	Okaka ..	Kauouja
6	Menaia ..	Ogadi	47	Waiamahasi ..	Hanuma
10	Melila ..	Bendora			

78 acres, or 2.3 per cent. of the total area of this type of forest. It will be seen that the 78 acres of strips carried 35 species and 223 trees, 6 feet and over in girth at breast height, containing 26,826 cubic feet of sawn timber, or 344 cubic feet per acre, and 120 cubic feet per tree. The composition of this forest differs entirely from the Galley Reach types, although it looks much the same to the casual observer. It is rain forest, but the mixture of species is different. I found only eight out of the 132 Galley Reach species, and the remainder—27 species— were new to me. Of the old specimens, No. 5—okamu—is now among the predominant trees, but No. 1—damoni—has fallen back to the 4 per cent. mark, and the two other predominant trees are new ones. No. 29—devoru—and No. 47—waiamahasi—have also about the same representation. No. 13—sihu—which was predominant on the Vanapa, carries here only 1½ per cent. of the total volume, while No. 34—ilimo—is not represented at all.

The three predominant species account for 51 per cent. of the total cubic contents, and 50 per cent. of the number of trees. Of the three, the *dipterocarp* No. 136—karawa—is by far the most numerous, every fourth tree in the forest is a karawa. Nearly one-third of the total volume is accounted for by this species. Even so, there are not enough trees to give one mill-log to the acre; the average works out at ten trees on 14 acres. They are not so numerous as to strike the eye, and make one say, "This is a dipterocarp forest." If anything, No. 5—okamu—arrests the eye more—probably owing to its red-brown scrolled bark and its developed buttresses. Until he becomes familiar with No. 136—karawa—the forester is apt to confound it with a dozen other species, while akamu is quite distinct and very easily recognizable.

On the results of the census this type should be called a dipterocrap forest. It will be interesting to compare it with a dipterocarp forest of the Philippines. Brown and Matthews have described the various types of dipterocarp forests that occur there, and the following data have been extracted from the valuable work they have published.(1). In the forest of Northern Negros, the dipterocarps, which number five main species, are represented by 43 trees to the hectare, containing 425 cubic metres; while all the other genera are represented by 1.4 trees to the hectare containing 6.16 cubic metres. These figures include all species down to 60 centimetres in diameter. Reducing these figures to cubic feet to the acre, we find 17½ dipterocarps containing 6,074 cubic feet, and half a tree of other genera, cubing 188 feet. Expressed as a percentage these data read: Dipterocarps, 98 per cent. of trees and 98 per cent. of the volume.

In the Bataan forest the diameter classes were measured down to 30 centimetres in diameter, but again I extract only those of 60 centimetres diameter upwards; these correspond to the 6 feet and over mill logs of my Saputa strip survey. Here are the figures in English measurements:—Six and a half trees to the acre, 6 feet and over in girth (of which four and a half were dipterocarp), contained 1,186 cubic feet, of which the dipterocarps cubed 911 cubic feet. The mill log dipterocarps here represented 70 per cent. of the total number of trees, and 75 per cent. of the cubic contents.

The figures for the Northern Laguna forest work out as follows:—The dipterocarps represent 94 per cent. of the trees and 90 per cent. of the volume. The total number of trees per acre was six and a half, and cubed 1,262 feet. This forest has been cut over, and valuable species other than dipterocarps removed under a desultory system of selection, which accounts for a somewhat heavier percentage of dipterocarps of logging size. The volume per acre of another part of this forest worked out as follows:—1,786 cubic feet, of which other genera accounted for 114 cubic feet.

Setting out the Philippine data with those of the Soputa area we have—

District.	Total.		Dipterocarps.		Dipterocarp Percentage		Volume Per Tree.
	Trees Per Acre.	Volume Per Acre.	Trees Per Acre.	Volume Per Acre.	Trees.	Volume.	
					%	%	
Northern Negros	18·0	6,182	17·5	6,074	98	98	342
Bataan ..	6·5	1,186	4·5	.911	70	75	182
N. Laguna No. 1	6·5	1,262	6·0	1,135	94	90	192
N. Laguna No. 2	..	1,786	..	1,672	..	93	..
Saputo ..	2·7	344	0·7	110	31	24	156

The Papuan dipterocarp forest compare very unfavorably with the Philippine one. Matthews' volumes are solid cubic contents, and mine, which are based on 0.5 form factor, could, therefore, be scaled up 30 per cent. to 40 per cent.; even so, the total volume per acre is only 437 cubic feet, as compared with 6,000 cubic feet in the best stand, and 1,186 in the lowest stand measured. While the number of species of Dipterocarpaceae in the Soputa forest is reduced to one, the number of other species is 34. This is another serious disadvantage, for such mixed forests are exceedingly difficult to manage and very wasteful to work. When allowance is made for my low-form factor, the volume per tree does not differ much from the Papuan forest, except in the case of the Negros forests, which is of exceptionally good quality.

It will be seen that I have not included any new valuable species in table XII. It is quite possible that further examination of the new species found in Buna district will enable this list to be added to. In the meantime, until the timbers have been put to practical use, and so tested, I hesitate to add to the number of obviously valuable timbers. A description of the species and their timbers will be found in section VI.

After completing the work around Soputa I inspected all the country to the north of the Kakoda track as far as Hauhohambo, and so back via Sagario, and the Ointatandi path to Wasida. All this country has been, or is being, cleared by the natives for farming purposes. The areas of grass lands are very numerous indeed, and the fringes of timber are narrow and small. The sites of many abandoned villages in the centre of grass patches show the trend of affairs; the natives, having exhausted the land, have moved their villages to the forest. They are now protecting enough forest around their villages to give them shelter, shade, and a sanitary dépôt. Such reserves have become a necessity owing to the increase of the area under grass, and the Government prohibition regarding making new villages. From Wasida, a round of inspections was made south, towards Mount Lamington, and west, to the Kumusi. Here we approach hilly country, and the forests are, for the most part, farm re-growth. Alluvial land is confined to the gullies, and stony and gravelly hill slopes, carrying less timber, replace the heavier stands of the plains. Though the farming seems to have been carried out as intensely, the re-growth is decidedly a forest one. Here grass land has not the same advantage as on the plains, and the weed trees have no difficulty in holding their own. Only on very steep slopes, so steep as to make the root-hold of large woody plants impossible, does grass-land beat wood-land. Of timber, there is little to report, though the weed tree re-growth was interesting, and I was able to collect a fair amount of botanical material. The following list gives the native names, and, where possible, the

(1) Brown and Matthews: Dipterocarp Forests. *Philippine Journal of Science*, Vol. IX., Nos. 5 and 6, Sec. A.

scientific names of the species encountered since leaving Soputa:—

161, Pako—*Sideroxylon anteridiferum.*
162, Digisi—*Aglaia sapindina.*
166, Girida—*Breynia cernua.*
170, Ewa—*Mangifera minor.*
172, Tikina—*Schefflera.*
173, (?) —*Hydnophytum keiense.*
174, Gigino—*Adenanthera pavonina.*
175, Guguma—*Pavetta platyclada.*
178, Tangere—*Elaeocarpus sepikanus.*
180, (?) —*Lauranthus* sp.
181, Simbe—*Fagraea racemosa.*
183, Yandere—*Symplocos aggregata.*

Of these, Nos. 161, 162, 170, and 178 are large trees. The fruit of No. 170 is an edible mango. Nos. 166, 172, 175, 181, and 183 are small trees—undergrowth of rain forest. No. 174 is a medium-sized tree with a pretty wood. Nos. 173 and 180 are parasites on large trees. The Hydnophytum is a myrmecophilous plant with a large tuber which forms the attachment to the limbs or trunk of the host. This tuber attains sometimes 18 inches across and 8 inches through, it is channelled with galleries inside and inhabited by ants. What is the function of the ant in this symbiosis—generally called myrmecophily—is not known. Possibly the function of the tuber is to store moisture, and the ant plays no part in the life of the plant, except, perhaps, that of an enemy, drinking the stored water. This plant is one of the arresting objects of the rain forest—a grotesque excrescence. The other parasite, No. 180, is a mistletoe with a rather showy flower.

From Wasida I went to Ointatandi. After leaving the Wasida gardens, the path goes through some third-rate rain forest in a damp flat too wet for cultivation, and then threads its way through a succession of grass patches broken by narrow belts of rain forest. On reaching the Kumusi, near where Ointatandi is marked on the map—though in reality that village has now been moved some 9 miles further down the river—a strip of rain forest occurs. This follows the river down for 5½ miles until the gardens of another village are encountered, and a re-growth of weed trees has established itself. From Ointatandi I went across the Kumusi, following the Ioma path, and looked over the timber in the hilly country of the Opi River. I found nothing of special interest, the growth on the hill slopes being poor and the alluvial land scanty and usually farmed. The magistrate at Ioma advised me not to pursue my investigations in the direction of his district, as he knew of no good forest in that area. I turned back and examined the forest on the Kumusi already referred to. That this forest remains in spite of the healthy, vigorous population in the vicinity is because the land is low-lying and often inundated. The Kumusi here is a large river, 300 yards wide, and is subject to very rapid rises, owing, no doubt, to its great length and the fact that sudden heavy rainstorms are a feature of the mountain country where it finds its source. These rain storms at the head waters cause rises of several feet at Ointatandi, where there may have been no rain for several days. The forest is narrow—from 10 chains to half a mile deep from the river bank; its stocking is poor, and it is only because no other area of large timber was found in this part that a survey was made of it. The area of forest of this type is about 2,540 acres, and the area covered by the strip survey was just 100 acres, which gives us a relation of 4 per cent. The data are summarized in Tables XIII., XIV., and XV. It will be seen that the species total 47, and are represented by 398, containing in all 55,137 cubic feet of sawn timber, or 551 cubic feet per acre, and 138 cubic feet per tree. The forest, while better than that near Soputa, is still far from the Philippine standard, and it is no longer a dipterocarp one. Indeed, only two karawas (No. 156) were found. The predominant species in number is No. 5—okamu—with 29.6 per cent., though its average volume per tree is so low that it only carries a total of 12.5 per cent. of the cubic contents. Ilimo, which was unrepresented at Soputa, here makes up 21 per cent. of the total volume. Subtract these 11,656 cubic feet, and our cubic content is reduced to a smaller volume per acre than that found in the forest near Soputa. The Kumusi ilimo nowhere attains the good even, aged, almost pure stands of the Vanapa. Here and there groups of fine trees occur, but, for the most part, this species is well mixed with others. If a name were to be given to this type of wood-land, I think okamu forest would describe it best. As at Soputa, this tree is most conspicuous. The new species number nineteen, as follow:—

No. 184, Hangeni.—A large tree with a stercu-lacious wood.
No. 185, Och.—A large tree (*Elaeocarpus coma-tus*).
No. 186, Wuwura.—A medium-sized tree with an interlocked timber.
No. 187, Nininge.—A large fig, with a good straight bark. (*Ficus* sp.)
No. 188, Nahihi.—A large tree with alternate cordate leaves.
No. 189, Behoro.—A large tree with hairy, broad leaves. (*Ficus* sp.)
No. 190, Gongogo.—A large tree with an umbrella crown. (*Polyscias* sp.)
No. 191, Sesewa (*Barringtonia calyptrocalyx*).—A very common third-story tree with very beautiful pink flowers. There is a rarer variety with white flowers.
No. 192, Mongua.—A large tree (*Cryptocarya* sp.), yielding a sound wood.
No. 193, Busa.—A large, heavily-buttressed tree.
N. 194, Au-u-jo.—A large tree. (*Ficus* sp.)
No. 195, Onga.—A large tree yielding a soft light wood.
No. 196, Bofere.—A large tree with a brown-hearted wood.
No. 197, ———.—*Canarium pineistipuyla.*—A large tree with leaves.
No. 198, Kimina.—A good hardwood tree.
No. 199, ———.—A large tree with a pink-heart wood. It exudes latex.
No. 200, Ondodo.—A large tree that is hard to distinguish from 190 from a general stand-point, and whose timber has well defined soft tissue like No. 201. Its juvenile leaves attain 5 feet in length.
No. 201, Asawa.—A large tree. The leaves have deep axilla at the junction of petiole and branchlet.
No. 202, Sirua.—A large tree yielding the most commonly used canoe-building timber Northern Division. (*Campnosper-mum brevipetiolata.*)

Of these, none deserves very special remark here. The last, if there were enough of it in any part of this country, would be worth attention; it is a good soft wood.

Of the Galley Reach species not already found in the Northern Division, No. 34—ilimo—is the most important and valuable. No. 74—vanea—so much used by the Motuans for cordage, occurs, but is not used by the Binandele people. No. 94 is a hardwood. No. 57 (*Cinnamomum inassoia*) is the cinnamon tree—the same species which yielded the product that was exported in the old days under the name of Massoi bark. Beccari calls this tree *Massoia aromatica.* For fuller descriptions of the various species, see section VI. The Kumusi River

TABLE XIII.

SURVEY OF THE FORESTS ON THE KUMUSI RIVER.—(ABOVE OINTATANDI, N.D.)

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
1	Damoni	*Dracontomelum mangiferum* ..	14	1,349	13·45	96	2·44	3·51	7·1
4	Nara	*Pterocarpus indicus* ..	3	119	1·19	39	0·21	0·75	33·3
5	Okamu	*Pometia pinnata*	118	6,924	69·24	58	12·55	29·62	0·8
6	Meneia	*Artocarpus* sp.	1	59	0·59	59	0·11	0·25	100 0
10	Melila	*Afzelia bijuga*	1	124	1·24	124	0·22	0·25	100·0
19	Sabi	*Sarcocephalus cordatus* ..	3	484	4·84	161	0·88	0·75	33·3
29	Devoru	*Alstonia scholaris*	11	2,669	26·69	243	4·84	2·76	9·0
34	Ilimo	*Octomeles sumatrana* ..	43	11,655	116·55	271	21·13	10·79	2·9
47	Waiamahasi ..	*Celtis philippinensis* ..	10	2,044	20·44	204	3·71	2·51	10·0
57	Asiru	*Cinnamomum mazoia* ..	8	1,781	17·81	223	3·25	2·00	12·5
74	Vanea	*Sterculaceae* Indt.	7	1,240	12·40	177	2·25	1·75	14·3
94	Arubi	Indt.	2	256	2·56	128	0·46	0·50	50·0
36	Okaka	*Terminalia catappoides* ..	2	605	6·05	304	1·10	0·50	50·0
130	Bio-bio	*Garcinia* sp.	7	1,346	13·46	192	2·44	1·75	14·3
136	Karawa	*Anisoptora polyandra* ..	2	271	2·71	135	0·49	0·50	50·0
140	Gnambo	Indt.	6	654	6·54	109	1·18	1·50	15·8
142	Sisira	*Canarium lineistipula* ..	7	607	6·07	87	1·10	1·75	14·3
143	Dibaba	Indt.	21	3,539	35·39	168	5·41	5·27	4·9
144	Duduye	*Semecarpus* sp.	4	548	5·48	137	0·99	1·00	25·0
145	Tato	Indt.	7	744	7·44	106	1·25	1·75	14·3
147	Sauma	*Endiandra* sp.	3	230	2·30	77	0·42	0·75	33·3
149	Boan	Indt.	2	372	3·72	186	0·67	0·50	50·0
152	Borua	Indt.	2	387	3·87	198	0·70	0·50	50·0
153	Bara	*Myristica* sp.	1	69	0·69	69	0·12	0·25	100·0
156	Tongoli	Indt.	3	421	4·21	140	0·86	0·75	33·3
158	Aruru	*Sarcocephalus cordatus* ..	1	101	1·01	101	0·18	0 25	100·0
160	.. .. ..	Indt.	7	1,301	13·01	186	2·35	1·75	14·3
162	.. .. ..	*Aglaia sapindina*	12	2,305	23·05	192	4·18	3·01	8·3
169A	Gareba	*Evodia lamprocarpa* ..	1	118	1·18	118	0·20	0·25	100·0
184	Hangeni	Indt.	12	1,644	16·44	120	2·98	3·01	8·3
185	Oeh	*Elaeocarpus comatus* ..	6	545	5·45	91	0·98	1·50	15·5
186	Wuwura	Indt.	18	1,841	18·41	102	3·35	4·51	5·5
187	Nininge	*Ficus* sp.	5	1,328	13·28	265	2·42	1·25	20·0
188	Nahihi	Indt.	3	598	5·98	199	1·07	0·75	33·3
189	Behoro	*Ficus* sp.	2	413	4·13	207	0·84	0·50	50·0
190	Gongofo	*Polyscias* sp.	1	179	1·79	179	0·32	0·25	100·0
192	Mongua	*Cryptocarya sp.*	5	749	7·49	149	1·25	1·25	20·0
193	Pusa	Indt.	11	1,877	18·77	171	3·42	2·76	9·0
194	Au-u-jo	*Ficus* sp.	2	380	3·80	190	0·68	0·50	50·0
195	Onga	Indt.	7	908	9·08	129	1·80	1·75	14·3
196	Pofere	Indt.	2	527	5·27	263	0·95	0·50	50·0
197	.. .. ..	*Canarium lineistipula* ..	7	700	7·00	100	1·27	1·75	14·3
198	Kimina	Indt.	2	219	2·19	109	0·40	0·50	50·0
199	Uwore	Indt.	1	135	1·35	135	0·24	0·25	100·0
200	Ondodo	Indt.	2	246	2·46	123	0·44	0·50	50·0
201	Asawa	Indt.	2	204	2·04	102	0·37	0·50	50 0
202	Siruga	*Campnospermum brevipetiolata*	1	320	3·20	320	0·58	0·25	100·0
		Total	398	55,137	551·00	138	100·00	100·00	0·25

TABLE XIV.

FOREST OF THE KUMUSI RIVER.

Predominant Species, viz., 5 per cent. and over of Total Cubic Contents.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
34	Ilimo	*Octomeles sumatrana* ..	43	11,655	116	271	21·0	10·8	2·9
5	Okamu	*Pometia pinnata*	118	6,924	69	58	12·5	29·6	0·8
143	Dibaba	Indt.	21	3,539	35	168	5·4	5·3	4·9
29	Devoru	*Alstonia scholaris*	11	2,669	27	243	4·8	2·7	9·0
		Total	193	24,887	249	128	48·4	32·0	17·6

is deep enough for floating rafts of logs in times of flood, but there would need to be a more extensive forest than that which I have described to make commercial exploitation a profitable venture. For local supplies the patches of timber on its banks will prove of great value, and this must, unless constructive forestry be undertaken, be the limit of their usefulness as a source of supply of wood. The question of dedicating reserves to assure this supply is dealt with under section A.3. Forest Policy.

Leaving the Kumusi I struck east to a village called Sagari. The country passed through was rather low-lying; the trail traversed innumerable swamps, and was in places a succession of log bridges. Where the land was high enough farms had been made. and the country was either under crop or in various stages of re-growth. The weed trees that comprised these farm woodlands was similar to those which I have described near Wasida. Virgin forest was not met with to any extent until a few miles short of Sagari. Here a new type of rain forest occurs, which is of so high a quality that, though the actual area of timber was small, it seemed worth surveying. This seemed the more desirable, as the natives—the country begins here to be rather thickly populated—were rapidly eating into the forest.

Sagari Forest.

The area of forest left here is about 800 acres, and the area covered by the strip survey was 40 acres, or 5 per cent. of the whole. Tables XVI. and XVII. give a summary of the data collected. It will be seen that the 40 acres of strips included 27 species, containing 30,561 cubic feet, or 764.5 cubic feet to the acre, and 176 cubic feet to the average tree. Turning now to Table XVII., it will be seen that only one species carries an aggregate volume of over 5 per cent., and that is No. 152—borua—which accounts for no less than 65 per cent. of the volume, and 32 per cent. of the number of trees. Next in importance is No. 5—okamu—but this is only in number of trees—10.4 per cent.—for in volume it only accounts for 3.8 per cent. Borua is a magnificent tree; the bole often exceeds 100 feet, while overall the tree attains 150 feet. While it has spur roots at the butt, it cannot be said to be buttressed, and so should cut up without too much waste. The wood is a good colour, and has a nice straight grain, with a pleasant sheen on the quarter and back. It polishes well, and is of handy lightness, about 37 lbs. to the cubic foot—altogether a very satisfactory wood to market if there is anywhere in Papua an area of this type of forest. Sylviculturally, it should be satisfactory, for it grows in close stands of pure, or almost pure, forest. It makes a very heavy canopy, and appears to have little undergrowth except seedlings of its own kind. Its second story also is only sub-dominant and dominated borua waiting their chance to get up to the

TABLE XV.

Survey of the Forests of Sagari, Northern Divisign.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
1	Damoni	*Dracontomelum mangiferum* ..	2	262	6·55	131	0·86	1·16	20·0
3	Medobi	Indt.	1	22	0·55	11	0·07	0·58	40·0
5	Okamu	*Pometia pinnata*	18	1,172	29·30	65	3·83	10·40	2·0
6	Meneai	*Artocarpus* sp.	4	1,412	35·30	353	4·44	2·21	10·0
29	Devoru	*Alstonia scholaris*	2	576	14·40	288	1·88	1·16	20·0
33	Bara	*Diospyros* sp.	2	236	5·90	118	0·77	1·16	20·0
74	Vanea	*Sterculaceae*	1	167	4·42	167	0·53	0·58	40·0
84	Otuni	*Sloanea paradisearum* ..	1	145	3·62	145	0·47	0·58	40·0
136	Garawa	*Anisoptora polyandra* ..	2	330	8·25	165	1·08	1·16	20·0
137	Dandike ..	*Rubiaceae*	2	336	8·40	168	1·10	1·16	20·0
142	Sisira	*Canarium lineistipula* ..	2	338	8·45	169	1·11	1·16	20·0
141	Komina	*Elæocarpus novo-guiniensis* ..	2	626	15·65	303	2·01	1·16	20·0
143	Dibaba	Indt.	1	160	4·00	160	0·50	0·58	40·0
144	Duduyo	*Semecarpus* sp.	1	112	2·80	112	0·37	0·58	40·0
145	Ano-Ano ..	Indt.	14	854	21·35	61	2·79	7·99	2·8
147	Sauma	*Endiandra* sp.	2	285	6·62	142	0·93	1·16	20·0
149	Tavili	Indt.	1	102	2·55	102	0·33	0·58	40·0
151	Lala	Indt.	5	1,173	29·32	286	3·84	2·89	8·0
152	Borua	Indt.	56	19,901	497·52	207	65·11	32·37	0·7
153	Bara	*Myristica* sp.	1	224	5·60	224	0·73	0·58	40·0
158	Aruru	*Sarcocephalus cordatus* ..	1	229	5·72	229	0·74	0·58	40·0
160	.. .. ..	Indt.	4	766	19·15	192	2·41	2·21	10·0
169A	Oiela	*Evodia lamprocarpa* ..	1	108	2·70	108	0·34	0·58	40·0
195	Onga	Indt.	1	109	2·72	109	0·35	0·58	40·0
200	Ondodo	Indt.	1	320	8·00	320	1·04	0·58	40·0
203	Kaira	*Maniltoa* sp. nov.	1	224	5·60	224	0·73	0·58	40·0
204	Gne-Gne	*Payena* sp.	1	372	9·30	372	1·22	0·58	40·0
		Total	173	30,561	764·00	176	100·00	100·00	..

TABLE XVI.

Dominant Species.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total.	Per Acre.	Per Tree.	To Total Cubic Contents.	To Total Number Trees.	
				Cubic ft.	Cubic ft.	Cubic ft.	%	%	
152	Borua	Indt.	56	19,901	497·5	207	65·11	32·3	0·7
5	Okamu	*Pometia pinnata*	18	1,172	29·3	65	3·80	10·4	2·2
		Total	74	21,073	526·8	271	68·91	42·7	2·9

light. Its seeds very heavily, and the ground is literally carpeted with baby trees. The fruit itself is a conspicuous object, 4 inches long and $1\frac{1}{2}$ inches diameter, a stout sausage with somewhat sharpened ends. When it has thrown down its root, and made its first leaves, the seedling looks very grotesque with this large sausage of a seed standing out stiffly at right angles. Unfortunately, I found no tree in flower, so Mr. White can only ascribe it tentatively to the apocynacious family—its generic and specific determination must await better material.

The data in Tables XVI. and XVII. do not give an idea of the maximum stands of this timber. The forest in reality might be divided into two; the first part was a borua and okamu forest, with some 12 acres of strip survey, and here grew 87 of the 96 borua trees enumerated in the tables. In other words, 12 acres carried 18,038 cubic feet, or 1,504 cubic feet per acre of one kind of timber—over seven trees to the acre cubing 207 cubic feet each. Of the remainder of the forest eight acres carried little or no timber, being low lying and swampy, and 20 acres carried fair average mixed rain forest for Papua. In the latter type were some very fine specimens of No. 151, lala. This tree, with its yellow-red, papery bark, is very conspicuous. Unfortunately it is so easily confounded with No. 226, lalagi (*Wormia quercifolia*), that I am unable to tell them apart by general appearance. I have either to cut into the wood, when, if it is lalagi, the wide mededullary rays show up on the quarter, or examine the fallen leaf and see if it has lalagi's scarred petiole whence the ligule has fallen. The leaves of lala are opposite, and those of lalagi alternate, which is the best check of all if you can get down a branch. Finally, the flowers of lalagi are a conspicuous thing on the ground, while lala seems a rare flowering species, and is unrelated to the Dilleniaceæ, for lalagi is a Wormia.

Of species first found in the Northern Division there are only two, viz., No. 203—kaira—(*Maniltoa* sp. nov.), a large leguminous tree, the wood of which was much sought after by the war-like Binandele folk to make handles for their murderous stone clubs of pineapple section. To-day it is used more often for axe handles and combs, and for the latter purpose is regarded as superior to No. 10—melila (*Afzelia bijuga*).

No. 204—Gne-Gne (*Payena* sp.).—This is one of the most handsome trees I have seen in Papua. It attains a height overall of over 150 feet. It has a very shapely crown which often covers a circle of 100 feet diameter; I have measured a bole of 135 feet, with girth of $8\frac{1}{2}$ feet just above the spur roots, which ascend to about 6 feet, and spread out from the trunk 7 feet; yet they cannot be called buttresses.

Leaving Sagari I pursued an easterly track that lead me through Vivisioni to Gona, a village on the coast in Holmcote Bay. All along the route were little patches of forest, but they were so intersected with farm lands as to be of little interest from a forestry standpoint. A large extent of low-lying land, subject to inundations, occurs around the lower Amboga, and this carries little timber.

Three fresh species were met with, viz.:—

No. 205.—Gasara, which yields a hard wood.

No. 206.—Inene (*Myristica pseudo-argentea*), a nutmeg tree, the nut of which, I am afraid, is not likely to be commercially valuable.

No. 207.—The much prized paper mulberry, *Broussonetia papyri*. This is the tree cultivated in all farm lands for its bark, which, when beaten out, makes skirts of the northern women, and perennial bands and aprons of their husbands. The stuff, when made up, usually goes by the name of Tapi cloth among white people.

Immediately behind the coast line is a dense scrub of regrowth or farm wood-lands. Figs are rather more common here, and No. 208—Wraiso (*Hibiscus tilliaceous*)—is everywhere abundant. Its striking yellow purple-eyed flowers, which turn rose pink when they fall to the ground, are a splash of colour on the tracks in July and August around Buna. The bark is sought after for tying up loads, and makes excellent cordage.

The forest growth along the beach is quite distinctive, and deserves a separate description.

Beach Forests of Buna District.

Wherever there is a creek or river mouth opening into the sea, the mangrove swamps occur with their characteristic tree formation, which I will describe later. Elsewhere the land is higher, and we find a more or less dense forest of low height growth. This is the beach forest. It contains a number of the rain forest species I have already described, but it also contains a number of purely sea-coast types, of which three are, perhaps, most common. No. 209—Otai-i (*Calophyllum inophyllum*)—a large tree with a curious habit of growth. Rooted above high water mark, it leans right out towards the sea. Sometimes the angle of lean is such that the tree makes less than 45° with the ground. Probably this curiously leaning habit has for its object the dissemination of the fruit, a spherical light nut which is sea-borne. The wood is beautiful, and would be very useful if only the bole were straighter; as it is, the only use to which it is put is boat knees. Its leaves are very leathery, and altogether it has the appearance of a species armed against most of the disabilities inherent to its habitat; sand saturated daily with sea water.

No. 217. *Sonneratia alba.*—This is the largese tree on the sandy beaches. It attains a girth of 13 feet, and a height of 90 feet, with a clear bole of 60 feet. While it is unbuttressed and without spur roots, it has a regular young thicket of those queer breathing roots, whose somewhat sesquepedalian name is pneumatophores. It has a showy red filamented flower, and yields a hard close-grained timber. Like Otai-i, it has very leathery leaves. It is a tree of salt water country, and will grow in very swampy land, thanks to its breathing roots.

Casuarina equisetifolia.—A medium to large tree with a wellfigured timber. It grows all round the coast at just above high-water mark. Wherever a bar silts up, and a spit of sand comes above the level of high spring tides, there a line of young casuarinas establishes itself. They are so regularly lined out, and so even aged that one is reminded of a plantation. It is a good sand-fixing species, and is ornamental, so adds to the beauty of the coastal scenery. In the days before petrol launches, the wood of this species was much in demand for boiler fuel.

As one goes inland from the sand beach a few yards, one meets with more rain forest species. No. 10—melila, No. 4—nara are common. The forest *Planchonia timorensis*, No. 2, gives place to the allied coastal species, *Barringtonia speciosa*. Another leguminous tree like No. 10—melila—is common; this is No. 216—jambo (*Pongamia glabra*). It yields a hard wood, but the sap and heart are the same colour, a light yellow. No. 218—laure (*Carapa moluccensis syn. Xylocarpus granatum*)—is a tree often met with, and easily recognized by its large round brown fruits. It is really a mangrove species, but grows also above the tidal level. No. 214—kuyuyu (*Thespesia populnea*)—is a tree which is rarely found outside the beach forests. No. 215—bindjopa—is a medium tree in the same locality. No. 234—kerea (*Hernandia peltata*) is at home in the beach forest.

The trees of the beach forests appear to bear more epiphytes than those of the rain forests. I think this may be illusory. The aerial gardens are so much lower, the trunks being shorter, that the wealth of ferns, orchids and climbers strikes the eye without the traveller having to crane his neck. This type of forest will always prove of use to the local native population and to the white planter, but where saw-milling on a larger scale is the method to be used, it is not of commercial importance.

The Hydrographer's Range.

Leaving the coast at Buna, I again penetrated inland, this time making for the Hydrographer's Range. The country passed through was similar to that which I have already described. It is known to most under the name of the Dobodura Plains. All this country was, at one time, a dipterocarp forest. From the fringes of forest still left, it was of better average quality than that described near Soputa. The dipterocarp, No. 136—karawa (*Anisoptera polyandra*)—here grows larger and occurs more plentifully to the acre. No. 5—okamu—is still very prominent, but in numbers, and above all in volume, it is far behind karawa. Nowhere did I find an area of forest large enough to warrant a detailed survey. Leaving the rich soil of the Dobodura Plains, I followed the course of the Embogu—a river that rises in the Hydrographer's Range, and, flowing north-east, empties into the sea north of Oro Bay. This river soon becomes torrential, and the natives' road is along its course. One passes through a steep, rocky, narrow gorge, and, crossing and re-crossing the river eight times, finally comes to a well-defined junction between which, on a sharp ridge, stands the village of Pernambata. All up the sides of the rapidly-rising mountains are new and old farm lands. The latter are covered with weed re-growth. No virgin forest of any extent is to be seen. The mountain-climbing bamboo, festooning a large *Bombax malabaricum*, gives a mixed monsoonal forest effect to a small patch of rain forest above the village. Leaving Pernambata, I climbed up through the farm lands, and once above them, and above the precipitous course of the Opi Creek, the left branch of the Embogu, I found some nice stands of timber. The country appears to be volcanic, and wherever the slope is not too steep, high forest has established itself. Between 1,000 and 2,000 feet, No. 219—kini of the Pernambata people (*Quercus junghuhnii*)—occurs. This tree, in spite of its botanical name, is more akin to the true oak or the beech than to the chestnut. It is easy to recognize by its somewhat grooved stem, which, like an European lime tree, is often surrounded with a petticoat of sucker shoots by its narrow very pointed leaves, and by its beech mast-like fruit. It does not reach its best development in the Hydrographer's Range, but is typical enough. It grows in pure stands of small area and is remarkable for having little or no soil cover below it. This species marks the end of the rain forest proper, and the beginning of the foothill forests. In the Hydrographer's Range, owing to the extraordinarily broken nature of the topography, the limit is not well marked. One moment you are in foothill forest, and the next you are among the okamus, lalagis and devorus of the rain forests. From a scenic point of view, these foothills of the Hydrographer's Range, up to 2,000 feet, are exceedingly beautiful. From the village of Atami a view over the whole plain to the Mambare River spreads out. Here one gets a better idea of the very large area of grass-land, particularly in the month of August, when the natives are burning these areas for wallaby. Around Atami, and between that village and Andaki, there are some nice patches of rain forest. And so one descends to the eastern branch of the Sambogi headquarters, known here as the Ere, and climbs up to Embi village—some 500 feet above the sea. The timber between the Ere River and Embi village is decidedly better, but it was not until I went down towards Urio that I found timber worth surveying. On the journey over this shoulder of the Hydrographer's Range some interesting species were met with—

No. 220, Siri.—A large tree, yielding a close grained timber.

No. 221, Lada.—A tree very tall like the No. 151 of the plains already referred to.

No. 224.—Is a little tree (*Garciniaassuga*), with a very conspicuous greengage-like fruit.

No. 225, Kesa (*Cyathocalyx polycarpum*).—Another small tree of the third story, much in demand for canoe seats and such like light wood. The wood has a pretty quarter grain.

No. 226, Lalagi (*Wormia quercifolia*).—A very large tree, with a striking orange red papery bark. It has alternate leaves, leaves of 1.5 inch petioles, and these also bear a deciduous ligule. The wood has a good colour, and has a handsomely-figured quarter grain. This is a rain forest species which finds its way up to the foothills a little way. I had met it several times before, but had not found it in flower.

No. 227, Jaruka (*Achradotypus* sp.).—A small sapotacious tree with remarkably developed cauliflory. It is of little interest from a forestry stand-point; a rather rare second-story tree; to the botanical systematist it should prove interesting, while to the native it has a very particular interest, being one of, if not actually, the most important of the sorcerer's trees.

Nos. 228 and 117, Hobaba (*Quercus pseudomoucca*).—At 2,000 feet occurs the true oak, No. 228, Hobaba, which is identical with the one I found at about the same height above Galley Reach, viz., No. 117.

No. 229, Painga.—Is a medium tree whose timber is without much value, but which yields a resin that is worth attention. The natives use it as they do the resin of the dipterocarps and other species to make lamp black, with which they do their tatooing.

Forests around Embi Lake.

Below Embi village there are three lakes, which lie at the foot of the hills. The one to the west is the largest — $2\frac{3}{4}$ miles long from where Embi Creek enters it, to where it flows out—and contains a fine wooded island. This lake is called Embi. The central one is smaller, and the eastern one smaller still. All drain into the Embogu, and the creeks to do this have to turn very sharply eastwards The Embi Creek is not more than a mile from the Sambogi when it leaves Embi Lake, yet the topography is such that it turns away from what must, at one time, have been its natural outlet to the sea, and, making a wide detour, enters the Embogu several miles to the east. The presence of these lakes, and the extraordinary topography of the country, all point to a great geological upheaval at some not very remote period. The Ere Valley also is an instance of a great geological change. Embi Creek rises quite close to the Ere River, but the latter flows down in a westerly and north-westerly direction to become the Sambogi, when it turns practically due

Panoramic view of Embi Lake, showing the forests to the westward.

Note the grass on precipice in the left hand view and the artificially formed grass lands on the extreme right. (See page 23.)

[*Photos by E. J. Frame, Esq.*

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east. The three lakes are at a low altitude—between 200 and 300 feet above sea level, and the slopes of the foothills are clothed to the water's edge with rain forest. In certain places where the slope is too steep, grass land has established itself, and this the native has extended by his annual hunting fires. A survey was made of the forests of Embi Lake. On the north side the lake is fringed with sago palm and forest, and beyond is a large grass area. To the south, however, lies the Hydrographer's Range, and the foothills are covered with a type of rain forest which I have not met with elsewhere. It consists of two species—No. 136, Karawa, the dipterocarp already referred to, and that wonderfully durable wood, No. 10, melila. Some other species were found, but they were so much in the minority as to be negligible. The figures will be found in Table XVII. These were obtained from strip surveys, 700 chains in length, or covering an area of 140 acres. I hesitate to say what percentage of the total area of this type of forest my strips represent, for, while I am able

TABLE XVII.

SURVEY OF THE FOREST AROUND EMBI LAKE, HYDROGRAPHER'S, NORTHERN DIVISION.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
10	Melila	*Afzelia bijuga*	427	33,943	242	79·49	29·85	50·8	0·32
136	Garawa	*Anisoptera polyandra* ..	354	74,249	530	245·19	65·14	43·3	0·38
238	Rasara	*Podocarpus neriifolius* ..	14	756					
206	Ineno	*Myristica pseudo-argentea* ..	8	1,029					
145	Ano-Ano ..	Indt.	6	840	..	..	5·01	5·9	3·0
239	Guti	*Calophyllum inophyllum* ..	7	504					
240	Pohara	Indt.	6	1,029					
205	Gasara	Indt.	8	1,568					
		Total	840	113,918	813	135·00	100·00	100·0	..

to fix the limits in altitude, I had not time to find out how far it extended east to west along the foothills. It will be seen that No. 136 and No. 10 together account for 95 per cent. of the volume, and 94 per cent. of the number of trees. The other seven species represented are of negligible importance so far as quantity and volume are concerned. It will be seen, also that No. 10—melila, or bendora, as the northern people call *Afzelia bijuga*—exceeds No. 136, karawa, in number of trees, but does not carry the volume. The average melila was one-third the size of the average karawa. The actual figures are as 79 is to 245 cubic feet per tree. Again, however, the dipterocarp failed to strike the eye so markedly as the melila; so to avoid difficulties, if this type of woodland is to be designated, I should call it a melila-karawa forest, or, better perhaps, bendora-karawa forest. The maximum melila measured had a girth of 10 feet, and a clear bole of 90 feet, while the largest karawa girthed 13½ feet, and shot up 110 feet to the first branch. While the total cubic contents per acre is not very great, it compares very favorably with all the other forests visited. But what makes this Hydrographer's forest valuable is the fact that no great mixture of species occurs. From the saw-milling stand-point—and that, after all, is the forestry stand-point—a forest of this type is very much more valuable than one which contains a host of different species, even if the latter carries twice the total volume of the first. The area that I found was insufficient for saw-milling purposes on a large scale, but it is quite possible that further areas of similar forest may be found in the foothills of this or neighbouring ranges, which would repay commercial exploitation. In the meantime, care should be taken to preserve this belt, and the native should be prevented from extending his farm lands to the slope carrying the typical forests. Of the other species: No. 238, rasara, is *Podocarpus nerii folius*, a second-story tree, with a nice timber like the Queensland brown pine. It may prove to be the same species. No. 239, guti (*Calophyllum* sp.) is sought after by canoe builders, as its timber makes good decking. It is a large handsome tree, with a grey, heavily ridged bark. Curiously enough, the bark yields a yellow, while the leaves yield a cream, latex. No. 240, pohana, is a large tree, with a dark brown scaly bark, and yields a nice light yellow wood. Nos. 205 and 206 I had met with before; also the useful canoe paddle wood, tatoa, No. 145.

Of other species, I should mention two glorious climbers. No. 222—*Agapetes Moorhousiana*. This climbing heath attains its best development at and over 2,000 feet; it bears masses of cerise, somewhat waxy flowers on the old wood of the stem and on the young twigs. The flowers themselves are about 1 inch long and bell-shaped, and are so closely set as to sometimes entirely hide the stem of the liana. The other climber is No. 243—*Hoya dimorpha*—which bears axillary umbells of beautiful pink flowers. The usual rain forest climbers, such as Freycinetias, occur here also. On the whole, the melila-karawa forests are less covered with epiphytes than the more mixed rain forests. Melila, with its rather smooth bark, offers little purchase for plants to root, and while karawa has rough enough bark, it does not seem to carry the aerial gardens in its branches one would expect to see. The undergrowth is also rather scanty, and except for the ever-present lawyer cane (*Calamus*) the woodland is very penetrable. The second and third story trees are not well represented in such a forest. No. 241, *Eugenia jambolana* (affin) was found everywhere; also 80, the cabbage tree Genda (*Gnetum gnemon*). The leaves of this species are used by the natives as we use cabbage. They must be picked very young, before they become leathery. The tree is much cultivated in villages throughout the Territory, not only for the leaves, but for the nut, the kernel of which is edible. The bark yields a strong fibre, and the rather attractive net bags that the Suku women affect are said to be made of string twisted from the bast of this tree.

Here and there on these foothills pure stands of tall, slender palm trees clothe the slopes in close formation, and are very beautiful and unexpected.

Floating Islands of the Lakes.

While the subject of floating islands is hardly a forestry one, it is, I think, of sufficient botanical and general interest to be referred to here. Around the margin of these lakes is a thick growth of water-loving plants. Those nearest the bank are marsh species, and those further out are water plants. Even the water lilies, No. 250 (*Nymphaea gigantea*) do not extend far from the banks, for the ground shelves rapidly, and the water is soon too deep for even their long stems, which reach 16 feet at times. The main vegetation consists of a large lily, No. 253 (*Sisum* sp., probably *S. anthelminticum*). This clothes the water's edge all round the lakes. It is a big plant, with leaves 5 to 6 feet long. It roots in the mud on the margin of the water, and puts out new horizontal stems into the water, from which grows a cluster of leaves and roots—a new plant, in fact. This method of propagation continues till the water's edge for 5 or 6 yards deep is a dense mass. Among these lilies are to be found other water plants, No. 251 (*Limmonthemum indicum.*) for instance; also a clambering fern, No. 255 (*Dryopteris gongylodes*); but most important of all, the plant making up the aquatic gardens is a sedge, No. 254 (*Cyperus* sp.). In itself it is the usual insignificant, triangular, stiff-stemmed sedge, but its root system is very developed, and it is masses of such roots that supply the buoyancy necessary to enable sections of vegetation to float. Quite large areas of lake-side vegetation detach themselves from the mass, and float out into the centre, and either tie up to a bank lower down, or are taken slowly down to the outlet, where they break up, if they have not done so on the way down. The largest I measured was 50 yards long by 30 yards wide, and was floating down at the rate of a furlong an hour. How and why these masses of vegetation detach themselves from the rest is not at all clear. How they are formed is easier to explain. The continually thrust out horizontal shoots of the sisum soon reach water so deep that they cannot root. They obtain their plant food from the parent, and grow their large tuft of 6-ft. leaves. Having no anchor, the weight of their top hamper of leaves capsizes the plant, which lies with its greenery half in and half out of the water, and with the horizontal stem turned up out of the water, with the young rootlets it tried to develop exposed to the air. On this stem, among these rootlets, falls the sedge seed, and soon there is a tuft of sedge leaves growing on the elbow-like rhizome of our lily. The sedge, as I have already stated, makes a large mass of roots and rootlets. A quite insignificant plant will have a root mass 18 inches square and 12 inches deep, and of considerable weight, but yet always a little lighter than water. On squeezing this mass below water, a quantity of air bubbles rise, and doubtless the whole carries enough air to bring it to a specific gravity of less than one. It was not possible to do more than roughly estimate the specific gravity of the detached cyperus root masses by the depth at which they floated after the aerial parts had been cut. I should put it at between 0.8 and 0.9. The specific gravity is sufficiently low for these root masses to support, not only the sedge leaves, but all the other vegetation; of these the dense masses of sisum are of great weight. When first seen, just under the water, the roots look like ordinary soil, and it is only when taken out and squeezed and examined that their true composition is made plain.

The interesting question of how these comparatively large areas of vegetation become detached requires further inquiry before it can be answered satisfactorily. Were these sheets of water subject to storms, an explanation would present itself, but I did not see more than a little ripple on Embi Lake, so sheltered is it by the mountains. A sudden rapid current would be a splendid agent for detaching these islands; but none occurs. The Embi stream is not a big one; Embi Lake is one of those closed valleys, and is 7-9½ fathoms deep all over; both its inlet and its outlet are choked with weeds and sago swamps; no sudden rises or falls occur, for the area is large and the stream too small to make any difference of level, even after a very heavy rain I experienced when camped there. That some explanation other than the natives' will be forthcoming in time is to be hoped. At the risk of being accused of digressing altogether from forestry and intruding into realms psychic, I give the natives' story of Embi Lake floating islands. The Embi people bury their dead in holes in a rocky hill slope above their village; the spirits of these dead descend from their caves, and enter the bodies of crocodiles in Embi Lake. The lake is, therefore, held in great reverence by the people, and the crocodiles in more than ordinary awe; but as an extra precaution there is a being or devil they appear also to call "Embi," and he inhabits a floating island which they call Kukuwaio. This island or its inhabitant—I could not quite separate them in the native's story—cries out at night when it is hungry, detaches the Kukuwaio from the bank, and journeys round and about the lake, seeking for food, finally tying up again at any convenient place to the bank. As a native put it, who had had the advantage of somewhat wider travel than his neighbours, and had seen the capital and the R.M.S. *Morinda* come in and go out, and heard her blowing her whistle, "Kukuwaio sing out all same *Morinda*, and walk about look along kai kai."

The natives appear to recognize only one floating island and refer to it as having been there always. A very aged man was produced to tell me that his father lived on the solid wooded island, and in his time Kukuwaio—the same floating island—existed. On my pointing out that I had seen two together, a large and a small one, I was informed that the smaller one was a child of the larger. There are so many things in a people's beliefs that are incredible and yet are accepted unhesitatingly, and Kukuwaio seems no more harmful than many things believed in by other and more highly civilized races. Curiosity in regard to a person's religious belief is usually resented, and so I desisted from further cross-examination, though I must confess I should have liked to discover what happened, according to the natives, to Kukuwaio's doubtless numerous family. I was camped a fortnight in the Hydrographer's before I saw one of these islands. The natives had told me of them, and had told many blood-curdling stores, with the object, I assumed of preventing my putting a canoe on the lake. By doing so I would save a great deal of time lost in walking round the waters to my work, which was getting farther and farther from my camp, and so, despite the inhabitants, a raft, and finally a canoe, was built on the shore of the lake. My first sight of one of these islands burst on me and my boys quite unexpectedly, and I must admit that the presence of an undoubted and perfectly good but brand-new island, covered with a vegetation 8 feet high, among which a common yellow compositae clambered conspicuously, was rather startling. My boys, except my policeman, who deserves every credit for standing his ground, stampeded into the bush, which, after all, was a very natural thing to do. Whether it was the suggestive effect of the folk stories I had listened to for a week, or my faith in the saying that "of valour the better part is discretion," I felt like sending for reinforcements before embarking on the raft to investigate the kukuwaio. However, with the aid of a policeman and a native dragged from the bush to propel the raft, the island was investigated then and there. This and subsequent investigations in the canoe made it possible for me to advance the above explanation of the formation of these phenomena.

Embi Lake. Ficus sp. drops its aerial roots into the water. Sisum sp. in foreground.

Embi Lake. In the foreground artificially created savannah ; in the distance the Hydrographers' Range (6,000 feet).

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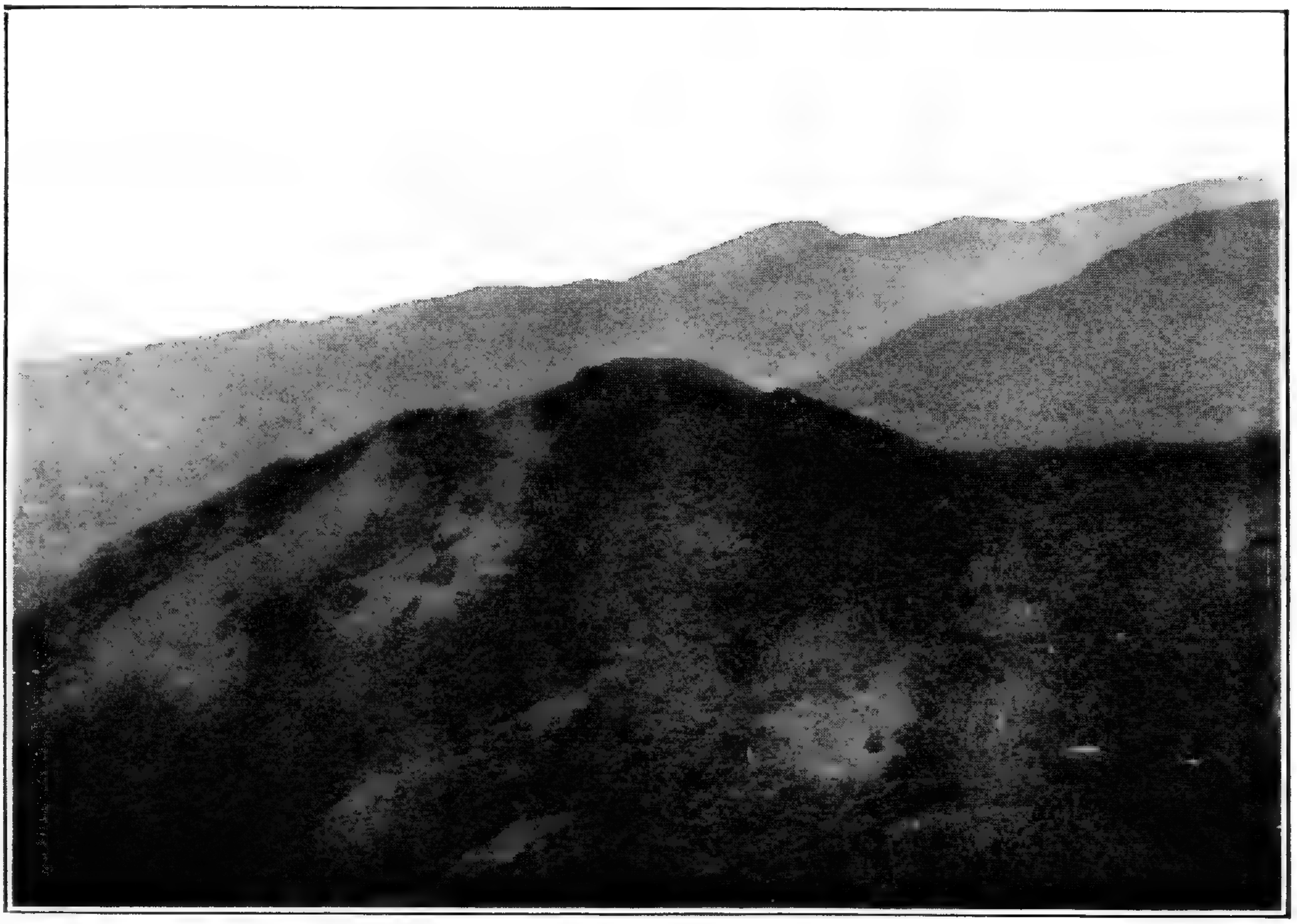
Embi Lake.



Foot Hill and Savannah Forest, Upper Kemp-Welch. (See page 33.)

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From a scenic point of view, Embi Lake is a most beautiful sheet of water. The island set in its middle rises green against the ever-changing lights of its waters, while the wooded mountains roll down to its margin, their peaks, 6,000 feet above, mirrored at one's feet.

Forests Between the Wire Rope Bridge and the Main Range.

I took the track that leads from Buna to Kokoda, and so on to Port Moresby, crossing the main range at about 9,000 feet, at a point called The Gap. Between the wire rope bridge over the Kumusi and Kokoda the country alters a great deal. One has left the plain country, and the rise per mile, though still very gentle, is more noticeable. The foothills of the main range crowd down on all sides, and the whole view is one of very hilly country. One crosses the Oivi, and here a very sharp, short rise occurs, and climbing out of the basin of the Kumusi one enters that of the Yodda, which flows north to north-west till it empties into the Mambare. The going is again flat, but the forests, which are of the rain forest type, are not of good quality. The trees are curiously small, and this seems more marked as regards diameter than height. At first they seem to be young trees, and the question presents itself, "Has the valley of the Yodda at one time carried a heavy population?" At present it is little peopled, and the explanation generally advanced is that the war-like tribes on all sides made it a no-man's land. The soil has every appearance of being rich; it is alluvium, on which natives would establish splendid taro and potato patches, and on which one would expect to find, in the absence of population, a dense stand of tall timber trees in rain forest formation. If it is a young forest, it may or may not have passed through the successive stages of weed regrowth to high forest. In composition it resembles the mixed forests of the plains I have already described. Geologically, the country is of recent formation, but recent only as geological epochs go; and what is the life of a tree to such a period of time as that covered by the deposit of alluvium in the Yodda Valley? Close investigation is necessary before this and several other apparently young forests can be explained. The Government station of Kokoda (1,200 feet) stands on the point of a peniplain, overlooking the Yodda Valley. The forest at the back of the station is of the rain forest type, and better in quality than that growing along the Yodda. I did not, however, make a survey of it, as it was necessary to reach Port Moresby as soon as possible. A description of the mountainous country which was passed through, between Kokoda and Kagi—4,800 feet, on the western side of the main range, and the country between 4,800 feet and sea level will be found in a separate section. I will now pass on to the western end of Papua, and describe the rain forest regions that occur behind the great network of tidal waterways that form the delta of the Purari River and the mouths of the other rivers lying between that river and the Kikori.

Rain Forests of the Delta Division.

Some idea of the enormous extent of this tidal swamp country may be gathered from the fact that I entered these island waterways at Alele Mouth in a launch drawing 3 ft. 4 in., and made my way to Kikori—about 85 miles in a straight line—without going out to sea. All those tidal waterways are, as might be expected, split up with innumerable areas of mangrove and nipa swamp lands. Here and there a higher bank is met with, but for the most part there is nothing but mangrove mud. In this the native of the delta lives, and apparently prospers. A description of the mangrove formation will be found on pages 47 and 48. Going up any of these waterways to a point where fresh water is met with, one comes to rain forest. The first river investigated was the Baroi, from which good communication is possible through the Wami to Romilly Sound, where, as I have shown on page 177, large ships can enter. As will be seen from the map, the Baroi twists and turns in a remarkable manner. Sometimes the two sides of a hair-pin bend are less than 10 chains across. This is a characteristic of all the rivers passing through low-lying country. The Baroi, right up to the trifurcation of the Purari into its main delta waterways, is very little above tidal waters, and at the same time it is subject to violent rises and falls, due to big floods in the main river. Such conditions make for instability of a watercourse, and the Baroi has doubtless made and unmade countless channels since it first started depositing silt. It do not know if its ever clear, but all the time I was on the river it was yellow, and water stood for 24 hours in a bucket would precipitate nearly a quarter of an inch of silt. That the course is permanent at all in any part of its length is very doubtful, and such permanence as it banks possess must be due to the timber. From the head of the delta to the Wami it is a fine deep waterway, flowing about 1½ miles an hour, but, though quite fresh, it is affected by the flood tides which dam back its waters. The timber is found growing on all those portions of the banks which are high enough to be more or less well drained. These generally occur on the convex sides of the numerous turns. Thus, opposite every piece of high forest is a stretch of low land fringed with rushes, behind which may be a stand of young ilimo in pure formation; or without any such tree-growth, the sago palm swamp begins. Even on the convex side the forest extends only a little way back from the river, and from 5 to 7 chains brings one to swamp land. These sago formations are the characteristic vegetation of this low land region, and the rain forests are little islands—insignificant dots in a sea of swampy country. This is a rich food country, and the native of the delta has no difficulty in getting supplies of sago, not only to satisfy himself, but to export to other communities to the east, where sago is difficult to obtain. Thus the lakatoi, laden with cooking pots, leave Hanuabada, the Port Moresby villages, and sail to the delta to buy sago This wealth of sago does not entirely satisfy him, for the delta native also makes gardens to grow bananas, and for this purpose cuts down small patches of forest along the banks of the rivers above the tidal waters. So, travelling up the Baroi, one passes numerous garden houses, planted in small clearings of the rain forest. Here the boys camp, too, when they come to get logs to make canoes; they do not build the canoes, however, for there are tradesmen in the villages who are skilled in cutting out the canoes, just as there are artists who alone can decorate them with traditional and very attractive designs. As I shall show later, these apparently very primitive natives are really better organized than most tribes in Papua.

Taking the whole length of the fresh water portion of the Baroi, 25 miles, I estimated the area of forest to be equal to one-half the length multiplied by an average width of five chains—this works out at 1,000 acres. Altogether five camps were made along this river, and thus a good proportion of the standing

timber was surveyed. The summary of the data will be found in the accompanying Tables XVIII. and XIX. The first camp at Ua—as that bend of the river is called—embraced a double width of forest, the bend being of hair-pin shape, and in places less than 10 chains in width. The area included in the strip survey

TABLE XVIII.

SURVEY OF THE FORESTS ON THE BAROI RIVER, UA CAMP, LEFT BANK.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
1	Damoni	*Dracontomelum mangiferum* ..	40	4,382	146·0	109	23·36	27·77	0·75
2	Kaeda	*Planchonia timorensis* ..	3	338	11·6	112	1·88	2·08	10·00
5	Okamu	*Pometia pinnata*	47	5,059	168·6	107	28·13	32·65	0·60
6	Meneia	*Artocarpus sp.*	1	259	8·6	259	1·44	0·69	30·00
10	Melila	*Afzelia bijuga*	1	78	2·6	78	0·44	0·69	30·00
19	Sabi	*Sarcocephalus cordatus* ..	5	737	24·5	147	4·10	3·46	6·00
29	Devoru	*Alstonia scholaris*	1	101	3·4	101	0·56	0·69	30·00
36	Okaka	*Terminalia catappoides* ..	1	154	5·1	154	0·86	0·69	30·00
47	Waiamahasi ..	*Celtis philippinensis* ..	1	77	2·6	77	0·43	0·69	30·00
275	Horakaika ..	*Podocarpus neriifolius* ..	1	20	0·6	20	0·11	0·69	30·00
276	Ulawaipa ..	Indt.	2	216	7·2	108	1·50	1·39	15·00
278	Haikaka	Indt.	12	1,684	56·4	140	9·36	8·33	2·50
279	Sihu	*Pterocymbium sp.*	2	478	15·9	239	2·66	1·39	15·00
280	Medupu	Indt.	1	320	10·6	320	1·78	0·69	30·00
281	Averavu	Indt.	1	115	3·8	115	0·64	0·69	30·00
282	Aoubu	*Dysoxylum fissum* ..	1	112	3·7	112	0·62	0·69	30·00
283	Pauka	Indt.	2	292	9·7	146	1·62	1·39	15·00
284	Upia	Indt.	3	477	15·9	159	2·65	2·08	10·00
285	Kovo	*Terminalia foveolata* ..	2	336	11·2	168	1·87	1·39	15·00
286	Here	Indt.	5	838	27·9	167	4·66	3·47	6·00
288	Buru-Buru ..	Indt.	1	518	17·2	518	2·88	1·39	30·00
289	Boru	*Celtis sp.*	2	318	10·6	159	1·77	1·39	15·00
290	Koredapu ..	*Ficus sp.*	1	158	5·2	158	0·88	0·69	30·00
291	Buria	Near *Dysoxylum caulostachyum*	1	158	5·2	158	0·88	0·69	30·00
292	Komara	Indt.	2	256	8·5	128	1·42	1·39	15·00
293	Loloke	Indt.	3	335	11·1	112	1·86	2·08	10·00
294	Haika	Indt.	1	88	2·9	88	0·49	1·39	30·00
295	Hiri	Indt.	1	58	1·9	58	0·32	1·39	30·00
		Total	144	17,962	598·0	124	100·00	100·00	..

TABLE XIX.

SURVEY OF THE FORESTS ON THE BAROI RIVER, U.A. CAMP, LEFT BANK.

Predominant species, viz., over 4 per cent. of volume.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
5	Okamu	*Pometia pinnata*	47	5,059	168·0	107	28·13	32·5	0·06
1	Damoni	*Dracontomelum mangiferum* ..	40	4,382	146·0	109	23·36	27·77	0·75
278	Haikaka	Indt.	12	1,684	56·4	140	9·36	8·33	2·5
286	Here	Indt.	5	838	27·9	167	4·66	3·47	6·00
198	Sabi	*Sarcocephalus cordatus* ..	5	737	24·5	147	4·10	3·46	6·00
		Total	109	12,700	414	116	68·5	75·00	..

was 30 acres, and represented over one-third of the total area of the timber on this particular bend. It will be seen from Table XVIII. that there were altogether 144 trees, 6 feet in girth and over, growing on the strips; their volume was 17,962 cubic feet, which works out at 599 cubic feet per acre, and 124 cubic feet per tree. In Table XIX. will be found enumerated the predominant trees. The stocking is so weak that I have reduced the percentage limit from 5 per cent. to 4 per cent., thereby including No. 191, Leichhardt's pine, and here. With these, then, are five species over the 4 per cent. mark, but of them only two are sufficiently numerous to be remarkable to one travelling up and down the river. They are No. 5, okamu, and No. 1, damoni, which together account for 51 per cent. of the volume and 60 per cent. of the stocking. There are a few more okamu than damoni, and together they run about three to the acre. Both are buttressed trees.

unfortunately, so that there is great waste in sawing, and the volume is much less than one would expect from such high trees.

No. 278, haikaka, yields a useful timber, which when worked up and polished would make a good mahogany substitute. No. 286, here, is the commonest canoe wood, except for ilimo, used in the Delta Division. No. 19, sabi, has already been mentioned, but here is only found in the sago swamps, with No. 10, melila, as its companion. It does not grow large, nor is it numerous. There appear to be two varieties—one with a very yellow wood, and the other with an almost white wood. These on further examination may prove to be distinct species. The bark and wood of both have the same cinchona taste.

Of the other trees already mentioned, No. 10, melila, deserves special remark, because here it grows in swampy country. Up to my visit to the delta, I had found melila accommodating itself to very varied conditions of environment. I have recorded it on the steep foothills of the Hydrographer's Range and on the hills behind Veimauri. It grows well on the higher ground just above the reach of the tide in Galley Reach. It thrives abundantly along the sea coast at no great distance from the shore. Here in the Delta Division it has accommodated itself to the sago swamps, and attains quite a large size in conditions that one would regard as quite inimical to tree growth of any sort not provided with special apparatus. The melila have got over the difficulty of living in water-logged ground by developing prop or aerial roots similar to those of a mangrove; though not so accentuated, they are quite well formed, and, seeing melila for the first time in such an environment, one might be excused for writing it down definitely as a prop-rooted swamp species.

Little groups of melila, mixed with No. 19, sabi, occur in all the sago swamps of the Baroi; nowhere, however, are the trees very abundant. Elsewhere, I am informed by Mr. Lett, who has established a mill on the Wami to cut timber from the Baroi and adjacent waterways, there are commercial stands of melila. Such stands of so useful a durable wood should prove of value, and I am sorry that I did not come across any of them during my travels, and so am unable to give any information as to their composition, volume, and area.

No. 2, kaeda; No. 6, meneia; No. 13, sihu; No. 29, devoru; No. 36, okaka; No. 47, wai-am-a-hasi; are all old friends. Of the sixteen new ones, besides the two mentioned above, several are of interest.

No. 275,[(a)] herikaka, is a conifer (*Podocarpus neriifolius*). Its wood is identical with No. 238, but there may be some botanical difference, so I have kept this "brown pine" separate for the present. It grows as well as No. 238, which was found in the Hydrographer's Range, but is only a small tree and unlikely to be of commercial interest.

No. 276, ulawaipa. An interesting constructional timber—one of the few timbers of Papua that is heavier than water. When seasoned, to 12 per cent. moisture its specific gravity is 1.03. It is very hard, and dark red-brown in colour. A number of the pores are filled with a red resin, or it may be a gum.

No. 277, harikou, yields a useful, rather light, easily-worked cabinet wood. When fresh cut it has the smell of the South African much-prized stink wood.

(*a*) Since compared and found identical botanically by Mr. C. T. White.

No. 280, medupu, yields a mahogany substitute. It also has red resin-filled pores. It might be straighter-grained with advantage.

No. 281, averavu, yields a white hardwood. The sap wood becomes discoloured after a while, but the heart remains a very clear white.

No. 282, aoubu (*Dysoxylon fissum*) yields a scented wood, which works easily enough and has a mahogany grain and texture. Its scent is like that of cedar.

No. 283, pauka, yields a rather soft woolly pale wood, This was met with on the Venapa, No. 109, Namuta.

No. 284, upia, yields a useful canoe wood.

No. 285, kovo (*Terminalia faveolata*), yields a very porous, yet good coloured, brown wood. It works easily, and would make a good cabinet wood.

No. 287, hekakoro (*Eugenia* sp.) yields one of the most beautiful cabinet woods in Papua. It is of a golden-yellow colour, and through this sheen of gold are scattered lines of red. These red rings are quite irregular, so the figure of a piece of timber backed off is particularly arresting, while the yellow and red lines of a quarter cut sample are beautiful enough also.

No. 288, buru-buru, yields a heavy constructional timber.

No. 289, boru (*Celtis* sp.) a cross-grained hardwood, subject to fungus attacks that discolour it.

No. 290, koredapa (*Ficus* sp.), a noble looking tree with very indifferent timber.

No. 291, buria (*Dysoxylum*, near *caulostachyum*), yields a very pretty brown cabinet wood of the mahogany type, with a yellow sheen on the quarter. It is easy to work.

No. 292, komara, yields a yellow wood of rather heavy and dense consistency.

No. 293 equals No. 199. This was met with before in the Kumusi, in the northern division.

No. 294, haiaka, yields a pale yellow wood, which turns grey on drying, and shows a good walnut grain on the back.

No. 295, hiri, a pretty cabinet wood; works well. Has a walnut grain on the back.

It is quite clear that in a patch of timber of this sort, if the saw-miller fails to find a market for his damoni and okamu timbers, he will have little hope of disposing of the scattered species that remain.

Camps were made in various other timber patches up the river as far as the head of the delta, and down to a few miles above the Wami, and the summaries of all the surveys carried out will be found in Tables XX. and XXI.

Two hundred and fifteen chains of traverse lines were cut, and the strips therefore covered an area of 43 acres, or 4.3 of the total estimated area of the Baroi timber. Everywhere on this stretch of the river—some 25 miles—the conditions are the same. A fringe of forest about 5 chains deep lines the bank; beyond that is swamp. All the lines I cut away from the river through these swamps revealed no high ground. The distribution and mixture of species in the fringe of forest was so similar in all four camps that I have combined all four surveys under one summary. This shows 193 trees, with a volume of 25,527 cubic feet, or 591 cubic feet to the acre, and 132 cubic feet per tree. As at the Ua Bend, the predominant species are damoni and okamu (see Table XXI.), but heri's

place is taken by sihu. Herikaka still holds her own—she now represents 6 per cent. of the volume. About 60 per cent. of the trees is represented by these four species, and they contain 46 per cent. of the total volume. There were twelve species not met with at Ua, of which the following brief notes may be of interest:—

No. 296, aqwu (*Meliaceae* indt.), a light cabinet wood.

No. 299, hora-hora, yields a soft white wood that, unfortunately, blues very quickly.

No. 300, oko (*Dysoxylon Pettigrewianum*), yields a strong, general-purpose wood, which works smoothly enough for cabinet making.

No. 301, yope, *Spondias dulcis,* yields a soft wood that cuts woolly. It would be suitable for cases if the blue mould trouble is preventable.

No. 302, hudahu, another soft wood, suitable for cases.

No. 303, ahko, (*Gmelina sessilis*), a useful firm wood, with a satin quarter grain. It is of light colour, and works easily and cleanly.

TABLE XX.

SURVEY OF THE FORESTS OF THE BAROI RIVER, CAMPS 2, 3, 4, and 5. (BOTH BANKS.)

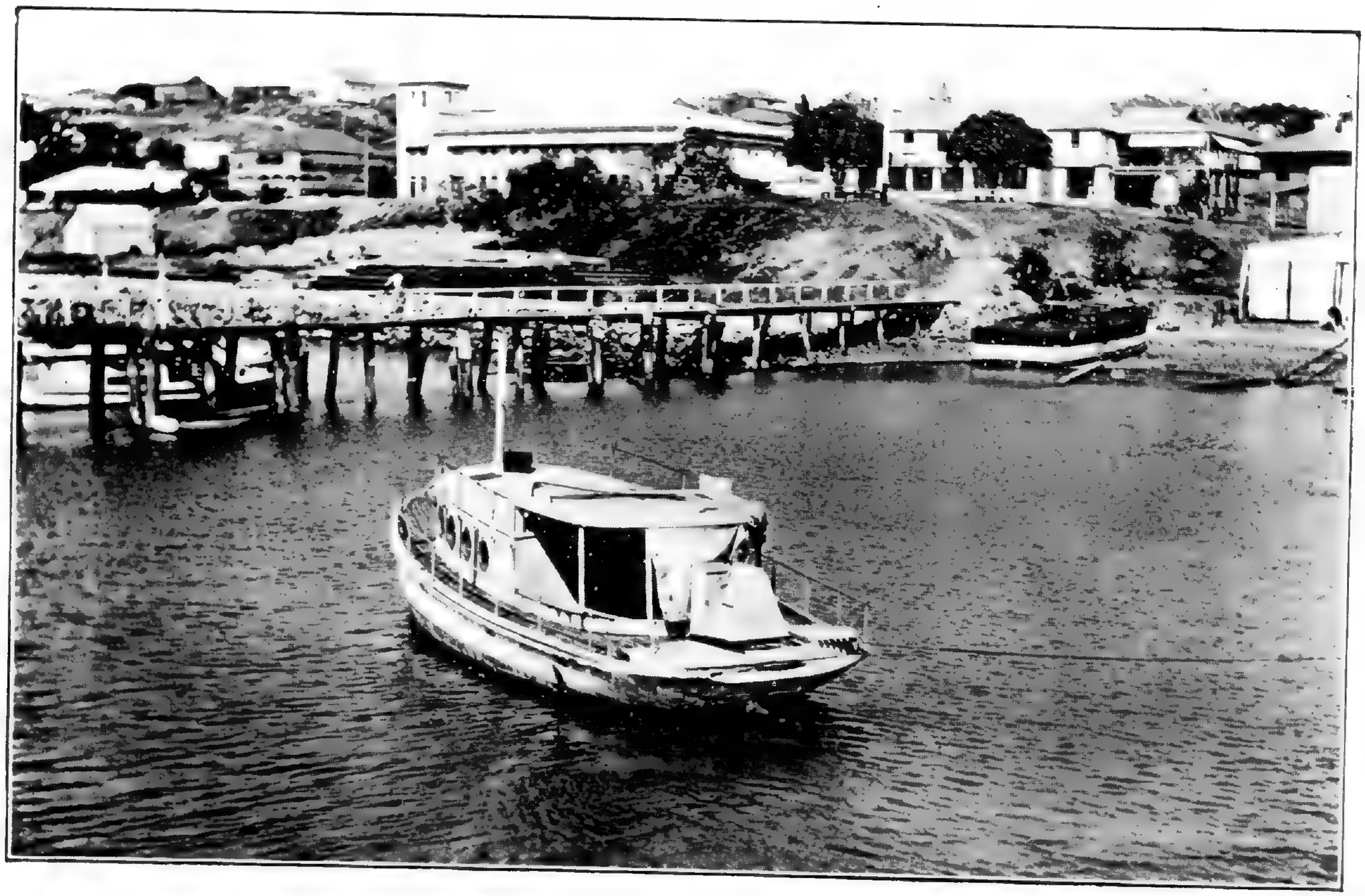
Herbarium. Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
1	Damoni	*Dracontomelum mangiferum* ..	23	2,839	66	123	11·2	11·9	1·8
2	Kaeda	*Planchonia timorensis* ..	5	672	15	134	2·6	2·6	8·6
4	Nara	*Pterocarpus indicus* ..	1	259	6	259	1·0	0·5	43·0
5	Okamu	*Pometia pinnata*	69	5,494	127	79	21·5	35·7	0·6
8	Kabo	*Laportea gigas*	1	210	5	210	0·8	0·5	43·0
10	Melila	*Afzelia bijuga*	1	166	4	166	0·6	0·5	43·0
19	Sabi	*Sarcocephalus cordatus* ..	5	690	16	138	2·7	2·6	8·0
34	Ilimo	*Octomeles sumatrana* ..	4	920	21	230	3·6	2·1	10·7
47	Waiamahasi ..	*Celtis philippineusis* ..	5	713	17	142	2·8	2·6	8·6
145	Ano-Ano	*Vitex cofassus*	1	128	3	128	0·5	0·5	43·0
276	Ulawaipa ..	Indt.	1	160	4	160	0·6	0·5	43·0
277	Harikou	Indt.	1	128	3	128	0·5	0·5	43·0
278	Haikaka	Indt.	12	1,556	36	129	6·1	6·1	3·6
279	Sihu	*Pterocymbium foveolata* ..	12	1,845	43	154	7·2	6·1	3·6
283	Pauka	Indt.	1	180	4	180	0·7	0·5	43·0
284	Upia	Indt.	5	440	10	88	1·7	2·6	8·6
285	Kovo	*Terminalia sp.*	4	699	16	174	2·8	2·1	10·7
286	Here	Indt.	4	495	11	124	1·9	2·1	10·7
289	Boru	*Celtis sp.*	1	375	9	375	1·5	0·5	43·0
292	Komara	Indt.	3	457	10	152	1·8	1·5	14·3
293	Loloke	Indt.	1	90	2	90	0·3	0·5	43·0
294	Haiaka	Indt.	7	1,253	29	179	4·9	3·6	6·1
295	Hiri	Indt.	1	50	1	50	0·2	0·5	43·0
296	Aawu	*Meliaceae*	1	93	2	93	0·3	0·5	43·0
299	Horahora ..	Indt.	7	1,520	35	217	5·9	3·6	6·1
300	Oko	*Dysoxylum pettigrewianum* ..	1	202	4	202	0·8	0·5	43·0
301	Yope	*Spondias dulcis*	4	677	15	169	2·6	2·1	10·7
302	Huda-hu ..	Indt.	1	166	4	166	0·7	0·5	43·0
303	Ahko	*Gmelina sessilis*	1	93	2	93	0·3	0·5	43·0
304	Auro	Indt.	3	1,053	24	351	4·1	1·5	14·3
305	Boa	*Antiaris toxicaria*	3	974	22	324	3·8	1·5	14·3
306	Wairo	*Canarium lineistipula* ..	1	180	4	180	0·7	0·5	43·0
308	Bahia	*Dysoxylum sp.*	1	141	3	141	0·5	0·5	43·0
309	Buhu	Indt.	1	79	2	79	0·3	0·5	43·0
310	Aberau	*Gamophyllum falcatum* ..	1	400	9	400	1·5	0·5	43·0
		Total	193	25,527	591	132	100·0	100·0	..

TABLE XXI.

FORESTS OF THE BAROI RIVER.

Predominant species, viz., over 5 per cent. of total volume.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
1	Damoni	*Dracontomelum mangiferum* ..	23	2,839	15	123	11·2	11·9	1·8
5	Okamu	*Pometia pinnata*	69	5,494	127	79	21·5	35·7	0·6
278	Haikaka	Indt.	12	1,556	36	129	6·1	6·1	3·6
279	Sihu	*Pterocymbium sp.*	12	1,845	43	154	7·2	6·1	3·6
		Total	116	11,734	272	101	46·0	60·0	0·37



[*Photo by Dr. Strong.*

The Launch *Kismet,* at Port Moresby. She navigated successfully the Purari River.

[*To face page* 29.]

No. 304, auro (*Pentaspodon Motleyi*), the oil tree of the delta. It not only yields a rather hard, straight-grained, heavy, brown timber, with an oily feel and a vinegar smell, but yields a heavy vegetable oil in comparatively copious quantities. See description in Section C, p. 113, also remarks on page 173.

No. 305, boa, (*Antiaris toxicaria*), a very light, porous wood, soon attacked by blue fungus. Its bark yields "tapi cloth."

No. 306 wairo (*Canarium lineïstipula*), a hardish wood that cuts soft; also badly stained with fungus.

No. 308, bahia (*Dysoxylon* sp.), a medium hard wood of a red-brown colour, with a mahogany grain. Should prove a good cabinet wood. I saw some nice beams, 18 inches x 18 inches, cut from this timber, lying at Upoia, the old camp of the Anglo-Persian Oil Company. That company would appear to have preferred this to any wood as a general purpose timber.

No. 309, buhu, a straight-grained, firm wood; works well, and has a satin grain.

No. 310, aberabu (*Gamophyllum falcatum*), a hard white wood.

In addition to the above, I came across a few trees outside the strips:—

No. 297, kaki kaki (*Garuga* sp.), proved to be identical with No. 20—uri—of the Galley Reach forests. It grows in the delta on quite different country from the foothills of the Veimauri, and attains much greater height and larger diameter.

No. 298, koraikavivi, proved to be identical with No. 88—time that I first found above Doura, on the Vanapa.

No. 316, urope (*Adenanthera pavonina*) yields a good, easily-worked and very beautiful cabinet wood.

I took the opportunity, while I had a launch at my disposal, to collect material of the common palms. Palm material is so bulky that it is difficult, in a country like Papua, when carriers are required for the purpose of carrying their own food, to transport it.

No. 311, dihihu, the tall palm with the small ($\frac{3}{8}$-in.) fruit in large panicles. The stem is used for flooring by the natives.

No. 312, apumehere, a medium palm, with a red, showy fruit. Spears are made from the trunk.

No. 313, kurabea, a medium palm with globose pink and white fruits containing three very dark-brown seeds.

No. 314, aporo, a tall palm with maiden hair cut fronds. It is used for flooring, and the Koiara natives like it for spears.

No. 315, doporo, a tall palm with a green oval fruit, 3 inches x $1\frac{3}{4}$ inches, contaning one seed. A betel substitute, and the split trunks are used for flooring.

Interesting as the fringe forests of the Baroi River are from a scientific stand-point, they leave a good deal to be desired from a commercial aspect. Having been told that there was likely to be excellent timber up the Purari, above the delta, I decided to pursue my investigations up that river.[a]

Mr. Moates accompanied me, and was of great assistance, not only in the continual everyday troubles that arose, but in landing and reconnoitring when we reached hostile country. While the Purari is a great, rapid-flowing river—and here and there the current was so fast as to make it necessary to anchor or tie up to the bank, and wait for better times—it is for the most part free from dangerous rapids and snags. So with the launch *Kismet*, which could just make 5.6 miles an hour, a native coxswain, Pipi, and a native engine boy, Maimo, we ascended the Purari to some 6 miles beyond the group of islands, and which is marked on the map on page 75A Biroe village, but which to-day is known by a sound which, as far as I can render it in our alphabet, might be spelt Dure-Durea. The map was plotted some time ago, and needs some correcting, not only in place and river names, but in the position of islands, rapids, &c. While the journey took five days to do, the actual running time of the launch was only 41 hours, and coming back to Ua camp, whence we had started, took 11 hours.

The timber proved of singularly poor class, and so my investigations were negative. This detracted very much from what was otherwise a pleasant excursion. Only those who have footed it through the Papuan jungles can realize the pleasure it is to journey by launch, making inroads here and there on the forests, but returning always to a snug home tied up stem and stern to stout trees on the bank. That the journey was not wholly without discomforts and excitements was only to be expected. Details of the voyage and the guides we took on from the big communal house that stands sentinel at the big bend opposite the river dubbed "Auro" on the map, but called something quite different by the Jude Namainas who inhabit that patch of the Purari, and the difficulties when we reached the Durea Namainas, have been left with the Resident Magistrate at Kikori (Mr. Woodward), where they may be of some use. Suffice it to say here that the natives up to the big bend already mentioned are kind and hospitable, if a little timid. They are called Ku-ku-kus by the coastal people, but call themselves Jude Namainas. Above the big bend there is a stretch of banks utterly ungardened, and this continues up to the group of islands already mentioned, where the Durea Namainas live. These people have communal houses on the islands, as well as garden houses, are cannibals, and are feared by the Jude Namainas. The guides we took from the big bend went in great fear of them, and spent their nights in the forward hold of the *Kismet*, which was little more than would hold the anchor chain, and when the hatch was down—they saw to that—had only the hawse pipe for ventilation. These Durea Namainas were decidedly unfriendly, and expressed this by signs, the purport of which was unmistakable. They also showed their contempt of us by a gesture which is very old, and yet so telling, that it is used with success by the London street arabs to-day. Passing beyond these islands, we reached a stretch of river 400 yards wide, 3 fathoms deep, and running 5 miles per hour, and here, through lack of petrol, we were obliged to turn back. This was particularly unfortunate, as we were entering more mountainous country, and we might have found some timber of more interest than what had been seen lower down. Also, we cannot have been far from the place where it is said the Purari passes through a canōn with 2,000-ft. walls. This is interesting, not only from a mere spectacular stand-point, but because I have failed to find any record of any one having visited it, and also it is not without interest to one who has inherited some little love of Egyptology, for it is called after the sacred cow of Isis, the Hathor canōn.[a]

Lest it be thought that the hostile nature of the Dure-a Namainas reflects discredit on the administration of the Delta Division, I hasten to add that these people are only a handful, that few launches can go up the Purari, and none such is possessed by the Resident Magistrate of the Division. Also, to correct any wrong impression as to these people's nature, I would point out that we were the third white party to visit them, and that they have really never been visited in the sense understood by magistrates, viz., with a view to establishing friendly relations. Indeed, the last party which visited them had a queer method of pacifying them, for they fired a volley over their heads. That was in 1912.[a]. In the circumstances, is it any wonder that we were received with contumely, and made the object of the oldest derisive gesture in the world?

(a) A rough sketch of the course, together with notes, bearings latitudes, rates of current, notes of prominent features, and other details, has been left with the Official Secretary (Mr. Leonard Murray).

(a) Annual Report Papua, 1912, p. 186.

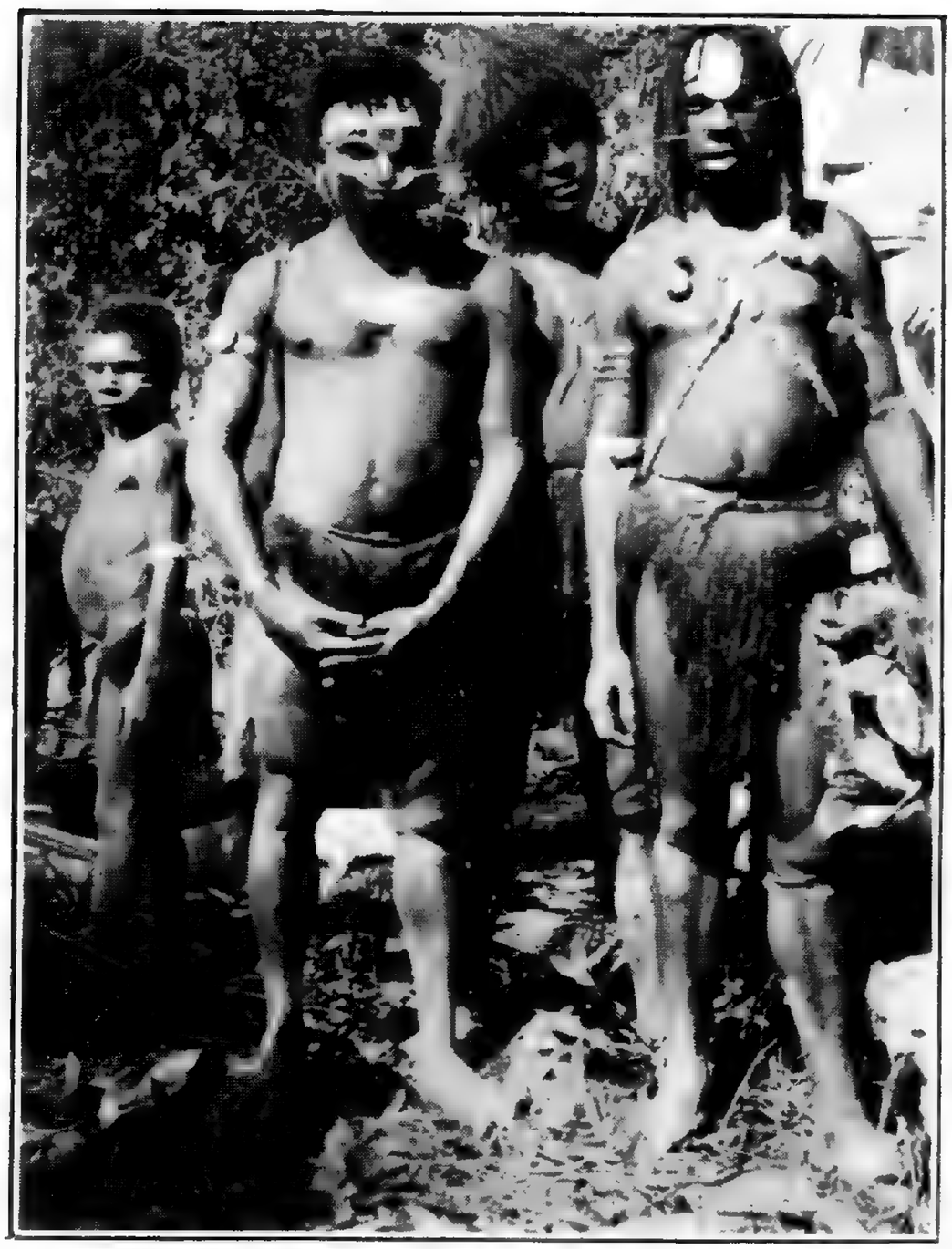
Description of the Purari Timber.

Pursuing the course of the Baroi to the head of the delta, one first meets the Ivo bifurcation, and, a little higher up, the now much broadened stream—300 yards at least—the Hourama River, which branches off to the right. One is then in the Purari proper, a 400-yards wide waterway. Both banks are low, and some 12 miles have to be traversed before the banks rise and hillocks begin to show up. A few miles higher the first rocks are seen, and steep wooded hills come down to the water's edge. The timber is, however, of poor quality—a forest of pole woods. From here on the country is all broken, the river winding its way through gully after gully. Some 30 miles up it narrows to 100 yards, and a large group of rocks, 15 feet high, near the right bank, causes a whirlpool. The current, which at the Hourama bifurcation was running a little over 2 miles an hour, is now running 3 miles. Innumerable little creeks are met with. These have their sources in the hills on each side, and make their way into the main river. The mouths are often masked by the jungle, so that I do not pretend to have recorded all of them in my field notes.

At about 35 miles the Sou Creek falls into the Purari, on the left bank. One of our guides, Purai by name, having a garden hut here, and the natives being generally willing to help, I decided on my way back to attempt to cut a traverse across to the Vailala. This would, I thought, save me work at the head of the Vailala—a river which was next on my itinerary—and I should get a good idea of the nature of the forest on both watersheds. I failed, however, to get through, and although the old map shows the two rivers to be less than 8 miles apart at this point, I am inclined to believe that a much wider belt of country divides them. The Sou Creek is navigable by canoe for a mile, which is somewhat surprising, as its mouth is so masked as to be easily overlooked. From then on it becomes torrential, and I abandoned it, cutting a line N.E. The natives, who had come down from Jude, on the big bend, while quite happy and friendly, were averse to carrying loads, so after two days of scramble I gave up the attempt to reach the Vailala. I had traversed some 6 miles, and crossed the Sou five times. There were numerous hunting huts, yet the Jude-Namainas insisted that no one ever used them, and that it was five "sleeps" to the Vailala over quite impossibly high mountains. They contradicted themselves somewhat flatly later, when they pointed out to me a high hill, about 3,000 feet, from which they said a view of the Vailala was obtainable. The hill appeared to be two days off and N.N.E. of my position, so I turned back. I mention these details as they may prove of some help to others who may wish to traverse this strip of land between the two rivers. It would probably be best to hold to the winding course of the So-u rather than do as I did—cut a line on a compass bearing. The So-u appeared to rise in the high hills, and these may prove to be the watershed. That there is a way over to the Vailala I think is certain, for when I later visited the country above Keke, on that river, a canoe load of Ku-ku-ku-ku people came down, and among them I recognized a Jude-Namaina from the big bend on the Purari. His friends could speak broken Vailala talk, and I learnt from him that he had crossed over from Jude a short time after I had been up there, and that it took him six "sleeps." The Jude-Namaina probably have some excellent reason for not showing strange people their private tracks.

Of timber I saw nothing of consequence. Along the mile of canoeable water-way, where the Sou follows an alluvial gully, there were a few nice ilimo. This species is conspicuous by its absence all along the Purari, the reason being that there is no alluvial land along its banks, which are steep and stony. Lower down above the delta, when low-lying land does occur, the nature of the country is too swampy to carry ilimo. Other rain forest species, of which No. 13, sihu, and No. 5, okamu, were most conspicuous, were seen, and further up, at 1,000 feet, No. 6, menaia, was met with. Nowhere, however, did I see forest worth surveying.

Some 4 miles above So-u Creek we passed McDowall Islands, where the current increased to 4 miles, and some difficulty was experienced in getting up. Above these islands high mountains begin to show up prominently, and the Purari is confined in a gully, and is dappled with whirlpools The mountains on the left bank are very fine, rising steeply from the water, and having apparently a razor-backed top. The timber is, unfortunately, monotonously poor. Another 7½ miles brought us to the Jude village, if a couple of communal houses, holding 50 males and an uncounted number of females (who are kept in a sort of pandanus-covered rubbish heap on the ground below one of the high-perched houses), can be called a village. Here is where the Aure, as it is called on the map, joins the Purari. The Jude-Namainas have a different name for this stream, which appears to have somewhat contracted in width and importance since it was first described and mapped. Our fine range of mountains now turn N.E., while to the north, following the Purari, begins another range of timbered hills, rising to mountains. The valley of the "Aure" is well defined by the N.E. range of mountains, which remain visible for a very long way up the Purari. They are rendered very distinctive by the white rock exposures which splash their otherwise green precipitous slopes. Mr. Stanley, with whom I discussed the geology of this part, is of the opinion that these are limestone exposures. Altogether there were seventeen canoes tied up to the bank at Jude, and these on examination proved to be all built of "here." I had hoped to find some cedar in these parts, but failed to do so, the boys denying all knowledge of the wood, which was rather remarkable, as Mr. McDonald, on the Vailala, had obtained some quantities of it up that river with the help of Ku-ku-ku-ku people. If it does occur on the Purari, the natives make no use of it. Their canoes are very ill-shapen, and some are quite crooked. They do not cut them down at each end, as do their delta brethren, and except for their rude finish, and that they have no outriggers, they are the usual river type of canoe. The poorness of the canoes is doubtless due to the poverty of the forests hereabouts. Passing Bevan Islands and several creeks, of which Hei, on the left bank, and Hou, on the right, are the largest, we came to Chalmers Islands. These are wooded, and six in number, and the current in between them runs 4½ miles per hour, and in parts the depth of water is only 1½ fathoms. The mountains have receded a little, and sharp wooded hills tumble down to the bank. The timber is very disappointing. Passing Gleeson Island—a bank of rushes—some 25 miles above Jude, we reached a small wooded island some 5 miles higher up. Just below this was a particularly bad stretch of water rapids on the left, and a deep stream on the right side, the latter running 6 miles. The central channel was very narrow, and it took two hours ten minutes to get up a distance of a quarter of a mile to the island. The country here is a tangled, broken mass of little hills, with big mountains to the north. Above the island the Pite River was passed, and a succession of swift stretches were met with. On the left the hills in places dropped precipitously 100 feet to the water, and the Purari swished through a narrow rocky-faced gorge. Some 35 miles above Jude the Poh River runs in on the left (right bank), and there for the first time signs of human life were seen since we left Jude. Gardens, perched up on the steep banks, were met with, and only a few miles higher the river widens out to 850 yards, and is strewn with islands, some only rush covered, other wooded. It is on the latter that farm houses and communal houses exist. These are the homes and gardens of the Dure-a Namainai. There is still no sign of alluvial lands. The bottom is all stones, and the islands are stony under their rushes or poor



Natives of the Jude Namaina Tribe (Kuku-Kuku), Middle Purari.

[*To face page* 30.]

timber growth. The surrounding country is very broken. To the south is a succession of small hills, all of recent geological formation—sandstones and mudstones. To the north rise range upon range of big mountains. After passing these islands we reached a stretch of the river 400 yards wide, 3 fathoms deep, and running 4.8 miles per hour, bearing 276 deg. It appeared to come from between two high ranges, which have a N.W. to S.E. trend.

Having examined the islands on the way back, and having been prevented from examining the surrounding country as well as I should have liked, owing to the hostility of the natives, we retraced our way to Ua. I made the farthest island of the group (Dure-a Namaina), 103 miles above Ua. I noticed along the course of the Purari here and there a number of *Casuarina nodiflora,* which rather surprised me, as I considered this to be a hill species of the savannah forests. Again, the great leafed *Dammaropsis Kingiana* was a common tree overhanging the water. Up to then I had considered this fig-like tree to be purely a mountain torrent species, growing at 4-6,000 feet. The common trees of the Purari are an *Albizzia, Pterocymbium,* and *Pometia.* A small palm, with delicate fronds and a little red fruit in a crowded weeping panicle, fringes the banks in many places.

From the point of view of floating timber, the Purari leaves nothing to be desired. There is no impediment on its course, and a log released at the Dure-a Islands would reach the head of the delta in eighteen hours. The river carries so large a volume of water, and at the same time is subject to such violent rises, due to night rains in its upper waters, that its course is always clear to the delta. Such snags as are deposited occur only at the mouths of tributaries, and only remain there until the main river rises again, and carries them down. It is unfortunate that so fine a means of log transport should be barren of sound timber.

Before leaving the delta of the Purari, the courses of the Ivo and Houramu were investigated, but the timber along these waterways was found to be even less plentiful than on the Baroi, so no surveys were made.

The Upper Era.

Through the kindness of the Resident Magistrate (Mr. Woodward), who organized and led the patrol, I was fortunate enough to visit the head waters of the Era. The map of this region is quite misleading, for the Era rises in the hills where Hou Creek has its source; the latter, as I have already shown, falls into the Purari below Chalmers Islands, and the Era into the bay called after it. Our object was to reach the Purari from the head of the Era, which we thought would be somewhere near the source of Poh Creek. Having penetrated some distance through unknown and particularly broken country, consisting of mudstones, shales, sandstones, with here and there a coal seam, we had the misfortune to lose our guide, who deserted us, and finally we returned by means of rafts down the Era, though at first we were ignorant that it was the same river we had started to ascend a fortnight previously. The whole of the country travelled over, which may be taken as the basin of the Era, carries no timber of importance. In the lower reaches of the river a few cedar were met with, but nowhere was there a forest of millable volume in this dreadfully broken country.

The Kikori River.

The Kikori River carries a little timber at its lower end, just above the salt water, but this soon peters out as the limestone formation is reached. From what Mr. Staniforth Smith has told me of the country between the Kikori and the Strickland, which is all limestone, there is no likelihood of timber being found in that region.

The Vailala River.

This river, though considerably smaller than the Purari, carries a sufficient volume of water to be easily navigable by the *Kismet* to a point above the Ivori junction. Beyond there it becomes very snaggy, and as the reversing gear of the launch had become unserviceable, I decided to go no higher. Starting from this highest point, surveys were made of the timber on each bank, six camps in all being made for this purpose. A summary of all data obtained will be found in Tables XXII. and XXIII. The total area of the strips covered 180 acres, and the traverses were cut parallel, and at right angles to the river. It will be seen altogether there were 478 trees, with a volume of 65,434, which worked out at 383 cubic feet per acre, and 135 cubic feet per tree. Examined camp by camp and traverse by traverse, it was found that the good timber was all close on to the river, and the traverses cut at right angles to the course all carried very inferior trees. The country either became swampy—this was usually the case on the lower reaches—or it became hilly, as was the case higher up. In both cases the quality degenerated, and the number of trees to the acre decreased. Here is an analysis of the data at each camp:—

No. of Camp.	Direction of Traverse.	Area Included in Strip.	No. of Trees.	Trees to the Acre.	Remarks.
1 ..	At right angles to river ..	13	36	2·7	Hilly country
2 ..	Parallel to river ..	15	74	4·9	Alluvial flat
2 ..	At right angles to river ..	10	17	1·7	Hilly country
3 ..	At right angles to river ..	32	42	1·3	Flat, wet country
3 ..	Parallel to river ..	20	72	3·6	Alluvial flat
4 ..	Parallel to river ..	16	57	3·6	Alluvial flat
4 ..	At right angles to river ..	25	40	1·6	Swampy land
5 ..	Parallel to river ..	33	73	2·2	Alluvial flat
6 ..	Parallel to river ..	16	74	4·2	Alluvial flat

Turning to the main Tables XXII. and XXIII., we see that there were five species that carried a volume of over 4½ per cent., and that together these accounted for 31 per cent. of the total volume, and 36 per cent. of the stocking. No. 5, okamu, is well in front again when the number of trees is considered, though, owing to the buttressed stem and relatively small girth, the volume is less than 5 per cent. Although only 26 ilimo were encountered, these accounted for nearly 11 per cent. of the total volume. I did not find them in close, pure stands, such as I described on the Venapa, but they were scattered among the mixed rain forest. No. 278, haikaka, is among the predominant trees, and the soft wood, No. 13, or No. 279, sihu. No. 300 is common as trees go in Papua, but its volume per tree is low. Just below the 4½ per cent. mark comes our oil tree, No. 304, auro, with 24 trees and 4.33 per cent. of the volume, and 4.94 per cent. of the stocking.

While a certain number of species recorded on the Baroi were not met with on the Vailala, a number of new trees were encountered.

No. 317, ai-i-hi, (*Eugenia* sp.) is a handsome tree, which, at the time I saw it, i.e., Decemher, was a mass of mauve flowers. The wood is of a hard constructional type.

No. 318, opopera (*Kingiadendron* sp.), or dika, yields a soft yellow timber that exudes a greenish gum.

No. 319, kirabu, (*Cinnimamum* sp.), yields a hard wood with a rather pretty grain.

No. 321, baiah, yields a hard, sound wood, with a smell like Ocotea.

No. 322, horopo, yields a soft brown wood, with a slight cedar fragrance. It is used for canoes.

No. 323, baiabu, (*Illipe* sp.), a pale brown, firm wood.

No. 324, auakou, yields a nicely grained cabinet wood of light weight.

No. 325, kuakeia (*Sideroxylon* sp.), yields a very uniform yellow-brown, rather hard wood.

No. 326, koboharua, yields a useful looking brown wood, with a pleasing grain.

No. 327, kokolaka, (*Vatica papuana*), yields another very uniform wood of lightish colour.

No. 328, ihopeia (*Spondias dulcis*), a grey, pretty-grained wood, but rather woolly.

No. 329, opa, yields a pale, light, soft wood.

No. 330, kora-u, yields a uniform pale wood.

No. 331, deke, a pale wood with a mottled quarter grain.

TABLE XXII.

SURVEY OF THE FORESTS ON THE VAILALA RIVER, CAMPS 1, 2, 3, 4, 5, AND 6 (BOTH BANKS).

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
1	Damoni	*Dracontomelum mangiferum* ..	19	2,398	13·3	126	3·68	3·81	9·4
2	Kaeda	*Planchonia timorensis* ..	1	265	1·4	265	0·40	0·20	180·0
4	Nara	*Pterocarpus indicus* ..	6	272	1·5	45	0·41	1·63	30·0
5	Okamu	*Pometia pinnata*	87	3,025	15·9	34	4·64	17·92	2·0
6	Meneia	*Artocarpus sp.*	2	550	3·0	275	0·84	0·41	90·0
9	Eti	*Cedrela toona var. australis* ..	2	616	3·4	308	0·93	0·41	90·0
10	Melila	*Afzelia bijuga*	15	1,490	8·3	89	2·29	3·09	12·0
15	Pidina	*Flindersia sp.*	2	315	1·8	157	0·49	0·41	90·0
19	Sabi	*Sarcocephalus cordatus* ..	4	590	3·3	147	0·91	0·82	45·0
22	Arimore	*Horsfieldia silvestris* ..	1	72	0·4	72	0·11	0·20	180·0
24	Kobura	*Pterygota forbesii f. v. m.* ..	8	1,066	6·0	133	1·64	1·64	22·0
29	Devoru	*Alstonia scholaris*	4	688	3·8	172	1·06	0·82	45·0
33	Bara	*Diospyros sp.*	4	391	2·2	97	0·60	0·82	45·0
34	Ilimo	*Octomeles sumatrana* ..	26	7,078	39·3	272	10·87	5·35	6·9
36	Okaka	*Terminalia catappoides* ..	12	1,722	9·6	145	2·65	2·47	15·0
47	Waiamahasi ..	*Celtis philippinensis* ..	14	1,962	19·9	140	3·04	2·88	12·8
57	Asiru	*Cinnamomum massoia* ..	1	124	0·7	124	0·19	0·20	180·0
136	Karawa	*Anisoptera polyandra* ..	4	668	3·7	167	1·02	0·82	45·0
170	Auroro	*Mangifera minor*	1	115	0·6	115	0·18	0·20	180·0
226	Lalagi	*Wormia quercifolia*	1	243	1·3	243	0·37	0·20	180·0
..	Okari	*Terminalia okari*	1	160	0·9	160	0·24	0·20	180·0
277	Harikou	Indt.	3	460	2.6	153	0·70	0·61	60·0
278	Haikaka	Indt.	14	2,931	16.3	209	4·45	2·88	12·8
279	Sihu	*Ptero cymbium* sp.	20	3,773	20·9	188	5·70	4·12	9·0
281	Averavu	Indt.	1	194	1·1	194	0·29	0·20	180·0
283	Pauka	Indt.	1	77	0·4	77	0·12	0·20	180·0
284	Upia	Indt.	3	270	1·5	90	0·41	0·61	60·0
286	Here	Indt.	12	2,112	11·8	175	3·24	2·47	15·0
288	Buru-Buru ..	Indt.	2	304	1·9	152	0·49	0·41	90·0
289	Boru	*Celtis* sp.	5	755	4·2	151	1·15	1·03	36·0
290	Koredapu ..	*Ficus* sp.	1	166	0·9	166	0·24	0·20	180·0
291	Buria	*Dysoxylum* sp. near *caulostachyum*	6	1,330	7·4	221	1·89	1·23	30·0
292	Komara	Indt.	10	1,397	7·7	140	1·99	2·06	18·0
294	Haiaka	Indt.	3	836	4·6	278	1·27	0·62	60·0
295	Hiri	Indt.	10	1,300	7·2	130	1·84	2·06	18·0
297	Uri	*Garuga* sp.	5	774	4·3	155	1·16	1·03	36·0
298	Tumunu	Indt.	1	240	1·3	240	0·37	0·20	180·0
299	Hora-Hora ..	Indt.	12	1,766	9·8	147	1·27	2·47	15·0
300	Oko	*Dysoxylum pettigrewianum* ..	30	3,473	19·2	116	5·33	6·18	6·0
301	Yope	*Spondias dulcis*	1	101	0·6	101	0·16	0·2	180·0
303	Ahko	*Gmelina sessilis*	3	644	3·6	214	0·99	0·62	60·0
304	Auro	*Pentaspodon Motleyi* ..	24	2,824	15·7	117	4·33	4·94	7·5
306	Wairo	*Canarium lineistipula* ..	1	98	0·5	98	0·15	0·2	180·0
308	Bahia	*Dysoxylum* sp.	6	738	4·1	123	1·12	1·23	30·0
309	Buhu	Indt.	7	1,375	7·6	196	1·95	1·44	28·0
317	Ai-ihi	*Eugenia* sp.	1	122	0·7	122	0·19	0·2	180·0
318	Opopeia	*Kingiodendron*	2	327	1·2	168	0·49	0·4	90·0
319	Kirabu	*Cinnamomum* sp.	2	455	2·5	227	0·69	0·41	90·0
320	.. .. ..	Indt.	2	260	1·4	130	0·39	0·41	90·0
321	Baiah	Indt.	4	498	2·7	124	0·76	0·82	45·0
322	Horopo	Indt.	4	552	3·1	138	0·84	0·82	45·0
323	Biaubu	*Illipe* sp.	5	814	4·4	162	1·23	1·03	36·0
324	Auakou	Indt.	1	217	1·2	217	0·33	0·2	180·0
325	Kuakoia	*Sidero* sp. *xylon*	4	844	4·7	211	1·28	0·82	45·0
326	Koboharua ..	Indt.	9	1,707	9·5	189	1·62	1·85	20·0
327	Kokolaka ..	*Vatica papuana*	2	332	2·1	166	0·50	0·41	90·0
328	Ihupeia	*Spondias dulcis*	9	1,682	9·3	187	2·58	0·82	20·0
329	Opa	Indt.	1	180	1·0	180	0·27	0·2	180·0
330	Kearu	Indt.	6	1,013	5·6	169	1·55	1·23	30·0
331	Doke	Indt.	6	1,064	5·9	177	1·64	1·23	30·0
334	Kavea	*Homaliaum pachyllum* ..	7	1,019	6·3	145	1·56	1·44	28·5
333	Napera	*Heritiera littoralis*	1	240	1·3	240	0·37	0·20	180·0 equals No. 85.
335	Urau	*Dracontomelum* sp.	5	790	4·4	158	1·21	0·61	36·0
336	Lara	*Elaeocarpus* sp.	3	376	2·1	125	0·58	1·03	60·0
337	Abaobua	Indt.	1	194	1·8	194	0·29	0·2	180·0
338	Mahei	*Canarium grandistipulatum* ..	1	275	1·5	275	0·41	0·2	180.0
340	Idare	*Terminalia* sp.	1	192	1·7	192	0·29	0·2	180·0
341	Hewara	*Ficus* sp.	1	275	1·5	275	0·41	0·2	180·0
342	Bau	*Celtis* sp. *affin. Nymanii* ..	1	259	1·4	259	0·40	0·2	180·0
		Total	485	65,434	383·0	135	100·00	100.00	..

Savannah Forest—Foot Hill Forest.

Foot Hill Forests, Upper Kemp-Welch.

[*To face page* 33.]

TABLE XXIII.

SURVEY OF THE FORESTS OF THE VAILALA RIVER.

Predominant species, viz., over 4½ per cent. of Cubic Contents.

Herbarium. Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
5	Okamu	*Pometia pinnata*	87	3,025	15·9	34	4·64	17·92	2
34	Ilimo	*Octomeles sumatrana* ..	26	7,078	39·3	272	10·87	5·35	7
278	Haikaka	Indt.	14	2,931	16·3	209	4·45	2·88	13
279	Sihu	*Pterocymbium* sp.	20	3,773	20·9	188	5·7	4·12	9
300	Oko	*Dysoxylum pettigrewianum* ..	30	3,473	19·2	116	5·33	6·18	6
		Total	177	20,280	112·0	114	31·00	36·00	..

No. 332, poioro, is a fan palm, the only one I have seen in Papua. The spread of its circular leaf, with its fimbricated circumference, is 6-7 feet in diameter. Two palms will thatch a house, and so it is much prized.

No. 333, pai-iru (*Heritiera littoralis*), turned out to be the same as No. 85, napera, of the Suku people. It yields a dark brown, hard, handsome wood.

No. 334, kavea (*Homalium pachyllum*), yields a uniformly brown wood of a hard constructional type.

No. 335, urau (*Dracontomelum* sp.), yields a dark brown, well-figured hard wood, very strong, rather heavy.

No. 336, lara (*Elaeocarpus* sp.), yields a pale, light, rather porous wood.

No. 337, abagbua, a canoe wood tree.

No. 338, mahei (*Canarium grandistipulatum*), yields a pretty mouse-brown wood.

No. 339 is the same as No. 318. (*Kingiodendron* sp.).

No. 340, idare (*Terminalia* sp.), yields a wood with a cigar-box texture and grain.

No. 341, hewara (*Ficus* sp.), a grey-brown wood, with a satin sheen on the quarter.

In addition to the above, a few species met with in other parts of the Territory were found on the Vailala. In the first place, No. 9, cedar, occurred here and there. Two were met with on the strips, and the Keke people and some Ku-ku-ku-ku folk, who came down to visit me, showed me stumps of trees they had cut for Mr. McDonald, and a few standing trees. As cedar country goes, this would, I suppose, be regarded as good for Papua. I estimate that there were about one tree to 100 acres. No. 10, melila, was represented by fifteen trees, and, while the bulk of these were in swamp country, with the same queer root system as I have noted about the Baroi melila, some were growing on higher ground, and were of normal habit. Two *Flindersia,* No. 15—were seen. The wood of this species is rather like Queensland silver ash (*F. schottiana*). Leichhardt's pine, No. 19, was not common. The rare aremore, No. 22 (*Horsfieldia silvestris*), was met with, also specimens of No. 57, the cinnamon tree. Another *sterculaceae* in *Pterygota Forbesii,* No. 24, was found again, and of course *Alstonia scholaris,* here called aijapo, was represented, but rather poorly. No. 33, bara, a Diospyros that thrives above Galley Reach, and whose jet black bark is very distinctive, was found here also. No. 36, okaka (*Terminalia catappoides*), was represented by twelve trees, and, curiously enough, its brother, *Terminalia okari,* whose nut is such a delicacy, was also met with. No. 47, waiamahasi (*Celtis philippinensis*), is a tree I have now met everywhere in the rain forests. Specimens of the dipertocarp, No. 136, karawa (*Anisoptera*), so common in the Bunda district, were comparatively rare on the Vailala. No. 170, the wild mango, is protected by the Vailala native. No. 226, *Wormia quercifolia,* was represented by one specimen.

My visit to the Vailala completed my inspection of the rain forests regions of the Territory, and I next visited the mountain forests. Before going on to describe the flora of this region, I will treat the country, which lies between the lowland mixed rain forests and the mid-mountain forests, and which I have designated as foothill forests.

FOOTHILL FORESTS.

These forests lie, roughly, between 1,000 and 5,500 feet. As I have already remarked, the boundaries are by no means clear—the mid-mountain forests coming down often below 5,000 feet, while the mixed rain forest is continuously cropping up in alluvial gullies and pockets in the mountains. Indeed, the foothill forests are not at all an easy type to describe. They lack character, and at times seem only a degenerated form of the rain forests of the lowlands; the same species keep cropping up, and the only difference is that the foothill rain forest is a pole wood, or at best an assembly of low, small-girthed trees. One has just decided that such is the case, and is beginning to ascribe reasons for the low quality of the rain forest, when patches of purely foothill species are met with, and the rain forest becomes quite dominated by what is certainly a different type of woodland. Even at its best, the volume of timber is small, and the foothill forest lacks quality; its height is low, and the trees do not attain the girth they do in the rain forests of the lowlands or in the mid-mountain forests higher up. There is still evidence at this elevation that if the rain forest type of the lowlands were given anything like favorable environmental conditions it would establish itself, ousting the foothill type proper. So it is that wherever there is a valley with sufficient flat land for the river to deposit alluvium, the rain forest of the Pometia type predominates, whatever the altitude, up to the cloud belt. The foothill forests are driven to the rocky country, the sharper slopes, the drier, poorer soils. Later I shall show that precisely the same thing occurs to the hoop pine forests in the mid-mountain belt. Certain true lowland species are also found in the typical foothill forests, and these I enumerate below:—

The most characteristic of the foothill trees is, I think, the *Quercus Junghuhnii,* which yields an oak type of wood, and does not resemble a chestnut in any respect, despite the botanical genus that was first ascribed to it. It arrests the eye at once on account of its habit of growth. It grows in clumps—sometimes an acre in extent—and the ground beneath it is clear of undergrowth, and is only covered with dry leaves, reminding one forcibly of a forest in a temperate climate. Its bark is channelled, like a fluted Corinthian pillar, and at its base it frequently throws out a petticoat of sucker shoots, so heightening the illusion of an old-country tree, for it resembles the lime in this respect. Its leaves are long and narrow, and taper to a fine point. They are not divided up with deep notches like the

typical oak, but are serrated for half their length from the tip. These are not so marked in the upper leaves, and at the very top the leaf is less acuminate and entire. While it is glossy green above, below it has an attractive coppery bloom. Its overall height rarely exceeds 50 feet, or its girth 6½ feet, and were it to grow singly, like the trees of the lowland rain forest, it would not strike the eye. It is that it occurs in almost pure formation that makes it remarkable. Its timber has a bright silver grain on the quarter, is otherwise of a light oak colour, and, like that timber, is fissile on the quarter. It is not durable, having been tried as house posts. It is hard to cut, and would make a good beam, but should be only used under cover from the weather.

No. 220, siri, and No. 221, lala, are both pronounced foothill types, and they make big trees, and carry a decided understory, among which the Garconia, bearing a green plum (No. 224), is a common tree. No. 263, an Albizzia, with a soft woolly timber, is the largest of the trees, and this species is found both in the rain forests on the Purari, Vailala, and Baroi, and up in the mid-mountain forests. It attains its largest size and widest spread of crown, and altogether its noblest habit, between 4,000 and 5,000 feet. The only conifer that grows in the foothills is a Podocarp, No. 238, which appears to be the same as that growing on the Baroi River. It is an unimportant brown-pine type of tree. A fig, with very weeping, fruiting panicles, reminding one of the willow pattern on the china, is a common tree. Several elaeocarps occur, of which the two largest trees are No. 355, with its bright blue fruit, and No. 354, with a scolloped edge nut; both yields soft woods. At the lower elevations of the foothills No. 9, cedar, is met with, but this popular species does not occur at any height. There are a number of Myrtaceae, of which the genus Eugenia is well represented, and of them No. 428 is probably the most striking. I call it the armadillo tree, for its bark hangs in overlapping, hard, persistent scales, like the armour of that quadruped. Several trees of the Lauraceae family are also met with—two cinnamon types and a Cryptocarva. No. 399, *Archidendron*, affin. *A. chrysocarpum*, with its magnificent panicles of caulifloral flowers, which smother the trunk and branches, is a very beautiful, though rather rare object. Another beautiful tree of the foothills is No. 420, *Grevillea densiflora*. Of the rain forest species that intrude into the foothills the commonest is No. 6, meneia (*Artocarpus* sp.). This climbs to quite a high altitude, and occurs on very steep slopes indeed. No. 7, okoia, too, which yields the resin most prized by the lower tribes for their tattooing, is common up to 4,000 feet. No. 10, melila, (*Afzelia bijuga*) becomes rare very soon, and can hardly be said to intrude beyond the first 2,000 feet. No. 11, manoi, the scent tree is met with here and there. No. 12, hodava, (*Terminalia* sp.), I did not see growing, but the natives had the empty shells of the nuts tied to their drums, and assured me that the tree grew in the hills. No. 13, sihu (*Pterocymbium* sp.), gives place to other Sterculiaceae, but No. 24, *Pterygota forbesii*, occurs here and there. While I came across no Flindersia fruits, I expect that this genus will be found hereabouts. Several Evodia climb up from the lowlands, of which *E. accidens* and *E. Bowickii* are the commonest. The former in full flower is a wonderful sight. No. 36 and 135, okaka (*Terminalia catappoides*), is rare, but occurs even at 4,000 feet. The ubiquitous No. 47, waiamahasi (*Celtis philippinensis*), is found almost to the cloud belt. The cabbage tree Gnetum, Nos. 80 and 242, provides greens to the villagers up to 3,000 feet. *Artocarpus incisa*, the bread fruit, is left behind at 3,000 feet, while the Pandanus of the plain gives way to the hill variety, with its 2-ft. long, red, fruity spikes, closely studded with little oily fruits. These form a valuable addition to the native diet, for the pericarp is full of oil, and makes a tasty dish when boiled up with taro, yams, or sweet potatoes. Two dipterocarps occur, of which No. 113 (*Hopea papuana*) is perhaps the commonest. As well as the Garcinia of the foothills, two intrude from the lowland, or at any rate are found in both localities. These are No. 115, moka, (*G. Hollrungii*), which yields a white latex, and No. 116, noru, which yields a yellow latex. One Barringtonia climbs to a higher elevation, i.e., No. 122, mea. An intermediate species is No. 225 (*Cyathocalyx polycarpum*). On the whole, I think it prefers the hills to the lowlands. No. 226, lalagi (*Wormia quercifolia*), shows its bright salmon paper-barked trunk up to 3,000 feet. No. 227, saruka, (*Achradotypus* sp.), the sorcerer's tree, grows more freely in the rocky hills than on the plains of Dobodura; also No. 229, pianga, another aromatic resin-yielding species. No. 334, kavea (*Homalium pachyllum*) is a floribundant species. It makes but a poor tree in the hills; its home is on the alluvium. There are doubtless many more species to record, but as the quality was so poor, I made no surveys in the areas of foothill country I traversed, and so made no collections of material except those that I have recorded.

The forests of the foothills are very dissimilar from those of the lowlands so far as epyphites are concerned. The aerial gardens are not so pronounced, and the lianas are not so large. Orchids abound, but they are less plentiful than in the rain forests proper. The soil cover is more ferny, filmy ferns being very common. I have already mentioned those two lovely climbers, *Agapetes Moorhousiana* and *Hoya dimorpha;* in addition, there are several upland Freycinetia, and at the higher elevations the mountain species is well established. A beautiful leguminous creeper, with an orange flower, occurs here and there. I took it to be a Mucuna, but it turned out to be *Strogylodon lucidus*. Several Mucuna occur also, of which the cream one is perhaps the commonest. A big climbing Araceae, with its stem flattened against the trunk of a tree, and its leaves torn to tatters, carries a large, yellow, fleshy flower, like and immense "lord and lady," and is very showy. Lawyer canes (Calamus), while common, are not so long and stout as in the lowlands, and a very fine slender species gradually takes the place of all others as one rises above 4,000 feet. That large genus of the nettle family, the Elatostema, begin to be seen at this height, and their number increases as you rise to the cloud belt. Here and there they cover the ground to the exclusion of all other plants, except the mountain palm, which only grows a few feet high, and is very ornamental. Of flowering shrubs the Melastomaceae are commonest, and are conspicuous, both owing to their flowers and their leaves; also a balsam (Impatiens), with a beautiful and very varied coloured flower. At lower altitudes the palms abound, but as one rises this family decreases rapidly, until it is only represented by the pretty mountain species I have already referred to.

The foothill forests are as wide a belt of country as probably any forest region in Papua. The topography of the belt is, however, so dreadfully broken, the hills are often so sharp, the ground so stony, that the quality of the timber is not high. The general impression one gets from it is a forest of scrubby pole woods. Owing to its good climate—it is not so high as to be very cold at night, or so low as to be malarious—it will always remain a populated region. All good patches of land will be cultivated, and most of the poorer land as well, as the population increases. It is fairly certain that as time goes on it will become grass land. This has already occurred wherever the population is dense enough, and, like the grass lands of the plains behind Buna, the use of fire is the main cause of the conversion to grass land. That areas of grass land occur in many parts of the foothills, where the population is very

The camp on Laruni Spur.
Note *araucaria cunninghamii* on sky line.

Laruni Spur, *Euc Tereticornis*, 4,800 feet.

[*To face page* 35.]

sparse, is a fact difficult to ascribe to any other reason but that a larger population existed in the past, and it has migrated to other parts of the Territory for various causes, possibly the most urgent being that it had exhausted the land, created the grass, and could no longer farm it. If any population remains, it is always sufficient to maintain the grass lands, for a couple of boys going hunting will set the whole countryside on fire. Outside "dry belts," viz., parts of the country which have two well-marked seasons, a dry and a wet one, all grass lands, except on slopes so precipitous as to make tree growth impossible, are artificially made by human agency. Woodland in the foothills has an even better chance in its battle with grassland than in the low lands, and wherever the grass is left unburnt a season a good crop of woody weeds comes up, and these are followed by a whole clan of light-demanding weed trees, which quickly kill out the grass and prepare the way for the better and more permanent foothill forest. In places where the whole population has come down from its strategical hill top villages to the valleys, the abandoned sites have entirely reverted to woodland. It is possible that in years to come, as the valleys of the foothills become grass lands, the native will be forced back to the summits of the hills once more, not this time in fear of his neighbours, but in fear of starvation. In the meantime his old garden lands are reclothing themselves with forest.

In the dry belt of the Central Division there is a different type of grass lands in the foothills, and these are natural savannah forests, consisting essentially of grass with a tree growth of *Eucalyptus tereticornis*, with, in certain places a mixture of *Casuarina nodiflora* and *Cicas media*. I saw no *E. alba, E. papuana,* or *E. clavegera,* no *Melaleuca* or *Banksia;* otherwise the general appearance of the savannah forest at 4,000-5,000 feet, along the Mimai, at the foot of Mount Obree, was similar in every respect to the savannah forest above Port Moresby, and on the top of Hombron Bluff. I regard these savannah forests as natural, for the eucalypts are of great age—one might call them immemorial. Where the foothill forests have been destroyed for farming purposes, grass land has succeeded it, but no eucalypts have established themselves. Here we see the artificial grass land and the savannah forest side by side, and wherever the native has entirely vacated the neighbourhood of an artificially created grass patch, the foothill forests re-establish themselves. Up at this elevation there is an undoubted dry belt influence. This is shown, not only by the permanent savannah forests of eucalypts, but by the presence of a gully forest, which differs in composition from the foothill forests. These gully forests are a counterpart of the gully forests which occur at low elevations in the dry belt, and which I have already described (page 5). They differ in composition, but have this similarity: that they are permanent islands in the savannah lands. Sometimes a few foothill species crop up, and sometimes an Araucaria is to be found rising its high crown far above the gully trees; but, generally speaking, these are exceptions, and the woods that clothe the gullies belong to different species. They are all considerably smaller in height and girth than the trees of the foothill forests. When a gully forest is cleared for farming, and later abandoned to nature, the first thing to come up is a dense thicket of *Dodonaea viscosa,* and other light-demanding shrubs. These quickly kill out the grass, and prepare the way for the gully species. I did not make a survey of these, as none was of apparent economic timber value. A soft-wooded Albizzia, No. 432, is common and characteristic, as is number 374, orena (*Rhus sinarubaefolia*). The savannah forests that occur at the foot of Mount Obree, on the sides of the valley of the Mimai, which is one of the headwaters of the Kemp Welch, differ from the savannah forests that occur further west, between the Naro River, which flows into the Brown, and the village of Kagi. Here *Casuarina nodiflora* is a prominent tree, and is to be found in close association with *Eucalyptus tereticornis;* also, curiously enough, it intrudes into the foothill forests, and in one place I saw it thriving alongside intruders from the cloud belt, such as hoop pine, and *Podocarpus cupressina,* and the two oaks.

I regret that I can advance no reason for the presence of these areas of natural savannah forests, with their islands of gully forests, at these high elevations in a region which seems truly of a foothill type. Geologically, there is, according to Mr. Stanley,[a] no reason why the foothill timber should not grow on the places occupied by savannah forests, or vice versa. It certainly is not a question of aspect, for they occur indiscriminately on all aspects of the foothills; nor is it a case of declivity; the foothill forests occupy as steep slopes as the savannah associations. That the dry belt has some influence is tolerably certain, for such natural savannah types do not occur elsewhere than in the dry belts. So far as the eucalyptus growth is concerned, I have not met it in the N.E. side of the range; but grass areas with cicads in them have been seen at similar altitudes on that side. The eucalypt savannah forests at 4-5,000 feet may be remnants of a much larger area of Australian silva which stretched from the sea coast to the cloud belt, and the foothill may be an intruding association, ousting the less vigorous form. Against so pleasing an explanation is the doubt that the eucalypt formation is so degenerate. Indeed, of the two forms the foothill forest appears to me to be less able to look after itself. The age of the eucalypts, and the wide belt of intervening rain forest and foothill forests, preclure, I think, any possibility of these being a wind or bird introduced species.

The Mid-mountain Forests.

This belt of forests is climatically very clearly defined, so far as its lower limits are concerned, for it corresponds to the cloud belt. Just so far as the clouds roll down the mountain is to be found the mid-mountain species in forest formation. In actual elevation above the sea, the limit is rather vague, for the cloud belt descends lower in some regions than in others. It is a question of topography and exposure to wind. In some valleys it creeps down to 4,500 feet; while on some slopes it is as high as 6,000 feet. I have laid down the lower limit of this forest region at 5,500 feet, but this figure must be taken as an average one, and not as a hard and fast line. Its upper limit is still less well marked, for its boundary is the mossy forests, where the clouds saturate the atmosphere for the greater part of the time. This varies in altitude for every change of topography, so that my limit of 7,500 feet must be regarded as rather arbitrary. Taken by and large it will not be found far out. It is the factors of humidity, rainfall, temperature, and exposure to or shelter from the wind more than the soil conditions that determines whether mossy forests or mid-mountain forests shall prevail. In the present state of our meteorological knowledge it is not possible to set out the limiting factors for each belt. When this can be done, a precise climatic boundary can be set to this and the higher floral regions.

The first thing that strikes the observer rising from the foothills to the main mountain range is that he has at last left the utterly broken country, and that the great mountains are becoming defined. Precipices, deep gorges, subsidiary peaks, do occur, but the main range stands out, and there are long slopes, spurs and ridges leading up to the great divide of Papua. Standing on the topmost ridge of a savannah forest, as one

(a) Report on the investigation of the unexplored mountain regions between the Mimai and Kagi, 1923. Home and Territories Department, Melbourne.

looks down over mile upon mile, stretching out to the coastline far in the distance, there is nothing but hill upon hill—broken range on broken range. Now and then a big valley, like that of the upper Kemp Welch, gives some idea of order. A ribbon of turbulent broken water, stretching out into the distance, seems to offer some chance of a road, but even that is soon lost in another medley of wave-like hills. Turn your back on this very beautiful picture of the foothills and you face the splendour of the mountains. In the early morning, before the clouds have rolled down on them, they appear to stand right over you; it seems but a short way to the divide, 6,000 feet above. All is a perfect even carpet of dark green, except where here and there a waterfall cuts a sharp white line, or a limestone rock exposure stars a slope. For 2,000 feet up grow the forests that I have termed "mid-mountain," and these forests are, so far as my investigations go, the highest quality forests of Papua. Particularly is this the case with the belt at the head of the Mimai. Long before you have reached the highest point of the last savannah forest you can see the big hoop pines standing out clear on every ridge and spur that offers you a sky line. Later, as you get nearer the lower limits of the belt, you pass a few stray ones that have established themselves in the gully or foothill forests, and the identity of the species is immediately made certain. It is the Queensland hoop pine, Australia's premier soft wood, that is known scientifically as *Araucaria Cunninghamii*. While this is not the commonest tree of the mid-mountain belt—indeed, there are very large areas where it is either unrepresented or, at any rate, rare—it is so splendid a tree, and so dominates the whole forest growth around, that it makes a more lasting impression on the mind of the traveller than the other and more numerous conifers, oaks, and other species. One's first impression of the mid-mountain forests, as seen from the outside, above the Mimai, and its confluents, is of a forest of moderate height-growth—about 100 feet—with every spur and ridge lined with very much taller hoop pines standing sentinel as it were over the intervening mixed forest. With a binocular it is possible to pick out odd hoop pines on the slopes, but for the most part they are confined to the ridges, and this, of course, makes them all the more strikingly conspicuous. It is little wonder that travellers, from the earliest times of Papua, have brought back tales of forests—tall pines or firs as they were perhaps more often called—growing high up on the lonely mountains far inland. Climbing up from the foothill forests, one enters the mid-mountain belt. The transition is gradual. At first one meets some oaks; there is no doubt about their being oaks, for the ground is covered with acorns; and one's attention is, as a rule, drawn to this, owing to the way the soil has been rooted up by wild pig. The wild pig is as fond of his acorn as is his domesticated brother in Europe, where at one time the value of a forest was estimated, not according to the number of cubic feet of oak beams, boards, and scantling it could yield, but the number of pigs it would feed; pannage was more valuable in those days than timber, and more valuable than grazing. There are three oaks, and these caused me some trouble, owing to the difficulty of obtaining botanical material, but their identity has now been determined specifically. They are represented in the herbarium and museum by Nos. 117, 418 and 425. These three oaks are *Quercus pseudo-molucca*. *Quercus lamponga*, and *Quercus spicata*. *Q. pseudo-molucca* bears a small acorn about the size of that of the European tree. It grows to a very large tree. I measured one 15 feet in girth and 80 feet to the first limb. The average, however, would be 8 feet in girth and 60 feet of bole. Its overall height is about 100 feet. I found it at much lower elevations, right down to the *Quercus Junghuhnii* stands at 3,000 feet, but the best developed trees stood at between 5,500 and 7,000 feet. I even found specimens at 8,000 feet, but they were poor in quality and festooned with moss. The timber is hard and dense, and not quite as heavy as water. Like all oaks, it is fissile on the quarter. It should be suitable for heavy constructional work, as it has every appearance of being a sound strong wood.

Quercus spicata and *Q. lamponga* bear very conspicuous fruit, the cupule of which is, on an average, 1½ inch across, and the nut 1 inch high and hemispherical. They differ from the small acorned species in the colour of the wood, which is a deeper brown at heart, and in the fact that, when you cut into it, the cambium layer turns a mauve colour on exposure to the air. The timber would prove of about the same value as the small acorned species. It is a little harder, and is heavier than water. They also are to be found at much lower altitudes in the foothill forests, but are at their best at 6,000 feet.

The undergrowth of the oak forests while not absent, as in the stands of *Quercus Junghuhnii,* is much sparser than in the mixed foothill forests. Already at this elevation the mosses, lichens, and liverworts begin to be more prevalent, and the *Elatostema*, of which there are numerous species, are beginning to make soil cover. The general impression gathered is of a rather temperate-climate type of forest, yet this is not really quite a correct statement, for the forest remains temperate looking only so long as you do not look up to the branches. These are covered with epiphytes and mosses, while, for the first time, one notices that "old man's beard" lichen hangs from the topmost branches. What then gives the forest this temperate appearance? It is, I think, the small number of species, the almost entire lack of big-stemmed creepers, the great diminution of the under storeys, the absence of prop roots, and, finally, the general mossiness of the country. Perhaps I should add that, as a rule, after 10 o'clock, there is a cold Scotch mist blowing through the forest, which is intemperate enough for any temperate climate.

Let us examine the mixture of species. Surveys were carried out on several of the slopes, and these were pushed, in one case, up to the main divide, an altitude of 9,000 feet. In another, the traverse was stopped at 8,500 feet, as the forest conditions had become very degenerated, and the growth consisted purely of very miserable moss-covered, prop-rooted, scrubby trees. The summary of these traverses will be found in Tables XXIV., XXV., and XXVI. All three show a very marked contrast to the tables I have given up to now. The number of species is much reduced, the total volume, and the volume per acre is pleasantly heavy, and the number of useful species is large, compared to any but the Hydrographer and the Borua forests. Examining them one by one:—Table XXIV. covers the long ridge that runs from Laruni village to the top of Mount Obree. Incidentally I may add that this is an easy, short, and, in every way, excellent way of getting to the top of Mount Obree. It can be done without severe exertion in six hours. The actual rise in elevation is from 4,800 feet to 10,200 feet, or 5,400 feet, but the slope is nowhere difficult.

From Laruni village to the 40-chain peg the forest was poor. Even the oaks were of no size. It will be noticed that I have put the two oaks on one line—the reason being that they were so mixed that it was not possible to separate 418 from 425.

From the 40-chain peg to 8,120 feet. which was 283 chains from Laruni, the main mid-mountain belt occurred. The slope was so gentle in places as to be almost flat, and here there was some depth of soil, and large mixture of species. These flatter portions were separated by steeper slopes where the main species

—all conifers—were predominant. It will be seen there were 24 different species, of which five were unknown in the sense that material was not collected from them and no record of their botanical differences, or the quality of their timbers, was recorded. I found it rather difficult to collect material in the mountains —not that it was harder to find, but because the natives found it too cold to work. A naked Papuan, exposed to the cold blast of a Scotch mist, becomes entirely insensible to bribes and to threats, or any other spurs that a European may resort to when his boys crumple. "Crumple" is, I think, the word that covers their dejected condition of shivers from which only an order to turn back home rouses them. The five species I failed to record were not important, represented as they were by one individual of each species. To the next forester who camps around 8,000 feet, I would suggest woollen shirts for his carriers and working boys.

TABLE XXIV.

SURVEY OF THE FORESTS ON THE MT. OBREE-LARUNI SPUR.

Herbarium. Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		Acres per Tree.
				Total C.F.	Per Acre C.F.	Per Tree C.F.	To Total Cubic Contents. Per Cent.	To Total Number Trees. Per Cent.	
359A	E-o	*Phyllocladus hypophyllus* ..	13	2,356	58	181	7·09	5·68	..
381	.. .. ..	*Libocedrus papuana* ..	2	315	7	157	0·95	0·87	..
269	.. .. ..	*Podocarpus cupressina* ..	10	1,623	40	162	4·88	4·36	..
377	Teo	*Podocarpus amara*	13	2,198	55	119	6·61	5·68	..
382	Ouru	*Flindersia pimenteliana* ..	3	382	9	127	1·15	1·31	..
418	.. .. ..	*Quercus lamponga*	41	4,680	117	114	13·08	17·9	..
425	.. .. ..	*Quercus spicata*							
29	Devoru	*Alstonia scholaris*	1	320	8	320	0·98	0·43	..
376	Yau	*Araucaria Cunninghamii* ..	52	9,131	228	175	27·48	12·71	..
19	Sabi	*Sarcocephalus cordatus* ..	1	403	10	403	1·21	0·43	..
384	Sere	*Eugenia* sp.	19	3,804	95	200	11·45	3·30	..
354	Bekanu	*Elaeocarpus* sp.	1	194	3	194	0·58	0·43	..
190	Gongofo	*Polyscias* sp.	1	154	4	154	0·46	0·43	..
385	Maro	*Eugenia* sp.	11	1,122	28	102	3·38	4·80	..
386	Suoro	*Sideroxylon novo-guineensis* ..	16	1,840	46	115	5·54	6·98	..
387	Ia	*Eugenia* sp.	10	900	22	90	2·7	4·36	..
389	Ibai	*Cryptocarya* sp.	15	1,920	58	128	5·78	6·54	..
391	Ame	*Sapotaceæ*	14	1,260	31	90	3·63	6·11	..
392	Binau	*Zanthoxylum* sp. syn. *Fagara*	1	135	3	135	0·40	0·43	..
Unknowns	.. .. ..	.. ..	5	441	11	88	1·33	2·18	..
		Total	229	33,158	829	145	100·00	100·00	..

The 24 species were represented by 229 trees, carrying a volume of 33,158 cubic feet, which works out at 829 cubic feet per acre, and 145 cubic feet per tree, and 5.7 trees to the acre. Of all the species, No. 376 —hoop pine (*Araucaria Cunninghamii,* Ait.)—was the most plentiful. It was represented by 52 trees, or 22.7 per cent. of the stocking, and 9,131 cubic feet, or 27.5 per cent. of the volume. The volume per tree works out at 175 cubic feet and 228 cubic feet per acre. Next to the hoop pines come the two oaks, No. 418 and 425. They account for 41 trees, 4,680 cubic feet or 117 cubic feet per acre, and 114 cubic feet per tree; 13 per cent. of the volume, and 18 per cent. of the stocking. Next in volume, we come to No. 384, a species of Eugenia, which is represented by only 3.3 per cent. of the stocking, but by a volume of 3,804 cubic feet, which works out at 11.5 per cent. of the total volume. This is sere, a large tree which is most conspicuous between 7,000 and 8,000 feet on a flattish ridge where most of the broad-leafed species occur. The bark is light brown and very scaley, and persists in an untidy manner. It yields a very hard, close-grained, heavy timber of high value for constructional purposes. Next in order is No. 377, which accounts for about 6 per cent. of the stocking and of the volume. This is teo, the big podocarp—*P. amara.* It yields a bole of 80 feet with a 10-ft. girth at breast height, and reaches 110 feet over all. Its timber is fine, close-grained yellow wood. Seasonal (?) rings streak it dark and light yellow alternately. It is a little heavy. Next we come to No. 359A, Eo, with the same number of trees, but slightly less volume than No. 377. This is a celery top pine—Phyllocladus, allied to the Tasmanian species which is so prized as a softwood. It differs from all the other mountain conifers in having flat, green, leaf-like structures, called by botanists phylloclades. They are really flattened, widened shoots, but pass as leaves to the ordinary person. They have a pretty powder blue bloom beneath, and this is much more marked in the young seedlings than in the "leaves" of old trees, as is the size, which is sometimes twice that of mature phiiloclades. This is a species that is not found at the lower limits of the belt, and really only reaches its best dimensions at 7,500 feet. It persists up to 9,000 feet, but rarely exceeds 5½ feet in girth and 25 feet high at the latter elevation. It is, at its best, a very short, stout boled tree—30 feet of bole would be about the average, and the girth runs up to 16 feet. Overall it does not exceed 50 feet. It has a thick, ridged bark, which is so dark a brown as to be almost black. It yields a compact pine wood with well marked concentric rings, which may or may not be seasonal. The timber is lighter than *Podocarpus nerifolius.*

Next in order is No. 389—Ibai—a Cryptocaria not as yet specifically determined. It is a large tree yielding a mill log of 70 feet, with a girth at butt of 8 feet. Its timber is mouse grey, but has a pleasant quarter grain, and would make a good all round wood for decorative panelling and indoor work. It is not too heavy for furniture. It is represented by 15 trees or 6½ per cent. of the stocking, and 5¾ per cent. of the volume. The last species above the 5 per cent. line is No. 386—Suoro (*Sideroxylon novo-quiniensis*)—another broad-leafed species, and be it noted, the leaves are quite big for a tree that flourishes at so high an elevation. The cut bark exudes a latex. The wood, when green, is yellow, but it dries a blue green; shows little grain except on cross section, when radial lines of pores show up. It is a heavy structural timber.

Of the species below the 5 per cent. volume line, there are 16, of which two are extraordinary intruders. No. 19—Sabi (*Sarcocephalus cordatus*), and No.

29—Devoru (*Alstonia scholaris*). Neither has the slightest business at such altitudes and in such company, and I am quite prepared to hear from some botanist, in years to come, that they differ from the devoru and sabi of the rain forests of the plains. To a timber man's tests, they are the same, and the devoru was particularly remarkable, for it was the only buttressed tree seen in the mid-mountain forests. Neither has any interest to timber men here, and I mention them merely to show their wide range of habitat.

No. 381 — *Libocedrus papuana*—is Sir William McGregor's cypress that he mentions in his ascent of Mt. Victoria; a fine tree with a bole of 60 feet and a girth at butt of 7½ feet. It is a companion to the Phyllocladus and struggles on beyond that species, right up to 10,200 feet and probably beyond, though not having penetrated higher, I cannot vouch for this from my own observation. It reaches its best development above the mid-mountain belt, at about 8,000 feet.

No. 269 is an important conifer—*Podocarpus cupressina syn up. imbricatus.* It, like the No. 381, has very cypress-like foliage and twigs. It has a much wider range in altitude than any other of the conifers. I found poor specimens as low as 3,500 feet; it does not, however, seem to thrive much above 7,000 feet, though it was at that altitude that I saw the best developed specimens. It will be seen that it almost reaches the 5 per cent. line in volume. It yields a clear white compact timber that appears to carry no resin.

No. 382—Ouru—has a particular interest, for it is *Flindersia pimenteliana*—this genus that has yielded such valuable timber to Queensland, of which the maple (*F. chalawaiana*) is the best known. Ouru, while of a much lighter colour, has a beautiful sheen on both back and quarter grains, and would certainly command a figure as a silver maple.

No. 355 is our blue fruited Elaeocarpus megacarpa, which we last saw thriving at 4,000 feet in the foothill forests. It seems almost as much at home at 7,000 feet, so long as there is a patch of deep soil for it to root in.

No. 387—Ia (*Eugensia* sp.). This tree happened to be represented by rather small individuals. It does grow to a big size, and the volume per tree recorded in the table is therefore misleading. A bole of 65 feet, with a basal growth of 9 feet is quite common. Except that the wood is darker, it is hard to separate it from No. 384. The leaves are rather similar, but the bark is different.

No. 392—Binau (*Zanthoxylum sp. syn Fagara*) is a thorn-covered tree with an ash leaf, which yields an exceedingly beautiful, saffron coloured cabinet wood. It is, unfortunately, rare.

It will be interesting to separate the Gymnospermae from the Angiospermae,—the pines from the broad-leafed trees—and see how they compare in number and volume.

The five conifers, viz., 376, 381, 359A, 269 and 377 are represented by 90 trees, carrying a volume of 15,623 cubic feet, which works out at 388 cubic feet of soft-wood per acre, and 46 per cent. of the total volume, and 40 per cent. of the total stocking. In short, the forest is nearly half a pine forest, along the spur that runs from Laruni to Mt. Obree. Were the slopes more continuously steep, and the two prominent flattish stretches out of the survey, then the coniferous percentage would have been higher still. At any rate it is high enough, and the main species is sufficiently striking to call it a pine forest. The somewhat heavy admixture of oak, and the character these trees give to the general view, leads me to qualify the title and call it a pine and oak forest.

These forests differ entirely from the foothill forests, and a description of them is much easier. In the first place there is not the confusion of mixed species. The number of species is comparatively small, and the number that matter can be counted on two hands. The total absence of heavy buttress roots (I do not regard the occurrence of No. 29 as normal) and the very slight development of root swellings is another characteristic. The trunks spring straight from the ground as a rule, and should make good mill logs, economical to cut. The ground is decidedly mossy, and any of the rougher-boled trees carry moss in the nooks and crannies of the bark. The branches of the higher trees are festooned with grey lichen ("old man's beard") and this is particularly striking on the crowns of the big hoop pines. Filmy ferns are plentiful on the ground, and on the small branches, but lianas are scarce and small. Orchids are plentiful, and they grow much lower on the stems than in the forests of lower altitudes, and are therefore more conspicuous. Some are rather prettily coloured, but none is really large and showy. The commonest soil covers, besides the ferns, are nettle family plants, Elatostema, which here and there cover an area of 50 yards square. There are several species, having largish leaves, and others so small that they resemble the leaves of a maiden-hair fern. Scattered here and there are clumps of plants of the ginger family of which the pretty yellow flowering Eriolopha makes a splash of colour in the somewhat sombre forest. As striking a ground cover as any is the tall stemmed moss Dawsonia sp. It covers quite large patches of forest soil and is generally taken by the traveller to be a seedling pine tree. It grows to about 15 inches high, and gives the forest a very temperate climate look. A number of shrubs are found wherever a flattish piece of land with the usual soil and the broad-leafed forest occurs. The family of Melastomaceæ is well represented and the species have an extraordinary range of habit from low semi-succulent plants to fair-sized somewhat weeping shrubs. The herbarium Nos. of these species are 346, 360, 403. A little magnolia, No. 347—*Drimys cyclopum*—is common at the higher altitudes. No. 358—Ardsi sp.—covers wide patches of ground, its berries are sown like red coral beads among the pretty tapering leaves. The number of myrtle plants and trees increase as one rises, and as I shall show when describing the mossy plants, that a Eugenia becomes the common tree above 8,000 feet. A very ornamental shrub is Antholoma Teighemi, which has yellow drooping bell flowers. No. 378 (*Daphniphyllum glaucescens*) is a small tree. No. 379 is a shrub, 10 feet high, and of straggling habits, belonging to the Monimiaceae. Two Araliaceæ—Nos. 383(*Timonius*) and 390 (*Boerlagioclendron Sayeri*)—are met with. There are no Calamus at this height, but a worse curse to the traveller—the mountain bamboo, No. 409—begins to show itself, and with it often grows the mountain pandanus. Of the palms, only one—the pretty low one which makes no aerial shoots—is common, but no tall palms occur. No. 407 (*Cyrtandra* sp.) is a small tree or big shrub with a yellow flower. Here and there the narrow leafed Freycinetia occurs. No. 410—*F. angustissima*—has a wide range in altitude.

The leaves of all species, with one or two notable exceptions, are small and rather coriaceous, rarely compound and usually entire. There has really been a progressive dimunition in the size of leaves, and a decrease in the number of compound leaf species since rising to the upper limits of the foothills. The decrease is not, however, noticeable to the eye until one enters the mid-mountain belt proper, and it is a question of measurement of leaves to tell that they are smaller at the upper limits of the foothill forests than they are at, say, 2,000 feet. The smallness of the

leaves in the mid-mountain belt is so marked that one is quite surprised when a fairly large leafed, or for that matter, a compound leafed tree is met with. I cannot say that this mid-mountain belt has the appearance of a forest of a temperate climate when looked at as a whole. Patches of it certainly remind me of forests in the Jura and Vosges, but what it is most like, to my mind, is the mist-belt forest that occurs in the Drakensburg Mountains in South Africa, at elevations of 6-7,000 feet. The similarity is really quite vague, for the South African type carries none of the tropical monocotyledons, which form an important part of the Papuan cloud-belt forests. What resemblance there is, is due to the mosses, lichen, liverworts, ferns and soil cover. The Papuan forest appears to be rather a lifeless one, but this I think is due more to the absence of one or two noisy birds than to the absence of all bird life. The doves, pigeons and hornbills were left 2,000 feet below, and that noisiest of noisy birds—the white cockatoo—does not come up higher than the foothills. There are numbers of birds but they are quiet ones, darting in and out of the greenery and moss. Some of the bigger ones are met with, too; the cassowary's spoor is quite plain in places, and right up above the cloud-belt the big-footed scrub hen makes her mountain of a nest. So fermentation of leaf mould is quite sufficient even here, where the thermometer drops below 50, to hatch out eggs. The most written about playground—that of the bower bird—is quite common. The little circus rimmed in with black, dried, hard fungus, and in the centre, the maypole-like erection, is met with everywhere. The only bird call that could be called loud, that I have heard in the mid-mountain forests, is that of the blue Bird of Paradise, and even he is quite subdued compared to his noisy brethren at lower elevations. This bird's plumage is the most beautiful blue, and one forgives him his rather ugly note since it draws one's attention to his presence. I say "his" advisedly, for his wife is rather a drab, dowdy person. Magani and cus-cus, and a rat—all marsupial—occur here, and in the branches of No. 384 (*Eugenia* sp.) we caught a nine feet six inch python alive. It had a nicely reticulated skin, had recently eaten a cus-cus, and was as much appreciated by the Laruni villagers as it was feared by the boys we had brought up with us. The country was not high enough for wild dog, which Sir William McGregor records at 11,000 feet.

The next survey was made of the forest on the somewhat isolated peak lying to the north of Laruni village, which is called Ubua. This peak divides the Mimai from the Vi confluents. It rises somewhat abruptly from the Mimai-Vi junction, and forms a razor-backed ridge, dropping down to join the amphitheatre of spurs that make the basin of the Mimai headwaters. On the Vi slope it is very abrupt indeed, and, in places, precipitous. Here, forest ceases except for an isolated hoop pine or two, and grass takes its place. On the lower elevations, also towards the junction of the two torrents, the slope is covered with grass or Eucalyptus savannah patches. This is all foothill country, and it is easy from Laruni to pick up the change to mid-mountain forest, which is rather well defined.

The summit of Ubua is only 6,400 feet, so it does not rise above the mid-mountain belt, and the change to mossy forests is not observable. A summary of the data collected is given in Table XXV. It will be seen that in the 18 acres covered by my strip, there were three conifers, two oaks, and eleven unknown broad-leafed species. The traverse was started at 5,200 feet and ended at the top. The 1,200 feet rise divides itself into two parts. The first runs from 5,200 to 5,800 and consists of an oak forest; both 418, *Q. lamponga,* and 425, *Q. spicata,* are represented, and number together 32 trees and eleven unknown broadleafed species. There are numerous seedlings and sapling hoop pines and Podocarpus cupressina, but no big conifers. From 5,200 feet to the top, 6,400 feet, the position is reversed; the stand of conifers is practically pure so far as the top story is concerned, and the oaks make up but a light second story, and there are no unknowns of mill log size. In short, it is pine country proper. Going back to Table XXV. the 89 trees covered 10,033 cubic feet timber, which works out as 557 cubic feet per acre, and 112 cubic feet per tree. Of these, Hoop pine accounted for 6,270 cubic feet and 348 cubic feet per tree or 62.5 per cent. of the volume, and 48.4 per cent. of the stocking. If the survey had been made only in the upper part of the Ubua, viz.: from 5,800 feet to the top, and right along it, the forest would have shown over 90 per cent. Hoop. The other species encountered below 5,800 feet reduced the average considerably. It will be at once remarked that celery-topped pine and Liboredrus papuana are absent. Ubua is not high enough for these species. The steep, precipitous slopes down to the Vi, cuts the forest in half, and one finds grass lands up to the edge of the crest. Here were found some interesting shrubby trees, species that thrive on the edge of high forests. No. 371—*Schuurmasia Henningsii*—a small tree, was last found on the edge of forest and steep grass lands in the Hydrographer's foothills at an altitude of about 500 feet. Now we find it growing at 6,000 feet where the coniferous belt is cut by a grassed precipice. No. 371a, a shrubby Scaevola, is common here; also a small white flowing Mucuna. In the grass I found the pretty blue herb *Whalenbergia gracilis,* and a red flowering ground orchid was conspicuous.

A survey was also made of the timber up to the Main Divide and to the north-west of Mt. Obree. To reach this, we followed the Mimai up some way, and then, crossing it, ascended a very steep slope—too steep to carry high timber—and, making a fairly well

TABLE XXV.

SURVEY OF THE FORESTS ON UBUA MOUNTAINS, NEAR LARUNI, CENTRAL DIVISION.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		
				Total c.f.	Per Acre C.f.	Per Tree C.f.	To Total Cubic Contents Per Cent.	To Total Number Trees. Per Cent.	Acres per Tree.
418	..	*Quercus lamponga*	32	1,871	104	58	18·6	35·9	..
425	..	*Quercus spicata*							
376	Yau	*Araucaria cunninghamii* ..	43	6,270	348	146	62·5	48·4	..
269	..	*Podocarpus cupressina*	3	484	27	161	4·8	3·3	..
Unknowns	..	.. ..	11	1,408	78	128	14·1	12·4	..
		Total	89	10,033	557	112	100·	100·	..

defined spur, we rose to 9,300 feet—the top of the range. Mr. E. R. Stanley was in charge of the expedition. He had passed over this country in his journey to Kokoda and back in 1916, and was the first to make mention of the pines growing around the head of the Kemp Welch River.[a] Under such expert and experienced guidance the survey was carried out without any trouble. A summary of the data gathered will be found in Table XXVI. From the Mimai, we ascended to 5,200 feet on a slope of 40 deg.; here the slope becomes gradual enough to carry timber, and the Hoop Pine Belt began. This continued for 90 chains to an elevation of 7,200, when it was replaced by celery-top and other conifers; these continued to 8,000 feet, when the mossy forest proper was met with, which continued to the top of the Divide at 9,300 feet. The whole chained distance reduced to the horizontal, from the Mimai to the Divide, was 290 chains. The timber belt lay between 5,200 and 8,000 feet and was 175 chains wide; the data recorded in the table refers

TABLE XXVI.

SURVEY OF THE FORESTS BETWEEN THE UPPER MIMAI AND THE MAIN DIVIDE.

Herbarium Number.	Local Name.	Scientific Name.	Number of Trees.	Cubic Contents.			Percentages of—		
				Total c.f.	Per Acre C.f.	Per Tree C.f.	To Total Cubic Contents Per Cent.	To Total Number Trees. Per Cent.	Trees per Acre.
376	Yau	*Araucaria Cunninghamii*	77	7,200	327	94	36·95	41·81	3·5
275	Korakaika	*Podocarpus neriifolius*	3	100	8	33	0·51	1·63	0·14
269	.. .. ..	*Podocarpus cupressina*	7	817	37	102	4·21	3·80	0·3
391	Ame	*Sapotaceæ*	3	249	11	83	1·08	1·63	0·14
Unknowns	.. .. ..	.. ..	14	1,572	72	112	8·11	7·60	0·6
377	Teo	*Podocarpus amara*	10	1,457	66	145	7·52	5·43	0·46
387	Ia	*Eugenia sp.*	3	532	24	177	2·74	1·63	0·14
359A	Eo	*Phyllocladus hypophyllus* ..	50	5,601	254	112	28·9	27·15	2·3
384	Sere	*Eugenia sp.*	4	568	25	142	2·92	2·17	0·2
418	.. .. ..	*Quercus lamponga*	13	1,272	58	98	6·39	7·16	0·6
425	.. .. ..	*Quercus spicata*							
		Total	184	19,368	880	99	100.	100.	8.

to this belt only. The area covered by the strip survey was 22 acres. It will be seen that on this area there were 184 trees, carrying a volume of 19,368 cubic feet, or 880 cubic feet per acre, and 100 cubic feet per tree. Of them Hoop Pine comes first with 42 per cent. of the stocking and 37 per cent. of the volume. Celery-top follows with 27 per cent. of the stocking, and 29 per cent. of the volume. The two oaks, Teo and fourteen unknowns, are all under 10 per cent. and over 5 per cent. of the stocking and volume. Together these predominant species make up 88 per cent. of the total volume—a satisfactory percentage.

Of the other species, no new trees were recorded. No. 275, (*Podocarpus neriifolius*) was meagrely represented, and No. 269—*Podocarpus cupressina*—came under the 5 per cent. line. No. 391—Ame (*Sapotaceae*) was present, three specimens being recorded; also No. 387—Ia—and No. 384, *Eugenia* sp.—Sere—whose timbers are so hard to separate. The largest tree was the Ia. The celery-top pines were very big in girth, but their height growth was ridiculously low, reminding one a little of the Japanese dwarf trees that one sees. No specimens of Libocedrus were encountered, which I thought was rather strange. At the upper limits of the belt and the lower limits of the mossy forests, a rather large area of country had been burnt, and here a climbing fern—a *Gleichenia,* I think—covered the ground and clambered over the stems of burnt trees and the young shrubs that had come up. A few clumps of grass occurred, but they obviously had no chance in the fight with the woody tree forms that were rapidly filling up the gaps in the forest. The country is probably very seldom visited, and opportunities to burn it cannot be numerous, owing to the climatic conditions, which are decidedly damp. I will return to this matter when dealing with the mossy forests.

Having examined the country at the headwaters of the Kemp Welch, Mr. Stanley decided to push north-west with the object of striking the headwaters of the Brown, and eventually reaching Kagi and the trail that leads to Port Moresby, and comes from Kokoda across the Range. This he carried out with great success. The country in question is uninhabited, and had not previously been visited or explored. Having now crossed it, I have, if possible, a still greater esteem for the natives intelligence, and for the good sense of the magistrates and patrol officers. Until we reached the country hunted in by Menari-Efogi people, there were no tracks, and it meant cutting our way through for seven days, with the exception of the loss of a rather important part of our commissariat, the party got safely through. For a full account of the journey, the geological formations encountered, the creeks and rivers we traversed, the heights we ascended, and all other scientific data, I would refer you to Mr. Stanley's report.[a] He has made a very clear map which sets out the route, and shows all the topography. The greater part of the journey was in the mid-mountain and foothill belt, though here and there we dropped to alluvial rain forest or rose to the mossy forests. The most noticeable thing regarding the forest on this traverse was the absence of Hoop Pine. After leaving the Mimai waters I saw only occasional hoop pine—nowhere were there any stands of it comparable to those I have recorded in Tables XXIV., XXV., XXVII. Standing on any of the shoulders of the mountains, and looking back over the Mimai in a south-easterly direction, one can see all the spurs spiked with hoop pine. That sharp peak "The Baron" has hoop pine growing right over its cap, and they are visible for great distances. Beyond The Baron to Mount Brown hoop pine is reported in good stands on the spurs of all the mountains. I can ascribe no reason for there being no good stands of hoop pine going north-west along the range from the Vi River. Conditions appear to be the same geologically, and the general nature of the country and its topography seem similar. It is possible that the influence of the dry belt makes itself felt to an extent which precludes the growth of hoop. In the present very fragmentary

(a). Geological expedition across the Owen Stanley Range, by E. R. Stanley, F.R.G.S., Government Geologist. Annual Report, Papua, 1917–1918, p. 75.

(a). E. R. Stanley, F.R.G.S. Report on the investigation of the unexplored mountainous region between the Mimai River and Kagi, 1923. Home and Territories Department, Melbourne.

knowledge of the flora and meteorology of Papua it is not possible to prove this. Hoop pine has been reported from various places, of which the following are official: Mount Brown, head of the Musa, the head of the Waria and the Samberigi. It will be seen that from the Samberigi in the far West, down to Mount Brown in the south-east, hoop has been found. It is not confined to one side of the range, but occurs on both the north-east and the south-west. It is probable that, when the whole mountain ranges are explored, further areas, similar to the Mount Brown to Mimai forests, will be discovered. So important a soft wood deserves to be sought for with care. The present inaccessibility of the mountains where it grows is more apparent than real, and a time will come when this timber will be marketed and prove a source of wealth to Papua and a boon to Australia, which imported £3,500,000 worth of timber in 1920-21, and most of this was soft wood.

Hoop Pines' habit of growing on the spurs of the mountains is a very marked characteristic. It appears to have been driven to the most exposed and rockiest portions by the broad-leafed species which admit of no competition on the lighter slopes where better soil occurs. This fact must not be forgotten in reading figures in the foregoing tables. The traverses were all taken with a view of obtaining hoop pine data, and so they all followed the spurs, and none was taken across the slopes from one spur to another. It is not possible, therefore, to arrive at even an approximate estimate of the total quantity of hoop pine available on the Kemp Welch headwaters. All that can be said is that for a mile deep above 5,000 feet altitude hoop pine occurs in the quantities given in the tables, on every sharp spur and ridge between Mount Brown and Ubua. At the source of the Mimai, I would estimate 258,000 cubic feet of hoop pine.

Between Laruni and Kagi no surveys were made. The forests of the mid-mountain belt that we met with had good stands of the two oaks. No. 384 (*Eugenia* sp.) was very common, while the conifers were represented by all the podocarps already referred to, and the Phyllocladus. One or two Libocedrus were seen, but I do not think we anywhere reached the optimum altitude of this tree—8,000 feet. A new tree, Dacrydium falciforma—No. 397—was found between the Adai and Tuwui Rivers. It does not attain any size, and in the neighbourhood was also found an Araucaria, which may prove to be Bidwill.[a] It is a medium sized tree, 7 feet in girth, with a 60-feet bole and 90 feet overall. Some new orchids and shrubs were found, and material of the mountain bamboo, rattan, and Freycinetia angustissima was collected. A Eugenia with very tapering, oil-dotted, small leaves was common everywhere. I shall refer to this again when writing of the mossy forests, for it climbs to the very top of all the mountains I have ascended. Its number is 398 (*Xanthomyrtus longicuspis*), and the Menari people know it as Faro. It yields a very dense, hard, red-brown wood; one of the heaviest of Papuan timbers.

The absence of hoop pine from the mid-mountain belt reduced the volume of the forests all along the face of the mountains on the course we traversed. In other respects, and but for the addition of some new trees, the composition of the forests was much the same until a long ridge was found. Here the moss forest descended down to 5,500 feet, and for two nights we camped on this ridge between 6,000 and 8,000 feet, and saw only mossy forest. After crossing the Naro at 4,900 feet, we climbed once more to 7,000 feet before dropping down to country of the Menari folk. Except for the absence of hoop, the forest was much the same as those already described near Laruni. The addition of a tall stemmed palm was noticeable, and the armadillo-barked Eugenia —No. 428—was found over 6,000 feet up on this last mountain.

The mid-mountain type of forest occurs on the north-east slope of the range, and is easy to visit from Kokoda. Here the large boled Albizzia climbs higher, but, generally speaking, the distribution of species is similar to the forests on the south-west aspect. There are a few large hoop pines, and, curiously enough, there are some dead ones right alongside the path where it goes up the last big climb but one. Here the continual clearing of the path on a rather steep slope, and the camping of the mail escort that twice every month passes backwards and forwards from Port Moresby to Buna, have caused a strip of grassland, fire being, of course, the agency that maintains the grass, and this caused the death of the hoop pines. There are fine long slopes along this flank of the range, and a big strip survey is indicated. It is easy of access, and the Biagi natives are good mountaineers, so that satisfactory labour would be available.

The Mossy Forests.

At the upper limits of the mid-mountain belt come the mossy forests. The altitude averages 7,500 feet, though, as I have shown, it occasionally is much lower, and sometimes does not begin until 8,000 feet is reached. The forest is so characteristic that there is no mistaking it. While the mid-mountain forest, particularly at its higher elevations, is mossy, it is not so continuously in the clouds as the true mossy forest, and is therefore not so often saturated with moisture. In the true mossy forests, there is only one story, and that a very dwarfed one. The stems of the trees are short and scraggy; they appear to be thicker than they really are, because of the heavy cloak of moss that surrounds trunk and limbs. The height growth of this association is 25 feet, and the maximum diameter is 12 inches, while the average is much below that. The trees, too, put out aerial roots, so that the traveller walks on a spring bed of roots covered with a green mattress of moss. Mosses and liverworts cover everything, and from the limbs hang in festoons the grey lichens. The orchids and other epiphytes grow low down on the stem as well as in the branches, and so are very conspicuous. Some are pretty, but none is really showy. The ground cover consists of mosses, of which Dawsonia sp. is the tallest. There are also quantities of filmy ferns and Salaginella. Some of he ferns are tiny delicate things; others rather large polypods. The large tree fern persists, as also does the mountain bamboo, a Pandanus and Freycinetia angustifolia. I saw no Calamus. These were left behind in the lower levels of the mid-mountain forests. The bamboo is, however, much more trouble, causing long delays while the benumbed natives cut a track through. Of flowering shrubs, there are a number, and the Melastomaceæ are well represented. Here occur the two rhododendrons, though I was not fortunate enough to see them in bloom. The tree growth consist of very few species, of which *Podocarpus thevetiifolius*—No. 257A—and (*Xanthomyrtus longicuspis*)—No. 398—form over 80 per cent. of the stocking. All species except one have little leaves; that one is *Fagraea* sp., whose comparatively large coriaceous leaves and white fleshy flowers make it conspicuous. At the very top of Mount Obree (10,240 feet), only the *Podocarpus* and *Eugenia* were found, and the *Podocarp* was the more numerous. Here, exposed to the elements on all sides, the trees are 13 feet high, and distorted to a degree which it is hard to describe. Twisted, gnarled, crooked, and bent, blanketed in moss, tufted with a thread-leafed orchid, carrying elbowed aerial roots, they look like an association of trees in a futurist's picture.

(a) Subsequently identified from New Guinea material as *A. Klinkii*.

The bird life in the mossy forest is certainly small; yet, even there, we found the mounds of the scrub hen and the circuses of the bower-bird; and one day, when the clouds did not come down till 12 noon, I saw quite a number of little birds darting about among the undergrowth of shrubs. It was that day that I was able to record drought conditions in the mossy forests. Everything was perfectly dry—the mosses cloaking the stems came off dry and brittle, and dust flowed out, the dead branches of trees were dry enough to burn at the first attempt when we lit the fire to boil the luncheon tea, and the whole forest gave one the appearance of having received no rain for some time. It is quite possible that such dry periods, instead of lasting one night and a morning, last two or three days, in which case the whole forest would become most inflammable. This is, to my mind, the only explanation for the comparatively large areas of burnt mossy forest. The normal condition of the mossy forests is to be enveloped in cloud, and to be, in consequence, saturated with moisture, but there are evidently times when periods of drought occur. The mossy forests in all probability receive actually less rain than the foothill and the mid-mountain forests.

Rather a curious thing, yet one that has been recorded elsewhere in the tropical mountains, is the presence of xerophytic epiphytes growing cheek-by-jowl, as it were, with mosses and filmy ferns on the trunks of the trees in this type of forest. The xerophytes appear to crowd to the upper branches, which point to a higher evaporation in these than at the base of the trunks. Until meteorological data are available, in particular temperature and rainfall, and humidity, it is not possible to put forward any general explanation of the dwarfing of tree growth in the mossy forests.

Alpine Grasslands.[a]

As a rule, in the mountains of the tropics, when one has passed the dwarfed mossy forest of the cloud belt, one reaches a xerophillous belt of shrubs; then alpine grassland prevails." How far Schimper's generalization is true for the high mountains of Papua, I am unable to say from my own observation, for the summit of Mount Obree, 10,240 feet, is the highest point I reached in the main range. From what has been written by Sir William MacGregor, it appears to be more or less applicable. When the ascent of Mount Victoria was made, and when, later, the Wharton Range was traversed, Sir William made a very fine collection of botanic material, which was subsequently examined by Baron F. v. Müller, and by Kew. The results were published in the annual reports of New Guinea between 1889 and 1894. Sir William MacGregor's observations about the flora are of such particular interest that I have made the following extracts from his dispatches:—[b]

> "About 9 a.m. next day we crossed the Vanapa for the last time on the outward journey. The altitude of this crossing was 10,130 feet, the temperature 59 degrees. It is even there a fine, mountain stream, about 5 yards broad, with a very rocky bed. On crossing, we began the ascent of the central ridge of the Owen Stanley range. At this point there are several large spaces on the face of the mountain, where grass grows freely, but on which there are no trees whatever. As wild dogs were howling in the vicinity, some of our people expected to find natives at these clearings, but I could see no trace whatever of human presence except our own, either past or present. Mr. Belford, when in advance of the three men, who were carrying all our food, set fire to the grass as a signal to those behind, who had lingered about the river, and must have been fully half-a-mile from us. To my great alarm, the fire in a few minutes covered scores of acres, and swept like a tornado in a straight course towards the river, whence our men were coming. I feared they should have to throw away their packs and run for their lives, but very fortunately there was a wet strip along the middle of this great grassy patch which did not burn, and along this they soon appeared, greatly to my relief. The surrounding forest growth, although it looked very dry, did not burn. Early in the afternoon, we reached the top of the great ridge at the point named Winter Height, which has an altitude of 11,882 feet. At about 5 p.m. we camped, after having walked about 5 miles, on the lowest part of the great central ridge, at a point where the top of a glen on the south side meets the top of the glen on the north side, forming the lowest part of the central portion of the Owen Stanley range, to which has been given the name of Dickson Pass. Its height is 10,884 feet, and it divides Mount Douglas from Winter Heights.
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> 42. In our camp at Dickson Pass the morning temperature before sunrise was 44 degrees, and at 8 a.m. it had risen to 55 degrees. The forest here is mainly composed of cypress. We had water near. We passed over the top of Mount Douglas, 11,796 feet, and had an opportunity of picking strawberries there. They were not of large size, excellent in flavour, but not quite ripe. At 5 p.m., we pitched camp, after a march of about 5 to 6 miles, some four hours' march from the top of Mount Victoria, the name I have given to the highest crest of the Great Owen Stanley range. Soon after we had camped, there arrived two Polynesians—George and Caesar Lifu—and four Papuans, sent by Mr. Cameron to bring us supplies. They had brought rice and flour, which we could manage without, but of meat, of which we had practically none, they did not bring an ounce. Indeed, it was clear that their enthusiasm to get to the top of the "Great Mountain" was greater than their consideration for us, for even the rice and flour they had left on the way, and now they joined us with empty hands and empty stomachs, and we had to share our scanty stock with them. They did not, however, return so light, as geological and botanical specimens had to be transported.
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> 43. At about 11 a.m., of the 11th June, I reached the top of the north-west peak of Mount Victoria, and at once set to work to collect geographical data, and botanical and other specimens. I do not feel competent to pronounce on the geological formation of Mount Victoria. The specimens will be duly examined by competent authorities hereafter, but it may be mentioned that a few hundred feet from the top of the highest crest, I saw the largest vein of quartz I have seen in the possession, about 15 inches thick. There are no trees on this mountain within 1,500 feet of the top, and but few bushes grow within 1,000 feet of the summit. The flora is disappointing, except as regards grasses, which were numerous, far beyond my expectations. There are probably few species or varieties of flowers or grasses of which we have not brought away examples, but the total will, it is to be feared, be surprisingly small. There are several varieties of daisies, buttercups,

(a) Schimper, A. F. Plant Geography, p. 721. See pp. 65, 66 in New Guinea section.
(b) Annual Report, British New Guinea, 1888–1889, pp. 43–44.

Burnt Dacrydium-Libocedrus Forest, 11,000 feet. (See pages 65 and 66.)

The Gorge of the Nomi River, 5–7,000 feet.

See Appendix II., page 180.

[*To face page* 42.]

forget-me-nots, heaths, &c. There are very few birds, the most noteworthy being the lark, only one specimen of which was obtained by my private collector, Joe Fiji; but to my great disappointment, I learned the day after we had left the mountain that Caesar, Lifu, and Joe had eaten two of my three new birds obtained on the mountain, and that one of the two was the lark.

44. We were camped two nights on Mount Victoria, the 11th and 12th June, at an altitude of 12,452 feet, that is about 670 feet from the top of the highest peaks, and we therefore can speak of its climate with some degree of authority. The temperature rose in the middle of the day on the tops of the peaks when the sun shone straight on them, to 70 degrees. In the morning the grass was all quite white with frost before the rays of the sun reached it. Icicles were brought into camp the afternoon of the day we got to the top; and next day I saw one, the largest I observed, more than an inch in diameter, and 7 or 8 inches long. During the day, from about 10 a.m. till 4 p.m., the temperature in the shade was between 50 degrees and 60 degrees. The sky was blue and cloudless, except when the wind was blowing strong from the south-east, when there was some haze. At night, there was no trace of cloud to be seen, except those that lay like lead in the great valleys below, and the stars shone out as brilliantly as on a frosty winter's night in the British Isles. From the dryness of all the plants and trees on the Owen Stanley range, it was apparent there had been no rain for several weeks, and the whole range did not show a single cataract or waterfall of any kind, nor even was there the murmuring of a mountain stream to break the deep oppressive silence that reigned on this great lone mountain. Mount Victoria is, during this season at least, emphatically a dry mountain, and the same may be said of all the other great mountains of the Owen Stanley range traversed by us; but yet, strange to say, water oozes from some of the gigantic rocks on the crest of Mount Victoria, and only 200 feet or 300 feet from the top of the south-east peak, I caught a small frog which was floating benumbed with cold in a little pool of water, where there was sufficient to enable one to say it was "running." We suffered much from the cold, as we had not sufficient clothing to protect us, so that, in spite of fires, a good deal of discomfort had to be endured. It seemed also to sharpen the appetites of a party already not strangers to hunger."

The results of Mr. Hemsley's determinations of the botanical material that was gathered at these high altitudes will be found in the annual report of that year.[a]

Grasslands were met with by Sir William between 10,000 and 11,000 feet. The forest at Dickson Pass, 10,884 feet, was "mainly comprised of cypress" (*Libocedrus papuana*). The upper limit of tree life would seem to be about 11,000 feet, when Schimper's alpine grassland conditions take the place of the dwarfed forest cut up by grass patches. The dryness of the climate is evidently great at these altitudes—at any rate at certain times of the year. Sir William found things very different when he re-visited the mountain in September, 1889, for he writes, "Nothing could be done in the fog and rain that lasted all day."[b] The ascent this time had been made from the Mambare in the north-west, and Mount Scratchley had been climbed. This mountain lies to the north-west of Mount Victoria, and rises to a height of 12,500 feet. Trailing bamboo was met with between 7,000 and 8,000 feet. "At 11,000 feet the greater part of the forest consists of cypress trees with a few araucarias, and the undergrowth becomes thin. Many trees from about 10,000 to 12,000 feet are 3 feet or more in diameter, and from 50 to 150 feet high. They are not smothered in moss above 10,000 feet to anything like the same degree as those that grow from 6,000 to 10,000 feet. A little grass begins to be met with in small patches at 11,000 feet. A grass patch at about 10,800 feet was white with frost at 8 a.m."

In a general description of the top of Mount Scratchley and the surrounding mountains, Sir William writes:—

"On the top of Mount Scratchley, there is probably an area of not less than two score square miles above 10,500 feet, the greater part of which is covered by grass, bare rocks, and clumps of trees and shrubs. There are at least three small lakes on the top, the largest having an area of probably 15 to 20 acres. The appearance of the mountain top from our first camp was most picturesque. Sharp ridges of a yellowish brown, sometimes so large as to become small hills, covered the broken ground in all directions. The hills and ridges bristled with rugged, sharp, grey rocks on which were often little heaps of broken up white quartz. Between rocks and ridges, and in some of the intervening valleys, there were clumps of a very strange weird-looking forest. This consisted almost entirely of cypress trees of a peculiar form. The top of each tree is a broad crown, quite flat, and even on the upper surface, light green in colour, with a tinge of yellow, while the stems, covered by lichens, are of a hoary grey. The branches are gnarled, and the stems short in proportion to the width of the crown. These trees do not grow close together, but rise on the sloping ground with the regularity of steps on a staircase. They are generally protected from the wind, and not a leaf seems to move on them, so that the whole view suggests irresistibly the idea of a petrified landscape. The dantesque appearance is further increased by a cycas with a short, thick, black stem, and a small crown of leaves, which generally grows in the grass in irregular rows at the edge of the cypress wood, and looks like a line of sentries posted round it.

Altogether, on the tops of the Owen Stanley range of Mount Scratchley, of the Wharton chain, and of Mount Albert Edward, there cannot be less than, say, 100 square miles of this grassy country. There is probably considerably more."

The Mangrove Forests.

These forests occur along the sea coast wherever there is an inlet or bay sufficiently sheltered to permit the trees to grow, and into which a river flows, depositing silt. A river with little fall is the most favorable to the formation of mangrove swamps, for delta conditions are set up—the fresh water meeting the flood tide daily, and depositing its bars of silt. These become large flats, covered at high tide, and exposed at low water. Here is the home of the mangroves and their great associate—the Nipa palm. These are all trees with very special aids to growth in the extraordinary situation they are found in, and aids, too, to propagation and broadcasting of seed. Wherever a new flat is formed, the seeds transplanted by the tide or the current, plant themselves, and the forest advances continually. On the upper limits of the mangrove forest, the land is slowly draining itself, and the mangrove is dying out; its reclamation work has been accomplished. But the conversion from swamp to dry land is very

(a) Annual Report, British New Guinea, 1897-1898, pp. 47 to 50.
(b) Annual Report, British New Guinea, 1896-1897, p. XIII.

slow indeed—so much so as to be inappreciable, except over long periods of time. These trees, growing in mud and salt water, and which are sometimes called halophytes, have all the appearance of xerophytes. The leaves are leathery and rounded at the ends; the cuticle is thick, and there are water storage tissues. The explanation of all these aids to the conservation of its water supply in a plant growing continually in water, is that the water is salt. It is essential that the little water that can be absorbed by the roots in the selective assimilation, and which is absorbed very slowly, should be conserved. So transpiration is reduced to a minimum, and there is a tendency in many species to succulence. They have large aerial roots, or, at any rate, root swellings, with surface roots on the ground. Others, e.g., *Sonneratia avicennia,* send up air roots from below the ground, and they stick up like a young thicket of leafless seedlings all around the old tree. The stand of timber is dense, and must carry a heavy volume per acre in such places as Galley Reach, where the trees grow to a comparatively large size. The commonest species of the mangrove swamps are:—

No. 213—*Rhizophora mucronata, Rhizophoraceæ.* 212—*Bruguiera Rheedii, Rhizophoraceæ.* 211—*Avicennia officinalis, Verbenaceæ.* 218—*Xylocarpus granatum, Meliaceæ. Nipa fruticans, Palmæ. Heritiera littoralis, Sterculiaceæ.*

No. 213 is recognized by its very branched prop-roots, which are like flying buttresses; otherwise it is very like 212 in general appearance.

No. 212.—Except in flower or fruit, only distinguishable from 213 by the absence of prop-roots.

The timbers of these two—our principal mangroves—are also very similar. Bruguiera wood is slightly lighter in color and in weight than that of *Rhizophora.* Both are very hard and heavy; otherwise, with their pretty quarter grain, they would make good cabinet woods. They should make good flooring.

No. 211.—*Avicennia* has a very thin, greeny-yellow, almost smooth, but really thin, papery, scaley bark, and is therefore very distinct from the last two, which have dark brown, rugged barks. Its wood has a fine grain on the back, owing to the remarkably clear bands of white, soft tissues showing up against the brown, hard tissue. It grows best on the edge of the swamp, approaching the beach forest (see page 21).

No. 218.—*Xylocarpus granatum* (*syn. Carapa*) has a large brown cannon ball of a fruit, with twenty pyramidical seeds inside. These are washed all round the shores of Papua, and with the Nipa fruit, are the commonest objects of the beaches. The wood is used for good cabinet work in other parts of the world. Another *Xylocarpus* is kasi kasi, a pile timber with a tremendous reputation for durability.

Heritiera littoralis bears a dark fruit with the Kurrajong rib to it. It also is to be picked up on the beaches. The wood is sound for many purposes, but very hard to work up. It has a good reputation for resisting borers, and even gives the ship worm some trouble.

Nipa palm is so well known as not to require description. Its long, very green leaves are a striking object along every tidal waterway and salt swamp land. In other lands, it is a valuable source of alcohol; here it is only used for thatching. The leaves of the Nipa are preferred to those of all the other palms for this purpose I refer to this species and the first two mangroves under the section "Minor Forest Products."

There are many other species in the mangrove associations, and these require identifying. Those that I have enumerated are merely the very common trees. As one rises from the mangroves, the beach forest is encountered. Some of the species of this formation have already been mentioned. I add here *Aegiceras majus,* which has the same viviparous method of propagation as the *Rhizophora,* which grows in the intermediate vegetation, and *Acanthus ilicifolius,* a climbing, scrubby plant with an attractive blue flower, and the leaf of Greek decorative art.

The area of mangrove swamps in Papua is not known, but it must be large, particularly in the western division, where huge rivers empty themselves slowly into the sea, passing through mile upon mile of low-lying tidal reaches.

3. FOREST POLICY.

From the earliest times in history every nation with any sort of civilized customs and laws found it necessary to lay down rules for the use by its people of the great national resources represented by the forests. The earliest record is probably in Justinian's Pandects, where provision is made for the cutting of timber on conservative lines. The timber was to be felled with a due regard to the requirements of the people in general, and the regeneration of the forest—cut in the same way as a good father of a family would cut his own private woodland. The cutting of vine sticks and firewood was so regulated as to assure the reservation of a sufficient number of trees to make timber later on. This regulation as to the reservation of standards, as they came to be called, will be found in the laws of all countries right up to the Code Napoleon, and in France to-day the old terms are still in use. The work of going through the coppice and reserving the young trees—the future mill logs—is known as "Balivage," which is derived from the word "Baliveau," the name given to the young reserved tree till it is 50 years old, when it becomes a "Moderne"; at 75 it is an "Ancien," and at 100 a "Bis-ancien." All through its life this tree, marked at the root with a brand, is safe from the woodman; only an authorized officer can mark it for felling, and this is only done when the tree is ready for the axe. The forests are the property of the people to use, and not to abuse, and a wise people so guards the cutting of its timber with laws and rules that the quantity of timber cut from a forest in a year is equal to the quantity it will grow in that time. The forest is a reservoir of wealth only so long as the interest of the wealth is made use of. Once the owner foolishly starts cutting into his capital, the reservoir is soon emptied, and the nation's timber, being exhausted, her requirements in this necessary commodity must be made good from outside her borders. Where sound government exists, such a possibility is unthinkable, and shortage of timber is not due to over-cutting, but through the growth of the population and industries. There is, however, a form of government which, while being of the very soundest in theory, in practice fails to safeguard its natural resources. It was Jean Jaques Rousseau who said—I translate from memory—"Were a community of Angels to select its form of government, it would choose a democratic form." In practice, so far as care of forests is concerned, and safeguarding the timber supply for democracy for all time, "government of the people by the people for the people," except when the democracy has risen on the ashes of some less angelic form

[*Photo by E. R. Stanley.*

A mountain type (Laruni 4,800 feet).

Houses in the sea (Hula).

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of government, seems to result in "fooling the great majority of the people all the time." The small minority that is not always fooled has never sufficient power at the ballot boxes to make itself really heard. I hope Sir Alexander Peacock was not right when he addressed a Premiers' Conference at which forestry was a subject of discussion—he said "The trouble about forestry is that trees have no votes."

Young democracies have, on the one hand, come to regard forests as mines of riches to exploit as fast as possible, and all and sundry have been encouraged to erect sawmills and cut down timber, or to regard them as hindrances to land settlement, excrescences to be destroyed to make room for agriculture; "We want men, not trees," is a telling electioneering cry. The conception of forests as permanent sources of wealth, of forestry as farming on a long rotation, seems hard for the people to realize. So, from the furthest forests of Northern Canada to the kauri stands of New Zealand, saw-mills have gutted the forests, and land companies or land settlement Ministers have destroyed what remained.

If I have referred to the usual democratic practice regarding forests and forestry in other lands, it is to make the comparison all the clearer with Papua. The Government of Papua is not democratic. The forests of Papua that are easily accessible are not such as to tempt the large sawmilling company. The labour supply of Papua is not likely to prove sufficient to enable large, new areas of plantations of coco-nuts, rubber, or other tropical crops to be established. It is not a white man's country, but is the home and property of the Papuan native, whose interests are being carefully and wisely safeguarded, while he is gradually being elevated from the stone age to that of petrol and wireless.

Papua has, therefore, a chance, even in this democratic age, of establishing a forest policy which will be appreciated by the people when they have reached the stage of civilization which is expected of them. At present, the timber requirements of Papua are negligible; the native requires no sawn wood, using, as he does, round poles and split timber for his houses. The white population, it is true, uses a little timber, but one small mill could supply all the present needs of public and private buildings and works. For some time to come, therefore, the forest policy of Papua will feel no great and insistent call from a people wanting cheap wood. The Territory has ample time to put its forest house in order, and it is exceptionally well situated from a forestry stand-point, and so should have no serious difficulty in effecting this object.

It will be said that there is really little need for a forest policy in Papua since the people are not likely to want timber except as rough pole woods. That is so, but Papua is an integral part of the British Empire, and is a colony of the Commonwealth of Australia. Were there no other reasons to advance but that of mere commercial aggrandisement, the importance of a forest policy, in a country like Papua, with its relatively cheap labour and its splendid growing conditions, and situated a week away from Australia, that imported £4,447,945 worth of soft wood in 1924-1925, would be sufficient. But it is obvious to any who have visited Papua that there are very large areas producing nothing, and which, as part of the Empire, should be producing their quota of food or raw materials.

Up to the present, the only policy has been to encourage sawmilling, and the laws relating thereto are included in *The Timber Ordinance (Consolidated)* 1909, which, except for the provision which deals with native rights, is an adaptation of the old Queensland Act. This Ordinance, among other things, provides:—

For the purchase by the Lieutenant-Governor, from the native owners, of timber lands, and the vesting of such lands in the Crown. They become timber reserves for the cutting of timber on native-owned land and on Crown land.

For the granting of permits to cut timber, £10 a year.

For the protection of an area of timber from cutting.

For the protection of a certain species of timber from cutting.

That a native requires no permit to cut.

That a royalty on all timber exported is paid (up to 7s. 6d. per 1,000 superficial feet).

For the declaration of timber reserves on any Crown land, except within 5 miles of a mine shaft.

For the granting of licences to cut timber in the timber reserves for which a rent of 10s. per year for every 100 acres is paid, and which have a currency of from one to 25 years.

For the granting of leases, agricultural and pastoral, under the Lands Ordinance within a timber reserve, and within a timber licence already granted.

For the cutting of sandalwood and collecting of rubber; a girth of 18 inches at 1 foot from the ground is the minimum girth for sandalwood trees. Below this they may not be cut. Sandal must be stacked. The stumps and bole must be branded.

That a licence is necessary to cut sandalwood or collect rubber, or to purchase them from a native.

For the making of regulations by the Lieutenant-Governor.

Such a legislative enactment as I have briefly summarized above is an excellent example of the kind of laws a young democracy passes to ensure the destruction of her natural timber resources as quickly as possible. Queensland has long since abandoned it, and has on her statute-books an Act which differs wholly from the old one, and provides for forest management as well as forest utilization.

That the forest resources of Papua, under this very encouraging Ordinance, have not ceased to exist, is for the reason I have already stated: they are not sufficiently valuable to tempt the exploiter. While this Ordinance has caused no harm in Papua, and I see no immediate need to alter it, it is possible (with the continuously rising price of timber, the exhaustion of the American and Canadian supplies to the point where exporting of timber ceases and the demand of Australia for her continually growing requirements in soft wood), that the mid-mountain forests of Papua may be worked, and so I set out here, as briefly as possible, the main points required in a legislative enactment designed to enable the management of the forests on such lines that, not only is the volume increment—and only the volume increment converted—into sawn wood but the regeneration of the forest and the future supply of timber for all time is assured.

Outline of a Forest Ordinance.

Constitution of a Forest Authority and Machinery to Administer the Ordinance and Carry Out the Regulations Made Under it.

The Forest Authority should be the Forest Department with a Conservator of Forests at its head, who is qualified, both by his forestry education and by his experience, for the position. The Forest Authority should have exclusive control and management of all matters of forest policy, and the administration of the Ordinance. The Conservator should have all power of appointing, promoting, and dismissing his staff.

The Dedication of Permanent Forest Reserves.

Such reserves will, generaly speaking, be on waste and vacant lands, but at times will require to be purchased from the native owners, and provision should be made for this. It may be argued that to reserve waste and vacant land is an unnecessary trouble, but the Forest Authority must know quite definitely what are the areas that he administers, in order that he may lay out his plans, which cover many years ahead. These reserves must not be subject to alteration at the whim of the surrounding population, and, once agreed to, should be permanent, except some very good reason to the contrary is adduced. The revocation of a reserve or the amendment of its boundaries should be a matter only to be dealt with by the Lieutenant-Governor and the Legislative Council.

It is generally found that a second and less safeguarded form of forest reservation is necessary to cover certain requirements. For instance: it may be deemed advisable to reserve a piece of timber land until the timber is cut, and then throw it open to agriculture, native or imported. Such reservation might be called "protected forests," and be revocable by the Commissioner for Lands and his Board, on the Forest Authority having first reported that the timber had been utilized.

Provision for Working Plans.

These are not the maps or blue prints of an engineer, but the written plan or scheme of work which lays down the method of management of an area of forest for some years in advance. They lay down, among many things, the maximum quantity of timber that may be removed annually from a certain forest, or the maximum area that can be cut over in one year; the various operations, sylvicultural and general, that are necessary to assure the optimum and maximum regeneration on the cut-over country. To assure a continuity ofpolicy and to prevent trifling alterations, the working plans should be submitted to the Lieutenant-Governor for approval, and, having been approved, should only be altered by the Lieutenant-Governor on the recommendation of the Forest Authority.

Permits to Cut Timber.

These permits should be granted, subject to the general regulations and to the requirements laid down in the working plans governing the area of forest over which the permit is granted. The permit would be granted subject also to the payment of the stumpage value of all timber as it is cut. A satisfactory deposit, covering the value of, say, three months' cutting, is a useful provision, on the application for the permit. The value of the timber to the Government should be equal to the cost of growing it again. Often, in fact generally, this figure is not accurately ascertainable at the time the permit is applied for, and an arbitrary value per cubic foot must be fixed as near this figure as is possible. It may be argued by the applicant, and he may be supported by members of the Government service—even the Treasurer—that the value fixed is too high, and that it is not possible for him to cut the timber at a profit. Such an argument, supported by the usual clap-trap about developing the Territory's latent resources, should not be listened to, unless the Government is prepared to meet the cost of regenerating the forest from other revenues.

When more than one person seeks to obtain the same permit, then the value per cubic foot should be obtained by means of an auction, or by calling for tenders. The upset price in the auction is the value set on the timber by the Forest Authority, and any increase on that value, bid or tendered by the would-be permit-holder, is a pleasant profit that the Forest Authority can satisfactorily utilize in developing his working plans.

Licences.

It is only in the case of scattered minor forest products, where many persons are engaged over very wide areas in collecting barks, gums, and resins, the value of the product should be paid for in licence fees. This should be an exceptional method, and, as far as possible, all "getting" of forest products, whether the cutting of timber or the gathering of nuts, should be covered by a permit, specifying areas and quantities, and price per unit of measurement or weight as the case may be.

FINANCES.

The general rule, which has now come to be accepted everywhere, is that the whole of the revenue of the forests should go back to the forests. The nation obtains its revenue from the timber industry, as it does from all other industries, in the form of direct and indirect taxation, and there can be no argument for special class-taxation—which is all that a royalty on timber means if that royalty is sunk in general revenue, and used for entirely other purposes than for re-establishing the forests as they are cut out. Owing to the general rapacity of Treasurers, it is found best, as a rule, to create a special fund at the Treasury into which forest revenue is paid, and from which it is drawn by the Forest Authority on warrant; the money so drawn being the amounts set out in the various "working plans" which have already received the Lieutenant-Governor's approval.

A general appropriation of the whole of the forest revenue for the year, then, is all that appears in the annual estimates, and the amounts collected are automatically credited to the special fund at the Treasury. A scheme of expenditure should, however, be submitted, showing clearly how much money is to be disbursed on each of the working plans, and a *résumé* should be made, showing the division of expenditure into salaries and works. This scheme of expenditure is read in conjunction with the Forest Authority's report for the previous year, in which appears a statement of expenditure under each working plan.

In the event of the funds derived from revenue being insufficient to cover the cost of the work laid down in the working plans, it would be for the Government to decide whether there should be a special grant or appropriation for forestry.

LOAN ESTIMATES.

Cost of Plantations.

This is an expenditure which comes naturally under the heading of loan estimates. A timber plantation is a reproductive work, and is a source of wealth from which this generation will derive very little, if anything; while the future generations will derive all the benefit. To charge the cost of making plantations against forestry revenue, or against general revenue, is, I think, unsound. The forestry revenue should equal the cost of regenerating the natural forests, and at any rate leave nothing to spare for so large a work as establishing areas of plantation timber. Provision, however, should be made for the payment of interest on the loan, and for a sinking fund. All revenue from the plantations would also be paid into the special forestry fund. The profit on the plantations, after paying all costs, including interest and sinking fund, should be more than sufficient to pay for the cost of regenerating the once artificially created forest.

It is possible that a definition of natural forests and plantations may clear up any misunderstanding that may have arisen on the question of this item of finances. "Natural forests" are those which were created by nature, and which have cost the country nothing. Their

regeneration is, generally speaking, a matter of judicious aids to nature, and is rarely one of planting. "Plantations" are forests created by man. The existing timber may be of low value, or there may be no timber; the policy of putting the land to the best use is being pursued, and a crop of timber is decided on. This is our plantation, which, after it has reached maturity, and been felled, may be regenerated by natural means, or may be replanted, whichever is the most advantageous. Its first cost only is a loan estimate item.

Regulations.

Provision must be made for promulgating regulations, and the powers granted in this direction should be very wide. With my very limited knowledge of local conditions, I cannot lay down what regulations are necessary. The working plan and the permit should cover most of the ground, and, in regard to the latter, it is convenient to have it in the form of an agreement entered into between the Forest Authority and the permit-holder. Thus, not only are its provisions agreed to by both sides, but it may be altered later on, should conditions demand an alteration.

Thus the bulk of the minor regulations would be incorporated in the permits, and the regulations made under the Act need only be those covering general matters, such as: unlawfully cutting timber; setting fire to forests; counterfeiting brands; bribing foresters; moving of seized timber, &c., &c.

There is one regulation which is important to get right from the start, and that is the system of measuring timber. An ancient and absurdly inaccurate system has been in vogue in Australia since its discovery, and is only being slowly dropped to-day. That is the "quarter girth" system of measurement, by which the girth at the middle of a log is divided by four, the result is squared, and this is taken as the mean area of the log, and is multiplied by the length to get the cubic contents. The error is obviously as π is to 4, or as 78.5 is to 100—an error of 21.5 per cent. on the real measurement. As tables are always used for working out this quarter girth volume of logs, the argument that this system is an easy one for the timber man may be discounted. Tables are available giving the solid cubic contents of a mill log, given the middle girth and the length. While the true volume of a standing tree is not obtainable, and all methods of measuring standing timber are prone to large inaccuracies, the volume of a felled tree can be ascertained to a degree of accuracy, sufficient for all practical purposes, if the middle girth is taken, and the area of a circle of that girth is multiplied by the length of the log. There is no reason to-day for using the obsolete quarter girth system, for the tables for this calculation are as handy as the quarter girth ones.

Policy as to the Natural Forests.

From my description of the forest regions, it will, I think, be gathered that the policy for the natural forests of the lowlands must be one of some difficulty. In the section dealing with the commercial aspect I give a general summary of all the surveys carried out, and I comment on the situation. There can be no great development of a timber industry in Papua. Little by little, as the timbers of special beauty, or of special quality for certain purposes, are discovered, a restricted market will be found overseas for a small proportion of a standing stock which is already deplorably light to the acre. The future of forestry in Papua is wrapped up in the development of minor forest products. Careful exploration of the country, and patient research into the vast store of minor products is likely to yield greater financial results than the cutting of the mixed rain forests of the lowlands and trying to dispose of the sawn products as Papuan softwoods and Papuan hardwoods. The forest policy for the lowland country, so far as timber is concerned, should be one of conversion. There are a certain number of species that, prima facie, are worth attention; others there are which, while obviously valuable, are not sufficiently social in habit, and must necessarily remain scattered in mixed formation. This type will not pay to deal with on forestry lines. Others can be disregarded because the soil they thrive in naturally is very rich, and such land is not available for forestry. The trees that are worth attention are those that naturally grow in pure stands, and whose timber is likely to prove serviceable for general purposes overseas. Of all the host of Papuan timbers, one only stands out pre-eminently in this respect, and that is ilimo. This species is naturally a social one and its timber would command a satisfactory price on the Australian market as a good all-round softwood. While not as strong as the best softwoods, the grain of ilimo is more beautiful, and the general appearance is better, than most softwoods she imports to-day, and I am confident that well-grown ilimo would realize a satisfactory price when properly sawn and machined. The policy of conversion in regard to ilimo should be pursued with a view to establishing pure forests of this species along the banks of some of the great watercourses which are sufficiently sparsely inhabited to be able to spare the land and where the land is true ilimo country. It would, for instance, be useless to try to establish ilimo on the mudstones and shales of the Purari river proper. The indication of ilimo soil is the presence of ilimo stands in pure formation. A careful search will be necessary before the best sites can be selected, and the selection should be made in order to get the largest possible areas. Small scattered plantations are expensive to control, while a large area, in one locality, is economical. The conversion will amount to planting. First, the present mixed stands of timber must be removed; much of it will be utilisable and should be sawn into marketable sizes. Next, on the cleared site, ilimo should be close planted. I am not prepared, at present, to lay down the spacing of this species. It is fast growing and clears its bole very well, and so might stand planting 8 feet apart, or about 840 trees to the acre. Careful sylvicultural study is required, however, before the distance apart at which this tree should be planted can be settled satisfactorily. This conversion of badly stocked mixed forests is really plantation work. Here and there, the existing stands of ilimo will be sufficiently good to supply a natural regeneration. But for the most part the work will be one of clearing and of planting. Whether the seed will require to be raised in nurseries, or whether the natural nurseries of ilimo will be found sufficiently numerous, and the plants in them sufficiently well rooted to require no other nursery treatment, is a matter also for more patient investigation than I have been able to give the subject. From my own observation I should say that new banks on the large rivers are formed so often, and then are so quickly and so densely clothed with a natural covering of baby ilimo, a supply of strong and satisfactory seedlings are obtainable from this source. If nurseries are decided on, then flying nurseries are indicated, which would be situated as near as possible to the area being planted and moved every few years. It is not only a question of transport of perishable plants from the nursery to the plantation, but one of economic supervision. The careful removal of the transplants from the nursery is as important as their proper planting, and as both operations go on simultaneously the nearer the nursery beds are to the plantation, the

better. Of the remainder of the species of the mixed forests of the lowlands I can only point to three which are, prima facie, worth planting, and these are: No. 4—nara (*pterocarpus indicus*); No. 3, medobi indt. and No. 10, melila (*Afzelia bijuga*). There are, as will be seen on referring to the description of species, a host of woods of all types, from the softest to the hardest, from plain casewoods to beautiful cabinet woods. But, until a great deal more sylvicultural research is carried out, it will not be possible to choose any but those that are obviously valuable and obviously social. These three certainly conform to the first desideratum, and as to their sociability they are none of them so social as ilimo, yet all are found now and then in clumps, and I have every hope that when planted they will thrive in pure stands. They all shade the ground well, and should require no second or third story species to help them in this respect. But here again, more sylvicultural study is required to find whether the growth of any of them would be improved by having an associate species. Of the three, nara—No. 4—is the most satisfactory regenerator, and the other two must be regarded as rather experimental. To begin converting the low quality mixed stands of the lowlands into pure stands of these three species would, I think, be a mistake. In regard to this country we must wait until sufficient sylvicultural research work is done, and we are not only sure that the chosen species will thrive under plantation conditions, but that the best species have been chosen from a timber stand-point. There is country, however, where it is not a case of the conversion—for the forests have already gone—but one of planting artificially created grasslands. That they should remain unproductive for generations, until in fact the natives develop such scientific and modern methods of farming as to bring them again under cultivation, is obviously very unsound. and the growth of a crop of timber is a solution of the difficulty.

Of the three indigenous trees that I have suggested as most suitable ones of all the Papuan species, medobi and melila are doubtful, because it is not known whether they can be grown in grassland. Savannah conditions in the tropics are particularly difficult for plantation purposes. It is the dense matted rhizomes of the two main grasses—*Imperata arundinacea* and *Saccharum spontaneum*—which form the kura kura, as the Motu people call the grasslands, which prevents the establishment of the rain forest, timber species. If fires are kept out, a forest of weed trees is the natural succession to grasslands, and these are followed eventually by the rain forest species. But we do not know to-day how many years this natural reversion to rain forest occupies. To convert a grassland straight away to a pure stand of a rain forest species is not easy, unless the species chosen is particularly vigorous, its root system is such as to compete successfully with the grass rhizomes, and it makes a thick canopy quickly enough to kill out the grass. Nara will do this, but I cannot say the same of melila, and medobi is also doubtful. The utilization of these grasslands of the northern division would, if reliance is to be placed solely on Papuan species that I know to be sound and will thrive in such conditions, means planting nara alone. But there is no obligation to look only to Papua for a tree for this work, though it is probable that other trees than nara will be picked from the rain forest species of this territory, which will prove eminently suitable. There is one species which I consider should be introduced from Burma, and that is teak (*Tectona grandis*). Not only is this a timber in universal demand throughout the world, but it has been proved already in other tropical countries, and has been established in pure plantations in Java and elsewhere quite successfully. With these two species, one indigenous and the other exotic, the work of planting up the waste grasslands between the hydrographer's and the kumusi could be undertaken with confidence. Working plans would be drawn up for the conduct of the work, and these would require some preliminary investigatory work to decide the many questions that must be answered. At present, so far as I have seen the country in question, the work might well start at the hydrographer's, and be carried across the Dobodura plains. This would also make it possible to undertake the care and further exploration of the melila-karawa forests, at the base of the hydrographer's, by the officer in charge of the plantation work. He would find a forest station in these foothills convenient, healthy, and picturesque.

Summing up the question of a policy for the lowland forests of Papua, I can only recommend a policy of research and of experimenting with various species. The exceptions are the ilimo country on the banks of large rivers and the artificial grasslands of the northern division. The conversion of mixed rain forests to pure ilimo is the best course. Its success is assured from a sylvicultural as well as a commercial stand. We are very fortunate in this species, for we have some generations of planting work carried out by the natives of the delta division. At Kikori, for instance, I inspected a canoe 66 feet long, made from an ilimo trunk. It had been made to the order of the magistrate, who wanted a specially big one for the conveyance of large gangs of natives from one place to another. It appeared to be an excellent piece of timber throughout, but the interesting thing about it was that the man who felled the tree and cut the canoe out was the son of the man who planted the tree. It was not possible to fix the age of the ilimo in years accurately, but the canoe maker was not an old man, and I should say that big mill logs could be grown in sixty to seventy-five years.

The other exception—the artificial grasslands of the Northern Division require to be made use of, and here I recommend plantations of teak and nara. I do not think there can be any doubt of the success of this scheme.

So much for the forest policy of the lowland country. It is probable that, while the research into the native rain forest is being conducted to ascertain the best way of bringing the bulk of the forests of this large region to their best development, applications will be made for permits to saw up timber. Sawmilling should be encouraged, for it must, if successful, lead to sound utilization of some of the standing stock, and will always help towards preparing the country for the commercial forests that will, as time goes on, be gradually established.

I have made no reference to the ownership of the forests to be created. Whether the land is to be bought from the natives, and the forests are to become Crown forests, or whether the land and the forests are to remain the natives' property, and the profits, less taxation, are to go to the village communities, is a matter of general government policy. It is possible, too, that in some divisions the communal forest would be naturally acceptable and a satisfactory solution. I have in mind the delta people, who, though individually apparently low in the scale of civilization, have evolved a social system of living in communities which might well be called towns instead of villages, so peopled are they, and who have already shown a greater forethought and longer view than the young white democracies of civilized lands, in the matter of assuring a future supply of wood for unborn generations. The northern native, on the other hand, with his little

hamlets of a few houses, and somewhat family system of living, would perhaps find a communal forest an entirely strange conception of doubtful value to him.

So little has been done regarding the minor forest products that I can at present only recommend the growing of one species—sandalwood. When research work has shown what the Papuan forests contain in the way of oils, resins, gums, fibres, drugs, &c., it may prove profitable to grow some of those species which yield products of proved value. Sandalwood is known, and the analysis which will be found on page 173 under minor forest products is certainly very satisfactory.

Sandalwood occurs in the Central Division dry belt, and grows both in the savannah forests and in the gully forests. It is not known yet what is the difference in the rate of growth and in the oil content between the wood obtained from exposed trees and those growing in the shade, but I anticipate that the savannah forest tree grows more slowly and contains more oil. The making of large plantations of sandalwood would certainly be sound forest policy. The work will not prove expensive, and the profits should be satisfactory. Experiments should be made with the Mysore sandalwood, *Santalum album*. There is no reason why it should not do well here, and it has always been regarded as the official sandalwood for medical purposes.

Mid-Mountain Forest Policy.

I pass over the large tract of country made up of broken foothills and covered with very poor timber. Minor product research may yield information as to the valuable barks, resins, etc., but I doubt whether, at any time, this belt can be used for the growth of timber. It should always prove a valuable native agricultural area. The mid-mountain forests, though of limited depth, contain species of the greatest importance, and though to-day they are regarded as inaccesible, they will not, I think, remain long in that condition. The stupendous shortage of softwoods in Australia is such that a coniferous belt in Papua, even at 6,000 feet altitude, is of great potential value, and, awaiting the day when its careful utilization can be undertaken, a systematic policy of improvement should be adopted. I have shown that the most important species—hoop pine—is confined to the stony edges of the spurs, and that the better slopes and better soils are taken up by broad-leafed species and a few conifers. When hoop pine has established itself on these slopes it is in every way as fine as the specimens on the spurs, but it requires a big hole in the canopy to let the sapling up to the light which it appears to demand at a fairly early age. My knowledge of the sylvicultural requirements of hoop pine is the scantiest, but fortunately this species has been under observation for some time in Queensland, and there has been published a valuable bulletin by Prof. N. W. Jolly.[a] I have extracted the following from the pages dealing with hoop pine:—

> Though trees attain their best development on moist, rich soils, the species thrives on soils of all descriptions, from drift sand to basalt, provided that the average annual rainfall exceeds 30 inches, and the drainage is satisfactory. It is a tree of the coastal ranges mainly, but is not found above an altitude of 3,000 feet. Owing primarily to the elimination of the competition of less hardy species, the densest stands are found on soils derived from sand, granite and shales, this being particularly evident on Fraser Island, in the Goodnight scrub, and in parts of the Gympie and Nanango Districts.
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> Although hoop pine is able to exist for many years under the shade of evergreen shrubs, eventually struggling through their dense cover and forming merchantable timber, healthy and vigorous development requires a free access of light as soon as the seedling growth is firmly established.
>
> The rate of growth in height is slow for the first year, but rapidly increases as the root system develops, annual shoots of 10 feet or even more have been recorded. The girth increment of naturally grown trees in virgin scrubs is slow, the measurements recorded over a period of three years showing an increase varying from nil to $1\frac{1}{4}$ inches per year, with an average of less than $\frac{1}{2}$ inch. This growth is due largely to the dry seasons experienced since measurements were instituted, and to the fact that adverse conditions under which the trees have developed, unaided, against the competition of other species, have resulted in the formation of hard, tight bark which is not readily shed, and which by its pressure exerts a strong retarding influence on the growth of the cambium layer. The rapid development of trees grown in the open gives rise to the expectation that an average girth increment approaching 1 inch per year will be obtained in well-managed forests.
>
> *Reproduction and Management.*
>
> Hoop pine coppices better than the average conifer, but not, as far as is yet known, with sufficient vigour to exercise any influence on forest management. It flowers generally in the spring, and fruits from January to April, the cones taking one and a half years to mature. Seed may be collected in small quantities every year, but general seed years occurred in 1913, 1916 (most infertile), and 1917, very large crops being borne. The seed, which is winged on two sides, is hard and woody, enclosing an insignificant kernel, and averaging when well developed about 1,400 seeds per 1 lb. weight. The distribution by wind is fair, seedlings having been found in open country up to 7 chains from the mother trees, but in the dense scrub the radius of distribution rarely exceeds 1 chain.
>
> The successful natural regeneration of hoop pine is dependent very largely on the wet seasons, the frequent failure of which has to a great extent accounted for the irregular distribution of the age classes, good reproduction apparently having occurred only on the comparatively rare occasions on which a good seed year coincided with a very favorable season. The large size of the seed compared with its weight is a considerable handicap against satisfactory reproduction as large numbers of seeds, instead of penetrating to the mineral soils, rest lightly on the leaf litter, germination being thus lessened considerably, while in addition a short spell of dry weather is sufficient to kill many seedlings before the tender young roots have reached the mineral soils and become firmly established. For this reason mainly, natural reproduction is generally mostly in evidence on the edges of hoop pine scrub, though the destruction of seedlings caused by scrub turkeys and other scrub birds is also an important factor. On the other hand, the protection against insolation and fire which is afforded to the young seedlings by

(a) Sylvicultural Notes on Forest Trees of Queensland, No. 3, Part 1. Government Printer, Brisbane.

the scrub growth is of considerable value in enabling them to establish themselves firmly. Once established, the seedlings are comparatively hardy, and will resist fairly severe droughts, although, as stated above, good summer and autumn rains are essential to complete success. The main points to which a forester must give attention in assisting natural reproduction are, firstly, the preparation of a suitable seed bed; secondly, the retention or provision of a shelter wood sufficient to protect the seedlings from insolation; thirdly, the protection from fire; and, fourthly, the removal of the shelter wood after the seedlings are established, in order to obtain the fastest growth possible. Whether the practical difficulties associated with natural regeneration will render this method more expensive than artificial regeneration or not has yet to be learned, and the results of a preliminary study of this aspect will be dealt with in a later bulletin.

As hoop pine cannot be described as a good soil improving species, and the shade cast by it is not sufficient to keep down the growth of weeds, the best results will probably be obtained by raising it either over an underwood of inferior species of little value or in association with a shade bearer; the most suitable shade bearer naturally associated with hoop pine is crows-foot elm—*Tarrietia argyrodendron*—which will, however, only attain marketable size in the more favoured localities."

In Papua, altitude compensates latitude, and hoop is no longer a coastal species, but begins at about 5,500 feet, and ceases at about 7,500 feet. In Queensland, as in Papua, it thrives when the competition is eliminated, and it requires light to develop healthily and vigorously. The increment of 1 inch a year expected in Queensland is a satisfactory figure, and there is every reason to suppose that "in well-managed forests" in Papua the same increment, or better, would be obtained. It was just beginning to shed its seed in January under Mount Obree. While in the cloudy belt where the Papuan hoop grows the difficulties of natural regeneration are not likely to be lack of rain, at the same time, the absence of regeneration on the slopes between the rock spurs, leads me to favour artificial regeneration, that is, planting instead of trying by aiding this species in its competition with broad-leafed trees to gradually extend its hold from the sharp spurs to the more fertile slopes. I am strengthened in my opinion also by the knowledge of the fact that Prof. Jolly now favours planting hoop in Queensland. The question of an understory to the hoop-pine in Papua must await further sylvicultural research. It appears to clear the ground under it very well, but if an associate broad-leafed species is required there is a capital choice of trees which grow naturally with hoop pine.

The policy in regard to the coniferous belt should be to extend, by planting hoop pine, the area under this species until it covers the whole width of country lying between the 5,500 and 7,500 contour lines. There will be a mixture of other conifers, at the upper limits, where it is probably a little cold for hoop, the celery-top will take its place, while, at the lower, the two big podocarps—*P. cupressina and P. nariifolia*—will thrive. How many of the broad-leafed species will be left as sylvicultural aids, or as yielders of timber, must be left to the forester who draws up the working plan of operations. Most of the broad-leafed species yield hard, dense, eucalypt-like timbers, e.g., the Eugenias. One is a very handsome cabinet wood—*Zanthoxylon sp.*—and there are the two oaks and a Flindersia, like the maple of Queensland. A good deal of technological, as well as sylvicultural work, should be carried out before the choice of broad-leafed species is made.

I think, except in certain favoured valleys, this coniferous belt of the middle mountains is above the limit of native cultivation, and is really unoccupied and waste land, and therefore available without any serious adjustment of boundaries with native owners. I have seen too little of the belt to advise as to the best place to begin the work, but the valley of the Kemp Welch up to the source of the Mimai, one of its highest tributaries, must finally become the transport route which will open up the forests of the Mount Obree district. So the slopes around these headwaters would seem to be particularly satisfactory for a start. They already carry good stands of hoop on the spurs, and the people of these parts are friendly disposed and of the robust mountain type, so that efficient labour should be available for the planting work.

Mossy Forests Policy.

The policy in regard to the mossy forests that lie above the mid-mountain belt must be one of general conservation only. They are valuable protection forests, and the danger of landslips and erosion, which would follow the destruction by fire on the steeper slopes, is one that must be recognized by all, and must be guarded against. I think that the fires that are lit are mostly of an accidental nature, except those that come in from higher elevations and alpine grasslands when the hunting of magani is practised by the natives. I do not think that the natives would be slow to realize the danger if it were pointed out to them, and a little care would suffice to prevent conflagrations occurring on the few occasions that the mossy forests are dry enough to burn.

Cost of the Forest Policy.

The cost of a forest policy such as I have outlined will be heavy when compared to the revenue being derived from the Territory to-day; on the other hand, it is hard to see in what other direction than the development of her wild and cultivated products Papua can increase her trade and commerce and her revenue; and in few directions are the opportunities so obviously alluring as in the systematic development of the products of her forests. The rapidity of the development must be in ratio to the amount of capital it is decided to invest. That the territory of Papua has no surplus funds for forestry seems clear, for she depends on a grant from the Commonwealth Government to enable her to square her ledger. The forest policy of Papua would seem to me, therefore, one for the Commonwealth to sponsor. She it is who must derive the greatest benefit from such a policy, being able to assure herself supplies of softwood for the future, when the world shortage of that commodity would have otherwise made her situation most difficult. In the year 1920-21 the quantity of timber imported for the whole of Australia was 192,457,777 superficial feet, valued at £3,524,145, and the quantity will increase as her industries develop.

As a rough estimate of the cost of the forest policy reduced to the main essentials of (1) ilimo, teak, and nara planting; (2) establishment of the mid-mountain belt of coniferous trees; (3) sandalwood planting; (4) research work. I would say that an annual appropriation of £12,000 would be required. This would be enough to provide for the planting of about 500 acres of ilimo, teak, and nara, and dealing with about 500 acres of mid-mountain forests and some 200 acres of sandalwood every year. Also for the salaries of the staff of the department, which should include

a conservator of forests, three forest officers, and a special forest research officer. All these men would require to be fully trained and qualified foresters. A small amount of clerical assistance would be necessary as well. The bulk of the expenditure would be on the reproductive work outlined above, and would be disbursed in the form of wages and in the purchase of the necessary implements. The programme is a very small one, and the area planted annually with softwoods is not sufficient when it comes to maturity to supply the needs of Australia, but it is a beginning, and when the value of the work is recognized further appropriations should be made available. As I have pointed out, the work being of a thoroughly reproductive character, and being expended on plantations, and not on the replacement of natural forests cut over by saw-millers, the appropriation is a true loan item charge.

The most satisfactory method of providing the cost would be by a special forestry loan which would assure a continuity of funds for a definite number of years ahead.

SECTION B.

FORESTS OF THE TERRITORY OF NEW GUINEA.

1. GENERAL.

The Territory of New Guinea, embracing as it does 91,000 square miles, is of, relatively speaking, large area, and as 21,000 square miles of this consists of islands, it extends over a wide tract of sea. The distances between its various parts will be clear when it is realized that its most northern island—Sae—is just south of the Equator, and its southern boundary is the parallel of 8 deg. south latitude, which is the northern boundary of Papua. East it extends to 159 deg. east longitude—the island of Nukumanu in the Tasman group, while its western boundary is Dutch New Guinea 144 deg. east longitude.

The largest area, 70,000 square miles, forms the north-east third of the island of New Guinea proper. The remainder is made up of New Britain, the largest island, 13,000 square miles, with Rabaul, the capital, at its north-eastern end; New Ireland, 3,000 square miles, a long narrow strip with a swelling at the southern end; Lavongai, which is a small, compact island of 600 square miles, and which used to be called New Hanover; the Admiralty Islands, a rather far-away group. All these comprise the Bismarck Archipelago; then come Bougainville and Buka—these are Solomon Islands, and are north of the British Solomons, which are administered by the Colonial Office.

Except for the two great valleys in the main island, where plain conditions are met with, the whole Territory may be written down as very mountainous. The highest mountains are to be found in New Guinea proper, where they rise to 15,416 feet. As in Papua, they trend north-east south-west, and though not continuous with the Owen Stanley Range, and broken again and again between Mount Edward and the Dutch border, they form a similar backbone. The Bismarck and Finnisterre ranges are, according to Mr. E. Stanley, virgations which are eventually lost in the Gazelle Peninsula.

New Britain boasts very mountainous country, and one of its volcanoes, "The Father," has a peak 7,546 feet high. The mountains of the southern end of New Ireland rise to 7,000 feet. None of the other islands possesses high mountains, yet all are exceedingly broken and very difficult to explore.

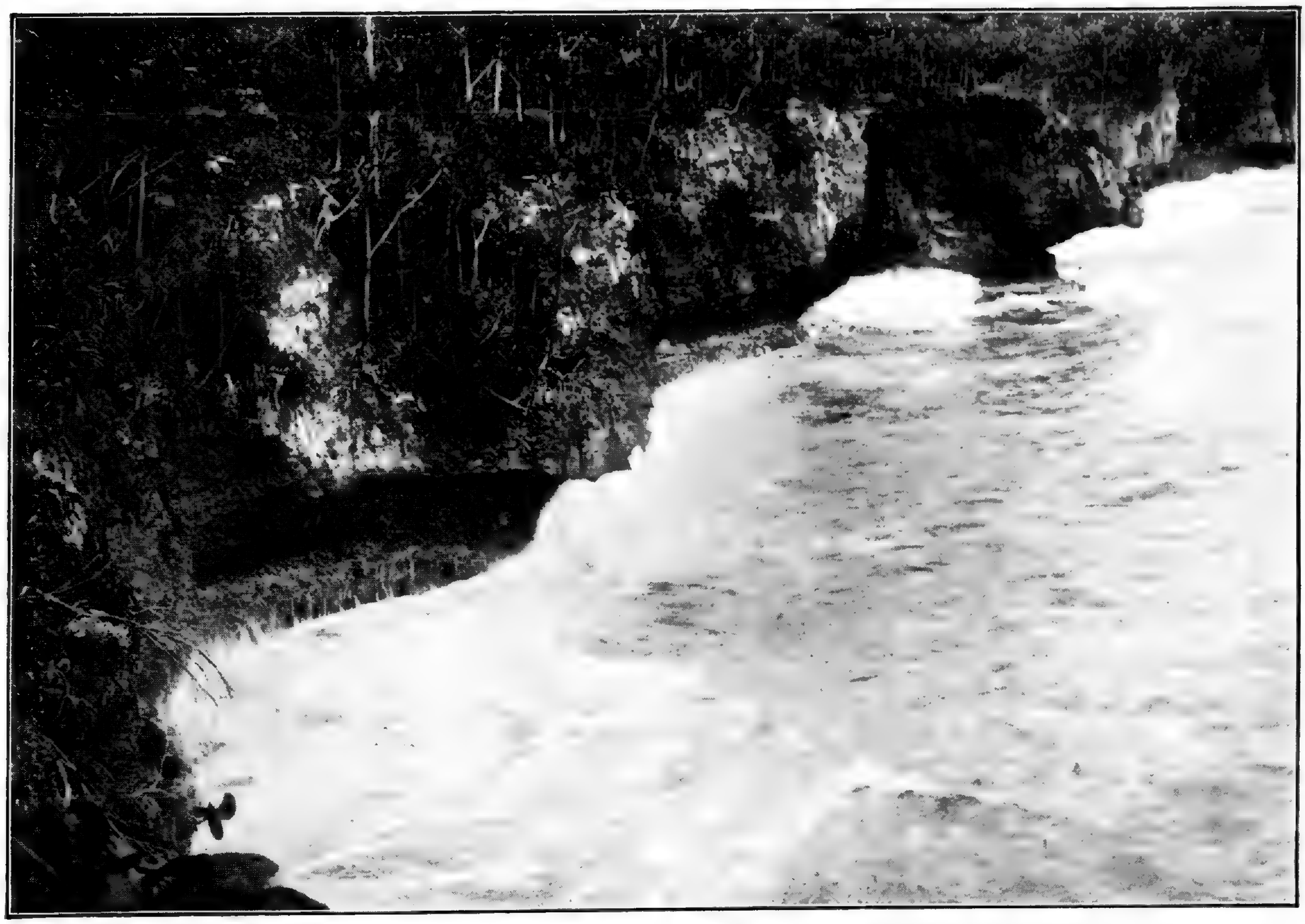
The two largest rivers of the Territory are the Sepik and the Ramu. The former is over 700 miles long, and is navigable for small craft drawing up to 10 feet of water for a distance of 330 miles. Some idea of the volume of the waters of this vast river may be gathered from the fact that in the north-west monsoon the natives of the Island Kadowar, which is 25 miles out to sea, draw up the Sepik water for drinking purposes. The muddy flow extends for miles, and only a narrow strip of blue sea separates it from the yellow waters of the Ramu. The Ramu is not such a great river, nor is it navigable in the same way. It has many rapids, and altogether is an entirely different type of waterway, being swifter and shallower. It is over 350 miles long, so is by no means a small river. I was repeatedly frustrated in my attempts to cross it, so I have a respect for the Ramu. It flows into the sea south of, and only 12 miles from, the Sepik. The Markham is another large river, which is also swift and not very deep. It rises back to back with the Ramu, and flows into the Huon Gulf, near the station of Lae. No other large rivers occur, for the mountains elsewhere come down too close to the sea, and nowhere is there another wide valley like the Ramu—Markham Valley or the Sepik Plain. Numerous small short rivers of torrential or semi-torrential type are encountered in all the islands, and some of them carry large volumes of water, and form serious obstacles to the traveller after rain has swollen them.

Mr. E. R. Stanley has described the geology of the Territory,[a] and has shown that early limestones occur throughout the Territory. I found them at 13,400 feet on a peak of Sarawaket. In other respects, the geology of the main island differs very little, if at all, from that of Papua. Young limestones are the predominant feature of the rest of the Territory, though volcanic agglomerates rather mask the fundamental formation all round the lower altitudes of New Britain and New Ireland. This late limestone goes right up to the top of the Bainings, and the elevated Lailet area in New Ireland is also the same series. Coraline limestone occurs all round the coast lines of the Territory, and in many places upraised beds of this formation are to be found a long way inland. Any one who has travelled up the streams and rivers of the Territory must have remarked on the enormous quantites of metamorphic rocks that have been washed down from inland. The sofer sedimentary rocks have for the most part been washed away, and old limestone and all the schists, gneisses, granites, and quartz litter the beds of the rivers. The late limestones would seem to have covered up these hard rocks. The backbone of the main island must for the most part be a continuance of the Owen Stanley series, for the stones of the rivers that have birth in that great central range are of the same character.

One wonders, however, what is the white rock exposed on the tops of the Bismarck Range—a rock which shone out so well in the morning sun when I was camped on the Middle Ramu that it might have been mistaken for snow. Similar white rock exposures were very conspicuous on the high range north of my highest camp on the Purari, and I came to the conclusion then that they were some form of limestone.

All over the Territory eruptive rocks are very much in evidence, and volcanic mud, scoria, and grey lava occur everywhere in the neighbourhood of active or dormant volcanoes, and large masses of volcanic agglomerates are a most striking feature in certain of the streams and rivers. In the water-ways of the Finisterre Range are masses of basalt, and this is the rock used by an early race to make the curious pestles and mortars; to what purpose these interesting and ornamental pulverizers were put remains a mystery.

(a) Report on Geology and Natural Resources. E. R. Stanley, in the Report to the League of Nations on the administration of New Guinea, July 21-July 22. Government Printer, Victoria, Australia.



Coastal limestone with covering of Pandanus.

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From a purely forestry stand-point, all soils of New Guinea are good forest soils, that is to say, they are all capable of growing high forest. Questions of slope and rainfall and altitude determine the type of forest that grows on a given area. Generally speaking, the rainfall is sufficient; exception alone must be made of the Rye coast, where, though no figures are available, the fall must be below 30 inches.

As in Papua, the climate is largely determined by the two monsoonal winds, and by the mountainous nature of the Territory. The south-east monsoon is the prevalent wind during the period that the sun is north of the Equator, that is, from March to September, and the north-west monsoon blows when the sun is south of the Equator. There is, however, a great variation in the dates of the beginning of each monsoon, and south-east winds may continue well into December. The north-west monsoonal season is generally taken as the west season, but there are places in the Territory where the position is reversed. The coast line fronting the Huon Gulf, from the mouth of the Markham to Cape Fortification, enjoys a dry season in the north-west monsoon, and gets all its rain in the south-east season. The Rye coast, which runs from Cape Fortification to the mouth of the Mindjim, is, for the first half at least, a very dry area, getting no rain in the south-east season, and not much in the north-west. The published British rainfall returns* cover so short a period of years, and come from so few stations, as to make it difficult to draw up a rainfall map. Dr. Hann,† in discussing the weather of New Guinea, writes, "The position of the coasts in connexion with the direction of the prevailing winds is really the decisive factor for the annual rain period, and on this account contrasting conditions appear at small distances apart." He then goes on to contrast Finsch-hafen, in Huon Gulf, with Stephansort, in Astrolabe Bay. In discussing the incidence of the rain, he writes, "On the whole north coast the thunderstorms, as well as rain, appear to happen chiefly in the night time."

Konstantin-hafen.—Night, 94.49 inches; day, 24.02 inches.

Frederick W. Hafen.—Night, 116.93 inches; day, 20.08 inches.

Erima-hafen. — Night, 93.31 inches; day, 9.45 inches.

Stephansort.—Night, 99.21 inches; day, 23.23 inches.

Sattelberg.—Night, 111.81 inches; day, 86.22 inches.

Herbertshoe. — Night, 31.10 inches; day, 42.52 inches.

"On Sattelberg (3,182 feet), above Finsch-hafen, the rainfall was 142 inches; November till April, 37 inches; May to October, 105 inches. At its foot, Simbang, still more fell—172.8 inches; November to April, 112 inches; May to October, 128.7 inches." The Sattelberg figures are most interesting, for any resident would say that more rain falls at the sanatorium than on the plain. It is a damp cold locality in the south-east season, but the Scotch mist and drizzle does not fill the rain gauge as do the heavy rains of the plain. It is unfortunate that after British occupation the keeping of records at Sattelberg was discontinued.

The absence of droughts is a popular myth, which one sees quoted in most publications. As I shall show later when dealing with the eucalyptus forests of South New Britain, a very severe drought occurred some ten years ago, which was followed by a great fire, which consumed much of the rain forest of the south coast of the island. In this connexion, Dr. Hann writes, "In the year 1895 a great drought set in in the Astrolabe Bay, which continued during 1896. The drought was also great in Java in 1896. At the same time, severe forms of malaria appeared, as also at Finsch-hafen under similar conditions in 1891. The years where the trade wind sets in violently suffer from dryness continually. A weaker trade wind is accompanied by a greater rainfall." These periods of great dryness are very scare, and generally one may regard the Territory as one of moderate to great humidity.

Most writers exaggerate the picture of the damp, dank, forest clad islands. Dr. Hann quotes Wallace's famous description of Borneo as applicable to New Guinea—"An orang-outang could reach from tree to tree through the whole island without even being compelled to put foot to ground." Dr. Hann goes on, "This could also find an application in New Guinea, and one could here expect that feat from the New Guinea tree kangaroo." I am afraid the marsupial would become rather footsore on the plains of the Markham or the Rye coast, and would have to acquire webbed feet to help him over the vast swamps of the Sepik and Ramu plains. Until data are obtained regarding the mountain regions, it is not possible to come to any conclusion as to the climate at various altitudes. Opportunity might, I think, be taken of the splendid peaceful penetration of the Lutheran Mission at Finsch-hafen to establish a chain of meteorological stations from sea-level to the top of Sarawaket, 13,400 feet. Daily-read stations at 5,000 or even 6,000 feet could be arranged, thanks to the native mission teachers, and one or two self-recording instruments, to be visited monthly, could be placed on the trail from Ogeramnagn to Sarawaket—one in the mossy forest, one in the Dacrydium-Phyllocladus forest, and finally one on the summit. The cost would be very small, and the result of great value. Mr. Hunt's ingenious rain-gauge which, though unattended, records the incidence of the rain, might well be used. Other self-recording instruments for temperature, barometrical pressure, and wind have been used successfully in the Philippines, and would answer equally well in New Guinea. Relative humidity and evaporation, which are most important factors governing the growth of forests, and to which are due the presence or absence of mossy forest, require recording also, and are really more important than temperatures. Frosts, doubtless, occur on the high mountains, for at Sarawaket I experienced a temperature of 33 degrees F. from midnight to dawn, and the grass was covered with hoar-frost in the morning. The Rev. Keysser, too, found ice up there, and records that one of his boys tried to bring a piece home to Finsch-hafen to show his wife. On the following page are the rainfall returns, taken from Hans Meyer's *German Colonial Kingdom*. Unfortunately, the period of years over which the observations were recorded is not given. Generally speaking, the climate of the Territory is the same as that of Papua. Temperatures are not excessive; relative humidity is high. Hurricanes are absent, and even strong gales are rare, so the common spectacle in other tropical lands of wide swathes cut through the jungle by tornado or hurricane is absent in New Guinea. For forestry, the climate is excellent, and there is little doubt that under that tropical sun and in those rich low lands timber could be grown with great success. It is the suitability of the climate and the excellent forest soils that have militated against the growth of even aged pure forests. All species have a good chance in that land, and so one finds the wonderful mixtures which, while delighting the mind of the systematist, are not what the forester wants. Only when conditions become hard and the fight for existence is acute does one find pure stands of conifers. So the hoop and other araucaria, beaten by the broad-leafed trees in the gullies, defy all competition on the sharp rocky

* See appendix A, p. 91. Report to League of Nations 1922–23.

† These data have been kindly communicated to me by Mr. Hunt, Commonwealth Meteorologist.

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RAINFALL AT INDIVIDUAL STATIONS IN KAISER WILHELM'S LAND (ACCORDING TO HANS MEYER, "THE GERMAN COLONIAL KINGDOM.")

100 points = 1 inch.

Station.	S. lat.	E. long.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
			Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
Berlinhafen ..	3° 9′	142° 31′	1,031	1,165	1,244	768	752	614	642	685	689	551	823	1,323	10,287
Ranumunde ..	4° 3′	144° 35′	921	429	953	480	1,055	386	965	201	638	63	417	1,177	7,685
Potsdamhafen ..	4° 15′	144° 57′	894	437	780	646	772	228	240	181	252	512	740	882	6,563
Hatzfeldthafen ..	4° 24′	145° 14′	1,606	1,376	1,004	1,461	492	311	705	354	468	626	1,209	1,177	10,791
Ranu iStation ..	5° 6′	144° 37′	2,346	984	3,512	2,610	1,965	1,035	937	1,299	3,173	504	3,460	882	22,707
Friedrch Wilhelmhafen	5° 12′	145° 50′	1,063	1,173	1,173	1,335	1,110	516	409	453	516	850	1,201	1,169	10,858
Jomba	5° 15′	145° 49′	1,133	1,574	1,154	1,091	1,295	858	409	366	752	768	1,043	1,240	11,483
Maraga	5° 21′	145° 46′	2,197	2,921	2,425	2,508	2,004	1,291	2,236	1,016	1,866	1,598	3,138	2,618	25,818
Erimahafen ..	5° 25′	145° 45′	1,591	1,508	1,693	1,437	1,031	417	468	354	314	654	1,339	1,354	12,160
Stephansort	5° 27′	145° 46′	1,760	1,591	1,756	1,220	862	402	283	272	520	618	1,276	1,268	11,828
Konstantinhafen ..	5° 29′	145° 51′	1,650	1,504	1,610	1,028	661	425	406	252	398	673	1,043	1,382	11,032
Finschhafen ..	6° 34′	147° 52′	280	295	457	1,016	1,280	1,693	1,874	1,929	1,287	1,516	929	465	13,021
Sattelberg	6° 30′	147° 48′	445	402	823	1,016	1,634	2,445	2,153	2,390	1,886	1,653	909	756	16,512
Simbing	6° 35′	147° 51′	356	299	650	1,083	2,114	2,590	2,291	2,303	2,047	1,528	1,319	665	17,247
Tami Islands ..	6° 46′	147° 56′	1,146	760	1,169	1,787	3,240	3,083	3,110	2,622	2,913	2,342	1,728	1,417	25,317
Cape Gerhards (Deinzerhohe)	6° 45′	147° 31′	1,016	693	1,421	1,331	2,122	2,716	2,598	2,339	1,953	2,374	1,098	988	20,649

edges of the spurs and ridges. And Eucalyptus, Naudiniana F. v. M., too, which, like E. rostrata, has acquired the art of growing in land inundated annually, thrives around the coast of New Britain, ousting or dominating the rain forest proper. Steep country seems the only serious obstacle to the growth of high timber at moderate elevations, and this is an obstacle that cannot be overcome, so that the broken precipitous foothills are never likely to be clothed with fine timber. The low lands, with their rain-forest conditions, and the mountains with their coniferous belts, offer a fine field for the forester, so that he will have much to do without troubling about the foothill country.

2. FOREST REGIONS.

There is no forest boundary between Papua and the Mandated Territory, and the forest regions fall into the same fairly well defined belts. On page 4, the limits of these belts are defined, and, with such differences as will now be explained, the same forest regions may be said to occur on the north side of the main dividing ranges, which form the backbone of the island of New Guinea, and on the larger islands, which together make up the group known as the Bismarck Archipelago. Bougainville, the most northerly island of the Solomon group, I did not explore; but from the coast it appeared to carry much the same type of vegetation as the islands of New Ireland and Lavongai (New Hanover). As in Papua, the regions are defined by climate and altitude. On the low levels, it is a question of rainfall more than any other factor that decides the nature of the vegetation. Here and there the geological formation or general soil conditions are such as to make heavy vegetation impossible, in spite of an ample rainfall. Good examples of this type of country occur in the volcanic pumices which, in places, are extensive enough to cause islands of grass in the rain forest belts. Generally speaking, the lower lying lands are made up of soils which are quite rich enough in plant foods to carry heavy forest growth, and it is purely a question of water supply as to whether the type of vegetation is hydrophyllous, sclerophyllous, or xerophyllous. On the coast also occur areas of swamp land subject to tidal flooding and there are found halophyllous formations, i.e., mangrove swamps.

As in the valley of the Fly River, in Papua, large areas occur in the Mandated Territory which are under fresh water for most of the year. The lower half of the Ramu, the greater part of the Sepik Valley, and other low-lying river formations, are examples. In them swamp grasses predominate, and there is little tree vegetation. Again, sclerophyllous species often thrust their way into purely rain forest formations, e.g., the stands of eucalyptus trees in both north and south coasts of New Britain. Here the nature of the belt is rather hard to define.

A very dry belt occurs between Cape Crettin and Astrolabe Bay, on the north-east coast of the mainland. Here the rainfall is so low that the conditions are frankly xerophilous, and there is an absence of any tall tree vegetation except in the gullies of the watercourses which drain the steep watershed formed by the Finisterre range. Step over step of grass lands follow the stratified and terraced limestone formation until an altitude is reached where the precipitation is sufficient to enable trees to grow and a poor pole wood precariously fastened to the almost precipitous slopes clothes the midmountain range. Further up the moss forest doubtless establishes itself in any sufficiently easy gradient, but for the most part the Finisterres are so abrupt that rock-faced precipices crown their heights. These grass areas of the Rye coast, as the region is called, are certainly natural, and differ entirely from the well watered but artifically formed grass land of the Markham and Ramu valleys, which I shall describe later. The Rye coast lacks the sclerophilous species that the main dry belt of Papua possesses. There are none of the Eucalyptus genus to help clothe the grass lands. Sandalwood also is absent. A shrubby Albizzia and our old friends Clerondendron sp. occur here and there. To guard their crops against the desiccating winds, the natives erect grass fences on the windward sides of their gardens. The coco-nut palm makes no show at all, though the natives assiduously try to grow it in every sheltered cove; it only attains a few inches in diameter and yields little nuts of poor quality. For fuel and house construction poles, the natives rely on the edaphic formations in the gullies, and in certain cases obtain their canoe logs from driftwood, washed up in the north-west monsoon.

Whether the eucalypts of the Port Moresby dry belt, viz., *Euc. papuana, Euc. clavegera, Euc. alba,* would grow along the Rye coast is an interesting question. I think they would, and they could form an important addition to this treeless belt. As stated on page 2, I did not find these dry country eucalypts on the north-eastern side of the dividing range at the Papuan end of New Guinea, and in the Mandated Territory their absence is again remarkable. The New Britain eucalyptus is another species altogether, Euc. Naudiniana, and is not a dry country tree. It may have found its way south from the Philippines, but it certainly has not come north-west from Australia.

Throughout the Mandated Territory there is no savannah forest such as occurs in Papua, but it is, I think, solely the absence of the dry country eucalyptus that makes the difference. Just as in Australia, this genus clothes what would otherwise be treeless wastes in the dry interior. So in the south-western side of New Guinea, wherever the rainfall is so low as to give the advantage to this sclerophyllous genus over the tropical forest, the gumtree flourishes.

Travelling round from the Rye coast into Astrolabe Bay the vegetation of the coastal belt gradually changes. The narrow strips of woodland along the creek beds, which on the Rye coast are the only forest areas in the sea of grass lands, little by little become wider. The coast line is still abrupt, but the rainfall is increasing and the areas of sufficiently watered soil are now more extensive. Soon the woodlands assume the shape of tongues growing from the high mountains and narrowing down to points at the mouths of the rivers and streams. The areas of grass lands and wood lands are now about equal in extent and from there on along the coast the wood lands increase and grass lands diminish until the characteristic rain forest becomes the typical vegetation. From the centre of Astrolabe Bay to the Dutch border rain forest predominates, and such grass lands that occur have been created by the natives in their cleaning and burning operations. Some of these areas of grass lands are very extensive indeed, and dotted as they are with trees, give the appearance of a natural savannah forest. I shall describe the country in the valleys of the Markham and Ramu Rivers, which chiefly consist of such man-made savannah formations.

Similarly on the islands of New Britain, New Ireland, and Lavongai, the grass lands that occur are not natural xerophilous regions, but are converted rain forests.

In Papua some fine areas of edaphic forests consisting of almost pure stands of ilimo (Octomeles sumatrana) occurred. These were not met with anywhere in the Mandated Territory. The species was common enough, but nowhere did it grow in close social forests. The river banks in this respect were disappointing.

In New Britain, however, occurs a very fine riverside type of forest, which consists of an almost pure stand of kamarere (Eucalyptus Naudiniana). Like Octomeles, this species thrives best in pure stands on the alluvium in a valley which is flat enough to be subject to annual flooding in the height of the rainy season, which in New Britain occurs in the north-west monsoon. The land, however, must be sufficiently well drained to clear itself of water between the floods, for the kamarere becomes stunted, gnarled, and asymmetrical in the water-logged portions. Though I have not found this species away from running water, I have it on very reliable authority that it occurs also on the lower slopes of the high volcano on the northern coast, which is known as "The Father," and on several places at a relatively high altitude on the flanks of the mountains on the southern side of the island of New Britain. Unfortunately, there are no large areas under this species and to-day owing to saw-milling operations; only one strip of virgin forest remains, viz., that on the Powell and Henry Reid Rivers, which empty into Wide Bay on the south coast. The species comes under the category of a giant gum, for it towers to a height of 240 feet and yields a mill log of 140 feet. It therefore rivals great gums of Australia. Entering a patch of kamarere, where the saw-miller has removed the undergrowth preparatory to felling the main crop, the appearance of the forest is very similar to that of a mountain ash forest in Victoria. The trees shed their bark in the same way and the colour and the boles though darker—sometimes it is purplish—are very like this species. The crowns, however, carry more spreading foliage. As is to be expected, the leaves do not hang down straight like the more sclerophyllous of the gum species, but spread out rather straightly, and their texture is not so leathery. Like its Australian smooth-barked sisters, it suffers dreadfully from fire, and large areas have been burned out in this part. Some idea of the size of the individual trees will be gathered from the following measurements of a felled tree. It was cut down and cross-cut into eight mill lengths, ready to move to the Korindal mill.

MEASUREMENTS OF A MILL LOG OF KAMARERE LYING AT KORINDAL, NEW BRITAIN.

1. Log, 20 feet in girth, 8 feet long.
2. Log, 18¼ feet in girth, 16 feet long.
3. Log, 15 feet in girth, 18½ feet long.
4. Log, 14 feet in girth, 19½ feet long.
5. Log, 13 feet in girth, 18½ feet long.
6. Log, 12½ feet in girth, 20½ feet long.
7. Log, 11½ feet in girth, 18½ feet long.
8. Log, 11 feet in girth, 17 feet long.

The total length of the mill log was, therefore, 136½ feet, and its solid cubic contents worked out at 2,120 cubic feet, or 25,440 super. feet. The form, factor, or taper of the log is practically 0.5. Unfortunately, like all eucalypts that grow very fast in early life, the centre of the logs is apt to be unsound, and I doubt whether a recovery of more than 33 per cent. can be expected from these trees. About the top cross-cut came 45 feet of crown log, which was too scarred and knotted with old branch marks to be fit for the mill. At 181 feet sprang the main bifurcation of the crown, which subdivided and spread into innumerable branches and branchlets to height of another 50 feet. So the tree measured 231½ feet, as follows:—

Mill log	136½
Crown log	45
Branches	50
	231½

While these New Guinea eucalyptus forests look much like a tall Australian forest when they have been cleared of their understory, the vegetation in its virgin state presents an entirely tropical appearance. The lower story of purely rainfall species obscures the view of the gum trunks to a large extent, while the crowns of the kamareres are entirely hidden from view.

Only when a break in the forests occurs, as, for instance, the bed of a river, are the giant trees clearly seen towering over the few tall rain-forest species that grow in social formation with them, and leaving the lower story quite dwarfed almost 200 feet below. The sight of this type of forest, when seen from the banks of a wide river, such as the Powell, is a very fine one. The rich, yet sober greens of the tropical lower story contrast very wonderfully with that curious blue-green colour which till now I had only associated with an Australian forest; and beauty is added to the scene by the lighter reflection of the picture in the still water of the river.

I managed also to get a view of the Kamarere forest from a mountain side, and from that position the tropical undergrowth and tall rain-forest species were all hidden by the spreading crowns of the gums, and the view presented was that of a very thick Australian forest like the mountain ash at Warburton, looked down on from the hills. The strip of eucalypt is always very narrow, and it meanders its way, following the course of the river or stream, a fringing forest itself fringed by the rain-forest proper. How pure is the kamarere stand is shown by a survey made of an area at Korindal.

SURVEY OF A SAMPLE AREA OF 14 ACRES AT KORINDAL, NEW BRITAIN.

Species.	Herbarium. No.	No. of Trees.	Cubic Contents.			Percentage		Trees to Acre.
			Total.	Per Tree.	Per Acre.	Trees.	Cub feet.	
Euc. Naudiniana ..	797	103	185,408	1,800	13,243	85.8	98.6	7·5
Pometia pinnata ..	586	5	646	129	46	4.2	0.3	0.3
Dractomelum maniferum	1	10	1,716	171	122	8.3	0.9	0.7
Celtis sp. ..	603	1	202	202	14	.85	0.1	0·07
Vitex cofassus	590	1	210	210	15	.85	0.1	0.07
Total ..	..	120	188,182					

It will be seen that, out of 120 trees, 103 are kamereres, or 85.8 per cent. of the stocking, of the others, our friend damoni takes next place with ten trees, then comes the common pometia with five trees, and two other species are represented by one tree each. While there is, therefore, a mixture of 14 per cent. of other species, these seventeen trees have a volume, in all, of 2,774 cubic feet, compared with 185,408 cubic feet, the volume of the kamareres, which therefore amounts to 98.6 of the total volume of the standing stock. The number of kamarere trees to the acre varies from one to twelve, but the average, both on the north coast and south coast of New Britain, approaches eight in first-quality forest.

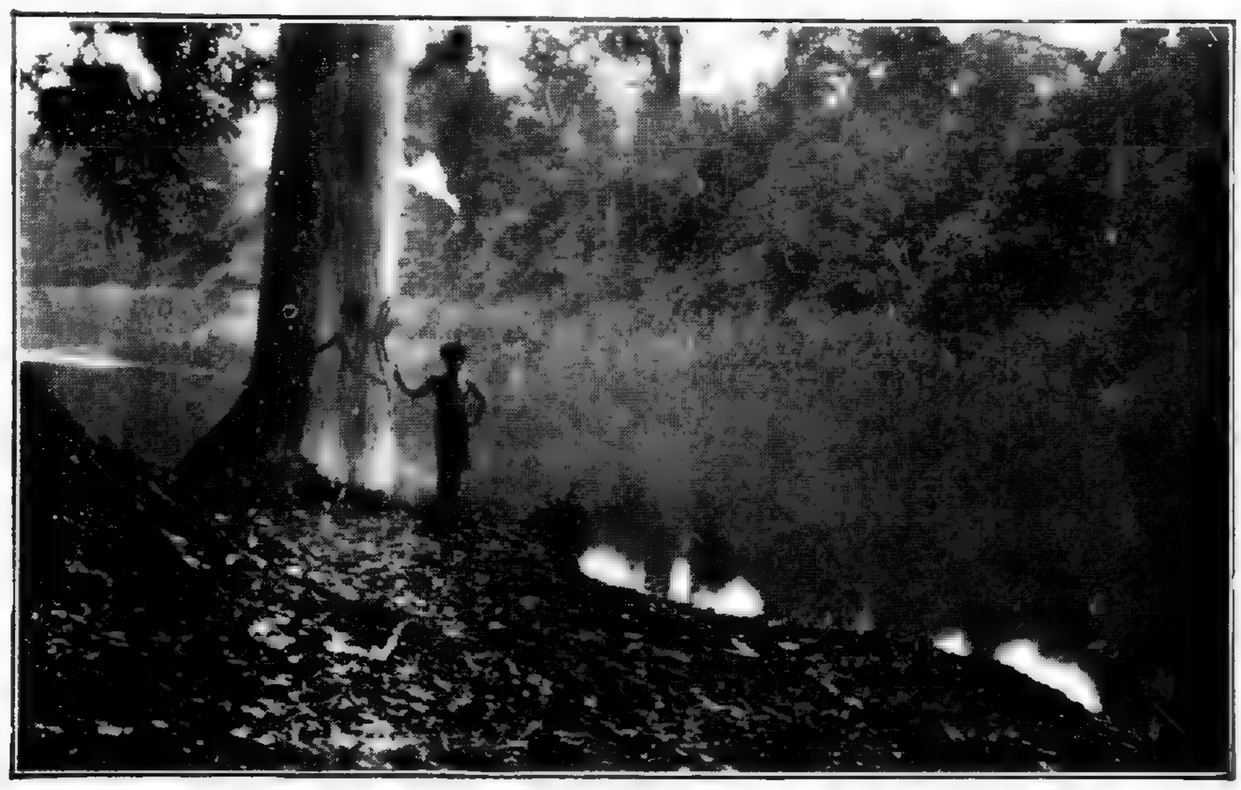
Unfortunately, the areas of kamarere forest are very limited indeed. It is a large patch that carries 2,000 trees, and when the mill was set up at Korindal the counted standing trees were only 1,000 in number. The forest on the Toreo River, which flows into the sea in Open Bay, on the north coast, yielded timber for eighteen years, and was probably the largest area of all. The Korindal forest still carries about 700 trees, or five years' cutting, and between that area and Rabaul lies another small forest, which is also being exploited in a conservative manner. Some kamarere occur on the flanks of "The Father," but what the number is I cannot say. Also behind Commodore Bay an area of this timber is said to exist. On various little streams on both north and south coast the species has been reported, but the only moderately extensive area still untouched about which precise information is available is that which occurs on the Powell and Henry Reid rivers. These two rivers empty into Wide Bay on the south coast. A glance at the map will show that this area is not far from that which has been exploited on the north coast, along the Toreo River. In actual distance, it is about 40 miles across the peninsula at this neck, and it takes three days to walk it. I have not been across, but have followed the Powell up to where it becomes torrential, and here the kamarere ceases. From this point, over the very slight rise in the centre and down to the first day of the Toreo, kamarere is, I am informed, only a day's march. A survey of the forests of the Powell River showed that the eucalyptus areas were not continuous, but occurred in patches wherever the land on the banks was low enough to carry deposits of alluvium and to be inundated by the high floods. Such areas are, comparatively speaking, rare. On the lower reaches, while the land on either side was flat enough, it was for the most part too swampy, while on the upper part the banks sloped too quickly up into foothills to carry the requisite soil and moisture conditions. Here and there along a tributary, or on a somewhat flatter yet elevated piece of country, the typical gum belt occurred, while on the river bank itself all along were scattered, singly or in groups, specimens of the species. Nowhere, however favorable the conditions. did the belt extend further than 5 chains from running water, and for the most part the width was barely 2 chains. It is a forest formation, similar in many respects to the Octomeles riverine forests. It is a more valuable forest, for its timber is greatly in demand in New Guinea. So much so that up to date the demand has not been filled, while Octomeles timber is regarded as a second-rate wood in the islands.

Octomeles has advantages over kamarere, for not only will it grow in less well-drained soils, but it resists fire splendidly. Kamarere, unfortunarely, is killed at once by a bush fire, and this is the cause of so large an area on both the Henry Reid and Powell being destroyed. It is one of the remarkable sights of New Britain to see the forests of dead eucalpyt trees.

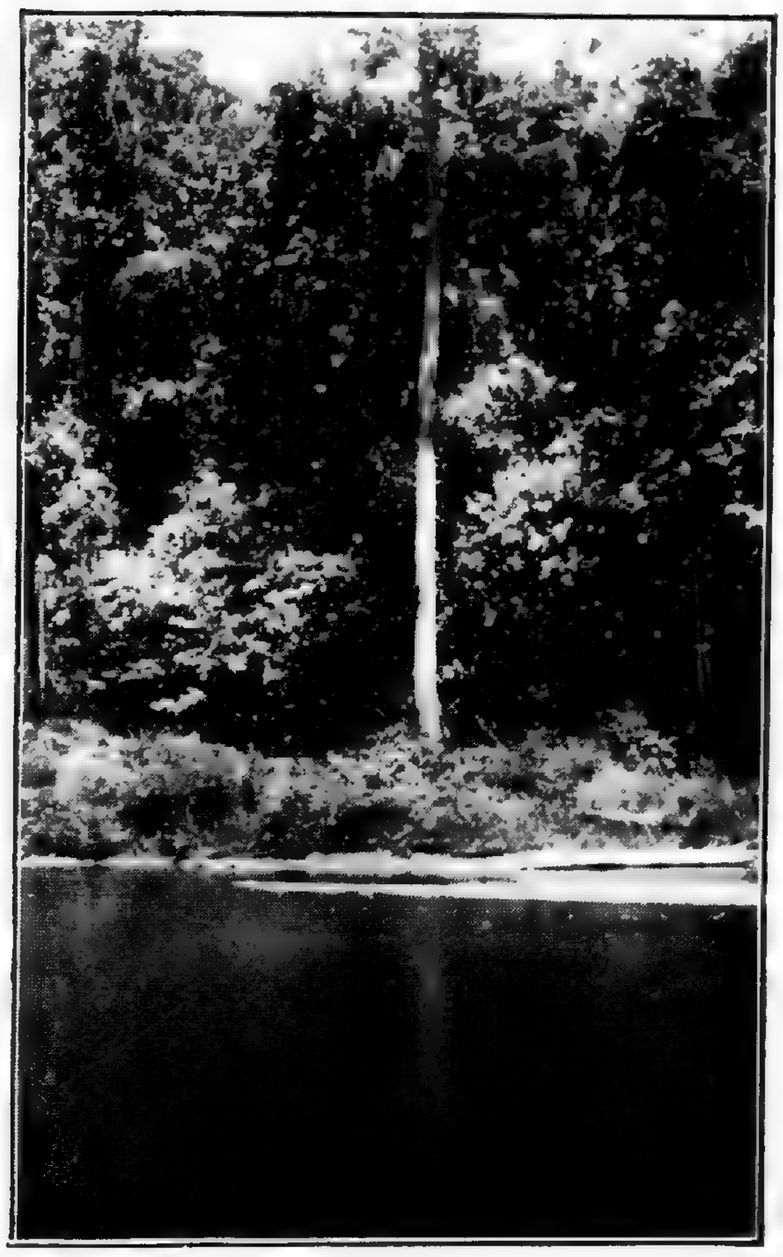
It is more conspicuous on the Henry Reid River than on the Powell, but on both the damage caused by a conflagration which occurred around 1916 is very surprising. There skeleton forests show, not only that this particular species of eucalypt is very tender to scorching, which might be guessed from the decorticated surface of the trunks, but that the country is subject to very pronounced dry seasons. At the time of my visit, it appeared to be impossible to burn any vegetation. The undergrowth was quite wet, and the branches were dripping heavy drops on to the ground all the time, yet, at times, the drought is sufficiently prolonged to dry up, not only the eucalypt detritus—the shed bark and dry leaves—but all the dank tropical rain-forest undergrowth and humus. That particular year, report has it, the the whole mountain side from one end of New Britain to the other was ablaze, and native crops and even some native villages were wiped out. This particular drought was not phenomenal, for the nature of the kamarere forest, with the mature stands and the young re-growth, show that fire is the main agent of destruction and reproduction.

This species is no exception to the genus; it is a strong, light demander, and only in open spaces does it reproduce itself properly. The stands one meets with at Korindal, Bolton's Mill, and on the Powell are, as nearly as possible, even aged. They have died together and come up together. Until the saw-miller came and clear-felled the forest, the reproduction took place only when a hole occurred in the forest; e.g., on the banks of rivers and when grandfather tree had died. Elsewhere the copiously shed seed germinated only to die suppressed by the cover of the lower story. The extent of even aged stands points to a general and periodic destruction over large areas of most of the tree vegetation. On the soil thus prepared the seed from the dying eucalypts—they seem always to yield most abundantly when scorched to the point of death—springs up like wheat, and takes complete possession of the soil. The same thing occurs when violent floods wash away an area of bank or deposit a new silt on a bend, as soon as the waters begin to subside, viz., when the dry season is in sight there sheds down from the eucalypts a bountiful supply of seed, and up springs a fine crop of seedlings, often only to be washed away by the first flood of next year. It is a very fast grower, and in seven years will attain a diameter of 6 inches and a height of 25-30 feet, so once it is established no tropical vegetation can compete with it, and later, when it has grown into a tree, only shade bearers can exist beneath its canopy. The Powell River timber did not suffer to the same extent as that on the Henry Reid. Here whole forests are standing white and gaunt, killed by the 1916 fire, while under the dry timber a regular even-aged stand of kamarere, healthy and strong, has established itself, and is flourishing against all-comers. Already this regrowth is up to 70 feet high and 1 foot in diameter, and doubtless in the course of time it will become the high forest, its ancestors

Eucalyptus Nordiniana. On the Powell River.

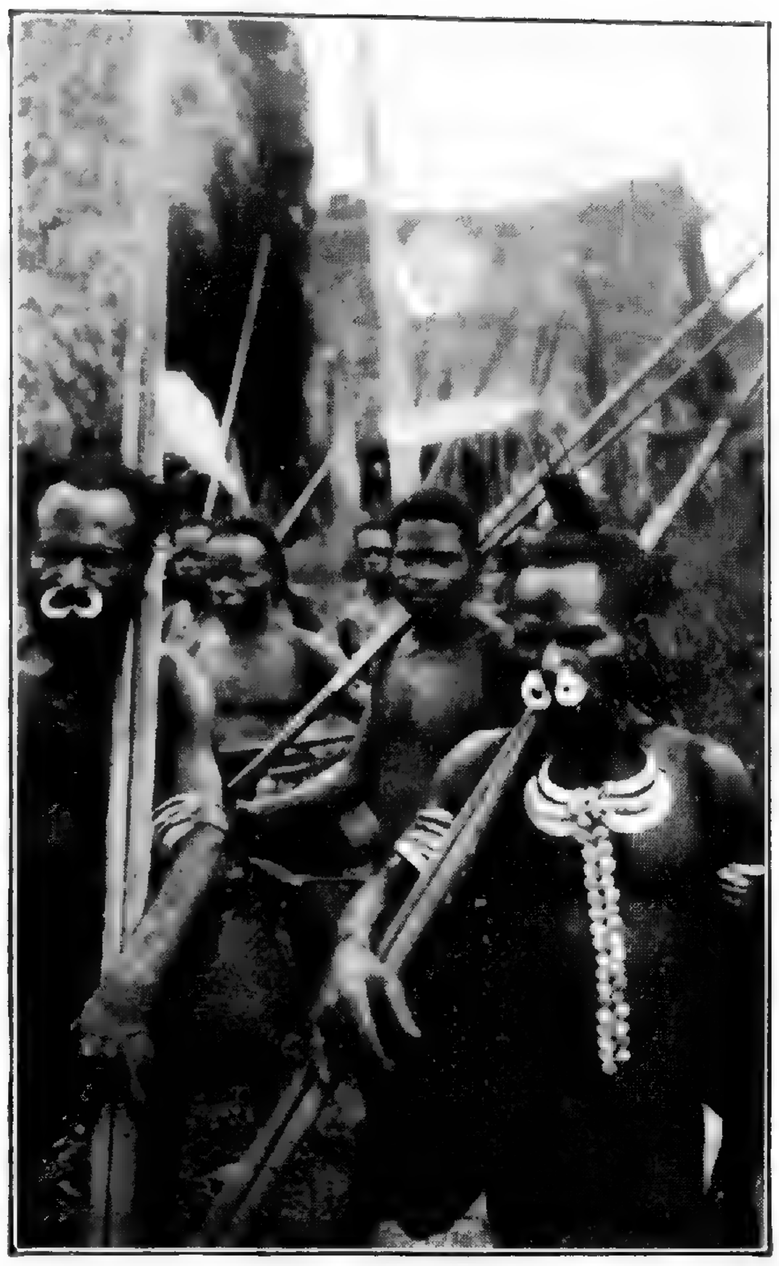


A mature tree.



A young tree.

[*To face page* 56.]



The middle Sepite and its natives (380 miles up). Note osprey plumes in their hair.

[*To face page* 60.]

having long since crashed to earth. It would be interesting to ascertain the periodicity of the fires. With the present meteorological knowledge it is not possible to establish the dates. From an examination of the growing and dead timber, I should say that those visitations are between 30 and 40 years apart.

There are always some areas that escape burning and, this, I think, is the reason why the forests are so particularly patchy and yet why every stand is of even age. The only species that beats it in growth, and then it is only in a very waterlogged soil, is *Octomeles sumatrana*. It also survives a fire that kills the gum outright, and so it is that in many of the lower levels a forest of Octomeles takes the place of the eucalypts, though white skeletons of the latter show that at one time they predominated. The shade cast by Octomeles is such that there is no possibility of a kamarere establishing itself under that canopy.

As a timber kamarere is well liked. It is a long-grained pinky wood with a consistency of mountain ash, and therefore useful for all general purposes. In the "Islands" it is used for house construction above ground, and for a number of other uses, of which planks for boats is perhaps the most common. It is heavy, but as a sapling it will float green, and when well seasoned it will float also. In the description of the tree (see p. 129) I have put the weight per cubic foot at 52 lb., but this must be taken as approximate, as the specific gravity of this wood, as in all eucalypts, varies enormously, according to the age of the wood and its position in the trunk.

Neglecting the Henry Reid River, where there is so little timber left as to be hardly worth consideration, the Powell River and its tributaries carry close on 500,000 cubic feet of timber. Except on the Yara, a confluent that joins the Powell 2½ miles up, where the timber is very large and fine, the average volume per tree is only 400 cubic feet, as compared with 1,800 cubic feet at Korindal, and on the lower reaches of the Powell the species become almost stunted, and would not yield 150 cubic feet of solid timber per tree.

Rain-forest Proper.

The Eucalyptus Naudiniana forest described above is an intrustive type boring its way into this tropical floral region—the rain-forest proper. This is the characteristic type of vegetation that clothes the lowlands and the sides of the hills to an altitude of 1,000 feet, on both the main islands of New Guinea and the numerous islands of the Bismarck Archipelago. The mixture of species is as bewildering as in Papua, and generally speaking the same species occur. In some areas new species were found, and in some the preponderant species were no longer the same. Celtis philippinensis, for instance, which in Papua takes a low place in order of numerical importance in the forest around Yalu, a few miles up the Markham River, is as common as Pometia pinnata.

This area of rain forest is of interest, as it is one of the few patches left by the natives. It appears to have been a no-man's land between two warring peoples: the coastal Yabim tribe and the inland Markham River people. Unfortunately, all the figures and notes relating to this forest were lost when my base camp on the Ramu River was destroyed, and in describing it I must rely on my memory and on the samples of timber which, fortunately, were left behind on the Ramu expedition.

Forests of the Lower Markham River around the Village of Yalu.

On the seaward side this forest is bounded by the coastal or beach forest and by the natives' cultivated lands. while inland it is bounded by the great grass plain, which extends for four days' march up the Markham and four days' march down the Ramu. To the north it reaches into the foothills of the Rawlinson Range, where again it peters out in grass land. To the south the Markham marks the limit of this type of forest. It is only a small area and of only scientific interest. Besides the extraordinary predominance of *Celtis philippinensis* the forest is remarkable for containing some specimens of cedar (*Cedrella toona* var. Australis, No. 626). This, like the cedar that occurs in Papua, is the true Queensland red cedar. In 9 miles of strip surveys cut through this area not one cedar was recorded, but the natives of Yalu were able to lead me to three specimens scattered over some 1,500 acres. The natives appreciate the wood for making houses, for it splits readily, also the boys on the coast right round from the mouth of the Markham to Finsch-hafen get the logs for making their very best canoes. Nowhere else did I actually see cedar growing on the main island of New Guinea, but it must also occur at Siasi (Rook Island), for I have seen cedar canoes that have come from there. Nowhere is it plentiful enough for even local canoe needs.

The following species were met with at Yalu. The natives' names are in the Yalu language. Usu (*Octomeles sumatrana*, No. 589, Pap. 34). The conditions are not sufficiently alluvial to permit of pure or social stands of this fine tree. It grows to as large a size here as usual, and is sought after when of medium size for canoe making. Afas (*Vitex cofassus*, No. 590, Pap. 91,145). This tree is common, and its wood is sought after for making canoe paddles. At the mission mill, near Finsch-hafen, it is sawn up into boards and used for inside work. It is a hard dense timber, but is not regarded in these parts as durable in the ground. Curiously enough, in New Ireland and Lavongai, where the tree is known as Ahsang, it is used for house props, and considered next to Kwila (*Afzelia bijuga*) in durability and quite as good as Nanga (*Pterocarpus indicus*).

Ombong (*Afzelia bijuga*, No. 585, Pap. 10). Not common in this forest.

Ngafir (*Pterocarpus indicus*, No. 587, Pap. 4). Rather scarce. Boys prize it for drum making.

Tze (*Pometia pinnata*, No. 586, Pap. 5). Very common, but does not reach a tree of the dimensions to be found in Lavongai.

Ambund (*Alstonia scholaris*, No. 594, Pap. 29). Not common and does not reach a great size.

Morinda citrifolia, No. 596, Pap. 232. Common on edge of rain forest and in grass lands. Cultivated in villages for its fruit.

Bread fruit (*Artocarpus incisa*, No. 597, Pap. 96). Common. Cultivated in farm lands for its fruit.

Woro (aff. *Chisocheton*, No. 598). A second story tree, with large compound leaves.

Several species of fig were met with, of which Otzol, No. 599, was most common. This species yields a fair bast cloth.

Narunkuf (Indt., No. 600), is another medium-sized tree whose timber has nothing much to recommend it.

Mom (*Artocarpus* sp., No. 601, Pap. 6). This is fairly common, and yields a useful soft light wood. The boys dislike cutting it owing to the very copious flow of latex, which splashes the axeman from head to foot.

Wisawis (*Pterocymbium* sp., No. 602, Pap. 13, 279). This very large tree occurs in scattered groups.

Mongong (*Celtis philippinensis*, No. 603, Pap. 47). Here this tree comes second to *Pometia pinnata* in point of abundance. From memory the percentages worked out at 6 per cent. and 5 per cent. respectively of the whole standing stock.

Timbong (Indt., No. 604). A large tree, yielding a soft woolly wood.

Amint (Indt., No. 605). Another of the same type of timber.

Aruntem (*Planchonia timorensis,* No. 606, Pap. 2). This species grows to an immense size in the Markham Valley. It prefers the damp and swampy localities, and thrives in social formation with *Sarcocephalus cordata* and a prop-rooted tree, material of which I did not collect, but which is probably a Myristica.

Minzimb (*Albizzia procera,* No. 607). This is not a large tree and its wood is of no consequence, but it is interesting, being of the intermediate type of rain forest—savannah forest tree. It is not common nor is it conspicuous in the rain forest except in the dry season, when it is leafless, and therefore more visible. When the natives have cleared the forest and grass lands have established themselves then this species springs up. It resists fire well and soon establishes itself in open savannah forest formation.

Woif (*Bombax malabaricum*). Another deciduous tree. It is a giant and rivals *Octomeles sumatrana* throughout New Guinea. In the Yula forests it is the largest of all species.

Bundur (*Breynia cernua,* No. 611, Pap. 166). A common little undergrowth.

Ebeve (*?Dysoxylum* sp., No. 612). This is a medium tree, and it yields a rather poor looking pale wood with a cedar-like smell.

Ongo (*Dracontomelum mangiferum,* No. 613, Pap. 1). Considering its commonness in Papua, I was surprised to find this a rather rare tree on the Markham. Its wood is the nearest approach to walnut that I have seen. There is a variety of species of the same genus which yields an edible fruit, but I have been quite unable to distinguish one from the other, and the natives themselves must see and taste the fruits before they can decide which it is. As a rule, a suffix meaning good or eating is added to the native name, when the edible one is spoken of.

Mafunga fung (*Chrysophyllum Roxburghii,* No. 614). A case-wood timber. It splits readily and is commonly used by the natives for boards in house construction. It is a tall tree, and its crown is wide-spreading and is usually a good place to look for pigeons, for the fruit is much appreciated by birds.

Kuwi (Indt., No. 615). The wood of this tree is very similar to the last one, but the bark and general appearance of the bole and crown is quite different. Also, the wood has a curious linseed oil-like odour.

Tizo (Indt., No. 616). A large tree yielding a cabinet wood of a brown colour. The inner bark yields a gum. It is rare.

Towind (*Rubiaceae,* No. 617). A third story tree which bears very ornamental, fragrant white flowers.

Angaw (Indt., No. 618). This is a large tree which yields an interlocked hard timber suitable for general construction.

Dua (*Mangifera minor,* No. 619, Pap. 41, 170). The common wild mango. It attains tremendous dimensions all along the coast of New Guinea. When the natives have destroyed all other trees they reserve this and even plant it for its fruit. While not to be compared with the cultivated Indian mango, it is nevertheless a valuable addition to the fruits of the Territory.

Kusu (*Dysoxylum* sp.(?), No. 620). A medium tree yielding a pale nondescript type of wood.

Popor, *Baccaurea* sp.(?), No. 622). A medium-sized tree yielding a light soft wood.

Aruntimf (*Sarcocephalus cordatus,* No. 624, Pap. 158). A tall slender tree that prefers the damper situations and is generally found growing with *Planchonia* sp. It yields a fair pine substitute.

Timong (*Baccaurea papuana,* No. 625, Pap. 230). As one travels through the forest the scent of the large caulifloral panicles of cream flowers that festoon the trunk of this little tree is overpowering.

In density this rain forest was much the same as that encountered in Papua on the flat lands. The great mixture of species and comparative scarcity of any first-rate timber, and also the small extent of the forest, preclude any possibility of working this timber commercially. At one time forest of this type stretched all the way along the coast between the mountains inland and the sea and all along and across the vast valleys of the Markham and Ramu Rivers. To-day artificially-formed grass lands have taken the place of the forests on the best of the land and in the less fertile areas a secondary weed tree growth has established itself. This is the case along the lower slopes of the mountains facing the sea.

Grasslands of Markham and Ramu.

Inland up the Markham and Ramu we find similar conditions to those met with in the northern division of Papua, with the difference that whereas the plains of the northern division are some 60 miles deep the plains of the Markham and Ramu cannot be less than 120 miles. The width varies with the opening and closing of the valley. In some places it is 20 miles wide, while at the heads of these rivers it is barely 5 miles wide. I visited the lower portion of the Markham Valley and the head of the Ramu Valley, and from the height of 13,400 feet—the summit of Sarawaket—I looked down on the whole area of grass lands. At first, in this bird's-eye view, the yellow grass looked like some great inland sea, and I asked my native guide the name of the water, and he laughed and said, "That is not water but grass land." It was a great surprise to me, for I had not at that time visited the Markham or Ramu, and I imagined the grass plains that I had, of course, heard of, to be like those of the northern division of Papua, viz., large and small patches of grass fringed with rain forest. Here the grasslands are uninterrupted and sweep on and on to the limit of vision. When I did visit the area I found that there were a few trees about, but very few, and chiefly Sarcocephalus in the damper lands and Altbizzia in the drier. Here and there thick-barked Clerodendrons held their own against fire, and along the watercourses, where the banks were high, grew an Erythrina. For the most part the Ramu banks were too low and subject to flooding, and carried only wild sugar cane. On page 14 of the Papuan portion of this report I have outlined the conditions which are brought about by the native in his farming operations and which finally lead to the establishment of such vast areas of grasslands as are to be found on the Markham and Ramu. On the better and deeper alluvium, kuvi or lalang (*Imperata arundinacea*) takes a firm hold, while on the more gravelly soils a kangaroo grass establishes itself. This grass also goes up into the hills on both sides of the great valley and is to be found eating its way into the forests, aided by the natives' hunting fires and clearing operations, as high as 3,000 feet. Here and there at this altitude one finds the two large Araucarias (*A. Cunninghami* and *A. Kpinkii*) standing dead over the grass lands, the smaller rain forest and foothills species having been burnt up altogether. With the help of this kangaroo grass the Savannah of the Ramu-Markham Valley has extended high up into the forests of the foothill type and actually reached what I am calling the mid-mountain forests.

Swampy Rain-Forest.

That these grass lands do not extend right through the immense valley from the mouth of the Markham in

Astrolabe Bay to the mouth of the Ramu, is because from about the 145th parallel of longitude the basin of the Ramu is so low that the whole country on each side of it for some miles is subject to inundation during the north-west monsoon. Here the Ramu changes its nature, and from a shallow river 700-900 yards broad and rarely more than 10 feet deep rolling rapidly over pebbles and gravel, it becomes a deep river rarely more than 100 yards and generally around 80 yards wide. Narrow, rather high banks wall it in but beyond, the inland country is almost as low as the river, and in consequence both the confluents and flood waters of the main river itself spread out over a large area. On bends the narrow banks are carried away and swamp formations occur; only on firm high banks do large trees flourish and all the rest of the land is covered with a swampy rain forest broken by pure swamp vegetation. In this swampy rain forest occur the bulk of the ordinary rain forest types, but owing to the conditions under which the trees exist they do not attain the height or diameter of the true rain forest types. Even on the narrow high banks the Pometia is of poor appearance, while the Octomeles are only half the size of those found in the patches of rain forest above this swamp area. Travelling through this country in March, viz., the end of the wet season, is exceedingly difficult and as will be seen from my description of my journey up the Ramu, which I give in detail in appendix.

The true swamp lands of the region which cover a large extent of country in the swamp rain forest, carry a vegetation of two Pandanus and Sarcocephelus with here and there where the water is shallow enough, wild sugar. Climbing ferns and creepers occur, but not plentifully, and neither the Pandanus or Sarcocephelus carry much epyphitic vegetation. The depth of the water in these swamps varies from a few inches to 4 feet, but what makes the penetration very difficult is the deep layer of mud below the water into which one sinks up to the waist. Along the strips of high banks the rain forest is as might be expected, festooned with orchids, ferns and other epyphites, while long reaches are so entangled with rattan (*Calamus* sp.) that progress is rendered very slow. It is a most unfortunate fact that the rain forests of the Markham have all been destroyed and converted into grass lands, and that the whole lower reaches of the Ramu are so wet as to carry at best a poor swamp form of rain forest, and at worst a pure swamp vegetation. It was in this extensive area that I hoped to find forests of commercial value, which with good rivers in either direction—the Ramu flows north-west and the Markham south-east and both rise back to back only 1,000 feet above the sea in the middle of the great valley—would be immediately accessible for saw-milling; and it was therefore a great disappointment to find no forests of any importance.

Forests Near Finsch-hafen.

Pursuing the investigation round the coast of New Guinea and inland I found rain forest all round, but everywhere it had been largely cleared by natives in farming, and when it was intact it was always on the poorer soils of the hills, and so was stunted and obviously a second class type. Surveys were made of the forests near Finsch-hafen, which is the Lutheran Mission's head-quarters. There is a saw-mill there run with an overshot water wheel, but after a comparatively speaking short life the little concern is meeting much difficulty in getting supplies of logs. Its output has been used for mission purposes to build the stations that these fine people have established far away in the bush. Both in appearance and composition, these rain forests are the same as those already described in the Papuan portion of this report. The common *Pometia pinnata* comes first in numerical order, and the natives know it under the name of Kuting. It is sawn into all sizes of timbers and used everywhere in the mission buildings, except in the ground. For posts and very exposed places, iron wood, as they call *Afzilia bijuga,* is preferred with Pterocarpus next best, and Kaar (*Vitex cofassus,* No. 590, Pap. 91, 145) for other indoor work.

Kesang-sang (Indt., No. 591) is used for "trade box" making, though it is worthy of a better use. Curiously enough, Kakerim (*Octomeles sumatrana,* No. 539, Pap. 34) is not made use of. Musi, the cinnamon barked tree usually called Massoi bark (*Cinnamoman massoia,* Var. *rotundatum,* No. 592) occurs in these forests rather plentifully. The common Alstonia occurs, but is not made use of, and the same may be recorded about *Pterocymbium* sp., No. 602, Pap. 13; *Celtis philippinensis* No. 603, Pap. 47 (*Planchonia Timorensis,* No. 606, Pap. 2). Termialia affin. catappa is rather sought after as a mill log, and the mill manager has planted this species in a gully behind the millrace. The walnut substitute Ongo of the Yalu people (Dracontomelum mangiferum No. 613, Pap. 1) is appreciated, but its wide buttress roots make it an uneconomical mill log. I found all the Papuan trees in the forests around Finschhafen and the forest survey that I made showed the stocking to approximate very closely with that of the forests around the Kumusi and Sagari in the northern division of Papua. Unfortunately, all data of the survey were lost, and again I have to rely on my memory for the above details. One species was certainly more plentiful here and that was Afzelia bijuga, while I never again found it in such stands as in the Hydrographer's range in Papua, I found it fairly well distributed round the coast of mandated portion of New Guinea, and in forest such as is to be found at Finsch-hafen it occurs to the extent of 1½ trees to the acre. The sawmilling operations have been confined to Afzelia, and the better woods detailed above and the less valuable softer woods have been left in the forest. This has been due to the sad experience gained by the Mission when they found that their soft wood linings and internal timbers generally were rapildy eaten by a termite. This pest differs from the many termites that attack woodwork in that he requires no gallery or connection to earth, but arrives flying and immediately sets to work to eat the woodwork, relying apparently for water on the moisture in the wood. At the Pan-Pacific Congress held in Sydney in 1923, Dr. M. Oshima described the ravages of a similar termite in Formosa, and gave a description of the steps that the Japanese Government was forced to take in order to protect its public buildings and works. Complete isolation from the soil is sufficient with most termites; indeed, at this congress, although representatives from all over the termite ridden lands that front the Pacific were present, none except our Formosan expert had come across a termite that required no gallery to earth. It was, therefore, of particular interest to me to meet with the same termite, or, at any rate, one with the same habits in New Guinea. The Lutheran Mission were forced to give up the use of all soft woods, except for case making, and to-day the mill is placed in great difficulties to get logs, as it must necessarily pick the eyes out of the forest.

Forests Behind Stephansort.

Passing the Rye coast with its dry belt of grass lands, which I have already referred to, the next rain forest I visited was behind the roadstead known as Stephansort. Here the coast which has been running parallel

with the trade winds, viz., south-east-north-west, now turns abruptly north, and the rainfall rapidly increases, and true rain forest conditions once more establish themselves. The population along the coast is fairly heavy, and so the bulk of the easily accessible forest has gone—converted under the usual system of shifting cultivation into weed tree re-growth. Here and there near a village a few of the old trees have been retained for shade and shelter, but for the most part the forest has gone. It is necessary to rise some way up the foothills before virgin bush is met with. Here the warring factions, coastal versus inland tribes, had made a no-man's land or, at any rate, a land where the population was very sparse and here, in consequence, some forest is still standing, but it is not first class rain forest, but rather a second class foothill type. I have never been quite satisfied with the designation "foothill forest" which I give to the Quercus type met with everywhere on the lower slopes of the ranges. The intrusion of rain forest species is so great that one finds it hard to say whether the forest is a foothill one or a second class stunted rain forest. At the back of Stephansort there is an absence of the usual foothill species proper, and I am inclined to regard the vegetation as rain forest which, owing to poor soil or steep slopes, has not attained its usual dimensions. The stocking is about the same as that met with at Veimauri, above Galley Reach in Papua. The country was crossed by three routes in my search for a good stand of timber, but none was found and no survey was made. A detailed account of the journeys across the coastal hills to the Ramu is given in appendix.

From Stephansort to Madang the forest conditions are similar, and thence along the coast to the Ramu and Sepik one sees only the usual second growth, with here and there a small patch of high forest or a few old giant trees. Man living just within his environment has cultivated food where timber grew and he is still able, without entirely oversetting nature's balance, to reap his crops and sow again, relying on the weed-tree second growth to restore the plant foods his taro, yam and sweet potatoes have absorbed. He is not a vigorous person hereabouts and his family is controlled naturally—for self control is hardly to be expected of him and artificial control, in spite of the stories current, is almost as unthinkable—so there is little danger of these folk, with their low birth-rate, turning their food lands into grass lands like their virile brothers and sisters in the Markham, or like the Binandeles of the northern division of Papua.

I did not visit the volcanic islands of Karkow, Manham or the smaller islands that lie all along this coast line, but from all accounts there was nothing remarkable in their forest flora. Some of the islands are still active volcanoes and Manham, for example, has large valleys altogether burnt out by the hot lava streams. Bam too is so active that no one lives in it, and nightly it is crowned with a red halo, while all day great mushrooms of cloud-like smoke rise, hang and vanish to be replaced by another cloud. Between the Madang and the mouth of the Ramu, the Dividing Range, separating the great valley of the Ramu from the sea, gradually drops until, on nearing the mouth, the land is quite flat and the usual swamp vegetation is met with. Though I have not crossed the Dividing Range north of Madang and, indeed, my knowledge of the country hereabouts is purely coastal, I do not think that any timber forests of importance will be found in the Range or on the slopes going down to the valley of the Ramu.

The Sepik.

As will be seen from the map, the mouth of the Ramu and Sepik rivers are barely 12 miles apart, and the nature of the country is marshy. On the coast itself and for a little way inland, tidal conditions prevail, with the usual mangrove formations. Inland further, one finds fresh water swamp lands with a good supply of sago palms; of heavy forest types—there are none until the land rises into hillocks when the usual rain forest is met with. One has to journey 36 miles up the Sepik before such hills are met with. Here at Marienberg occurs a clump of hills which are clothed in rain forest, and where the Roman Catholic Mission propose moving their mill from its present position at the head-quarters of the society at Alexis-hafen. There, like the mill at Finsch-hafen, the log transport question has become very difficult and another site must, in consequence, be found in order that timber may be provided for the construction of mission buildings, boats and all manner of things. The Marienberg forest I did not regard as sufficiently interesting to make a survey, but the Father in charge of the Mission expected to get three Afzelias to the hectare from it, which is fair quality forest for this species. I went up the Sepik for 290 miles in search of forests. Interesting as this expedition was it was from a forestry viewpoint, very disappointing. From 36 miles to 236 miles there are no forests at all, the whole basin of the Sepik is one vast swamp. The banks are, for short distances, high enough to carry crops in the dry season—crops which require no fences from wild pigs, these pests being unable to live in such a country—and here and there a stilt strutted village is perched on the narrow water-logged ridges in the green expanse of grass-covered swamp. Sometimes the great river changes its course and throws up a new bank, leaving the old one with its village and husbandry marooned on a lagoon, which was once the river bed, and which now is connected precariously to the main stream by one or two narrow channels. In the rain season the banks are awash and canoes are the sole means of communication, while in the dry weather it is a matter of canoes and mud wading. It is little wonder that the men of these parts wear no clothes at all and the women the absolute minimum. In some places a bank is high enough to escape inundation even in the wet season. Here there is always a large village and the people plant trees—coco-nuts, rose apples and other fruit trees, and often for ornament the common Erythrina. The food of the people is mainly sago which they obtain up the tributaries, of which there are a great number. I was not able to explore any of these, but from all accounts the swamp conditions prevail until the hills are reached, which in some cases are 80 miles back. Growing here and there on banks above flood level is a curious oil bearing tree. Kwata (Campnosperma brevipetiolata No. 785). The oil exudes from the wood and the trunk is tapped by the natives who prize the oil as an unguent and a detergent. It smells rather like the oil obtained from the tree on the Baroi (Pentaspodon Motleyi, No. 304), but it has no blistering properties and can be used as a body smear, which is its main use, I gathered. The oil does not exude quickly, for it takes two moons to fill a bamboo joint.

At 230 miles up the Sepik, the Hunstein range appears on both sides and here forests are once more met with. The quality is, however, poor and there is a total absence of the best type of rain forest trees, their place being taken by a poor growth of medium sized species of a semi foothill character. This range rises to 700 feet, but I was unable to find any forests of value on the slopes or crest. Cultivation has not been heavy, the people having apparently contented themselves with riverbank gardens. A little higher up the village or villages of Yesa crowns an offshoot of the

Hunstein range. The people here seem to be of a more mountain type, and the hill has been cultivated in a similar manner to what one sees in the real mountains of Papua and New Guinea. There is no timber left, and they conduct their tree burials on scaffolds leaning on Mango trees. They have planted fruit trees and coco-nuts and appear to be a vigorous people. Both men and women go naked.

Further up the river one finds the same vast plain of swamp, and at 290 miles after visiting a village I turned back. Transport is the great difficulty in the region and it would, I think, be necessary to penetrate to the main range some 300 miles further up, or up one of the large tributaries to the hills before the forest conditions replace swamp. The nature of these swamp lands differs entirely from those of the middle Ramu. There the vegetation is arboreal if stunted; at the worst you get a forest of Pandanus. Here it is all floating grass swamp. The natives make the blades of their canoe paddles with a fish tail instead of tapering them to a point. With this tool they can both paddle in clear water and pole through this floating grass. In the dry season some areas become dry enough to offer a precarious foothold, but it is only the crust that is dry, and if you are not careful you will flounder waist deep in mud when trying to cross a patch. The illusion of strong ground is heightened by the presence of little shrubs and young saplings that have sprung up since the previous rains. Large areas of the crust become detached in the lagoons and back waters, and come floating down the main stream looking like solid islands with their bushes, and now and again a trunk of a tree or some other heavy object in the middle. I was not there during the season when the largest of these islands were coming down, but in July I measured one which was 42 yards long and about 20 yards wide and carried a firm little sapling of Sarcocephalus with a cloak of white bracted Mussaenda on it. Though at times they floated by with an appearance of some mass and cohesion, yet none had the solid look of the floating islands of Embe Lake already described. They lacked the tall lily, and so were much less elevated areas of greenery, and their depth was visibly much less than the sedge-rooted phenomena of the lakes in Papua.

Turning now to the rain forest areas of the smaller islands, viz., New Britain, New Ireland and Lavongai (late New Hanover) which I visited after I had completed the work on the main island of New Guinea, I must at once confess that the forests were very disappointing, and that nowhere except in the Eucalyptus belts—formations which are intrusive and which I have already described—did I find any areas of rain forest fit for commercial exploitation. Fine trees I did find, and a vast number of species, all mixed together in the dense jungle, but nothing immediately profitable to a saw-miller. I will describe each area beginning with the Island of New Britain.

Rain Forests of the Island of New Britain.

All round the island occurs the characteristic rain forest which I have already described. The population on the lower, flatter portions where the largest trees should grow is in many parts very small, so that I had high hopes of finding virgin high forest of good quality along the valleys of some of the larger rivers. These, however, I did not find but instead found large areas of second rate rain forest which had every appearance of having been farmed over in the distant past and having regrown, but had not as yet reached full maturity. It is probable that the cause was not cultivation but fire, for large as is the rainfall there is no doubt—the evidence of the burnt eucalyptus forests proves it indubitably—that great droughts occur at somewhat long intervals. It may be that some great fire wiped the greater part of the low land forests out, and that what we see to-day is merely the young regrowth. Here and there patches of good forests occur, but they are of relatively small area and are quite accountable in the fire theory for such islands of saved forest are only natural. These show what type of forest was growing here before the fire or other cataclysm destroyed it.

Here is the survey of a characteristic patch of such forest taken in the valley of the Powell River, close to where the eucalyptus forest occurred. First, I should say that while rainfall figures were not collected before the Government station was established two years ago, a full year's data are available. These cover September, 1923-August, 1924, and total 115.41 inches, which seems a low annual rainfall for this vegetation and certainly any diminution of this fall in a drought year, for instance, would be followed by grave fire dangers, especially in a country whose people use fire quite indiscriminately.

Rain Forests of the Powell River, New Britain.

Sample area, 32 acres parallel with river.

—	No. of Trees.	Cubic Contents.		
		Total.	Per Tree.	Per Acre.
Pometia pinnata	77	10,026	130	313
Dractomelum mangiferum ..	11	1,392	145	50
Alstonia scholaris	10	3,608	360	112
Spondias dulcis	10	2,311	231	72
Pterocymbium sp.	5	1,464	292	33
Unknown	3	622	207	19
Sterculia sp.	1	156	156	5
Wormia quercifolia	1	193	193	6
Sarcocephalis cordatus ..	1	204	204	6
	119	20,176	170	616

Rain Forests of the Powell River, New Britain.

Sample area of 40 acres at right angles with river.

—	No. of Trees.	Cubic Contents.		
		Total.	Per Tree.	Per Acre.
Pometia pinnata	44	4,866	110	121
Octomeles sumatrana	14	7,236	518	181
Dractomelum mangiferum ..	14	2,726	215	63
Spondias dulcis	12	2,787	232	69
Alstonia scholaris	12	2,578	215	63
Pterocymbium sp.	9	2,244	250	56
Unknown	8	1,096	137	27
Sterculia sp.	2	492	246	12
Vitex cofassus	2	84	42	2
Pterocarpus indicus	1	49	49	1
	118	24,178	205	595

It will be seen that the mixture is not so great as in most rain forests. The volume, on the other hand, is not high, and in the inland sample area it is mainly made up of Octomeles. In both areas Pometia pinnata is the best represented species, and curiously enough Celtis philippinensis, which was so well represented in the New Guinea forests, was scarce here, and no tree of mill log size was found in either sample area. The Pometia or "tun," as the natives around Rabaul call this species, grows big and tall in the forests, and not only is its average volume higher than usual, but it is less grooved and buttressed, therefore a better mill log. The rarity

of Pterocarpus was remarkable, and as for Afzelia bijuga, I came across only one tree in fifteen days' surveying about here. Cedar (Cedrella toona var Australis) occurs in the hills, for I have seen pieces of the wood, but it is very rare, for I did not see a specimen in all my travels on both north and south coast of New Britain. Here are the native names for the commoner trees:—Asang (*Vitex cofassus*), Tun (*Pometia pinnata*), Erima (*Octomeles sumatrana*), Lup (*Dractomelum mangiferum*), Kwila (*Afzelia bijuga*), Sawa (*Alstonia scholaris*), Gotgot (*Celtis philippinensis*), Kiau (*Garcinia sp.*), Manga (*Pterocarpus indicus*), Epenge (*Wormia sp.*), Musa (*Cinnamomum massoia*); Nabung (*Macaranga sp. No.* 787), Elu Kalaka (*Myrstica sp.*) Utum (*Barringtonia speciosa*), Talisa (*Terminalia catappa*), Kurong (*Bruguiera sp.*), Tongong (*Rhizophora sp.*), Baia (*Calophyllum inophyllum*), Bogun (*Avicennia officinalis*).

Rain Forests of New Ireland.

The northern part of the island consists of a long narrow strip of land rising to no great height in the middle. The population is, comparatively speaking, big, and all the forest has been cultivated, and so converted into scrub regrowth. That very big timber once grew on this island is shown by the presence of magnificent specimens of the following species, which may be seen near villages along the main road:—Octomeles sumatrana, Pterocarpus indicus, Pometia pinnata, Celtis philippinensis, Pterocymbium sp., Terminalia catappa, and T. Okari affin., Vitex cofassus, Planchonia sp., Alstonia scholaris, Dracontomelum mangiferum, Mangifera minor, and many more.

All the New Guinea forest species seemed to be represented, and trees like Pometia were of magnificent proportions and very free from grooves and buttresses. I think the largest Octomeles I have ever seen I found in this part of the Kavieng district. I did not visit the southern end of the island, which falls in the Namatanai district, but from all accounts there is no rain forest of commercial value there either, though large trees occur to show that in the past some fine forest existed wherever the country was not too steep to carry high timber. I shall have occasion to refer again to New Ireland when I deal with the question of foothill forests and mangrove formations. From a commercial point of view, accessible forests that could be profitably sawn do not exist. North-west of New Ireland lies the compact little island of Lavongai (New Hanover). Here the story is very similar to that of New Ireland. Practically the whole island to-day is covered with a regrowth forest of weed trees. The population to-day is very small, and I was considerably puzzled by the presence of such large areas of country, which appeared to have been reduced to their present state of second growth, or even to grass, by natives and their shifting cultivation. Either Lavongai once supported a much larger population or else the island has been swept by devastating fires. Old natives to whom I spoke admitted that sickness had carried off a number of villages and that large fires had occurred, but nothing phenomenal or catastrophic in the way of an epidemic or a fire could be remembered. The soil on the hill slopes is good, thoroughly suitable for the culture of tropical fruits such as cacao, and it has all carried dense high forest of the rain forest type. I went to the top of the hills or mountains from two points on the coast, and so had a good look over this little island. Along the coast there are still some magnificent Kwila trees (Afzelia bijuga) finer than I have seen anywhere, I think. It was from this point that the 60-ft. Kwila piles were obtained for Rabaul Harbour works. In my diary recording the walk up to Likdin, a village situated on the summit of the mountain with a splendid view over to Kavieng, I see that I mention the extraordinary rarity of Pometia pinnata—only one tree was met with in a four and a quarter hours' tramp from the coast to the top. The woody climbing Melastomacea with mauve flowers was well out in bloom. The natives call it Tubunta in New Britain (Indt. No. 796). The commonest large tree was Singwa (Campnospermum brevipetiola No. 785, 799), which is used for canoe making; its oil is not known to these people. Of new species Bou-u (Colophyllum sp. No. 800) was a nice timber tree. Sapilul (Polyosma lagunensis No. 801) is a small tree with beautiful terminal spikes of very fragrant flowers—it is too small to yield timber. Kulan (Wienmannia Ledermannii No. 802) is a larger tree, yielding a strong rather interlocked wood. Mail (Gordonia fragrans No. 804) is a still bigger tree with rose like flower. It yields also cross-grained wood. The little Ta-autim (Barringtonia quadrigibosa No. 803), with its long pendant spikes of flowers, arrests the eye through the masses of corolla tubes that litter the ground under it. Sukai (Myristica montana No. 805) is a little fruited nutmeg tree. The nut is half the size of the usual one met with. A very large number of the rain forest species were encountered, and with the exception of the rarity of Pometia pinnata, the mixture in the original bush was probably typical. It was hard to find any but the smallest patches of virgin forest.

In my climb from Bau-ung to the top of the mountain at the eastern end of the island I encountered the same conditions. The villages on the top are new, having been established as a result of a reversal of the German policy, which was to bring all villages down to the beach. In spite, however, of their newness, the forest had been all farmed or burnt in the past, and this cultivation, doubtless, dates from old pre-German days. On the lower lands were some magnificent specimens of Kwila (*Afzelia bijuga*) and Tun (*Pometia pinnata*), but higher up they were not well represented. It was in Lavongai that I found Ahsang (*Vitex cofassus*) being used for house props and being sent over to Kavieng for the same purpose. Comparatively young saplings, just large enough to make a prop are made use of. This was interesting, for on the main land of New Guinea this wood is regarded as decidedly not durable in the ground.

Foot Hill Forests.

As will be seen in the Papuan portion of this report (page 34), the foot hill type of forest is due to the conditions of environment. Given a good level or easy sloping plateau at even 4,000 feet, rain forests oust the foot hill forests. On the steep slopes of all the ranges, both on the main island of New Guinea and on the numerous smaller islands which are mountainous in character, this foot hill type of vegetation occurs. It is more distinctive on the main island than on New Britain, but that is because that very characteristic foot hill tree Quercus Junghuhnii, is confined to New Guinea proper, and does not occur on New Britain, Lavongai, and New Ireland. The other foot hill trees enumerated on page 34 were all met with. Of conifers, however, it is interesting to note that the two common Araucarias, viz., Hoop-pine (A. Cunninghami and A. Klinkii), come well down into the foot hill forest above Finsch-hafen and all along the ranges, dividing the Ramu and Markham basin from the sea. So the overlap of midmountain trees is very marked, and it is not only in this regard, but the other oaks also find their way down below 3,000 feet, i.e., Q. pseudo molucca, Q. spicata and its variety depressa, Q. lamponga. Evodias of the lower lands climbs up to here also, and makes the confusion worse, while a host of purely rock forest species are to be found. The main difference, at

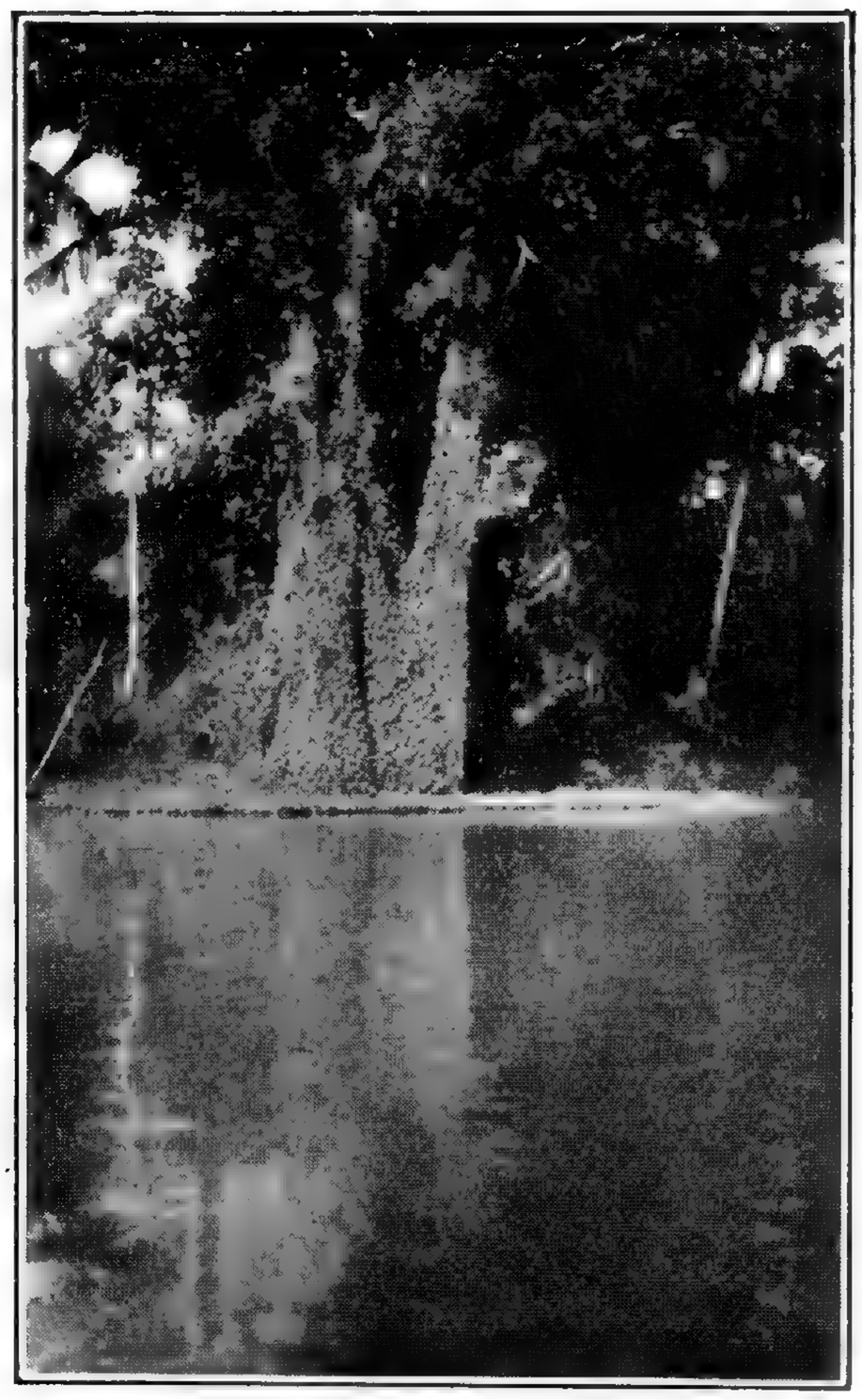
Hoop-pine. *Araucaria Cunninghamii.*

Butts of trees.

Top against the sky. Ramu River in the distance, 2,000 feet below.

[*To face page* 63.]

Lower Sepik—Swamp Forest.



Lower Sepik. Ipomoea sp. covering a fig in the Swamp Forest.

[*To face page* 62.]

any rate on New Britain, is that the foot hill forests are only pole woods, and that they have not that wonderful heavy clothing of epyphites that the main forest boasts, nor its tangle of lianas. Again, the foot hill forests have not the height growth of the midmountain forests. Although the type is not very well defined, and both midmountain and lowland species meet in it, the type of forest is really distinct from the rain forest below and the coniferous midmountain forest above. Everywhere that the slope is not too steep for cultivation, these foot hill forests are being turned into grass lands. While the native farms, even higher into the coniferous belt, he prefers the foot hills for his garden. Sometimes he is forced to terrace the steep slopes of the hills before he can plant his sweet potato crop. Elsewhere, driven up higher by the grass he himself has helped to establish, he farms on the edge of that bleak region the moss forest. Farm lands, and even villages, in the midmountain area are more common in New Guinea than in Papua, especially is this the case where the population is heavy. New Ireland must shortly face a land problem for her highlands, at any rate, in the northern half of the island, are rapidly going to grass. I climbed from Kundam (116 miles down the Kawieng road) up to the Lelet country, which is the roof of the island. It has been called a plateau, but in reality this term does not describe it very accurately. It is a series of sharp ridges with deep gullies in between. It is all limestone country, and the ridges are about 3,000 feet above the sea.

The whole of the area right over to the south-east side where a perpendicular wall or cliff of limestone forms the boundary, has at one time been covered with rain forest and foothill forest. The gullies carried the former and the ridges and steep slopes the latter. Shifting cultivation has converted it into a curious vegetation of shrubs, bushes and grass lands and tree ferns. There is evidently a good rainfall and the forest is trying hard to establish itself but the grass aided by fire is winning slowly and surely everywhere. It is lalang grass for the most part which is all the more serious as natives find its rhyzomes impossible to eradicate with their primitive tools. Here and there bracken has established itself strongly and gives a moor land effect to the landscape. Except for the timber in the gullies, the only trees left are those either cultivated for their fruits, such as mango and roseapple, or retained for shade. Alstonia scholaris seems a favorite village shade tree. The natives all over New Guinea have a pretty taste in flowers and plant hibiscus, poinciana, pulcherrima and so-called crotons, along the roads and about their villages. On this cleared highland country these splashes of highly coloured flowers or leaves were perhaps a little more arresting than under the cocoanuts by the seashore. The variegated-leafed Erythrina, with its masses of crimson flowers is as much planted for its beauty as is the Anatto (*Bixa orellana*) for its red dye which is mainly used for face paint in New Ireland.

On Lavongai, the foothill forest is confined to the very steep ridges, for the height of the island is not very great and, anywhere that soil conditions are favorable, rain forest occurs. The foothill forest is the exception on Lavongai, and in this respect the little island differs from others I have visited. Among interesting foothill trees found was Kulan (*Weimannia Ledermannii* No. 802) which bears very regularly serrate leaves. It penetrates into the rain forest and is not confined to Lavongai, for I found it on the steep slope above Kundam in New Ireland.

The Midmountain Forests.

In the Papuan portion (p. 38) will be found a general description of the midmountain region in that territory. On the other side of the main range the same conditions occur so that when I was climbing the mountains called the Bismarcks, I could easily imagine myself back on the Owen Stanley range. In one important matter the midmountain forests of the Mandated Territory differ and that is that they come down a great deal lower. The general rule determining the lower limits of the midmountain forest still holds good: the region is bounded by the cloud line. Everyone who has gazed on these great mountain masses has noticed how clear they are in the early dawn and how by 9 o'clock they are capped with clouds which by 10 a.m., as a rule, reach a certain fairly constant level. This is the lower limit of the midmountain forest. In some valleys, such as that of the Ramu and Markham, conditions exist which bring the cloud belt down much lower than on a mountain slope rising directly from the sea and entirely exposed to the trade winds. In the Markham valley, in the early morning, one sees the land breeze waft great balls of cloud down the valley and the sides of the Rawlinson and Finisterre range, they collect and melt together till there is a belt of white cloud of great width entirely blanketting the forest between about 3,000 and 6,000 feet altitude. Above them rise the great peaks quite clear, except perhaps a little cap of cloud on the summit. Later—it is only a matter of hours—the land breeze drops and the south-east trade wind from the sea blows up the valley and all the mountains from peaks to the first formed belt are enveloped in cloud. What I think occurs is that the great humid layer of air that lies over the lowlands and the river itself rises as the sun's heat increases and the land wind carries it down the valley. Wherever this heavily moisture laden wind encounters a cold enough surface it turns into cloud. There is continuous transference of water vapour from the plain to the mountain and it merely becomes visible as cloud, because it reaches the requisite temperature. Without the land breeze these clouds would form, but they would form less quickly and would not be so apparent as they are when driven along and piled up against the mountains. At higher altitude there is no land breeze effect and it is not till a few hours later that this region is cloaked in clouds. So it is that in the mountains rising from the Markham Valley the midmountain forest comes down to 2,000 feet. Above Finsch-hafen it lies around 3,000 feet. In the range between Astrolabe Bay and the Ramu, there is no midmountain forest on the sea-ward aspect, while on the 2-4,000 feet ridges overlooking the Ramu, midmountain forest occurs down to 2,500 feet. On the other side of the Ramu stand the large range of mountains called the Bismarcks and here the midmountain forest occurs comparatively low down. Camped just above the level of the Ramu I observed that only on exceptionally bright days were the mountains clear above 2,500 feet after 11 a. m. It was at the end of the north-west season that I visited this region, and it usually rained from two or three p.m. on. Sights for latitude and longitude were not easy to get and the best time I found was just after sunset. One could generally count on half an hour of clear sky at that time. After midnight a clearing of the clouds would often take place and the sky in this case generally continued clear till morning. At dawn the serrated edge of the Central and Bismarck Ranges and the frowning top of Mt. Otto and Mt. Helweg are all as clear cut as possible against the pale sky, while over the Ramu itself hangs a bank of fog which is soon sucked up by the sun. The river hereabouts is 700 feet above the sea so that the blanket of clouds that soon covers the mountains down to 2,500 seems much lower than it really is.

Hoop pine (Araucaria Cunninghami No. 639, Pap. 376) as in Papua, is the distinctive species of the

mid-mountain forests and is common everywhere on the main island between 2,000 and 4,000 feet. There is also Araucaria Klinkii No. 642. Both these "pines" are very conspicuous for they are driven to the rocky spurs and knife-edge ridges by the less hardy and more leafy species and there they stand out against the sky in a most imposing manner. It is by no means the most common species of the midmountain forest but it is the most conspicuous. All the oaks occur here and in places they are very numerous, making up 40-55 per cent. of the standing stock. Several surveys of this type of forest were made, but unfortunately these data were destroyed in the looting of my Ramu base camp and I must again rely on my memory. I have not even the botanical and wood specimens, for these were also destroyed. Fortunately, my diary of the Sarawaket climbs was recovered and that contained some information and data of a survey.

The forests behind Finsch-hafen are not quite the characteristic midmountain type and so the figures of stocking must not be accepted as applying to forests in the mountain at the source of the Ramu. One very important difference is the complete absence of the two Araucarias after you pass what might be called the Coastal range. Beyond Sattleberg, which is about 3,000 feet high, the Araucarias were very rare. A description of these forests is, I think, necessary.

Midmountain Forests on the South-Eastern End of Finisterre Range.

As one rises from the old farm second growth, and enters the midmountain forest, one is struck by the number of purely rain forest species that still persist. Of these the most common and highest climber is Alstonia scholaris and A. longissima. It is hard to distinguish the one from the other and the difficulty is accentuated when at a higher altitude one finds kweta (A. macrophylla, Wall, No. 571). Homalanthus populifolius is a little tree that seems to find itself just as much at home at 6,000 feet as at sea level—its prettily coloured spade shaped leaves make it a showy tree Another rain forest species is Celtis philippinensis, but its limit would seem to be around 4,500 feet. Mussaenda frondosa, a climber that spots with its cream bracts the dark green of the lowland forest, is also found at 7,000 feet among the podocarpus and dacrydium. The variety met with is glabriflora. Gnetum gnemon and its affinities flourishes up to 7,000 feet also, and is much prized by the natives for both the green food its young leaves yield, and the excellent cordage fibre for net making that its bast provides. A treelet of the foothill vegetation and midmountain forest is the common Dodonea viscosa, and the clambering fern Gleichenia dichotoma is common to both regions. I also found it right up above the moss forests at 11,000 feet, so it has a wide range in altitude.

The main new trees found in the Sarawaket midmountain forests were: Podocarpus amara Blume, a large conifer yielding a wood that I found impossible to distinguish from P. neriifolius (Pap. 377). Kuri (Indet. No. 553) is a medium-sized broad-leafed tree yielding a light softwood. Mutzurumtzu is the name given by the native to the soft-leafed podocarp of the Philippines P. cupressina. which thrives all over the high mountains of New Guinea. Ngangi is a big tree, but not a conifer and it yields a pale coloured, rather hard wood. Mang or Hadu (Himantandra Belgraveana, Schlh. No. 568) is of the Magnolia family and related to the Drymis that grows in the moss forest a few thousand feet higher.

Eugenia and Calophyllum are represented by several species, but lack of flowering material make their closer identification impossible. White Kania eugenioides is easily mistaken for either of these genera until the handsome yellow terminal panicles are found. Sali, No. 569, Cyr Tandra sp., is one of the large trees of the midmountain forests, yielding a hard heavy timber with an interlocked grain. Kweta (Alstonia macrophylla No. 571) is easily confounded with either of the low country Alstonia, the wood is very similar, and in spite of the name the leaves are about as big.

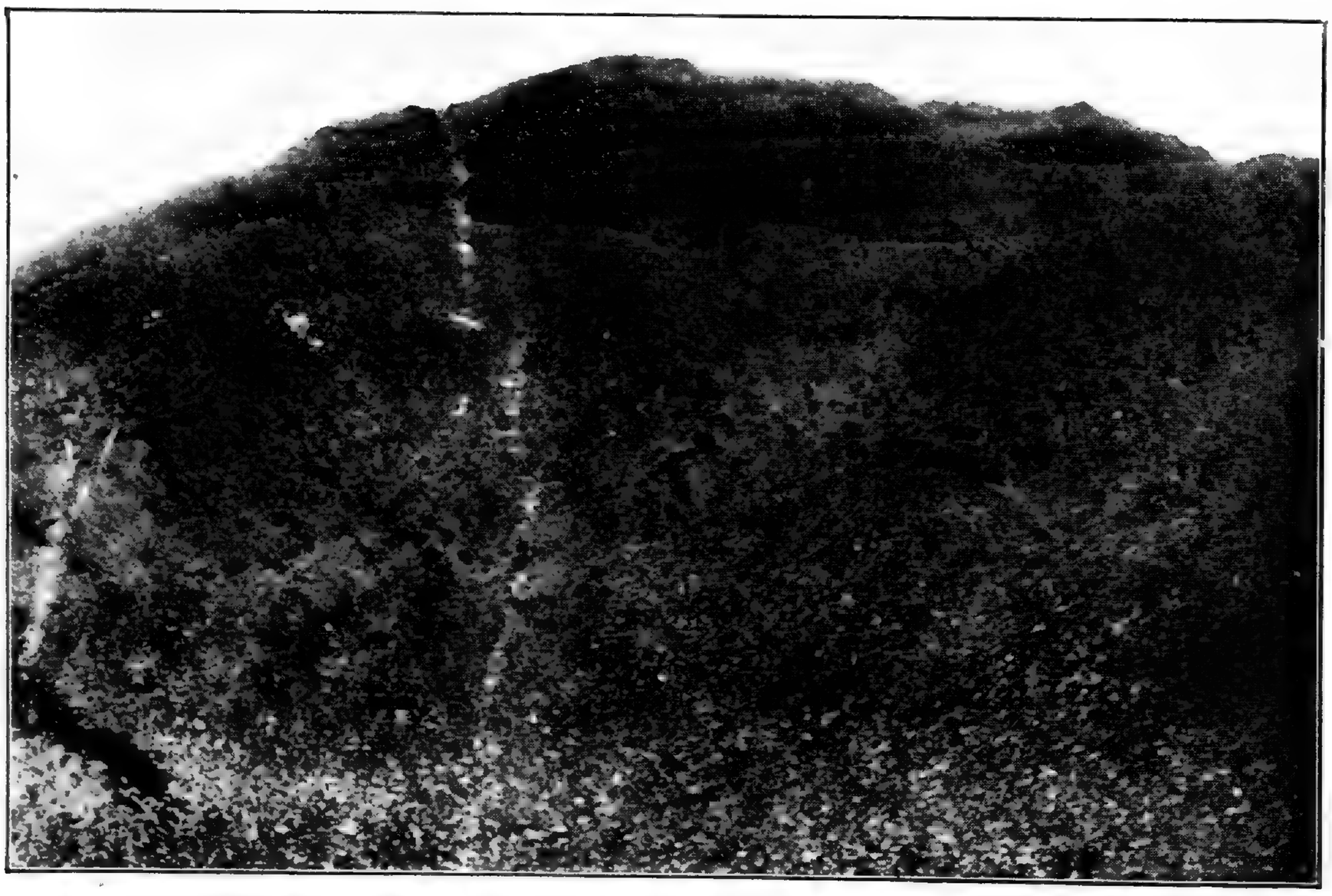
A big Lauraceae is Turama, with its fine spreading crown and tall symetrical unbuttressed bole. Its wood is very attractive—a good cabinet wood of dark brown colour. A little tree with a wide range and a lovely flower, which I omitted to mention as climbing from the foothill to 7,000 feet, is Schurmansia Henningsii, K. Sch. The only difference is that on the midmountain region it is frankly a third story tree, while lower down we find it on the edge of rain forest and foothill forest or in grass land fully exposed to light. Anonioides pulchra with its chestnut-like seed vessels is rather common. It grows into a big tree. The timber works easily and has a pretty quarter grain. The oaks already described in the Papuan section are quite numerous throughout this region, and Mr. Helbig, of Sattleberg, utilizes the bark of two of them to make leather for the mission cobbling.

A very common undergrowth in the oak stands is a Cyrtandra, though it seems to thrive best under Quercus Junghuhni, which often makes a pure forest. A beautiful creeper with port wine coloured flowers, makes a fine show from 3,000 to 5,000 feet—it is Dichrotrichum Chalmersii, F. v. M., No. 572.

A new Hoya, No. 566, *Eu-Hoya* sp., is another ornamental creeper. A tree of the fig family, which in Papua was found only along the banks of watercourses, is *Damnaropsis kingiana,* No. 550; in the mountains of New Guinea it is to be found on rather dry and very steep slopes. It springs up where the mid-mountain forest has been destroyed, and with its immense leaves is a very conspicuous little tree.

Of the ground covers of the forest of this region the Urticaceae are the most prominent. They are all unmistakably of the nettle family, although they vary in size and in appearance a great deal. The largest—the giant-leafed ground nettle—stands 2 ft. 6 in. high; botanically it is called *Cypholophus pachycarpus* H. Winkl., No. 547. Then there is one with a large but acuminate leaf called *Pilea pellis-crocodili,* No. 540. Another with as big a leaf but not so pointed a one is *Elatostema macrophyllum* Brong. var. *Majusculum* K. Sch., No. 539. Then there is a small pointed leafed one known as *E. sesquifolium* Hassk, No. 541. The very small-leafed nettles, so small as to look like maiden-hair, are not found as low as this, but I will come to them when we reach the moss forest. On the upper limits of the mid-mountain belt are to be found two exquisite Rhodendrons. *R. Carringtoniae,* No. 527, has a fragrant, very showy white flower. *R. Hansemannii* Warb., No. 531, has a fine yellow flower. *R. Warianum* Schlecter is a climbing, scrambling shrub with pale-pink trumpets. While on the subject of beautiful flowering plants, I must mention the glorious balsams. The genus *Impatiens* stars the ground in the most wonderful way. The shades of colour compassed by this genus ranges from a pure white through pink to a mauve or to a scarlet. Another family which adds greatly to the beauty of the forest is the *Melatomaceae.* A white and a pink Medinella are perhaps the most striking of this beautiful order owing to their fine flowers, but there are other genera whose wide heavily-veined leaves are very ornamental. The great digitate-leafed Aralia (*Schefflera* sp., No. 546) is to be found everywhere. It is a large, woody climber, which reaches to the crowns of the highest trees. The cactus creeper *Muchlenbeckia platyclada* Meiss, No. 551, that I found growing on the fig trees around Laruni, in Papua, thrives also in the

Lake at the head of Ogai River (11,000 feet). Southern crest of Sarawaket in distance.



The southern crest of Sarawaket, 12,484 feet.

See Appendix II, page 175.

[*To face page* 65.]

mid-mountain forest of the Mandated Territory. It seems to prefer figs to any other host.

Turning from the aesthetic side to the material, I will give the result of the Ogeramnang survey. This is a little sample area of 4 acres. It is probably on account of this that the data collected escaped the general pillage of my gear, for I had them in my diary.

FORESTS OF OGERAMNANG.

Sample Area, 4 acres.

Herb. No.	Native Names.	No. of Trees.	Volume.			Percentages—		Acres to Trees.	Botanical Name.
			Total.	Per Acre.	Per Tree.	To Total Volume.	To Trees.		
525	Gua	2	263	66	131	13·5	8·71	2	*Semecarpus sp.*
553	Kuvi	12	882	220	73	45·3	52·17	½	*Indt.*
552	Gerep	1	258	64	258	13·25	4·35	4	*Podocarpus amara.*
554	Mutzumutsu ..	All undersized		..	..	..	..	..	*Podocarpus cupressina*
555	Ngangi	5	286	57	7·1	14·69	21·74	1¼	*Indt.*
556	Mang	2	190	47	95	9·76	8·71	2	*Himantandra Belgraveana*
557	Soan	1	68	17	68	3·49	4·35	4	*Calophyllum sp.*
		23	1,947	486	84	100	100	..	

From the above little sample area it will be seen that the stocking in these mid-mountain forests is light. They lack the heavy stands of Araucaria, which made this type of country so attractive in Papua. The other species enumerated on the previous page did not fall within the sample area, which shows that they are not very common. That none of the oaks showed up was singular, for, as a rule, they are plentiful. Kuvi, No. 553, was remarkably plentiful—indeed, half the stand consisted of this rather soft, and, I am afraid, not very valuable species.

I got better, and, I think, more representative sample areas above Joangey and on the other slope of the Bengi River, but the papers relating to this work were destroyed, and from memory I cannot say more than that the forest had a large percentage of big conifers—Dacrydium and Podocarpus—and that the oaks were strongly represented.

THE MOSSY FORESTS.

In the Papuan section of this report, p. 45, I have described the appearance and general composition of that curious vegetation of the clouds—the mossy forests. In the Mandated Territory it occurs at about the same levels, viz., between 7,500 and 8,000 feet, and continues up to 11,000 feet. It is the most distressingly uncomfortable region a traveller encounters in the tropics. Better by far find yourself benighted in a mosquito-infested swamp on the Ramu than forced to camp in the mossy forests. The continuous cold Scotch mist blows through this stunted tangle, and all the world drips. Nothing will burn, and even when he has foresight enough to bring up firewood with him, the traveller has some trouble to keep a fire going. With the temperature down to 40 deg., and the air saturated with moisture, the native carriers suffer acutely, and blankets and flannel shirts are not enough to keep them warm under a dank tent fly. The wise ones will take advantage of a large Phyllocladus with well-spread aerial roots, and on these will pile moss and leaves until a bell tent is made with a living pole growing through the peak. In that, with a good fire, a number of boys will keep warm till dawn. The best way is not to camp in this inhospitable region, but push on and up till the so-called alpine vegetation is reached. Unfortunately, the country between 7,500 and 11,000 feet is often very difficult, and one is forced to camp before getting free of the mossy forests.

In addition to the species enumerated in the Papuan mossy forests, I can now add the following: *Styphelia* sp., a shrub which occurs in openings in the forest and on its upper limits in grass land. All the Rhododendrons are to be found in the mossy forest. Those of the mid-mountain region penetrate well up to 10,000 feet, and *R. communae* coming down to meet them from the upper grass lands. In holes, too, are to be found the three species of Rubus, and at 10,000 feet the daisy (*Brachycome*). *Schefflera setulosa* occurs at about the same height, and clambers over the crooked stems of the trees; it is one of the very few lianas to penetrate so high. Of soilcovers, the common *Dawsonia* is most plentiful, as are filmy ferns and nettles. A new species of *Pilea* was met with around 9,000 feet, and four species of *Elatostema*. Of trees there is little to write till 10,500 feet is reached, when the timber of the higher levels begins to be met with. *Phyllocladus hopophyllus, Dacrydium* sp., *Libocedrus papuana, Semecarpus* sp., *Podocarpus* sp. These trees will be described in the next sub-section, for I think they must be regarded as belonging to the so-called alpine flora and as intruders in the mossy forest.

HIGH MOUNTAIN FOREST (ALPINE GRASS LANDS).

I am not at all happy about the name given to the upper limits of mountainous regions in the tropics. My exploration of such areas in the Mandated Territory has shown that the Schimper generalization regarding these lofty regions is not applicable. There is grass land in plenty, but it is not a natural feature of the vegetation, except on very steep slopes, so steep as to make tree growth impossible; elsewhere, these vast areas of grass are due to natives burning the forest. At one time, these bald-headed mountains were covered with a forest of Podocarpus, Dacrydium, and Phyllocladus, with a few non-coniferous woods, such as Eugenia and Calophyllum. The precipitous slopes and marsh lands carried graminae, and these grasses have been spread by the natives. Annually he goes up to the topmost peaks of all the ranges and hunts the wallaby. It is only on the lower mountains, those that only reach the mossy forest—a region the native dislikes as much as I do—are there no tracks, but where tracks are found in the mossy forest it is a sure sign that away beyond is hunting country, and up there will be found rough shelters, and even well-built huts, to give the hunters protection in the cold nights. The nights are very cold at 12,000 feet, as will be seen from the temperature records below. All the grass top is criss-crossed with hunting pads, and the waters, which are in the form of lakes and marshlands, carry both snipe and duck, while the thick red-brown coated wallaby is very common in the grass. A fuller description of one area of this high mountain region will be found in the Appendix, which contains my diary of the ascent of Sarawaket.

To call this region grass land when the grass is a man-spread vegetation of comparatively recent date, and where, were the native to cease hunting and burning, the coniferous forest would return, seems to me to be a mistake, and so I call the region high mountain forest. In the Papuan section I have assumed that the Schimper hypothesis held good for New Guinea, and gave extracts from Sir W. MacGregor's explorations, which went generally to show that the alpine grass land theory might be accepted in Papua. These same extracts, however, read in the light of my exploration of high mountains in the Mandated Territory,

are equally consistent with the undoubted fact that those heights were at one time forest land, and have been denuded and burned to grass by the native. So Sir William, no doubt, regarded the Wharton Range and Mount Victoria "cypresses" as naturally wide-sown trees, just as travellers in the vast plains of grass of the Markham Valley regard the few scattered trees they encounter as the natural and original vegetation of the area. In both cases, an examination of the edges of the grass land or a careful inspection of the clumps of forest that are to be found isolated in a sea of grass, would show that the conditions are not natural, and the tree growth is merely nature's survival of man's work. On the edge of the grass area on the tops of the high mountains stand the coniferous forests, and yearly the bald cap is extended downwards until it meets the true cloud belt region—the mossy forest. The annual burn does not take place only from the top, but fires are lit in the interior of the forest also, and so islands of grass are formed, which increase every year. It is in these little islands that the natives make their camping grounds, for the surrounding forest affords some shelter from the keen winds. All around is a fringe of dead timber, reminding one forcibly of a settlement out-back in Australia. The illusion is heightened by the tall tree ferns, which resist the fires for a year or two and make a great show of green in the skeleton forest.

I am forced to the conclusion from what I have actually seen in the tropics of New Guinea and in West Africa, that all grass lands occurring in the tropics where the rainfall and soil conditions are sufficient to support dense forest, are artifically caused by mankind in his shifting cultivation or in his hunting. At sea-level cultivation begins and hunting fires finish the conversion, while at 12,000 feet hunting fires alone are sufficient to turn a forest into grass land. What vegetation exists at still higher elevations, such as in the mountains of Dutch New Guinea, and which are said to reach the snow line, has not as far as I am aware, been recorded, but all that I have seen leads me to think that the coniferous forest persists until the climate conditions render tree growth impossible.

Climatically, the high mountain region is magnificent. The nights are cold, temperature of 33 deg. being recorded from 11 p.m. to dawn, but the days until about 4 p.m. are delightfully clear during the dry season. For a few hours in the frosty dawn one looks down on the world with the sea studded with little islands washing a very clear shore, and all around stand peak upon peak of great mountains. The valleys deep down are clothed in fog, but otherwise the whole sweep of mountain and foothills is plain to see until the great heat of the sun starts the upward rush of watery vapour, and all the land is blotted out. At 13,450 feet on the peak of Sarawaket at 10 a.m. there was nothing to be seen below one but cloud, while all around peaks of a few thousand feet lower altitude stood out of a sea of rolling clouds in the most extraordinary manner. The whole world seemed changed, and there was I perched on an island with nothing but cloud between me and the next island peak. The top crests of the Bismarcks, miles away to the north-west glinted golden, doubtless a rock exposure reflecting the sun. All the valley of the Markham and the Ramu and all the sea and midmountain country beneath me had vanished in cloud. It is a very lonely sensation to be thus cut off from the world on the topmost point of land, and nothing but clear blue sky above one and a sea of cloud around. Shortly after 11 o'clock thick wisps of cloud collected by the south-east trades on the peak, and it grew very cold until they blew away, and the sun now near the zenith poured down its heat again. Soon the wisps of cloud became more permanent, and finally a little cap of cloud, covering the peak some 50-100 feet down stuck fast, and from it, mushroomed upwards, a large mass of white cloud into the clear blue sky. I had left the peak then, and was in full warm sunshine 1,000 feet below. By sundown this cloud had quite disappeared, and in the frosty air the peak looked sharp and clear from my camp below it.

There was one curious point about the atmospheric conditions which is worth recording. The general night conditions appeared excellent for radio work, yet I failed to read such strong signals as Cavite N.P.M.

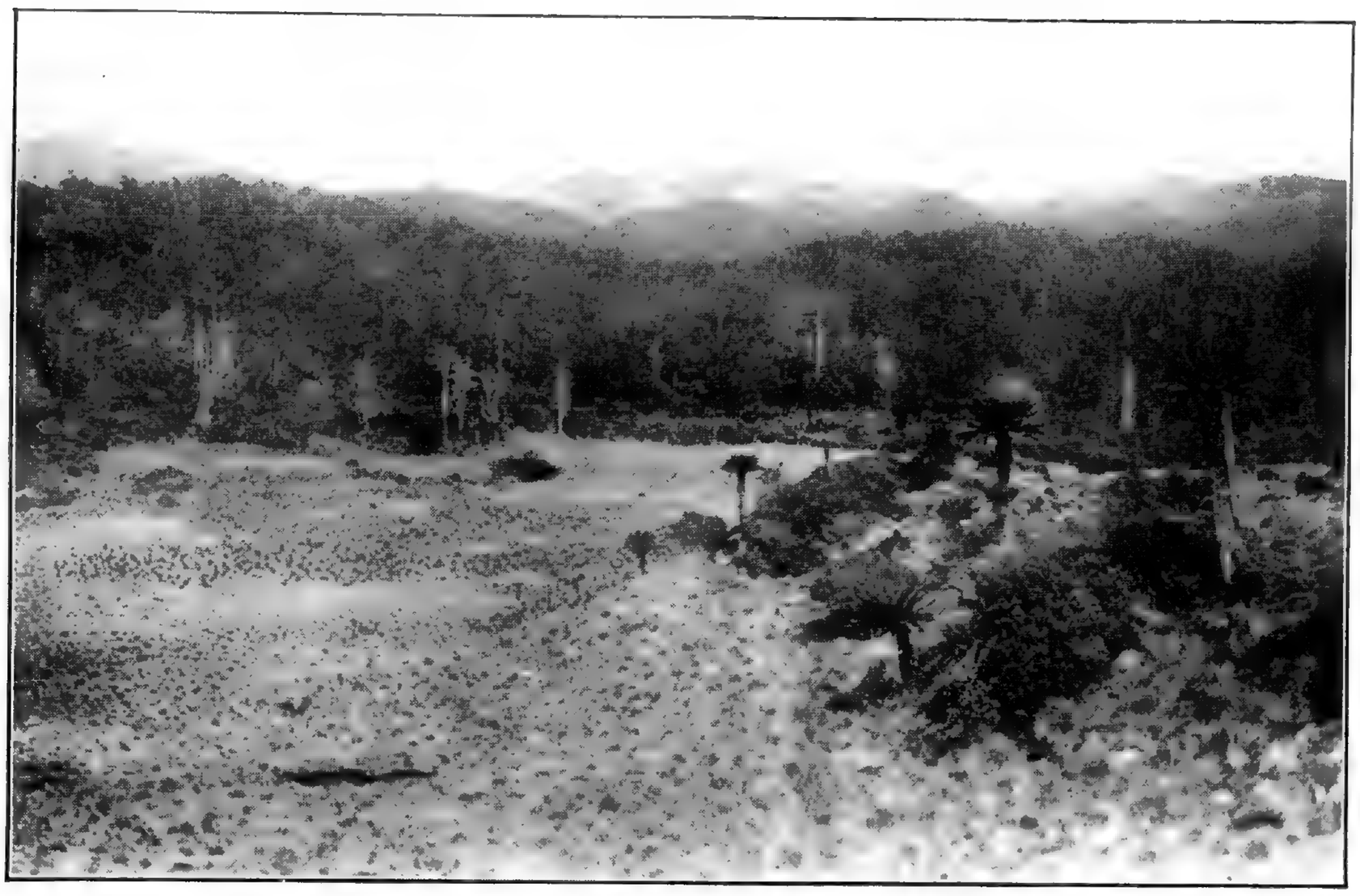
It was most unfortunate, for I relied on their midnight time signal for my longitude observation. The atmospheric conditions would, I think, be logged by an operator as "statics bad." It was not a case of distant lightning causing the usual "atmospherics," though their growlings were there all the night, but my aerial appeared to be continuously charged, and while by touching the grid, I could get a dash or a couple of dots, the signals were at once wiped out until I again touched the grid. I tried both during the night and day, and while up to date, except in a strong and very local thunderstorm, I had never failed to pick up time, I was unable to get any signals until I got down to 10,000 feet. It is probable that travellers at high altitudes elsewhere have suffered from the same difficulty, and have found a means of overcoming it, but I have failed to find any record of such an experience, nor have technical men been able to explain it. I advance as a theory to account for the phenomenon that such high peaks as Sarawaket act as large lightning conductors. Points of discharge, as it were, of these mighty mountain ranges. I experienced no thunder at my highest camp, but below in the cloud belt from this high elevation I watched many thunderstorms. After one of them a very strong rain storm blew over the peak, accompanied by hail, but no thunder or lightning. These high mountain tops appear to be subject to the same seasonal climate as the coast. The influence is still the south-east and the north-west monsoons, and the dry season at the peak corresponds with the dry season on the coast. So with Sarawaket, the highest and yet the most south-easterly peak of the Finisterre group, the dry season corresponds with Finsch-hafen, and occurs during the north-west monsoon, that trade wind leaving its watery vapour at the north-west end of the Finisterre, and reaching the south-east end comparatively dry. When I was on the top the natives had just begun to burn, and they expected to hunt from then on to February or March; camping at 11,000 feet for, sometimes, a week or more, which shows that these mountain natives whose villages are at about 5,000 feet, are as hardy as the Zulus.

Mangrove Forests.

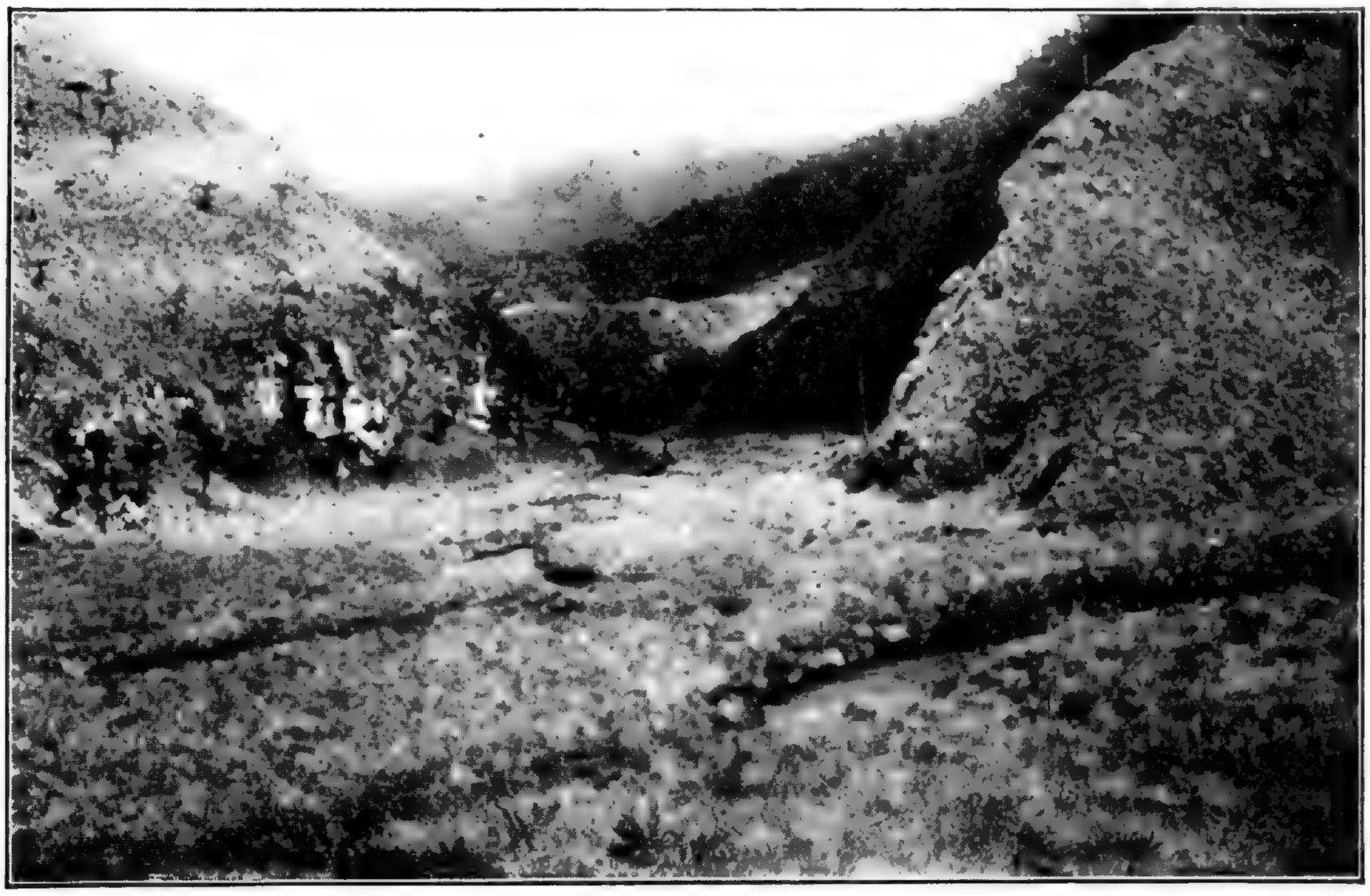
In the Papuan section, p. 47, I have described the characteristic mangrove forests. In the Mandated Territory they are similar in composition, but nowhere are there such vast areas of these forests of the sea as in the Delta division of Papua.

The mighty Sepik and the Ramu, though probably discharging more water and silt than that great group of rivers that flow into the Papuan Gulf, have little or no tidal estuaries, and so the mangrove forests are narrow strips extending but a few miles inland, and linking the Ramu to the Sepik.

Elsewhere there are little patches of mangrove behind an island or under the lee of a headland or along a low-lying, swampy shore, but no extensive area occurs. When it occurs on the islands of New



Edge of Dacrydium-Libocedrus Forest. Artificially formed grass lands in foreground, gradually extending into the forest. South and north crests of Sarawatek in the distance.



Mongi head waters in limestone formation. The fires have destroyed the forest and for the most part only tree ferns remain.

[*To face page* 66.]

Ireland and of Lavongai, both Rhizophora and Bruguiera attain magnificent dimensions, so that 60-feet piles could be cut from these forests without much casting around. I was particularly impressed with the tremendous dimensions of the trees in a swamp that occurs on the north coast of New Ireland, close to a plantation called Kinadam. For commercial production of either tannin from mangrove bark, or alcohol from Nipa, Papua offers a far larger field. In fact, as far as Nipa is concerned, the Territory is extraordinarily poor.

3. FOREST POLICY.

Continuity being the first principle of a policy which governs the management of a crop of such long life as timber trees, one is hampered in making suggestions for a Territory the future of which is not definitely laid down. I am forced to regard the administration as continuous, although it is only a mandate which is subject to revision from time to time. It is certain that, should the mandate pass into other hands than those of Australia, the forest assets will not cease to be well cared for, and a policy formulated to-day would with such alterations as the change necessitated, hold good under the administration of another power. I am convinced of this because a forest policy cannot in any way prove harmful to the native; it is a form of husbandry which will not only prove acceptable to the inhabitants, but will recommend itself to all nations owing to its great civilizing effect. The planting of trees and the conversion of trunks into timber and timber into articles for use within and, possibly, beyond the Territory, will teach the native not only long views, but several trades in which wood is the raw material. Forestry, and all its allied crafts, has the advantage of being a rural occupation, and in this it is to be preferred to many a technical industry which necessitates a training in Rabaul or some other centre. Those who have seen the river natives not only conserve, but actually plant trees to yield timber for canoe making for their sons, must agree that forestry will be more acceptable in New Guinea than in many a white man's country. Where woodworking is concerned, whether it be carving or canoe making, decorating houses, or making household utensils, the native from Bougainville to the Sepik with the rudimentary tools he possesses, is a craftsman—

> "Au plus profond des bois la patrie a son coeur
> Un peuple sans forêts est un peuple qui meurt."

In many parts the native is dying out, some say it is his inability to live up to the new environment that the white man has brought to him. That he has lost his old incentives, his head hunts, his tribal fights and his ceremonial dances, and he has in exchange freedom from attack, rapine and murder, ease of life and general apathy. That the jolt from the stone age to the petrol age has been too violent, and he cannot assimilate all that we now give him in the way of new thought. As a corrective to this state of affairs, a forest policy, carrying with it a general planting campaign might prove of value. Such plantations would have fewer of the objections of the coastal coconut plantations. For instance, boys would not be brought from the high mountains to sea level, but would be utilized to plant or tend hoop-pine forests at 5,000 feet. There is a very wide range of districts, altitudes, and climates to choose boys from, and an equally wide range for plantation sites. The establishment of small wood-working industries in the natural forest should also be part of the policy, and here the native would learn saw-milling and the use of tools in all manner of wood-working. and the public works would be certain of a supply of timber for local purposes instead of having to import the bulk of its wood from Sydney, which is the rule to-day. I do not say that the timber thus cut or fashioned will be much cheaper, but the natives will have learnt a trade, and rural industries will be the outcome in the end which should supply an interest in life. That such a policy would be acceptable to the native I feel sure, and there is little, I think, to object to in it from any point of view, so that it should commend itself to the League of Nations.

In the Papuan section I have outlined a forest policy for that Territory. The Mandated Territory is in much the same situation. There is no need to alter the present ordinance for, as in Papua, its aim is to encourage the saw-miller to cut all before him, and had there been anything to cut at a profit it would all be held by Australian companies, if not all cut out by them.

In case any of the midmountain hoop-pine country becomes profitable to work owing to heightened prices, then an ordinance such as I have outlined for Papua would, I think, meet the case.

Policy as to the Natural Forests—Low Country.

Research and Planting.—These are the two main things to be done. First, a forester must study the sylvicultural requirements of the best species. Then would come the improvement of the forests. It will be slow work, but if from the present chaotic mixture of species can be evolved a normal forest growing only valuable trees, the time spent on research will not be wasted. As for plantations, the vast valley of the Markham and Upper Ramu, all that portion which the natives have transformed from forest to grass land, should be planted up with Teak, Pterocarpus, and such other valuable species as experience will show the forester, are satisfactory. On the drier areas, sandalwood should be tried, and in the meantime research into the various oils and by-products mentioned in the field notes to the species may show the way to other valuable trees also worth planting.

The Mid Mountain Forest Policy.

Here there is sound work to be done by a far-seeing Government. The hoop-pine of Queensland is rapidly being exhausted, the growing of more will prove difficult and expensive, while in the Mandated Territory it thrives at fairly low altitudes, and can be planted at a much lower cost than in Australia. I say fairly low altitudes, for I have in mind the Papuan stands which were very high up. On the mountains that stretch from the Rawlinson to Mount Cromwell group on the sea side and all along the mountains on both sides of the Markham Valley, and down the Ramu Valley for 40 miles, hoop-pine grows well at 2,000-3,000 feet, and these are obvious places to plant it on a very large scale. This country offers a far better opportunity than the coniferous belt in Papua, which is 3,000 feet higher. The policy should be to restore the hoop-pine forest, where it has been destroyed by natives, and to extend it into the non-coniferous forest between the ridges. What is known of the sylviculture of hoop-pine has been written by Prof. N. Jolly, and will be found reprinted on page 53 of this report. It is quite impossible to estimate the value of such plantations of hoop-pine, but the attractiveness of the proposal must be patent to any one who realizes that Australia requires to-day over £4,400,000 worth of softwood, and her imports from the United States of America must in the near future dwindle, and then cease altogether.

Mossy Forests Policy.

These forests are great sponges which soak up the rain and let it down slowly through the hills, streams, and rivers. They must be protected, for they are the mothers of the water-courses. Without the mossy forests the rivers would become torrential in character. In the rains the floods would be devastating, and in the dries the rivers would be dry or chaplets of pools. It is to the mossy forests we owe the water in the dry season when we need it most. The only enemy of the mossy forest is man with his fire-stick, and here, I think, education of the native by the forester is all that is needed. The native has no cause to set the mossy forest ablaze in those rare spells of drought that I recorded in Papua. The fires of the high mountain forests will not, I think, work down except by unusual chance into the mossy forest, so they are safe enough once the native has the matter explained to him.

High Mountain Forests.

As for these, I really am at a loss what to advise. Their loss is certain unless strong repressive steps are taken to prevent the native hunting on the caps of the mountains, and to do that is very difficult, at any rate, with the present system of patrolling even if it were sound from an administrative stand-point. The timber is far too high up even to be of commercial value, and the importance of these forests is geographical and scientific. They are certainly "protection forests," and tend to regulate the run off of the waters, and also form a buffer between the bald cap above and the mossy forests below. Scientifically they have great interest, and for that reason alone, as large areas as possible, should be preserved for botanical reasons. The area of burnt-over grass lands is now quite large enough for the meat requirements of the inhabitants below, and the native would be quite prepared to hand over the remainder to the Government as national parks. This would not effect the object, for the annual hunting fires would gradually eat into the reserves until they were wholly destroyed. To stop grass burning by the natives would, as I have already said, be very difficult, and the alternative of closing the mountain tops to them would be a great hardship. I must leave the solution of the problem to the future foresters of the Territory, and can only hope that it will be found before this very interesting coniferous belt ceases to exist.

SECTION C.

FIELD NOTES DESCRIBING SPECIES THAT HAVE BEEN MORE OR LESS BOTANICALLY DETERMINED.

Elsewhere* I have described the method employed in collecting botanical material—leaves, flowers, root, bark, and wood—and other field work. From the "axe cuts" of the timbers brought back from the forest hand specimens were prepared, and these were cut so as to expose the radial and tangential surfaces, and so facilitate the macroscopical examination of the rays, pores, soft tissue, &c. Also, solutions of the sawdust of the woods were obtained and the colour of the solution noted. The same was done in the case of barks, only, unfortunately, a number of them were lost in transit.

To these solutions iron salts were added, and the reaction, if any, recorded as a rough guide to the presence of tannins. The weight per cubic foot was obtained by comparing the weight of a specimen weighed in the ordinary way with its weight when supported but immersed in a vessel of water. The latter operation gives the weight of the displaced water. The specimens were dried out in a jacketed oven till they lost no more weight, and the specific gravity corrected to a moisture content of 12 per cent., which is the accepted moisture content for seasoned woods. From this figure the weight per cubic foot was calculated, as it was possible in the great majority of cases only to deal with two specimens of each species, and these came from the same tree and the same part of that tree, the weight per cubic foot must be accepted as approximate.

I think the descriptions require little explanation, except, perhaps, those that record the results of the macroscopical examination, where the following explanation will assist the reader:—

"Ray" is a contraction for medullary or pith ray.

"Pore" is the synonym for vessel.

"Septate" means divided by a partition or partitions.

"Soft tissue" is the same as wood parenchyma—a jaw-breaker beloved of Xylologists.

The number of rays is given to the inch circumference; the number of pores to the square inch; both on the cross section. By "quarter grain" or "the quarter" the surface exposed by a quarter cut or radial cut is indicated. By "back grain" or "on the back," the surface exposed when the wood is backed off—cut tangentially—is indicated. The words "quarter" and "back" are those commonly used by timber folk to denote these two surfaces, and cuts in between the two extremes are known as "half quarter" or "half back." It will be noticed that while Mr. White† has been able, in the comparatively short time that has elapsed since he received the material, to identify a number of specimens, both generically and specifically. A number still await specific determination. Some of the material I sent him was not sufficient, or in too bad a condition for determination. Summing up the position, the last herbarium number is 811, and of these 226 have been fully identified by Mr. White; 136 have been determined generically, 27 having been given their family. There remain 125 specimens of which material has been collected which is insufficient for botanical determination. Finally, there are 220 blanks (125 of these were specimens lost on the Ramu, and 159 numbers between 441, end of Papuan collection, and 500, beginning New Guinea collection); 69 duplicate specimens, and eight numbers used twice and distinguished thus: "157" and "157A."

It will be seen that only the first step to a systematic botanical survey of our tree species has been made. I have tried to give all the information obtainable about the species, material of which was insufficient for botanical determination, so that, when this important section of the scientific knowledge of Papua is seriously undertaken, there should not be any difficulty in matching new material with mine. The macroscopic examination of timbers was carried out in cases of woods which were obviously not commercial timbers, but I had this idea in mind: the leaf and twig specimens are easily confounded, and the macroscopical details of a timber add an excellent check.

The same for water solutions of woods and barks, and the use of an iron salt re-agent. I found these a great help when I have been at a loss to separate two species otherwise similar. It is a thousand pities that the systematic work so ably begun by Sir William MacGregor in 1889 in Papua should have been allowed to drop, and that no steps were taken to describe the flora of Papua until Mr. White's visit in 1921. As for the Territory of New Guinea, the work of German scientists appears to have been wholly lost. It is to be hoped the botanical work will now continue until the bulk of the species is determined. The collection of botanical material from tall trees is always troublesome, but it is essential that this branch of the work be persevered in, for trees form a very large part of the flora of the Territory, besides being of more economic value as a rule. I wish it to be clear, also, that I am not a botanist, and my descriptions are purely notes such as a forester makes. A number of the species were found to be new, and have been scientifically described by Mr. White. The remainder of the determined species have already been botanically described, and those desirous of studying them should refer to the authorities. A bibliography of the literature bearing on the New Guinea flora will be found in Appendix.

The technology of the individual timbers of Papua is a subject that requires long and patient study. The number is so very great, and there are types allied to almost all the well-known timbers of the world. To say definitely this timber is good for one purpose, and that for another purpose, is not at present possible. In my notes I have indicated obvious qualities and defects; also I have stated whether the woods cut hard, firm, soft, and woolly. All such estimates are questions of comparison, and are not scientifically fixed physical characteristics. Indeed, in the hands of another, different results might be obtained. The only satisfactory way of testing the physical characteristics of timbers is to put them to use—it is a question of "eating

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* Appendix I.

† Gvvernment Botanist, Queensland.

the pudding." Very few New Guinea timbers have been tried, and the criterion for them has been very different from that of more developed countries. In New Guinea, what is looked for is a durable wood. Buildings which should be permanent are built of wood, and the owner naturally tries to find wood which will last as long as possible. Timbers that do not last are condemned as wholly bad, when, in reality, sometimes their only defect is to be less durable than others in a particularly bad climate for preserving wood. So we see ilimo condemned, and melila or kwila placed perhaps on a pinnacle it does not wholly deserve. While the positions would not be reversed were those two timbers to reach a market in a land where stone and steel are used for permanent works, and wood is only used in protected places under buildings and for ornamental and special uses, in such a market ilimo would, however, probably be as sought after as melila.

As a forerunner of testing timber by use, mechanical tests are of great value. These consist of tests of the strength of the wood in all directions, its hardness, its combustibility, its working qualities. Of the New Guinea timbers, only six have been tested,* and these were—

Ulabo ..	..	Afzelia bijuga ..	..	My. No.	10
Alaga ..	..	Pometia pinnata	..	,, ,,	5
Tamonau	..	Indt. ..	.. Possibly	,, ,,	137
Madave	..	Indt. ..	..	— —	—
Ilimo ..	..	Octomeles sumatrana		,, ,,	34
Kokoilo ..	..	Calophyllum inophyllum		,, ,,	209

Of the six, one—Madave—I have not traced. This is an Eastern Division native name, and I have not visited the forests of that part of Papua. Burnett† gives its Vailala synonym as "Oma," but I failed to find the tree there. I am a little doubtful about Tamonau being identical with my No. 137. In the absence of descriptions, it is quite impossible to be sure of any tree. The native names tend rather to confuse than to help. Mr. Mann carried out various exhaustive tests, and found that the weights of the timbers at 11-12 per cent. moisture were—

A. *Afzelia bijuga*	..	58.7 lbs. per cubic foot.
B. *Pometia pinnata*	..	39.4 lbs. per cubic foot.
C. *Calophyllum inophyllum*		38.6 lbs. per cubic foot.
D. *Octomeles sumatrana*	..	23.1 lbs. per cubic foot.

In bending, melila turned ont to be the best wood; then came *Calophyllum inophyllum,* then okamu, while ilimo was at the bottom of the list. Here is a summary of the tests—

Name.	No.	Cross Breaking Tests.		Compression Breaking Weight.	Tension Breaking Weight.	Shearing.
		Modulus of Rupture.	Modulus of Elasticity.			
Afzelia bijuga ..	10	16,485	2,084,250	9,522	15,750	2,120
Pometia pinnata ..	5	8,185	1,539,500	6,110	14,505	1,670
Calophyllum inophyllum	209	5,275	799,675	4,795	4,960	2,010
Octomeles sumatrana ..	34	4,736	795,900	3,550	5,300	882

In cross breaking, compression along the grain, tension along the grain, and shearing, the results are in pounds to the square inch. Both Calophyllum and Octomeles are weak timbers compared with Afzelia, but that is not to say that they are not as useful, or more so, for certain purposes. Calophyllum is almost as beautiful as cedar, and mortices and joins well; it is sought after for boat knees and crooks; while ilimo is an excellent lining, ceiling, and wainscot timber. Okamu has a very fine grain, and is light enough for all furniture work, and strong enough for all general structural purposes. The burning tests of these four timbers showed that the differences between them were slight; the charcoal tests turned out as shown in the following table:—

Afzelia	..	33.8 per cent. of charcoal
Pometia	..	21.0 per cent. of charcoal
Calophyllum	..	27.9 per cent. of charcoal
Octomeles	..	24.2 per cent. of charcoal

which are exactly what one could expect.

Mr. Mann's paper contains much valuable information, and his charts, diagrams, and photographs of fractures are most interesting. On page 36, he writes—

> "Papua contains a great variety of timber trees, the wood from which is of economic value; it is therefore essential that a botanical survey be undertaken, and a thorough investigation be entered upon in order to prove their usefulness for the great variety of purposes to which timber is applied."

I am in thorough agreement with Mr. Mann, and if the botanical work had only been persevered with, and the testing continued in the able way it had been begun, we should to-day be in a position to speak with authority about the physical characteristics of Papuan timbers.

Native Names in Papua.

A great confusion exists regarding the native names of trees. The very large number of languages spoken in New Guinea, combined with the enormous number of trees that are to be found, makes it very difficult to use the native names of trees as a means of identification. To a sojourner like myself, the muddle appears to be hopeless, for not only does each defined language-clan call the same tree by different names, but one hamlet within such a region will have names which differ from the names given these trees by the next hamlet. They seem to speak the same language, but have new names for trees. Even in the Northern Division, where the Binandere language is current, with slight variations, over a large area, one meets extraordinary differences in the names. In the case of people living in savannah forests on the edge of the rain forests there is an exchange of names. For instance: the people at Doura, on the Lower Vanapa, use Suku names. The Doura folk are not great bushmen, while the Suku people are proper mountain folk. I have set the name of the village that uses it against the name in my description, but I am not at all sure that I am right in all cases. The natives may have been unaware that the name was an imported one, or I may have been misinformed deliberately. So, in the vocabulary I have drawn up, the general locality in which the names are current has been indicated, instead of particular villages. The difficulty of common names for timbers is one that crops up in all new countries, and nowhere have I experienced so much trouble as in Papua. In most countries, while there may be six or more languages spoken by natives, there is a *lingua franca* that all understand and speak sufficiently for general usage. The native police, owing to their training barracks being situated in Port Moresby, have scattered a broken Motuan dialect through the Territory, and this may become a *lingua franca* in the course of time. At present, however, it does not appear to be as generally satisfactory as it might be, nor is it by any means a dialect that will carry the traveller anywhere. In the matter of tree names it is useless, for the particular people from whom "Police Motuan" has developed are the villages of Hanuabada on the sea, in the centre of the dry belt. Also, while some of the old folk know a few names of forest trees, the young generation is quite ignorant. Their callings do not take them into the forest. The old people use

* Some of the Properties of six Papuan Timbers. James Mann. Royal Society of Victoria. Vol. XXIV., Part 1, 1911.

† Gilbert Burnett. Timber Trees of the Territory of Papua.

names which were brought to them by the Koiari folk, I think. The police cannot learn the Motuan names of trees during their period of training, and so, with the exception of a few very common trees, they use their own country names for trees when talking to a white man, although the whole of the conversation is otherwise in Police Motuan. As examples of the confusion, I will give the names of some common trees—

Locality.	No. 34.	No. 10.	No. 4.	No. 5.
Motu of Galley Reach	Ilimo ..	Bedira	Nara ..	Okamu
Hanuabada Motu	Ilimo ..	Melila ..	Malava	Okamu
Buna Binendere ..	Benumba	Bendora	Taoro ..	Koiawa
Vailala	I-chea ..	Pira ..	Apa ..	Ohabu

Another tree, No. 57, *Cinnamomum massoia,* is called Asiru at Galley Beach, but the Motuans of Port Moresby call it Api-api. The only solution to the difficulty of local common names is, to my mind, the christening of the trees with an official native name. Take No. 10, for instance, which is *Afzelia bijuga;* this tree is known to every native in Papua under various names. To white folk it is known everywhere, I think, as Melila, though in the Delta Division a Goaribari native gave me "Bendora" as the white man's name for this tree. He had learnt it from a Northern police constable. "Ulabo," its Eastern Division name, is sometimes heard, but, generally speaking, from one end of Papua to the other, the white man calls it Melila. In the case of No. 4—*Pterocarpus indicus*—a wood the natives prize very much, for they make their drums of it, "Malava" would seem to be the accepted name. Ilimo has certainly come to stay, and Okamu is, I think, likely to be accepted in preference to Ohabu, though the latter runs it close in popularity with Europeans. These, then, are what might be termed the official native names, and it would be a great advantage if the list of such commonly used native names could be enlarged. The choice should, generally speaking, be one of ease of pronunciation. A number of Vailala noises for trees are hard to translate into our very cramped alphabet. Such things as "Oihihu"—No. 311—or "Ai-ihi"—No. 317—should not, I think, be perpetuated in the vocabulary of official tree names. The Northern "boys" are very good bushmen; they know their trees very well indeed, and their language is not such a gutteral mumbling as the Vailala speech. There are numbers of them in the police force, so I anticipate that, as time goes on, the Northern tree names, other than the Motuan ones I have already quoted, will become accepted. Until the full botanical survey is made, and the herbarium specimens named by the competent authority, together with wood and bark taken from the specimen tree, are available for examination in the museum of the Agricultural Department, it is quite hopeless to attempt to evolve any sort of order out of the chaotic babel of names.

There is another name that has to be considered, and that is the trade name. We can call a tree "Scotch fir" or "pine," or "Riga pine," or "Memel pine," but we sell it as "deal." There are twenty mahoganies on the market, but only two are obtained from true mahoganies. All the rest have grains that resemble mahogany. While stringy bark was sold from Tasmania as V.D.L. it fetched no price; when it was called "Australian oak" it enabled saw-millers to reap a pleasant profit. "Good wine needs no bush"; with timber it is a question of seeing that the right kind of bush is used. The hasty calling of a timber by the name of a thoroughly known, better wood, may condemn it for ever. The use of the names teak, oak, walnut, mahogany, cedar, with "Papuan," "Island," or "New Guinea" prefixed, should be used with caution. Personally, without seeing the timbers in use a great deal more than I have, I am not prepared to recommend trade names. No. 1—Damoni—has been sold as walnut, and it is proposed to sell No. 5—Okamu—as red walnut. Teak has been suggested as a trade name for melila, and there are several more engaging the attention of timber people. With the exception, perhaps, of ilimo, I do not think any of our native names would make good sellers. Whether No. 4—Malava—should be sold under its Indian name of "Padouk," which is well known on the markets of several countries, or under any of its trade names, such as rosewood (that is what it is called when exported from Burma), or mahogany, or redwood, or chalanga, as other lands call it, or be given a quite distinctive Papuan selling name, must be decided by the saw-millers of the future.

One thing should be avoided, and that is the criminal proceeding of labelling all woods either "soft" or "hard." More harm has been done in the Australian timber trade by selling seven to twelve different woods to one man for one job under the name of Australian hardwood. No two timbers are the same, and to ask a contractor to accept them as the same, and get his carpenters to work them all up as one timber, is to make quite certain of getting no further orders. The comparative ease with which Jarrah shoulders the Victorian hardwoods off the market is not only because of its merits—Victoria possesses as good, and better, woods—but because, thanks to a system of export brands, the purchaser is sure of getting timber true to name. It was rendered vitally necessary to Western Australia, owing to the similarity between Jarrah and Karri, and the saw-millers, to save themselves from themselves, arranged a system of branding, and got the Government to embody it in a regulation of the Forests Department, so that all timber leaving Western Australia is examined and branded "J" or "K" by an officer of the Forests Department. What was necessary in the case where only two timbers were being confused and sold together as one kind, is infinitely more important in the tropics, where the number of similar timbers is so great. With all the microscopic examination, and all aids that I can use, I have the greatest difficulty in separating some of them, and often the most troublesome come from different botanical families. The trees can be separated easily in such a case, but the timbers are very difficult. Yet both, though alike, are different; each expands and contracts at different rates and to a different degree, works differently, and possibly takes paint or polish differently. If both were used in say, the framing of a panel, or in a floor, trouble would ensue, and the Papuan hardwoods, as a whole, would be condemned at once. The presence of a good hoop pine and other real soft woods makes it doubly necessary to avoid labelling rubbishy, spongy woods of the lowlands by any name that can later on be confused with the timbers Australia wants, viz., pine.

The Mandated Territory boasts as many native names as Papua, and without labouring the subject I can only impress on the authorities the importance of establishing an official common name vocabulary. Here are the names most used by white people for the commonest trees in the Territory, and their origin:—

Common Name.	*Language of.*	*Botanical Name.*
Kwila	Rabaul	*Afzelia bijuga*
Irima	„	*Octomeles sumatrana*
Tun or Atun	„	*Pometia pinnata*
Lup or Alup	„	*Dracontomelum mangiferum.*
Ivanga	„	*Pterocarpus indicus*
Calophyllum	„	*Colophyllum inophyllum*
Galep	?	*Terminalia catappa*
Kamarere	Rabaul	*Eucalyptus Naudiniana*

That official tree names are not difficult to the native is shown by his adopting Calophyllum. The Germans must have taught him this name and it has stuck, false quantities and all.

FIELD NOTES DESCRIBING SPECIES.

Musci.

Dawsonia sp., Nos. 261, 523.

Soil covering in moss forests, 12 inches to 15 inches high.
Locality.—Trail from Kokoda to Gap and again from Gap to Uberi; at altitudes of 4,600 to 7,400 feet.
Date.—August.
Remarks.—Whole forest soil covered with this as you reach the moss forests. It is the distinctive moss all round the mountains of New Guinea, from 2,500 to 10,000 feet.
Material collected.—Plant.

Equisetaceae.

Equisetum sp., No. 784.

Leaves.—Usual "mares tail" type.
Locality.—Some river (4,000 feet).
Date.—December, 1924.
Remarks.—I saw this at about the same altitude under Mount Obree, in Papua.
Material collected.—Leaves.

Polypodiaceae.

Dryopyteris gongylodes, No. 255.

An aquatic clambering fern. Sends out stems into the water, which root on the floating masses formed by 254.
Locality.—Embi Lake.
Date.—August.
Remarks.—The floating islands are covered with this fern.
Material collected.—Leaf, stem, root.

Polypodium, No. 508.

A climbing fern epiphytic on green and dead timber.
Locality.—Sarawaket. Libocedrus-Dacrydium forests, 8,000 to 10,000 feet.
Date.—20th November, 1923.
Material collected.—Leaves, with spores.

Gleicheniaceae.

Gleichenia dichotoma, No. 549.

Climbing fern.
Locality.—Nomi River.
Date.—November, 1923.
Native name.—Tulong.
Remarks.—A common fern, with a wide range, from 2,000 to 10,000 feet. The first species to invade burnt forest.
Material collected.—Leaves.

Gnetaceae.

Gnetum gnemon affinities, Nos. 80, 242, 563.

A small tree, 18 inches girth; 25 feet overall. Not buttressed.
Leaves.—Simple, opposite, exstipulate, petiole, $\frac{1}{2}$ inch. Blade, 5 inches to 9 inches by $1\frac{3}{4}$ inches to $2\frac{1}{4}$ inches; elliptical or lanceolate. Glabrous. Thin.
Flowers.—Axillary spikes, $2\frac{1}{2}$ inches long.
Fruit.—Purple or plum coloured ellipsoidal drupes $1\frac{1}{2}$ inches long by $\frac{5}{8}$-inch middle diameter. Mezocarp, 1-16-inch to $\frac{1}{8}$-inch. Very thin endocarp. Kernel, 1 inch by 5-16-inch; also ellipsoidal.
Bark.—Grey, smooth, except for regularly set raised rings, 4 inches to 12 inches apart, caused by the growth and fall of opposite set branches. A distinct swelling takes place at junction of branch with trunk.
Locality.—Widespread in the coastal plains and up the foothills to 2,000 feet. Fruit collected, Veimauri; flowers, Hydrographer's Range in Northern Division.
Date.—Fruiting Veimauri, May; flowering, Hydrographer's, August.
Native names.—Tu-a (Suku), Suffitz (Yalu), Genda (Buna), Doro (Vailala and Kerema).
Remarks.—A useful tree. The leaves are used as a cabbage, and are quite a good substitute. The kernel of the nut is eaten. The bark contains a strong fibre used for making fishing nets and women's carrying nets. The Rev. Sturtzhoffeker, of the Markham mission, states that poles are good for wharf work in fresh water.
Material collected.—Leaves, fruits, flowers.

Coniferae.

Araucaria Cunninghamii (Ait.), Nos. 376, 639; Araucaria klinkii, No. 642; Dacrydium elatum, Nos. 404, 519, 567; Dacrydium falciforme, Nos. 397, 519; Libocedrus papuana, Nos. 381, 520; Phyllocladus hypophyllus, Nos. 359A, 518; Podocarpus amara Blume, Nos. 377, 552; Podocarpus cupressina (Syn. P. Imbricatus, B.C.), Nos. 269, 554; Podocarpus neriifolius Don., Nos. 275, 238; Aff. Podocarpus thevetiifolius Zippel, No. 357A; Podocarpus sp., No. 524.

Araucaria klinkii, No. 642.

A large tree, 9 feet in girth, and 150 feet overall. Branches whorled.
Leaves.—Very stiff, festooned at the extremities of the branches.
Bark.—$1\frac{1}{4}$ inch thick; dark reddish-brown; very rugged. Inner bark at first a rich red, but deeper is a pink. Exudes resin copiously. Solution, colourless; no precipitate.
Wood.—Yellow, uniform, axes well. Pockets of resin occur in the wood where injuries have occurred.
Rays.—Indistinct; rather coarse, 90 rays to the inch. Show up as slightly darker yellow oblongs on quarter, 1-50-inch deep. General.—An even grained, compact wood. The general colour is a pale yellow with alternating rings of slightly darker yellow. These rings are irregularly spaced, and are not seasonal. Weighs 38 lb. per cubic foot. Solution, colourless; no precipitate.
Locality.—Ongoruna, 2,000 feet.
Date.—February, 1924.
Native names.—Rassu (Ongoruna), Pai (Waria).
Remarks.—This species is more conspicuous than A. Cunninghami, which grows in the same locality, but not socially with it. Its conspicuousness is due, not only to its occupancy of the skyline ridges and mountain crests for Cunningham's tree chooses the same sites, but to the tufts of leaves at the end of the branches. It is common between 2,000 and 3,000 feet behind Finschhafen and at the same elevation on the hills of the upper Ramu. It has been reported to me from the Waria and the Gold-fields behind the Huon Gulf.

Araucaria Cunninghamii Ait., No. 376.

The largest tree of the mountains of Papua; 16 feet in girth, and 150 feet overall. Bole up to 80 feet.

Fruit.—Cones.

Bark.—$\frac{3}{4}$ inch to 1 inch; dark-grown; very scaly, peeling off in thickish papery layers, horizontally, giving the bole a ringed appearance; more often than not the half-shed bark hangs raggedly to the bole. Inner bark mottled brown and white. Exudes a white opaque resin. Solution, colourless; faint precipitate.

Wood.—Streaked white and yellow.

Rays.—200. Very indistinct, about 1-100 inch deep. Show up on quarter slightly darker yellow. General.—A light-yellow, uniform wood. Solution wood: colourless; no precipitate. Cuts rather hard. 35 lb. per cubic foot.

Locality.—While a few trees were found as low as 3,500 feet, the lower limit of the main belt of hoop pine would appear to be 4,000 feet; between this and 5,200 feet trees were scarce, but between 5,200 feet and 8,000 feet, on the spurs of Mount Obree, they were plentiful. Here they are the conspicuous trees of the forest, standing well above the surrounding trees, and always occupying the sky line on ridges and spurs. It would seem the Pict or Scot of the forest world driven to grow on stony precipitous ridges, and to leave the better soil and easier slopes to its broad-leafed brethren. On the southern side of the range, between the Nornu river, near Obree and Mount Victoria, there are only scattered hoop pines here and there. This may be due to the influence of the dry belt. It is common all along the ranges on each side of the Ramu Markham Valley, from 1,500 feet to 4,000 feet.

Date.—February, 1923.

Native names.—Yau (Kemp Welsh people). Also on the hills and mountains that close in the Ramu.

Material collected.—Leaves, of mature trees and seedling tree, cones, wood, and bark.

Podocarpus Amara Blume, Nos. 377 and 552.

A large tree, 10 feet by 80 feet bole by 110 over all. No buttresses.

Leaves.—Podocarp type up to $8\frac{1}{2}$ inches by $\frac{1}{2}$ inch. Branches whorled.

Flowers.—Immature.

Bark.—$\frac{1}{2}$ inch thick, a dark-brown, scaly, scales lying close and shedding in irregular patches. Inner bark light-brown, speckled white. Solution, tawney red; dark-green precipitate.

Wood.—Sap $2\frac{1}{2}$ inches, yellow, heart a light red-brown.

Rays.—100, fine, straight or only slightly wavy; less than 1-100 inch deep, and show up as wavy lines on quarter. Pores.—Absent. Soft tissue.—Absent. General.—A fine close-grained yellow wood. Seasonal (?) rings streak it darker and lighter yellow. Sol. wood: colourless; no precipitate. Cuts firm to hard. 38 lb. per cubic foot.

Locality.—This pine occurs in the same locality as hoop pine, but has a wider range across the Owen Stanley Range, behind the dry belt. The largest trees were met with on the spur running from Mt. Obree to the village of Laruni at an altitude of 7,000 feet.

Date.—23rd February.

Native name.—Teo (Laruni).

Remarks.—A sound, firm pine, wide range above 6,000 feet.

Material collected.—Leaves, immature flowers, bark, wood.

Podocarpus cupressina R. Br. (syn. *P. imbricatus* Br.), Nos. 269, 554.

Large tree, 8 feet girth, 80 feet of bole and 120 feet over all.

Leaves.—Characteristic Taxus type.

Flowers.—Unfortunately unable to find fruit and flowers.

Fruit.—As above.

Bark.—Cinnamon to purple brown, scaly. Inner bark yellow-brown. Solution, faint yellow. No precipitate.

Wood.—A clear white timber with a band now and then of pale yellow wood.

Rays.—Clear, 300, very pale yellow, wavy, very indistinct on quarter. General.—A clear white coniferous timber showing little or no grain. Does not appear to be resinous. Solution wood; colourless; no precipitate. Cuts firm to a little hard. 29 to 37 lb. per cubic foot.

Locality.—5,000 feet up on the Owen Stanley Range on trail between Kokoda and Gap, and again on the spurs on the western side of the range down to an altitude of 3,500 feet. Here, however, the trees were small. Some fine specimens at 7,000 feet on Mt. Obree. Common on the lower slopes of Sarawaket.

Date.—Collected in August.

Native name.—Mutzu mutsu.

Remarks.—The wood cuts easily, and should work well. It has a long fibre, pulps well, and should make a good mechanical newsprint pulp.

Material collected.—Leaves, wood, bark.

Podocarpus neriifolius Don, Nos. 238 and 275.

Medium tree, $7\frac{1}{2}$ feet girth and 50 feet bole. 100 feet over all. No buttresses. Branches very horizontal.

Leaves.—Simple, alternate. Petiole, $\frac{1}{4}$ inch. Blade, 4 to $6\frac{1}{2}$ by $\frac{5}{8}$ to $\frac{13}{16}$ inch. Linear-lanceolate, acuminate, slightly twisted from petiole to tip. Venation invisible. Glabrous, coriaceous. Twig green, longitudinally grooved.

Flowers.—Sessile in groups of three in the leaf axile.

Fruit.—Axillary, characteristic.

Bark.—Cinnamon brown to nigger, scaly. Scales longitudinal, narrow. Fibres often twisted so that bark is spirally lined. Inner bark red-brown. Solution faint yellow. Green precipitate.

Wood.—Oregon yellow, traversed with straw yellow rings, which show up as longitudinal lines on the quarter.

Rays.—450-500. Very fine and indistinct on cross section. 1-60th inch deep; show up as faint lines on quarter. A number of red-brown resin ducts are visible in a translucent section. Soft tissue.—Absent. General.—A yellow and white close-grained coniferous wood. Solution wood: colourless; no precipitate. 34 lb. per cubic foot.

Locality.—Hydrographer foot hills and foot hills of Owen Stanley Range, both sides, at about 600 to 1,500 feet.

Date.—Flowers in August in Hydrographer's Range.

Native names.—Rasara (Horonda), Hera Kaika (Vailala).

Remarks.—A useful coniferous timber. Found it in various parts at low levels, e.g., Baroi River, but it is rare.

Material collected.—Leaves, flowers, buds, wood, bark; immature fruit.

Affin. *Podocarpus thevetiifolius* Zippel, No. 357A.

A small tree, 4 feet girth, with a bole of 50 feet, and 70 feet over all.

Leaves.—Typical Podocarpus leaf, up to 2 inches by $\frac{3}{8}$ inch.

Flowers.—Immature.

Bark.—Light-brown, somewhat fibrous. Inner bark lighter brown. Solution pale brown. Green precipitate.

Wood.—Sap undefined, streaked white and yellow.

Rays.—So fine as to be uncountable; show up as minute lines on quarter. General.—A pale yellow wood showing no grain. Solution wood: colourless; no precipitate. Cuts soft and clean. 45 lb. per cubic feet.

Locality.—5,500 feet to 10,300 feet. Mt. Obree.

Date.—January, 1923.

Remarks.—At the top of Mt. Obree, 10,300 feet, this tree forms 50 per cent. of the stocking, and here it becomes very dwarfed in height and in girth.

Material collected.—Leaves, immature flowers, bark, wood.

Podocarpus sp., No. 524.

A medium tree, 4 feet in girth; a bole of 50 feet, and 80 feet over all.

Leaves.—Characteristic podocarp leaves.

Bark.—Less than $\frac{1}{4}$ inch thick, brown, longitudinally lined, usually spirally. Inner bark salmon pink. Solution colourless; pale green precipitate.

Wood.—Sap undefined; yellow. Rays.—2,500 to the inch, very fine and hard to distinguish on the quarter. General.—A dense even-grained wood showing unequal irregular rings of pale and darker yellow. Cuts firmly. Solution colourless; no precipitate.

Locality.—Moss Forest, Mongi Valley, 8,000 feet. Below Sarawaket.

Material collected.—Leaves, wood, and bark.

Dacrydium elatum Wall, Nos. 404, 567.

A tree, 8 feet girth, with a bole of 60 feet, and attaining an overall height of 90 feet; but as a rule, more slender; old trees develop grooves for a height of 12 feet from the butt.

Leaves.—Very larch-like, drooping, soft.

Bark.—$\frac{1}{4}$ inch thick, mauve-brown, pustular; scaly, sheds in jig-saw patterns. Inner bark, red. It exudes a resin sparingly. Solution, weak tea; no precipitate.

Wood.—Sap undefined, yellow.

Rays.—Too fine to count on cross section, but they show up indistinctly on the quarter, 1-80 inch deep.

General.—A pale yellow wood streaked with darker yellow, close-grained, and uniform. Cuts rather hard, and weighs 36 lb. to the cubic foot. Solution, faint mauve; no precipitate.

Locality.—Iongey divide between Adai and Naro, 4,000 feet.

Date.—November, 1923, and February.

Native name.—Belitzi (Ogeramnagn).

Remarks.—Young trees are in demand for the various stations of the Lutheran Mission for Christmas trees.

Material collected.—Leaves, wood, bark.

Dacrydium falciforme Pilger, Nos. 397, 519.

Have only seen trees 6 inches girth and 20 feet high. Natives say it grows to a big tree.

Bark.—Solution, very faint yellow; green precipitate.

Rays.—Very fine, uncountable, being nearly same colour as the wood; show up a little on quarter as fine streaks. Numerous minute resin ducts filled with dark resin occur. Soft tissue.—Absent. General.—A pale yellow wood showing no grain. Sol. wood: colourless; very slight green precipitate. Cuts hard. 41 lb. per cubic foot.

Locality.—Top of ridge between Adai and Tuhui Rivers.

Date.—February, 1923.

Native name.—Olong (Ogeramnang).

Remarks.—Scarce. On the slopes of Mt. Sarawaket it, or a tree very like it, flourishes between 9,000 and 10,000 feet, and makes a fine upstanding tree.

Material collected.—Leaves, bark, and wood.

Libocedrus papuana, F. v. M., Nos. 520, 381.

A large tree, 7 ft. 6 in. girth, a bole of 60 feet, and 90 feet over all.

Leaves.—Very cypress like, glaucous beneath. Seedling leaves very much larger than those of mature trees, and more glaucous.

Bark.—$\frac{1}{4}$ inch thick, dark-brown when wet, grey-brown when dry. (Usually wet.) Flatly ridged, ridges about 1 inch wide. Inner bark creamy-pink. Sparsely resinous. Solution, rose; strong green precipitate.

Wood.—Sap $1\frac{1}{2}$ inches, yellow. Heart a rich brown.

Rays.—150 to 200, brown, somewhat sinuous, exceedingly hard to see except in translucent section, 1-50 inch deep; show up as little brown specks and streaks on quarter. Soft tissue.—Absent. General.—A yellow-brown wood. Showing rings of yellow and brown on cross but very little grain on other sections. Solution wood: colourless; brown precipitate. Cuts rather hard but clean. 37 lb. per cubic foot.

Locality.—Owen Stanley Range, 8,000 to 10,000 feet. Common on the Mt. Obree-Laruni spur, and along the main divide. At the higher altitudes it is much dwarfed. Fine specimens on Sarawaket.

Date.—February, 1923.

Native name.—Kumtsu (Ogeramnagn).

Remarks.—A good pine timber, but not as plentiful as the other Coniferæ. It is smooth working, and cuts rather soft, but is really a firm wood.

Material collected.—Leaves, bark, wood.

Phyllocladus hypophyllus Hook, Nos. 518, 359A.

A large short-boled tree, 16 feet girth, 30 feet of bole, and 50 feet over all.

Leaves.—Phylloclads.

Bark.—1 inch thick, a very dark red-brown, almost black, rough, ridged, scaly. Inner bark yellow-brown. Solution, tawny; blue precipitate.

Wood.—Sap undefined, white and yellow, in concentric rings.

Rays.—Very fine and hard to count, 170 to 200 to the inch. Do not show up on quarter. General.—A compact firm wood, yellow, with rings of darker yellow here and there. Solution wood: colourless; no precipitate. Cuts rather hard. 35 lb. per cubic foot.

Locality.—Mt. Obree and main Owen Stanley Range. It occurs at the upper limits of the Hoop pine belt, viz., about 7,000 feet, and reaches its largest dimensions at about 7,500 feet, and continues up to 9,000 feet, but here it is rarely over 5 ft. 6 in. girth and 25 feet over all.
Date.—February, 1923.
Native names.—Eo (Laruni), Mana (Menari), Dede (Ogeramnagn).
Remarks.—A good pine timber. On Sarawaket it grew a 60-ft. bole, and attained 100 feet over all. It was wide branching and apt to lean over.
Material collected.—Leaves, wood, bark.

PANDANACEAE.

Freycinetia sp., No. 236; Freycinetia angustissima Ridl., No. 410.

Freycinetia angustissima Ridl., No. 410.

The Mountain Freycinetia.
Locality.—Between Adai and Naro Rivers. Its range is extremely wide in the mountains. From 4,500 feet to 10,300 feet, and all over the Owen Stanley Range between those heights.
Date.—February, 1923.
Remarks.—Probably extends higher, but 10,300 feet is as high as I have been as yet.
Material collected.—Leaves and fruits.

Freycinetia sp., No. 236.

A climber attaining 30 or 40 feet. Stem up to $1\frac{1}{2}$ inches diameter. Sends down aerial roots from all parts of stem.
Leaves.—Simple, alternate, $\frac{1}{3}$ ranked. Sessile. Base of leaf encloses stem. Blade, 6 inches to 12 inches by $1\frac{1}{8}$ inches to $1\frac{1}{4}$ inches. Linear, acuminate. Margin and midribs armed with forward pointed spines for a distance of $1\frac{1}{2}$ inches from base of leaf. Marginal spines wear down, leaving only 1 inch at tip spiney, but spines on midrib and on margin at base persist. Apparently an aid to climbing. Coriaceous, parallel veined. Dark green, shiny above; pale green below. The branches are pendulous and apparently monopodial and are armed at nodes with strong curved spines $\frac{1}{8}$ inch.
Flowers.—Unisexual; only male flowers seen. Apparently infra axillary, possibly burst through leaf axils, and are really axillary. Male flower: acyclic, about 37 bracts arranged in $\frac{1}{3}$ inch philotaxy. The basal ones are similar to young leaves, green and armed on margin and tip with spines. The older ones, viz., those higher up, are carmen coloured, the marginal spines are greatly reduced or are absent, and the point of the bract is green and mucronate. The highest of all have no marginal spines, and the apical spines are reduced and are no longer prominent, and are of the same colour—carmen—as the rest of the bract. 4 inches by $2\frac{1}{2}$ inches, triangular, apiculate, parallel veined, coriaceous.
A 3-in. synandria, each 3 inches long. Lower half white, oval section $\frac{1}{4}$ inch by $\frac{3}{16}$ inch diameter, bearing stamens. Filaments green, $\frac{1}{16}$ inch. Anthers yellow, dorsifixed, $\frac{3}{64}$ inch.
Locality.—All through Rain forests from sea-level to 6,000 feet or beginning of Moss forests.
Date.—Flowers in Hydrographer's Range in August.
Native name.—Anderi (Buna).

Remarks.—The aerial roots are the favorite fibre used for making armlets and leglets.
Material collected.—Leaves and flowers.

GRAMINEAE.

Sacharum sp., No. 654; Deschampsia caespitosa Beauv., No. 503; Indt., No. 409. Indt. No. 254.

Saccharum sp., No. 654.

Locality.—Ramu, near the village of Cohu.
Date.—March, 1924.
Remarks.—This grass takes up all the marshy land, and in March and April the banks of the Ramu and low-lying land of the valley is white with the tasselled tops of this species.
Material collected.—Only one specimen.

Deschampsia caespitosa Beauv., No. 503.

Grass.
Locality.—Sarawaket, 7,000 to 13,500 feet.
Remarks.—It covers the summit of the Finisterre Range, and clothes the valleys at elevations as low as 7,000 feet. Its rhizomes stand out from the ground black and branched. It is annually burnt by hunting parties of natives.
Material collected.—Leaves, stem, and roots.

Indt., No. 409.

Bamboo of mountains. Stem up to 1 inch diameter.
Locality.—Between Adai and Naro Rivers, but it is to be found everywhere, from 3,000 feet to the very top of the Owen Stanley Range.
Date.—February, 1923.
Remarks.—It is the most provoking barrier to climbing the mountains. It forms quite dense thickets, and is hard to slash.
Material collected.—Leaves and flowers.

No. 254.

This plant germinates on the upturned roots of sisum. It makes a very large mass of roots, apparently quite out of proportion to the size of the aerial part of the plant. These root masses, with the sedge growing, float. The specific gravity of the whole is very nearly that of water, just sufficiently less to enable the mass to float and carry not only its own shoots, but other vegetation, viz., 250 Nymphaea, and 255 Dryopteris. On pulling the root masses to pieces they are found to be full of humus and air.
Locality.—Embi Lake.
Date.—August.
Remarks.—This sedge seems to be the most important factor in the formation of these floating islands.
Material collected.—Whole plant.

PALMAE.

Calamus sp., No. 395; Calyptrocalyx sp., No. 312; Arenga gracilicaulis Bail., No. 313; Caryota sp., No. 314; Indt., No. 315; Livistona sp., No. 332; Indt., No. 400; Indt., No. 311.

Arenga gracilicaulis Bail., No. 313.

A medium palm, 25 feet tall, with a $5\frac{1}{2}$ inch diameter.
Fruit.—On stout stiff spikes, 2 feet long and $\frac{1}{4}$ inch thick, arising from a very stout main stalk. Round, pale pink and white, $\frac{7}{8}$ inch diameter, containing three very dark brown flattened-on-one-side seeds.
Wood.—Pale pink, traversed by very dark brown or black fibres.

Bark.—Brown, but stripped it is green, streaked with the dark-brown fibres.
Locality.—Baroi.
Date.—November.
Remarks.—Kurabea (Vailala). Used sometimes for house posts. Durability, one and a half years.
Material collected.—Leaves, fruit, stem.

Calamus sp., No. 395.

A rattan, 85 feet long and diameter of $\frac{3}{8}$ inch only.
Locality.—Owen Stanley Range. 3,500 feet to 10,000 feet.
Date.—February, 1923.
Material collected.—Leaves and fruit.

Calyptrocalyx sp., No. 312.

A medium-sized palm, 30 feet high at most, and $3\frac{1}{2}$ inches in diameter.
Fruit.—This is borne on stout 3 feet pendant spikes, which hang from a panicle of spikes. It is red and showy, $2\frac{1}{4}$ inches by 1 inch diameter, and contains a white seed, 1 inch by $\frac{1}{2}$ inch. This is eaten when betel nut cannot be got.
Bark.—On scraping off moss it is found to be brown.
Wood.—Brown with yellow fibres.
Locality.—Baroi.
Native name.—Apu-me-here (Vailala).
Date.—November.
Remarks.—Good spears are made from this palm.
Material collected.—Leaves, fruit, portion of stem.

Caryota sp., No. 314.

A tall palm, 75 feet high and 9 inches diameter.
Leaves.—Maiden hair pinnate.
Fruit.—Globose, $\frac{3}{4}$ inch diameter, containing one seed.
Bark.—Brown.
Wood.—Pale, streaked with very dark brown, or black, fibres.
Locality.—Baroi.
Date.—November.
Native name.—Aporo (Vailala).
Remarks.—Used for flooring, and by the Koiari and other tribes to make spears.
Material collected.—Leaves, fruit, stem.

Livistona sp., No. 332.

A very graceful palm, attaining 50 feet, with a straight stem 6 inches diameter at butt. The crown of leaves arises from the apex in a very symmetrical manner, and the long stalks, terminating in circular fan-like blades, make this palm particularly ornamental.
Leaves.—Stalk 5 feet to 8 feet long; half round; 2 inches wide at base and covered for 1 foot from base with short spikes pointing backwards. The blade is circular, and 6 to 7 feet in diameter. The stalk is set pretty well in the centre, and the blade is open here to the tip of the stalk. The remainder of the blade is entire for a radius of 2 feet, and then divides to the circumference into an indefinite number of points about 2 feet long.
Fruit.—On pendant stalk 5 feet long; red; globose; $1\frac{1}{2}$ inches diameter.
Stem.—Grey-brown. The wood is pale-pink, except on the outside for 1 inch, when the fibres are dark-brown.
Locality.—Hills inland from Vailala River.
Date.—December, 1922.
Native name.—Poioro (Vailala).
Remarks.—This palm is much prized by the natives, who say that two trees are sufficient to yield enough leaves to thatch a house.
Material collected.—Leaves, fruit, and stem.

Indt., No. 400.

Mountain palm. Does not make an aerial shoot or stem, but has a rosette of large leaves sprouting from the ground.
Leaves.—Pinnate, up to 8 feet long; leaflets up to 14 inches, and $\frac{1}{2}$ inch wide.
Flowers.—Rachis, 24 inches, bearing five or six spikes of sessile flowers.
Fruit.—Globose, orange-red when fully ripe, shiny, $\frac{1}{2}$ inch diameter.
Locality.—Between Nornu and Naro Rivers. This palm has a wide range at high altitudes, as I found it everywhere between 3,500 to 10,300 feet on the Owen Stanley Range.
Material collected.—Flowers and fruit.

Indt., No. 311.

A tall palm, 75 feet high and 9 inches diameter.
Fruit.—On the 24-in. spikes of a large weeping panicle are an infinite number of little sessile corrugated capsules, $\frac{3}{8}$ inch x $\frac{1}{8}$ inch, each containing one white seed, about the shape and size of a large grain of cleaned rice.
Bark.—On scraping the moss-covered surface, it is a deep-brown or black.
Wood.—Reddish, with yellow fibres.
Locality.—Baroi.
Date.—November.
Native name.—Di-hi-hu (Vailala).
Remarks.—The stems are split and laid down as flooring in the houses.
Material collected.—Leaves, fruit, portion of stem.

Indt., No. 315.

A tall palm, 75 feet, with a diameter of 8 inches.
Fruit.—Green, oval; 3 inches x $1\frac{3}{4}$ inches, containing one seed 1 inch x $1\frac{1}{4}$ inches. On 24-in. stiff spikes arising from a main stalk, which is stout and stiff.
Bark.—Brown; inner bark red, streaked with yellow fibre.
Wood.—Pale pink, streaked with yellow fibres; very soft at centre.
Locality.—Baroi.
Date.—November.
Native name.—Doporo (Vailala).
Remarks.—Seed eaten when betel lacking; wood used for house flooring.
Material collected.—Leaves, fruit, stem.

Araceae.

Epipremnum Zippelianum, No. 401; Pistia stratiotes, No. 256.

Epipremnum Zippelianum, No. 401.

Leaves.—Simple; so deeply pinnatafid as to appear to be a compound pinnate.
Flowers.—Large, bright yellow.
Locality.—Between Nornu and Naro Rivers; 4,000 feet.
Date.—February, 1923.
Remarks.—This very showy flowered climber is common, and has a wide range. It does not appear, however, to flower often.
Material collected.—Leaf and flowers.

Pistia stratiotes Linn, No. 256.

A floating weed to be found singly or in small numbers scattered all over the surface of the lake. Along the edges it occurs in much greater

profusion between the leaves of the water lilies and 253 Sisum, 254 Cyperus, 255 Dryopterus. This plant seems to send out lateral shoots from which new plants develop, then break off and float away. They appear also to propagate from seed, for freshly germinated very young plants were found on the root masses of 254.
Locality.—Embi Lake. Found also floating down the Sepik, and in still lagoons behind the banks of that river.
Date.—August.
Remarks.—The roots are cooked and fed to his mistress by a native desirous of increasing the lady's affection.

FLAGELLARACEAE.

Sisum sp. (Prob. *S. anthelminticum*), No. 253.

Large plant, 6 feet high.
Leaves.—A large cluster, 6 feet long.
Stem.—The main stem puts out these clusters of leaves and also puts out fresh shoots into the water, and these bear new clusters of leaves. When the growth of a new shoot extends out into deep water the weight of the leaf cluster is apt to over-balance the shoot, so that it is turned up above water with its roots uppermost. On the root surface thus exposed there germinates 254 Cyperus, and intertwined with both is 255 Dryopterus, while floating around them is 256 Bistia. The vegetation thus formed, through some cause which was not at all clear to me, detaches itself from the banks in pieces up to 50 yards square, and then floats about, carried by the faint current towards the mouth of the lake, until it disintegrates or goes aground. The presence of floating islands has given rise to a number of superstitions connected with Embi Lake, so that my investigations of its flora were rather hampered.
Material collected.—Leaves, flowers.

LILIACEAE.

Dracaena angustifolia Roxb., No. 632.

A little tree, rarely more than 12 feet high and 20 inches in girth.
Leaves.—Linear.
Flowers.—Cream.
Bark.—Grey.
Locality.—Yonombo.
Date.—15th February, 1924.
Native names.—Nanage (Moontu), Wane (Yonombo).
Remarks.—A very common undergrowth in rain forests and foot-hill forest to 5,000 feet.
Material collected.—Leaves, flowers.

IRIDACEAE.

Libertia pulchella Spreng, No. 507.

Plant up to 10 inches high.
Flowers.—White.
Locality.—Salawaket, 8-10,000 feet.
Date.—23rd November.
Remarks.—A common object in the Libocedrus-Dacrydium forest.
Material collected.—Leaves and flowers.

ZINGIBERACEAE.

Eriolopha, No. 268.

A plant 2 ft. 6 in. high.
Flowers.—A pretty shade of orange yellow.
Fruit.—Yellow capsule, containing a large number of red arilled seeds.
Locality.—Trail to Gap from Kokoda, at an altitude of 4,000 to 7,400 feet.
Material collected.—Leaves and flowers.

ORCHIDACEAE.

Calanthe flabelliformis, No. 433; Calanthe sp., No. 411; Calanthe latissimoformis Rogers, No. 426A; Ceratostylis calceiformis Rogers, No. 361; Dendrobium bilamellatum Rogers, No. 408; Dendrobium Lane Poolei Rogers, No. 406; Dendrobium Delphinioides, No. 394; Epiblastus tuberculatus Rogers No. 373; Oberonia oblonga Rogers, No. 414; Phalaenopsis amabilis Bl. var. Papuana schltr., No. 807; Spathoglottis Lane-Poolei Rogers, No. 249; Indt. Nos. 526, 529, 262.

Calanthe flabelliformis Rogers, No. 433.

Orchid. Terrestrial. 4 feet high.
Leaves.—Large.
Flowers.—White, exceedingly ornamental.
Locality.—Uberi, in wet, swampy river-side country.
Date.—February, 1923.
Remarks.—The most arresting orchid I have seen in Papua.
Material collected.—Flowers and leaves.

Calanthe sp., No. 411.

Orchid. Epiphyte, mossy forests.
Flowers.—Yellow.
Locality.—Between Adai and Naro Rivers.
Date.—February, 1923.
Remarks.—Common.
Material collected.—Leaves and flowers.

Calanthe latissimiformis, Rogers, No. 426A.

Ceratostylis calceiformis Rogers, No. 361.

Orchid. With grass-like stem and minute white flowers.
Locality.—Owen Stanley Range. Mt. Obree, 8,000 to 10,300 feet altitudes. On trunks of trees in the moss forests.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Dendrobium Lane-Poolei Rogers, No. 406.

Orchid. Epiphyte on moss covered trunks.
Flowers.—Orange yellow pendant.
Locality.—Between Adai and Naro; 6,000 to 7,800 feet.
Date.—February, 1923.
Remarks.—Common, conspicuous orchid of the lower elevations of the mossy forests.
Material collected.—Flowers and leaves.

Dendrobium delphinioides, No. 394.

Orchid. Epiphytic on tree trunks.
Flowers.—Red, pendant.
Locality.—Owen Stanley Range, 5,000 feet, near Laruni.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Dendrobium caliculimentum Rogers, No. 265.

An epiphytic orchid, hanging in 3 feet to 4 feet pendant stems.
Flowers.—Ornamental, dark rose at base, pale rose at tips. Reminds on of the Cape heaths.
Locality.—6,000 feet on trail between Kokoda and the Gap.
Date.—Flowers in August.
Remarks.—A beautiful orchid.

Dendrobium bilamellatum Rogers, No. 408.

Epiphyte of the mossy forests.
Flowers.—Dark mauve main labium with orange tip; rest mauve.
Locality.—Between Adai and Naro in mossy forests; 7,800 feet.
Material collected.—Leaves and flowers.

Epiblastus tuberculatus Rogers, No. 373.

A red-ground orchid.
Locality.—6,400 feet on Owen Stanley Range.
Material collected.—Leaves and flowers.

Oberonia oblonga Rogers No. 414.

Orchid. Epiphyte.
Flowers.—Pendant spikes of minute brown flowers.
Locality.—Between Adai and Naro. 6,000 feet.
Date.—February, 1923.
Remarks.—Very scarce; only one plant seen.
Material collected.—Leaves and one flower.

Phalaenopsis amabilis Bl. var. Papuana Schlt., No. 807.

Orchid epiphyte on a Pometia.
Flowers.—White, 3½ inches across. The largest orchid I have seen in the Territory.
Locality.—Kundam.
Date.—26th August.
Material collected.—Leaves, flowers, roots.

Spathoglottis Lane-Poolei Rogers, No. 249.

Epiphytic on fallen sago in Embi Lake.
Main flower axis 4 feet high, apparently monopodium; woody.
Leaves.—4 ft. 6 in. x 3 inches.
Date.—August, 1922.
Material collected.—Leaves, flowers, fruits, roots.

Orchid epiphyte, Indt., No. 526.

Flowers.—Pitcher shaped, red base and yellow lip.
Locality.—Nomi-Ake divide. Sarawaket, 7,000 feet.
Date.—23rd November.
Material collected.—Leaves, roots, flowers.

Indt., No. 529.

A ground orchid.
Flowers.—Purple.
Locality.—Edge of limestone precipice above Nomi River, 7,000 feet.
Date.—23rd November.
Material collected.—Leaves and flowers.

Indt., No. 262.

A ground orchid.
Locality.—5,000 to 6,000 feet, Owen Stanley Range on trail from Kokoda to Gap.
Date.—Flowers in August.
Material collected.—Plant with flowers.

Casuarinae.

Casuarina nodiflorum, No. 426.

A medium tree, 7 feet girth, 35 feet bole, 65 feet overall; no buttresses.
Leaves.—Characteristic casuarina leaf.
Fruit.—Characteristic casuarina fruit.
Bark.—Solution rose, green precipitate.
Wood Rays.—Very conspicuous. (1) Coarse, 8, light brown; these are up to 1-40th inch wide and 7-10th inch deep; show up as loud silver grain on quarter and lozenges on back. (2) Fine, 200 to the inch. Pores.—Clear, 500 to 1,000 single, irregularly, scattered, and in short sinuous radial chains. Soft tissue.—Fine ladder rungs connecting up rays, about 100 to the inch. General.—A pale yellow timber, with strong bold figure; solution wood, colourless, green precipitate; cuts hard, and the sections curl up and are difficult to examine; 70 lb. per cubic foot.
Locality.—Between Menari and Efogi, at an altitude of between 4,000 and 5,000 feet. On one side of a hill it is growing in grass lands in association with *Euc. tereticornis,* on the other it is buried in a rain forest-clothed ravine. It has a wide range all through the uplands of both Territories, As much at home on Upper Ramu as Upper Purari.
Material collected.—Leaves with fruits attached, bark, wood.

Piperaceae.

Piper sp., No. 545.

Small tree, 15 feet high.
Locality.—Nomi River, 5,000 feet.
Date.—23rd November.
Remarks.—A common undergrowth in damp places. It has a wide range, from sea-level to 6,000 feet. The natives prefer the climbing Piper to this one as a betel pepper.
Material collected.—Leaves, flowers.

Fagaceae.

Quercus Junghuhnii Miq., Nos. 219, 427, 570; Quercus lamponga Miq., Nos. 418, 585; Quercus pseudomolucca Bl., Nos. 228, 117; Quercus spicata Smith, var. depressa King, Nos. 270, 425, 582.

Quercus Junghuhnii, Nos. 219, 427, 570.

Medium tree, 6½ feet girth and 50 feet bole. No buttresses, but base of trunk often grooved and sometimes surrounded by a skirt of stool shoots.
Leaves.—Simple, alternate. Petiole, ½ inch; blade, 2½ to 5¼ inches x ⅝ to 1¼ inches. Very acuminate. Broadly serrate for half length from tip. Green, shiny above, glaucous, with coppery tint below. Midribs, prominent, yellow. Veins, distinct, glaubrous, and more or less coriaceous. Twig covered with lenticels.
Flowers.—Erect axillary at end of branchlets.
Fruit.—A green, silky, scaly (scales projecting 1-10th inch) cupule, which splits down and allows a conical brown nut to emerge. The nut is covered with a felt of fine brown hairs ⅝ inch by 5-16th inch diameter. Within, it is silken coated.
Bark.—Grey. Partly flatly ridged, partly longitudinally lined. Inner bark cinnamon-brown, traversed by wide medullary rays. Solution, tawny; strong blue precipitate.
Wood.—Sap ill-defined; yellow-brown, darkening to brown.
Rays.—Very conspicuous. Coarse and fine. There are seven coarse, which are really bundles of twelve to twenty fine ones. These are up to 1-20th inch broad and up to ¾ inch deep; quite straight. Show up as loud silver grain on quarter. The fine ones are most irregular in distance apart; 300 to 450 to the inch, about 1-120th inch deep, and they show up as fine rippling lines on quarter. Pores.—Conspicuous, 2,000 to 3,000, arranged in chains radially, single, variable in size; immersed in soft tissue. Soft tissue.—Conspicuous; ladder rungs, very fine, connect up the coarse rays about 130 to the inch; also surrounds pores. General.—A mouse-coloured oak wood, fissile on the quarter. Solution wood; very pale yellow; copper precipitate. Cuts hard. 48 lb. per cubic foot.

Locality.—Hydrographer's, Northern Division, 2,000 feet. Between the Gap and Kagi, 5,000 feet. Between Kagi and Uribaiva, Central Division, at altitude of between 2,500 and 4,000 feet. On hills between Uberi and Sogeri, Central Division, at 2,000 to 2,500 feet.

Date.—Fruits in Hydrographer's in August.

Native name.—Kini (Pernambata).

Remarks.—The trees in the Hydrographer's were not so well grown as those I met coming down from the Gap to Sogeri. The timber is a typical oak or beech type. The serration of the leaf does not appear to be a fixed character. Leaves at top of tree are entire. A wide range over upper foot-hills of New Guinea.

Material collected.—Leaves and fruits, wood and bark.

Quercus pseudo-molucca Bl., Nos. 228, 117.

A large tree, 9 feet girth by 80 feet bole and 100 feet overall. No buttresses.

Leaves.—Simple, alternate, scaly stipulate on very young leaves; caducous. Petiole, 3-16th to $\frac{1}{4}$ inch; blade, $3\frac{1}{2}$ to 6 inches x $1\frac{3}{8}$ to $2\frac{1}{4}$ inches. Entire; margin more or less wavy; oblanceolate to lanceolate; more or less asymmetrical; pale yellow; slightly glaucous below.

Fruit.—An acorn.

Bark.—Grey; pustular in vertical lines, giving appearance of ridges in between; inner bark red-brown. Solution tawny; strong blue precipitate.

Wood.—Sap ill-defined, yellow to brown—a good brown.

Rays.—Very conspicuous; coarse and fine. The coarse, seven to eight, are really bundles of a number of fine rays. They are up to 1-15th inch wide and $\frac{1}{2}$ inch deep. Appear as a loud silver grain on quarter and dull brown lozenges on back. The fine rays number about 170, but are hard to count; they are very shallow, and show up as minute specks on quarter. Pores.—Conspicuous, 1,500 to 3,000 in less and more porous zones, arranged in irregular sinuous chains lying in a radial direction. Septate, but more commonly single. Surrounded by soft tissue. Soft tissue.—Clear; fine lines, 160 to the inch, about twice as coarse as the fine rays, connect up the coarse rays as rungs in a ladder; sometimes crossing, sometimes broken by fine rays. General.—A brown oak with a loud silver grain on the quarter. Solution wood: faint yellow; blue precipitate; cuts hard; 47 to 51 lb. per cubic foot.

Locality.—Northern Division, from 1,000 to 3,000 feet; Central Division, from 2,000 to 4,000 feet; New Guinea, over 1,500 feet and up to 5,000 feet.

Date.—Fruits in June, July, and August.

Native names.—Hobaba (Buna), Hopapa (Embi), Koroba (Suku).

Remarks.—The wood is a sound oak, and worth further attention.

Material collected.—Leaves, fruit, bark, wood.

Quercus spicata Smith, or *Q. spicata* var. *depressa*, Nos. 425, 582.

A large tree, 10 feet girth, 70 feet bole, and 30 feet over all. No buttresses.

Leaves.—Simple, alternate; petiole, 3-16th to $\frac{1}{4}$ inch; blade, up to $5\frac{1}{2}$ inch x $2\frac{1}{4}$ inch; lanceolate, acuminate; glaucous below, very pale green above; glabrous; often twisted from base to apex; twig glaucous.

Flowers.—Terminal erect panicles; only immature collected.

Fruit.—An acorn. Cupule on average $1\frac{1}{2}$ inch diameter, very shallow, scaly; nut $1\frac{1}{2}$ inch diameter and 1 inch high, hemispherical.

Bark.—$\frac{3}{8}$ inch thick, grey, scaly; inner bark red, streaked with white. Cambium layer turn mauve on exposure. Solution colourless; strong blue precipitate.

Wood.—Sap ill-defined; yellow, deepening to a good brown.

Sapwood.

Rays.—Very conspicuous. Coarse rays, four to five, straight; $\frac{1}{2}$ inch deep. Conspicuous silver grain on quarter. Fine rays, 300, very sinuous and broken here and there by pores. Pores.—Conspicuous, 1,200 to 2,000 in short radially-arranged sinuous chains surrounded by soft tissue. Soft tissue.—Clear. Very wavy fine lines connect up the coarse rays crossing the fine rays, but stopped by pores which are surrounded. Generally resemble rungs in a cellarman's ladder. General.—An oak timber with a rather loud quarter grain, dense and heavy, hard. Yellow. Solution wood: colourless; pale green precipitate. Cuts very hard, leaving a very clean shiny surface. 60 lb. per cubic foot.

Heartwood.

Rays.—Very conspicuous. Two kinds. (1) Wide yellow, seven to the inch, often composite, 5-32nd to 7-32nd inch deep. (2) Fine yellow, 200 to the inch. Pores.—Conspicuous, in wavy, radial snake-like lines; immersed in soft tissue. Soft tissue.—Conspicuous; surrounds and links up pores, also in very fine wavy lines link up the fine rays and coarse rays like the rungs of a cellarman's ladder. General.—A brown oak with a very loud quarter grain, and characteristically free splitting on the quarter. A heavy structural timber. Solution wood: colourless; green precipitate. Cuts very hard, leaving a bone-like shiny surface. 68 lb. per cubic foot.

Locality.—Between Menari and Efogi, 5,000 feet to 8,000 feet.

Date.—February, 1923.

Remarks.—This oak is found growing with the smaller acorned species, and is hard to distinguish. The best way is, I think, by the colour of the cambium layer after exposure. Both these oaks can also be confused with *Q. junghuhnii*. The last has no acorns, its bark is always channelled or grooved, it usually has a skirt of sucker shoots, and always grows at a lower altitude, usually in a pure stand.

Material collected.—Leaves, immature flowers, bark, wood.

Quercus spicata Smith, var. *depressa* King, No. 270.

Medium tree, 4 feet girth and 80 feet high.

Leaves,—Simple, alternate, stipulate; petiole, $\frac{1}{2}$ inch to $\frac{3}{4}$ inch, curved or twisted to bring leaves in same more or less horizontal plane; blade, 3 to 11 inches x 2 to $2\frac{1}{4}$ inches. Lanceolate to oval or oblanceolate, acuminate. Midrib and veins yellow, prominent below and above. Entire, margin a little reflexed; glaucous; stiff. Twig terete, light green, becomes covered with corky lenticels as it grows older.

Fruit.—Only last season's decaying fruit seen; cupule rotted; acorn $1\frac{3}{4}$ inches diameter, 1 inch high, hemispherical.

Bark.—¼ inch thick, grey, scaly; scales longitudinal and turned up at edges. In the larger trees this gives a ridged effect. Inner bark white, streaked with yellow; discolours rapidly; also cambium layer turns mauve. Solution yellow; strong blue precipitate.
Wood.—Sap undefined, yellow.
Locality.—Kagi to Uberi, on the hills from 2,000 feet to 4,000 feet.
Date.—Collected August.
Native name.—Karai (Kagi).
Remarks.—The largest acorn I have seen.
Material collected.—Leaves and acorn.

Quercus lamponga Miq., No. 418.

Locality.—Menari, 4,000 feet.
Date.—February, 1923.
Remarks.—This oak grows to a large size, 15 feet girth and 70 feet of bole, and is usually associated with the oak with the large acorn. (See Nos. 270 and 425.) Often they form the understory with *P. cupressina* and the other conifers of the mountains to *A. cunninghami,* which stands over them as a first story. The ground in this type of forest is usually almost free of soil-covering plants. Oak leaves and the leaves of the conifers cover the ground. The range in altitude of these two oaks is from 3,500 to 8,000 feet; at the upper limits they become shorter, and their boles are covered with moss, while the ground is covered with various types of soil cover.
Material collected.—Leaves, flowers, immature acorns on shoot, old acorns, bark, wood.

ULMACEAE.

Celtis philippinensis Blanco No. 47; Celtis sp., Nos. 110, 289, 573, 603; Celtis sp. affinities C. Nymanii K. Sch., No. 342.

Celtis philippinensis Blanco, No. 47.

A large tree 8 feet x 70 feet bole; 120 feet over all. Buttressed.
Leaves.—Simple, alternate, petiole, ½ inch venation, palmate. Three main veins, acuminate, glabrous above, pubescent beneath. The size of the blade is very variable, from 4 inches by 2 inches to 8 inches by 5 inches. Loses its leaves in June, and tree stands defoliated for two or three days only.
Flowers.—Axillary panicles of apparently apetalous flowers. K.5, A.5.
Fruit.—A globose drupe; ¾ inch diameter. Green ripening to apple red and green, containing a hard corrugated nut ⅜ inch diameter, containing a white kernel, 3-16th inch diameter. Pericarp is eaten by birds and the kernel by rodents.
Bark.—Greeny grey, fairly smooth, less than ¼ inch thick. Inner bark pale yellow.
Wood.—Sap undefined. Pale yellow or white.
Rays.—150. Dark-brown. Straight. Pores.—2,800 to 5,000, single, thickly and less thickly scattered zones immersed in and connected by soft tissue. Here and there a double row. Soft tissue.—Broken lines connect up the pores. General.—A grey timber with a walnut grain. Solution wood: discoloured; no precipitate. Cuts hard. 56 lb. per cubic foot.
Locality.—Wide range over the coastal country up to about 1,000 feet. Veimauri, Vanapa, Aroa, Buna District, Kumusi Valley; foot hills, Hydrographer Range.
Date.—Flowers Vanapa, June.
Native names.—Wai-am-a-Hasi (Suku), Hanuma (Buna) Ha-Adi (Vailala).
Remarks.—A straight-grained medium hardwood, which would be useful for general internal work were it not for the tendency it has to turn a dirty blue in drying.
Material collected.—Leaves, wood, fruit.

Celtis sp., No. 603.

A large tree; 10 feet in girth, with a bole of 90 feet, and 120 feet over all. Buttressed to 10 feet in large specimens.
Leaves.—Very variable in size, but unmistakable owing to their trinerved appearance.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Mongong (Yalu).
Remarks.—This species attains a greater diameter and height than any I have seen in Papua, but I think it is identical with No. 47.
Material collected.—Leaves, wood, bark.

Celtis sp., affin. *C. Nymanii,* K. Sch., No. 342.

Large tree, 9 feet in girth, 80 feet bole, and 150 feet over all. No buttresses.
Leaves.—Simple, alternate. Petiole, ¼ inch; blade, 3¼ to 5 inches by 1½ to 2¾ inches. Obovate; base somewhat cordate. Midrib and veins prominent and pubescent below; upper surface sandpapery. Acuminate, thin, soft.
Bark.—Smooth, except for pustules. Grey; inner bark streaked yellow and white. Solution, colourless; no precipitate.
Wood.—Sap undefined, pale yellow.
Rays.—120. Yellow, slightly wavy, shallow, but visible on quarter as shiny oblong. Pores.—Clear, 4,000 to 6,000, radially septate (2 and 3), evenly scattered, except where soft tissue occurs where they are in a concentric ring. Soft tissue.—About ten concentric lines to the inch, brown, thin crowded with pores. General.—A yellow wood. Solution colourless; no precipitate. Cuts hardish and woolly. 38 lb. per cubic foot.
Locality.—Vailala.
Date.—January, 1923.
Native name.—Bau.
Remarks.—A medium, hard tough wood.
Material collected.—Leaves, bark, wood.

Celtis sp., No. 573.

A large tree, 8 feet in girth, with a bole of 60 feet, and attaining 100 feet over all. Not buttressed.
Leaves.—Simple, alternate. Petiole, ½ inch; blade, 5 to 7 inches by 2¼ to 3 inches. Very acuminate, somewhat oblique, venatation distinct lower lateral pair give trinerved appearance; lower surface glaucous.
Bark.—¾ inch, dark-brown, scaly. Scales very small, and shed irregularly, leaving bole rough, which is increased by numerous pustules. Inner bark yellow, speckled with white. Solution, colourless; very faint green precipitate.
Wood.—Sap undefined; pale yellow to pink. Splits easily. Rays.—70 coarse, and a number of very fine ones in between coarse ones, 1-80th to 1-20th inch deep. Show up as shining wavy bands. Pores.—3,200 single show up as brown grooves on quarter and back. General.—A mouse-coloured wood; cuts hard, and weighs 43 lb. to the cubic foot. Solution, colourless; very faint green precipitate.
Locality.—Joangey.

Date.—December, 1923.
Native name.—Boiso (Joangey).
Material collected.—Leaves, wood, bark.

Celtis sp., No. 110.

A large tree, 15 feet girth, with a bole of 100 feet. Heavily buttressed.
Leaves.—Simple, alternate. Petiole, ½ inch; blade, 2½ to 4 by 1½ to 2½ inches; ovate; entire, acuminate; glabrous above; finely pubescent below.
Bark.—Smooth, except for pustules; grey; inner bark yellow spotted with brown; solution, faint brown; no precipitate.
Wood.—Sap undefined; yellow.
Rays.—150; somewhat sinuous around pores, and rather wavy up to 1-40th inch deep, but average about 1-80th inch; specks, lines, and oblongs on quarter. Pores.—Clear, 2,500 to 5,000 in less and more porous zones; single, more rarely radially septate. Soft tissue.—Surrounds and links pores in short irregular chains. General.—A grey timber, rather cross-grained, hard and heavy. Solution colourless; no precipitate. Cuts very hard. 60 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Namoa (Suku).
Remarks.—A hard interlocked timber.
Material collected.—Leaves, bark, wood.

Celtis sp., No. 289.

Large tree, 8 feet in girth, with a 75-feet bole, and attaining 110 feet over all. Somewhat widely buttressed up to 8 feet. Crown wide spread like a fig.
Leaves.—Simple, alternate; petiole, ¼ inch, pubescent, twisted, grooved; blade 2 to 4½ inches by 1 to 2⅛ inches; ovate, elliptical; acuminate; midrib and veins pubescent below; glabrous above; slightly asymmetrical.
Bark.—Grey; pustular; faintly longitudinally lined; wrinkled horizontally here and there in the first 20 feet; inner bark white, finely speckled with brown. Solution, colourless; absinthe precipitate.
Wood.—Sap undefined. Successive growths of white and straw-coloured timber give the appearance of a coniferous wood. A very hard, tough strong timber. Suffers from blue-mould, however. Solution, colourless; no precipitate. Cuts hard. 53 lb. per cubic foot.
Rays.—130; white; rather coarse wavy, but not sinuous to any extent, more generally at a tangent to pores rarely around them. Less than 1-100th inch deep, but clear-cut lines on quarter, and so quite distinct. Pores.—Clear, 3,500 to 4,000, single and radially septate, more rarely in groups of 3 and 4. Soft tissue.—Absent.
Locality.—Baroi.
Date.—October.
Native names.—Boru (Vailala), Mokore (Evara).
Material collected.—Leaves, bark, wood.

Moraceae.

Artocarpus sp., Nos. 6,601; Artocarpus incisa, Nos. 96, 597; Broussonetia papyrifera, No. 207; Dammaropsis Kingiana, Nos. 260, 550; Ficus sp., Nos. 42, 81, 97, 111, 104, 187, 189, 194, 252, 290, 341, 599.

Artocarpus sp., No. 6,601.

A large tree up to 16 feet girth, 80 feet bole, 120 feet over all; spur roots up to 3 feet.
Leaves.—Simple, alternate. Petiole, ½ to ⅞ inch; blade, oblanceolate; 4 to 5 inches by 2 to 3 inches; entire margin undulate, acute, glabrous, thin, stiff; venation prominent, yellow. Juvenile leaves up to 13 by 4 inches; acuminate, very thin.
Flowers.—Green composite, 3 inches long, 1¼ inches in diameter, wrinkled and covered with short brown spines.
Bark.—Very scaley; orange to red-brown. Inner bark red-brown. Yields white latex very abundantly.
Wood.—Sap rather ill-defined. Starting cream-white, it deepens to a yellowish brown.
Rays.—170 to 200; brown, sinuous round pores 1-40 inch deep show up on quarter as wavy lines. Pores.—Conspicuous; 1,200 to 1,800 evenly scattered, single and radially spetate (2-3). Soft tissue.—Clear, in thin concentric lines about 8 to the inch, also fine short broken lines join pores. General.—A light yellow-brown wood. Blues in streaks. Solution wood: colourless; no precipitate. Cuts soft but woolly. Weighs 30 lb. to the cubic foot.
Locality.—Material collected Veimauri. It is a common tree all round both Territories. It attains its best development on alluvial flats, but is to be met with as high as 3,000 feet on the spurs of the main range.
Date.—May, 1922.
Native names.—Menaia (Suku), Ogadi (Buna), Durarabo (Vailala), Kuru (Evara), Nom (Yalu).
Remarks.—A straight-grained, medium softwood.
Material collected.—Leaves, bark, wood.

Artocarpus incisa Forst., Nos. 96 and 597.

A large tree, common throughout the Territory in low lands. It is reserved by the natives when they clear land for cultivation, and its fruit (Bread-fruit) is a common diet everywhere below 3,000 feet. Above that altitude the bread-fruit does not flourish, and the long red-fruited pandanus takes its place as a native fruit tree. Here and there the natives plant bread-fruit seedlings, or sow the nuts in their gardens, but, generally speaking, they content themselves with protecting the young trees that shoot up naturally on farm lands.
Artocarpus incisa is one of the large and more permanent of the first crop of re-growth that springs up on cleared land. Unlike the Macaranga, Evodias and other purely light-demanding species, whose life is very short, the bread-fruit will stand some shade, and in turn makes a dense cover for the more permanent forest species.
The wood is soft and of no account.
Native name.—Sekeri (Suku).

Dammaropsis kingiana Warbg., Nos. 260 and 550.

Small tree, 3 feet in girth and 25 feet high. Branches at 15 feet. Exudes a thin latex copiously.
Leaves.—Simple, alternate, stipulate; petiole, 3¼ to 3½ inches; blade, 2 ft. by 1 ft. 7 in. cordate; two glands in axils. Young leaves enclosed in two pale yellow sheath-like stipules. Petiole and midrib stout; these and veins red. Leaf more or less coriaceous.
Fruit.—A globose bract covered composite fruit, about 5 inches in diameter, arising in the axilla of leaves.

Bark.—Grey.
Locality.—Found growing on the rock-strewn banks of fast torrents at an altitude of 2,500 to 4,000 feet on the Owen Stanley Range. Common above Kokoda on the Port Moresby trail. Later found this along the Purgri and other comparatively slow streams of the Delta division, and found it on the slopes of the mountains above Ogeramuagu at 5,000 feet.
Date.—Fruits in August.
Remarks.—A very striking tree with its large leaves.
Material collected.—Leaves and section of fruit.

Broussonetia papyrifera Vent., No. 207.

A tree, the bark of which is the most common raw material for the manufacture of native cloth known generally as "Tapa" cloth. This species is cultivated in the native gardens; slips being planted here and there among the food crops. They are cut down when they are between 5 inches and 6 inches girth, and the bark is stripped off and carried to the village. Here it is beaten with a wooden club-shaped mallet, one surface of which is flattened and roughened with criss-cross scores, on a hardwood log. The beating process goes on for a considerable time, and toward the end, when the bark—originally 6 inches wide—is in the neighbourhood of 18 inches, a stone mallet of the same shape as the wooden one is used. The cloth when finished may be 20 inches wide, and is now hung up on lines to dry. Afterwards, designs in yellow, red, and black native dyes are painted on.

In the Northern Division these native cloths are worn by both sexes. The males use it as a perineal band and an apron, while the woman wears it around her waist. Throughout the Territory the same cloth is made in the same manner, but not by any means from the same tree. A number of figs yield good "Tapa" cloth, and the long cloaks which stretch from head to calf, and which are the particular dress of the women (and blankets of the men) of the tribes of the Upper Purari (Namainas), usually called Ku-ku-ku-kus by the coastal folk, are made from the bark of a large fig. The mountain people (males) affect a cap to keep their mops of hair dry in the ceaseless mist-rains, and this is made of fig "Tapa" cloth (see No. 97).

Ficus sp., No. 97.

A large tree, 8 feet girth and a bole of 50 feet. Narrow buttresses up to 10 feet.
Leaves.—Simple, alternate; petiole $\frac{1}{4}$; blade $5\frac{1}{2}$ x $3\frac{1}{2}$; ovate, acuminate, pubescent on both surfaces, asymmetrical, slightly serrate, thin.
Bark.—$\frac{1}{4}$ inch thick. Grey. Smooth, except for pustules. Inner bark white, but turns yellow on exposure.
Wood.—Sap undefined. Pale yellow to white.
Locality.—Vanapa.
Date.—May, 1922.
Native names.—Aosi (Doura), Iowa (Suku).
Remarks.—The bark of this species is used to make tapa cloth.
Material collected.—Leaves.

Ficus sp., No. 252.

Large tree, 60 feet high, sending down aerial roots into the water.
Locality.—Embi Lake.
Date.—August.
Remarks.—The aerial roots have in one case made a forest in the water so that you may paddle your canoe in and out among them.
Material collected.—Leaves and fruit.

Ficus sp., No. 290.

A large tree. 11 feet in girth with an 85 foot bole and 120 feet over all. Buttresses up to 10 feet radius. Wide branching.
Leaves.—Simple, alternate; petiole $\frac{1}{2}$ inch; blade up to 8 inches x $4\frac{1}{2}$ inches; ovate, acute, regularly and prominently veined; glaucous below; shiny green above; glabrous, coriaceous; exudes latex wherever broken.
Fruit.—A curiously shaped fig, viz., a flattened obovoid, covered with a silky down.
Bark.—$\frac{3}{4}$ inch thick; grey; longitudinally lined with oblong shallow horizontal depressions here and there in the first 20 feet. More or less horizontally wrinkled throughout. Very pustular. Inner bark yellow. Exudes latex sparingly.
Wood.—Characteristic fig wood. Growth rings well defined by the presence of white soft tissue in concentric rings. Pores distinct. Rays fine.
Locality.—Bari.
Date.—October.
Native names.—Koredapu (Vailala), E-ere (Evara).
Remarks.—A possible case timber if it doesn't blue too badly. It splits readily on the back along the soft tissue.
Material collected.—Leaves, fruit, bark, wood.

Ficus sp., No. 42.

A medium tree, 7 feet in girth with a bole of 30 feet. Without buttresses.
Leaves.—Simple, alternate; petiole $\frac{5}{8}$, hispid; blade $7\frac{1}{2}$-9 x $3\frac{3}{4}$-5; obovate; acuminate; somewhat serrate; hispid.
Rays.—150. Yellow; turn grey in old wood. 1/60 inch deep, show up on quarter as dark oblongs; sinuous around and broken here and there by pores. Pores.—Conspicuous. 900 to 1,500 single and radially septate (2 to 4). Soft tissue. —Very conspicuous, in wavy zig-zag broken lines joining up pores. General.—A grey wood. Solution wood; colourless; no precipitate. Cuts soft and woolly. 36 lb. per cub. foot.
Bark.—Greeny-yellow; scaly; smooth except for fine edges of turned up scales. Inner bark yellow-green. Exudes latex. Solution faint yellow. No precipitate.
Wood.—Sap undefined. White.
Locality.—Foothills; Veimauri.
Date.—May, 1922.
Native name.—Mohu (Suku).
Remarks.—A soft, straight grained timber.
Material collected.—Leaves, wood, bark.

Ficus sp., No. 341.

Large tree. 9 feet in girth, 85 feet bole, and 110 feet overall. No buttresses.
Leaves.—Simple, alternate; petiole $\frac{3}{4}$ inch to 1 inch; blade 5 inches to 12 inches x $2\frac{1}{4}$-$3\frac{3}{4}$; oblanceolate, acuminate, glaucous below, glabrous, thin. Twig green, dotted with brown lenticels.
Bark.—$\frac{3}{8}$ thick. Grey. Scaly—scales shedding like plane tree bark. Inner bark, pale yellow. Solution colourless; no precipitate.
Wood.—Sap 3 inches, pale yellow. Heart a dark brown.
Rays.—100-120. Fine, indistinct specks on quarter 1/50 inch deep. Pores.—Clear. 3,000-4,000 radially septate (2); evenly distributed. Soft

tissue.—Here and there is crowded in very fine concentric rings 4 to ¼ of an inch then a gap without, and then perhaps a couple of lines. General.—A pale wood streaked with brown, pretty sheen on quarter. Solution wood: colourless; no precipitate. Cuts easily. 37 lb. per cubic foot.
Locality.—Vailala.
Date.—January, 1923.
Native name.—Hewara (Vailala).
Remarks.—A medium hard wood. Cuts easily.
Material collected.—Leaves, bark and wood.

Ficus sp., No. 81.
A small tree.
Leaves.—Simple, alternate; petiole ½-¾; blade 2 in.-6 in., x 1-3½; oval, acuminate, serrate; both surfaces covered with short stiff fine hairs, making leaf sand-papery to touch.
Locality.—Veia Creek, alluvial flat.
Date.—May, 1922.
Native name.—Anano (Doura).
Remarks.—The bast is used to make perineal band.
Material collected.—Leaves.

Ficus sp., No. 111.
A large tree, 12 feet girth and a bole of 90 feet.
Leaves.—Simple, alternate; petiole 1½ inches; blade 7 x 4½; ovate, entire, densely pubescent beneath; spare hairs above.
Rays.—150. Yellow. Undulate but not sinuous, coarse ones number 80. 1/40 deep show up on quarter. The rest are very fine and are broken by pores. Pores.—Conspicuous. 400 large single and radially septate 2-3. Soft tissue.—Conspicuous. Very coarse white bands, about 30 to the inch. Here and there fine ones but most over 1/80 inch thick; cross rays and link up pores. General.—A pale soft wood. Solution wood: colourless; no precipitate. Cuts soft and woolly. 19 lb. per cubic foot.
Bark.—Exudes latex. Solution faint yellow. No precipitate.
Wood.—Sap undefined. Pale yellow flecked with saffron.
Locality.—Vanapa.
Date.—May, 1922.
Native names.—Neseki (Suku), Roi-i (Doura).
Remarks.—The bark of this tree is used by the natives to make their perineal bands.
Material collected.—Leaves.

Ficus sp., No. 104.
A large tree. 14 feet in girth with a bole of 50 feet. Narow buttresses up to 8 feet.
Leaves.—Simple, alternate; petiole ½-1 inch; blade 7-12 x 2½-5; lanceolate, oval, entire, acuminate, glabrous, thin.
Bark.—Pustular, otherwise smooth. Grey. Inner bark light yellow. Exudes latex.
Wood.—Sap undefined. Light yellow.
Rays.—190-195 to the inch. 50 are coarse and rest fine to very fine; all light yellow; 1/40 inch deep; show up as shiny, short lines on quarter. Pores.—Clear. 100. Very regular; mostly single but some radially septate (2). Soft tissue.—Conspicuous. 40 very coarse yellow brown lines to the inch, very regular. Straight broken or half broken by pores or surrounding pores. About three times as thick as rays. General.—A pale wood much attacked by blue fungus. The soft tissue is rotted readily and causes entire decomposition of the timber. Solution wood: colourless; no precipitate. Cuts soft and woolly. 23 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Kevao (Doura).
Material collected.—Leaves and wood.

Ficus sp., No. 187.
A large tree. 8 feet in girth with a fine bole of 80 feet. Moderately buttressed to 4 feet.
Leaves.—Simple, alternate; petiole ½-1; blade 3½-7 x 1¾-3; oval; acuminate; glabrous.
Fruit.—A fig; 1¼ in diameter.
Bark.—½ inch thick, grey, finely pustular. Inner bark, yellow, streaked with white. Exudes thin latex sparingly.
Wood.—Sap undefined. Pale yellow to straw. Soft tissue—characteristically distinct.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Nininge.
Remarks.—A poor soft wood; so rapidly attacked by fungus as to be destroyed in a few months.
Material collected.—Leaves.

Ficus sp., No. 189.
A large tree, 8 feet in girth, with a 60-foot bole and medium buttresses up to 5 or 6 feet.
Leaves.—Simple, alternate; petiole ⅞-1¼; blade 5-9 x 4-6. Asymmetrically ovate-cordate; slightly pubescent below; bristly pubescent above. Twig rusty tomentose; hollow.
Bark.—Finely longitudinally lined. Inner bark white. Solution very pale yellow. No precipitate.
Rays.—White; coarse 80; sinuous around pores; hardly show up on quarter. Pores.—Conspicuous; 1,000 to 2,000 in less and more porous zones; single and radially septate 2-3. Soft tissue.—Conspicuous white lines. Some are continuous rings, others short broken lines; all link up the pores and often surround them. General.—A pale timber. Solution wood: opal; no precipitate. Cuts soft and woolly. 29 lb. per cubic foot.
Wood.—Sap undefined. Pale yellow.
Locality.—Kumusi, near Onitatandi.
Date.—July, 1922.
Native name.—Behoro (Oitatandi).
Material collected.—Leaves, wood.

Ficus sp., No. 194.
A large tree. 7½ feet in girth with an unbuttressed bole of 75 feet.
Leaves.—Simple, alternate; petiole ½-¾; blade 4-8 x 2-3¾; obovate, acuminate, glabrous.
Rays.—Clear. 90. Yellow. Sinuous and broken; 1/30 inch deep. Show up as silvery bands on quarter. Pores.—Conspicuous. 800-1200 evenly scattered. Single and radially septate (2). Soft tissue.—Absent. General.—A white timber with a straight grain. A shiny silver figure on quarter. Solution wood: colourless; no precipitate. Cuts firm but woolly. 29 lb. per cubic foot.
Bark.—Red-brown mottled with gray. Pustular; delicately scaly; longitudinally lined. Inner bark salmon.
Wood.—Sap 4 inches white. Heart a yellow brown.
Locality.—Kumusi, near Oitatandi.
Date.—July, 1922.
Native names.—Au-u-jo (Oitatandi), Sind (Buna).

Remarks.—A pretty enough grain.
Material collected.—Leaves and wood.

Ficus sp. No. 599.
Strangling species.
Native name.—Otzob (Yalu).

URTICACEAE.

Antiaris toxicaria, No. 305; Cypholophus pachycarpus, No. 547; Elatostema sesquifolium, No. 541; Elatostema velutinicaule H. Winkl., No. 267; Elatostema sp. (Elatostema macrophyllum var. majusculum, No. 259 and No. 539), No. 522; Laportea gigas, No. 168; Laportea corallodesma, No. 8; Pipturus argenteus Wedd., No. 422; Pipturus incanus, No. 633; indt., No. 75; Pilea sp., nov., No. 515; Pilea pellis-crocodili, No. 540.

Antiaris toxicaria Lesch, No. 305.
Large tree. Girth 9 feet, bole 70 feet, 100 feet overall. Buttressed to 8 feet.
Leaves.—Simple, alternate; petiole $\frac{3}{8}$; blade 3 inches to $5\frac{1}{4}$ x $1\frac{1}{2}$ to 2 inches; lanceolate and oblanceolate, acuminate, glabrous, thin. Midrib and veins yellow and prominent below.
Flowers.—Axillary. Only buds seen.
Bark.—Grey brown. Longitudinally lined big pustules. Inner bark cream. Strong fibre. Exudes latex. Solution colourless; no precipitate.
Wood.—Sap undefined. Pale yellow or white.
Rays.—Clear. 100. White, rather straight; up to 1-40 inch deep, lines on quarter. Pores.—Conspicuous. 4,000 to 5,000 single and radially septate. Also quite a number are divided irregularly the septum at any angle. Soft tissue.—Absent. General.—A pale rapidly blueing soft light wood. Solution wood: colourless; no precipitate. Cuts soft. 22 lb. per cubic foot.
Locality.—Baroi.
Date.—October.
Native names.—Boa (Vailala), Idumu (Evara).
Remarks.—A soft, porous, woolly wood, attacked by blue mould a week after cutting. The bark makes the "tapa cloth" of the Delta.
Material collected.—Leaves, buds, bark, wood.

Cypholophus pachycarpus. H. Winkl., No. 547.
Giant leafed ground nettle, 2 feet 6 inches high.
Locality.—Nomi River, 5,000 feet.
Date.—November, 1923.
Native name.—Embalema (Ogeramnagn).
Material collected.—Leaves. Flowers.

Elatostema sp., No. 522.
Soil cover.
Locality.—Moss forest of Mongi valley, below Salawaket, 8,000 feet.
Date.—November, 1923.
Remarks.—A ground nettle.
Material collected.—Leaves and flowers.

Elatostema macrophyllum Brong. Var. *majusculum* H. Winkl. No. 539.
Large leafed ground nettle, 2 ft. 6 in. high.
Locality.—Nomi River, 5,000 feet.
Date.—November 23.
Material collected.—Leaves. Flowers.

Elatostema sesquifolium Hassk., No. 541.
The small accuminate leafed ground nettle, 2 feet high.
Locality.—Nomi River, 5,000 feet.
Date.—22nd November, 1923.
Material collected.—Leaves. Flowers.

Elatostema majusculum, No. 259.
Soil covering 18-24 inches high, more or less succulent.
Leaves.—Simple, alternate. Petiole $\frac{1}{8}$ inch. Blade 6 x $1\frac{3}{4}$. Acuminate, very assymetrical, serrate, glabrous, thin.
Flowers.—Axillary in head.
Locality.—Between 4,000-5,000 feet on Owen Stanely Range. Road from Kokoda to Port Moresby.
Date.—August.
Remarks.—The whole forest floor is covered by this ground nettle at this altitude.
Material collected.—Leaves and flowers.

Elatostema velutinicaule H. Winkl, No. 267.
A more or less succulent plant, 15 inches high.
Locality.—5,400 feet on trail from Kokoda to the Gap. A common ground nettle in the moss forests.
Date.—August.
Material collected.—Leaves and flowers.

Laportea gigas, Wedd, No. 8.
The nettle or stinging tree. A large tree 9 feet in girth, 40 feet of bole and 80 feet overall. Narrow buttresses.
Leaves.—Simple, alternate; grouped at end of branches; petiole 4 to 6 inches; blade obovate, cordate, markedly acuminate. Petiole, midrib and veins armed with stinging hairs. Pubescent below; upper surface glabrous, shiny.
Bark.—$\frac{1}{2}$ inch thick. Yellow brown. Scaly; inner bark red.
Wood.—Sap undefined; white.
Locality.—Collected near Veimauri. Common about there and all round Papua on lowlands.
Date.—May, 1922.
Native names.—Kabo (Motu), Kua (Vailala), Pokane (Evara).
Remarks.—The juvenile leaves have more stinging hairs than the mature ones. The wood is soft, spongy, and is not used.
Material collected.—Wood and bark.

Laportea corallodesme Lautb, No. 633.
A third story tree 2 feet in girth and 25 feet high.
Flowers.—Red, pubescent, caulifloral.
Locality.—Yonombo.
Native names.—Koi (Mountu), Botu (Yonombo).
Remarks.—Common.
Material collected.—Leaves and flowers.

Pilea, new species, No. 515.
A nettle like ground cover.
Locality.—Salawaket 9,000 feet.
Date.—November 23.
Material.—Leaves and flowers.

Pilea pellis-crocodili, H. Winkle, No. 540.
The large acuminate leafed ground nettle, 2 feet high.
Locality.—Nomi river, 5,000 feet.
Material collected.—Leaves and flowers.

Pipturus incanus, No. 168.
Small tree 30 feet by 2 feet girth. Springs up in old farm lands.
Leaves.—Simple, alternate, exstipulate; petiole up to $1\frac{1}{2}$ inches; blade up to $4\frac{1}{2}$ x 2 inches; lanceolate, acuminate; pubescent above and below; three veins.

Flowers.—Axillary spikes bearing sessile heads of white flowers.
Locality.—All old farm lands.
Date.—Flowers in Buna District in July.
Native name.—Gurega (Binandele and Buna).
Material collected.—Leaves and flowers.

Pipturus argenteus Wedd, No. 422.

A small tree. 20 feet overall.
Leaves.—Very pale green below.
Locality.—Menari, 5,000 feet. Old farm lands.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Indt., No. 75.

A medium sized tree, 7 feet in girth with a bole of 35 feet. Narrow buttresses extending in grooves up to the branches.
Leaves.—Simple, alternate; Lanceolate. Armed with stinging hairs along midrib and main veins.
Bark.—$\frac{1}{4}$ inch thick; smooth; grey. Inner bark yellow. Solution colourless; no precipitate.
Wood.—Sap undefined. Pale yellow.
Rays.—Conspicuous; 36 very coarse rays and a very large number of very fine rays too fine to count; 1/10 inch deep; showing up as grey squares on quarter. Pores.—Conspicuous. The wood breaks up so badly as to make pore counting difficult. They run about 4,000 to the square inch, are single and spetate (2-4) mostly radially though here and there are septate pores whose division is diagonal and sometimes parallel to the rays. Soft tissue.—Conspicuous; abundant in lines tangentially. This tissue rots out leaving the wood proper intact. General.—A poor pale soft wood. Solution wood; colourless; no precipitate. Cuts soft and woolly. 25 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Kabo (Motu).
Remarks.—The leaves of small saplings and seedlings give one a very painful sting indeed.
Material collected.—Wood.

Proteaceae.

Grevillea densiflora, No. 420.

Small tree, 3 feet girth and 40 feet overall.
Leaves.—Simple, alternate; red pubescent bud in axil; petiole 1-1$\frac{1}{2}$; blade 9 x 3$\frac{1}{4}$, elliptical, acute, glabrous, coriaceous.
Flowers.—Pendant on spikes, 10 inches long, bearing an indefinite number of orange flowers.
Bark.—Gray, longitudinally lined; pustular. Inner bark pink and white. Solution colourless; no precipitate.
Wood.—Sap undefined. Protea timber.
Rays.—Very conspicuous. (1) Coarse 20 to the inch 1/10 inch deep, show up well on quarter. (2) Fine 53 to the inch. Both light brown. Pores.—Clear, 3,000 to 3,500; scattered, septate, more often tangentially than radially; sometimes a group of four or five, but usually two. Soft tissue.—Linking up the rays with wavy thin lines hard to see. General.—A pale pinky white wood, characteristic protea grain. Solution, wood, colourless; no precipitate; cuts soft and fairly clean; 43 lb. per cubic foot.
Locality.—Menari, 4,000 feet. Old farm lands.
Date.—February, 1923.
Native name.—Sauge (Menari).
Remarks.—A very ornamental flower.
Material collected.—Leaves, flowers, bark, wood.

Santalaceae.

Santalum sp., No. 433A.

Locality.—About 15 miles east of Port Moresby.
Date.—September.
Remarks.—I have not seen this tree, and the specimens of leaves and flowers were collected by Mr. Gors, in grass lands, about 15 miles east of Port Moresby, in the month of September. It is this species that yielded the sandalwood of commerce in which a trade from Papua flourished some twenty years ago.
Material collected.—Leaves, flowers, and wood.

Loranthaceae.

Loranthus navae guineae, No. 790; Loranthus sp., Nos. 180, 257; Loranthus novae-guineae Bail., No. 790; Loranthaceae, No. 132.

Loranthus novae guineae Bail., No. 790.

Flowers.—Red tube and green petals.
Locality.—Malu (middle sepik, 230 miles up).
Date.—19th July.
Remarks.—Found on an Erythrina, but common on a number of trees.
Material collected.—Leaves and flowers.

Loranthus sp., No. 257.

A common mistletoe.
Locality.—Buna.
Date.—August.
Native name.—Masewa.
Material collected.—Leaves and flowers.

Loranthus sp., No. 180.

A common mistletoe. Parasitical on a number of low-growing shrubs.
Leaves.—Simple, opposite; petiole, $\frac{1}{2}$ inch; blade, up to 6 x 3$\frac{1}{2}$ inches; ovate, obtuse, entire, margin recurved.
Flowers.—Red and yellow.
Locality.—A wide range from sea level to an altitude of 3,000 feet.
Date.—Flowers in Northern Division in July.
Material collected.—Leaves and flowers.

Polygonaceae.

Muhlenbeckia platyclada Meiss, Nos. 363, 551.

A cactus-like creeper attaining 35 feet up boles of trees in open spaces at 5,000 feet on the O. S. R. and on the Finisterre and Bismarcks at about the same altitude. It prefers figs.
Material collected.—Stem, leaves, and flowers.

Nyctaginaceae.

Pisonia Brunonia Endl (*Syn. P. umbellifera*), No. 128.

Large tree 11 feet girth, a bole up to 35 feet and making 70 feet overall. Not buttressed. Wide branching.
Leaves.—Simple, alternate, gland in axilla; petiole $\frac{1}{2}$-$\frac{3}{4}$; blade 5$\frac{1}{8}$-9$\frac{1}{2}$ x 2-3$\frac{1}{2}$. Lanceolate, acute, glabrous, thin.
Flowers.—Terminal panicles.
Bark.—Brown smooth except for wrinkles. Less than $\frac{1}{4}$ inch thick. Inner bark white, turning brown on exposure.
Wood.—Sap undefined, white. Rays and pores invisible to naked eye.
Locality.—Aroa.
Date.—Flowers in May and June.
Native name.—Kuve (Suku).
Remarks.—A light soft timber. It is readily attacked by fungus disease and disintegrated in the course of a month or so.
Material.—Leaves, wood.

NYMPHAEACEAE.

Nymphaea gigantea Linn., No. 250.

Flower blue. Stalk up to 16 feet long.
Locality.—Embi Lake.
Date.—August.
Remarks.—Owing to the depth of the lake, which is on an average 9½ fathoms, this lily is confined to the margins and out to 16 feet depth.
Material collected.—Leaves, flowers; in herbarium.

RANUNCULACEAE.

Clematis Pickeringii A.Gr., No. 179.

Creeper up to 30 feet in height on edges of rain forest and in clearings.
Locality.—Buna District throughout the flat country.
Native name.—Tutaratatara (Wasida).
Remarks.—The natives feed the leaves and seed to their dogs to make them fleet of foot.
Material collected.—Leaves, flowers, fruits; in herbarium.

MAGNOLIACEAE.

Drimys cyclopum, Diels, No. 347; Himantandra Belgraveana, Nos. 556, 568.

Drimys cyclopum, Diels, No. 347.

A shrub 15 feet high—undergrowth.
Flowers.—White.
Locality.—Mist forests, 8,000 feet—Mt. Obree.
Date.—January, 1923.
Material Collected.—Leaves and flowers.

Himantandra Belgraveana (F. v. M.), Diels, Nos. 556, 568.

Large tree 9 feet in girth with a bole of 70 feet and attaining a height of 100 feet over all. Somewhat asymmetrical at butt, or spur roots extend in grooves up the bole for about 8 feet.
Leaves.—Simple, alternate; petiole ¾ grooved; blade 4-5 by 1¾, bronzed to glaucous beneath.
Flowers.—Terminal single. Only buds seen.
Bark.—Grey, pustular, finely longitudinally lined, smells of turnips. Inner bark yellow speckled with white. Solution colourless; faint green precipitate.
Wood.—White. Sap undefined. Splits easily both ways. Rays.—Inconspicuous because of their white colour. 130-140 1/100 inch deep; indistinct on quarter. Pores.—2,600-2,800 radially septate 2-3 often two rows joined, making a group of 5 or 6. Show up as brownish grooves on quarter. Soft Tissue.—Thin white lines irregularly spaced, single and double; sometimes as few as four to the inch, at other times 17-20 to the inch. General.—A white soft wood weighing 33 lb. to the cubic foot. Solution colourless; milky precipitate.
Locality.—Joangey.
Date.—December, 1923.
Native names.—Hodu (Joangey), Mang (Ogeramnagn).
Remarks.—Commonly used for making planks for housebuilding in these parts. The trunk is split down, and one or two wide boards are split off; these are adzed more or less flat, and put into use.
Material collected.—Leaves, buds, wood, bark.

ANONACEAE.

Cyathocalyx polycarpum White & Francis ined., No. 225.

Small tree, 18 inches girth, and 45 feet over all. Undergrowth; rain forests; no buttresses.
Leaves.—Simple, alternate, exstipulate; petiole, ¼ to ⅜ inch; blade, 5 to 9 inches x 3 to 4 inches; elliptical, lanceolate, and oblanceolate; acuminate, entire; midribs and veins prominent below; midribs above, and petiole rusty; more or less coriaceous.
Flowers.—Axillary groups of seven solitary flowers. Peduncle, 1 inch. The flower has a slightly spicy smell.
Fruit.—A red fleshy berry, 1 inch long by ¾ inch diameter, containing 1 to 3 red seeds from 3-16 inch to ¼ inch diameter.
Bark.—¼ inch; mottled grey and brown; smooth. Inner bark yellow, streaked with white.
Wood.—Sap undefined, white.
Rays.—Conspicuous, 70. Cream; straight, 7-inch deep; show up as broad bands on quarter. Pores.—Clear, 1,000 to 1,500; evenly scattered, radially, and rarely diagonally septate, but more often single. Soft tissue.—120 fine white lines, finer than rays, link up rays like ladder rungs. General.—A white wood. Solution wood: colourless; no precipitate. Cuts soft. 28 lb. per cubic foot.
Locality.—Throughout the rain forests of the Northern Division up to 1,500 feet.
Date.—Flowers from July to August in Northern Division.
Native names.—Esa (Embi), Kesa (Buna).
Remarks.—A soft light wood with a wonderful silver grain on the quarter. Used by natives for canoe seats.
Material collected.—Leaves, flowers, wood.

MYRISTICACEAE.

Myristica sp., Nos. 43, 153, 150; Myristica montana, No. 805; Myristica pseudo-argentea, No. 206.

Myristica sp., No. 153.

A large tree, 7½ feet in girth, with a bole of 70 feet, which is lightly or not buttressed.
Leaves.—Simple, alternate; petiole, ¾ inch; blade, 7 to 9 inches x 3 to 4 inches; oval, acuminate, slightly coriaceous, glabrous.
Bark.—½ inch thick; dark-brown, dappled with grey; smooth except for faint horizontal wrinkles. Inner bark red, streaked with faint lines of yellow. Exudes red, slightly sticky, sap. Solution, orange-red; green precipitate.
Wood.—Sap undefined. Yellow to white, streaked with pale red.
Rays.—Clear, 2,200; yellow. A little wavy and rather sinuous; 1-40th inch deep; showing up well on quarter as straight lines and oblongs. Pores.—Clear, 2,000, evenly scattered; septate (2) and less commonly single. Soft tissue.—Clear; thin concentric lines slightly thicker than rays, irregularly spaced, about 170 to the inch radius. General.—A yellow brown wood with a satin gleam on the pretty quarter surface. Straight grained. Solution wood: colourless; no precipitate. Cuts firm. 37 lb. per cubic foot.
Locality.—Soputa, near Buna.
Date.—July, 1922.
Native name.—Bara (Buna).
Material collected.—Leaves, bark,

Myristica sp., No. 150.

A large tree, 7 feet in girth, with a bole of 55 feet, and root swellings up to 2 feet.
Leaves.—Simple, alternate; petiole, 1¼ to 1½ inches; blade, 10½ to 12 x 3¾ to 5 inches; lanceolate, acuminate, glabrous.

Bark.—½ inch thick; dappled light and dark-grey; smooth; finely longitudinally lined. Inner bark yellow-brown, streaked with yellow.
Wood.—Sap undefined; white or pale yellow.
Rays.—150, coarse, yellow-brown, wavy and sinuous; 1-40th inch deep; show up as lines on quarter. Between these coarse rays are a number, 300-400, very fine rays. They are indistinct, and hard to count. Pores—1,500, scattered, rarely single, generally radially septate, 2 to 4. Encrusted with a sparkley deposit. Soft tissue.—Eighteen concentric continuous fine lines to the 1-inch radius. They are a little thicker than the rays, and are irregularly spaced. General.—A yellow wood with a pink tinge and a pretty enough quarter grain. Straight grained. Solution wood: colourless; pale-green precipitate. Cuts soft; 33 lb. per cubic foot.
Locality.—Saputa, near Buna.
Date.—July, 1922.
Native name.—Kore.
Material collected.—Leaves, wood.

Myristica sp., No. 43.

A medium tree with a stout bole, 30 feet long, and a girth of 8 feet. Standing mangrove-like on prop roots.
Leaves.—Simple, alternate; petiole, ½ to 1¼ inch; blade, oblanceolate, 3 x 7 inches; glabrous, green shiny above and glaucous beneath, entire, margin recurved, acuminate, thin.
Bark.—¼ inch thick, brown; smooth. Inner bark red brown. Solution, tawny; no precipitate.
Wood.—Sap undefined, pale-yellow to white, streaked with light-brown markings.
Rays.—190, yellow; wavy, also sinuous around pores; 1-20th inch deep, show up on quarter as oblongs. Pores.—2,000 to 2,500; single and radially septate, 2 to 4 inches; evenly scattered. Soft tissue.—About nine thin lines to the inch. They are concentric rings, and are without undulations. General.—A pale-yellow wood. Solution wood: colourless; no precipitate. Cuts soft and clean. 27 lb. per cubic foot.
Locality.—Veimauri, in fresh water swamps.
Date.—May, 1922.
Native names.—Kwara (Suku), Bokene (Vailala).
Remarks.—Soft wood.
Material collected.—Leaves, wood, bark.

Myristica pseudo-argentea Warbg. (?), No. 206.

Large tree, 8 feet girth, and 85 feet bole. Spur rooted.
Leaves.—Simple, alternate, exstipulate; petiole, 1 to 2 inches; lamina extending down petiole, and making it almost a tube; blade, 1 ft. 3 in. to 2 ft. 4 in. x 5 to 9½ in.; oblanceolate. acuminate, coriaceous, glaucous below; midrib veins, petiole, and young shoots rusty tomentose. Upper surface of leaf green, shiny.
Fruit.—Schizocarp, 2¼ x 2 inches; stout peduncle, ½ inch; yellow-brown, velvety, splitting in two. Pericarp, ½ inch, containing one seed, 1¼ x ⅞ inch; ellipsoid with a rose-pink fleshy aril which, starting from the base, divides into a number of narrow filaments, each tapering to a hair's width. These filaments closely envelop the seeds, and are tangled and crumpled together at its apex. The nut is covered with more or less regular grooves where aril lay. Hard woody testa, 1-32 inch thick. Both aril and seed exude red gum.
Bark.—Mottled grey and green; black, scaly, scales papery, lying very close. Inner bark brown, faintly streaked with white. Solution, pale yellow; no precipitate.
Wood.—Sap undefined; pale yellow deepening to rose. The rose colour is apparently due to a red gum in the wood.
Rays.—220, yellow; sinuous around and broken by pores, 1-50th inch deep; small specks on quarter. Pores.—Clear, 2,500 to 4,000 more often septate (2) than single. Soft tissue.—Continuous concentric lines, about twenty to the inch, thicker than rays. General.—A pretty mahogany-grained wood. Solution wood: colourless; no precipitate. Cuts firm. Weighs 35 lb. per cubic foot.
Locality.—Sageri, Northern Division.
Date.—July.
Native name.—Inene.
Remarks.—A hardwood with a pretty grain.
Material collected.—Leaves, fruit, wood, bark.

Myristica montana Roxg (?), No. 805.

A small myristica, 6 inches in diameter, and 20 feet high.
Leaves.—Coriaceous.
Fruit.—Usual two-valved fruit, light-green in colour, and containing the characteristic red aril entwined nut. This is the smallest nutmeg I have met with.
Bark.—Brown.
Locality.—Bengi.
Date.—23rd August.
Native name.—Sukai.
Material collected.—Leaves, fruit.

Monimiaceae.

Indt., No. 379.

A shrub 10 feet high and of a straggling habit.
Leaves.—Simple, opposite; petiole, ½ to ¾ inch; blade, 4 x 3½ inches; margin indented acuminate. Twig, black.
Fruit.—Immature.
Locality.—Mount Obree, Laruni spur, 8,000 to 9,000 feet.
Date.—February, 1923.
Material collected.—Leaves and immature fruit.

Hernandiaceae.

Hernandia peltata, Nos. 234, 610.

A tree, 7½ inches in girth.
Leaves.—Simple, alternate; petiole, 4½ to 5 inches; blade, 6 to 8 inches x 4½ to 6 inches; cordate; petiole inserted ⅝ to ½ inch from base of blade; might be called sub-peltate. Acute, glabrous, more or less coriaceous, shiny above, pale-green below.
Flowers.—Axillary panicles of male and female sage-coloured flowers; peduncle, ¼ inch; bracteoles, ¼ x 3-16th inch. Obovate.
Fruit.—A capsule enclosed in a more or less fleshy light-green translucent envelope which becomes membraneous on drying. The envelope is adnate to the peduncle at base of capsule, but is free at apex, where there is a circular aperture ⅜ inch diameter through which protrudes the apex of the capsule. Venation of envelope reticulated. Capsule, 1 x 3-16th inch, ribbed like a papaver capsule.
Bark.—Grey, scaley, ridged. Solution, faint yellow; no precipitate.
Wood.—Sap undefined.

Rays.—100, sinuous; 1-60th inch deep, show up little on quarter owing to colour. Pores.—1,000 to 1,500, single and radially septate (two, rarely three). Soft tissue.—Clear, 50 to 70 lines coarser than rays. They are concentric, but broken, linking up and surrounding pores; here and there a finer continuous ring occurs. General.—A white wood. Solution, wood, colourless; no precipitate. Cuts soft; 26 lb. per cubic foot.
Locality.—Sea coast (Northern Division), Veimauri foothills, Baroi alluvial flats.
Native names.—Kuyuyu (Buna), Kerea (Suku), Baraida (Vailala), Aputz (Yalu).
Date.—Flowers and friuts in Northern Division in July and August.
Remarks.—A light soft wood made into canoes.
Material collected.—Leaves, flowers, wood, bark.

Lauraceae.

Cinnamomum massoia Schwe, Nos. 57, 592; Cinnamonium sp., No. 319; Litsea grandifolia Teschn, No. 60; Cryptocarya sp., No. 79, 192, 359; (?) Endiandra sp., No. 147; Indt., No. 574.

Cinnamomum sp., No. 319.

A large tree, 9 feet in girth, a bole of 90 feet and 120 feet overall. No buttresses, but moderate root swellings; a spreading crown.
Leaves.—Simple, opposite; petiole, 1¼ inch, stout grooved; blade, 6 to 9 inches x 3½ to 4¾ inches; oval to lanceolate, acuminate, entire, coriaceous. Midrib and lateral veins distinct, and prominent below. The lateral veins follow up midrib for ¼ inch or so before branching to margin. The twig is flattened and grooved at apex.
Flowers.—Only buds seen; axillary panicles.
Bark.—½ inch thick; purple brown; covered with minute flakey scales which rub off; otherwise smooth. Inner bark cinnamon brown. Solution, colourless; very faint precipitate.
Wood.—Sap., 3½ inches, saffron. Heart, walnut-brown, and saffron in concentric rings.
Rays.—140 to 200, yellow; sinuous, twisting around pores, 1-50th to 1-80th inch deep; showing as light-brown lines on quarter. Pores.—2,000 to 2,500, single, and radially septate (two to three), evenly scattered. Soft tissue.—In thin double lines, about three to the inch. General.—A yellow-brown to dark-brown wood with a pretty quarter grain. Solution, wood, colourless; faint precipitate. Cuts firm to hard and clean; 43 lb. per cubic foot.
Locality.—Vailala River.
Date.—December, 1922.
Native name.—Kirabu (Vailala).
Remarks.—A firm interlocked grained timber.
Material collected.—Leaves, flowers, bark, wood.

Cinnamomum massoia Schewe, var. *rotumdatum* Schewe, No. 592.

Locality.—Finch-Haffen.
Date.—December, 1923.
Native names.—Musi (Yabim), Sahulu (Waria), Wontu (Yalu).
Remarks.—See Papua 57. The leaves seem to vary in size and shape to an extraordinary degree.
Material collected.—Leaves, wood, bark.

Cinnamomum massoia Schewe, No. 57, 592.

Large tree, 10 feet girth by 75 feet bole, and 125 feet overall. The average would be about 7 feet and 60 feet of bole. Not buttressed.
Leaves.—Simple, alternate, and subopposite; petiole, ¼ to ¾ inch; blade, obovate to oblanceolate, entire, acuminate; variable in size, 4 x 7 inches, 3½ x 9 inches, 2½ x 7 inches, 1⅜ x 5½ inches; glaucous below, dull-green above. Two basal lateral veins join midrib low down, giving appearance of three veined leaf.
Bark.—Greeny grey-brown, ½ inch thick, covered with regular pustules. Inner bark red-brown. Fragrant. Solution, colourless; faint green precipitate.
Wood.—Sap undefined; light-brown.
Rays.—140, yellow, 1-100th inch deep; show up as little specks on quarter. Slightly sinuous around pores. Pores.—6,400. Very closely sown; single and radially septate, two to three. Soft tissue.—Absent. General.—A pale-brown or mouse-coloured wood; porous and light. Solution, wood, colourless; no precipitate. Cuts very soft and woolly; requires a razor to cut a section. Fragrant, cinnamon smell; 24 lb. per cubic foot.
Locality.—Veimauri, Venapa, Buna district, Hydrographer's, Opi, Kumusi. All over plain and foothills to 1,500 feet.
Native names.—Asiru (Suku), Api-Api (Motu), Pai-Isa (Vailala), Pausa (Buna).
Remarks.—The bark of this specimen is worth attention as a spice; it has a strong cinnamon smell. The wood is cedar like, and has a pretty satin flash on the quarter. It is used for canoe making, being light and easy to adze. It is also used to announce to a maid that a boy loves her. The boy chews the bark, and expectorates as he passes the lady.
Material collected.—Leaves, bark, wood.

Cryptocarya sp., No. 192.

A large tree, 8½ feet in girth, and 75 feet of bole, with small buttresses or spur roots up to 2½ feet.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 4 x 1½ inches; lanceolate, acuminate, glabrous; somewhat coriaceous.
Bark.—Grey; smooth, faint longitudinal lines. Inner bark light-brown, streaked with yellow; bright yellow next cambium layer.
Wood.—Sap undefined; white or pale yellow.
Rays.—Clear, coarse 80; yellow, sinuous around pores, 1-30th inch deep; show up as wavy lines on quarter. Very fine lines—too fine to count—lie between the coarse ones. Pores.—Clear, 3,000 to 4,000 in less and more porous zones; single and radially septate, two or three. Soft tissue.—One or two thin continuous concentric lines to the inch radius. These are sometimes double. General.—A pinky white wood with a maple quarter grain. Solution, wood, colourless; no precipitate. Cuts firm and clean; 31 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Mongua (Buna).
Remarks.—A hardwood.
Material collected.—Leaves, wood.

Cryptocarya sp., No. 389.

A large tree; girth, 8 feet; bole, 70 feet; 120 feet overall. Small spur roots, but no buttresses.
Leaves.—Simple, alternate; petiole ⅜ to ½ inch; blade, 2¼ to 2¾ inches x ⅞ to 1⅝ inch; lanceolate, obovate, oval, elliptical, acuminate; midrib and veins yellow, and very prominent. In some cases the lateral veins arise so close to base of midrib as to give leaf a five-veined

appearance. In soft young leaves the veins below are covered with a dense yellow pubescence; this is absent in older leaves, which are glaucous, hard, stiff, and more or less coriaceous.
Wood.—Sap undefined, yellow to pink.
Rays.—(1) 55, coarse brown, 1-30th inch deep; oblongs on the quarter; (2) 320, very fine indeed. Pores.—Clear, 4,000 to 6,000, fairly evenly scattered; single, rarely septate (2). Soft tissue.—Absent. General.—A mouse-brown wood showing a pleasant grain on the quarter. Solution wood: colourless; no precipitate. Cuts firm. 37 lb. per cubic foot.
Bark.—½ inch thick; a very dark-brown to greeny black. Very pustular; pustules standing out ¼ inch in longitudinal corky lines. Inner bark pale brown, streaked with yellow. Leaves, sap with washboard appearance. Solution, colourless; no precipitate.
Locality.—Mount Obree to Laruni Spur, 7,000 to 8,000 feet.
Date.—February, 1923.
Native name.—Ibai (Laruni).
Remarks.—A hard interlocked timber.
Material collected.—Leaves, bark and wood.

Cryptocarya sp., No. 79.

A large tree, 8 feet in girth, and 45 feet of bole.
Leaves.—Simple, alternate; petiole, ¾ inch; blade, 7½ x 2½ to 3½ inches; oval to obovate, acuminate, glabrous, entire, thin.
Bark.—½ to ¾ inch thick. Fairly smooth. Grey. Inner bark brown.
Wood.—Sap undefined; pale yellow.
Rays.—80, coarse, pale yellow, 1-80 inch deep; showing up in rather pretty wavy lines here and there on quarter; and 260 very fine rays; all wavy but not sinuous; the fine ones are broken by pores. Pores.—4,500, rather evenly sown, single and radially septate (2). Soft tissue.—Very fine lines indeed run concentrically without much undulation. Generally two or three in ½ inch radius, and then none for an inch. General.—A mouse-coloured timber, somewhat cross-grained. Solution, wood, colourless; no precipitate. Cuts hard; 41 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Tokobio (Suku).
Remarks.—A medium hardwood.
Material collected.—Leaves, wood.

Endiandra sp., No. 147.

A large tree, 6 feet in girth, and bole 45 feet with small buttresses up to 4 feet.
Leaves.—Simple, alternate; petiole, ½ to ¾ inch; blade, 5 to 7 inches x 3 to 3½ inches; obovate to oblanceolate, acuminate, glaucous below, thin; brown spots at junction of veins with midribs.
Bark.—½ inch thick; brown, dappled with grey; smooth. Inner bark pink with yellow-brown streaks.
Wood.—Sap undefined, white.
Rays.—200, yellow; sinuous around pores. 1-30th inch deep; show up as specks on quarter. Pores.—1,500 to 2,000, fairly evenly scattered; single and radially septate (2 to 4). Soft tissue.—Absent. General.—A grey-brown wood with a somewhat twisted grain, but works well, and has a faint cedar perfume. Solution, wood, colourless; no precipitate. Cuts soft and clean; 26 lb. per cubic foot.
Locality.—Suputu, near Buna.
Date.—July, 1922.
Native name.—Sauma.
Remarks.—A hardwood with a twisted interlocked grain.
Material collected.—Leaves, wood, and bark.

Indt., No. 574.

A large tree, 10 feet in girth, with a bole of 55 feet, and 90 feet overall. It has a wide-spreading crown and a cylindrical bole without buttresses.
Leaves.—Simple, alternate; petiole, ¾ to 1 inch; blade, 6 to 8 inches x 5 to 6 inches, occasionally narrower, 4½ inches and longer, 8½ inches when lanceolate. As a rule they are orbicular, and the lower surface is glaucous, and the texture coriaceous.
Bark.—¾ to 1 inch; grey, finely pustular, otherwise smooth. Inner bark a light chocolate-brown. When bark is stripped the wood is left covered with lumps. Solution, a very faint yellow; no precipitate.
Wood.—Sap, 2 inches, white. Heart, a good brown; a hard tough wood to axe.
Rays.—230 to 260, distinct; 1-80 inch deep, rather wavy; inconspicuous on quarter. Pores.—1,500 to 2,000; evenly scattered single and radially septate (2), show as brown grooves on quarter. Soft tissue.—Thin, but distinct lines irregularly spaced; sometimes double; sometimes four crowded together; here and there, ⅕ inch apart. General.—A brown wood with a grain that would show up well in cabinet work. Rather hard to cut, and somewhat interlocked; weighs 49 lb. to cubic foot. Solution, colourless; no precipitate.
Locality.—Joangey.
Date.—December, 1923.
Native name.—Turama (Joangey).
Material collected.—Leaves, wood, bark.

Litsea grandifolia Teschn, No. 60.

Small tree, 35 feet overall, and 3 feet girth.
Leaves.—Simple, alternate, exstipulate; petiole, 2½ inches; blade 18 x 6 inches; oblanceolate, pubescent below, glabrous above; bunched at end of branchlets.
Flowers.—In clusters of two to five on old wood or in axilla of leaves.
Locality.—Veimauri.
Date.—May for flowering.
Native name.—Toranu (Suku).
Remarks.—A tree of the second story, Rain Forest.
Material collected.—Leaves and flowers.

ROSACEAE.

Parinarium laurinum; Rubus moluccanus, No. 177; Rubus rosaefolius, No. 345; Rubus sp., Nos. 510, 511, 512.

Parinarium laurinum, A. gray, No. 810.

A small to medium tree 3 feet in girth and 30 feet high.
Leaves.—Simple alternate on swollen brown tomentose petiole ⅜ inch long; blade 5 inches to 10 inches x 1½ to 2 inches; lanceolate, somewhat oblique, acuminate venation prominent, stiff, glabrous, thin.
Fruit.—A very hard brown rough woody fruit, ovoid in shape when ripe, 3 inches x 2 inches. When green a flattened ovoid. Woody shell 5/16 inch thick; inside a convoluted kernel 2 inches x 1½ inches.

Bark.—One-eighth of an inch thick. Brown finely lined. Inner bark reddish.
Wood.—Sap white 1 inch heart light brown. Axes firmly. Rays.—Very indistinct, 390-400; sinuous around if not broken by pores which cover a width of up to 5 rays. Indistinct on longitudinal sections. Pores.—900 to 2,000 in irregularly scattered clumps; single. Soft Tissue.—Very fine lines link up the rays. 250 to the inch. General.—A reddish brown wood with a dense grain. Cuts hard. Weighs 52 lb. per cubic foot.
Locality.—Mavelo River.
Date.—13th September.
Remarks.—The shell of the fruit is grated up on the stem of a pandanus and the gratings are used to make caulking for canoes.
Material collected.—Leaves, fruit, bark, wood.

Rubus moluccanus (under revision), No. 177.

A climber attaining a height of 30 feet on old fallen timber and young regrowth. Requires light to develop and is killed by dense shade.
Locality.—Common all round territory and up to 4,600 feet.
Date.—Flowers and fruits during the dry season.
Native names.—Kurere (Binandeli), Kakendi (Wasida).
Material collected.—Leaves, flowers and fruit; in herbarium.
Remarks.—The berry is edible and somewhat like the cultivated raspberry.

Rubus rosaefolius, No. 345.

A straggling raspberry.
Flowers.—White.
Fruit.—A red raspberry.
Locality.—Between 4,000 and 7,000 feet on the Owen Stanley Range. It occurs alongside R. moluccanus at the lower elevations, but over 6,000 feet the latter ceases.
Date.—February, 1923.
Remarks.—The fruit, while having much the same appearance as an European alpine strawberry, is insipid and watery. Is this the strawberry mentioned by Sir W. McGregor in his report on the ascent of Mount Victoria?
Material collected.—Leaves, flowers, fruit.

Rubus sp., No. 512.

Flowers.—White.
Locality.—Holes in the Libocedrus forest Sarawaket 10,000 feet.
Date.—November, 1923.
Remarks.—510, 511 and 512 were all found within a quarter of a mile of one another and in addition there was a third Rubus similar to R. rosaefolius but large leafed, which unfortunately was not flowering.
Material collected.—Leaves and flowers.

Rubus sp., No. 511.

Flowers.—White.
Locality.—Holes in Libocedrus forest Sarawaket 10,000 feet.
Date.—November, 1923.
Remarks.—This appears to differ four R. rosaefolius see 512.
Material collected.—Leaves and flowers.

Rubus sp., No. 510.

Flowers.—White.
Locality.—Holes in Libocedrus forest 10,000 feet.
Date.—November, 1923.
Remarks.—The range of this species if it is R. moluccanus is remarkable for it is to be found at sea level and right up through the foothills and on the mountains to the great height of 10,000 feet.
Material collected.—Leaves and buds.

SAXIFRAGACEAE.

Kania eugenioides, No. 558; Polyosma lagumensis, No. 801.

Kania eugenioides, Schlk., No. 558.

A small tree. Five feet in girth with a bole of 35 feet and 60 feet overall.
Leaves.—Simple, opposite; petiole $\frac{1}{4}$; blade 2 to $3\frac{1}{2}$ inches by $\frac{1}{2}$ to 1 inch; elliptical tapering to a blunt point; more or less coriaceous.
Flowers.—Yellow in terminal panicles.
Bark.—$\frac{1}{4}$ inch thick; grey, scaly. Sheds in irregular untidy more or less longitudinal pieces. Inner bark red. Exudes a red kino or gum. Solution.—Pale brown; green precipitate.
Wood.—Sap about 2 inches; heart pink. Rays.—50-60 distinct, straight, pale. In between these about four times as many fine rays. The coarser ones are 1/90 inch deep and show up as wavy streaks on the quarter. Pores.—6,000 single, evenly scattered show up as brownish grooves on the quarter. Soft tissue.—Broken thin brown lines linking up rays and surrounding the few pores they come in contact with. General.—A light yellow brown wood; dense and even grained; hard to cut. Solution colourless; blueish precipitate.
Locality.—Ogeramnang.
Date.—November, 1923.
Native name.—Sumut (Ogeramnang).
Remarks.—This is said by natives to grow to a very large tree 10 feet girth and 80 feet high.

Polyosma lagunensis Merr, No. 801.

A small tree 18 inches in diameter and 40 feet high.
Leaves.—Simple alternate, terminal pair often opposite; petiole $1\frac{1}{2}$ inches grooved; blade 4 to 7 inches by 2 to $2\frac{1}{2}$ inches, elliptical, acute thin.
Flowers.—Terminal spikes 6 inches long and white, shortly pedunculate; very fragrant flowers.
Bark.—$\frac{1}{2}$ inch thick, grey, ridged. Inner bark white.
Wood.—Yellow, axes firmly. Rays.—340 to 350 of which 70 to 80 are coarse straight and conspicuous and 270 are indistinct and sinous around the pores. Show up very little on the quarter and back. Pores.—Indistinct, 8,100 to 8,300, radially septate (2-6), constricted between rays which are slightly bulged. Soft tissue.—Very fine to minute lines join the rays. General.—A mouse coloured firm-cutting close grained wood. Weighs 36 lb. to the cubic foot.
Locality.—Likdin.
Date.—August, 1924.
Native name.—Sapilul (Likdin).
Material collected.—Leaves, wood, bark, flowers.

CUNONIACEAE.

Weinmannia Ledermannii, Schltr., No. 802.

A medium tree, 6 feet in girth with a bole of 50 feet and attaining 70 feet overall. Not buttressed.

Leaves.—Compound *opposite.* Rachis 2½ inches bearing 1 to 3 pairs of opposite leaflets and a terminal one. Leaflets are sessile except terminal which have ¼ inch petiole. The blade is 2 to 3¼ by ½ to 1¼ inches; the margin is very regularly serrate. In shape the blade is lanceolate obovate and even elliptical, it is glabrous and thin.
Flowers.—Axillary panicles of white flowers crowded at end of branchlets.
Bark.—¼ inch thick, red-brown; scaley to shaggy, pustular. Inner bark brown spotted with yellow pustules.
Wood.—Sap 1 inch yellow deepening through pink to red. Axes firmly. Rays.—240 to 250, of which 80 are coarse and distinct and 160-170 are inconspicuous and sinuous around pores. Show up little on longitudinal sections. Pores.—Indistinct. 14,500, single, crowded between rays, sometimes appear to be tangentially septate. Soft tissue.—Invisible. General.—A reddish dense wood cuts hard and has little grain. Weighs 45 lb. to the cubic foot.
Locality.—Likdin.
Date.—August, 1924.
Native name.—Kulan (Likdin).
Material collected.—Leaves, bark, wood, flowers.

Leguminosae *Mimosoideae.*

Adenanthera pavonina, Nos. 174, 316; Albizzia sp., Nos. 26, 263, 432; Albizzia procera, No. 607; Archidendron sp. affin. A. chrysocarpum Laut. et. K.Sch., No. 399; Serianthes sp. nr. S. grandiflora Benth, No. 649.

Adenanthera pavonina, Linn., Nos. 174, 316.

Medium tree, 5 feet in girth, 30 feet of bole, and 80 feet overall.
Leaves.—Bicompound, subopposite, main stalk 12 inches long; secondary stalk subopposite, 4½ inches, bearing leaflets. Leaflets alternate, exstipulate; petiole 1-16; blade 1⅛ by 9-16 inches.
Flowers.—Axillary spikes bearing a large number of shortly pedunculate ⅛ inch white flowers.
Fruit.—A legume, 4 to 5 inches long, curls up on drying and contains flattened obovoid seeds, 7-10 by 5-16 inches, red with a black spot at end.
Wood.—Sap, 2 inches, pale yellow. Heart a fine saffron colour streaked with brown.
Rays.—400; yellow; very fine indeed, very sinuous to get around large pores or broken by them. very shallow indeed; just visible as minute specks on quarter. Pores.—Conspicuous in porous and almost non-porous zones; the latter carry as few as 600 pores, and the former up to 1,500. Filled with red deposit. Soft tissue.—Concentric thin, usually double, lines, about eight to the inch, but they vary in spacing distance. They are not wavy like ordinary wavy soft tissue, but undulate in wide sweeping curves. General.—A very pretty golden wood with mauve red pore streaks. Solution wood, colourless; faint blue precipitate. Cuts hard; 37 lb. per cubic foot.
Bark.—Grey-brown, finely longitudinally lined, red just below the surface. Inner bark yellow.
Locality.—Buna district.
Date.—Flowers in July, Buna district.
Native names.—Gigino (Buna).
Remarks.—A good cabinet wood.
Material collected.—Leaves, flowers, legume, seeds, wood, bark.

Albizzia procera, Benth, No. 607.

A small tree with a girth of 3 feet and a bole of 20 feet and 35 feet overall.
Leaves.—Bi-compound. Primary:—Alternate, rachis 10 inches to 12 inches, bearing five pairs of opposite secondary leaflets whose stalks are 3 inches to 6 inches long, and carry nine pairs of opposite leaflets. Petioles, 1/16 inch; blade, ¾ to 1¼ inches x ½ to 9/16 inch; glabrous, thin, oblique, obovate, obtuse, notched at apex.
Flowers.—White axillary.
Fruit.—A pod 4 inches long, and thin.
Bark.—Smooth, thin, plane-like, shiny.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Minzimb (Yalu).
Remarks.—A treelet that springs up in grass lands of the Markham, and is to be found in any clearing in the forest and in villages.
Material collected.—Leaves, flowers, fruit.

Albizzia sp., No. 26.

A large tree, 8 feet in girth, and a bole of 60 feet and 100 feet overall; no buttresses.
Leaves.—Bi-compound. Primary stalk alternate; 6 inches long (a gland ¼ inch from base) bearing six pairs of sub-opposite and opposite leaflets. Secondary stalks 1½ to 2 inches long, which in turn bear about seven pairs of opposite leaflets; these are sessile oblong, ½ inch to ⅝ inch long; lanceolate, obtuse, deciduous.
Fruit.—A thin pod, 4¼ inches long, containing thirteen to fifteen seeds.
Bark.—⅜ inch thick, grey to very dark brown. Inner bark yellow. Solution colourless. No precipitate.
Rays.—Rays 150, very slightly undulate but usually broken by pores; yellow to yellow brown. Pores.—Conspicuous; from 1,500 to 3,000 in openly and closely sown zones; single and septate (2). Soft tissue.—Conspicuous; surrounds pores and links them up in groups of two to five; here and there very fine concentric lines, they run from seven to ten to the inch. General.—A yellow to yellow-brown wood; solution wood, colourless; dark-green precipitate. Cuts hard and clean; 51 lb. to cubic foot.
Wood.—Sap pale yellow; 3½ inches thick; heart a very dark brown.
Locality.—Foothills behind Veimauri. It is very common in the dry belt from Galley Reach to Rigo.
Date.—May, 1922.
Native names.—Mokeke (Motu); Berekeke (Suku); Gemona (Buna).
Remarks.—A hard interlocked grained timber. Useful for house posts.
Material collected.—Leaves, wood, and bark.

Albizzia fulva, White & Francis ined., No. 263.

Very large tree, 13 feet girth and 150 feet high, with an 80 feet bole.
Leaves.—Compound, alternate, stipulate, pinnate. Stalk 9 inches. Secondary stalk 1½ to 4 inches. Leaflets opposite, sessile; blade 7/16 x 3/16 inches. Asymmetrical; glabrous; obtuse.
Flowers.—Axillary panicles, white.
Fruit.—A thin pod, 5 inches long and ½ inch wide.
Bark.—Grey, pustular; otherwise smooth. Solution colourless; cloudy brown precipitate.
Wood.—Sap undefined; pale yellow darkening to deep yellow.

Rays.—Very fine and numerous; unable to count them owing to difficulty of cutting a translucent section. Pores.—Conspicuous; 500; single and radially septate (two to three), rather evenly scattered. Soft tissue.—Absent. General.—A pale timber with a streak here and there of blue or brown, due to discolouration of pores; straight grained, soft and spongy. Solution wood, colourless; slightly discoloured precipitate. Cuts soft and woolly; 18 lb. per cubic foot.
Locality.—3,000 to 5,000 feet on Owen Stanley Range. Trail from Kokoda to Gap.
Date.—Flowers in August.
Native names.—Haiede (Vailala).
Remarks.—A hard wood.
Material collected.—Leaves, flowers, wood and bark.

Albizzia sp., No. 432.

A medium tree 3½ feet girth x 60 feet overall.
Leaves.—Twice compound, alternate; stalk 9 inches. Secondary leaflets opposite, no terminal one; stalk 3½ inches. Tertiary leaflets opposite, no terminal one; petiole 1-16th inch; blade, ⅞ x 1¼ inches; asymmetrical, elliptical, soft, acute.
Flowers.—Terminal and axillary panicles of white flowers.
Bark.—¼ inch; grey, smooth except for pustules. Inner bark yellow.
Wood.—Sap undefined; yellow; rays fine; pores numerous, conspicuous.
Locality.—Iorobaiva; 3,000 to 4,000 feet, in forests of ravines in otherwise grassy hill.
Date.—February, 1923.
Material collected.—Leaves, flowers, bark, wood.

Serianthes sp. nr. S. grandiflora, Benth, No. 649.

A large tree 9 feet x 80 feet x 40 feet bole, wide, branchy, unbuttressed.
Leaves.—Bipinnate.
Flowers.—White, axillary.
Fruit.—A pod 7 inches long by 3 inches wide.
Bark.—½ inch thick; grey, ridged, pustular; exudes sticky gum. Inner bark streaked red and white. The bark becomes very hard, indeed, on drying. Solution brown; purple precipitate.
Wood—Rays.—140; thin sinuous around, and occasionally broken by pores 1-120th of an inch deep show up as distinct lines on quarter. Pores.—Conspicuous, 2,100 to 2,500 single and septate radially and diagonally (two to four) show up as brown streaks on longitudinal sections. Soft tissue.—Absent. General.—A loosely-knit timber of a pale colour, works easily; weighs 40 lb. to cubic foot. Solution.—Tawny, blue precipitate.
Locality.—Amage (Upper Ramu).
Date.—March, 1924.
Native names.—Kerefere (Kohu).
Remarks.—Handsome shade tree.
Material collected.—Leaves, flowers.

Archidendron sp., affin. *A. chrysocarpum* Laut et K. Sch., No. 399.

A medium tree, 5½-in. girth, 50 ft. bole, and 80-ft. overall; no buttresses.
Leaves.—Bipinnate; petiole, ¼ inch; blade up to 12 inches x 4½ inches. Obovate, acuminate, glabrous, thin.
Flowers.—Caulifloral. Heavy panicles of white filamented flowers, arising from old wood, right down to 3 feet from ground on trunk.
Bark.—¼ inch brown; scaly. Inner bark yellow.
Wood.—Sap undefined; white; pores, distinct; rays, invisible.
Locality.—Between Nornu and Naro Rivers.
Date.—February, 1923.
Remarks.—A conspicuous white-flowered tree.
Material collected.—Leaves and flowers, bark and wood.

LEGUMINOSAE *Caesalpinoideae.*

Afzelia bijuga, Nos. 10, 588; Bauhinia Schlechteri, No. 793; Cassia Bartoni, No. 344; Cassia glauca, No. 351; Kingiodendron (Dialium sp.), Nos. 318, 339; Maniltoa sp. nov., 203. Indt., 782.

Afzelia bijuga. A Gray. *Syn. Intsia amboinensis,* No. 10.

A large tree, 8 feet girth, 50 feet bole, and 80 feet over all. In certain localities it is buttressed for a few feet up the bole; in others it has but a slight root swelling. In the swamp lands of the Delta Division it assumes the characteristic habit of swamp trees, making distinct prop roots.
Leaves.—Compound, alternate. Leaflets opposite; petiole ¼; blade 3½ x 2 inches to 5 inches x 2½ inches; ovate, glabrous, somewhat asymmetrical.
Bark.—Less than ¼ inch thick. Light brown Fairly smooth.
Wood.—Sap up to 5 inches thick, but averaging 2 inches. Light yellow. Heart a good red-brown.
Sapwood from buttress.
Rays.—150, very fine brown. Pores.—Conspicuous; 900 to 3,000 irregularly scattered large single and radially septate (2-3-4), conspicuous owing to very dark-brown soft tissue surrounding each pore and joining up groups. Soft tissue.—Distinct. Very dark-brown surrounds pores and connects up small groups across rays. Also fine concentric lines two to the inch. General.—The sap is a grey yellow. Solution wood slightly discoloured; faint green precipitate. Hard to cut; weighs 48 lb. per cubic foot.
Heartwood.
Rays.—1,300 to 1,600, brown sinuous around and broken by pores just visible on quarter as very fine lines. Pores.—Conspicuous; 1,700 to 2,700; singly and radially septate (2-3) in thinner and thicker sown zones; immersed in soft tissue about 50 to the square inch; are filled with a yellow deposit. Soft tissue.—Clear. Surrounds pores and links up small groups. In addition there are 10 to 14 very fine lines of soft tissue to the inch. Where these occur the pores are least thick. General.—A dark red-brown wood with a mahogany grain. Solution wood dark red-brown; heavy blue precipitate. Cuts hard and clean. Weighs 53 lb. per cubic foot.
Locality.—Collected material on foothills behind Veimauri. It is common all round the Territory up to a few hundred feet above sea-level. In the Delta Division it attains its optimum growth in the swamps; elsewhere the best trees I have seen were on hillsides. On the northern foothills of the Hydrographer's Range this tree grows with a dipterocarp as sole other tree species. I have not met such an association elsewhere.
Date.—May, 1922.

Native names.—Melila (Motu); Dedira (Suku); Bendora (Binendele); Pira (Vailala); Eh (Evara, Delta Division); Kaboing (Yabim); Ombong (Yalu); Sabol (Waria); Kwila (Rabaul).
Remarks.—The most sought after timber in Papua. The reason is that it is more durable in the ground than most other woods, and so has been used for house posts, bridges, wharfs, &c., &c. Worked up into furniture it presents the appearance of mahogany, but is decidedly heavier than that cabinet wood. It is hard to distinguish the timber from the African species, *Afz. africana.* The counter wood of West Africa and mahogany of Northern Transvaal and Rhodesia. It is similarly gritty to plane, and is therefore not an easy working wood.
Material collected.—Leaves, bark, wood.

Bauhinia Schlechteri Harms, No. 793.

Small to medium tree, 50 feet high.
Leaves.—Simple, alternate; petiole ½ inch to 1½ inches, stout, swollen and wrinkled at both junction with stem and with blade; the blade is ovate to subcordate 4 inches to 7 inches by 3½ to 5 inches, six veins arise from base of midribs; glabrous, chartaceous, tapering to rather a blunt point.
Fruit.—A large terminal pod 12 inches to 18 inches long, terminating in a point, and containing 3 or 4 large beans, which, when ripe, are mahogany-coloured, and much resemble the beans of Entada sp.
Bark.—Grey.
Wood.—Soft, white.
Locality.—Mogendo (Lower Sepik).
Date.—24th July, 1924.
Native Name.—Kongangle (Sepik).
Remarks.—The beans are common objects on the sea-shore.
Material collected.—Leaves, fruit.

Cassia Bartoni, F. v. M., No. 344.

A medium tree, 50 feet overall; wide branching; no buttresses.
Leaves.—Compound; pinnate; alternate. Stalk 8 inches to 10 inches, grooved on the upper surface, and covered with yellow appressed hairs. Leaflets, 12 to 13 pairs, alternate, subopposite and opposite; no terminal leaflet. Petiole 1-16th inch, covered with pale yellow appressed hairs. Blade, 1 inch to 1¾ inches long; basal and terminal pair are smallest; oblong mucronate midrib protruding 1-32nd inch as a spine. Pubescent below; glabrescent above.
Flowers.—Characteristic Cassia type. Petals rose-pink; calyx purple-red; stamens yellow.
Fruit.—Cylindrical; dark-brown to black pod up to 20 inches long and ¾ inch in diameter. Shell 1-32nd inch thick. The pod is divided transversely into a number of compartments, each containing a yellow-brown pea 5-16th x ¼ inch.
Bark.—Mottled grey and brown.
Locality.—Upper Kemp Welch. 4,000 feet.
Date.—February, 1923.
Native name.—Gosai (Amie).
Remarks.—A very ornamental tree. The fruit is used by native women as a rattle in their dances.
Material collected.—Leaves, fruit, flowers.

Cassia glauca, No. 351.

A scrambling leguminous shrub.
Flowers.—Yellow.
Locality.—6,000 feet—spurs of Mt. Obree.
Date.—January, 1923.
Remarks.—In openings in the forest and on old farm lands.
Material Collected.—Leaves and flowers.

Kingiodendron sp. (*Dialium* sp.), Nos. 318 and 339.

A large tree, 9 feet in girth, with an 80-ft. bole, and attaining 110 feet in total height. No buttresses.
Leaves.—Compound. Stalk 1¾ inches to 2 inches, sometimes bearing only one terminal leaflet, but usually a pair of alternate lateral leaflets and a pair of opposite terminal ones. Petiole 5-16th inch, black and stout. Blade 3 to 6 x 1½ to 2 inches; lanceolate, acuminate, entire, coriaceous; midrib yellow.
Flowers.—Axillary panicles, 4 inches long, of small cream sessile flowers. Several panicles arise in one axil.
Bark.—½ inch thick. Dappled green and brown; pustular—the pustules connected by fine lines. Here and there adventitious buds form knobs up to 1 inch diameter. Inner bark streaked mauve and yellow. Solution pinky-yellow, slight precipitate.
Wood.—Sap ill-defined; white, deepening to pale-pink. Pores conspicuous.
Rays.—115 to 130 fine and 45 to 50 wider conspicuous brown rays, 1-20th inch deep on quarter, with pretty figure. Pores.—1,350 to 1,450, rather evenly distributed in single and radially septate, 2-3 groups. Soft tissue.—Thin concentric rings, 9 to 12 to the inch. General.—A pale-yellow wood with brown specks and streaks due to rays and pores. Stained with a gum. Solution wood, colourless. Slight precipitate. Cuts soft. 37 lb. per cubic foot.
Locality.—Vailala river.
Date.—December, 1922.
Native names.—Opopeia (Vailala), also Dika.
Remarks.—Straight-grained; soft to cut. Used by the Anglo-Persian Oil Company for house construction.
Material collected.—Leaves, flowers, bark, wood.

Manilltoa sp. nov., No. 203.

Large tree, 8 feet in girth, with a bole of 60 feet. Large buttresses up to 6 feet.
Leaves.—Compound, alternate, exstipulate. Stalk 5 inches to 8½ inches, much thickened for ½ inch from base; prominent gland in axil. Five pairs of leaflets; opposite; petiole ⅜ inch; blade 2¼ to 4½ x 1½ to 2; very asymmetrically elliptical to obovate, acuminate, stiff, rather coriaceous. Dark-green, shiny above, pale glaucous below. Twigs and branches covered with small corky lenticels.
Bark.—Grey, covered with small pustules. Inner bark streaked with yellow. Solution colourless. No precipitate.
Wood.—Sap undefined. Pale-yellow, deepening to a light-brown.
Flowers.—Axillary cymes arising from a mass of bud bracts.
Rays.—230 to 250. Yellow. Wavy and sinuous; 1-60th inch deep. Show up as yellow lines on quarter. Pores.—2,000 to 2,500 in zones of less and more porous wood; single and radially septate (2). Soft tissue.—Conspicuous wavy concentric continuous and broken lines, 100 to the inch, link up and surround pores. Much coarser than rays. General.—A yellow-brown

wood with an attractive grain on the back due to the presence of lines of soft tissue. Solution wood, colourless; no precipitate. Cuts hard. 55 lb. per cubic foot.
Locality.—Sageri; Northern Division.
Date.—Flowers July.
Native name.—Kaira (Buna).
Remarks.—A very hard wood, as much thought of by natives as Afzilia bijuga. They make clubs of it, and sometimes combs.
Material collected.—Leaves, flowers, wood, bark.

No. 782—

A medium tree, 8-ft. girth, 20-ft. bole, 35 feet over all.
Leaves.—Simple, alternate. Petiole, $1\frac{1}{4}$ inches, grooved; blade, average 9 x 5 inches, cordate, based, and tapering to a fine point, venation palmate, margin faintly undulate, glabrous, thin.
Flowers.—Large, showy, with white, red-streaked petals, axillary, total length 6 inches, petals 3 inches, calyx equals tube 3 inches.
Fruit.—A pod 5 to 8 inches long and 3 inches wide, dark-brown when dry; contains 2, rarely 3, seeds $1\frac{1}{2}$ x 1 inches, $\frac{1}{8}$ x $\frac{1}{4}$ inch, mahogany brown.
Bark.—Grey, smooth, except for lines of pustules.
Wood.—White, axes very easily, a poor, soft wood.
Locality.—Waimeriba (left bank of Ramu).
Date.—April, 194.
Remarks.—A very ornamental flower.
Material collected.—Leaves, flowers, pod, and seed.

LEGUMINOSAE PAPILIONATAE.

Desmodium sinuatum, No. 352; Desmodium rufescens D.C., No. 348; Desmodium umbillatum, No. 436; Erythrina sp., No. 657, Mucuna sp., No. 372; Pomgamia glabra, No. 216; Pterocarpus indicus, Nos. 4, 210, 587; Strongylodon sp., No. 652; Strongylodon lucidus, No. 402; Stylosanthes mucronata, No. 441; Indt., No. 215.

Desmodium rufescens D.C. affin., No. 348.

A scrambling leguminous shrub, 4 feet high.
Flowers.—Mauve.
Locality.—Grass and abandoned farm lands, at 5,000 feet—lower spurs of Mt. Obree.
Date.—January, 1923.
Remarks.—Very common.
Material collected.—Leaves and flowers.

Desmodium sinuatum, No. 352.

A trifoliate leguminous shrub, 5 feet high.
Flowers.—Mauve.
Locality.—Spurs of Mt. Obree—5,000 feet.
Date.—January, 1923.
Remarks.—Occurs in the grass lands and old farm lands, and is quite common.
Material collected.—Leaves and flowers.

Desmodium umbillatum, No. 436.

A small tree.
Flowers.—White.
Locality.—Port Moresby.
Date.—May, 1922.
Remarks.—Very common.
Material collected.—Leaves and flowers.

Erythrina sp., No. 657.

A wide-spreading short-boled tree. Girth 8 feet, bole 2 to 20 feet, crown 30 feet.
Leaves.—Compound (trifoliate) alternate. Main petiole swollen, at base 3 inches to $3\frac{1}{2}$ inches; lateral ones $\frac{1}{4}$ inch, swollen; terminal, 2 inches, swollen at junction with leaf. All petioles have warts at base of swelling. Blades: lateral $3\frac{1}{2}$ x 2, terminal $5\frac{1}{4}$ x $4\frac{1}{2}$; broad-based, almost cordate, tapering to apex. Chartaceous glabrous and lower surface glaucous. Twig covered with brown lenticles and armed with short erect spines.
Flowers.—Crimson.
Bark.—Half-inch thick, grey, ragged and slightly scaley. Inner bark pink. Solution colourless; no precipitate.
Wood.—Pale yellow, axes easily.
Rays.—Conspicuous, 44 coarse, straight, 1-20 inch deep, show up as oblongs on quarter. Pores.—Conspicuous 400-500 single and rarely septate. Form heavy grooves on both back and quarter. Soft tissue.—Conspicuous, 50 wavy lines to the inch bending round pores. Very conspicuous on back and quarter. General.—A very soft light wood, common on Ramu. Weighs 14 lb. to the cubic foot. It discolours on exposure. Solution colourless; no precipitate.
Locality.—Kohu (village), the Ramu.
Date.—April, 1924.
Native name.—Pani (Kohu).
Remarks.—Prefers river banks. The glaucous under surface of the leaves make this species conspicuous when a wind is blowing. Planted for shade and ornament on Sepik.
Material collected.—Leaves, wood, bark, flowers.

Mucuna sp., No. 372.

Flowers.—Smaller than usual, white.
Fruit.—Pod 5 inch green, covered with brown penetrating hairs.
Locality.—6,000 feet. Owen Stanley Range.
Date.—February, 1923.
Remarks.—Found by Mr. Stanley, Government Geologist. Unfortunately pods were lost so that material is reduced to a few leaves, two flowers, and some seeds.

Pongamia glabra, No. 216.

A medium tree; 6 feet girth, and 50 feet over all.
Leaves.—Compound, alternate, exstipulate. Stalk 5 inches carrying two pairs and an odd leaflet. Leaflets simple, opposite; petiole $\frac{1}{4}$ inch, round, a darker green than stalk or midribs, and finely transversely wrinkled. Lower pair $2\frac{1}{2}$ x $1\frac{3}{4}$ inches. Upper $4\frac{3}{4}$ x $2\frac{3}{4}$ inches. Terminal 6 x $3\frac{3}{4}$ inches. All ovate, more or less acute; glabrous; thin.
Flowers.—Axillary racemes up to 6 inches long bearing mauve flowers inserted in pairs on stem on 5-16th inch peduncle.
Fruit.—A pod $2\frac{1}{4}$ x $1\frac{1}{2}$ inches and $\frac{1}{8}$ to 3-16th inch thick. Green; glabrous; more or less rugose. Asymmetrically oblong and terminating in a spine. Peduncle 7-16th inch long; contains two seeds, $\frac{3}{8}$ inch diameter, flattened, ovoid, and having a 1-16th inch projection at side of base.
Bark.—Half an inch thick; grey, more or less smooth, longitudinally finely fissured. Inner bark streaked yellow and white. Solution pale yellow; cloudy precipitate.
Wood.—Sap undefined, yellow.
Rays.—220. Straight or a little sinuous. Less than 1-100th inch deep; just visible as little specks and very fine lines on quarter. Pores.—Conspicuous, 600 to 1,000 in zones of less and

more porous wood. More often septate (2-3) than single. The septum is generally tangential, but may be radial or diagonal. Thus three pores occur with a radial and half a diagonal or tangential septum. Soft tissue.—Very conspicuous; white, concentric wavy lines; they are not regularly spaced; sometimes crowded, sometimes more widely separated. Average 55 to the inch radius. General.—A white yellow wood showing nice yellow figure on back due to contrast of soft (white) tissue and relatively hard yellow tissue; straight grained. Solution wood, colourless; no precipitate. Cuts hard; 45 lb. per cubic foot.

Locality.—I only found it within a short distance of sea-coast.

Date.—Flowers in July in the Northern Division.

Native name.—Jambo (Buna).

Remarks.—A hard wood.

Material collected.—Leaves, flowers, fruit, wood, bark.

Pterocarpus indicus Willd., Nos. 4, 210, 587.

A large tree, average bole, 9 feet x 25 feet, 80 feet over all. One specimen on Vanapa River measured 15½ feet x 30 feet of straight bole. Boles of from 30 to 50 feet are met with, but as a general rule this species tends to divide into several large limbs low down; also it is frequently gnarled and twisted. It is more or less spur rooted, but not definitely buttressed. The logs are frequently hollow.

Leaves.—Compound, alternate. Variable in size; in young trees the stalk may attain 12 inches in length; in full-grown specimens the stalk is 3 to 5 inches long, bearing 6 to 8 leaflets, alternate, petiolate, and also one terminal leaflet. The petioles of the leaflets are about 3-16th inch and the blade 1¾ to 3 inches x 1⅛ to 1¾ inches. Ovate, acuminate, entire, margin wavy, glabrous, thin.

Flowers.—Axillary racemes 2 to 2½ inches long. A few compound, but for the most part single flowers on peduncles 5-16th of an inch long. Colour yellow; margins of petals fimbriate.

Fruit.—Winged orbicular pod 3 inches x 1½ to 1¾ inches, containing one seed.

Bark.—Greyish yellow to greenish brown, ¼ to 7-16th inch thick; scaly, scales papery. Inner bark cream speckled with red kino; exudes red kino freely.

Wood.—Sap, white to pale yellow, 2 inches thick. Heart, yellow to red-brown. Fragrant, like cedar, but a true rosewood grain.

White variety of timber.

Rays.—180, white, hard to see, less than 1-100th inch deep, faint lines on quarter. Pores.—Conspicuous, 400 to 1,700 in almost non-porous and fairly porous zones; single and radially septate 2-4. They are small in non-porous and large and conspicuous in porous zones. Soft tissue.—Conspicuous; coarse, white, wavy concentric, unbroken lines, six to the inch in the non-porous wood; they run together when the zone diminishes in breadth. Fine white wavy concentric broken and continuous lines, twelve to the inch, in the porous zones. General.—A pale-yellow timber streaked with white. The soft tissue gives it a well-marked back grain, and the same cause makes the quarter grain dull white and shiny yellow in vertical bands. Solution wood, colourless; no precipitate. Cuts firm to hard; 39 lb. per cubic foot.

Red variety of timber.

Rays.—360, red, fine, sinuous around and broken by pores; hardly show up on quarter. Pores.—Conspicuous. A ring pored wood average 183 to the square inch from minimum of 80 to maximum of 800. Whether rings of most porous wood and least porous are seasonal it is hard to say. Variable in size. Single sometimes radially septate (2-3). Soft tissue.—Conspicuous white, wavy, concentric lines 70 to the inch link up small pores. Rings of large pores are free of soft tissue. General.—Concentric rings of red or brown and lighter coloured, which show up on cross-section each bounded by single ring of large pores. Solution wood, colourless; dark-red brown precipitate. Cuts soft; weighs 37 lb. to the cubic foot.

Locality.—Wide-spread from coast to 3,000 feet everywhere. Seldom to be found, except as isolated specimens. Flowers in Buna district in August.

Date.—June and August, 1922.

Native names.—Aiamani (Suku), Kalelong (Yabim), Ngafin (Yalu), Taoro (Binendeli), Saoro (Buna), Apa (Vailala), Haravea (Evara), Marava (Motu).

Remarks.—A very beautiful reddish timber, having all the qualities of rosewood. The natives use it for the making of drums. The Kino is worth investigation, as a very similar Kino derived from the same genus in India forms a valuable forest product.

Material collected.—Leaves, flowers, fruit, wood, bark.

Strongylodon lucidus, No. 402.

(Found by Mr. Stanley.)

Flowers.—A bright orange.

Fruit.—Not seen.

Locality.—Junction of Adai and Inumu Rivers, 2,200 feet.

Date.—February, 1923.

Remarks.—An exceedingly beautiful creeper, not so striking as the crimson one, but much more lovely in a less brilliant way.

Material collected.—Leaves and flowers.

Strongylodon sp., No. 652.

A creeper reaching to the tops of trees, but preferring openings in the forest.

Leaves.—Trifoliate.

Flowers.—Orange-pink.

Locality.—Kohu.

Date.—29th March, 1924.

Native names.—Amwam (Kohu).

Material collected.—Leaves and flowers.

Indt., No. 215.

A medium tree up to 40 feet over all.

Leaves.—Compound, opposite. Stalk 9 inches, bearing four pairs of opposite leaflets and a terminal one; petiole, ¼ inch; blade 2 to 4½ inches x 1¼ to 1¾ inches; lanceolate to ovate; more or less asymmetrical, glabrous, thin.

Fruit.—A pod, 18 inches long.

Bark.—One-quarter inch thick; grey-brown; rough, scaly. Inner bark brown, ¼ inch. Solution yellow; light-green precipitate.

Wood.—Sap undefined; white to pale yellow.

Locality.—100 yards from coast, Buna.

Rays.—Clear, 300, white, hard to see; seem to be fairly straight. Very shallow, just visible on quarter as wavy lines. Pores.—4,000 to 4,500 in more porous wood; 3,000 in less porous wood.

In the first they are arranged regularly in rungs of soft tissue; in the second they are irregularly scattered; single and radially or diagonally septate. Soft tissue.—In two formations. (1) Concentric, rather coarse lines broken by pores and slightly wavy, 50 to the inch, quite regular. These are bounded by a perfectly concentric thin line. (2) Then comes a zone of wood when the soft tissue consists of short broken lines connecting the pores up irregularly. General.—A white wood, the soft tissue gives it a grain on the quarter. Solution wood, colourless; no precipitate. Cuts soft; 23 lb. per cubic foot.

Date.—July, 1922.
Native name.—Bindjopa (Buna).
Material collected.—Leaves, wood, bark.

Stylosanthes mucronata Willd., No. 441.

A small herb, very common around Port Moresby. It is said to have first made its appearance in 1920, and since then has covered an extensive area. It shoots up in January and February, and comes into flower in April at the beginning of the dry season, and then dies off as soon as it has fruited. It is a fodder plant of some value, judging by the avidity with which the horses and other stock eat it, and the good condition it keeps them in.

Leaves.—It is vigorous enough to kill out most of the other smaller herbs and grasses, and makes a regular carpet.
Locality.—Government House grounds, Port Moresby.
Date.—April, 1923.
Material collected.—Leaves and flowers.

Oxalidiaceae.

Averrhoa Bilimbi, No. 789; Oxalis corniculata, No. 350.

Averrhoa Bilimbi Linn., No. 789.

A small to medium sized tree.
Leaves.—Compound imparipinnate, rachis 18 to 24 inches, hairy, swollen at base, bearing twelve pairs of leaflets. Leaflets, petiole $\frac{1}{8}$ to $\frac{1}{4}$ inch, hairy; blade, lanceolate with somewhat cordate base.
Flowers.—Caulifloral, sessile, white and pink, growing in groups on the stem.
Fruit.—Five-angled, fleshy, yellow, $4\frac{1}{2}$ inches long.
Bark.—Grey.
Locality.—Malu (Middle Sepik, 230 miles up).
Date.—19th July.
Native names.—Wosikopi (Awatib).
Remarks.—A cultivated tree; the fruit is eaten, but is too sour for a white man's taste. Very common throughout the Territory.
Material collected.—Leaves, flowers and fruit.

Oxalis corniculata Linn., No. 350.

A creeping, scrambling, trifoliate plant.
Flowers.—Yellow.
Locality.—5,000 feet, lower spurs of Mt. Obree.
Date.—January, 1923.
Remarks.—Common.
Material collected.—Leaves, flowers.

Rutaceae.

Acronychia sp., No. 357; Evodia accidens, Nos. 95A, 364, 630; Evodia Bowickii, No. 95; Evodia hortensis, No. 307; Evodia lamprocarpa, No. 169A; Flindersia sp., No. 15; Flindersia sp. nov., No. 362; Flindersia pimenteliana F. v. M., No. 382; Xanthoxylum sp. (Syn.) Fagara sp., No. 392.

Acronychia sp., No. 357.

A small tree.
Locality.—7,300 feet, Mt. Obree.
Date.—January, 1923.
Material collected.—Leaves and fruit.

Evodia accidens, Blume, Nos. 364, 95A, 630.

A small tree 3 feet in girth and 35 feet over all.
Leaves.—Trifoliate.
Flowers.—Axillary corimbose panicles on old wood of mauve-pink flowers. Very showy; all the younger branches being covered with the flowers.
Bark.—One-quarter inch, grey, ridged; inner bark yellow. Solution golden yellow; no precipitate.
Wood.—Sap undefined; soft tissue in wavy concentric lines.
Rays.—170 to 200, white. Pores.—Clear, 2,000 to 3,000; fairly evenly scattered with here and there a close-sown band; single and radially septate. Soft tissue.—Clear; in concentric undulating lines, 60 to the inch, linking up pores. General.—A white timber subject to blue fungus. Solution wood, discoloured; no precipitate. Cuts firm; 42 lb. per cubic foot.
Locality.—Old farm lands at 5,000 feet, Owen Stanley Range, also on the Ramu at lower levels.
Native names.—Bapwan (Hururu), Umbena (Yabob).
Remarks.—Springs up on abandoned farm lands; abundant; if wounded, stem exudes a clear gum which hardens to an opaque wax-coloured substance, which is used to fasten bow strings.
Material collected.—Flowers, leaves, bark, wood.

Evodia bowickii Forst., No. 95.

Medium tree 4 ft. x 60 ft. bole, and 100 feet over all. Not buttressed.
Leaves.—Trifoliate, opposite, decussate, stipulate. Petiole, $1\frac{1}{4}$ inches; blade, 7 x $3\frac{1}{2}$ inches to 10 x $4\frac{1}{2}$ inches; oblanceolate; glabrous; thin; brittle.
Flowers.—Pink, in opposite corymbs; ornamental; conspicuous.
Bark.—In young trees perfectly smooth and covered with a white bloom like a eucalypt. In older trees the bloom disappears and the surface becomes dappled grey and brown. Inner bark red-brown, streaked with pale yellow.
Wood.—Sap undefined, yellow.
Rays.—160, yellow, wavy and sinuous round pores, 1-50th inch deep; show up as yellow oblongs on quarter. Pores.—1,500 to 3,000. In less and more porous zones the latter predominate; single and radially septate (2). Soft tissue.—About three continuous fairly straight concentric lines to the inch, these are often double. Between these thin lines there are a large number of broken lines joining up the pores, these are thicker and are zig-zaggy. General.—A white soft wood. Solution wood, colourless; no precipitate. Cuts soft and woolly; soft tissue makes section cutting very difficult; 28 lb. per cubic foot.
Locality.—Venapa, Veimauri, Aroa.
Date.—Flowers in May.
Native name.—Kolina (Suku).
Material collected.—Leaves, flowers, wood, bark.

Evodia hortensis Forst., No. 307.

A shrub or small tree. 20 feet high, and 2 inches diameter. Branches low down.

Leaves.—Simple, opposite, decussate. Petiole, ¾ to 1½ inches; swollen at both junctions—stem and blade. Blade averages 10 x 1¾ inches; irregular in shape; some have deep indentations on one side and are entire on the other; others undulate on both sides, but at different distances from the base. Others again, have long spur-like projections, sometimes 3 inches long. Lastly, some are entire on both margins and more or less lanceolate or elliptical. The surface of the leaves is glabrous; heavily oil-dotted. In texture the leaves are soft and thin. When crushed between the fingers they give out a strong perfume, somewhat between a lemon scented verbena and a mint.

Flowers.—Axillary panicles of white flowers. Peduncles, 1-32nd inch, slightly pubescent.

Fruit.—Green, oil-dotted, dehiscent capsule; 3-16th inch long by ⅛ inch diameter, containing one seed.

Locality.—Baroi.

Date.—November.

Native names.—Bopa (Vailala), Kabua (Binanderi), Kairarura (Evara), Ebala (Motu).

Remarks.—It is cultivated by the natives in the Delta and Northern Divisions for its fragrant leaves which are either wrapped up and strung as necklaces. They are boiled in coco-nut oil and dried in the sun, or merely dried without preparation. The necklaces are worn at dances by the boys, who will also place the treated leaves in their armlets. Said to be much appreciated by their partners of the opposite sex.

Material collected.—Leaves, flowers, and fruit.

Evodia lamprocarpa Forst., No. 169A.

Large tree, 7 feet girth and 60 feet overall. One of the first forest trees to overtop the farm regrowth.

Leaves.—Trifoliate, opposite. Petiole, 5 inches; leaflet's petiole, ¼ inch; lateral pair, 7 inches x 4¼; terminal, 10 x 5. Lanceolate, acuminate, downy below; smooth above.

Fruit.—A dehiscent capsule, containing one jet-black round seed 1-10th inch diameter.

Bark.—½ inch thick. Grey mottled with brown. Longitudinally wrinkled. Inner bark white streaked with yellow.

Wood.—Sap undefined, white, soft.

Rays.—210; wavy and slightly sinuous around pores; 1-50th inch deep; show up as lines on quarter. Pores.—Conspicuous. 2,000 to 3,000; single and radially septate (2); rather evenly scattered. Soft tissue.—Absent. General.—A white straight-grained wood. Solution wood, colourless; no precipitate. Cuts firm; 32 lb. per cubic foot.

Locality.—All round the Territory up to 2,000 feet.

Date.—Fruits in North-west Division in July.

Native name.—Gareba (Buna).

Material collected.—Leaves, fruit, wood.

Flindersia macrocarpa White & Francis ined., No. 362.

Large tree, 8 feet girth, with a 70-ft. bole and 100 feet overall. No buttresses.

Leaves.—Compound, alternate. Stalk 9 inches, green, pubescent when young; in older leaves blackish and warty. Leaflets opposite and subopposite; 4 pairs and a terminal one. Petiole ¼ inch, except terminal, ¾ inch. Blade 3½ to 8½ x 2 to 2½; lanceolate, acuminate, curved from base to apex; more or less asymmetrical; midrib prominent yellow. Lateral veins are clear, and follow the midrib a little way before diverging; margin slightly recurved; surface glabrous; texture somewhat coriaceous.

Fruit.—Single, two and three on stout stalk, 8 inches long. Green, 6 inches long, covered with stout spines ½ inch long and ¼ inch wide at base. Dehisces into five canoe-shaped segments, each containing fleshy core 1 inch deep, on the side of which are embedded numerous winged seeds 3 inches long and 1 inch wide, the seed itself being 1½ inches x ¾ inch. When the fruit is mature enough to open it is 9 inches to 10 inches long.

Bark.—⅜ inch thick. Grey-brown, faintly longitudinally lined, otherwise smooth; fibrous. Inner bark yellow brown, streaked with yellow.

Wood.—Sap undefined, white and pale-yellow.

Rays.—Clear. 120 to 140. Yellow. 1-25th inch deep; show up as lines on quarter. Pores.—Clear. 3,000 to 6,000; very narrow bands of very crowded pores occur about 6 to the inch; remainder evenly scattered; septate radially (2 to 3). Soft tissue.—Absent. General.—A pale clean wood with a satin sheen on quarter. Solution wood, colourless; no precipitate. 47 lb. per cubic foot.

Locality.—5,000 feet up the main Owen Stanley Range.

Date.—February, 1923.

Native name.—Zizanu (Laruni).

Remarks.—A hard wood.

Material collected.—Leaves, fruit, bark, wood.

Flindersia sp., No. 15.

Large tree, 8 feet girth, 90 feet bole, and 110 feet overall. No buttresses.

Leaves.—Compound, alternate. Stalk, 6 inches to 8 inches. Three pairs of leaflets and a terminal one; leaflets opposite; petiole, ¼ inch and terminal one 1¼ inch; blade, 3 inches to 6¾ inches x 1½ inches to 2½ inches; oval to elliptical, tapering evenly to base and apex; midrib prominent below; venation distinct; apex more or less acute; glabrous; thin.

Flowers.—Only buds collected. Terminal panicles 6½ inches long, on stout somewhat square sectioned main stalk.

Fruit.—Only half-rotted seed vessels collected. Characteristic Flindersia seed vessel, 5½ inches long.

Bark.—¾ inch; grey-brown; smooth, except for fine longitudinal lines of pustules. Inner bark yellow-brown. Solution colourless, and no precipitate.

Wood.—Sap 1¾ inches; pale-yellow; heart yellow-brown.

Rays.—Clear. 115 to 120 to the inch, yellow, 1-20th inch deep, show up clearly on quarter, giving wood a maple grain. Pores.—3,000 to 4,000 radially septate, 2 to 3, evenly scattered. Soft tissue.—Conspicuous. Thin concentric lines at irregular intervals, 5 to 10 to the inch. General.—A pale timber with a uniform grain. Solution wood colourless, no precipitate. Cuts hard, and breaks up along pores, making section cutting very difficult. 46 lb. per cubic foot.

Locality.—Vailala, Venapa, Veimauri, Aroa.

Date.—December, 1922.

Native names.—Auria (Vailala), Pedina (Suku).
Material collected.—Leaves, flowers, seed vessels, bark, wood.

Flindersia pimenteliana F. v. M., No. 382.

A large tree, 8 feet in girth, 65 feet of bole, and 80 feet overall. No buttresses.
Leaves.—Compound, alternate, subopposite and opposite. Stalk 2 inches to 3 inches, bearing two lateral pairs and one terminal leaflet. Leaflets opposite. Petiole $\frac{3}{8}$ inch, terminal petiole $\frac{3}{4}$ inch; blade 3 to 4 inches x 1 to $1\frac{3}{4}$ inches; lanceolate, acuminate, light-green below, dark-green above; glabrous; more or less coriaceous; midrib yellow, prominent. Stalk yellow-green, warty. Branchlets brown, covered with small lenticles.
Fruit.—Dry ones picked up from under the tree; 3 inches long, armed with short spines, separating into canoe-shaped segments 5-16th inch deep. Seed not seen.
Bark.—$\frac{3}{8}$ inch thick; mottled grey and brown; smooth, except for warty excrescences, which are up to 3 inches in circumference, and stand out 1 inch from the bole. Inner bark red-brown, streaked with white. Solution sherry; no precipitate.
Wood.—Sap ill-defined, white, deepening to a pink.
Rays.—160. Yellow. 1-50th inch to 1-70th inch deep, showing as a multitude of spots on the quarter. Pores.—Clear. 3,000 to 4,000; single and diagonally septate (2). Evenly scattered. Soft tissue.—Absent. General.—A pinky-yellow timber with a satin sheen on back and quarter. Solution wood, tawny; very slight greenish precipitate. Cuts soft and clean. 43 lb. per cubic foot.
Locality.—7,000 feet. Mt. Obree to Laruni Spur.
Date.—February, 1923.
Native name.—Ouru (Laruni).
Remarks.—A hard maple; not common. Cairn's silk wood.
Material collected.—Leaves, dry seed-vessels, bark, wood.

Xanthoxylum syn. *Fagara* sp., No. 392.

A large tree, 7ft. 6 in. in girth, 80-ft. bole, and 100 feet overall. Small spur roots.
Leaves.—Compound, alternate. Stalk $10\frac{1}{2}$ inches to 17 inches, bearing 9 to 17 pairs of opposite leaflets, and no terminal one. Leaflets: Petiole 1-16th inch; blade, 2 to $2\frac{3}{4}$ inches x $\frac{3}{4}$ inch, asymmetrically lanceolate, acuminate; midrib prominent, yellow, thin, soft. Twig and branches covered with sharp hard spines, $\frac{1}{8}$ inch to 3-16th inch long.
Bark.—$\frac{3}{8}$ inch thick, grey; longitudinally lined. pustular; somewhat scaly at butt. Inner bark yellow, streaked with cream; rapidly turns brown and cream. Solution colourless. Rather strong precipitate.
Wood.—Sap $2\frac{1}{2}$ to 3 inch. A bright eye-arresting saffron, heart a darker saffron.
Rays.—145 to 165. Fine; do not show upon quarter. Pores.—Clear. 5,000 to 7,000; septate radially (2, 3, and 4). Surrounded by lighter-coloured soft tissue which shows them up. The groups are fairly evenly distributed. General.—The wood, which is saffron, has a lovely satin sheen on both back and quarter. Solution wood colourless. No precipitate. Cuts firmly, works easily. 35 lb. per cubic foot.
Locality.—Mt. Obree. 7,000 feet. Spur to Laruni.
Date.—February, 1923.
Native name.—Bina-u (Laruni).
Remarks.—A beautiful saffron-coloured hardish wood. On the quarter the rays show up very well.
Material collected.—Leaves, bark, wood.

BURSERACEAE.

Canarium grandistipulatum, No. 338; Canarium lineistipula, Nos. 306, 142, 197; Canarium maluense, No. 244; Garuga sp., No. 297; Indt., No. 560.

Canarium lineistipula Laut. and K. Sch, Nos. 197, 306, 142.

Large tree, 8 feet girth, and 60 feet of bole. More or less buttressed.
Leaves.—Compound, alternate, stipulate. Stalk 9 inches to 14 inches, bearing four to five pairs of leaflets; opposite; petiole $\frac{3}{8}$ inch; slightly pubescent; blade 6 to 8 inches x 2 to $2\frac{1}{2}$ inches; obovate, sometimes asymmetrical, glabrous except for midribs; scantily pubescent; acuminate; thin.
Flowers.—Axillary, panicles of cream flowers.
Fruit.—A berry, $\frac{3}{8}$ inch in diameter.
Bark.—Yellow-brown; pustular and scaly; scales papery. Inner bark salmon-pink.
Wood.—Sap ill-defined, pale-yellow, deepening to pinky-yellow.
Rays.—170. Yellow. Very sinuous. 1-40th inch deep; distinct on quarter. Pores.—Conspicuous. 4,000 to 5,000, crowded rather evenly. More often single than radially septate (2 to 3). Soft tissue.—Absent. General.—A pinky-yellow wood with a straight grain and pleasant-looking both quarter and back. Solution wood pale-yellow; no precipitate. Cuts firm. 29 lb. to 33 lb. per cubic foot.
Locality.—Kumusi River, Northern Division.
Date.—Flowers in July.
Native names.—Sisera (Buna), Wairo (Vailala), Nuri (Evara).
Remarks.—A medium soft wood, with a nice grain on back.
Material collected.—Leaves, flowers, wood, fruit, bark.

Canarium grandistipulatum Lautb., No. 338.

A large tree, with a girth of 9 feet, a bole of 85 feet, and attaining 110 feet overall. Large buttresses up to 15 feet.
Leaves.—Compound, alternate. Stalks, stout, grooved, 12 inches to 14 inches long, bearing five pairs of opposite leaflets and a terminal one; petioles, respectively $\frac{3}{4}$ to 1 inch and 2 inches; blade 4 to 8 inches x 2 to $3\frac{1}{2}$ inches; lancealote; midrib and veins prominent below; acuminate; glabrous; more or less coriaceous. Branchlets stout, and leaf arises from a large brown velvety fimbriate margined bract.
Fruit.—Single terminal on a very short peduncle. Calyx, persistent, brown velvety surface, but hard. A drupe $2\frac{1}{2}$ inches in diameter and 3 inches long. Exudes resin. Pericarp 5-16th to 11-16th inch, firm, fleshy. Nut 2 inches long, with a triangular cross section, $1\frac{3}{4}$ inches across, divided into three compartments, each containing a white kernel $\frac{3}{4}$ by $\frac{5}{8}$ inch.

Bark.—¼ inch thick; grey, scaly, shedding clean and leaving surface more or less smooth, but pustular. Inner bark red-brown. Solution orange; precipitate present.
Wood.—Sap ill-defined, about 3 inches, pinky-yellow. Heart pink.
Rays.—120 to 140 to the inch; wavy, hard to see or count, consists much the same colour as wood on cross section, on radial 1-50th inch deep, show up well as dark-brown specks. Pores.—Clear; 3,500 to 4,500; mostly single, a few radially septate (2); scattered evenly. Soft tissue.—Absent. General.—A mouse-brown wood with a pretty grain. Solution wood, orange; precipitate present. Cuts a little hard; 34 lb. per cubic foot.
Locality.—Vailala.
Date.—January, 1923.
Native name.—Mahei (Vailala).
Remarks.—A hard wood.
Material collected.—Leaves, fruit, bark, wood.

Canarium Maluense Lautb, No. 244.

A large tree, 8 feet in girth, 80 feet bole, and 110 feet overall. No buttresses.
Leaves.—Compound, alternate; stalk 5 to 5½ inches, swollen at base to ¼ inch diameter, otherwise ⅛ inch; covered with brown lenticels. Leaflets, two pairs and a terminal; rarely three pairs; lateral leaflets simple, opposite; petiole ¾ to 1 inch; lower pair 3¼ to 5 inches x 1¾ to 2½ inches; upper pair, 5 to 7¼ inches x 2 to 3 inches. Terminal one; petiole 1¼ to 2 inches; blade 5 to 7½ inches x 2¼ to 3⅜ inches. All leaflets acuminate, coriaceous; midrib and veins yellow, and very prominent and pubescent below; petiole much swollen at junction with blade. Stalk swollen where upper and terminal leaflets join.
Flowers.—Axillary cymose panicles, 6 inches to 9 inches long of heads of 2 to 4 sessile flowers.
Bark.—¼ inch thick. Grey, splashed here and there with yellow. Smooth except for abundant small corky pustules. Exudes a fragrant resin from the cambium layer. Inner bark yellow-brown. Solution tinged with pink. Muddy-brown precipitate.
Wood.—Sap ill-defined, white to yellow.
Rays.—160 to 170. Reddish-brown. Very sinuous around pores and very broken. 1-100th inch deep; show up as specks on quarter. Pores.—Clear. 6,000 to 6,500. Single and radially septate (2). Soft tissue.—Absent. General.—A pinky-brown wood, with a straight grain. Solution wood colourless; no precipitate. Cuts firm to hard; 37 lb. per cubic foot.
Locality.—Hydrographer's.
Date.—Flowers in August.
Remarks.—A straight-grained sound medium hard wood.
Material collected.—Leaves, flowers, wood.

Indt. 560.

A small tree, 25 feet high.
Leaves.—Trifoliate.
Flowers.—White with yellow anthers.
Locality.—Ogeramnang.
Date.—November, 1923.
Material collected.—Leaves, flowers.

Garuga sp., No. 297.

A large tree, with a girth of 8½ feet, a bole of 60 feet, and reaching 100 feet overall. Medium buttresses up to 8 feet.
Leaves.—Compound, alternate. Stalk up to 16 inches long, bearing about twelve opposite and sub-opposite leaflets. Petiole 1 to 3-16th inch; blade, small in leaflets at base of stalk 1½ to ⅝ inches, and increases in size up the stalk to 6¼ x 2 inches; margin more or less serrate. Here again the serration is very well defined in sucker leaves; also this type of leaf is pubescent. In leaves from mature trees the serration is not well defined, and the surface is glabrous. The terminal leaflet is smaller than the uppermost pair. All are acuminate, lanceolate, and thin.
Bark.—1⅛ inch thick; grey, scaly, pustular; the pustules are in longitudinal lines; the scales are fairly thin, and shed in irregular patches 3 inches to 4 inches across. Inner bark streaked pink-red and white. Solution colourless; no precipitate.
Wood.—Sap 2 inches, pale-yellow. Heart a good deep-brown. Rays fine. Pores numerous; distinct.
Rays.—130 to 140; very fine dark-brown, sinuous around pores, about 1-100th inch deep, mere lines on quarter. Pores.—Conspicuous. 2,700 to 3,400 in zones of varying density; single and radially septate. Soft tissue.—Absent. General.—A grey timber; attacked by blue fungus. Solution wood, a greenish discolouration; no precipitate. Cuts soft and fairly clean; 27 lb. to the cubic foot.
Locality.—Baroi.
Date.—October.
Native names.—Kakikaki (Vailala), Uri (Motu).
Remarks.—A good general purpose timber. Nice enough looking for furniture, but on the heavy side.
Material collected.—Wood, bark, leaves, fruit.

Meliaceae.

Aglaia elaeagnoidea, No. 50; Aglaia sapindina, Nos. 162 and 133; Aglaia obliqua, No. 132; Cedrella Toona var. australia F. v. M., Nos. 9 and 626; Chisocheton sp., No. 808; Chisocheton erythrocarpus, *Hiern*, No. 353; Chisocheton Biroi affin., Nos. 231A and 598; Dysoxylum caulostachyum Miq. affin., No. 291; Dysoxylum pettigrewianum *Bail.*, No. 300; Dysoxylum sp., Nos. 90, 66, 127, 148, 308, 612, and 620; Dysoxylum fissum, No. 282; Xylocarpus granatum, Nos. 343 and 218; Indt., No. 296.

Aglaia elaeagnoidea Benth, No. 50.

A medium tree, 7 feet girth, with a 30-ft. bole. Without buttresses.
Leaves.—Compound, alternate; stalk 7½ to 9½ inches, bearing four pairs and a terminal leaflet. The leaflets are alternate, except last pair, which is opposite; petiole ¼ inch; blade 3¾ to 6 inches x 2 to 2¼ inches; ovate to lanceolate; acuminate; entire; thin. Midrib, veins and stem rough; warty; red-brown.
Bark.—¼ to ½ inch thick. Greeny-grey. Fairly smooth. Inner bark yellow.
Wood.—Sap not defined; pale-yellow or white.
Rays.—So fine and close as to be uncountable. Pores.—600 to 1,200; large and conspicuous, irregularly scattered; single. Soft tissue.—Exceedingly fine lines run at right angles to rays. General.—A grey wood, with pores showing up as black streaks. Solution wood, colourless. No precipitate. Cuts a little hard. Difficult to get a section owing to soft tissue; 42 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Uva (Suku).
Remarks.—A hard interlocked-grained timber. A rare tree.
Material collected.—Leaves and wood.

Aglaia sapindina Benth., Nos. 133 and 162.

Large tree, 8 feet by 60-ft. bole. Medium buttresses up to 7 feet.
Leaves.—Compound, alternate. Stalk 8 inches to 18 inches, carrying 6 to 7 pairs of leaflets with or without a terminal leaflet. Leaflets opposite and subopposite, 4 inches to 8 inches x 2 inches to 2½ inches, asymmetrical, subsessile, elliptical, acuminate, thin; leaflets from young trees pubescent below; slightly pubescent above. In mature trees this pubescence is reduced, or disappears, at any rate on the upper surface. Margin finely serrate.
Flowers.—Axillary panicles about 6 inches long, of very small white fragrant flowers.
Fruit.—Globose, ½ inch diameter, green speckled with brown; two to four seeds.
Bark.—½ inch thick; greeny-brown, lineally lined to flatly ridged, pustular. Inner bark streaked light-brown and yellow.
Wood.—Sap ill-defined. Pale-yellow, deepening to a pink.
Rays.—140. Coarse brown sinuous round pores; 1-100th inch deep, faint lines on quarter. Pores.—Conspicuous. 600 to 1,400, in porous and less porous zones, single and more or less radially septate 2 to 4. Soft tissue.—Conspicuous lines thicker than rays link up in a very zig-zag manner, the pores running tangentially to them. General.—A white soft wood with brown markings. Solution wood, colourless; no precipitate. Cuts very soft; 33 lb. per cubic foot.
Locality.—Buna District, Sangara, and all plain country.
Date.—Flowers and fruits July and August.
Native names.—Digisi (Buna), Zigisi (Binandele); also variously pronounced Sigisi and Jigisi.
Remarks.—A hard wood.
Material collected.—Leaves, flowers, fruit, bark, wood.

Cedrella Toona Roxb., var. *australis*, F. v. M., Nos. 9, 626.

A large tree, up to 16 feet in girth and 80 feet of bole; 120 feet overall. Buttressed up to 10 feet or more.
Leaves.—Compound; alternate; deciduous. Stalk 12 inches to 19 inches. Leaflets subopposite and alternate; petiole ¼ inch; 6 to 7 pairs; blade 4 inches to 5½ inches x 3 inches to 3½ inches. somewhat asymmetrical; acuminate; membranous; glabrous.
Bark.—½ inch thick. Scaly. Red-brown to grey-brown. Rough to rugged. Inner bark red. Solution pale-red. No precipitate.
Wood.—Sap ½ inch. Pale yellow-brown or white. Heart cedar brown.
Rays.—100 to 120 to the inch, red, inconspicuous owing to colour; 1-15 inch deep; conspicuous on quarter. Pores.—More or less ring pored; 900 to 2,300, small, and few in zones where the soft tissue is absent, and large septate numerous where soft tissue is frequent. Soft tissue.—Red, rather straight lines, finer than rays, continuous; also surrounds pores. General.—A red cigar-box wood, fragrant. Solution wood, pale red; no precipitate. Cuts soft, but woolly; weighs 46 lb. to the cubic foot.
Locality.—Collected leaves and wood near Veimauri. It is to be met with all along the western side of the Owen Stanley Range, mainly on the foot hills. Nowhere is it common, and rarely is more than one tree found at a time. I failed to find it n the Northern Division; but it occurs in New Guinea and in New Britain.
Date.—May, 1922.
Native names.—Epi (Suku), Kapere (Vailala), Mufus (Yalu).
Remarks.—The same tree as the Queensland red cedar, and the timber is as useful.
Material collected.—Leaves, wood, bark.

Affinitis *Chisocheton biroi* Harns, No. 598.

A medium tree, averaging 5 feet in girth, with a bole of 25 feet, and 50 feet overall, occasionally up to 7½ feet by 50 feet by 80 feet.
Leaves.—Compound alternate. Rachis up to 3 feet, very swollen at base, bearing 8 to 12 pairs of leaflets; petiole ¾ to 1 inch, swollen; blade averages 13 inches x 5½ inches; lanceolate, acuminate, veins prominent.
Fruit.—A red, somewhat woody, fruit, opening in two.
Bark.—½ inch, greenish-brown, scaly, peels in large plates, leaving the bark smooth in young trees and pustular in old. Inner bark cream-streaked yellow. Solution colourless. No precipitate.
Wood.—Sap undefined, pale-yellow or white. Axes easily.
Rays.—Distinct. 190 to 220; white, irregularly spaced; fairly straight; 1-50th inch deep. Pores.—Distinct; very few; 300 to 500; very irregularly scattered; large. Soft tissue.—Conspicuous; 100 distinct lines thicker than rays, crooked. General.—A soft open wood, cuts very soft; Solution colourless; no precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Woro (Yalu).
Material collected.—Leaves, fruit, wood, bark.

Chisocheton erythrocarpus Hiern, No. 353.

A climber, attaining 50 feet.
Leaves, compound, alternate; stalk 10 inches; 3 to 4 pairs of opposite leaflets; petiole 5-16ths to 7-16ths inch; blade 4½ to 6 x 2 to 2¼ inches; lower surface, midrib, veins, petiole, and stalk covered with light-coloured hairs; oblanceolate; acuminate; thin; soft.
Flowers.—Only buds collected. Axillary panicles 3 inches to 4 inches long.
Locality.—Spurs of Mt. Obree to 6,000 feet.
Date.—January, 1923.
Remarks.—A forest climber.
Material collected.—Leaves and buds.

Chisocheton sp., No. 808.

A medium tree, 7 feet in girth, and 60 feet high the stem usually channelled.
Leaves.—Compound, alternate. Rachis stout, much swollen at junction with stem; of variable length, from 9 inches to 2 feet, bearing from 3 to 8 pairs of opposite leaflets. Leaflets on stout swollen ½-inch petioles; blade 10 to 14 inches x 4½ to 7 inches, variable in shape from lanceolate to oblong; midribs and veins prominent.

Fruit.—Red, globose to pear-shaped, 3 inches to 4 inches diameter; pericarp 1 inch, white, exudes latex. Contains two and sometimes three nuts, which are somewhat kidney-shaped, 2¼ inches long, 1 inch diameter. They are borne on stout spikes 2 feet long, in groups of three on short peduncles.

Bark.—¼ inch thick; greenish-grey; scales off in large pieces, leaving under surface mouse-coloured. Inner bark white, turns a dirty brown rapidly after exposure.

Wood.—White, sap undefined; axes easily.

Rays.—Fine, clear, 290, pale, sinuous; indistinct on longitudinal sections. Pores.—Conspicuous; 70 to 1,200, in thinly and thickly sown bands. radially septate (2 to 3); encrusted with yellow, which makes conspicuous lines on back and quarter. Soft tissue.—Very conspicuous, undulating lines, about 1-100th of an inch thick, 30 to 60 to the inch, surround pores. General.—A white wood, that cuts soft and shows little grain. Weighs 38 lb. to the cubic foot.

Locality.—Mavelo River.

Date.—13th September.

Material collected.—Leaves, fruit, wood, bark.

Dysoxylum sp., near *Dysoxylum caulostachyum*. Miq. affinities, No. 291.

Large tree, 9 feet in girth, with a 90-ft bole and 125 feet overall; not buttressed, but butt end somewhat asymmetrical in section and sometimes almost triangular.

Leaves.—Simple; alternate; petiole, ⅝ inch to ¾ inch; blade, 3 inches to 5½ inches by 1½ inches to 2¼ inches; obovate; acuminate; glabrous; coriaceous.

Flowers.—The buds in the axils of the leaves were just beginning to form.

Bark.—⅜ inch thick; grey; very pustular; inner bark, mauve pink, speckled with yellow. Solution, colourless; no precipitate.

Wood.—Sap 1 inch to 1½ inches, yellow; heart, a red-brown; medium hard, but easily worked; straight grained; light. The wood exudes a slightly sticky sap.

Rays.—150; red-brown; rather sinuous, 1-50-inch deep; show up well on quarter as mauve lines. Pores.—Clear; 5,000; very evenly scattered, single, and radially septate (2). Soft tissue.—Absent. General.—A bright-brown wood, shiny; a yellow sheen on the quarter; a light, easy-working, sound, straight-grained wood. Solution wood, colourless; no precipitate. Cuts firm; 34 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native names.—Buria (Vailala), Ukapa (Evara).

Remarks.—A good cabinet wood. Said by Mr. Maddock to be durable.

Material collected.—Leaves, bark, wood.

Dysoxylum Pettigrewianum Bail., No. 300.

Large tree, with a girth of 12 feet, a bole of 60 feet, and reaching 110 feet overall; heavily buttressed to 15 feet, and grooved or fluted on for another 10 feet.

Leaves.—Compound; stalk up to 14 inches; leaflets opposite, or sub-opposite, and a terminal one; petiole, 7-16 inch swollen; 3 inches to 9 inches by 2 inches to 3½ inches; oblong to elliptical, acuminate, glabrous.

Flowers.—Only buds collected; axillary spike of apparently shortly peduncled pentaminous, cream-white flowers.

Rays.—300 to 350; pale yellow, sinuous, broken; indistinct on quarter. Pores.—Clear; 3,500 to 4,000; single, and radially septate. Soft tissue. Yellow; short wavy broken lines, twelve to the inch; undulate across rays. They are broken by pores, but here and there one or a pair of lines make a continuous ring passing between pores. General.—A straw-coloured, straight-grained wood, showing little grain. Solution wood, colourless; no precipitate. Cuts hard; 39 lb. per cubic foot.

Bark.—Mottled, reddish, and grey-brown; scaly scales, shedding in fairly large patches; darker under scales than surface; also pustular when fresh bark is exposed; pustules weather off later. Inner bark a yellow-brown; straight fibred. Solution, colourless; no precipitate.

Wood.—Sap, 2 inches; pale-yellow or white; heart, a red-brown.

Locality.—Baroi.

Date.—October.

Native names.—Oko (Evara), Doyokea (Vailala).

Remarks.—A medium hard, long-fibred wood; works smoothly, and, if not too heavy, would make a fair cabinet wood; useful for all general purposes. Occurs also in N. Queensland.

Material collected.—Leaves, buds, bark, wood.

Dysoxylum Fissum White and Francis ined., No. 282.

A tree of medium size, 6 feet in girth, a 60-ft. bole, and 90 feet overall; narrow buttresses up to 12 feet.

Leaves.—Compound, alternate. Stalk up to 30 in. long, carrying about 7 pairs of opposite leaflets and a terminal one; blade 5 in. to 8½ in. x 3 in.; ovate to oblong; acuminate, glabrous; thin. The base of the leaf stalk is thickened and forms a deep buttressed axil.

Flowers.—Only buds seen, Apparently axillary spikes.

Bark.—⅛ in. thick; brown; scaley; scales shedding in fairly large patches; very pustular—the corky lenticels standing out prominently from the bark; inner bark, red. Solution, pale yellow; absinthe precipitate.

Wood.—Sap, pale yellow; 6 in.; heart a good brown.

Rays.—200. Brown; sinuous around and broken by pores. Less than 1-100 in. deep, and indistinct on quarter. Pores.—Clear. 1,200 to 1,600; single and radially septate (2). A certain number 70 to the inch, filled with red resin. Soft Tissue.—Clear; wavy lines running around pores, but continuous. General.—A pink brown wood with a nice straight mahogany grain and fragrant like cedar. Solution, wood; colourless; pale green precipitate. Cuts firm to hard; 43 lb. per cubic foot.

Locality.—Baroi River.

Date.—October, 1922.

Native name.—A-o-ubu (Vailala).

Remarks.—A sound medium hardwood with a cedar perfume.

Material collected.—Leaves, buds, bark, wood.

Dysoxylum sp., No. 66.

Large tree, 8 feet girth x 65 feet of bole; buttresses up to 6 feet.

Leaves.—Compound, alternate, exstipulate, stalk 8-14 in.; leaflets alternate; petiole ½; blade, 5-9 x 2½-3; lanceolate and oblanceolate, entire; margin, wavy; glabrous.
Fruit.—Brown; obovoid 1 in. x 1¼, hanging in panicles on old wood; three locs.; rarely more than two seeds; pericarp exudes latex.
Bark.—Light brown, scaly; the scales come off in rather large pieces; inner bark red. Solution colourless; no precipitate.
Wood.—Sap ill-defined; white merging into a yellow heart.
Rays.—250-260; not visible on quarter; yellow sinuous round and broken by pores. Pores.—Clear; 4,000-7,000; very porous zones occur about 3 to the inch; single and radially septate (2); encrusted with white deposit. Soft tissue.—Clear; wavy lines thicker than the rays link up the pores tangentially. General.—A pale wood with a close grain, and a cedar fragrence. Solution wood; colourless; no precipitate. Cuts hard; 48 lb. per cubic foot.
Locality.—Veimauri.
Date.—Fruits in May.
Native name.—Ha-wa-ra-lavea (Suku).
Material collected.—Leaves and fruits.

Dysoxylum sp., No. 620.

Medium to large tree, 6 feet in girth with a 50-foot bole and 90 feet overall; spur rooted and grooved to 10 feet.
Leaves.—Compound alternate; rachis, 6 inches to 8½ feet, swollen at base, bearing 3 to 4 pairs of opposite leaflets, but no terminal one; leaflets subsessile 4 to 6½ inches oblanceolate, acuminate, glabrous, thin.
Bark.—Greeny-brown; scaley; shedding in little pieces; inner bark streaked orange and white; smells of turnips. Solution, pale yellow; no precipitate.
Wood.—Sap undefined yellow; axes rather hard; splits well on back along soft tissue; badly on the quarter; smells of turnips.
Rays.—200-240 clear pale sinuous around pores; finer ones broken by pores; 1-50th inch deep; thin bands on quarter. Pores.—2,300 clear, rather evenly scattered; single and radially septate (2-3). Soft Tissue.—80 lines; conspicuous, thicker than rays, crooked, linking up pores and surrounding them. General.—A pale yellow or white wood; cuts firm; straight grained. Solution, colourless; no precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Kusud (Yalu).
Material collected.—Leaves, wood, bark.

Dysoxylum sp., No. 148.

A large tree, 8 feet girth, 60 feet bole, medium buttresses up to 6 feet.
Leaves.—Compound, alternate; stalk up to 19 inches; six pairs of leaflets, opposite, subopposite and alternate with terminal one; blade, 5-7½ x 3-3½; obovate, acuminate, slightly asymmetrical, glabrous, thin.
Fruit.—A 4 loc. capsule ¾ inch; obovoid, yellow-brown, speckled with yellow, containing one, two or three flattened ovoid seeds; the seeds are red on rounded side and white on flattened side, except at tips.
Bark.—One quarter inch thick; brown, scaly, pustular; scales adhering in oblong plates; inner bark yellow, streaked with faint red.
Wood.—Sap undefined, yellow.
Rays.—350; pale; sinuous round pores; do not show up clearly on quarter. Pores.—Clear; 5,000 evenly scattered single and radially septate (2 rarely 3). Soft Tissue.—Coarse wavy white lines thicker than rays form concentric rings; 140 to the inch radius. General.—A smooth grey timber with a yellow tinge; fragrance of cedar. Solution, wood; colourless; very faint green precipitate. Cuts hard; 53 lb. per cubic foot.
Locality.—Buna District.
Date.—Fruits in July.
Native names.—Susa (Buna), Tuta (Binandele).
Material collected.—Leaves, fruit, wood.

Dysoxylum sp., No. 308.

Large tree; 9 feet girth, 80 feet bole; buttressed up to 6 feet.
Leaves.—Compound, alternate; stalk, 10 to 15 inches, bearing 4 to 5 pairs of opposite leaflets and a terminal one; petiole, ⅜ to ½ inches; blade, 4¼-8 x 2-3; lanceolate; blunt pointed; glabrous; thin.
Fruit.—A yellow dehiscent obovoid fruit, 3 inches long by 2¼ diam.; surface downy; it splits into three parts, remaining joined at peduncle and dropping three red, boot-shaped seeds, 2¼ long by 1 inch deep.
Bark.—½ inch thick, yellow-brown; scaly; scales coming off in irregular patches about 8 inches across, leaving surface more or less scroll marked; exudes latex. Solution, colourless; no precipitate.
Wood.—Sap ill-defined, starting yellow, deepens through pink to a red-brown.
Rays.—220; Reddish brown; sinuous and broken; 1-50th inch deep; show up as brown lines on quarter. Pores.—Conspicuous; 2,000 to 3,000; single and radially septate 2. Soft Tissue.—Absent. General.—A brown straight mahogany grained wool. Solution, wood; colourless; no precipitate. Cuts a little hard; 51 lb. per cubic foot.
Locality.—Baroi.
Date.—October.
Native name.—Ba-hi-a (Vailala); Enei (Evara).
Remarks.—A medium hard wood, straight grained and useful looking.
Material collected.—Leaves, fruit, bark, wood.

Dysoxylum sp., No. 612.

A medium tree, 7 feet in girth, with a bole of 40 feet and 60 feet overall.
Leaves.—Compound alternate; rachis, 18 inches long with a large swelling at base, bearing 6 pairs of opposite leaflets and odd one; petiole, ½ inch swollen; blade, 5 to 9 inches by 2½; oblique, glabrous, thin; occasionally terminal pair and terminal leaflet much larger.
Bark.—⅜ inch thick; red-brown; scaly; shedding in large irregular untidy patches; scrolled beneath; inner bark streaked red and white; solution colourless; no precipitate.
Wood.—Sap undefined; pale yellow.
Rays.—350-400 fine rays sinuous around pores; owing to pale colour not clearly visible on longitudinal section; 1-50th inch deep. Pores.—1,800 to 2,400 single and radially septate (2-3). Soft Tissue.—80 to 90 distinct white continuous lines linking up the pores and partly or completely immersing them. General.—A white wood showing no grain. Cuts soft. Solution, colourless; no precipitate.

Locality.—Yalu.
Date.—December, 1923.
Native name.—Ebeve (Yalu).
Material collected.—Leaves, wood, bark.

Indt., No. 296.

Medium tree, 8½ feet in girth, with a bole of 30 feet.

Leaves.—Compound, alternate; the stalk oval in section and much swollen at butt is 15 to 25 inches long, and bears 6 to 7 pairs of opposite and subopposite leaflets and a terminal one; blade, 4½ to 10 inches x 2½ to 4½; ovate to elliptical; acuminate, glabrous, thin. The twig is bright green and is covered with brown lenticels.

Fruit.—A yellow 4 segmented capsule 1¼ inches diameter containing 2 to 4 seeds; the fruit is borne on the old wood on spikes up to 10 inches long.

Bark.—¼ inch thick; grey scaley, pustular; inner bark white prominently streaked with yellow; solution tawney; cloudy precipitate.

Wood.—Sap 2 inches yellow; heart a red brown.

Rays.—200; pale yellow; sinuous around and broken by pores; 1-100th inch deep; show up as specks on quarter. Pores.—Conspicuous; 2500; single; seldom radially septate 2. Soft Tissue.—Very broken wavy lines about 70 to the inch. General.—A yellow cabinet wood without much in the way of grain. Solution wood, colourless; no precipitate. Cuts a little hard; 44 lb. per cubic foot.

Locality.—Baroi.
Date.—October.
Native names.—A-a-wu (Vailala), Iko-Akani (Evara).
Remarks.—A medium hard cabinet wood.
Material collected.—Leaves, fruit, bark, wood.

Dysoxylum sp., Nos. 90, 127.

A large tree 9 feet girth, a bole of 50 feet and 100 feet overall; small spur roots

Leaves.—Compound, alternate; leaf stalk, 10 inches, carrying 5 pairs leaflets with or without a terminal one; opposite and subopposite; petiole, ¼ to ½; blade, 3½-5¾ x 1¾-2; ovate to lanceolate.

Fruit.—A brown more or less kidney shaped fruit containing 3 nuts, of which one or two only come to maturity.

Bark.—Half-inch orange, brown, tesselated; inner bark pinky brown; exudes latex abundantly; solution, colourless; no precipitate.

Wood.—Sap pale, 2 inches; heart red.

Rays.—280; pink; coarse ones 180; 100 very fine; coarse ones very sinuous indeed, twisting and turning around pores, sometimes almost running together to make room for a large pore; fine ones broken by pores; up to 1-50th inch deep, but most show as specks on quarter. Pores.—Conspicuous; 2000 to 2500; single radially septate here and there the division is diagonal or even tangential. Soft Tissue.—Absent. General.—A pink timber with a straight mahogany grain and pleasant figure. Solution, wood; colourless; no precipitate. Cuts soft; 36 lb. per cubic foot.

Locality.—Aroa.
Date.—Fruits in May and June.
Native name.—Kiloe (Suku).
Remarks.—A straight grained cedar-like timber worth attention.
Material collected.—Leaves, fruits, wood, bark.

Xylocarpus granatum, Nos. 343, 218.

A medium sized tree; 3 ft. 6 in. to 4 ft. girth; 60 feet overall; no buttresses.

Leaves.—Compound, opposite; stalk, 2 inches to 4 inches, bearing 2 pairs of opposite leaflets; petiole, ¼ to ⅜ stout; of the terminal pair, one is often absent, or the stalk from the first pair up is thin and petiolear and makes the leaf appear trifoliate, or again one of the terminal leaflets is reduced in size; finally it sometimes happens that one leaflet arises from the end of the stalk on a petiole 1½ inches long, giving the terminal leaflets an alternate appearance; blade, 3 inches to 4¼ x 1¾-3; obovate to oval or elliptical, blunt pointed; venation distinct; somewhat coriaceous; twig bright brown, ribbed and covered with lighter brown lenticels.

Fruit.—Globose, 7½ diameter; rind, ¼ green, smooth, covered with brown markings; four lines of dehiscence; inside pink, leatherly; seeds number 19 to 20 and measure about 1¾ x 1 inch; flattened hemispheroids, and are surrounded by pinky white fleshy tissue; these seeds are grouped in fives and sometimes in four, and each group occupies one quarter of the globose fruit, and it is divided from its neighbors by a white, orange-like septum. They all fit closely together, and once separated are as hard to reassemble as a jigsaw puzzle. The fruit dehisces along the four lines, and the seeds are scattered and are sea-borne; in December and January the beaches are strewn with them.

Bark.—Very thin, 1-16th inch at most; yellow brown; scaly like a plane tree; inner bark pink. Solution, pale brown; green precipitate.

Wood.—Sap undefined, pale yellow to pale pink.

Rays.—230; yellow; 1-80th inch deep; mere specks on quarter. Pores.—3200 to 5700; mostly single, here and there radially septate; on each side and in soft tissue they are very crowded and small. Soft Tissue.—Thin lines about six to the inch and marked off with small crowded pores. General.—A compact yellow wood showing little grain except where soft tissue streaks it; solution, wood; colourless; faint green precipitate; cuts hard; 38 lb. per cubic foot.

Locality.—Galley Reach and all other Mangrove formations.
Date.—January, 1923.
Native names.—Apura (Vailala), Wagua (Tufi), Kairu (Motu), Laure (Buna).
Remarks.—A firm or soft wood; a dye extracted from the bark is used by the Binendele to colour his tapi cloth red.
Material collected.—Leaves, fruit, bark, wood.

MALPIGHIACEAE.

Ryssopterus timorensis, No. 421.

A climber.
Flowers.—Yellow.
Locality.—Menari; 5000 feet; old farm lands.
Date.—February, 1923.
Material collected.—Leaves and flowers.

EUPHORBIACEAE.

Aleurites moluccana Willd., No. 126; Baccaurea papuana, Nos. 230, 625; Baccaurea sp., Nos. 55, 622; Breynia cernua, Nos. 166, 611; Bridelia subnuda, No. 794; Daphniphyllum glaucescens, Blume, No. 378; Endospermum formicarum, No. 21; Glochidion globosum, No. 629; Homa-

lanthuspopulifolius, No. 576; Macaranga chrysotricha Laut. & Sch. (?), No. 166A; Macaranga sp., No. 787; Macaranga riparia, Engl., No. 164.

Aleurites moluccana Willd., No. 126.

A large tree 9 feet in girth and 60 feet of bole; unbuttressed.

Leaves.—Simple, alternate; petiole, 4 inches to 7 inches; blade, 5 inches to 9 inches x $3\frac{1}{2}$ to $5\frac{1}{2}$; ovate cordate, entire, acuminate, glabrous, thin.

Fruit.—Only seen dried nuts after attack by rodents; these are $1\frac{1}{4}$ inches long by 1 inch through. The kernel is said to be edible.

Bark.—Pustular, the pustules forming longitudinal lines, giving the tree a snake skin appearance; grey, immediately underneath red, while the inner bark is speckled brown and white; solution, faint yellow; no precipitate.

Rays.—Clear; 210; very sinuous when they reach a pore or group of pores; 1-50th inch deep; visible as lines on the quarter. Pores.—Conspicuous; 700-800 to the square inch, some single, but mostly radially septate (6); sometimes such a group is divided again through centre radially making 12 in all. Soft Tissue. Very fine lines link up in an irregular manner the rays about 200 to the inch. General.—A white wood; straight grained. Solution, wood, colourless; no precipitate. Cuts soft; 29 lb. per cubic foot.

Locality.—Aroa.

Date.—May 22nd.

Native name.—Omo (Motu).

Remarks.—Candle nut.

Material collected.—Leaves and nuts.

Baccaurea papuana Bail, Nos. 230, 625.

Small tree; 18-inch girth to 40 feet high; no buttresses.

Leaves.—Simple, alternate, exstipulate; petiole, $\frac{1}{2}$ inch; blade, $3\frac{1}{4}$ inches to 6 x $1\frac{1}{2}$ to $2\frac{3}{4}$; oblanceolate, acuminate, more or less sinuate; green, shiny, above; pale green, matt, below; glabrous, thin.

Flowers.—Cauliflora, inflorescence springing from the trunk from 3 feet up to the first limb; racemes, 6 inches to 9 inches long, bearing single or compound female cream flowers, usually solitary; peduncle, $\frac{1}{4}$ inch.

Fruit.—Purple globose or ovoid berry $1\frac{3}{4}$ x $1\frac{1}{2}$; pericarp firm, fleshy, about $\frac{1}{4}$ inch thick; two to four seeds each enclosed in juicy flesh; seed $\frac{3}{8}$ long and $\frac{1}{4}$ wide and flat; pericarp and flesh eaten.

Bark.—Grey, more or less fibrous, longitudinally lined; excrescences due to cauliflory; solution, colourless; no precipitate.

Wood.—Sap undefined; white.

Rays.—Clear; two kinds—(1) coarse wavy in wide curves and a little sinuous, show up as wavy diagonal lines on quarter, (2) fine 150-180, very sinuous, same thickness as soft tissue. Pores.—10,000 to 17,000, very minute, single, but more generally radially septate (2-9). Soft Tissue.—Minute short lines ladder rung the rays; 400 to the inch radius. General.—A white timber with a clear but interlocked grain. Solution, wood, colourless; no precipitate. Cuts firm; 39 lb. per cubic foot.

Locality.—Swamp country behind Buna Bay.

Date.—Flowers in August.

Native names.—Meina (Buna), Timong (Yalu).

Remarks.—The wood has a flesh quarter grain; the strongest scented flower in the jungle.

Material collected.—Leaves, flowers, wood.

Baccaurea sp., No. 55.

A medium tree, 5 feet in girth, and 60 feet overall; not buttressed, but somewhat deeply grooved at butt.

Leaves.—Simple, alternate, exstipulate. Petiole, $\frac{1}{2}$ inch; blade, $6\frac{1}{4}$ to $7\frac{1}{2}$ inches x $2\frac{1}{2}$ to $3\frac{1}{3}$ inches. Lanceloate, acuminate, glabrous, thin.

Fruit.—On old wood. Purple-brown globose $1\frac{1}{8}$ inch diameter. Slightly flattened, containing 4 flattened seeds, each surrounded by edible pericarp.

Bark.—Very rough, brown, $\frac{1}{2}$ inch thick. Inner bark red-brown. Solution colourless; no precipitate.

Rays.—270. Very fine, and very indistinct; do not show up on quarter. Pores.—About 10,000; small, and hard to count on account of soft tissue. Soft tissue.—Clear. In very wavey thin lines, 12-15 to the inch, linking up pores and immersing them. General.—A close-grained yellow wood, with a streaked quarter grain, due to soft tissue alternating with hard tissue. Solution wood; colourless; no precipitate; cuts hard; 56 lb. per cubic foot.

Wood.—Sap pale-yellow, merging into heart wood light-brown.

Locality.—Aroa.

Date.—Fruits in June.

Native name.—Veri Veri (Suku).

Remarks.—A useful hardwood, with interlocked grain.

Material collected.—Leaves, fruit.

Baccaurea sp., No. 622.

A medium tree, 6 feet in girth, 45 feet of bole, and 60 feet overall.

Leaves.—Simple alternate, or in false whorls; petiole, $\frac{3}{4}$ to $2\frac{1}{2}$ inches; bent at right-angles at junction with blade swollen, and browned, and wrinkled; swollen also at junction with the twig; blade, 6 x $2\frac{1}{2}$ to 4 inches; obovate, acuminate, glabrous, broadly serrate. Very young leaves are copper-coloured.

Flowers.—Immature; on axillary spikes.

Bark.—$\frac{1}{2}$ inch thick; brown, finely pustular. Inner bark streaked white and yellow. Exudes a cream latex. Solution.—Very pale yellow.

Wood.—Sap undefined; white.

Rays.—Very fine indeed; 440-460; sinuous around and broken by pores; do not show up clearly on the quarter. Pores.—Clear to distinct; 2,000 single, and radially septate (2-6). Some contain yellow deposit. Soft tissue.—Fine broken lines ladder-rung the rays. General.—A light-brown wood; when dry, cuts soft; splits easily. Solution: very pale yellow; slight darkening precipitate.

Locality.—Yalu.

Date.—23rd December.

Native name.—Popor.

Material collected.—Leaves, wood, bark, fruit, buds.

Breynia cernua Muell., Nos. 166, 611.

Small tree, 15 feet high, and 1 foot girth. Undergrowth in rain forests.

Leaves.—Simple, alternate, stipulate; petiole, $\frac{1}{4}$ inch; blade up to $3\frac{3}{4}$ inches x $1\frac{1}{2}$ inches; glabrous; soft; cordate.

Fruit.—Small globose capsule, about 3-20th inch diameter. 6 loc. Calyx persists as a bright crimson disc.
Locality.—All rain forests up to 2,000 feet.
Date.—Fruits in Northern Division in July.
Native names. — Girida (Binandeli), Gi-ira (Buna), Bundur (Yalu).
Remarks.—The crimson calyx makes this little tree a very pretty object of the bush. The leaves are arranged horizontally on the twig, while the crimson calyx fruits stand up at right angles.
Material collected.—Leaves and fruits.

Bridelia subnuda K. Sch et Lauterb, No. 794.

A small to medium tree, 45 feet high.
Leaves.—Simple alternate. Petiole, ¼ inch.
Flowers.—Axillary, capitate, sessile, white.
Bark.—Grey.
Wood.—White, soft.
Locality.—Mogondo (Lower Sepik).
Date.—24th July.
Native name.—Kaningi.
Remarks.—Common.
Material collected.—Leaves, flowers.

Daphniphyllum glaucescens Blume, No. 378.

A small tree, 25 feet high.
Leaves.—Simple, alternate; petiole, 2 inches; blade, 7 inches x 2 inches, tapering evenly to both ends; acuminate, glabrous, somewhat glacous beneath. Twig covered with large lenticels.
Fruit.—Immature.
Locality.—Mt. Obree. Laruni spur, 9,000 feet.
Date.—23rd February.
Material collected.—Leaves, immature fruits.

Endospermum formicarum Becc., No. 21.

A large tree, 8 feet x 70 feet bole, with narrow buttresses running up to 8 feet.
Leaves.—Simple, alternate. Petiole, up to 5½ inches; blade, up to 8 inches diameter; peltate, acuminate, glabrous, coriaceous.
Flowers.—Axillary panicles 6 inches long.
Fruit.—Berry, green, pubescent. In panicles on hairy peduncles, and pedicels ¼ inch diameter, containing one seed.
Bark.—More or less smooth, grey-brown. Inner bark streaked white and orange. ½ inch thick.
Wood.—Sap wood ill-defined; white, merging into yellow.
Rays.—Clear, 210, 1-60th inch deep; show up a little on the quarter as wavy lines. Pores.—Clear, 1,600 to 3,300, irregularly scattered, radially septate 2-11. It is these septate groups or chains that increase the number of pores to 3,300. Soft tissue.—Very fine lines indeed join up the rays. General.—A pale timber. Solution colourless; no precipitate. Soft to cut; weighs 27 lb. per cubic foot.
Locality.—Vanapa, Veimauri, Aroa.
Date.—June, 1922.
Native name.—Kerea (Suku).
Remarks.—A light soft wood, rather nicely marked on quarter; suitable for indoor work.
Material collected.—Leaves, green fruits, bark, wood.

Affinities *Glochidion globosum* J. J. Smith, No. 629.

A small to medium tree, 3 feet to 4 feet in girth, and 40 feet high.
Leaves.—Simple alternate. Petiole, 7-16th inch pubescent; blade, 4½ to 7 inches x 2 to 3 inches; lanceolate, acuminate, lightly pubescent below and on midribs.
Flowers.—Axillary small; shortly pedunculate, in groups of 4 to 5.
Fruit.—A small pinky-white fruit, which, when ripe and dry, loses its skin, and exposes a number of red flattened kidney-shaped seeds, arranged so that all are attached at centres.
Bark.—½ inch, grey, ridged. Inner bark pink.
Wood.—Sap ill-defined; yellow.
Locality.—Gasara.
Date.—24th January.
Native names.—Seep (Yabim), Tapuro (Waria).
Remarks.—The inner bark is somewhat sticky, and this is scraped off from the outer with shells, and the fibre thus obtained is utilized without further preparation to caulk the topsides of canoes. A pig's leg bone is used to tamp it in, and the caulking hardens, and seems as efficacious as tar and oakum.
Material collected.—Leaves, fruit, wood, bark.

Homalanthus populifolius Grah, No. 576.

A little tree, 25 feet high, with a decorative crown.
Leaves.—Spade-shaped. The young ones are red, and make the tree conspicuous. Exudes latex.
Flowers.—Terminal spikes.
Fruit.—¾ inch green capsules.
Locality.—Joangey.
Date.—December, 1923.
Native name.—Deming.
Remarks.—Very common in more open spaces of forest, and in old farm lands. The latex is feared by natives, causing great pain when it gets in the eye.
Material collected.—Leaves and flowers.

Macaranga chrysotricha Laut. and K. Sch., No. 166A.

Small tree, 25 feet high; springs up on old farm lands.
Leaves.—Simple, alternate, stipulate; petiole, 1½ inches; blade, 6 inches x 6 inches; cordate, acuminate, pubescent above and below; also petiole and twig. Soft.
Flowers.—Axillary panicles.
Locality.—Farm lands everywhere.
Date.—Flowers in July in Buna District.
Native name.—Gega (Buna).
Material collected.—Leaves and flowers.

Macaranga riparia Engl., No. 164.

Small tree, 3 feet girth, and 30 feet overall. Regrowth on old farm lands.
Leaves.—Alternate; petiole up to 9 inches; blade up to 18 inches x 18 inches; three-pointed; cordate based; rusty pubescent above; glaucous below.
Flowers.—Axillary panicles.
Wood.—White. Large pith, traversed with red kino ducts.
Locality.—Everywhere on old farm lands.
Date.—Flowers in July in Buna District.
Native name.—Gibore (Binandeli and Buna).
Material collected.—Leaves and flowers.

Macaranga sp., No. 787.

A medium to large tree, 6 ft. 6 in. in girth, with a 40-feet bole, and reaching 60 feet overall. Medium buttresses to a height of 8 feet.
Leaves.—Crowded at the end of the branches. Simple, alternate; petiole, 2 to 4 inches, bent at right angles at junction with blade—two glands occur here; blade, 5½ to 8 inches x 4½ to 6½ inches; generally cordate; also peltate. Venation very prominent below, and glands occur

at some of the axilla of tertiary veins; upper surface glabrous, lower downy. Stem covered with scars of fallen leaves.
Fruit.—On panicles up to 1 foot long. A small green drupe.
Bark.—Grey and brown. Scaly; scales shed in small more or less round patches, leaving bole crocodile-skinned. Inner bark speckled yellow and orange.
Wood.—Yellow. Sap undefined. Axes firmly.
Locality.—Abunti; (Middle Sepik), Hills 400 to 600 feet.
Date.—14th July.
Native name.—Mabung (Lavongai).
Remarks.—Said to be used for canoes. Wood and bark have a turnip smell. Later, in Lavongai, I found this growing with a bole of 90 feet.
Material collected.—Leaves, fruit, wood, bark.

ANACARDIACEAE.

Campnospermum brevipetiolata, Vilkns, Nos. 202, 785, 799; Dracontomelum mangiferum, Nos. 1, 613; Dracontomelum sp., Nos. 51, 335; Mangifera minor, Nos. 41, 170, 619; Pleiogynium solandri, No. 125; Rhus sinarubafolia, No. 374; Semecarpus australiensis, No. 93; Semecarpus sp., Nos. 144, 525; Spondias dulcis Forst f., Nos. 301, 328, 809. Pentaspodon Motleyi, No. 304.

Campnospermum brevipetiolata Vilkns, Nos. 202, 785, 799.

A large tree, 10 feet in girth; with a heavily buttressed (up to 8 feet) bole of 80 feet.
Leaves.—Crowded at the end of branches. Simple in false whorls; sub-sessile; auricled; 22 x 7 inches; oblanceolate; more or less coriaceous; obtuse; stiff; midrib and veins yellow, and very prominent below; glabrous. Juvenile leaves are copper-tinted below; older ones are slightly glaucous.
Fruit.—Borne on axillary; rusty tomentose panicles up to 15 inches long. A round, purple drupe, containing flattened ovoid green seed.
Rays.—210; brown; sinuous; 1-80th inch deep; show up as fine lines and oblongs on quarter. Pores.—18,000, very evenly crushed into the available space. Single and radially septate (2). Soft tissue.—Absent. General.—A white or yellow wood that turns a mauve-brown when dry. Light straight grained, much in demand for canoes in Northern Division. Solution wood, colourless; slight discoloured precipitate. Cuts soft and firm; 44 lb. per cubic foot.
Bark.—One-quarter inch thick; pustular; delicately scaly, scales papery. Inner bark streaked cream and yellow; exudes a very sparse white sap from cambium layer.
Wood.—Sap undefined; cream to pinky yellow.
Locality.—Onitatandi.
Date.—July, 1922.
Native names.—Siruga (Buna), Siluya (Onitatandi), Kwata (Marienberg), Singawa (Rabaul).
Remarks.—The wood of this tree yields a clear yellow oil, which is used by the Sepik native for the same purpose as coco-nut oil. Two transversal cuts 2 feet apart are made in the trunk and a groove is cut connecting them. A guttering and receptacle combined is made of a bamboo joint and fastened at lower end of grove. Over the which to exclude rain is arranged the spathe of a palm. It takes two months to fill a bamboo joint.
Material collected.—Leaves, also fruit in formalin and some oil, wood, bark, and flowers.

Dracontomelum mangiferum, Blume, Nos. 1 and 613.

A large tree, 10 feet girth, 80 feet bole, and 120 feet over all. Very large and wide-spreading buttresses. Probably the most heavily buttressed tree in Papua. The girth is, relatively speaking, small above the buttresses, and gives the tree an unbalanced appearance.
Leaves.—Compound, alternate. Stalk 3 inches to 4 inches; leaflets alternate, about twelve; petiole, $\frac{3}{8}$ inch; blade, $2\frac{1}{2}$ to 6 inches x 1 to 2 inches, asymmetrical; entire; acuminate; thin; glabrous. Glands at axil of some of the veins. The shape of the leaf is very variable; some are plainly ovate and show no asymmetry.
Bark.—One-quarter inch thick; dappled brown and olive; scaly but decorticates in small irregular patches, leaving the surface fairly smooth; immediately below the outer bark the colour is bright green; the inner bark is pale yellow. Solution colourless; slight precipitate.
Wood.—Sap 4 inches, pale yellow; heart a good walnut brown, with a pretty figure.
Rays.—200 to the inch, inconspicuous, very shallow; walnut flash on quarter. Pores.—Conspicuous, 500 to square inch; scattered regularly over the section in radially septate (2); contain dark deposit. Soft tissue.—Absent. General.—Walnut grain caused by concentric bands of dark and light brown wood; hard to cut. Solution colourless; bark does not react; wood does slightly; weighs 47 lb. per cubic foot.
Locality.—Material collected near Veimauri Creek. This species is to be found growing all round Papua and New Guinea in the lowlands.
Date.—May, 1922.
Native names.—Damoni (Motu), Onomba (Binendele), Aua (Vailala), Dorea (Evara W.).
Remarks.—A sound straight-grained hardwood, with a walnut colour and figure. It has been sold as walnut by the Manu Manu Mill.
Material collected.—Leaves, wood, bark, fruit and flowers.

Dracontomelum sp., Nos. 51, 335.

A large tree, average dimensions $7\frac{1}{2}$ feet girth x 35 feet of clean bole and 110 feet over all. Specimens up to 10 feet girth and 70 feet bole are to be met with, but are rare. Heavily buttressed. Buttresses spreading out 6 feet and ascending to 12 feet.
Leaves.—Compound, alternate, stalk up to 2 feet long, leaflets alternate to sub-opposite, subsessile, lanceolate, usually second and third pair are sub-opposite. Blade, 3 to 8 inches x $1\frac{1}{2}$ to 3 inches, margin faintly serrate or entire and slightly wavy, acuminate, finely pubescent below, puberulous above, thin.
Flowers.—Terminal, racemose panicles 4 to 6 inches long.
Fruit.—A yellow globose somewhat flattened drupe, $\frac{7}{8}$ inch long and 1 inch diameter. Pericarp, 3-32nd inch, tough. Mesocarp fleshy, $\frac{1}{8}$ to $\frac{1}{4}$ inch, thickened at base, containing a hard woody, corrugated, irregular-shaped nut of variable size. The cross-section is a spherical triangle and it contains two to three seeds, 3-16th inch long.
Bark.—Light-brown; scaly. More or less smooth, except where scales still adhere. Apparently decorticates annually. Surface like a plane tree.

Inner bark red-brown; ¼ to ½ inch thick. Smells like raw turnip; solution colourless; strong precipitate.

Wood.—Sap undefined; pale yellow or white wood.

Rays.—120-140 to the inch; brown; undulate and sinuous around pores; 1-40th inch deep; show up as oblongs on quarter. Pores.—Clear, 1,300 to 3,000. The closer sowing of the pores is really due to chains of radially septate pores (2-4). Soft tissue.—Not prevalent. Thin rings sometimes double or treble about one zone to the inch. General.—A grey-brown wood with a handsome walnut grain. Solution wood, colourless; faint green precipitate. Cuts firm and clean; hard to get a translucent section; 52 lb. per cubic foot.

Locality.—Veimauri, Vanapa, Aroa. Not found in Northern Division.

Date.—Flowers in June in Vanapa District.

Native names.—Habere (Suku), Urau (Vailala).

Remarks.—A hard timber, difficult to distinguish from No. 1, in fact both have been sold as New Guinea walnut. As a tree it is only by cutting into the wood that it can be distinguished from No. 5, unless, of course, the tree is in flower.

Material collected.—Leaves, flowers, wood, fruits, bark.

Mangifera minor Bl., Nos. 41, 170, 619.

A large tree, 8½ feet girth and a bole of 50 feet; no buttresses.

Leaves.—Simple, alternate. Petiole, 1½ to 2½ inches, twisted; blade, 11 inches x 3 inches to 8 inches x 1⅓ inches; lanceolate; acuminate; glabrous; thin.

Flowers.—Axillary panicles 7 to 8 inches long at end of branchlets.

Bark.—½ inch thick, light-brown; somewhat rugged in parts. Inner bark pale yellow.

Wood.—Sap undefined; white with a saffron tinge.

Rays.—240. Brown sinuous around and broken by pores, 1-100th inch deep; show up as brown specks on quarter. Pores.—Conspicuous, 1,400 to 2,000, single irregularly scattered, here and there diagonal chain occurs that give a semblance of order; many filled with black deposit. Soft tissue.—Fine concentric lines, sometimes several of them are joined and make one coarse line sown with a chain of pores. The lines are wavy and run from pore to pore, but always cut the pore tangentially. General.—A grey timber, streaked with dark pore lines on back and quarter, and with soft tissue showing conspicuously as rings on a cross-section. Solution wood, slightly discoloured; a green precipitate. Cuts firm and clean; 45 lb. per cubic foot.

Locality.—Wide range over lower altitudes up to 2,000 feet; Veimauri foothills.

Date.—May, 1922.

Native names.—Ihara (Suku), Ewa (Buna), Auroro (Vailala), Dua (Yalu).

Remarks.—A straight-grained hardwood. It grows larger on the north coast of New Guinea.

Material collected.—Leaves, wood, bark, flowers.

Pleiogynium solandri Engl., No. 125.

A large tree, 9 feet girth and 75 feet bole; buttressed up to 4 feet.

Leaves.—Crowded at end of branchlets, compound, alternate; stalk, 7 to 9 inches; five to six pairs of leaflets and a terminal one. Leaflets sub-opposite or opposite. Terminal leaf's petiole 1 inch. Remaining pairs shortly petiolate (⅛-¼); blade, 2 to 4 inches x 1¼ to 1¾ inches; entire, glabrous, elliptical; glands at junction of secondary veins with midribs.

Flowers.—Axillary.

Fruit.—¾ inch diameter. Red fleshy pericarp; contains hard nut shaped like a crown with ten apertures between the points of the crown.

Bark.—½ inch thick, grey, roughly ridged. Inner bark red, streaked with white. Exudes a meagre flow of milky sticky sap; solution, strong red-brown; blue precipitate.

Wood.—Sap pale pink, 3 inches; heart a fine dark-brown.

Locality.—Aroa.

Rays.—160-165, pinky yellow, slightly sinuous around pores and very wavy in large sweeping curves; 1-100th inch deep; show up as specks on quarter. Pores.—Conspicuous, 6,000 to 8,000 in less and more porous zones. Single and radially septate (2). Soft tissue.—Rare, about one very thin ring to the inch radius. General.—A pinky yellow wood, somewhat cross grained, often showing curly or fiddle-backed grain on quarter. Solution wood, a pale pink; strong blue precipitate. Cuts hard; 57 lb. per cubic foot.

Date.—Flowers and fruits in May and June.

Native name.—Vasapa (Suku).

Remarks.—A fine coloured hardwood, should polish well, but interlocked grain will make it hard to work.

Material collected.—Leaves, flowers, fruit, nut, wood, bark.

Rhus sinarubaefolia A. Gray, No. 374.

A medium tree, up to 80 feet over all; no buttresses.

Leaves.—Compound, alternate; stalk about 1 ft. 9 in. long, bearing about twelve pairs of sub-opposite and opposite leaflets and a terminal one; petiole, 3-16th inch; blade, increasing in size from base 3 x 1½ inches to end pair 6½ x 2 inches; terminal leaflet has petiole 1 inch long and blade 5½ x 2 inches; all are lanceolate, acuminate, curved back along midribs and half-closed, latter prominent, as are veins, coriaceous. Branchlets stout with very thick pith.

Flowers.—Axillary, erect panicles at end of branches bearing numerous small pink sessile flowers on stout stems.

Fruit.—Immature; red.

Bark.—Grey, large pustules, irregularly longitudinally lined. Inner bark streaked pink and white. Exudes latex. Solution discoloured; greenish-black precipitate.

Wood.—Sap undefined, white to pale pink.

Rays.—170, composed of coarse and fine yellow rays; show up as specks on the quarter. Pores.—3,000 to 6,000, single, rarely radially septate (2-3) in relatively thinly and closely sown bands. Soft tissue.—Absent. General.—A pale wood, with a saffron sheen. Solution wood, discoloured; faint blue precipitate. Cuts soft; 34 lb. per cubic foot.

Locality.—Laruni. A common tree of the wooded gullies that occur in the grass hills of the dry belt, here it rarely exceeds 5½ feet girth and 30 feet bole.

Date.—February, 1923.

Native name.—Orena (Laruni).

Remarks.—Soft wood.

Material collected.—Leaves, flowers, wood, bark.

Semecarpus sp., No. 144.

Large tree, 7 feet in girth, with an 80 feet bole; not buttressed.

Leaves.—Simple, alternate, much thickened petiole ½ inch; blade, up to 24 inches x 7 inches; lanceolate, acuminate, glabrous, thin; stout prominent midribs and veins.

Fruit.—A flattened obovoid, rusty tomentose drupe; 1¼ inch larger diameter; ¾ inch smaller diameter; 1½ inch deep. Exudes brown gum from pericarp. Calyx persists and forms a cap at base of fruit.

Bark.—One inch thick; brown, pustular. Inner bark red-brown. Exudes a very dark, almost black gum from inner half of bark.

Wood.—Sap ill-defined. Starting white it deepens to a pinky yellow.

Rays.—120, coarse, very dark brown, sinuous round, rarely broken by pores. Possibly fine rays in between, but not visible by hand lens. 1-100th inch deep; show up as specks on quarter. Pores.—Clear, 1,200 rather evenly scattered, immersed in soft tissue. Radially septate (2-4). Filled with brown deposit. Soft tissue.—Surrounds pores and extends each side in short line, sometimes these continue and link up with next pore. Here and there twice or thrice to the inch there occur lines of soft tissue which are really compound short lines crowded together, and so giving appearance of a continuous ring. General.—A grey wood, streaked with brown pore lines. Solution wood. colourless; no precipitate. Cuts soft and woolly; 28 lb. per cubic foot.

Locality.—Buna District.

Date.—Fruits in July.

Native name.—Duduye (Buna).

Remarks.—A straight-grained soft wood, with pretty flash on quarter, but unfortunately subject to discolouration.

Material collected.—Leaves, fruit, wood.

Spondias dulcis Forst. f., No. 301, 328, 809.

Large tree, 8 feet x 60 feet bole, and 100 feet over all; not buttressed, but spur rooted.

Leaves.—Compound, alternate; stalk, 12 to 17 inches, having five to eight pairs of sub-opposite and opposite leaflets; petiole, ¼ inch; blade, 5 to 6½ inches x 2½ to 3 inches; ovate to lanceolate, acuminate; margin serrate; somewhat asymmetrical, more or less coriaceous, venation very distinct; marginal veined; size of the leaves decreases to the terminal one. The broken stalk smelt of mango.

Flowers.—White, small, in terminal erect panicles.

Fruit.—An ovoid, yellow drupe, up to 2 inches long x 1¾ inches diameter; average, 1¾ x 1½ inches; pericarp, 3-16th inch, covering a corrugated woody nut. Section at centre of nut is a 4-5 pointed star. There are an indefinite number of seeds in each point of the star. Smells strongly of mango.

Bark.—¾ inch, grey, longitudinally lined; pustular. Inner bark white, streaked with yellow. Solution, colourless; no precipitate.

Wood.—Sap undefined.

Rays.—Clear, 500-600, brown, indistinct on cross-section; show up as brown squares 1-32nd to 1-20th inch deep on quarter, and show up as thin very dark brown ellipses on back. Pores.—Conspicuous, 2,000 to 3,000, radially septate (2), evenly scattered. Soft Tissue.—Surrounds pores; shows them up as white dots on cross-section. General.—A grey soft wood with speckled grain. Solution wood, colourless; very slight precipitate. Cuts easily but woolly; 28 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native names.—Iopeia (Vailala), Kara (Evara).

Remarks.—A soft open wood, fit for case making if the blue mould to which it is so subject can be prevented.

Material collected.—Leaves, bark, wood, flowers, buds, fruit.

Semecarpus australiensis Engl., No. 93.

Large tree 8 feet girth and 60 feet bole; without buttresses.

Leaves.—Simple, alternate, petiole, 1¼ inches to 3 inches; swollen at base, rusty tomentose; blade, 12 inches x 4 inches to 15 inches x 4½ inches; oblanceolate, acuminate, entire, margin recurved, glabrous above; below, rusty hairs on midrib and main veins, remainder pubescent; the sapling leaves are glabrous above and below.

Fruit.—Only dry rat-eaten empty nuts seen, 2 inches x 1½; flattened obovoid; back heavily corrugated; front more or less smooth.

Bark.—Brown caries moss in interstices of scales, finely and wavily fissured longitudinally; inner bark light brown. Solution, colourless; green precipitate.

Wood.—Sap undefined; pale yellow.

Rays.—110 yellow, including very fine ones; the coarse ones are very conspicuous; very straight fine ones broken by pores, large ones deform pores; 1.30th inch deep wavy lines on quarter. Pores.—4500 very evenly scattered; all single, baby ones occur grouped round large ones; latter very conspicuous. Soft Tissue.—Absent. General.—Solution, wood; colourless; no precipitate. Cuts fairly hard; 31 lb. per cubic foot.

Locality.—Vanapa, Veimauri.

Date.—Collected in June.

Native names.—Huna (Suku), Ekipatila (Doura).

Material collected.—Leaves, two nuts, wood, bark.

Semecarpus, No. 525.

A large tree 10 feet in girth, with a bole of 45 feet and 80 feet overall.

Leaves.—Simple; opposite; petiole, ¼ inch; blade, 2 inches to 4 inches x ¾ inch to 2 inches; broadly obovate; shallowly serrate, upper half only; thin.

Bark.—¾ inch thick; yellow brown; slightly wrinkled horizontally and pustular; inner bark is streaked yellow and white; exudes a dark-brown sap. Solution, colourless; no precipitate.

Wood.—Sap undefined, yellow.

Rays.—100-1500 to the inch; 1-50th inch deep; show up as little yellow oblongs on the quarter. Pores.—20,000 to 30,000 to the square inch, mostly single, but here and there radially septate (2). Soft Tissue.—Absent. General.—A white open grained soft coarse wood. Solution colourless; no precipitate.

Locality.—Divide between Nomi and Ake Rivers. Salawaket, 7,000 feet.

Date.—23rd November.

Native name.—Gua.

Remarks.—Occurs from 2,000 to 7,000 feet; natives use black sap to mark woodwork, &c., with curious designs and pictures of beasts.

Material collected.—Leaves, wood, bark.

Pentaspodon Motleyii (near), No. 304—

Large tree, 8 feet girth, bole 80 feet, 120 feet over all. Heavily buttressed to 15 feet.

Leaves.—Compound, alternate. Stalk, 4 to 7 inches, bearing four to five pairs of opposite or sub-opposite leaflets; shortly petiolate, 3-16th inch; blade, 3 to 5 inches x $1\frac{1}{8}$ to $1\frac{1}{2}$ inches; lanceolate, acuminate with a somewhat blunt apex; glabrous, thin; bark of twig scantily exudes white latex.

Bark.—$\frac{1}{8}$ inch thick, grey; scaly; scales shedding in large patches; inner bark brown; exudes brown latex scantily; solution colourless, no precipitate.

Wood.—Sap 1 inch, pale yellow; heart deep brown, which lightens to a pale brown on drying.

Rays.—200, brown, sinuous, 1-80th inch deep; fine rather indistinct lines on quarter. Pores.—Clear, 7,000 to 9,000, single, more rarely radially septate; a relatively small number are filled with a yellow-brown deposit. Soft tissue.—Absent. General.—A brown, straight-grained timber, with an oily surface; shavings boiled in water yield oil. Solution wood, colourless; pale-blue precipitate. Cuts rather hard, but works smoothly; 52 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native names.—Auro (Vailala), Inene (Evara).

Remarks.—A dense, straight-grained wood, not difficult to work. The wood contains an oil in such abundance that it may be collected in conveniently placed receptacles, much as resin is collected from the Maratime Pine—only the cut must reach the heart. In many cases the flow is very heavy, and in one instance a gallon of the oil was collected in three hours. In such cases it is probable that reservoirs of oil have been formed in hollows caused by rot, and the axe has tapped a crack that has piped off the supply. While a miscroscope may yield some explanation of the formation of the oil in the wood, a lens shows no special canals or vessels as one would expect to see. The oil is heavy and misty brown in colour; it resembles motor lubricating oil as used for cylinders. It has a smell which is hard to describe though somewhat familiar—somewhat fishy linseed oil is the nearest I can get to it.

Material collected.—Leaves, bark, wood.

Celastraceae.

Indt., No. 548.

A small tree; 30 feet high.

Flowers.—White fragrant.

Locality.—Nomi River, 5,000 feet.

Date.—23rd November,

Native name.—Kuset (Ogeramanagn).

Material collected.—Leaves, flowers.

Sapindaceae.

Alectryon ferrugineus, Radlk., No. 438; Dodonaea Viscosa, Nos. 419, 561; Gomophyllum falcatum, No. 310; Pometia pinnata, Nos. 5, 586.

Alectryon ferrugineus Radlk., No. 438.

A small tree.

Locality.—Port Moresby. Seashore and up the gullies.

Date.—April, 1922.

Remarks.—Common.

Material collected.—Leaves and fruit.

Dodonaea viscosa Linn, Nos. 419, 561.

A small tree; 1 foot girth and 25 feet overall.

Leaves.—Collected.

Fruit.—Collected.

Bark.—$\frac{1}{4}$ inch grey brown, fibrous; inner bark, yellow brown.

Wood.—Yellow.

Locality.—Grass lands and old farm lands near Menari, 5,000 feet; Ogeramagn, 4-7,000 feet.

Date.—February, 1923.

Native name.—Gelea (Menari).

Material collected.—Leaves, fruit, bark, wood.

Gamophyllum falcatum, No. 310.

A large tree with a 10 feet girth and 100 feet bole, while it attains a height of 130 feet overall; it has neither buttresses, spur roots or root swellings, but grows up tall and straight from the ground.

Leaves.—Compound, alternate; stalk, 9 inches, bearing 7 to 12 alternate leaflets; petiole, $\frac{1}{4}$ inch; blade, $2\frac{3}{4}$ to $4\frac{1}{4}$ x 1 to $1\frac{1}{2}$; lanceolate, asymmetrical with a slight anti-clock twist from base to acuminate apex; glabrous; thin.

Flowers.—Only buds seen; axillary.

Bark.—Purple brown; very scaly; scales adhere untidily in plates of all sizes; pull off a scale and the under-surface is yellow brown; the outer scales are stiff and rough, but the inner ones are soft and papery; cut into them, and the inner bark is a pale yellow. Solution, yellow; no precipitate.

Wood.—Sap undefined; pale yellow.

Rays.—230 to 250; white; very fine and invisible on translucent section; show up as very fine lines on the quarter. Pores.—Clear; 6,300 to 10,100 in bands thinly and thickly scattered; single and in short wavy diagonal chains; a number of the pores are impregnated with a yellow resin or oil, this is visible in translucent section. Soft Tissue.—Links up the pores in chains. General.—A white wood, showing little or no grain. Solution wood, colourless; no precipitate. Cuts hard; 51 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native name.—Aberabu (Vailala).

Remarks.—A very hard, heavy, interlocked grained timber.

Material collected.—Leaves, buds, bark, wood.

Pometia pinnata Forst., Nos. 5, 586.

A large tree, average bole $5\frac{1}{2}$ x 30 feet, 100 feet overall, but specimens up to 10 feet in girth and 70 feet bole; heavily buttressed; the buttresses spread out 7 feet from the trunk and extend up it in grooves to 15 feet; the bole measurements given above are exclusive of this buttressed portion of the trunk; having regard to the very high buttresses, the bole is of small girth.

Leaves.—Compound, alternate; leaf stalk up to 18 inches long, and having pinnate leaflets which are alternate to subopposite; shortly petiolate, $\frac{1}{8}$ inch; blade, 2 inches to 7 inches by $\frac{3}{4}$ inch to $2\frac{1}{4}$ inches; lanceolate, acuminate; margin more or less shallowly toothed; glabrous, except midrib and lateral veins, which carry scattered hairs.

Flowers.—Axillary racemes, 6 inches to 9 inches.

Fruit.—Ripens in October in the Purari country; panicles, 12 inches to 15 inches long, stout grooved main stalk bearing pear-shaped drupes

1½ inches x 1 inch; apple red and green and with a similar surface; epicarp egg-shell thickness and brittle; mesocarp divides itself into two; on the outside a white pulp, adhering to the epicarp, and within a jelly-like substance ⅛ inch thick at sides, and 1-16th inch thick at apex, vanishing at base, where the pulp-like tissue fills the whole space between peduncle and nut; the jelly-like substance is eaten by natives, and much sought after by birds and fruit bats. Within is the nut 13-16th long and 9-16th diameter; endocarp shiny brown, like a hazel nut, which it resembles in shape, and has the same white thin shell at base for a distance of 4-16th to 5-16th; the endocarp is very thin, and the kernel fills the whole space within. Very often the fruits are joined together at base, but for the most part they are single on stout peduncles ¼ inch long.

Bark.—Scaly red brown; scales coming off in small pieces and leaving bark fairly smooth; ¼ inch thick; inner bark a light red brown; solution, yellow rose; strong green precipitate.

Wood.—Sapwood, white 1 inch; heart wood, red.

Rays.—400 to 2,000 brown up to 1-50th inch deep show up as wavy lines and oblongs on quarter; sinuous diverging round and between pores. Pores.—Conspicuous; 400 to 2,000 irregularly scattered here and there; one picks up a diagonal chain, but for the most part they show no order; bands of closely and thinly sown pores alternate. Soft Tissue.—Absent. General.—A reddish brown with a walnut grain. Solution wood; yellow rose; strong green precipitate. Hard to cut; weighs 53 lb. per cubic foot.

Locality.—This specie has a wide range all round the coast and up to an altitude of 1,000 feet. It is one of the commonest trees in the Northern Division, but is to be seen growing to larger dimensions in the Galley Reach forests. It is common all round New Guinea, and on the islands of the Bismarck Archipelago.

Date.—Northern Division, August.

Native names.—Okamu (Motuan), Koiawo (Buna), Ohabu (Vail.), Daine (Evara), Cuhing (Yabim), Bas (Waria), Tun (Rabaul), Tze (Yalu).

Remarks.—A useful wood which has already been used for boat planking with some success. It is strong, its colour is good, and it bends. A hard wood, but it works well.

Material collected.—Leaves, flowers, immature fruits, bark, wood.

Balsaminaceae.

Impatiens sp., Nos. 530, 423, 543.

Impatiens sp., No. 543.

A herb 2 feet high.

Flowers.—White to mauve through cream and pink.

Locality.—Nomi River, 5000 feet.

Date.—November, 1923.

Remarks.—A very common and beautiful balsam.

Material collected.—Leaves, flowers.

Impatiens sp., Nos. 423, 530.

A plant, 4 feet high, with bright crimson long spurred flowers.

Locality.—Menari to Naro in wet gullies. Sarawaket.

Date.—February, 1923.

Remarks.—This is the only species that has crimson flowers. There are a very large number of shades of the common species, but I think this is different.

Material collected.—Flowers and leaves.

Rhamnaceae.

Alphitonia moluccana Teijsm and Binn, No. 169.

Small tree 40 feet high and 3 feet in girth; springs up on old farm lands.

Leaves.—Simple, alternate, exstipulate; petiole, ½ inch; blade, up to 7 inches x 2 inches; lanceolate to elliptical; green shiny above; glaucous below; glabrous.

Fruit.—A purple drupe.

Bark.—Grey with brown pustules; fragrant, the scent somewhat spicey.

Locality.—All farm lands.

Date.—Fruits in July in Buna District.

Native names.—Oiela (Buna and Binandele).

Remarks.—Bark is worth investigating.

Material collected.—Leaves, fruit, wood, bark.

Elaeocarpaceae.

Anoniodes pulchra, No. 581; Antholoma Tieghemi F. v. M., No. 370; Elaeocarpus affin. E. novo-guineensis Warburg., No. 87; Elaeocarpus megacarpus Schltr., No. 355; Elaeocarpus sp. nov., No. 185; Elaeocarpus sepikanus, Schltr., No. 178; Elaeocarpus sp., Nos. 102, 380, 354, 336; Elaeocarpus novo-guineensis Warb., No. 141; Sloanea paradisiarum, No. 84.

Anoniodes pulchra Schltr., No. 581.

A large tree with a girth of 8 feet, a bole of 60 feet, and 100 feet overall. Medium buttresses to 6 and 8 feet, spreading 4 feet.

Leaves.—Simple, alternate; stipules, ⅜ inch to ½ inch; petiole, 1¾ to 2 inches; blade, 4½ to 5 by 2½ to 3; shape variable; condate base, but more or less obovate; serrate; obtuse; coarse; lower surface hairy, upper surface rough; stipules fall off readily.

Fruit.—A chestnut covered with spines ¾ inch long containing 3-4 red, black tipped seeds.

Bark.—Grey, covered with rather large brown pustules; inner bark streaked red and brown.

Wood.—Sap undefined white, deepening to a pink; axes and splits easily.

Rays.—50-80 coarse distinct; 220 fine ones; straight except for sweeping curves which are, I think, due to defective sample; 1-40th inch deep; wavy bands and oblongs on ¼ the quarter. Pores.—2,500 to 4,700; distinct single and raidally septate (2 and 3) in thinly and thickly sown zones; thicker in areas of bunched soft tissue; show up as reddish streaks on the quarter. Soft Tissue. About 9 thin brown lines to the inch; irregularly spread sometimes 6 will be bunched in 1-6 inch, and elsewhere there will only be 2 in 1-3 inch. General.—A pink wood cuts easily, pretty ¼ grain. Solution colourless; blue precipitate.

Locality.—Ioangey.

Date.—December, 1923.

Material collected.—Leaves, wood, fruit, bark.

Antholoma Tieghemi F. v. M., No. 370.

A shrub 8 feet high.

Leaves.—Simple, alternate; petiole, up to ½ inch swollen at junction with twig and with blade; margin indented, acuminate glabrous.

Flowers.—Axillary, solitary, pendant, at end of branchlets; peduncle, 1½.
Locality.—6,000 feet, Owen Stanley Range.
Date.—23rd February.
Remarks.—A very ornamental shrub.
Material collected.—Leaves and flowers.

Sloanea paradisiarum, No. 84.

A large tree with developed buttresses; 7 feet by 60 feet bole and 90 feet to 100 feet overall.
Leaves.—Simple, alternate, exstipulate; petiole, ½ to 2½ inches; blade, 3½ to 6 x 4 inches to 11 inches; obovate, undulate, glabrous, thin.
Fruit.—Hard woody capsule, 2 inches x 1¼ to 4 inches x 2 inches covered with stiff bristles; these soon wear off, and are only to be seen on fairly fresh fruits; opens from apex into three parts.
Bark.—Grey; inner bark yellow; ¼ inch thick. Solution, madeira; blue precipitate.
Wood.—Sap undefined, white.
Rays.—Coarse; 72; yellow to pale yellow sinuous around pores; 1-15th inch deep; show up well on quarter; between them are more than twice the number very fine ones. Pores.—Conspicuous; 5,000 to 8,000 very porous and less porous zones; single and radially and diagonally septate (2); sometimes a shamrock group of 3. Soft Tissue.—Absent. General.—A mouse coloured somewhat interlocked wood. Solution wood: yellow; dirty-green precipitate. Cuts soft and clean; weighs 35 lb. per cubic foot.
Locality.—A common tree with a wide range around the lower altitudes of Papua from the plain to 2,000 feet.
Date.—Fruits from June to July.
Native names.—Otuni (Suku), Oh-e (Buna).
Material collected.—Leaves, fruits, wood.

Elaeocarpus aff. *E. novo-guineensis* Warburg, No. 87.

A large tree with narrow buttresses.
Leaves.—Simple, alternate; petiole, ¼; blade, 7 x 3½; lanceolate; serrate; glabrous; thin.
Bark.—½ inch thick; grey; smooth; inner bark yellow-brown; solution, dark ruby red; dirty green precipitate.
Wood.—Sap undefined; white.
Rays.—Coarse; 26; yellow; probably fine ones occur, but could not see them; 1-50th inch deep; show up as specks and lines on quarter. Pores.—5,000 to 6,000 evenly scattered, single and radially septate (2-4). Soft Tissue.—Absent. General.—A pale wood, rather close grained. Solution wood: slightly discoloured; no precipitate. Cuts soft and clean; 28 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Sigore (Suku).
Material collected.—Leaves, wood, bark.

Elaeocarpus comatus Wh. & Fr. ined., No. 185.

Large tree, 8 feet girth and 55 feet bole; buttressed to a height of 5 feet.
Leaves.—Bunched at end of branchlets; simple, alternate; petiole, 1¼ to 3 inches; blade, 4½ to 9 x 2½ to 4¾; obovate, acute, soft pointed, margin wavy; each vein terminates in a soft spine, projecting 1-16th inch beyond margin; pubescent on veins and midribs.
Flowers.—Panicles of about six flowers on a peduncle set in axilla of leaves.
Rays.—Coarse ones 60, wavy and sinuous; 1-80th inch deep; show up as fine lines on quarter; fine ones hard to count—about 500. Pores.—Conspicuous; 2,500-3,500, single and septate (2-3), filled with brown deposit. Soft Tissue.—Absent. General.—A straight grained light yellow wood streaked with dark-brown pore grooves. Solution wood: colourless; no precipitate. Cuts firm; 30 lb. per cubic foot.
Bark.—Grey, pustular; inner bark yellow, specked with white; ⅜ inch. Solution yellow; dirty-brown precipitate.
Wood.—Sap undefined, white.
Locality.—Northern Division, Kumusi River.
Date.—Flowers July.
Native name.—Ohe.
Remarks.—A medium soft wood; a useful timber.
Material collected.—Leaves, flowers, wood, bark.

Elaeocarpus sepikanus Schltr., No. 178.

Large tree, 8 feet girth and 60 feet bole.
Leaves:—Simple, alternate, exstipulate; petiole, up to 2½ inches; blade, up to 6 x 3½; oval, acuminate, broadly serrate; gland at junction of midrib and most of the veins.
Flowers.—Crowded at end of branches in axillary spikes up to 4 inches long, bearing a number of single, regular, pentamerous, perigynous, pedunculate, stiff, cream coloured flowers; peduncle 7-10th, hairy.
Bark.—¼ inch thick; grey mottled with brown, faintly pustular; inner bark red brown, streaked with yellow; solution, colourless; cloudy precipitate.
Wood.—White to cream; sap undefined.
Rays.—Clear; 100, of which about 30 are brown, coarse and wavy; 1-30th inch deep and show up as conspicuous lines on quarter; the other 70 are fine, brown, sinuous around or broken by pores and invisible except here and there, as minute specks on the quarter. Pores.—Conspicuous; 1,000; single, more rarely septate (2 and 3); here and there bands of almost non-porous wood occur. Soft Tissue.—Exceedingly fine irregular lines run from ray to ray—they are too numerous to count; in addition, fine continuous concentric lines occur—about three to the inch. General.—A pink wood with a straight grain; attacked by blue fungus. Solution wood: colourless; no precipitate. Cuts hard and clean; 51 lb. per cubic foot.
Locality.—Buna District up to 1,500 feet.
Date.—Flowers in July.
Native name.—Tangere (Buna).
Remarks.—A hard wood with a pretty quarter grain.
Material collected.—Leaves, flowers, wood, bark.

Elaeocarpus megacarpus Schltr., No. 335.

Large tree; 10 feet in girth, with a bole of 85 feet and 120 feet overall; high, but rather narrow, buttresses.
Leaves.—Terminal false whorls; petiole, 1¼; blade, 7-8 x 2½ to 2¾; obovate, glabrous, stiff, margin wavy, midrib and veins yellow, prominent below; style persistent, 13-16th.
Flowers.—Only overblown ones seen; panicles, 4 inches to 6 inches long, bearing pedunculate flowers; peduncle, ½ inch to 1½ inches.
Fruit.—A drupe 2¼ x 1¾; ellipsoidal; nut 2¼ x 1½ x ¾ thick scalloped edge, dividing down centre and containing kernel, 1¼ x ⅜.
Bark.—⅝ inch thick; grey, pustular, fibrous; inner bark red brown, streaked with yellow. Solution pale yellow; faint green brown precipitate.

Wood.—Sap undefined, white.
Rays.—Clear; (1) coarse 52 to the inch, yellow brown, 1-40th inch deep, brown oblongs on quarter; (2) a very large number of exceedingly fine rays, so fine as to be uncountable. Pores.—Conspicuous; 2,500; single and radially septate (2-3); evenly scattered. Soft Tissue.—Absent. General. — A light brown or yellow wood. Solution wood: colourless; slightly discoloured precipitate. Cuts soft, fairly clean; 31 lb. per cubic foot.
Locality.—Valley of the Mimai, head waters of Kemp Welch River—4,000 feet.
Date.—January, 1923.
Native name.—Mado.
Remarks.—A firm wood.
Material collected.—Leaves, fruits, flowers, bark, wood.

Elaeocarpus sp., No. 336.

A large tree; 7½ feet girth, a bole of 60 feet and overall 100 feet; buttresses up to 8 feet.
Leaves.—Crowded at the end of stout branchlets; simple, alternate; petiole, 1½ to 2 inches; blade, 3½ to 8½ x 1¼ to 4; oblong to oval; serrate; midrib and veins prominent, the latter often wavy; acuminate; somewhat curved back from petiole to tip and half closed.
Bark.—¼ inch thick; grey; smooth, except for longitudinal lines of pustules; inner bark yellow brown. Solution, sherry; fairly strong precipitate.
Wood.—Sap undefined, pale yellow to pale pink.
Rays.—Two types—(1) fine about 60; (2) very fine, uncountable; about 1.200th inch deep, showing up very little on the quarter. Pores.—Conspicuous; 1,600-2,000; single and radially septate 2-3, occasionally a pair tangentially septate. Soft tissue.—Absent. General.—A pale timber. Solution wood: colourless; very faint precipitate. Cuts firm but woolly; section cutting difficult; 32 lb. per cubic foot.
Locality.—Vailala.
Date.—January, 1923.
Native name: Lara (Vailala).
Remarks.—A hard wood.
Material collected.—Leaves, bark and wood.

Elaeocarpus sp., No. 102.

Large tree, 8 feet girth by 60 feet bole; heavily buttressed.
Leaves.—Simple, alternate; petiole, ½ to ¾; much thickened at base of blade; blade, 3½ x 2¼ to 3 x 4; ovate broadly serrate acuminate, slightly coriaceous.
Fruit.—A drupe; outside of pericarp green covered with brown spots; ¼ inch thick; nut hard, in section star shaped, four rounded limbs; 1½ x 1⅛; peduncle, ½ inch.
Bark.—Grey, smooth; inner bark red brown, streaked with white. Solution, colourless; violet precipitate.
Wood.—Sap undefined, white.
Rays.—70; coarse; 350 very fine; all pink; sinuous around pores; coarse ones are 1-40th inch deep and show up as oblongs on quarter. Pores.—Clear; 2,500 to 3,000; small, single and radially septate (2-4). Soft tissue.—Absent. General.—A pink or mauve timber with a close grain. Solution wood: colourless; no precipitate. Cuts hard; 40 lb. per cubic foot.
Lovality.—Vanapa.
Date.—Fruits in June.
Native name.—Avava (Dora).
Material collected.—Leaves, fruit, wood, bark.

Elaeocarpus sp., No. 380.

A straggling tree 50 feet high, 3 feet girth.
Leaves.—Alternate, serrate.
Fruit.—A globose drupe ½ inch diameter.
Locality.—Mt. Obree. Laruni spur, 8-9,000 feet.
Date.—February 23.
Material collected.—Leaves and fruit.

Elaeocarpus novo-guineensis Warb., No. 141.

Large tree, 12 feet girth, 60 feet bole; narrow buttresses up to 15 feet.
Leaves.—Simple, alternate, exstipulate; petiole, ¼; blade, 5½ to 6 x 2 to 2½; serrate, lanceolate, acuminate, glabrous, thin.
Fruit.—Panicles of globose green drupes; thin pericarp containing hard corrugated nut, and within a kernel; pigeons eat green pericarp.
Bark.—¼ inch thick; dappled brown and white; smooth; inner bark pale yellow.
Wood.—Sap undefined; pale yellow or white.
Rays.—75 coarse; brown, sinuous around pores; 1-40th inch deep, specks on quarter; 420 very fine, hard to count, sinuous and broken by pores. Pores.—Conspicuous; 3,000 single, but more commonly radially septate (2-5 and rarely 7 and 8). Soft tissue.—Absent. General.—A white, light, coarse, straight grained wood. Solution wood; colourless; faint green precipitate. Cuts soft and woolly; 26 lb. per cubic foot.
Locality,—Buna District.
Date.—Fruits in July.
Native name: Komina.
Remarks.—A light open grained soft wood.
Material collected.—Leaves, fruit, wood.

Elaeocarpus sp., No. 354.

A large tree; 8½ feet in girth, 75 feet of bole and 120 feet over all; no buttresses, but spur-rooted.
Leaves.—Simple, alternate; petiole, ⅜ inch; blade, 3 to 5 x 1¼ to 1¾; oblanceolate, acute, serrate, glabrous, thin; pits occur at axils of lateral veins.
Fruit.—A globose, bright blue drupe, 1½ inches diameter on a half-inch peduncle; pericarp, ⅛ to ¼; nut brown, very corrugated; corrugations sharp; contains four seeds, ⅜ inch long.
Bark.—¾ brown, pustular; inner bark yellow, streaked with white; solution tawny; blue precipitate.
Wood.—Sap undefined, white.
Rays.—(1) Coarse 30; (2) very fine indeed 190 to 200; brown; slightly sinuous; the coarse rays are up to 1-40th inch deep; showing up as brown oblongs on quarter. Pores.—Conspicuous; 2000; single and radially septate (2); fairly evenly distributed. General.—A grey brown timber. Solution wood: yellow; blue precipitate. Cuts soft and clean; 29 lb. per cubic foot.
Locality.—3000 to 7000 feet, Mt. Obree.
Date.—January, 1923.
Native name.—Bekanu.
Remarks.—A common mountain species with a wide range; a soft wood.
Material collected.—Leaves, fruit, bark, wood.

MALVACEAE.

Hibiscus D'Albertisii, Nos. 28, 786; Hibiscus tiliaceus, No. 208; Thespesia populnea, Nos. 31, 214; Urena lobata, No. 349.

Hibiscus tiliaceus, No. 208.

Medium tree; 4 ft. 6 in., girth, 35 feet over all; no buttresses.

Leaves.—Simple, alternate; petiole, 2 inches to 4 inches; blade, $2\frac{3}{4}$ to 7 x $2\frac{3}{4}$ to 7; cordate lapping over at base; acuminate, pubescent, glaucous below; green, shiny, above.

Flowers.—Monochasial cymes of pentamerous; yellow dark red-centred flowers; many lobed epicalyx; 5 inches across when full bloom, turning a rose pink when beginning to fade; style with anthers adnate; stigma red five fid.

Fruit.—A green dehiscent capsule $\frac{3}{4}$ inch long; dehiscing down five sutures; each segment contains two membraneous receptacles holding five seeds; seeds are uniform, 3-16th inch long; brown; pubescent.

Bark.—Grey, longitudinally ridged; corky brown between ridges.

Locality.—A purely coastal species, extending not more than 10 miles inland.

Date.—Flowers Northern Division July to August.

Native name: Wariso (Buna).

Remarks.—Bark used for tying purposes.

Material collected.—Leaves and flowers.

Hibiscus D'Albertisii F. v. M., Nos. 28, 786.

Medium tree, 6 feet x 40 feet bole, 60 feet over all; an understory tree of the rain forests; wide branching, heavy foliage; no buttresses.

Leaves.—Simple, alternate, exstipulate, entire ovate cordate, 6 inches x $4\frac{1}{2}$ inches; obtuse emarginate, glabrous, thin; petiole, $1\frac{1}{2}$ inches.

Flowers.—A showy pale pink flower, 3 inches x $1\frac{1}{2}$ inches wide.

Bark.—Grey fibrous more or less rough; inner bark white streaked with brown; $\frac{1}{2}$ inch thick; solution slightly yellow; no precipitate.

Wood.—Sap white or light yellow, 2 inches; heart dark yellow or brown; soft to axe.

Rays.—Clear; 142 brown, somewhat sinuous around pores 1-40th inch deep, but show up very indistinctly on quarter. Pores.—Conspicuous; 1,300 to 1,600 evenly scattered, single with a few here and there more or less radially septate (2). Soft tissue.—Very fine lines indeed, irregularly linking the rays; very hard to distinguish. General.—A grey timber subject to blueing; rings of pore free wood show up on cross section. Solution wood: colourless; no precipitate. Cuts soft and clean; 39 lb. per cubic foot.

Locality.—Veimauri, Vanapa, up to 1000 feet; also Abunti, Middle Sepik.

Date.—June, 1922.

Native name.—Variva (Suku).

Remarks.—Though this tree does not attain large dimensions, it is valuable for house props, having the reputation of being as durable as No. 10 Afzelia Bijuga.

Material collected.—Leaves, flowers, wood, bark.

Thespesia sp., No. 31.

A large tree without buttresses.

Leaves.—Simple, alternate, grouped at the end of the branches; petiole, 1 inch to 4 inches; blade, 4 to 6 x 3 to 4; cordate, entire, thin, acuminate, glabrous.

Flowers.—Yellow.

Fruit.—Globose capsule containing silk covered seeds.

Bark.—Light brown, somewhat stringy; inner bark pale pink; 1 inch thick. Solution colourless; very faint greenish precipitate.

Wood.—Sap, pale yellow; 2 inches thick; heart, red brown.

Rays.—Clear; 80-90; yellow slightly sinuous around pores, depth very variable up to 1-20th inch; show up as oblongs on quarter. Pores.—Conspicuous; 2,500 to 4,000 in thickly and thinly sown zones, single and more or less radially septate (2-4). Soft tissue.—Very fine concentric lines, about 16 to the inch. General.—A pale brown timber. Solution wood: colourless; a very slightly greenish, discoloured precipitate. Cuts soft and clean; 34 lb. per cubic foot.

Locality.—Veimauri, Vanaga, Aroa.

Date.—April and June, 1922.

Native name.—Toto (Suku).

Remarks.—A light pale wood with the growth rings and rays showing up well on quarter; medium soft wood.

Material collected.—Leaves, flowers, wood, bark.

Thespesia populnea, No. 214.

Small straggling tree up to 35 feet high; much branched.

Leaves.—Simple, alternate, exstipulate; petiole up to $4\frac{1}{2}$ inches; blade, up to $7\frac{1}{2}$ x $5\frac{1}{4}$; cordate, drip pointed, venation yellow, prominent; glabrous, more or less coriaceous.

Flowers.—Axillary, solitary saffron coloured centre dark red, but turns rose when fading; peduncle, $1\frac{1}{4}$.

Fruit.—A brown capsule, globose, flattened at apex, containing about 10 silky brown seeds, three corneredly ovoid.

Bark.—Rough, ridged, scaly; covered at intervals with large pustules; outer bark $\frac{1}{4}$ inch, brown, corky; inner bark white, fibrous.

Rays.—200; yellow; wavy and very sinuous around, and here and there broken by pores; very indistinct on quarter. Pores.—Clear; 5,000 to 7,000 in zones of less and more porous wood; some are filled with golden deposit; single and radially septate (2-3). Soft tissue.—Absent. General.—A yellow, smooth, close and straight grained, clear wood. Solution wood: colourless; no precipitate. Cuts firm; 43 lb. per cubic foot.

Locality.—Along the sea beach only.

Date.—Flowers in July in Northern Division.

Native name.—Kuyuyu (Buna).

Material collected.—Leaves and flowers.

Urena lobata, No. 349.

A mallow—4 feet high.

Flowers.—Mauve.

Locality.—Old farm lands; 5,000 feet on lower spurs of Mt. Obree.

Date.—January, 1923.

Remarks.—Very common in old farm lands.

Material collected.—Leaves and flowers.

BOMBACACEAE.

Bombax malabaricum Linn, Nos. 98, 608.

A very large tree up to 23 feet girth and 90 feet bole; very heavily buttressed.

Leaves.—Trifoliate.

Flowers.—Conspicuous; red.

Fruit.—A capsule, containing kapok-tufted seeds.

Rays.—72; brown, wavy, sinuous; 1-25 inch deep; wavy bands on quarter. Pores.—Conspicuous; 1,000 large, radially septate (2-3). Soft tissue. —Exceedingly close minute lines link up the

rays, rendering the whole wood mealy. General.—A mouse-coloured wood, exceedingly porous. Solution wood: very pale yellow; no precipitate. Cuts soft and woolly; hard to get a section; 23 lb. per cubic foot.

Bark.—1 inch thick; grey, ridged, rugged; inner bark red.

Wood.—Sap undefined; pinky yellow.

Locality.—Quite common in the dry belt, but I have not met it in the Western or the Northern Divisions in a wild state.

Date.—It flowers in the middle of the dry season. June to July.

Native names.—Varu (Motu), Woif (Yalu).

Remarks.—Its handsome red flowers should make it a more general favorite for ornamental planting. The kapok contained in the seed vessels is, in other countries, a valuable commercial article. It is common in many parts, and in the Yalu forest was the largest tree.

Material collected.—Leaves, wood, bark.

Sterculiaceae.

Heritiera littoralis, Nos. 333, 85; Kleinhovia hospita, No. 182; Pterygota Forbesii F. v. M., No. 24; Pterocymbium sp., Nos. 13, 279, 602; Sterculia (affiin, S. Edelfeltia), No. 67; Indt., No. 53; Indt., No. 74.

Heritiera littoralis Ait., Nos. 333, 85.

Large tree, 10 feet girth, 60 feet bole, and 100 feet over all; large buttresses to 12 feet.

Leaves.—Simple, alternate; petiole, $\frac{3}{4}$ to 1 inch; blade, 4 to $6\frac{1}{2}$ inches by 2 to $4\frac{3}{4}$ inches; elliptical and obovate; more generally the latter; midrib and lateral veins yellow, prominent, shiny above; below brown, warty, coriaceous; upper surface shiny; lower, coppery sheen. Sapling leaves: petiole, 3 inches; blade, 9 inches; elliptical to lanceolate; lower surface silvery. Young leaves are lanceolate, and have petioles up to 3 inches.

Flowers.—Axillary panicles 5 to 6 inches long; cream campanulate, pedunculate ($\frac{1}{8}$ inch long) flowers.

Bark.—$\frac{1}{2}$ inch, grey-brown; longitudinally scaly, shedding in irregular patches; inner bark red, finely streaked with white; solution, colourless; faint precipitate.

Wood.—Sap, $2\frac{1}{4}$ inches, pale-yellow to pink; heart a good red-brown.

Rays.—120. Yellow, fine, 1-50 to 1-70 inch deep, showing as brown streaks on quarter. Pores.—Clear, 1,300 to 1,700, somewhat irregularly scattered; single and radially septate (2). Soft tissue.—Very fine ladder rungs between rays; so fine as to take some finding. General.—A dark-brown handsome wood. Solution wood: colourless; slightly precipitate. Cuts hard, leaving shiny surface; 63 lb. per cubic foot.

Locality.—Vailala, Veia.

Date.—December, 1922.

Native names.—Pai-iru (Vailala), Napera (Suku).

Remarks.—A good hard wood. The leaves from young trees are used for wrapping tobacco in—as cigarette paper, in short.

Material collected.—Leaves, flowers, bark, wood.

Pterocymbium sp., Nos. 13, 279, 602.

Leaves.—Flowers before the leaves appear. The tree comes into leaf in December. Simple, alternate; petiole, $1\frac{1}{2}$ to 2 inches; blade, 3 to 4 inches long, cordate, glabrous, thin; venation yellow, and very distinct.

Flowers.—Panicles grouped at extremities of branches. Bears at its summit a head of anthers, surrounding the ovary from which protrudes a minute five-pointed stigma. The ovary is five loc.

Fruit.—The fruit adheres to the gynophore until K. separates from the peduncle and falls. A brown, somewhat ribbed, obovoid thin capsule, $\frac{1}{2}$ inch long by 5-16 inch diameter, finished with wing, shaped like a lady's slipper, with a very prominent heel. The total length is $3\frac{1}{2}$ inches, and the heel juts out $\frac{7}{8}$ inch. The wing is membranous and veined. The seed in its capsule is attached to the top of the slipper, and from this point still persists the style, $\frac{3}{8}$ inch long. The winged seeds detach themselves in fives from the top of these tall trees, and spinning, parachuting, and planing, they are carried some distance. The heel fills out with air, and acts as a parachute, while the toe forms a plane. They rise on any upward air draught, and so descend to the ground in a succession of undulations. At first I took them for butterflies. (Baroi, November, 1922.)

Bark.—$\frac{3}{8}$ inch thick; dark-grey, longitudinally lined; inner bark red, streaked with white—like bacon.

Wood.—White; sap undefined; lace grained; soft; light.

Rays.—Very conspicuous; 130, of which about 40 are coarse, and the rest fine, but the coarse gradually decrease in width and the fine gradually increase until they are coarse, 1-16 inch deep, show up well on quarter. Pores.—Conspicuous; very few; 300 to 500 sown in zones of varying thickness. Soft tissue.—Absent. General.—A white wood, quickly attacked by blue fungus. Solution slight; dirty-brown precipitate. Cuts soft and clean; 29 lb. per cubic foot.

Locality.—Baroi River—Purari Delta.

Date.—Flowers in October.

Native names.—E—A (Vailala); Sihu (Suku); Husisi (Buna); Wisawis (Yalu).

Remarks.—A soft wood; quickly spoilt by blue fungus. If possible to kiln dry should prove a useful indoor wood.

Material collected.—Leaves, flowers, bark, wood, fruit.

Kleinhovia hospita, No. 182.

Small tree, 50 feet high and $2\frac{1}{2}$ feet in girth. Comes up in abandoned farm lands. Young saplings used for roofing timbers and load poles. Young leaves cooked as a vegetable.

Leaves.—Simple, alternate, stipulate; petiole up to 7 inches; blade up to $7\frac{1}{2}$ by 7 inches; cordate, acuminate, glabrous, thin.

Flowers.—Axillary panicles of pink flowers.

Fruit.—A five-celled dehiscent capsule.

Bark.—Grey; longitudinally lined.

Locality.—Everywhere where there has been a native garden.

Date.—Flowers in July, in Northern Division.

Native name.—Ombora (Buna).

Remarks.—A very light wood—hence its use.

Material collected.—Leaves, flowers, fruits.

Pterygota Forbesii F. v. M., No. 24.

A large tree, 9 feet by 65 feet bole; 120 feet over all; large buttresses spreading out and ascending to 12 feet.

Leaves.—Simple, alternate; bunched at end of branchlets; petiole, 4 to 6 inches; blade 9 by 6 inches; cordate, acuminate; slightly undulate, glabrous.

Flowers.—Axillary panicles.

Fruit.—Dry, woody, dehiscent follicle, obovoid, woody, brown, tomentose pedunculate; 6 inches long, 5 inches broad, and 4½ inches thick; containing 35 to 45 winged seeds; the wing being white when fresh and membranous, 2½ by 1 inch, carrying seed 1 3-16 by ⅜ inch.

Bark.—Greenish-grey, smooth; inner bark yellow; solution, faint yellow; no precipitate.

Wood.—Sap undefined; light yellow; straight grained; medium hard wood.

Rays.—Conspicuous. very dark-grown; fairly straight; 100; 1-30 inch deep; show up well on quarter. Pores.—Conspicuous; 1,200; single, and more or less radially septate (2-3). They appear in my sample as dark-brown, streaked both back and quarter. Soft tissue.—Conspicuous. Joins up the rays with dark-brown lines about same width as rays, and forming concentric rings; 114 to the inch. Here and there (about six to the inch) the rings of soft tissue are crowded three and four together, forming a soft zone. General.—A grey wood; it blues very easily. The colour of rays and soft tissue should be checked with fresh sample. Solution wood: colourless; no precipitate. Cuts soft and clean; 51 lb. per cubic foot.

Locality.—Veimauri, Vanapa, Aroa; up to 1,000 feet altitude.

Date.—June, 1922.

Native names.—Kobura (Suku); Hokeia (Vailala); Tomberu (Buna).

Remarks.—The wood turns blue on drying, which detracts from its worth, otherwise rather pretty on quarter where growth rings show up.

Material collected.—Leaves, flowers, seeds, wood.

Sterculia affin. *S. Edelfeltia,* No. 67.

Large tree, 7½ feet in girth, and a bole up to 60 feet; butressed up to 9 feet.

Leaves.—Simple, alternate; petiole, 4 to 5 inches; blade, 5 to 9 inches by 4 to 3½ inches; lanceolate, acuminate, entire; finely pubescent below; glabrous above.

Fruit.—One to five recurved; red follicles united at base to peduncle; folicles, 2½ to 3 inches; contain five to seven seeds.

Bark.—Smooth, grey; inner bark, light brown; solution, colourless; no precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—Conspicuous; 23. Coarse, and a large number of uncountable fine ones; yellow, straight, or only here and there sinuous around a pore; 1-15 inch deep; show up as broad grey shiny bands on quarter, and as brown lozenges on back. Pores.—1,800 to 2,500; very conspicuous; single, and radially septate (2), rarely (3). Soft tissue.—Absent. General.—A pale-yellow, porous, straight-grained wood, with a loud quarter figure. Solution wood: colourless; no precipitate. Cuts very soft and woolly; 23 lb. per cubic foot.

Locality.—Veimauri, Vanapa, Aroa. Hydrographers up to 2,000 feet. Also Main Range.

Date.—Fruits from May to August.

Native name.—Bakua (Suku).

Remarks.—A very light, soft, porous wood; used to float sinkers.

Material collected.—Leaves, fruit, wood, bark.

Indt., No. 53.

A large tree; 7 feet in girth, with a 30-ft. bole; unbuttressed.

Bark.—½ inch thick; grey-green; smooth. Immediately below surface yellow; inner bark yellow.

Wood.—Sap undefined; light-yellow or white.

Rays. 24; yellow, very prominent, straight, up to 1-10 inch deep; showing up in conspicuous bands on quarter and brown lozenges on back. Between these wide rays there are a number of minute rays too fine to count. Pores.—100 to 600, large, conspicuous, mostly single; here and there septate ones occur. Soft tissue.—Wide undulate bands, about five to the inch, joining coarse rays, and separated from next band by a narrow band of hard tissue. General.—A pale, open-grained, soft wood. Solution wood: pale yellow; no precipitate. Cuts soft and woolly; 20 lb. per cubic foot.

Locality.—Veimauri.

Date.—May, 1922.

Native name.—Minhihi (Suku).

Remarks.—A soft, open-grained Sterculaceæ.

Material collected.—Wood.

Indt., No. 74.

A large tree, 8 feet girth, and 40 feet bole; non-buttressed.

Leaves.—Simple, alternate; petiole, 1¼ to 5 inches; blade 3½ to 10 inches by 3½ to 9 inches; cordate divided into three lobes; shiny glabrous above; tomentose below.

Bark.—1 inch thick; finely ridged; outer bark hard to cut; grey to dark-brown; inner bark, light-brown.

Wood.—Sap undefined; pale yellow.

Rays.—Conspicuous; 26. Very coarse dark-brown rays, and 27 fine rays; up to 1-5 inch deep; showing up as rough bands on the quarter, and as dark-brown lozenges on back. Pores.—Clear; 1,900 to 3,000; septate, more or less radially; rather evenly scattered, except where zones of small pores occur near soft tissue. Soft tissue. About three narrow lines to the inch. This tissue is that attacked by gum of which heavy deposits are made, so much so as to cause an interruption in the continuity of the wood. In addition to these easily visible lines of soft tissue there are a large number of very fine lines of soft tissue. It is along these that the wood splits. General.—A poor, pale wood, but valuable tree on account of the excellent rope it yields; gum veins are common. Solution wood: faint yellow; no precipitate. Cuts soft; 17 lb. per cubic foot.

Locality.—Veimauri.

Date.—May, 1922.

Native name.—Vanea (Motu).

Remarks.—The bark is soaked in water for two weeks; then dried in the sun, when it separates into thin sheets. These sheets are divided up into ribbands about ¼ inch wide, and then are twisted together into string and light rope. The cordage made from this species is strong, and is principally used for the manufacture of heavy nets employed in the catching of dugong and turtle in the sea. The wood is the characteristic lace-grain of the Sterculaceæ.

Material collected.—Leaves and wood.

DILLENIACEAE.

Saurauja Schumanniana Poolei, No. 165; Saurauja sp. nov., No. 431; Saurauja plurilocularis, No. 416; Wormia quercifolia, Nos. 226, 631; Saurauja

Roemeri, Laut., No. 528; Saurauja Conferta, No. 538; Dillenia alata var. macrophylla, No. 631.

Saurauja Plurilocularis White & Francis ined., No. 416

A small tree; 20 feet.
Leaves.—Large, serrate, coriaceous, oblanceolate.
Flowers.—Pentamerous, white. The petals are a faint rose pink at base.
Locality.—Banks of Upper Naro River; 5,000 feet.
Date.—February, 1923.
Remarks.—It grows with its roots practically in the torrent, and has for neighbour Dammaropsis Kingiana, No. 260.
Material collected.—Flowers and leaves.

Saurauja sp. nov., No. 431.

Shrub to small tree, 20 feet over all.
Leaves.—Alternate, coriaceous, serrate.
Flowers.—Pink, showy.
Locality.—Forests of the ravines of the grassy hills around Iorobaiva; 3,000 to 4,000 feet.
Date.—February, 1923.
Material collected.—Leaves, flowers.

Saurauja Poolei White & Francis ined., No. 165.

Small tree up to 20 feet. Spreading, almost rambling habit. Undergrowth, rain forests.
Leaves.—Simple, alternate; petiole, 1 inch; blade up to $6\frac{1}{2}$ x $3\frac{3}{4}$ inches; pubescent above and below; midrib above and margin armed with spines; acuminate.
Flowers.—K.5, C.5. Pink.
Locality.—All rain forests up to 2,000 feet.
Date.—Flowers in July in Buna District.
Native name.—Osé (Wasida).
Material collected.—Leaves and flowers.

Saurauja conferta Warburg, No. 538.

A straggling branched tree, 25 feet high.
Flowers.—White.
Locality.—Nomi River, 5,000 feet.
Date.—November, 1923.
Remarks.—A common undergrowth in rain forest and foothill forest.
Material collected.—Leaves and flowers.

Affinities, *Saurauja Roemeri* Lauterb, No. 528.

A small tree, 15 feet high.
Flowers.—White campanulate.
Locality.—Edge of limestone precipice above Nomi River, 7,000 feet.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Wormia quercifolia White & Francis ined., No. 226.

A large handsome tree, 80 feet bole, 100 feet over all, and 12 feet girth. Spur-rooted, but not buttressed.

Leaves.—Simple, alternate; petiole, $1\frac{1}{2}$ to $1\frac{3}{4}$ inches. Young leaves have a petiole bearing a wing or ligule, 5-16 to 6-16 inch wide along upper edge of petiole; this strips off early, leaving a scar along its whole length. Blade, 5 to $6\frac{1}{4}$ inches x 3 to $4\frac{1}{2}$ inches, variable in shape from elliptical to obovate; apex mucronate; margin undulate in some leaves more than others, while some are almost straight edged; venation and midrib prominent below; coriaceous, glabrous; pale-green below; dark-green and shiny above.

Flowers.—Terminal cymes bearing as a rule two solitary flowers. Peduncles, $1\frac{1}{8}$ to $1\frac{1}{4}$ inches.

Bark.—$\frac{3}{8}$ inch thick; yellow to red-brown or red. Scaly, papery; scales like a *Melaleuca*. Inner bark streaked yellow-brown and cream.
Wood.—Sap ill-defined; pale yellow deepening to rose-brown. A beautiful grain on the quarter.
Rays.—Two kinds. (1) Conspicuous, 50 yellow, coarse, straight. They really consist of bundles of fine rays; about $\frac{1}{5}$ inch deep. Show up as loud silver grain on quarter, only it is pink. (2) 140. Very sinuous and broken by pores. Pores.—2,000 to 2,500, evenly scattered; single. Soft tissue.—Absent. General.—A pink-brown wood with a very figures quarter grain. Solution wood: colourless; very pale-green precipitate. Cuts firm to hard; 49 lb. per cubic foot.
Locality.—Mainland opposite Samarai. Northern Division, up to 1,500 feet. Easily confused with a tree with a similar bark, but opposite leaves. Found another wormia of lower dimensions, but with larger and more orbicular leaves, unfortunately not in flower.
Date.—Flowers July to August, in Northern Division.
Native names.—Lalagi (Buna and Binandele), Hokore (Vailala).
Material collected.—Leaves, flowers, wood, bark.

Dillenia alata Gilg., var. *macrophylla* Lautb., No. 631.

A small tree 20 feet high and 3 feet in girth.
Leaves.—Have deciduous ligules.
Locality.—Ramu.
Date.—11th February, 1924.
Remarks.—A common tree in the low-lying country on each side of the Ramu.
Material collected.—Leaves.

OCHNACEAE.

Schurmansia Henningsii K. Sch., Nos. 237, 371, 580.

Small tree or large shrub, branching low down with many branchlets; 20 feet high.
Leaves.—Simple, alternate, sessile or subsessile; grouped at intervals of 4 or 6 inches along branchlets, the intervening interval being that occupied by last year's flowers; blade, 15 to 30 inches by 3 to $5\frac{1}{2}$ inches; oblanceolate; margin recurved, serrate, serration apiculate; glabrous; coriaceous; prominent yellow midrib. Young leaves red, conspicuous.
Flowers.—Terminal, compound, corymbs of white flowers. Corymbs 12 inches long and 18 inches across. Peduncle 3/32.
Fruit.—A green dehiscent capsule $\frac{3}{4}$ inch long by $\frac{1}{8}$ inch diameter. Three sutures along which it opens, but remains closed at apex. Seed very minute, winged like the propeller of an aeroplane, the seed taking the place of the hub 3/16 inch from tip to tip.
Locality.—Hydrographer's on edge of rain forests and grass lands. Owen Stanley 6,000 feet on edge of Hoop Pine forest, Finisterre Range, 4,000 feet; undergrowth in Dacrydurm Forest.
Date.—Flowers in Hydrographer's in August.
Native name.—Kembusa (Buna).
Remarks.—A very ornamental shrub.
Material collected.—Leaves, flowers, fruits; in herbarium. A pink variety also occurs in the Hydrographer's.

THEACEAE.

Eurya sp. nov., No. 505; Gordonia fragrans, No. 804.

Eurya sp. nov., No. 505.

Shrub up to 20 feet high.

Flowers.—White.
Locality.—Salawaket 10,000 feet.
Material collected.—Leaves and flowers.

Gordonia fragrans Merrill, No. 804.

A large tree 8 feet in girth with a 50 foot bole and attaining 100 feet over all. Not buttressed.
Leaves.—Simple alternate; petiole $\frac{1}{4}$ inch curved up; blade $3\frac{1}{2}$ to 5 inches by $1\frac{3}{4}$ to 2 inches, tapering equally to both ends, blunt pointed, shallowly serrate, rather coriaceous, glabrous.
Flowers.—A white or cream rose, single, axillary, at end of branchlets.
Fruit.—A capsule opening in five valves.
Bark.—Grey, scaly, scales shedding in largish plates leaving under bark scrolled. Inner bark streaked light and dark brown.
Wood.—Sap ill-defined, deepening from white to a rose yellow. Axes stiffly. A cross grained wood.
Rays.—Very fine indeed 250, single, of which 100 are coarser; these are straight but the finer ones are slightly sinuous around pores. 1/60th inch deep; show up as brown oblongs on quarter. Soft tissue.—Very fine lines link up coarse rays crossing the finer ones irregularly. General.—A mouse-coloured hard wood with a difficult grain. Weighs 48 lb. to the cubic foot.
Locality.—Likdin.
Date.—August, 1923.
Native name.—Mail (Likdin).
Remarks.—The bark is broken up in streams to kill fish. Worth trying for tan.
Material collected.—Leaves, flowers, wood, bark, fruit.

GUTTIFERAE.

Calophyllum inophyllum, No. 209; Calophyllum sp., Nos. 239, 424, 557, 800; Garcinia sp., Nos. 130, 584; Garcinia Hollrungii, No. 115; Garcinia assuga Lautbch., Nos. 58, 224; Indt., No. 116.

Calophyllum inophyllum, No. 209.

Large tree, 12 feet girth and 50 feet high; always gnarled and leaning over on to the beach at an angle of less than 45 degrees with the ground.
Leaves.—Simple, opposite, exstipulate; petiole $\frac{1}{2}$ to $\frac{3}{4}$; blade $3\frac{1}{2}$ to $6\frac{3}{4}$ by 2 to $3\frac{1}{2}$; elliptical, notched; veins very fine and regular and parallel; light green below; dark green above; shiny on both sides; midribs only prominent below; coriaceous. Exude latex.
Flowers.—Racemose panicles 6 inches long; erect axillary; peduncle $\frac{3}{4}$ to $1\frac{1}{4}$.
Fruit.—A drupe; nut, globose $1\frac{3}{4}$ diameter in a fibrous pericarp. $\frac{1}{8}$ inch thick; shell of nut 1/16 inch; kernel ovoid, 1 inch by $\frac{3}{4}$ inch, surrounded by pithy tissue. The fruit is sea-borne.
Bark.—$\frac{1}{2}$ inch thick. Grey, yellow, scaly; scales papery. Inner bark cream, speckled with red. Exudes kino.
Wood.—Sap 2 inches. Pale yellow; heart cedar brown; a beautiful rose wood.
Rays.—250. Red brown. Less than 1/100 inch deep; show up as minute specks on quarter. Very irregular, sinuous and broken. Pores.—Clear. 2,000 to 3,000 in marked zones of less and more porous wood; arranged in chains irregularly; single and radially septate 2-3; filled with red deposit. Soft tissue.—50 red-brown lines to the inch; concentric wavy more or less continuous as they occur in less or more porous wood; in latter broken by pores; coarser than rays. Closer together in less porous wood. General.—A red brown pleasant looking timber. The soft tissue gives it a very pretty grain on back, while the red filled pores improve both back and quarter grain. Solution wood: colourless, no precipitate. Cuts firm to hard. 40 lb. per cubic foot.
Locality.—Along the seashore only.
Date.—Flowers in July in Northern Division.
Native names.—Otai-i (Buna), Kokoilo (Samarai).
Remarks.—A very beautiful hard wood; unfortunately the bole is rarely straight enough to yield timber of any length. It is much used for boat knees.
Material collected.—Leaves, flowers, fruit, wood.

Calophyllum sp., No. 239.

A large tree. 10 feet in girth with an unbuttressed bole of 100 feet, and attaining 130 feet over all.
Leaves.—Simple, opposite; petiole $1\frac{1}{4}$ to $1\frac{1}{2}$; blade $4\frac{1}{2}$ to $7\frac{1}{2}$ by 2 to 4; oval to ovate; acute; shiny above; yellow-green bloom below; midrib rusty tomentose, prominent. Venation very fine, very parallel, very regular. Twig rusty, tomentose. The bark of the branches, the veins of the leaves, etc., exude a *cream* coloured latex.
Bark.—$\frac{1}{2}$ inch thick; grey; flatly ridged; ridges 1 inch to $1\frac{1}{2}$ inches apart and leading into each other. Inner bark brown, finely streaked with yellow. Exudes *yellow* latex.
Wood.—Sap ill-defined. Yellow to rose.
Rays.—260. Red brown, very sinuous round and broken by pores. 1/100 inch deep. Inconspicuous on quarter. Pores.—Conspicuous. 4,000 to 5,000. Single and radially septate (2). Amassed in short radial chains. Soft tissue.—Conspicuous. 12 coarse red brown lines to the inch; they are wavy and more or less continuous; also around pores. General.—A red brown wood with pretty back grain. Solution wood: colourless. Faint green precipitate. Cuts rather hard to hard. 39 lb. per cubic foot.
Locality.—Horonda, Northern Division.
Date.—July, 1922.
Native names.—Guti (Buna), Gahi (Horonda).
Remarks.—A medium hard wood, sought after for canoe decking.
Material collected.—Leaves and wood.

Calophyllum sp., No. 800.

A large tree, 9 feet in girth with a 60 feet bole and reaching 100 feet over all. Narrow spur roots.
Leaves.—Simple opposite; petiole, $\frac{1}{2}$ inch, grooved, twisted, wrinkled; blade $5\frac{1}{2}$ inches by 2 inches; tapering evenly to each end, blunt pointed, more or less coriaceous, parallel veined.
Bark.—$\frac{1}{2}$ inch thick, brown, longitudinally lined to shallowly fissured. Inner bark light brown, next cambium a faint yellow.
Wood.—Sap, 4 inches, pale yellow; heart brown. Axes firmly.
Locality.—Likdin.
Date.—August, 1923.
Native name.—Bou-u (Lidkin).
Material collected.—Leaves, wood, bark.

Calophyllum sp., No. 557.

A medium sized tree, 8 feet in girth with a bole of 50 feet and attaining 80 feet over all.
Leaves.—Simple, opposite; petiole 3/16 inch; blade $1\frac{1}{2}$ to $1\frac{3}{4}$ by $\frac{3}{4}$ to $\frac{7}{8}$; obovate, obtuse, coriaceous, finely parallel veined. Exudes pale yellow latex.

Bark.—¾ inch thick, rough, grey with a crocodile skin appearance. Sheds scale in little pieces. Inner bark orange, speckled with red. Exudes a yellow gummy latex.
Wood.—Sap ill-defined, deepening from white to pink.
Locality.—Ogeramnang.
Date.—November, 1923.
Native name.—Soan.
Material collected.—Leaves, wood, bark.

Calophyllum sp. No. 424.

A large tree. 9 feet girth, 60 feet bole and 30 feet over all. No buttresses.
Leaves.—Simple, opposite; petiole ⅝; blade up to 2¼ by 1; lanceolate; venation pinnate; very fine and parallel; coriaceous; acute.
Bark.—2 inches thick, deeply ridged, grey. Inner bark yellow brown. Solution ruby; strong green precipitate.
Wood.—Sap 3½, yellow, streaked with pink. Heart red brown.
Rays.—Very fine indeed 340 pale, sinuous; showing up as specks on the quarter, 1/100 inch deep. Pores.—Conspicuous. 1,400 to 2,400 in short, irregular, snaky radial chains; encrusted with a red deposit. Soft tissue.—Conspicuous. Broken wavy sometimes crooked concentric lines with branches joining up groups of pores. General.—A red timber with a snake and ladder cross section. Solution wood: pale brown; strong green precipitate. Cuts hard and clean. 52 lb. per cubic foot.
Locality.—Between Menari and Efogi; 5,000 feet.
Date.—February, 1923.
Remarks.—A hard, straight-grained, very long-fibred timber. Might be tested for a handle wood.
Material collected.—Leaves, bark, wood.

Indt., No. 116.

A large tree. Seven feet in girth with a bole of 60 feet and buttressed.
Leaves.—Simple, opposite; petiole ½ to 1¼; blade 6 to 11 by 3½ to 5½; obovate to oval; entire; obtuse; notched; coriaceous; glabrous; venation indistinct. Differs from 115, *Garcinia Holrungii,* in having yellow—not white—latex, and having indistinct venation.
Bark.—Cinnamon-brown to black. Exudes a yellow latex abundantly. Inner bark pink. Solution colourless, no precipitate.
Wood.—Sap undefined. Pale yellow or white.
Rays.—Clear. 120; pale yellow; sinuous but owing closeness and distinctness of rays they appear straight. Up to 1/10 inch deep. Showing up as nice silver grain on quarter. Pores.—Clear. 3,000 to 4,500 evenly crushed between rays single but here and there radially septate (2). Soft tissue.—Ladder rungs as coarse as rays connect latter and often surround pores on the way. General.—A grey brown timber very similar in structure and with same silver quarter grain as 115. Solution wood: colourless, no precipitate. Cuts hard and clean. 55 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native names.—Noru (Suku), Paka (Doura).
Material collected—Leaves and wood.

Garcinia assuga Lautbch, No. 224.

Small tree, 4½ feet girth and 50 feet over all. No buttresses.
Leaves.—Simple, opposite; petiole ¼; blade 3 to 4¾ by 1⅜ to 1¾; elliptical to oblanceolate; acuminate, coriaceous.
Fruit.—A green plum up to 1½ inches long and 1¼ inches diameter; about six seeds half-moon shaped ½ by ¼.
Bark.—¼ inch thick. Very dark brown to black; scaly; scales smooth, longitudinal, 2 inches wide; longitudinally lined; inner bark yellow, streaked with red. Exudes yellow latex. Solution: pale yellow; green precipitate.
Wood.—Sap ill-defined. Yellow, deepening to rose.
Rays.—220. Pale yellow. Very slightly sinuous. Shallow. Show up faintly as mottled grain on quarter. Pores.—Conspicuous. 2,500 to 3,000, single and septate (2). Soft tissue.—Conspicuous. Rather coarse, wavy, continuous lines occur 1 to the inch; between them are a number—160 to the inch—of broken, fine, yet clear, lines cross fine rays and ladder rung the coarse. They are coarser than rays. General.—A yellow brown wood with a pink tinge and a nicely mottled quarter grain. Solution wood: colourless, very pale green precipitate. Cuts hard. 59 lb. per cubic foot.
Locality.—Forests of the foothills of Hydrographer's up to 2,000 feet.
Date.—Fruits in August in Hydrographer's.
Material collected.—Leaves, fruit, wood, bark.

Garcinia assuga (?) Lautbch, No. 58.

A medium sized tree. Five feet girth by 25 feet bole. Not buttressed.
Leaves.—Simple, opposite; petiole ¼ to ½; blade 3 to 3¾ by 1¼ to 1½; oblanceolate, acuminate, entire, rather coriaceous, glabrous.
Fruit.—A small pale-green pomme, ½ inch diameter. Edible.
Bark.—A deep cinnamon-brown, fibrous, ¼ inch thick. Exudes a saffron-coloured latex. Solution, faint yellow; faint green precipitate.
Wood.—Sap and heart same, light red-brown.
Rays.—160-170. Yellow; show up as minute specks on quarter. Pores.—Clear, 2,300 to 2,700; single, fairly evenly scattered; some filled with ruby-red deposit. Soft tissue.—Clear; close set lines, 12 to the inch, about as wide as the rays; very wavy, linking up the pores and surrounding them. General.—A pleasant even-grained brownish timber; very fissile on back along the line of soft tissue. Solution wood: colourless; no precipitate. Cuts hard; 58 lb. per cubic foot.
Locality.—Veimauri, Aroa, Vanapa.
Date.—Fruits in June.
Native names.—Bio-bio (Motu).
Remarks.—Sought after by natives for its fruit. The timber is straight grain, but too small for commercial purposes.
Material collected.—Leaves, fruit, wood, bark.

Garcinia Hollrungii, No. 115.

Medium tree, 5½ feet girth, 60 feet bole.
Leaves.—Simple, opposite, exstipulate; petiole, ¾ to 1 inch; blade, elliptical; 6 to 8½ x 4¼ inches; obovate to elliptical; coriaceous, glabrous; heavy stiff foliage; stout branchlets. Veins very distinct when held up to light.
Fruit.—A pomme with the apex depressed, 2 x 2 inches, 6 loc.
Bark.—¼ inch thick, dingey brown to green black; exudes latex. Solution colourless; no precipitate
Wood.—Sap undefined, white.

Rays.—Clear. 130-135. Yellow. Conspicuous though fine; somewhat sinuous round pores, but generally give appearance of straightness. Up to 1-10th inch deep; very conspicuous bands of silver grain on quarter; not distinctive on back. Pores.—2,000 to 3,000, rather evenly scattered single and radially septate (2). Soft tissue.—Little ladder rungs finer than, and linking up, the rays very iregularly. Surround pores in the road or run at a tangent to them. General.—A pleasant yellow timber with pretty silver quarter grain. Solution wood: colourless; no precipitate. Cuts rather hard, but very clean; 40 lb. per cubic foot.
Locality.—Wanapa; 1,000 feet.
Date.—Fruits in June.
Native names.—Moka (Suku).
Material collected.—Leaves, fruit, bark, wood.

Garcinia sp., No. 130.

A medium-sized tree.
Leaves.—Simple, opposite; petiole, $\frac{1}{2}$ inch; blade, 5 to $6\frac{1}{2}$ x $2\frac{1}{2}$ to $2\frac{3}{4}$ inches; oval to obovate, acuminate, glabrous, entire, thin.
Fruit.—A very pale-green pomme, $1\frac{1}{4}$ inches diameter; it is edible.
Rays.—Clear. 165; yellow; slightly sinuous; show up as specks on the quarter. Pores.—Clear. 3,000 to 3,500; single and radially septate (2), evenly scattered. Soft tissue.—Clear. 140 to 200 lines to the inch, about same thickness as rays; wavy, broken by coarse rays; linking, surrounding, and crossing pores. General.—A yellow wood with a straight grain and a good surface. Solution wood; colourless; no precipitate. Cuts hard; 57 lb. per cubic foot.
Bark.—Solution colourless; no precipitate.
Locality.—Aroa. It is common all round the Territory on the low lands.
Date.—22nd May, 1922.
Native names.—Bio-bio.
Remarks.—A fruit worth attention for cultivation; it is much larger than its sister No. 58, and is sweeter to the palate.
Material collected.—Leaves, fruit, wood, and bark.

Garcinia sp., No. 584.

A small tree, 45 feet high. A tree of the third story.
Leaves.—Opposite.
Fruit.—Pomme.
Bark.—Exudes a yellow latex.
Locality.—Yunsain.
Date.—December, 1923.
Material collected.—Leaves and fruit.

Dipterocarpaceæ.

Anisoptera polyandra Bl., Nos. 136, 223; Indt., No. 112; Hopea papuana Diels?, No. 113; Vatica papuana, Nos. 327A, 435.

Anisoptera polyandra Bl., Nos. 136 and 223.

Large tree up to 13 feet girth, and 100 feet of bole; 130 feet over all. Average dimensions, 8 x 70 feet bole. Not buttressed.
Leaves.—Simple, alternate, exstipulate; petiole, $\frac{3}{4}$ to 1 inch; blade, 3 to $4\frac{1}{2}$ x $1\frac{1}{2}$ to 2 inches; oblanceolate, glabrous; yellow to rusty below; light green above; acute. The leaves of saplings are much larger; petiole, $2\frac{1}{2}$ inches; blade, 6 to 12 x $4\frac{1}{2}$ to 5 inches. Elliptical, acuminate; scattered hairs below; midrib pubescent; glabrous above.
Fruit.—Nut $\frac{7}{8}$ inch with enveloping persistent calyx, two lobes of which are developed into wings, $4\frac{3}{4}$ to 5 x $\frac{7}{8}$ inches.
Bark.—Grey, with a tinge of red-brown; pustular; longitudinally lined at top; flatly ridged at butt. Inner bark streaked with yellow.
Wood.—Sap undefined, pale yellow.
Rays.—Clear. 110; yellow; rather straight except for kinks round pores here and there; 1-60th inch deep; show up as wavy lines on quarter. Pores.—Clear. 5,000, evenly strung between rays; single, rarely septate, then usually diagonally. Soft tissue.—Rare and indistinct, being very fine concentric continuous rings, about three to the inch. General.—A very pale-yellow to light-brown resinous wood. Straight grained. Solution wood: colourless; no precipitate. Cuts a little hard; 43 lb. per cubic foot.
Locality.—Buna to Wire Rope. Hydrographer's, to 2,000 feet.
Date.—Fruits in June in Northern Division.
Native names.—Garawa (Buna), Karawa or Warawa (Binandele), Karalaka (Vailala).
Remarks.—A sound hardwood. This species forms a social-two-species-forest with *Afzelia bijuga* in the foot-hills of the Hydrographer's up to 1,000 feet; above that it is more scattered, and *Afzelia* does not occur.
Material collected.—Leaves (from young and old trees), fruit, wood, bark.

Indt., No. 112.

A large tree, 10 feet girth with 80 feet bole. Possesses root swellings, but is not buttressed.
Leaves.—Simple, alternate; petiole, $1\frac{1}{4}$ inches, turned at right angles at junction with blade; blade, $3\frac{1}{2}$ to $8\frac{1}{2}$ inches x 2 to 5 inches; obovate; glabrous, entire; margin undulate, acute, thin, stiff.
Bark.—$\frac{1}{2}$ inch thick. Grey-brown; smooth, except for pustules when young, and flatly ridged when old. Inner bark, pale-yellow, streaked with light-brown. Solution colourless; no precipitate.
Wood.—Sap ill-defined. Starting cream, deepens through yellow to a light-brown. Resinous.
Rays.—90 to 110 to inch. Yellow-brown, conspicuous. 1-20th inch deep; show up well on quarter. Pores.—Single, 4,000 to 6,500 to the square inch; evenly distributed. Soft tissue.—Absent. General.—A yellow to brown resinous timber. Solution wood: colourless; no precipitate. Cuts hard, but cleanly; 41 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Demo (Suku).
Remarks.—A timber that resembles the Dipterocarps of commerce.
Material collected.—Leaves, wood, bark.

Hopea papuana Diels (Affin.)?, No. 113.

Medium tree, 6 by 60 feet bole. Not buttressed.
Leaves.—Simple, alternate, exstipulate; petiole, $\frac{1}{2}$ inch, curved to turned at right angles; blade, $5\frac{1}{2}$ to 7 x 2 to $2\frac{3}{4}$ inches; lanceolate acuminate, entire, margin recurved; glabrous; thin.
Fruit.—One-seeded, 3-16th inch long, enclosed in five lobed persistent calyx. Two of the lobes developed into wings $2\frac{1}{2}$ inches long by $\frac{1}{2}$ inch wide; oblanceolate.
Bark.—$\frac{1}{2}$ inch thick; dark-brown, somewhat scaly; inner bark white. Solution faint yellow; no precipitate.

Wood.—Slightly resinous. Sap undefined, cream coloured.

Rays.—150 to 160; yellow; somewhat sinuous around pores. 1-30th inch; show up as specks, and lines on quarter. Pores.—Clear. 5,000 to 7,500; single and radially septate (2, rarely 3); sometimes tangentially septate; in zones of very porous and less porous wood. Soft tissue. —Short, fine, scarcely visible broken lines here and there join up pores, but the main soft tissue consists of fine continuous concentric hardly undulate white rings. These are sometimes doubled, trebled, or quadrupled. Sometimes they are so close as to form one line 1-20th inch thick, but more often they are separate if close together. The hard tissue around is more porous than elsewhere, but the pores are small. General.—A brown wood showing little or no grain. Solution wood; colourless; no precipitate. Cuts very hard; 55 lb. per cubic foot.

Locality.—Vanapa, up the foothills towards Suku to an altitude of 2,000 feet.

Date.—Seeded in June.

Native names.—Koka-pilo-pilo (Doura).

Remarks.—The winged seeds are a plaything for the native children.

Material collected.—Leaves, fruit, wood, bark.

Vatica papuana Dyer, Nos. 327 and 435.

Large tree, 8 feet girth; a bole of 75 feet and 100 feet overall. No buttresses.

Leaves.—Simple, alternate; petiole, $\frac{3}{4}$ inch; rusty tomentose; blade, 7 to 9 x $2\frac{1}{4}$ to $3\frac{1}{4}$ inches; elliptical, acuminate; midrib and veins pubescent below; prominent.

Flowers.—Only very immature collected.

Fruit.—A shizocarp, 2 x $1\frac{1}{4}$ inches; brown, rough; five sepalled calyx persists; splits into three, and allows an obovoid nut 1 x $1\frac{1}{4}$ inches to fall. The nut divides into two parts.

Bark.—$\frac{3}{4}$ inch thick. Smooth, except for horiontal wrinkles. Grey-green. Inner bark light-brown, streaked with white. Solution colourless; no precipitate.

Wood.—Sap, $5\frac{1}{4}$ inches, yellow. Heart a light-brown. Resinous.

Rays.—120 to 140; yellow; fine. Pores.—20,000 to 23,000, very small; immersed in soft tissue, and packed close together; where rays are close they are in a single line; where wide enough apart they are in groups of three, but not septate. Soft tissue.—Around and linking up pores. General.—A yellow-grey wood showing no grain. Solution wood: colourless; no precipitate. Cuts easily and cleanly, but a hard wood; 42 lb. per cubic foot.

Locality.—Vailala River.

Date.—December, 1922.

Native names.—Kokolaka (Vailala); Bou-ura (Keke).

Remarks.—The resin is collected, and is used for torches and for tatooing. It exudes copiously from holes made by boring insects. Sometimes it is clear and yellow, but for the most part it is an opaque white resin, looking like candle grease on the bole. Curiously enough, while obviously a good resin it has only been exported from Sud Est. In Sydney it is used for varnishes.

Material collected.—Leaves, immature flowers, resin, bark, wood.

COCHLOSPERMACEAE.

Cochlospermum gillivrayi, No. 434.

A small deciduous tree.

Flowers.—Yellow, ornamental.

Rays.—Clear. 70 to 80 to the inch. Brown, 1-40th up to $\frac{1}{5}$ inch deep; showing up as brown specks and oblongs on quarter. Pores.—24,000 to 26,000. Very small and crowded closely together; single. Soft tissue.—Absent. General.—A mouse-brown wood showing little grain. The cross section is so covered with minute pores as to appear woolly. Solution wood: colourless; no precipitate. Cuts firm, but woolly; required a razor to get a surface to see pores, and section breaks up; 39 lb. per cubic foot.

Bark.—Solution cherry; no precipitate.

Locality.—Port Moresby.

Date.—Flowers in September, and is in leaf in November.

Remarks.—Planted by whites for ornament. Very common all round Port Moresby.

Material collected.—Leaves, flowers, fruits.

FLACOURTIACEAE.

Homalium pachyphyllum, Nos. 334, 798; Pangium edule, 811.

Homalium pachyphyllum Gilg., Nos. 334, 798.

Large tree, $8\frac{1}{2}$ feet girth, 80 feet bole; 110 feet over all. Narrow buttresses up to 8 feet.

Leaves.—Simple, alternate; petiole, $\frac{3}{8}$ to $\frac{1}{2}$ inch, twisted; blade, 6 to 9 x $3\frac{1}{2}$ to 5 inches; oval, ovate, obovate, suborbicular, bluntly serrate; acute or subacuminate; slightly coriaceous; glabrous. The midrib and veins are prominent and regular.

Flowers.—Axillary panicles, 11 inches long. Rachis pubescent, bearing small yellow-green flowers, either solitary or in pairs. Peduncle, $\frac{1}{8}$ to 3-16th inch, pubescent. Perianth salver-shaped, 5-16th inch long, pubescent.

Fruit.—Little red berries when immature.

Bark.—$\frac{5}{8}$ inch thick, grey-brown. Smooth, except for longitudinal lines of pustules. Inner bark yellow-brown. Solution colourless; green precipitate.

Wood.—Sap undefined, orange.

Rays.—290 to 330; red-brown; sinuous; about 80 coarse ones, the rest very fine indeed; shallow, 1-40th inch, showing up a little on quarter. Pores.—12,000 to 15,000, evenly scattered; radially septate (2). Soft tissue.—Absent. General. —A uniformly brown wood, and showing little grain. Solution wood: colourless; green precipitate. Cuts medium hard; 61 lb. per cubic foot.

Locality.—Vailala.

Date.—December, 1922.

Native names.—Kavea (Vailala), Malasa (Nakanai).

Remarks.—A hard dense timber. All the supporting posts of the buildings at Upoia (Anglo-Persian Oil Co.) are of this timber, and appear to be in good order. In demand in the island of New Britain as an oar wood.

Material collected.—Leaves, flowers, bark, wood.

Pangium edule Reut, No. 811.

A medium tree, 6 x 50 feet, heavily buttressed.

Leaves.—Simple, alternate, bunched at ends of branchlets; petiole, 10 inches; much swollen at base; blade, up to 1 foot by 9 inches, cordate, glabrous, thin; venation very distinct; four veins arise from base of midrib.

Fruit.—An asymmetrical pear-shaped fruit, some 6 inches long and 5 inches diameter, with peduncle set off the apex. The shell is brown and rough, and ¼ inch thick, and inside are some twenty irregularly-shaped nuts which fit into one another.
Bark.—Reddish-brown.
Wood.—White.
Locality.—Wide Bay.
Date.—September, 1923.
Native name.—Amigi (Sulka).
Remarks.—The kernel of the nuts are eaten after washing to remove toxic properties. The shells of the nuts are used as rattles on dancing masks.
Material collected.—Leaves and fruit.

DATISCACEAE.

Octomeles sumatrana Miq., Nos. 34, 589.

Probably the largest tree of Papua; 15 feet girth; 100 feet bole and 180 feet over all. Heavily buttressed; buttresses spread out 8 feet and ascend to a height of 12 or 15 feet.

Leaves.—Simple, alternate, petiole up to 12 inches long in young trees and blade 12 x 9. In older trees petiole 2½ to 5 inches grooved; blade 5 to 9 by 2½ to 7; cordate, acuminate, glaucous; midrib and base of veins red-brown.

Flowers.—Pendant spikes 12 to 18 inches long of sessile flowers. Only specimens seen were picked up off the ground and appeared to consist of unfertilized flowers.

Fruit.—Not seen.

Rays. — Heartwood. — Conspicuous; 100; dark brown; sinuous round pores 1/40 inch deep; show on quarter as specks and wavy lines. Pores. —Conspicuous. 1,500 to 3,500 in more or less porous zones; singly and radially septate (2). Soft tissue.—Absent. General.—A light brown straight grained porous wood. Solution wood: slightly discoloured; no precipitate. Cuts very soft and clean. 23 lb. per cubic foot. Sapwood. —Same as heart, but the colour is light yellow, and it weighs 21 lb. per cubic foot. Also the wood is softer and more woolly to cut.
Bark.—Grey brown, scaly, 1 inch thick. Inner bark red-brown. Somewhat ridged at butt.
Locality.—Well distributed throughout the lower altitudes and alluvial flats all round the coast. Attains largest dimensions on alluvium bordering large deep rivers like the Vanapa, but is also to be found growing to a great size in pockets of the foothills up to 1,500 feet.
Locality.—Vanapa, Veimauri, Aroa, Kumusi and all rivers of Buna District and foothills of Hydrographer Range.
Date.—Fruit ripening in September, 1922.
Native names.—Ipa (Evara), Kakerim (Yabim), Usu (Yalu), Erima (Rabaul), Ilimo (Motu and Suku), Benumba (Buna, Binendeli, &c.), I-Ohea (Vailala).
Remarks.—A fine wood, suitable for all kinds of indoor carpentering work. It has a pretty satin grain, and is very light indeed.
Material collected.—Leaves and spikes of dry flower calyxes, wood, bark.

BEGONIACEAE.

Begonia sp., No. 266.

A plant 4 feet high.
Flowers.—White.
Locality.—2,500 to 5,000; trail from Kokoda to Gap.
Remarks.—A showy flower.
Material collected.—Leaves and flowers.

Begonia sp., No. 405.

A low herbaceous plant; ground cover in the gullies at 6,000-7,000 feet altitude.
Leaves.—Soft; hairy.
Flowers.—White.
Locality.—Between the Adai and Naro Rivers; 6,300 feet.
Date.—February, 1923.
Remarks.—Common.
Material collected.—Leaves and flowers.

THYMELAEACEAE.

Drapetes ericoides Hook. f., No. 517.

A shrub.
Locality. — Sarawaket grass lands and edge of forest.
Date.—November, 1923.
Remarks.—Grows in association with 501, *Styphelia.*
Material collected.—Leaves and flowers.

LYTHRACEAE.

Lagerstraemia sp., No. 105.

Medium tree, 8 feet girth and 50 feet bole. Narrow buttresses up to 8 feet.
Leaves.—Simple, opposite, stipulate, petiole ¼ inch; blade 4½ x 3; ovate, acuminate, glabrous, entire, thin.
Flowers.—Terminal panicles.
Bark.—Less than ¼ inch thick; grey, scaly; scales leathery. Inner bark white, streaked with yellow. The cambium layer turns mauve soon after exposure to air. Solution sherry. Green blue precipitate.
Wood. — Sap undefined. White, flecked with yellow.
Rays.—300 very fine, pale, sinuous, round, and broken by pores. 1/80 inch deep; show up as specks on quarter. Pores.—Conspicuous, 3,500-4,000 large pores; single, some radially some tangentially septate (2) in a narrow, 1/10 inch, very porous zone; then less porous zone 1,800-2,200 about 1/5 inch thick, here the pores are smaller and septate ones less plentiful. Then another zone of porous wood and so on. Soft tissue.—Conspicuous; broken zigzag lines connecting the pores also edge of nearly porous wood is bounded by one or sometimes two continuous lines of soft tissue. General.—An easy working nice looking brown wood. Solution wood: copper. Strong blue precipitate. Cuts firm and clean. 35 lb. per cubic foot.
Locality.—Vanapa.
Date.—Flowers in May and June.
Material collected.—Flowers, leaves, wood, bark.

SONNERATIACEAE.

Sonneratia alba, No. 217.

Largest tree on the sand beach. 13 feet girth, 60 feet bole, and 90 feet over all. No buttresses. Around the roots and sometimes extending over an area of 50 feet is a thicket of pneumatophores.
Leaves.—Simple, opposite, exstipulate; petiole 4/16 to 5/16; blade 1¼ inches to 6 inches by 1-5 inches, almost circular, but some leaves distinctly elliptical or oval; very coriaceous; venation indistinct; obtuse; glabrous.

Flowers.—Solitary terminal, with pretty pink stamens.
Bark.—$\frac{1}{8}$ inch thick; grey-brown; flatly longitudinally ridged. Inner bark red-brown. Solution: tawny; blue precipitate.
Wood.—Sap ill-defined; yellow, deepening to a pink.
Locality.—On sand beach only and always within reach of spring tides. All round Territories.
Rays.—360. Very sinuous, very shallow; scarcely visible on quarter. Pores.—12,000 to 14,000 single and radially septate, evenly crushed into available space. Soft tissue.—Absent. General.—A mouse coloured wood showing very little grain. Solution wood: colourless; pale-blue precipitate. Cuts rather hard. 37 lb. per cubic foot.
Date.—Flowers in July in Northern Division.
Remarks.—A handsome flowering tree. A hard close-grained timber.
Material collected.—Leaves, flowers, wood, bark.

RHIZOPHORACEAE.

Bruguiera Rheedii, No. 212; Rhizophora mucronata, No. 213.

Bruguiera Rheedii, No. 212.

A medium tree *without buttresses.*
Leaves.—Simple, alternate; petiole $1\frac{1}{4}$ to 2; blade $4\frac{1}{2}$ to $7\frac{1}{2}$ by 2 to $3\frac{1}{2}$; elliptical, glabrous, coriaceous. *Venation in green leaves very indistinct.*
Flowers.—Axillary, solitary. Peduncle $\frac{3}{8}$ by $\frac{5}{8}$.
Bark.—$\frac{1}{2}$ inch thick. Grey, very rough, ridged and rugged. Inner bark red brown, streaked with yellow. Solution cherry; dark green precipitate.
Wood.—Sap, $1\frac{1}{2}$, pale yellow; heart brown.
Rays.—110; yellow; very slightly sinuous; show up as a beautiful moiré silk grain on quarter. Pores.—7,500-11,500 in more or less porous zones; single; many filled with ruby coloured deposit. Soft tissue.—Absent. General.—A red-brown dense heavy hard wood; straight grained. Solution wood: pink; green precipitate. Cuts very hard indeed. 71 lb. per cubic foot.
Date.—Flowers in Northern Division in July and August.
Native names.—Bagoia (Buna), Arara (Motu).
Remarks.—The wood is used for house posts and has a durability of three years. Red mangrove.
Material collected.—Leaves, wood, bark and flowers.
Locality.—Mangrove swamps throughout the territory.

Rhizophora mucronata, No. 213.

Medium tree with *flying buttresses.*
Leaves.—Simple, alternate; petiole, &c., same as 212, but apiculate more translucent and *venation more distinct.*
Flowers.—More or less waxy in texture.
Bark.—$\frac{1}{2}$ inch thick. Same as 212 but inner bark red, faintly streaked with yellow.
Wood.—Sap ill-defined, yellow, darkening to red brown.
Rays.—170. Red brown; not sinuous but often wavy in sweeping large curves; show up well on quarter in wavy bands and streaks. Pores.—10,000 very evenly scattered; single, more rarely radially septate (2). Soft tissue.—Absent. General.—A red-brown heavy wood with a pretty figure on the quarter. Solution wood, colourless; a slight discoloured precipitate. Cuts very hard. 62 lb. per cubic foot.
Locality.—Mangrove swamps throughout the Territory.
Date.—Flowers in July in the Northern Division.
Native names.—Komo (Buna), Totoa (Motu).
Remarks.—Same use as 212. Unless flowering 213 and 212 are hard to distinguish one from the other. The more distinct venation of the leaves and the possession of flying buttresses by 213 makes it really quite distinct when one has learnt to look out for these characters. Both are hard woods with a pretty quarter grain.
Material collected.—Leaves, flowers, wood, bark.

COMBRETACEAE.

Terminalia affin. T. Okari, C. T. W., No. 36; Terminalia affin. T. Catappa Linn, No. 135; Terminalia sp., Nos. 12, 285, 340, 651.

Terminalia catappoides White & Francis ined., Nos. 36, 135.

A large tree, 16 feet in girth with a bole of 80 feet and 130 feet over all. Heavily buttressed to 10 feet. Stands leafless for about a month in the dry season.
Leaves.—Grouped at the extremities of branchlets; simple, alternate; petiole $\frac{1}{4}$ inch; blade 10 to 14 by 4 to $5\frac{1}{4}$; broadly obovate; very blunt pointed; auricled at base; midribs stout; glabrous; rather coriaceous.
Flowers.—Pendant spikes up to 24 inches long, arising from the leaf axils and bearing an indefinite number of single pedunculate flowers. Peduncle $\frac{1}{4}$.
Fruit.—Only nut seen. A smaller edition of T. Okari nut, viz., a hard corrugated nut; the corrugations filled with fibrous tissue; 3 inches long by $1\frac{3}{4}$ diameter; kernel $\frac{5}{8}$ by $\frac{1}{4}$ diameter.
Bark.—$\frac{1}{2}$ inch thick. Brown; pustular; more or less deeply longitudinally lined, fissured, grooved or ridged. Inner bark red, streaked with white. Solution: dark brown; strong blue precipitate.
Wood.—Sap ill-defined. Starts a pale yellow, deepens to a deep brown at heart.
Rays.—125 to 130 coarse and fine, yellow brown, sinuous around and broken by pores, less than 1/100 inch deep, show up as minute specks on quarter. Pores.—Conspicuous. 2500 evenly scattered. Soft tissue.—Absent. General.—Grey brown timber with a satin sheen on quarter. Solution wood: colourless, strong blue reaction. Cuts rather hard. 40 lb. per cubic foot.
Locality.—A wide range all round Papua from sea level to 1,000 feet.
Date.—Flowers at the beginning and fruits at the end of the North West Season.
Native names.—Okaka (Suku), Kau-ou-ya (Buna), Yoru (Vail).
Remarks.—Very easily confounded with T. Okari. The kernel is eaten. The wood is a good hard cabinet and general purpose wood.
Material collected.—Leaves, nuts, flowers, bark, wood.

Terminalia sp., No. 12.

Large tree with well-developed buttress roots.
Leaves.—Simple, alternate; petiole, $1\frac{1}{2}$ to $1\frac{3}{4}$ inches; blade, $3\frac{1}{2}$ x 2 to $5\frac{3}{4}$ by 3 inches; broadly obovate; acute.
Fruit.—Only dry nuts seen. A walnut, 2 x $1\frac{1}{2}$ inches. Shell, $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. Kernel fills interior.

Bark.—Grey-brown, $\frac{1}{8}$ inch thick; almost smooth. Light-brown immediately below surface. Inner bark olive. Solution tawny; blue precipitate.
Wood.—Sap undefined. Saffron to yellow-brown.
Rays.—200-250. Very fine, very shallow, show up as very minute dots on quarter. Pores.—Clear. 2,500-4,500, irregularly scattered septate 2 and 3, also in small groups.—Soft tissue.—Conspicuous; wavy lines connect up pores, also here and there are single, double and treble concentric lines. General.—A brown timber with a well-marked walnut grain. Solution wood: colourless; slight greenish precipitate. Cuts fairly soft; weighs 48 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Hodava (Motu).
Remarks.—A dense, hard, long-fibred wood.
Material collected.—Leaves, nuts, bark, wood.

Terminalia faveolata White & Francis ined., No. 285.

Large tree, 15 feet girth, with a 90 feet bole, and 120 feet overall. Very heavily buttressed up to 15 feet.
Leaves.—Simple, alternate; petiole, 7-16th to $\frac{1}{2}$ inch; blade, $3\frac{1}{2}$ to $4\frac{1}{2}$ x $1\frac{3}{4}$ to $2\frac{1}{2}$ inches. Elliptical to ovate; acuminate, glabrous, thin.
Fruit.—Immature fruit collected. Apparently a nut.
Bark.—$\frac{3}{4}$ inch thick. Brown, scaly; longitudinally lined. Inner bark purple-brown; not unlike T. Okari. Solution tawny; strong blue precipitate.
Wood.—Sap, 1 inch, pale yellow. Heart a good brown.
Rays.—140; red-brown; sinuous round and broken by pores. 1-100th inch deep, and showing up as minute specks on quarter. Pores.—Very conspicuous; 3,000 to 4,000; single and radially septate, occasionally tangentially septate. Soft tissue.—Surrounds pores. General.—A nice looking brown wood, so porous that one can blow through it and suck up water through it like cane. Works up well. Solution wood: pale yellow; blue precipitate. Cuts soft, but clean; 34 lb. per cubic foot.
Locality.—Baroi.
Date.—October, 1922.
Native names. — Kovo (Vailala), Koivai-a (Evara).
Remarks.—A pretty cabinet wood; fairly hard, but easily worked.
Material collected.—Leaves, bark, wood.

Terminalia sp., No. 340.

Large tree, 8 feet girth, a bole of 75 feet, and 100 feet overall. Narrow buttresses up to 4 feet, and grooved up to 12 feet.
Leaves.—Simple, alternate; crowded at end of branchlets; petiole, $\frac{3}{8}$ to $1\frac{1}{2}$ inches (average, $\frac{1}{2}$ inch); blade, 3 to $7\frac{1}{4}$ x $1\frac{1}{2}$ to $2\frac{3}{4}$ inches; obovate, obtuse, notched; midrip rusty, tomentose above; midrib and veins prominent, and pubescent (brown hairs) below; coriaceous.
Rays.—Clear. (1) coarse, 50; (2) fine, 100; brown sinuous twisting a little to get around pores; 1-80th inch deep, showing up as little brown specks on quarter. Pores.—Conspicuous. 3,000 to 3,600; single and radially septate (2 to 4); bands of large pores occur, and then bands of small crowded pores. The dark bands have least pores. Soft tissue.—Apparently absent. General.—A brown timber uniform grain. Dark bands between large and small pores show up well on cross section. Back and quarter show cigar box grain. Solution wood: colourless; green precipitate. Cuts soft and clean; 31 lb. per cubic foot.
Bark.—$\frac{1}{4}$ inch; grey, scaly; corky, covered with pits or depressions. Inner bark mauve-brown. Solution tawny; strong blue precipitate.
Wood.—Sap, $\frac{3}{4}$, pale yellow; heart a good deep brown.
Locality.—Vailala.
Date.—January, 1923.
Native name.—Idare (Vailala).
Remarks.—Soft to cut, but a medium hard wood. Worth attention.
Material collected.—Leaves, bark, wood.

Terminalia sp., No. 651.

A large tree, 9 feet in girth, with a bole of 60 feet, and 80 feet over all. Buttressed to 10 feet.
Leaves.—Simple alternate, bunched at end of branches; petiole, 1 to $1\frac{1}{2}$ inches; blade, 4 to 6 x 3 to $3\frac{1}{2}$ inches; obovate to oval, generally tapering to base.
Fruit.—A walnut, only dry empty shells seen.
Bark.—3-16th inch thick; reddish-brown, scaly; scales thin, almost papery. Inner bark yellow. Solution tawny; no precipitate
Wood.—Yellow.
Rays.—3,400-3,700; very fine sinuous lines broken by pores, 1-150th inch deep; show up faintly on quarter. Pores.—Distinct, 400 to 1,500 inches, thickly and thinly sown bands; single. Cause rather a nice back grain. Soft tissue.—Conspicuous, 30 to 50 wavy brown lines to the inch; link up pores. General.—A mauve-coloured wood; even grained, cuts firm. Solution colourless; no precipitate.
Locality.—Amage, on upper Ramu.
Date.—March, 1924.
Native name.—Ai-isan (Amage).
Remarks.—This may be the alleged Juglans of German travellers tales.
Material collected.—Leaves and fruit.

Myrtaceæ.

Barringtonia quadrigibosa, No. 803; Barringtonia calyptrocalyx, No. 191; Barringtonia Forbesii, No. 122; Barringtonia speciosa, No. 235; Barringtonia sp., No. 593; Eugenia jambolana, No. 241; Eugenia jambos, No. 791; Eugenia javanica, No. 806; Eugenia sp., Nos. 68, 89, 92, 121, 131, 287, 384, 385, 387, 428, 579, 317, 627; Eucalyptus naudiniana, No. 797; ?Metrosideros sp., No. 264; Metrosideros sp. nov, No. 534; Octamyrtus insignis, No. 163; Planchonia timorensis, Nos. 2, 606; Xanthomyrtus longicuspis, No. 398; Indt., No. 358A.

Barringtonia calyptrocalyx K.Sch., No. 191.

Small tree, 1 foot girth, 30 feet high; undergrowth, rain forests.
Leaves.—Only grows a tuft of leaves at extremity of tall branchless stem; simple, alternate, subsessile; blade, 18 inches to 3 ft. 6 in. x 5 to 8 inches;; oblanceolate, acuminate, glabrous.
Flowers.—Long, pendant spikes on old wood. Pink.
Locality.—Kumusi River, but it has a wide range throughout the rain forests of the lower altitudes.
Date.—Flowers in July in the Kumusi forests.
Native name.—Sesewa (Ointatandi).

Remarks.—There is also another species or variety with white flowers.
Material collected.—Leaf and flowers.

Barringtonia Forbesii Bak. fil., No. 122.

Small tree.
Leaves.—Simple, alternate; petiole, ½ to 1 inch; blade 4 to 6 by 2 to 3 inches; elliptical, acute, glabrous.
Flowers.—Stamen tube, 1¼ inches long; white.
Fruit.—Not seen.
Locality.—Vanapa.
Date.—Flowers in June.
Native name.—Me-a (Dora).
Material collected.—Leaves and flowers.

Barringtonia Quadrigibosa Lauterb., No. 803.

A small tree, 20 feet over all, with a stem 10 inches in diameter. Undergrowth in rain forest.
Leaves.—Simple, alternate; bunched at end of branchlets; petiole, 1 to 1¼ inches; blade, 10 to 14 x 2½ to 3½ inches; oblanceolate, acuminate, glabrous, thin.
Flowers.—Hanging in pendant spikes, 2 to 3 feet long. The flowers apparently come out at night, for though the ground under the tree is littered with petals and filament tubes only buds are available on the branches.
Bark.—Grey-green, longitudinally lined.
Locality.—Likdin.
Date.—August, 1923.
Native name.—Ta-autim.
Material collected.—Leaves and flowers.

Barringtonia speciosa Linn. f., No. 235.

A large tree on sea coast; 12 feet girth, and 60 feet overall.
Leaves.—Simple, alternate, sessile; crowded at end of stout ribbed branchlets; blade, 9 to 14 x 4¼ to 6 inches; obovate, emarginate, glabrous, fleshy; stout midribs.
Flowers.—Terminal racemes; peduncle, 2½ inches; bract, ½ x ¼ inch; bud, 1¾ by 1 inch.
Fruit.—A large indihiscent pedunculate (2 inches) capsule. In cross section it is rectangular, 4 inches square. In longitudinal section it is pear shaped 8½ inches long. The exterior is (when fresh) green and shiny and hard; turns brown later. The calyx and style persist at apex. Within the shell (⅛ inch) is a wall of fibrous tissue, ranging in thickness from ½ to 1 inch. Lining this is a tough fibrous coating 1-32nd inch thick, and within this is a single elipsoid seed 2½ x 2 inches.
Wood.—Sap undefined. White.
Rays.—140. Coarse and fine; former rather sinuous, latter almost straight; yellow. Do not show up on quarter. Pores.—Clear, 2,000 to 2,500, rather evenly distributed. Single and less often radially septate (2). Soft tissue.—Conspicuous. 50 lines to the inch; white, wavy; thicker than rays, and continuous. General.—A white light wood showing little or no grain. Solution wood: colourless; no precipitate. Cuts soft and clean; 31 lb. per cubic foot.
Locality.—Sea beach just within reach of spring tides. Northern Division.
Date.—Flowers and fruits in July and August in Northern Division.
Remarks.—The fruit is sea-borne, and is to be picked up all round the Territory.
Material collected.—Leaves, flowers, fruit, wood, bark.

Barringtonia sp., No. 593.

A small tree, 35 feet high.
Leaves.—Large alternate, bunched at the end of the bunches.
Flowers.—Terminal pendant, 3-feet spikes, bearing shortly pedunculate flowers. Pink calyx and white filaments. Ornamental.
Fruit.—4 to 5 by 3 inches diameter; stand out at right angles to the spike. Urn-shaped calyx and style persist at end. Purple coloured. Mezocarp ½ inch thick, with a hard nut with a ¼-inch shell, and within that a kernel 2¼ inches long and 1 inch diameter. It is eaten, and so the tree is prized by the natives.
Locality.—Sibam.
Date.—December, 1923.
Native name.—Pao (Laluan).
Remarks.—The pendant flowers are very showy, while the fruits give the tree a curious appearance.
Material collected.—Leaves, flowers, buds, fruit.

Eucalyptus Naudiniana F. v. M, No. 797.

A giant tree, 25 feet in girth, 150 of bole, and attaining 230 feet over all.
Leaves.—Simple, opposite and sub-opposite; petiole, ½ to ¾ inch twisted; blade, 3 to 6 x 2 to 2 inches; lanceolate; acuminate; a little leathery. Twig rectangular in section and grooved.
Flowers.—In axially and terminal panicles. Rachis up to 4 inches, bearing groups of flowers on pedicles, which shorten from 1 inch to nothing from base to apex of panicle. The group consists usually of four flowers with ¼ inch peduncles. Filaments, ¾ inch, cream; style, ¼ inch, exserted. Cap, dome shaped, ⅛ inch diameter.
Fruit.—Last years capsules picked up were a little over ⅛ inch across with exserted valves.
Bark.—Less than ¼ inch, decorticates all the year round in thin papery ribbons which quickly blow down. When first exposed the surface is bright green, and this gradually changes through blue to purple, and finally as it dries to shed it is of a red brick colour. The inner bark is white. From 1 foot to 18 inches from ground the old bark persists.
Wood.—Sap, 1 to 1¼ inches, white; heart, red-brown. Axes firmly.
Rays.—Very fine indeed, 290-300. Sinuous around, but not broken by pores. Indistinct on back and quarter. Pores.—Four thousand per square inch; small, but visible owing to soft tissue surrounding and linking them up in broken lines running diagonally across the rays. On longitudinal sections red encrustations are conspicuous. Soft tissue.—Exceedingly fine lines; about 300 to the inch link up the rays, ladder fashion, and in addition link up the pores and surround them. General.—A hard, general purpose wood of a light red-brown colour. Works up well for eucalyptus timber. Weighs 52 lb. per cubic foot.
Locality.—Korindal.
Date.—1st August, 1924.
Native names.—Komo (Nakenai), Kamarere (Rabaul).
Remarks.—It is social in habit, and it occurs in the Island of New Britain. Occurs also in Zamboanga and Cotabato in the Philippines.
Material collected.—Leaves, wood, flowers, fruit, bark.

Eugenia jambolana (affin.), No. 241.

Small tree, 15 feet high, 5 inch diameter, undergrowth in rain forest.
Leaves.—Simple, opposite; petiole, ½ inch; blade, 6 to 7 x 3 to 3½ inches; oval to ovate; glabrous, coriaceous, acuminate.
Flowers.—Caulifloral. Racemose panicles arising from the trunk of the tree as low as 3 inches from the ground, and standing out stiffly at right angles to the stem.
Fruit.—A red velvety drupe, 1 x ⅝ inch. Obovoid stigma persistent, containing exalbuminous nut, ½ inch long.
Bark.—Smooth; grey, mottled with red.
Wood.—White to yellow-brown.
Locality.—Hydrographer's.
Date.—Flowers in August.
Material collected.—Leaves and flowers.

Eugenia jambos Linn, No. 791.

Leaves.—Large.
Flowers.—White.
Fruit.—Pink, 3½ inches diameter. A drupe containing round nut, ½ inch diameter.
Locality.—Malu. (Middle Sepik, 230 miles up).
Date.—19th July.
Native name.—Kap (Awatib).
Remarks.—Good eating. Cultivated throughout this Territory.
Material collected.—Leaves, fruit and flowers.

.*Eugenia javanica* Lam., No. 806.

A medium tree, wide spreading, 5 feet in girth, and 60 feet high.
Leaves.—Opposite, large; rather fleshy.
Flowers.—White in terminal and axillary panicles. I had the usual difficulty in finding open flowers that occurs with all this tribe.
Fruit.—Only saw green immature fruit, 3 inches long, 1 inch diameter, with persistent style and usual Barringtonia shape.
Bark.—Grey-brown, scaly.
Locality.—Bau-ung.
Date.—24th August.
Native name.—Ngoro (Baining).
Remarks.—The fruit is eaten. This species is confined to the sand beach, and grows next door to the big *B. speciosa.*
Material collected.—Leaves, flowers, buds.

Eugenia sp., No. 287.

A medium-sized tree, 6 feet in girth, with a bole of 40 feet, and 80 feet over all. Small buttresses.
Leaves.—Simple, alternate; petiole, ¼ inch; blade, 6 to 12 by 2 to 3 inches; elliptical, acuminate, glabrous, thin. Young leaves red and mango like.
Later.—Leaves were collected from a more mature tree; simple, alternate; petiole, ¼ inch; blade, 4½ to 6 x 2 to 3 inches; obovate to elliptical; obtuse, glabrous, coriaceous; midrib and veins yellow, prominent.
Bark.—Grey; fairly smooth. Inner bark brown. Solution colourless; no precipitate.
Wood.—Sap, 4 inches, pale-yellow. Heart a beautiful red, streaked with gold.
Rays.—220. Red-brown; wavy, somewhat sinuous; 1.50th inch deep, specks and lines on quarter. Pores.—Clear, 1,500; rather variable in size; single and irregularly septate; radial, tangential, diagonal groups of 4, &c. Soft tissue.—Clear. Fine lines about same thickness as rays, but not so clear cut, yet more visible. They are wavy, but on the whole continuous, and 100 to the inch, now close together; now separated by 1-10th inch or so. General.—A golden coloured wood with red streaks which show up beautifully on the back. They occur as red rings at irregular intervals through a cross section of the wood. Solution wood; colourless; green precipitate. Cuts firm; 41 lb. per cubic foot.
Locality.—Baroi.
Date.—October.
Native name.—Hekakoro (Vailala).
Remarks.—One of the most beautiful cabinet woods in Papua.
Material collected.—Leaves, bark, wood.

Eugenia sp., No. 89.

Medium tree, 5 feet girth, and 40 feet over all. Not buttressed, but stem is channelled.
Leaves.—Simple, opposite, sessile or subsessile, lanceolate; blade up to 10 inches long by 3½ inches wide; entire, glabrous.
Flowers.—Axillary, and frequently low down on the old wood of the bole.
Bark.—Greeny-grey, fairly smooth. Inner bark brown. Solution tawny; strong blue precipitate.
Wood.—Sapwood, yellow for ½ inch; heart, light-brown for 3 inches, then very dark-brown.
Rays.—210. Yellow. Wavy, more or less sinuous around, and broken by pores. Show up as minute specks on quarter. Less than 1-100th inch deep. Pores.—Between 7,000 and 10,000; very close set, very small, very numerous; single and radially septate (2 to 3). Fairly evenly scattered. Soft tissue.—Very numerous; fine concentric lines link up pores. General.—A brown wood with a very dense grain. Solution wood: discoloured; blue precipitate. Cuts hard; 52 lb. per cubic foot.
Locality.—Vanapa, Veimauri, Aroa.
Date.—Flowers from April to June.
Native names.—Fotai-a (Suku), Maita Maita (Motu).
Remarks.—The fruit is said to be edible.
Material collected.—Leaves and one flower, wood and bark.

Eugenia sp., No. 92.

A large tree, 7 feet in girth, and a 50 feet bole. Heavily buttressed.
Leaves.—Simple, opposite; petiole, ¼ to ½ inch; blade, 5 to 9 x 3 to 4 inches; entire, thinly; coriaceous, glabrous, double marginal vein.
Bark.—Grey-brown, scaly. Inner bark light-brown.
Wood.—Sap ill-defined. Starting pale-yellow merges into light-brown.
Locality.—Vanapa.
Date.—May, 1922.
Native names.—Luvutate (Suku), Bisi Bisi (Doura).
Material collected.—Leaves.

Eugenia sp., No. 68.

A large tree, 6½ foot girth with a 50 feet bole. Buttressed up to 4 feet.
Leaves.—Simple, opposite; petiole ¼ inch. Blade 5 to 5¾ by 2 to 2¼ inches; lanceolate; acuminate; entire; glabrous; thin.
Bark.—½ inch thick; scaly; dark-brown: Inner bark yellow.
Wood.—Sap ill-defined, merging into heart; yellow.

Rays.—150; yellow; sinuous around pores; up to 1-20th inch deep; show up as oblongs on quarter. Pores.—5,000 to 6,000; single and septate (2-3) evenly scattered. Soft tissue.—Absent. General. — Mouse-brown; straight grained. Solution wood: colourless; no precipitate. Cuts rather hard; 41 lbs. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Bado (Suku).
Remarks.—A hard wood used by Goaribari and Kiwai Tribes to make combs.
Material collected.—Leaves and wood.

Eugenia sp., No. 131.

A small tree.
Leaves.—Simple, opposite, subopposite, alternate; petiole $\frac{1}{4}$; blade 4 to $7\frac{1}{2}$ by $2\frac{1}{2}$; ovate to lanceolate, entire, glabrous.
Rays.—Clear. 90 fine, 120 very fine indeed, all very pale yellow, straight 1-60th inch deep, showing up as thin lines on quarter. Pores.—2,500 to 4,500 in zones of porous and less porous wood, radially septate (2 and 3)). Soft tissue.—Absent. General.—A white wood. Solution wood: colourless, no precipitate. Cuts soft. 26 lb. per cubic foot.
Locality.—Aroa.
Date—May, 1922.
Native names.—Fotaia (Suku), Maita-Maita (Motu).
Remarks.—This is the small fruiting variety of Eugenia.
Material collected.—Leaves, flowers, fruit in formalin.

Eugenia sp., No. 384.

A large tree. 15 feet in girth, 80 feet of bole and 125 feet over all. Not buttressed, but has pronounced root swellings or spurs.
Leaves.—Simple, opposite, decussate; petiole 3/16; blade $1\frac{1}{2}$ to 2 by $\frac{7}{8}$ to 1 inches, asymetrically obovate, acute, coriaceous; midrib prominent, pale yellow; venation distinct, marginal vein present.
Bark.—$\frac{1}{2}$ inch thick, a light brown; very scaly; scales longitudinally arranged and $\frac{1}{4}$ to 3 inches wide—average about 1 inch; several thicknesses of scales persist, giving tree an untidy appearance. Inner bark a slightly deeper shade of brown. Solution sherry. Strong blue precipitate.
Wood.—Sap $\frac{1}{2}$ inch, yellow. Heart an oily brown.
Rays.—14 easily visible ones to the inch, between which are about 270 fine ones to the inch; show up as thin lines on quarter. Pores.—Clear. 10,000 in more or less regular concentric bands. Thin bands 1-40th to 1-50th inch wide of almost poreless and without soft tissue then bands thick with pores and which are connected by and immersed in soft tissue. The pores are single and radially septate (2-4 and occasional 5 and 7). General.—A grey brown timber showing a little grain. Solution wood: colourless, strong blue precipitate. Cuts very hard. 55 lb. per cubic foot.
Locality.—Mt. Obree to Laruni Spur on a flattish portion between 7,000 and 8,000 feet, where broadleafed species take the place of Coniferae.
Date.—February, 1923.
Native name.—Sere.
Remarks.—A hard, close-grained, interlocked timber. Common.
Material collected.—Leaves, bark, wood.

Eugenia sp., No. 385.

A large tree. Eight feet in girth with a bole of 80 feet and 130 feet overall. Not buttressed but spur-rooted.
Leaves.—Simple, opposite and subopposite; petiole $\frac{3}{8}$, grooved; blade $2\frac{1}{2}$ to 3 by $1\frac{1}{4}$ inches; obovate to oval, acute, more or less twisted from base to apex; midrib yellow, prominent; veins indistinct; glaucous below; green, shiny above; coriaceous. When leaves crushed they emit faint apple perfume.
Bark.—$\frac{1}{4}$ to $\frac{3}{8}$ inch; salmon; scaly; scales papery. Inner bark a lighter pink. Solution light yellow; faint precipitate.
Wood.—Sap, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, yellow. Heart a deep red brown; very fine indeed.
Rays.—370. Very fine dark brown, somewhat sinuous. 1-75th inch deep. About 70 to the inch are coarser. Pores.—Clear. 100,000 to 110,000 plentifully scattered. Soft tissue.—Surrounds and links up pores in short wavy lines, running across rays. General.—A dark red brown wood. Solution wood: faint yellow, slight precipitate. Cuts hard; 59 lb. per cubic foot.
Locality.—Mt. Obree to Laruni Spur—7,000 to 8,000 feet.
Date.—February, 1923.
Native name.—Maro (Laruni).
Remarks.—A hard, dense wood.
Material collected.—Leaves, bark, wood.

Eugenia sp., No. 387.

Large tree. Girth 9 feet, bole 65 feet, over all 100 feet. Medium spur roots; no buttresses.
Leaves.—Simple, opposite, decussate; petiole $\frac{1}{4}$; blade $1\frac{1}{4}$ to $2\frac{1}{4}$ by $\frac{7}{8}$ to $1\frac{1}{8}$; obovate to oval, more or less acuminate; midrib prominent; veins distinct; marginal vein present; coriaceous.
Bark.—Grey-brown. Pustular fibrous. Scaly; the scales are very small and thin, and lie close so that it is only on close inspection that the scaliness is observable. Inner bark yellow brown with a powdery sheen. Solution colourless. Strong blue precipitate.
Wood.—Sap $2\frac{1}{4}$ to $2\frac{1}{2}$, light brown. Heart a deep brown.
Rays.—300 to 500, of which 14 to 16 are plainly visible, the rest are very fine indeed; yellow, showing up as specks on quarter. Pores.—Clear. 6,000 to 8,000 in close sown and wider sown bands. Soft tissue.—More or less clear. Surrounds pores and link them in broken and tangential lines. General.—A grey-brown timber showing little grain. Solution wood: colourless, strong blue precipitate. Cuts very hard; 55 lb. per cubic foot.
Locality.—Mt. Obree to Laruni Spur. 7,000 to 8,000 feet.
Date.—February, 1923.
Native name.—Ia (Laruni).
Remarks.—A hard, interlocked timber. Appears to be close to No. 384.
Material collected.—Leaves, bark, wood.

Eugenia sp., No. 428.

A large tree 10 feet girth and 60 feet bole, 100 feet over all. Spur rooted.
Leaves.—Simple, opposite; petiole 5-16 inch grooved; blade 2 by $\frac{5}{8}$; lanceolate acuminate, venation fine but clear, slightly coriaceous.

Bark.—Reddish-yellow brown; scaly; the scales persist for many years gradually detaching themselves, starting from the base of each scale. This method of decortication results in there being a number of scales overlapping vertically, the topmost one projecting perhaps 3 inches from bole of tree. It gives the tree an armadillo-like appearance. Inner bark light yellow-brown. Solution brown; strong blue precipitate.

Wood.—Sap ill-defined, deepening from a yellow to a dark red brown.

Rays.—140-170. Brown; show up as fine brown lines on the quarter. Pores.—Clear. 9,000 to 16,000 in alternate bands of close radially septate (2-7) minute pores and more open bands of somewhat larger single and radially septate pores (2) Here and there groups of 4-5 septate pores occur in square formation. Soft tissue.—Exceedingly fine lines just visible connect up the rays at close intervals. General.—A mouse brown timber with a uniform grain. Solution wood: a slight copper tinge; strong blue precipitate. Cuts hard and the pores are so minute and close it requires a razor to get a surface. 54 lb. per cubic foot.

Locality.—Between Iorobaiva and Naro 5,000 feet. It has a wide range and is to be found anywhere between 3,000 and 6,500 feet on the Owen Stanley Range.

Material collected.—Leaves, bark, wood.

Eugenia sp., No. 121.

Large tree with a girth of 8 feet and a bole of 60 feet.

Leaves.—Simple, opposite; petiole $\frac{1}{4}$; blade 5 to $5\frac{3}{4}$ by $1\frac{1}{2}$ to 2 inches; lanceolate or oval; acuminate; entire; glabrous; heavily oil-dotted.

Bark.—Grey-brown; scaly. Inner bark red-brown. 1-40th inch deep; show up as oblongs and specks on quarter. Pores.—Clear. 3,000 to 4,500 in less and more porous bands, single, rarely radially septate (2). Soft tissue.—Absent. General.—A mouse-brown wood, straight grained, and a pretty figure on the quarter. Solution wood: colourless; faint brown precipitate. Cuts hard; 54 lb. per cubic foot.

Wood.—Sap undefined; yellow.

Rays.—200-250; yellow; sinuous round pores.

Locality.—Vanapa.

Date.—May, 1922.

Material collected—Leaves, wood.

Eugenia sp., Nos. 317 and 627.

A large, graceful tree; 8 feet girth; 50 feet bole and 90 feet over all. Narrow buttresses.

Leaves.—Simple, opposite and subopposite; petiole $\frac{3}{8}$, twisted; blade 3 to $4\frac{1}{2}$ inches by $1\frac{1}{4}$ to $1\frac{7}{8}$ inches; elliptical to lanceolate; distinct venation and a marginal vein; midrib prominent, brown; glabrous; rather coriaceous; acute to acuminate.

Flowers.—Large terminal corymbs of mauve flowers. The flowers are numerous, and, though small, form a conspicuous mass at ends of branchlets. Bud 3-16 inch with 1-32 inch lid which opens like a eucalyptus bud. When fully cut the cone-shaped receptacle is 3-16 inch long and mauve, and bears an indefinite number of filaments inserted on its edge. These are 3-16 inch long, mauve, and bear small yellow capitate anthers. G. style white, terete 3-16 inch long.

Bark.—$\frac{1}{2}$ inch thick, yellow at butt and when shaded; when exposed it is cream white. Scaly: scales papery, leaving a surface finely scrolled. Inner bark, red brown. Solution sherry. Strong blue precipitate.

Wood.—Sap $1\frac{1}{2}$ inch, pale yellow. Heart a red brown.

Rays.—(1) Coarse 100; (2) Fine 220. 1-80th inch deep; show up as small brown oblongs on quarter. Sinuous twisting around pores. Pores.—Clear. 5,000 to 10,000. Single and radially septate two or in groups of three. They occur in concentric bands increasing and decreasing in number to the square inch. The dark bands are where the pores are least numerous. Soft tissue.—Absent. General.—Pink brown wood. Solution wood: very pale pink; strong blue precipitate. Cuts hard. 48 lb. per cubic foot.

Locality.—Collected on Vailala River. Also seen on Baroi, Purari and Kikori Rivers.

Date.—December, 1922.

Native names.—Ai-i-hi (Vailala), Kewarikura (Keke), Abaru (Yabim).

Remarks.—A very showy tree. A tough, hard, interlocked grained wood.

Material collected.—Leaves, flowers, bark, wood.

Eugenia sp., No. 579.

A large tree, 8 feet in girth with a bole of 70 feet and attaining 100 feet over all. Not buttressed but it has a tendency to develop spurs and grooves in maturity.

Leaves.—Simple, opposite. Petiole $\frac{1}{4}$-$\frac{1}{2}$; blade $3\frac{1}{2}$ to $4\frac{1}{2}$ inches by $1\frac{3}{4}$ to 2 inches; tapering more or less evenly to each end; thin, shiny.

Bark.—$\frac{1}{4}$ inch thick; reddish brown; scaly and very untidy for the scales do not shed completely and hang down in long strips where they come off cleanly they leave the under bark scrolled. Inner bark yellow brown. Dark tawny solution; strong muddy-green precipitate.

Wood.—Sap ill-defined, starting grey deepens to a good dark brown.

Rays.—300-360, fairly straight, large pores cause kinks; some coarse, some fine; 1-16th inch deep; inconspicuous on quarter; pores—1,500 single and radially septate (2). General.—A mouse-coloured dense wood with a close straight grain; weighs 51 lb. to cubic foot. Solution: colourless; blue precipitate.

Locality.—Ioangey.

Date.—December, 1923.

Native name.—Taipwa.

Remarks.—Compare Papua No. 428.

Material collected.—Leaves. Bark, Wood.

Planchonia timorensis Blume, Nos. 2 and 606.

A large tree 9 feet girth, 60 feet bole, up to 120 feet over all; no buttresses or flange roots but grows up straight from the ground.

Leaves.—Simple, alternate, petiolate, decurrent, venation pinnate, 6 by 4 inches obovate, finely serrate, acute glabrous, thin.

Flowers.—Regular. The tubes of stamens with 4 petals adhering fall to the ground, apparently during night, as I was unable to find a specimen of a fully blown flower on the trees. Pink and white, large, conspicuous when fallen.

Fruit.—Fleshy, green, smooth; $3\frac{1}{2}$ by $2\frac{1}{2}$ with persistent calyx and style at apex. Rots on ground and is much eaten by wild pig; contains large number three-sided seeds 7-16th by 3-16th inch.

Bark.—Red brown, rough, fibrous; ½ inch thick. Inner bark red-brown. The bark of saplings is very stringy and is used by the natives for tying up bundles, &c. Solution tawny; strong blue precipitate.
Wood.—Sap pale yellow, 3½ to 4 inches. Heart red brown. A hard general utility wood.
Rays.—280 to 300 red brown, do not show up plainly on quarter, the colour being nearly same as wood, 1-40th inch deep. Pores.—Conspicuous. 3,000 to 3,500 rather evenly scattered, radially septate (2 to 7). Soft tissue.—Surrounds the pores, also in very thin ladder rungs joining rays. General.—A red brown wood showing little grain. Solution wood; colourless; faint green precipitate. Cuts hard. Weighs 55 lb. per cubic foot.
Locality.—Vanapa; Veimauri; Aroa.
Date.—June, 1922.
Native names.—Kaeda (Suku), Bibira (Buna), Paira (Evara), Puri-iki (Vailala), Aruntern (Yalu).
Remarks.—The size to which this tree grows makes it a useful milling timber. Its colour is good and it should command a price where heavy strong timbers are required.
Material collected.—Leaves, flowers, fruit, wood, bark.

Metrosideros sp., No. 264.

Small tree, 3 feet girth and 50 feet high.
Leaves.—Simple, alternate; petiole 3-16th inch; blade 1⅜ by 7-16 inches; obovate, more or less acute, margin recurved; rusty tomentose below; glabrous above; rather coriaceous.
Flowers.—Axillary cymose corymbs at end of branches. Scarlet, conspicuous, gorgeous and floribundant. Peduncle 3-32 pubescent.
Rays.—250-270; pale yellow or white; very shallow, visible as fine lines on quarter. Pores.—9,000 to 10,000. Very small but visible owing to white edging. Here and there less porous zones occur. Soft tissue.—Appears to be absent. General.—An exceedingly dense grainless wood, very heavy. Solution wood: colourless, blue precipitate. Cuts hard. 66 lb. per cubic foot.
Bark.—Yellow brown, longitudinally scaly; scales about ½ inch wide. Inner bark yellow. Solution colourless. Strong blue precipitate.
Wood.—Sap undefined; yellow, deepening to dark yellow or light brown.
Locality.—Trail from Kokoda to the Gap at 5,400 feet.
Date.—Flowers in August.
Remarks.—The most ornamental tree I have seen in Papua. The dark green myrtle foliage and the scarlet flowers, make a contrast which is most beautiful. The scarlet crowns can be picked out across wide valleys in these mountains.
Material collected.—Leaves, flowers, wood, bark.

Metrosideros new species, No. 534.

A small tree up to 30 feet high.
Flowers.—Showy red filamented flowers.
Locality.—Edge of lime stone precipice above Nomi River.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Octamyrtus insignis Diels, No. 163.

A small tree 15 inches girth and 15 feet high. Undergrowth in rain forests. Wide branching and somewhat weeping.
Leaves.—Simple, opposite; petiole ½ inch; blade 9 by 5½ inches; obovate, acuminate; pubescent, coriaceous.
Flowers.—Red axillary, one to each axil. Shortly pedunculate. 4 bracts.
Bark.—Brown, rough.
Locality.—Throughout rain forests up to an altitude of 2,000 feet.
Date.—Flowers in Buna District in July.
Remarks.—A showy flower.
Material collected.—Leaves and flowers; in herbarium.

Xanthomyrtus longicuspis Diels, No. 398.

A tree 6½ feet in girth by 30 feet of bole and 50 feet over all.
Leaves.—Simple, opposite. 2 inches by ¾ inch, lanceolate, exceedingly acuminate, thin, glabrous, oil dotted. Twig pubescent.
Bark.—⅛ inch, brown; scaly; sometimes these scales persist, hanging to the tree in an untidy manner. Inner bark red. Solution faint rose; very faint precipitate.
Wood.—Sap, ½ inch, yellow. Heart a very deep red.
Rays.—44 to 47 to the inch. Yellow. Do not show up on the quarter. Pores.—32,000 to 47,000 up to about 2,000 to the square inch are impregnated with a red brown deposit. They lie in very short, irregular radial chains. Soft tissue.—About one thin line to the inch. General.—A dark red-brown compact timber showing no grain. Solution wood: faint rose; strong blue precipitate. Cuts hard. 63 lb. per cubic foot.
Locality.—Ridge between Adai and Tuhui Rivers. It has a wide range from an altitude of 5,000 feet upwards, all along the Owen Stanley Range. In many places it forms the only associate species of tree with the Conifers.
Date.—February, 1923.
Native name.—Faro (Menari).
Material collected.—Leaves, bark, wood.

Indt., No. 358A.

A small tree, 3 feet girth and 30 feet over all.
Leaves.—Simple, opposite; petiole 3-32nd; blade up to 1 inch by ½ inch. Oil dotted.
Locality.—Mt. Obree and main Owen Stanley Range—8,000 to 10,300 feet. As one rises this species becomes more and more numerous, until finally at the top of the range it shares with the Podocarp, 357A, P. Thevitiifolius, the whole of the space.
Date.—February, 1923.
Material collected.—Leaves.

MELASTOMACEAE.

Medinilla sp., Nos. 360, 403, 535, 536; Indt., No. 430; Melastoma sp., No. 796; Poikilogyne setosa, No. 346; Osbeckia chinensis, Linn. No. 638.

Medinilla sp., No. 360.

A succulent plant, 4 feet high.
Flowers.—White, with red calyx.
Locality.—7,000 to 8,000 feet on main Owen Stanley Range.
Date.—February, 1923.
Remarks.—An ornamental plant.
Material collected.—Leaves and flowers.

Medinilla sp., No. 536.

A shrub up to 12 feet high.
Flowers.—White.
Locality.—Nomi River. 5,000 feet.
Date.—November, 1923.
Material collected.—Leaves. Flowers.

Medinilla sp., No. 535.

A shrub up to 8 feet high.
Flowers.—Pink.
Locality.—Nomi River, 5,000 feet.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Medinilla sp., No. 403.

A small tree or large shrub.
Leaves.—Three veined.
Flowers.—Very showy pink.
Locality.—Junction of Adai and Inumu Rivers. 2,200 feet.
Material collected.—Leaves and flowers.

Melastoma, No. 796.

A strong woody climber, attaining 30 feet.
Leaves.— Simple opposite, 6 to 9 inches by 4 inches wide, on a very short entirely twisted petiole. The blade is elliptical, acuminate and coriaceous.
Flowers.—Delicate mauve-coloured flowers grow on the old wood in bunches; long calyx tubes.
Locality.—Korindal (New Britain).
Date.—11th August.
Native name.—Tabuata (Nakanai).
Remarks.—A decorative creeper.
Material collected.—Leaves and flowers.

Poikilogyne setosa White & Francis ined., 346.

A shrub with a scrambling habit.
Leaves.—Simple, opposite; petiole 1 to 2 inches; blade 3 x $2\frac{1}{2}$ inches to 4 by 3 inches; the petiole stem and veins are hairy; margin dentate; midrib and four prominent veins present.
Flowers.—Lake coloured; calyx $\frac{1}{2}$; petals $\frac{3}{8}$; anthers yellow $\frac{1}{4}$ inch long; style terete, curved at stigma.
Locality.—7,500 feet, Mt. Obree.
Date.—January, 1923.
Native name.—Dabai (Laruni).
Remarks.—Showy flowering shrub.
Material collected.—Leaves and flowers.

Indt., No. 430.

Leaves.—Soft, velvety, cordate, lower surface purple, upper dark green.
Flowers.—Pink.
Locality.—Iorobaiva, 3,000 to 4,000 feet.
Date.—February 1923,
Remarks.—A most ornamental plant.
Material collected.—Leaves and flowers.

Osbeckia chinensis Linn, No. 638.

A herb.
Flowers.—Mauve.
Locality.—Grass hills upper Ramu up to 1,700 feet.
Date.—29th February, 1924.
Remarks.—Common.
Material collected.—Leaves, flowers.

ARALIACEAE.

Boerlagiodendron Sayeri, No. 390; Horsfieldia silvestris, Nos. 22, 231; Polyscias sp., No. 190; Polyscias sp., No. 388; Schefflera sp., Nos. 172, 546; Schefflera setulosa (affin.), No. 516.

Boerlagiodendron Sayeri Harms, No. 390.

A third story specie—20 feet high.
Leaves.—Large, acer-like, but more deeply fid and serrate.
Flowers.—Terminal umbels, purple and white.
Locality.—Laruni Spur, Mt. Obree, 7,000 feet.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Horsfieldia silvestris Warbg., Nos. 22, 231.

A medium tree, 7 feet by 70 feet over all. No buttress roots.
Leaves.—Alternate; subsessile, entire; acuminate; rusty tomentose below; green, shiny above.
Flowers.—Yellow.
Bark.—$\frac{1}{4}$ inch thick, greeny grey; fairly rough; rather fibrous; pale red below surface. Solution slightly discoloured. Faint greenish precipitate.
Wood.—Sap 2 inches, pale; heart yellow.
Rays.—180; red; sinuous round, and here and there broken by pores; 1-20th inch deep; conspicuous bands and oblongs. Pores.—Clear. 1,200 to 1,400; single and radially septate (2). Tissue.—Fine concentric, continuous lines 30-35 to the inch radius. Also a number of broken lines. These are like the others only finer and break off short. General.—A smooth straight grained wood with a nicely marked quarter grain. Solution wood, colourless; no precipitate. Cuts firm. 36 lb. per cubic foot.
Locality.—Vaimauri, Buna.
Native names.—Aremore (Suku), Kore (Buna), Dabaukiba (Vailala).
Date.—May, 1922, July 1922.
Remarks.—A light, soft timber, easily worked. Rays show up on the quarter.
Material collected.—Leaves, flowers, bark, wood.

Polyscias cibaria White & Francis ined., No. 388.

A third story specie; 20 feet high and somewhat rambling in habit.
Leaves.—Compound, asymmetrical, aromatic.
Flowers.—Large terminal panicles of small white flowers.
Locality.—Mt. Obree to Laruni Spur, 7,000 feet. (Said by natives to grow down to sea level.)
Date.—February, 1923.
Remarks.—Leaves and flowers are cooked with coco-nut oil and put in armlets in dances.
Material collected.—Leaves and flowers.

Polyscias sp., No. 190.

A large tree; 8 feet in girth with an unbuttressed bole of 70 feet.
Leaves. — Compound, alternate; stalk about 19 inches. Leaflets opposite; subsessile; blade 2 to $4\frac{1}{2}$ inches by $1\frac{1}{4}$ to 2 inches; about 9 pairs and a terminal one. There is a distinct constriction or waist in the stalk at the points where the pairs of leaflets spring.
Bark.—$\frac{1}{2}$ inch thick; pustular; the pustules in longitudinal lines or ridges; inner bark yellow. Solution pale yellow; pale green precipitate.
Wood.—Sap undefined. Pale yellow.
Rays.—Conspicuous; coarse 50; yellow, straight or only a little sinuous. 1-5 inch deep. Showing up well on the quarter. Between these coarse rays are a large number of very fine ones too fine to count.—Pores.—Conspicuous; 3,000 evenly scattered. Single and radially septate 2-3. Soft tissue.—Absent. General.—A white timber streaked with yellow pore grooves. A

very pretty quarter grain. Solution wood: colourless; no precipitate. Cuts soft and woolly. 23 lb. per cubic foot.
Locality.—Kumusi, near Onitatandi.
Date.—July, 1922.
Native name.—Gongofo (Onitatandi).
Remarks.—A very soft, open, porous wood. The rays show up prettily on the quarter.
Material collected.—Leaves, wood, bark.

Schefflera, No. 172.

Small tree, 1 foot in girth and 30 feet overall. Undergrowth in rain forests.
Leaves.—Alternate in a bunch at top of stem; digitate petiole up to 26 inches; leaflets 9 to 10; petioles 2 inches; blade up to 12½ x 5¼; lanceolate, acuminate, glabrous, coriaceous.
Flowers.—Spikes 18 inches long, bearing umbels of 5 to 8 flowers on a pedicel ½ inch long and peduncles 3-20th inch long.
Bark.—Mottled grey and brown.
Locality.—All through rain forests up to 2,500 feet.
Date.—Flowers in Northern Division in July.
Native name.—Tikina (Binandele and Buna).
Remarks.—Probably the most common undergrowth of this size.
Material collected.—Leaves and flowers.

Affinities *Schefflera setulosa* Harms, No. 516.

A Liane, but sometimes grows as a lank sapling tree.
Leaves.—Digitate. Midribs on under surface are covered with long hairs.
Flowers.—White terminal heavy spikes.
Locality.—Sarawaket 9,000 feet.
Remarks.—A wide range; as it is to be found 100 feet above sea level on *Pometia pinnata* and at 10,000 on a *Phyllocladus.* Leaves in demand as cigarette papers.
Material collected.—Leaves.

Schefflera sp., No. 546.

A Liane.
Leaves.—Digitate.
Flowers.—White in terminal spikes.
Locality.—Nomi River, 5,000 feet.
Date.—November, 1923.
Native name.—Gombera (Ogeramnagn).
Remarks.—Related to No. 516, but much slighter all over.
Material collected.—Leaves, flowers.

Umbelliferae.

Indt., No. 542; Oenanthe Schlechteri, Wolff., No. 562.

Indt., No. 542.

A hemlock, 2 feet 6 inches high.
Flowers.—White.
Locality.—Nomi River, 5,000 feet.
Date.—November, 1923.
Material collected.—Leaves, flowers.

Oenanthe Schlechteri Wolff, No. 562.

Large cordate leaves with characteristic venation.
Flowers.—Lilac to pink in long terminal panicles.
Locality.—Kulentufu-Ioangey.
Date.—November, 1923.
Material collected.—Leaves, flowers.

Ericaceae.

Agapetes Moorhousiana, Nos. 222, 575; Rhododendron communae, No. 502; Vaccinium blepharocalyx, No. 521; Diplycosia mundula, No. 504; Rhododendron Carringtoniae, No. 527; Rhododendron Hausemanni, No. 531; Rhododendron Warianum, No. 532.

Agapetes Moorhousiana, Nos. 222, 575.

A Liane growing to a height of 40 feet.
Leaves.—Simple, alternate; petiole ¼; blade 3½ to 6½ by ¾ to 2¼ inches; lanceolate, acuminate, glabrous, coriaceous; a pair of prominent veins arise near base of midribs and give appearance of tri-nerved leaf.
Flowers.—Single in groups on old wood. Here and there they are so thickly placed as to completely surround the stem. A fine rose colour.
Locality.—Over 2,500 feet, Hydrographer's, and over 3,000 feet on the western slopes of the Owen Stanley Range and widely distributed over the midmountain region of New Guinea.
Date.—Flowers in August.
Native name.—Biliki (Pernambata).
Remarks.—A most conspicuous and gorgeous creeper. Very florabundant.
Material collected.—Leaves and flowers.

Diplycosia mundula (F. v. M.) Schltr., No. 504.

A shrub up to 7 feet high, grows socially with Styphelia sp.
Flowers.—Small white.
Locality.—Salawaket grass lands and on edge of Libocedrus forest 6,000 to 12,000 feet.
Date.—20th November, 1923.
Material collected.—Leaves and flowers.

Rhododendron communae Fortser, No. 502.

A shrub up to 20 feet.
Flowers.—Handsome crimson trumpets.
Locality.—Sarawaket, grass lands and edge of Libocedrus forest 6,000 to 9,000 feet.
Date.—20th November, 1923.
Material collected.—Leaves and flowers.

Rhododendron Warianum Schlecter, No. 532.

A creeper.
Flowers.—Pale pink trumpets.
Locality.—Edge of limestone precipice above Nomi River; 7,000 feet.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Rhododendron Hausemanni Warbg., No. 531.

A scrambling shrub.
Flowers.—Yellow conspicuous.
Locality.—Edge of limestone precipice above Nomi River, 7,000 feet.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Rhododendron Carringtoniae F. v. M., No. 527.

A shrub to small tree.
Flowers.—White fragrant very showy.
Locality.—Divide between Nomi and Ake. Sarawaket 7,000.
Date.—November, 1923.
Material collected.—Leaves, flowers.

Vaccinium blepharocalyx Schlecter, No. 521.

A small tree up to 25 feet high.
Locality.—Sarawaket; on edge of grass land and forest of Mongi valley; 8,000 feet.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Myrcinaceae.

Aegiceras majus, No. 233; Ardisia Poolei, No. 393; Ardisia sp., No. 358.

Aegiceras majus, No. 233.

Shrub.
Leaves.—Simple, exstipulate; petiole ¼ to ½ inch; blade 2 to 4 inches by 1¼ to 2 inches; obovate, obtuse, more or less coriaceous, glabrous.
Flowers.—White axillary in groups. Perigynous. Peduncle ½ inch.
Fruit.—A J-shaped greeny yellow follicle in groups. Peduncle ½ inch. Contorted calyx persistent ¼ inch. Style persistent at apex of fruit. From point of style to base of calyx ¾ inch, 3-32 inch in diameter. Containing single green (when fresh) seed.
Locality.—All round coast of Territory.
Date.—Flowers June to August.
Native names.—Monoko (Buna), Hudihudi (Motuan).
Remarks.—The flowers which are very fragrant are used as arm decorations in dances.
Material collected.—Leaves, flowers, fruits.

Ardisia Poolei White & Francis ined., No 393.

A small tree or large shrub of the third story.
Leaves.—Alternate.
Flowers.—Red.
Locality.—4,000 feet, Owen Stanley Range, near Laruni.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Ardisia sp., No. 358.

A shrub.
Leaves.—Small, alternate, very acuminate.
Flowers.—White.
Fruit.—A red berry, ½-inch diameter; seed, ¼-inch round.
Locality.—7.400 feet, Mount Obree.
Date.—January, 1923.
Material collected.—Leaves, flowers, fruit.

Sapotaceae.

Chrysophyllum Roxburghii, No. 614; Illipe sp., No. 323; Lucuma sp., No. 123; (?) Payena sp., No. 204; Achradotypus sp., No. 227; Indt., No. 391; Sideroxylon sp., Nos. 161, 325; Sideroxylon novo-guineense, No. 386; Indt., No. 120.

Chrysophyllum Roxburghii G. Don, No. 614.

A large tree with a girth of 8 feet, a bole of 100 feet, and attaining a height of 120 feet over all; root swellings to 2 feet, often grooved to 10 feet.
Leaves.—Simple alternate; petiole, 5-16th inch, rusty tomentose (also twig); blade, 3-6 by 1-1¾ inches; lanceolate, acuminate, glabrous, thin, soft; midrib rusty, tomentose, also surface of young leaves, but soon rubs off.
Fruit.—A green to yellow apple, smells of quince; 1¾ inch long by 2 inches in diameter, somewhat ribbed, containing about five flattened brown seeds ¾ inch long by ½ inch wide, somewhat kidney shaped.
Bark.—½ inch thick; brown, splashed with grey lichen; longitudinally lined and roughened. Inner bark white, streaked with pink. Exudes a white latex. Solution colourless. No precipitate.
Wood.—Sap undefined, white. Axes easily and splits well.
Rays.—270 distinct, pale, sinuous around pores; 1-10th inch deep, conspicuous bands on quarter. Pores.—5,000 to 6,000 single and radially septate 2-7; seem to be arranged in irregular chains between the rays. Soft tissue.—Very fine lines about 500 to the inch, ladder-rung the rays. General.—A white wood, soft to cut, straight-grained. Solution colourless. No precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Mafungafung (Yalu).
Remarks.—Fruit eaten by pigeon. Wood used to make planks for building houses.
Material collected.—Leaves, fruit, wood, bark.

Lucuma sp., No. 123.

A medium tree, 4 feet girth, 50 feet over all. Bole channelled; low branching.
Leaves.—Simple opposite; petiole, ¼; blade 2½ to 4 x 1½ to 2¾ inches; elliptical, acuminate, glabrous, thin.
Fruit.—A red drupe, surface tomentose, ovoid; 3 x 1½, nut 1¾ x ¾ inches. Brown, polished, all but back, light-brown unpolished. Kernel, eaten by rats, 1½ x 11-16th inches.
Bark.—Grey-brown, flatly ridged. Inner bark pale yellow, streaked with orange yellow. Less than ¼ in thick. Solution faint yellow, no precipitate.
Wood.—Sap undefined, yellow.
Rays.—Very numerous and fine, between 400 and 500 to the inch; visible as very fine lines on quarter. Pores.—5,000 to 9,000; variation mainly due to sub-division of pores, which here and there are radially septate (7). Soft tissue.—Very fine lines indeed link up rays. General.—A yellow wood with a dense, close, straight grain. Solution wood; faint yellow; faint green precipitate. Cuts hard. 62 lb. per cubic foot.
Locality.—Aroa.
Date.—Fruits in June.
Native name.—Yokokoro (Suku).
Remarks.—A hard, straight-grained, dense timber.
Material.—Leaves, fruit, nut, wood, bark.

Illipe sp., No. 323.

A large tree, 10 feet in girth, 90-feet bole, and 110 feet over all. An umbrella crown. Spur-rooted.
Leaves.—Simple, alternate; very crowded at end of branches; petiole, 1 to 1½ inches, swollen at base; blades, 6-8 x 2¼ to 3¼ inches, tapering evenly to base; obovate; apex notched, coriaceous; glabrous.
Fruit.—Only immature collected. 1½ inch peduncle. Calyx persistent; also style.
Bark.—½ inch thick; brown, scaly, and longitudinally lined; scales shed in irregular patches 3-8 inches across, and leave depressions on bole. Inner bark red, exudes latex abundantly. Solution colourless; a slight precipitate.
Wood.—Sap ill-defined, pale yellow, deepening to red.
Rays.—So fine as not to be countable; show up on quarter; 1-32 inch deep. Pores.—3,000 to 4,000 radially septate; 1 to 3, or radial chains up to 7. Conspicuous; filled with sparkling deposit, shows up on back. Soft tissue.—Absent. General.—Rings of darker wood show up, but main colour is yellow; a pale brown, firm wood. Solution wood: orange; slight precipitate. Cuts firmly. 32 lb. per cubic foot.
Locality.—Vailala River.
Date.—December, 1922.
Native names.—Baiabu (Vailala).
Remarks.—A hard wood.
Material collected.—Leaves, immature fruit, bark, wood.

Achradotypus sp., No. 227.

Small tree, 18 inch girth and 50 feet high.

Leaves.—Simple, alternate; petiole, 1 to 2 inches; blade, $3\frac{1}{2}$ to 9 x 2 to $2\frac{3}{4}$ inches; oblanceolate to lanceolate, acuminate, more or less coriaceous, glabrous.

Flowers.—Cauliflory, single, sessile white flowers arising from buds on the trunk of the tree. The floral areas form excrescences on the bole, projecting 3 inches, and having a diameter of 8 inches. These excrescences are covered with sessile flowers.

Fruit.—Very dark green, almost black, smooth, $3\frac{1}{2}$ inches long by 2 inches diameter. Generally 3 to 4 to each floral area. Contains nut $2\frac{1}{4}$ x $1\frac{1}{4}$ inches. Boat shaped. Lower part smooth, shiny, grey, streaked, and speckled with brown. Upper part rough, yellow-grey.

Bark.—Grey, brown pustular. Inner bark streaked with yellow. Exudes latex.

Wood.—Sap undefined; a red brown.

Rays.—300, red, brown; straight, broken by pores, shallow, show up as faint lines on quarter. Pores.—Clear, 4,000 to 5,000, in short, sinuous, generally radially septate (2 to 5). Soft tissue.—Very fine lines, finer than rays, connect latter; irregularly spaced, about 300 to the inch. General.—A pink, brown timber of a heavy constructional type. Solution wood: very pale pink; very faint green precipitate; cuts hard. 54 lb. per cubic foot.

Locality.—Embi, in Hydrographer range.

Date.—Flowering and fruiting in August.

Native names.—Saruka (Embi), Jaruka (Buna).

Remarks.—This little tree is the most feared sorcerer's tree in the northern division. Its appearance with the black fruit standing out at right angles to the stem is certainly remarkable, and may possibly be the cause of its choice for sorcery purposes. So feared is it that I was unable to get my boys to touch, far less carry, the specimens I collected, and it took some tact and some ingenuity to get away with them. The yield of latex is abundant, and it coagulates well, so may be worth further investigation.

Material collected.—Leaves, flowers, fruits, bark, wood.

Payena sp., No. 204.

Very large tree, girth, at 7 feet from ground, $8\frac{1}{2}$ feet; bole, 135 feet, and 170 feet over all; crown spread, 90 feet; mid girth, $7\frac{1}{2}$ feet; spur roots spread out 7 feet from the butt, and ascend to 6 feet. They are not true buttresses, however.

Leaves.—Simple, alternate; petiole, $\frac{1}{4}$ to $\frac{3}{4}$ inches; blade, $1\frac{1}{4}$ to $1\frac{5}{8}$ x $2\frac{1}{8}$ to $2\frac{3}{4}$ inches; obovate, notched, margin recurved, midrib very prominent below, coriaceous, dark green, shiny above, pale green below.

Flowers.—Terminal in groups up to 9 on a peduncle 5-16th inch long.

Fruit.—Only immature seen.

Bark.—$\frac{1}{2}$ inch thick, red-brown, scaly, pustular; the scales in parts small, irregular, 4 inches across; elsewhere on the same bole in longitudinal patches, 2 feet x 3 inches; inner bark cream, streaked with yellow; exudes latex. Solution colourless; no precipitate.

Wood.—Sap undefined, starts yellow and deepens to a rose brown.

Rays.—300 to 330, yellow, sinuous around pores; 1-100th inch deep, minute specks on quarter. Pores.—Clear, 800 to 3,500 in almost non-porous and very porous zones, more often septate 2 to 3 than single; filled with sparkling deposit. Soft tissue.—Conspicuous; wavy, concentric, more or less continuous lines about as fine as rays. The waviness is very marked. General.—A yellow-brown wood, with a straight clear grain. Solution wood: colourless; no precipitate; cuts hard; 44 lb. per cubic foot.

Locality.—Sageri, Northern Division.

Date.—August.

Native name.—Gne-gne.

Remarks.—A noble tree, but rare. The leaves are said to be used for making a red dye to stain the tappi cloth so affected in this division.

Material collected.—Leaves, flowers, immature fruit, bark, wood.

Sideroxylon novoguineense K. Sch., No. 386.

A large tree, $8\frac{1}{2}$ feet in girth, 60 feet of bole, and 80 feet over all. Slightly spur-rooted.

Leaves.—Simple, alternate; petiole, $\frac{3}{4}$ to $\frac{7}{8}$ inch; blade, $2\frac{1}{2}$ to 5 x 2 to 3 inches; oval to obovate, obtuse, margin slightly recurved, and whole blade slightly closed; midrib and veins pale yellow, prominent; coriaceous; exudes latex.

Bark.—$\frac{1}{4}$ inch thick, grey, longitudinally lined to ridged, pustular; exudes latex; inner bark streaked pink and white. Solution colourless; faint precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—600 to the inch, vey fine, but light colour; about 1-40th inch deep, but not very plain on quarter. Pores.—Small, but conspicuous, between 5,000 and 6,000 to the square inch in snake-like radial chains, septate, but hard to say how many are so, and how many are linked single pores. Soft tissue.—Links up rays by wavy minute white lines set very close together. General.—Colour, when green yellow, and when dry blue green; shows little grain. Solution wood: colourless; no precipitate. 50 lb. per cubic foot.

Locality.—Mount Obree to Laruni Spur; 7,000 to 8,000 feet.

Date.—February, 1923.

Native name.—Suoro (Laruni).

Remarks.—A hard, straight-grained timber.

Material collected.—Leaves, bark, wood.

Sideroxylon anteridiferum White & Francis ined., No. 161.

Large tree, 8 feet girth, with a 70 feet bole. Heavily buttressed.

Leaves.—Simple, alternate; petiole, 2 to $2\frac{1}{2}$ inches; blade, up to 16 x 7 inches; obviate, acuminate; lower surface copper coloured; upper, shiny green. Exudes latex from veins and midribs.

Flowers.—In axillary clusters of sessile flowers.

Rays.—180; white; wavy and sinuous, less than 100th inch deep; makes the quarter grain shiny. Pores.—Conspicuous. 1,500 to 3,000 in septate chains between the rays (2 to 7); filled with yellow deposit. Soft tissue.—Thin, wavy, more or less continuous lines cross the rays, and pass along septa of pores. About 9 to the inch, but spacing is not regular. General.—A white wood streaked with yellow pore lines. Solution wood: colourless; no precipitate. Cuts firm; 36 lb. per cubic foot.

Bark.—$\frac{1}{4}$ inch thick. Mottled green and brown. Slightly pustular, otherwise smooth. Exudes latex. Inner bark salmon streaked with pale yellow. Solution faint yellow; green precipitate.

Wood.—Sap undefined, white.
Locality.—Buna District, on the plain.
Date.—Flowers in July.
Native names.—Pako (Buna), Solio (Sangara).
Remarks.—A hard wood.
Material collected.—Leaves, flowers, bark, wood.

Sideroxylon sp., No. 325.

A large tree, 11 feet in girth, 60 feet bole, and 95 feet over all. Wide buttress up to 12 feet.

Leaves.—Simple, alternate; petiole, 5-16th to $\frac{1}{2}$ inch; blade, $2\frac{3}{4}$ to $4\frac{1}{2}$ x 1 to $1\frac{3}{5}$ inches; elliptical, tapering to a somewhat blunt point. midrib prominent below; glabrous, stiff. The blade is curved backwards along midrib, and is half closed. Young twigs are covered with a creamy bloom.

Flowers.—Axillary in groups of 4 to 14. The flower is small, pale-green, and stands on a 3-16th inch peduncle.

Wood.—Sap undefined, pale yellow.

Bark.—$\frac{5}{8}$ inch thick; smooth, except for longitudinal lines of pustules. Inner bark, light-brown, streaked with yellow. Exudes latex sparingly. Solution colourless; faint precipitate.

Rays.—200 to 240; yellow; very fine, and difficult to count; show up on quarter 1-40th inch deep as yellow specks. Pores.—Conspicuous. 2,400 to 2,800 in snake-like radial lines; radially septate, 1 to 4, evenly distributed; filled with glistening deposit. Soft tissue.—Absent. General.—A yellow uniform wood. Solution wood; colourless; faint precipitate. Cuts firmly to hard; 36 lb. per cubic foot.

Locality.—Vailala River.
Date.—December, 1922.
Native name.—Kuakeia (Vailala).
Remarks.—Medium, hard, straight grained timber.
Material collected.—Leaves, flowers, bark, wood.

Indt., No. 120.

A large tree, 7 feet in girth, with a bole of 60 feet. Hard to say whether this tree is spur-rooted or buttressed.

Leaves.—Simple, alternate; petiole, $\frac{5}{8}$ inch; blade, 3 to $4\frac{1}{2}$ x $1\frac{3}{8}$ to 2 inches; obovate or oblanceolate; entire, acuminate; petiole and branchlets rusty, tomentose.

Bark.—Grey. Most evenly longitudinally fissured or flatly ridged. Inner bark, white spotted with yellow. Exudes latex. Solution faint; no precipitate.

Wood.—Sap, 2 inches, pale yellow. Heart a red-brown.

Rays.—200, fine yellow; very sinuous round pores; show up very little on quarter. Pores.—Clear, 3,000. Single and radial septate (2 to 7), crowded between rays. Soft tissue.—Very fine rungs connect up rays. General.—A somewhat pink wood with a very interlocked grain. Solution wood: faint yellow; very faint green precipitate. Cuts firm; 41 lb. per cubic foot.

Locality.—Vanapa.
Date.—May, 1922.
Native name.—Ooka (Suku).
Material collected.—Leaves, bark, wood.

Indt., No. 391.

Large tree, 10 feet girth, and 50 feet of bole, wide branching. Buttresses up to 5 feet.

Leaves.—Simple, alternate; petiole, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches; blade, $5\frac{1}{2}$ to $7\frac{1}{2}$ x $3\frac{3}{4}$ to 4 inches; elliptical, obtuse; midrib and veins prominent, warty, covered with yellow bloom below, and pale silvery sheen with a bronze effect above; coriaceous. Exudes latex.

Bark.—$\frac{3}{8}$ inch thick; grey; very pustular. Inner bark red, faintly lined with white. Exudes latex. Solution, pale orange; slight precipitate.

Wood.—Sap undefined, a pale red-brown.

Rays.—White, 300 to 400; very fine, minutely shallow. Pores.—Clear. 1,600 to the square inch. Radially arranged in irregular wavy lines, septate (2 to 7). Contain glistening deposit. Soft tissue.—Links up the rays by minute thin white lines, very close together. Thin dark rings of wood here and there; otherwise yellow. General.—A yellow-brown wood showing little grain except on the quarter. Solution wood: pale orange; slight precipitate. Cuts hard; 50 lb. per cubic foot.

Locality.—7,000 feet on the spur of Mt. Obree.
Date.—February, 1923.
Native name.—Ame (Laruni).
Remarks.—An interlocked, medium hard wood.
Material collected.—Leaves, bark, and wood.

Ebenaceae.

Diospyros sp., No. 33.

A medium-sized tree, 6 x 70 feet bole. No buttresses.

Leaves.—Simple, alternate; petiole, $\frac{1}{4}$ to $\frac{1}{2}$ inch; blade, 6 to 9 x 2 to 3 inches; lanceolate, acuminate, glabrous; shiny above; glaucous beneath.

Fruit.—A hard, dingey, yellow, woody, pomme, globose, 4 inches diameter, enclosing four seeds, 1 x $1\frac{3}{4}$ inches.

Bark.—Green-black. Exterior very hard to cut. Inner bark, red-brown, less than $\frac{1}{4}$ inch thick. Solution tawny; strong Prussian blue precipitate.

Wood.—Pale-yellow.

Rays.—Very fine indeed; uncountable, sinuous. Pores.—1,000 to 3,500, very irregularly scattered, single and radially septate (2 to 4). Soft tissue.—Very fine indeed minute lines linking rays. General.—A pinky yellow timber with pores showing as dark lines on back and quarter. Solution wood: colourless; strong prussian blue precipitate. Cuts soft; 53 lb. per cubic foot.

Locality.—Veimauri, Vanapa, Kumusi.
Date.—April, 1922; in fruit on Vanapa.
Native names.—Bara (Suku), Gah-a (Buna), Ka-uka (Vailala).

Remarks.—Not common in the Northern Division; quite common in the forests of the Vanapa. A hard dense wood.

Material collected.—Leaves, fruit, bark, wood.

Symplocaceae.

Symplocos aggregata White & Francis ined., No. 183.

A small tree, 18 inches girth, 30 feet high. Undergrowth of rain forests.

Leaves.—Simple, alternate; petiole, 1 inch; blade, 8 x $3\frac{3}{4}$ inches; obovate or elliptical, acuminate, glabrous.

Flowers.—Sub-sessile; bunches of axillary white fragrant flowers.

Bark.—Grey, smooth.
Locality.—All rain forest country.
Date.—Flowers in July in the Northern Division.
Native name.—Yandere.
Material collected.—Leaves and flowers.

LOGANIACEAE.

Couthovia brachyura, No. 138; Fagraea racemosa, No. 181; Fagraea sp., No. 356; Fagraea obovata, No. 533.

Couthovia brachyura Gilg. and Beue, Beitr, No. 138.

Large tree, 12 feet in girth, with a bole of 50 feet. Narrow buttresses up to 15 feet, and continuing up the bole, rendering its section asymmetrical.

Leaves.—Simple, opposite, decussate; stipules sheathing twig; petiole, ½ inch; blade, 5½ to 7 x 4 to 5 inches; ovate, acute, glabrous; slightly coriaceous.

Flowers.—Terminal panicles. K.5, C.5, A.5.

Fruit.—A white irregular shaped, somewhat obcovoid drupe, 1¼ inch long x ¾ inch diameter.

Bark.—Light-brown, scaly, scales papery; inner bark, dead white. Solution pale yellow; brown precipitate.

Wood.—Sap undefined, white, soft.

Rays.—3,000, dark-brown, wavy and sinuous around pores. 1-40th inch deep; indistinct wavy lines on quarter. Pores.—Conspicuous, 700 to 2,000; irregularly scattered, radially septate 2 to 3, sometimes single. Soft tissue.—Absent. General.—A pale straight-grained wood that is quickly attacked by blue fungus. Solution wood, colourless; pale green precipitate. Cuts soft; 30 lb. per cubic foot.

Locality.—Buna District.

Date.—Flowers and fruits in July.

Native name.—Pegamba (Buna).

Remarks.—A soft light wood.

Material collected.—Leaves, flowers, wood, bark.

Fagraea racemosa, No. 181.

Small tree, 1 foot in girth, and 25 feet high. Undergrowth in rain forests.

Leaves.—Simple, opposite; petiole, ¾ inch; base of petiole a pair of leaves united to enclose stem; blade up to 10 x 5¾ inches; ovate, accuminate, glabrous.

Flowers.—Terminal panicles, 12 inches long, bearing, sessile, white, perigynous, campanulate flowers.

Locality.—Rain forests in the Buna Plains.

Date.—Flowers in July.

Native names.—Simbe (Buna), Omborupa (Wasida).

Material collected.—Leaves and flowers.

Affinities *Fagraea obvata,* No. 533.

A small tree, 15 feet high.

Leaves.—Opposite, coriaceous.

Flowers.—Campanulate, cream coloured, handsome.

Locality.—On edge of limestone precipice above Nomi River.

Date.—November, 1923.

Material collected.—Leaves and flowers.

Fagraea sp., No. 356.

A large, short-boled tree, 12 feet girth, 15 feet bole, and 35 feet over all.

Leaves.—Terminal on stout noded branchlets. Simple, opposite; petiole, ¼ inch; blade, up to 3½ x 2 inches; sub-orbicular, obtuse, coriaceous, margin recurved; midrib prominent; veins indistinct.

Flowers.—Terminal arising from axils of terminal leaves. One to each axil.

Bark.—¾ inch, dark-brown, ridged and rugged. Inner bark dead white.

Wood.—Sap undefined, white. Rays and pores invisible.

Locality.—Mt. Obree, 7,000 to 10,000, and all along Owen Stanley Range at this altitude.

Date.—January, 1923.

Remarks.—A hard wood. The last large tree met with ascending the Owen Stanley Range, and the last big-leafed tree before the tree vegetation becomes entirely small-leafed.

Material collected.—Leaves, flowers, bark, wood.

GENTIANACEA.

Limmonthemum indicum, Gris., No. 251; Exacum tetragonum, No. 636.

Limmonthemum indicum Gris., No. 251.

A small plant.

Locality.—Embi Lake.

Date.—August.

Material collected.—Leaf and flower.

Exacum tetragonum, Roxb., No. 636.

A herb, about 2 feet high.

Flowers.—Blue, conspicuous.

Locality.—Grass hills of Upper Ramu, up to 1,700 feet.

Date.—February, 1924.

Remarks.—Common.

Material collected.—Leaves, flowers.

APOCYNACEAE.

Alstonia scholaris, Nos. 29, 594; Alstonia longissima, No. 103; Alstonia macrophylla, No. 571; Voacunga papuana, No. 440.

Alstonia scholaris, R. Br., No. 29.

A large tree, 11 feet in girth, 90 feet bole, and 120 feet overall. It is very narrowly buttressed, and the buttresses extend up the trunk making it asymmetrical in section. As a rule it is more or less triangular and fluted.

Leaves.—Simple, whorled; petiole, ½ inch; blade, 4½ x 2 inches, lanceolate, entire, retuse, glabrous; coriaceous, dark green above and light green beneath; exudes latex from every broken vein.

Flowers.—Panicles of white flowers.

Bark.—½ inch thick, grey green, roughish; inner bark yellow; exudes latex abundantly. Solution colourless; faint precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—130, fine, straight, slightly dark yellow, 1-50th inch deep, showing on quarter a little. Pores.—Clear, 800, radially septate, 2 to 3, scattered. Soft tissue.—Clear, very wavy lines, running more or less concentrically 30 to the inch. General.—A uniform yellow wood. Solution wood; colourless; no precipitate: cuts soft and woolly; 32 lb. per cubic foot.

Locality.—Collected leaves near Veimauri, and flowers in Port Moresby. It is a very common tree all round the Territory on the lowlands and foothills.

Date.—May, 1922, leaves; March, 1923, flowers.

Native Names.—Devoru (Motu), Aijapo (Vailala); Amika (Evara, in Delta Division); Didima (Buna).

Remarks.—A soft, light wood suitable for inside work; requires careful drying or it blues. Known in Queensland as milkwood or white pine. "A decoction of the bark is used as a tonic and febrifuge, and is said to be an emmenagogue, anticholeric, and vulvary"—(Brown, *Minor Pro-*

ducts of Philippine Forests, Vol. III., p. 222.) "The bark of the tree furnishes a drug "Ditain," considered useful in chronic diarrhœa and dysentery."—(Bailey, *Queensland Flora,* 985.)
Material collected.—Leaves, flowers, wood, bark.

Alstonia longissima, R. Br., No. 103.

A medium sized tree, 6½ feet girth and 70 feet bole.
Leaves.—Simple, whorled; petiole, ¼ inch; blade, 7 to 12 x 2 to 4½ inches; oblanceolate, tapering to base, acute; midribs and veins thinly pubescent below.
Flowers.—Axillary in terminal panicles.
Fruit.—A pair of long (12 to 20 inches) dehiscent follicles, twist up on opening.
Bark.—Grey, fissured; inner bark yellow-brown; ½ inch thick; exudes latex.
Wood.—Sap undefined, pale yellow or white.
Rays.—Clear, 200 very fine, white, pretty straight, except when groups of bigger pores cause kinks. Very shallow, fine lines only just visible on quarter. Pores.—Exceedingly minute and crowded, 40,000; evenly scattered, hard to say whether chains of 3, 4, 5, 6, and 7 are septate or single. Zones occur where the pores are so minute as to be uncountable with hand lens. These may be more or less porous zones, and are white in colour. Soft tissue.—4 to 6 fine continuous concentric rings to the inch radius. General.—A close-grained, almost white, timber; interlocked. Solution wood; a faint yellow; no precipitate. Cuts hard; 46 lb. per cubic foot.
Locality.—Vanapa, Veimauri, Buna, Hydrographer's, all coastal country, and up foothills to 2,500 feet.
Native names.—Oua (Doura), Ewura (Buna), Ambund (Yalu).
Remarks.—Common tree with a range round the whole of Papua. It is one of the first trees to overtop the growth on the farm lands, and is in turn overtopped by the main forest species.
Material collected.—Leaves, flowers, fruit, wood.

Alstonia machrophylla Wall, No. 571.

A medium sized tree, 6 feet in girth with a bole of 35 feet, and 70 feet over all unbuttressed; very cylindrical.
Leaves.—Simple whorled; petiole ¼ inch; blade, 5½ to 7 x 1¾ to 2¾ inches; venation prominent; obovate, mucronate, thin; exudes latex.
Flowers.—Terminal, flattened, whorled panicles of white pentamerous flowers. Fragrant.
Fruit.—Follicle, 20 inches long. Only dry specimens without seed picked up on the ground.
Bark.—½ inch, thick, grey, smooth, except for pustules in irregular longitudinal lines; inner bark yellow, exudes latex. Solution colourless; no precipitate.
Wood.—Sap.—2 inches, pale yellow; heart a light brown.
Rays.—250 distinct, straight, pale 1-70 inch deep, showing up as pale specks on the quarter. Pores.—21,400; radially septate, 2 to 4; somewhat crooked between rays, so that septum sometimes diagonal. Soft tissue.—Absent. General.—A pale wood, and cuts sard, shows little or no grain, and weights 51 lb. to the cubic foot. Solution colourless, no precipitate.
Locality.—Joangey.
Date.—December, 1923.
Native name.—Qweta (Joangey).
Material collected. — Leaves, flowers, dry seed vessels, wood, bark.

Voacuma papuana, K. Sch., No. 440.

A small tree branching low down.
Flowers.—White, heavily scented.
Fruit.—A bright, orange colour, 3 inches diameter, pear-shaped, and two are joined at base.
Locality.—Page's Camp, Veimauri. Common all round territory in the lowlands.
Date.—May, 1922.
Material collected.—Leaves, flowers.

ASCLEPIADACEAE.

Hoya dimorpha, No. 243; Eu-Hoya sp. nov., No. 566.

Hoya dimorpha, No. 243.

A climber, attaining 30 to 40 feet. The stem is grey-brown, covered with corky pustules; exudes latex.
Leaves.—Simple, opposite; petiole, ½ inch; blade, 1½ to 7½ x ½ to 2¼ inches; lanceolate, acute to acuminate; fleshy, thick. Exudes latex when broken.
Flowers.—Axillary pink umbels.
Locality.—Hydrographer's.
Date.—Flowers in August.
Material collected.—Leaves.

Eu-Hoya sp. nov., No. 566.

A creeper.
Leaves.—Exudes white latex.
Flowers.—White with pink centres.
Locality.—Joangey.
Date.—December, 1923.
Remarks.—Ornamental.
Material collected.—Leaves, flowers.

CONVOLVULACEAE.

Impomoea batatas Poir., No. 564.

Flowers.—Mauve salvers.
Locality.—Kulentufu.
Date.—November, 1923.
Remarks.—The common sweet potato.
Material collected.—Leaves, flowers.

BORAGINACEAE.

Cordia subcordata, No. 439; Cordia sp., No. 63; Cordia myxa, No. 628; Zoellera procumbens Warb., No. 506.

Cordia myxa Linn, No. 628.

A large tree with a girth of 8 feet and bole of 60 feet, and attaining 80 feet over all.
Leaves.—Simple alternate; petiole, 1 inch; blade, 2 to 3 x 2 to 3 inches; cordate, obtuse; coriaceous, thin.
Flowers.—Axillary panicles of white pentamerous flowers.
Bark.—¾ inch, grey, fibrous, longitudinally lined, somewhat scaly on upper portion; inner bark white. Solution colourless. No precipitate.
Wood.—Yellow; sap undefined. Rays.—70 to 90 straight, brown, distinct; 1-20th to 1-15th inch, conspicuous on quarter owing to brown colour. Pores.—900 to 1,600 single and radially septate 2; show up as brown grooves on the longitudinal sections. Soft tissue.—Conspicuous, 80 lines to the inch, considerably thicker than rays; broken by rays, surrounds pores; shows upon back as wavy brown bands. General.—A pale wood, with pretty brown grain both on quarter and on back; smells like cedar. Solution pale brown, grey-brown precipitate.
Locality.—Lea.

Date.—January, 1924.
Native names.—Ampoing (Yabim); Akua (Laluan).
Material collected.—Leaves, wood, flowers, bark.

Cordia subcordata, No. 439.

A small, rather shapely, wide-branching tree.
Flowers.—Yellow.
Locality.—Port Moresby, near sea shore.
Date.—April, 1922.
Remarks.—A handsome tree, with ornamental flowers.
Material collected.—Leaves and flowers.

Cordia sp., No. 63.

A large, but generally crooked tree; 10 feet in girth, with a 30 feet bole; grooved up to 10 feet.
Leaves.—Simple, alternate; petiole, 1 to 2 inches; blade, 5 x 6 inches; cordate, glabrous, entire, thin.
Bark.—$\frac{1}{4}$ inch thick; scaly in places, but more or less smooth; fibrous, dark brown. Inner bark white on fresh cutting; turns a dirty green on exposure. Solution, faint yellow; faint green; precipitate.
Wood.—Sap undefined; pale yellow.
Rays.—150; wavy, but only rarely sinuous around pores; 1-40th inch deep; show up as oblongs and specks on quarter. Pores.—Conspicuous, 1,500 to 2,500 rather evenly scattered; single and radially septate (2 to 3); some impregnated with black, possibly a fungus. Soft tissue.—Very fine lines, very irregularly distanced one from the other. General.—A pinky-grey wood, with a good quarter grain. Solution wood: colourless; no precipitate. Cuts a little hard. 37 lb. per cubic foot.
Locality.—Veimauri; also Venapa and Aroa.
Date.—May, 1922.
Native names.—Amausi (Suku).
Remarks.—A soft wood; blues very quickly.
Material collected.—Leaves, wood, bark.

Zoellera procumbens, Wurbg, No. 506.

Ground cover.
Flowers.—White to mauve.
Locality.—Sarawaket, 8,000 to 12,000 feet.
Date.—November, 1923.
Material collected.—Leaves and flowers.

Verbenaceae.

Avicennia officinalis, No. 211; Clerodendron floribundum, No. 437; Clerorendron tracyanum, No. 171; Geunsia farinosa, No. 167; Gmelina sp., No. 303; Vitex sp., No. 82; Vitex cofassus, Nos. 91, 145, 590.

Avicennia officinalis, No. 211.

Medium tree, 6 feet girth and 50 feet over all; not buttressed.
Leaves.—Simple, opposite; petiole, $\frac{1}{2}$ to $\frac{3}{4}$ inch; blade, 4 to 6 x 1 to $1\frac{3}{4}$ inches; lanceolate, acute, glabrous, somewhat coriaceous; glaucous below.
Flowers.—Terminal cymes of orange sessile flowers in heads of 5 to 9.
Bark.—$\frac{1}{8}$ inch thick, smooth, green and grey; thin, papery scales; inner bark pale yellow. Solution colourless. No precipitate.
Wood.—Yellow. Sap undefined.
Rays.—200 to 250, very slightly sinuous, coarse and fine; apparently broken by lines of soft tissue; 1-80th inch deep; wavy lines on quarter. Pores.—Clear; two kinds. Very large in lines of soft tissue, 45 to the inch; filled with yellow deposit. Between the lines of soft tissue occurs porous wood. The pores are small and run 10,000 to the square inch, evenly scattered and generally septate (2-3). Soft tissue.—Very conspicuous; in wavy coarse concentric, but irregular, white lines, studded with large pores. The curious thing is that these lines not only run into each other gradually, but are here and there linked by lines at right angles—a fact noted by many authorities. General.—White wood, streaked with brown pore grooves. Solution wood; colourless; no precipitate; cuts hard; 55 lb. per cubic foot.
Locality.—Sea-coast, northern Division.
Date.—Flowers in northern division in August.
Native name.—Dada-ing.
Remarks.—The soft tissue is so porous as to render the wood easily fissile along the rings of growth. Should make a good shingle. Medium hard.
Material collected.—Leaves, flowers, wood.

Clerodendron floribundum, No. 437.

A small tree, up to 20 feet over all.
Bark.—Grey; deeply channelled or grooved and very suberous.
Locality.—Port Moresby.
Date.—April, 1922.
Remarks.—Very common.
Material collected.—Leaves and flowers.

Clerodendron tracyanum, No. 171.

Small tree-undergrowth of abandoned farm lands; 12 inches girth, and 15 feet overall.
Leaves.—Simple, opposite, stipulate; petiole, up to 6 inches; blade, 11 x 8 inches, cordate; hirsute below, densely pubescent above; scantily and irregularly serrate with a few spines.
Flowers.—Terminal corymbs of white flowers.
Fruit.—A white irregular obovoid, wrinkled; drupe, $1\frac{1}{4}$ by $\frac{1}{2}$ in.; pericarp, soft, fleshy; nut hard.
Locality.—Buna district.
Date.—Flowers and fruits in July.
Native name.—Penbagi (Buna and Binandeli).
Material collected.—Leaves, flowers, fruits.

Geunsia farinosa, No. 167.

Small tree, 15 feet high by 1 foot girth. Rambling, spreading. Springs up on old farm lands.
Leaves.—Simple, opposite; petiole, 1 inch; blade, 9 x 4 inches; lanceolate, acuminate; densely pubescent above and below; also petiole and twig.
Flowers.—In axillary panicles. Mauve.
Locality.—All old farm lands in rain forest country.
Date.—Flowers in July in Buna district.
Native name.—Ongesa (Buna).
Material collected.—Leaves and flowers.

Gmelina sessilis, White & Francis ined., No. 303.

New Guinea beech.—A large tree, with a girth of 8 feet and a bole of 70 feet; 110 feet over all. More or less buttressed to 8 feet.
Leaves.—Simple opposite (decussate); petiole, 1 inch, grooved hairy; blade, 4 to 6 x 3 to $3\frac{1}{2}$ inches; ovate, acuminate; pubescent above, hairy below; margin wavily indented. Soft.
Flowers.—Terminal spikes, 4 to 6 inches long, bearing a number of shortly pedunculated flowers grouped in threes; bract $\frac{7}{8}$ x $\frac{5}{8}$ inch below each group, and a number of smaller bracts at base of each flower.

Bark.—¼ inch thick; brown pustular longitudinally lined. Inner bark cream, streaked with yellow. Solution colourless. No precipitate.
Wood.—Sap yellow, 1½. Heart a good brown.
Rays.—100; yellow, sinuous round, and broken by pores, 1-60th inch deep. Contrast rather well with other and lighter tissue on quarter. Pores.—Clear, 1,500 to 2,500, single and septate. The septum lies at any angle, though more commonly tangential; yet three or four septa uniting at the centre of the pore are common. Soft tissue.—Absent. General.—A light straw-coloured timber showing a pretty satin quarter grain. Soluwood; colourless; no precipitate; cuts firm; 26 lb. per cubic foot.
Locality.—Baroi.
Date.—October.
Native names.—Ah-ko (Vailala); Paio (Evara).
Remarks.—A softish wood, being used in the construction of the saw-mill on the Wami. A very sound wood.
Material collected.—Leaves, bark, wood.

Vitex cofassus R.W., Nos. 91, 145, 590.

New Guinea teak.—A large tree, 8 feet in girth, with a grooved gnarled bole up to 70 feet.
Leaves.—Simple, opposite, decussate; petiole, ¾ to 2 inches; blade, 4½ to 7 x ¼ to 3 inches; lanceolate, acuminate, glabrous, thin; stem square.
Bark.—¼ inch thick, pale brown, slightly papery, more or less smooth; inner bark white streaked with yellow. Solution colourless, faint brown precipitate.
Wood.—Sap, 3 inch, yellow; heart a deep dark brown.
Rays.—100, pale yellow; slightly sinuous around pores; very fine. Show up as minute wavy lines on the quarter. Pores.—5,500 to 7,000 in less and more porous zones; single and radially septate (2); all very minute. Soft tissue.—In very thin lines, about 10 to the inch. General.—A clear brown timber, with a straight grain and a satin figure on the quarter; solution wood faint yellow; very dark red-brown precipitate; cuts hard; 42 to 46 lb. per cubic foot.
Locality.—Suputu, Venapa.
Date.—May, 1922; July, 1922.
Native names.—Anoano (Doura); Tato-o (Buna); Bai-ah (Vailala); Ka-ar (Yabim); Afas (Yalu); Ahsang (Rabaul).
Remarks.—A hard, dense wood, used for making canoe paddles, but worth attention for all sound work. It might well be called New Guinea teak.
Material collected.—Leaves, wood, bark, flowers, fruit.

Vitex sp., No. 82.

A large tree, 11 feet girth and 50 feet bole; medium buttresses, extending as ridges up the bole.
Leaves.—Compound, opposite; peduncle, 5 inches; palmate; digitate; five leaflets; petiole, ¼ to 1 inch; blade, ⅜ x 2 to 2½ inches; lanceolate; smaller ones obovate; acuminate; glabrous; shiny above.
Bark.—Less than ¼ inch thick, scaly; burnt umber. Inner bark yellow. Solution yellow. Muddy-green precipitate.
Wood.—Sap undefined; pale yellow or white.
Rays.—180; yellow. Exceedingly sinuous around, and very much broken up by pores. Show up as tiny specks on quarter. Pores.—In zones of unequal width and density. The very porous wood runs up to 5,000 to the square inch, while the least porous has only 500. Incrusted with white deposit. Soft tissue.—Clear; represented by numerous short or discontinuous, concentric, thin wavy lines. The number of these to the inch radius is irregular. General.—A grey-brown, straight-grained wood, full of tannin; solution wood muddy; strong blue precipitate; cuts on the hard side; 34 lb. per cubic foot.
Locality.—Veia Creek, alluvial flat.
Date.—May, 1922.
Native name.—Agi.
Remarks.—A light, moderately hard wood. Rare.
Material collected.—Leaves, wood, bark.

Solanaceae.

Solanum aviculare, Forst., No. 544.

A small tree, 15 feet high.
Flowers.—Blue.
Fruit.—Ellipsoidal; 1 x ½ inch; orange.
Locality.—Nomi River, at 5,000 feet.
Date.—November, 1923.
Native name.—Wasim.
Material collected.—Leaves, flowers, fruit.

Bignonaceae.

Diplanthera tetraphylla, No. 273.

Medium tree, 5½ feet in girth and 60 feet high.
Leaves.—Simple, whorled; petiole, 1¼ to 1¾ inch, covered with a felt of yellow hairs; blade, 4½ to 8½ x 2½ to 6½ inches, broadly obovate, obtuse, coriaceous, glabrous above; felt of yellow hairs below; midrib and veins prominent, yellow below; one, two, or three glands at junction with petiole; slightly auricled.
Flowers.—Erect, terminal compound corymb of pedunculate yellow flowers. The peduncles stand out at right angles or less to the spike, and they are crowded together so as to give the appearance of umbelles at a distance. Main peduncle stout, 1 inch, yellow, pubescent, bearing a flower and two secondary peduncles ¾ inch; each of these in turn bears a single flower and two tertiary peduncles ⅝ inch, each bearing two bractioles and a flower.
Bark.—Grey, rough, ridged at base; ⅝ inch; inner bark white, streaked with brown. Solution yellow. Pale-green precipitate.
Wood.—Pale yellow to white.
Rays.—220; wavy, not sinuous, but broken by larger pores, 1-60th inch deep; faint lines on quarter. Pores.—1,500 to 2,500, in zones of less and more porous wood, here and there radially septate, but more often single. Soft tissue.—Fine, broken, short white lines surround and connect up pores; in some cases merely extends in little lines on each side of pore it surrounds. General.—A pale wood, with a straight grain. Solution wood colourless; very pale-green precipitate. Cuts firm; 34 lb. per cubic foot.
Locality.—Grass patches, at altitude of 1,000 to 2,000 feet.
Date.—August, .
Remarks.—A brittle, soft wood.
Material collected.—Leaves, flowers, wood, bark.

Gesneraceae.

Aeschynanthus discorensis, No. 413; Aeschynanthus nummularius, No. 396; Cyrtandra sp., Nos. 407, 569; Cyrtandropsis monoica, No. 415; Dichrotrichum Chalmersii, No. 572; Baea lanuginosa, No. 640.

Aeschynanthus discorensis Schltr., No. 413.

A small creeper.
Flowers.—Crimson trumpets.
Locality.—Between Adai and Naro, 6,000 feet, but is to be found anywhere between 4,000 and 10,000 feet on the Owen Stanley Range.
Date.—February, 1923.
Remarks.—The stem and leaves are inconspicuous, but the flowers strew the forest floor at this time of the year.
Material collected.—Leaves and flowers.

Aeschynanthus nummularius K. Sch., No. 396.

A creeper. Clings tightly by roots on its stem to the bole of trees, while its leaves lie flat out.
Flowers.—Red.
Locality.—Owen Stanley Range. 5,000 feet.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Cyrtandra sp., Nos. 407, 569.

Small tree or shrub, 15 feet.
Leaves.—Broadly serrate.
Flowers.—Yellow.
Locality.—Between Adai and Naro, in ravines at 6,000 feet. Also above Joangey.
Remarks.—Common.
Material collected.—Flowers and leaves.

Cyrtandropsis monoica Lausb., No. 415.

Ground cover; 2 feet high.
Leaves.—Serrate.
Flowers.—White, campanulate.
Locality.—In ravines between Adai and Naro; 5,500 feet.
Date.—February, 1923.
Remarks.—Common.
Material collected.—Leaves and flowers.

Dichrotrichum Chalmersii F.v.M., No. 572.

A creeper.
Flowers.—Port wine coloured, very handsome, heavy trumpet flowers.
Locality.—Joangey and throughout from 3-5,000 feet.
Date.—December, 1923.
Material collected.—Leaves and flowers.

Baea lanuginosa Laut et Schum, No. 640.

A small plant, 12 inches high.
Flowers.—Blue.
Locality.—Hanep.
Date.—February, 1924.
Remarks.—A common plant in the grass hills of the Ramu up to 1,700 feet.
Material collected.—Leaves, flowers.

Acanthaceae.

Acanthus ilicifolius, No. 258; Justicia sp., No. 271; Calycacanthus Magnusianus, No. 637.

Acanthus ilicifolius Linn., No. 258.

A clambering more or less prostrate plant.
Leaves.—Simple, opposite, four spines set at right angles to leaves; petiole, ¾ inch; blade, 6¼ to 2¼ inches, undulate, armed with spines; apiculate, glabrous, more or less coriaceous.
Flowers.—A good blue. Boys decorate themselves with it.
Locality.—Buna Swamp.
Date.—Flowers in August.
Native name.—Seseko (Binendele).
Material collected.—Leaves and flowers.

Calycacanthus Magnusianus Linn., No. 637.

Shrub, 15 feet high.
Flowers.—Cerise, axillary and caulifloral.
Locality.—Rain forest on hills of Upper Ramu to 3,000 feet.
Date.—29th February, 1924.
Remarks.—Common.
Material collected.—Leaves, flowers.

Justicia sp., No. 271.

A plant, 2 feet high.
Leaves.—Simple, opposite, exstipulate; petiole, ¼ inch, pubescent; blade, 3 x 1½ inches; elliptical, acuminate; midrib and veins pubescent below; above slightly pubescent.
Flowers.—Diachasial cymes, white flowers.
Locality.—Soil covering in rain forest on the western spurs of the Owen Stanley Range, between 3,000 and 4,200 feet.
Date.—Flowers in August.
Remarks.—Quite common.
Material collected.—Leaves and flowers.

Rubiaceae.

Hedyotis galdiodes F. v. M., No. 412; Hydnophytum keiense, Becc. affin., No. 173; Morinda citrifolia (Linn.), Nos. 232-596; Mitregyna parvifolia Korth., No. 792; Mussaenda frondosa, No. 565; Pavetta platyclada, No. 175; Sarcocephalus cordatus (Miq.), Nos. 158, 19; Sarcocephalus sp., No. 624; ? Timonius, No. 383; Uncaria sp., No. 417; Indt., No. 137; Indt., No. 617; Gaertnera sp., No. 634.

Hedyotis galioides F. v.M., No. 412.

A small ground cover.
Flowers.—White.
Locality.—Openings in forests where fires have occurred, and graminæ invaded the ground. Between Adai and Naro; 6,000 feet.
Date.—February, 1923.
Remarks.—The fires are followed by an invasion, first, of a hard-leafed climbing fern—looks like a gleichenia—and then by grasses and this little plant.
Material collected.—Leaves and flowers.

Hydnophytum Keiense Becc.—affin., No. 173.

A common epiphyte on the trunks and branches of many different species.
Leaves.—Simple, opposite; petiole, 1 inch; blade, 10½ x 4 inches; lanceolate, acuminate, glabrous, thin.
Flowers.—Short axillary spikes of sessile flowers.
Locality.—Buna District.
Date.—Flowers in Buna District in July.
Remarks.—At the point of connexion with the host a large swelling occurs which finally forms an hemispherical growth 8 inches wide by 4 inches high. The interior of the growth is a series of holes and channels.
Material collected.—Leaves and flowers.

Morinda citrifolia Linn., Nos. 232, 596.

A small tree, very common throughout the lowlands of the Territory. Unlike the negro of West Africa, who attaches great medicinal properties to the leaves and fruits of this species, the Papuan makes no use of it.

Mitregyna parvifolia Korth., No. 792.

A medium to large tree.
Leaves.—Alternate, cordate, thin.
Fruit.—On terminal panciles.

Bark.—Grey.
Wood.—White, soft.
Locality.—Awatib.
Date.—20th July.
Native name.—Bahns (Awatib).
Remarks.—Appears to be deciduous. Used for canoe making.
Material collected.—Leaves and fruit.

Mussaenda frondosa Linn; var. *glabriflora* K. Sch., No. 565.
Flowers.—Yellow, with white bracts.
Locality.—Joangey.
Date.—December, 1923.
Remarks.—Common from sea-level to 7,000 feet.
Material collected.—Leaves, flowers.

Pavetta platyclada, No. 175.
Small tree or large shrub, 15 feet high. Spreading branches with somewhat weeping habit. Undergrowth of the Rain forests.
Leaves.—Simple, opposite; petiole, ½ inch; blade, up to 6 x 2¾ inches; obovate, acuminate, glabrous, thin.
Flowers.—Terminal compound cymes of white, slightly fragrant flowers.
Rays.—400, dark yellow or brown, of which 50 are conspicuous and coarse, and the remainder very fine and some indistinct. The coarse ones are very straight and have only little kinks to get round some of the pores. The fine ones are sinuous and are broken by the pores. They do not show up much on the quarter. The coarse ones are about 1-60th inch deep. Pores.—3,000 to 4,500, fairly evenly scattered. Single and radially septate (2-4). Soft tissue.—Absent. General.—A mouse-grey wood with a straight grain. Solution wood colourless, very faint green precipitate. Cuts firm; 35 lb. per cubic foot.
Bark.—Grey, somewhat scaly. Solution, tawny; blue precipitate.
Locality.—Rain forests of Northern Division, up to 1,500 feet.
Date.—Flowers in July.
Native name.—Guguma (Buna).
Material collected.—Flowers and leaves.

Timonius sp., No. 383.
Small shrub, 6 to 7 feet high.
Leaves.—Opposite.
Flowers.—White; very fragrant; in threes.
Locality.—Mt. Obree to Laruni spur, 6,500 feet.
Date.—February, 1923.
Material collected.—Leaves and flowers.

Sarcocephalus cordatus Miq., Nos. 19 and 158.
A tall tree with a slender bole, 8 feet girth, 60 feet bole, 90 feet over all. No buttresses.
Leaves.—Simple, opposite; petiole, 1¾ inches, twisted; blade, 8 x 5-15 x 9½ inches; ovate-cordate, acuminate, entire, glabrous above and a felt of soft hairs beneath.
Bark.—½ inch thick; light brown. Very pustular; crumbling; ridged; often twisted spirally round bole. Inner bark yellow; corky; bitter to taste. Solution, yellow to orange; no precipitate, or faint traces of precipitate.
Wood.—Sap undefined, pale yellow or white to dark yellow.
White Variety of Wood.
Rays.—180-200, yellow, slightly sinuous, sometimes prominent, sometimes obscure, very inconspicuous on the quarter. Pores.—Conspicuous. 2,400-2,500 single and radially septate, 2-3. Evenly scattered except where concentric narrow bands of small pores occur. Soft tissue.—Absent. General.—A pale-yellow or white timber, uniform grain. Solution wood colourless, no precipitate. Cuts soft and clean; 33 lb. per cubic foot.
Yellow Variety of Wood.
Rays.—250, yellow, up to 1-25th inch; show up as slightly darker oblongs on quarter; slightly sinuous around pores. Pores.—Conspicuous, 4,000 to 5,000, mostly single, a few radially septate (2) evenly scattered. Soft tissue.—Absent. General.—A saffron-coloured timber. Solution wood pale, no precipitate. Cuts soft and clean; 39 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native names.—Sabi (Suku), Tiga (Buna), Ziga (Binendele), Pepoia (Vailala).
Remarks.—The bark has a medicinal value. "Tincture of the bark is somewhat fluorescent; may be used medicinally in cases where simple bitters are indicated; appears to be useful as calumba." F. L. Bancroft, M.B., *Queensland Flora,* p. 741. "Fruit eaten. Bark soaked in water produces vomiting and cure in cases of sore stomach." Roth in the same publication. "The wood also furnishes a good dye." Bailey, *Queensland Flora,* p. 741. The wood is a useful pine substitute, and is well known in Queensland as Leichhardt Pine.
Material collected.—Leaves, wood and bark.

Sarcocephalus sp., No. 624.
A tall tree, 7½ feet in girth with a 75-ft. bole and 90 feet over all. Buttressed to 8 feet.
Leaves.—Simple, opposite; petiole, 1 inch to 1¼ inches; blade, 6 to 16 inches by 5½ to 8 inches; ovate to broadly lanceolate; somewhat cordate at base; acuminate; a felt of hairs below, glabrous above; midrib and petiole very stout; venation very clear and regular.
Flowers.—A composite head 1½ to 2 inches in diameter.
Bark.—Yellow-brown, ridged, pustular. Inner bark white.
Wood.—Sap undefined, white. Axes easily, splits well on the back.
Rays.—220, of which 50-60 are coarse and the rest are fine. 1-60th inch deep; show up as thin lines on quarter. Pores.—Conspicuous, 1,300 to 2,000; single, but more often radially septate (2-3) in zones of less or more porous wood. Soft tissue.—Absent. General.—A yellow, straight-grained wood; solution wood colourless, no precipitate; cuts soft; 27 lb. per cubic foot.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Aruntimf (Yalu).
Remarks.—There is another sarcocephalus with yellow wood and fruit eaten by pigs. This one is not eaten. See Papuan Nos. 19 and 158.
Material collected.—Leaves, wood, bark.

Uncaria sp., No. 417.
A creeper.
Leaves and stem.—Hairy.
Flowers.—Red calyx tube and greeny-yellow petals; in heads of indefinite number on 1½-in. pedicel.
Locality.—Menari; 4,000 feet.

Indt., No. 617.

A third-story tree, 25 feet high and a girth of 20 inches.

Leaves.--Large, opposite, thin, glabrous.

Flowers.—White, salver-shaped, axillary, fragrant.

Fruit.—Ovoid, 2 inches x 1¾ inches, woody nut covered with fine papery scales. Shell, ¼ inch; contains a large number of small seeds.

Bark.—Grey, pustular.

Locality.—Yalu.

Date.—December, 1923.

Native name.—Tuwind.

Material collected.—Leaves, flowers, fruit.

Indt., No. 137.

A large tree, 8 feet in girth with a bole of 45 feet. Buttressed narrowly to 8 feet.

Leaves.—Simple, alternate; petiole, ½ inch; blade, 4 to 5 inches x 2 to 2½ inches, obovate, acute, glabrous, coriaceous.

Bark.—¼ inch thick; grey-brown; scaly, scales papery. Inner bark red-brown. Solution, yellow; faint green precipitate.

Wood.—Sap undefined, dark yellow.

Rays.—200, yellow; very indistinct, very wavy, and sinuous around pores. Up to 1-40th inch deep, but very indistinct on quarter. Pores.—7,000, so small and indistinct as to make counting difficult; in more porous and less porous zones; single and radially septate (2). Soft tissue.—Absent. General.—A pale timber with a pinkish tinge; straight grained. Solution wood colourless, no precipitate. Cuts firm; 37 lb. per cubic foot.

Locality.—Saputu, Buna.

Date.—July.

Native name.—Dandike (Buna).

Material collected.—Leaves, wood, bark.

Gaertnera sp., No. 634.

A shrub up to 10 feet high.

Leaves.—Opposite, rather coriaceous.

Flowers.—Waxy, white.

Locality.—Boku River.

Date.—15th February, 1924.

Native names.—Dango-dango (Mountu), Tuku (Yonombo).

Remarks.—Common undergrowth in Rain forests.

Material collected.—Leaves, flowers.

CUCURBITACEAE.

Trichosanthes bracteata Voight, No. 375.

A creeper attaining 30 feet.

Leaves.—Acer-like.

Flowers.—Pentamerous, large white. Margins of petals, fimbriate.

Locality.—Open spaces in Rain forests or on old farm lands. Owen Stanley Range. 5,000 feet altitude.

Date.—February, 1923.

Material collected.—Leaves and flowers.

CAMPANULACEAE.

Whalenbergia gracilis, No. 369.

A herb, 18 to 24 inches high.

Flowers.—Blue.

Locality.—6,000 to 7,000 feet, grass lands, Owen Stanley Range.

Date.—February, 1923.

Material collected.—Leaves, flowers.

GOODENIACEAE.

Scaevola novo-guineensis K. Sch., No. 371A.

A scrambling shrub.

Flowers.—Yellow.

Locality.—6,000 feet up Owen Stanley Range on the edge of forest and grass land.

Date.—February, 1923.

Material collected.—Leaves and flowers.

COMPOSITAE.

Olearia sp. nov., Nos. 359, 368; Vernonia arborea, Nos. 429, 509; Brachycome sp., No. 513; Emilia prenanthoidea, No. 537; Blumea chinensis, No. 577.

Vernonia arborea Hamlt., No. 429.

A medium tree, 3 feet girth, 60 feet over all.

Leaves.—Alternate, oblanceolate, soft; twig very lenticular.

Flowers.—Lilac.

Bark.—¼ inch, grey-brown. Inner bark yellow; solution tawny, faint precipitate.

Rays.—80-90, pale yellow; showing up as specks on quarter. Pores.—Clear. 1,800 to 2,000 immersed in soft tissue; single and radially septate (2). Soft tissue.—Surrounds pores. General.—A pale-yellow or white wood. Solution wood colourless, slightly precipitate. Cuts soft and woolly; 24 lb. per cubic foot.

Locality.—Iorobaiva, 3,000 feet. Common in forests that occur in the ravines of the grassy hills of this locality.

Date.—February, 1923.

Material collected.—Leaves, flowers, wood.

Vernonia affinities V. arborea, No. 509.

A small tree 25 feet high.

Leaves.—Undersurface of leaves glaucous to copper coloured.

Flowers.—White.

Locality.—Sarawaket, edge of Libocedrus forest, and grass lands.

Date.—November, 1923.

Material collected.—Leaves, flowers, and fruit.

Olearia vernonioicles, White and Francis ined., Nos. 359, 368.

A shrub.

Leaves.—Glaucous below.

Flowers.—Axillary, white.

Locality.—Main Owen Stanley Range, 7,400 feet.

Date.—February, 1923.

Material collected.—Leaves and flowers.

Brachycome sp., No. 513.

A daisy.

Flowers.—White.

Locality.—Holes in the Libocedrus forest, 10,000 feet, Sarawaket.

Date.—November, 1923.

Material collected.—Leaves and flowers.

Emilia prenanthoidea D.C., No. 537.

A herb, 24 inches high.

Locality.—Edge of limestone precipice above Nomi River.

Date.—November, 1923.

Material collected.—Leaves, flowers.

Blumea chinensis D.C., No. 577.

A herb.

Leaves.—A common compositae.

Locality.—Joangey.

Date.—December, 1923.

Native name.—Kwetskwatolong.

Remarks.—Common in old grass lands and open spaces.
Material collected.—Leaves, flowers.

EPACRIDACEAE.

Styphelia sp., No. 501.

A shrub up to 15 feet high.
Flowers.—Small, white.
Locality.—Grass land and on edge of Libocedrus forest, Sarawaket, 6,000 to 12,000 feet.
Date.—20th November, 1923.
Material collected.—Leaves and flowers.

*FIELD NOTES DESCRIBING THOSE TREES WHOSE IDENTITY HAS NOT BEEN DETERMINED.

No. 3—

A large tree; 8 feet girth, a bole of 70 feet and 100 feet over all. Heavily buttressed.
Leaves.—Compound, alternate; stalk, 6½ to 10 inches long; leaflets alternate, about 11; petiole, ¼ inch; blade, ovate to lanceolate, 2¾ x 1¼ inches to 4 x 1¾ inches; acuminate, entire, glabrous, thin.
Bark.—¼ inch thick, greyish-green, scaly, somewhat rough through the scales coming off in irregular patches of some thickness. Inner bark salmon. Solution tawny, dirty brown precipitate.
Wood.—Sap a pale red; 2½ to 3 inches thick; heart a deep red-brown.
Rays.—200, red-brown, sinuous around and broken by pores; do not show up on quarter. Pores.—Conspicuous; 3,000 to 4,000 scattered in groups of small and large pores, single and radially septate (1 to 2 and rarely 3 or 4). Here and there narrow bands of very small pores. Pores contain red-brown deposit. Soft tissue.—Only visible in translucent section, thin red-brown wavy concentric lines joining up rays and going around pores. General.—A red-brown mahogany-like wood. Solution wood colourless, no precipitate. Cuts soft and clean; weighs 35 lb. to the cubic foot.
Locality.—Material collected near Veimauri Creek. The tree occurs all over the country falling to Galley Reach, but nowhere else did I find it.
Date.—May, 1922.
Native name.—Medobi (Suku and Motu).
Remarks.—A very useful and beautiful cabinet wood, much prized by all who have used it. Given the name of Silky Teak, under which small quantities reached the Australian market.
Material collected.—Leaves, bark, wood. Leaves sent to Mr. White.

No. 7—

A large tree, 8 feet in girth, but with a relatively short bole—45 feet at most, and 80 feet over all. Not buttressed.
Leaves.—Simple, alternate; petiole, ¾ to 1 inch; blade, 4 to 8 inches x 2 to 3¼ inches; ovate, obovate, acuminate, thin, glabrous.
Bark.—1¼ inches thick, yellow-brown, scaly, ridged flatly, rough. Inner bark burnt umber. Solution light tawny; heavy blue precipitate.
Wood.—Sap 1 inch, light-yellow or white. Heart, light-brown, streaked here and there with dark-brown veins. Exudes resin.
Rays.—120, yellow; 1-50th inch deep, show up as white lines on quarter, straight or very slightly sinuous around larger pores. Pores.—Conspicuous, 4,500 to 7,500; evenly scattered except where bands of soft tissue occur, when they are closely sown and very small. Soft tissue.—Clear; very wavy concentric bands generally occur in double or treble rows. General.—A yellow-brown wood, with streaks of red-brown; these may be due to gum which this tree exudes. Solution wood colourless, a very faint green precipitate. Cuts on the hard side; weighs 41 lb. to the cubic foot.
Locality.—Collected leaves at Veimauri.
Date.—May, 1922.
Native names.—Namanu (Motuan), Okoia (Suku).
Remarks.—The natives burn the resin and collect the lamp black, which they use for tattooing.
Material collected.—Leaves, bark, wood.

No. 11—

A large tree, 8 feet in girth, with a bole of 60 feet. No buttress roots.
Leaves.—Compound, leaflets opposite; petiolate.
Bark.—Less than ¼ inch thick, grey-brown, fairly smooth; scaly, scales shed in more or less irregular patches, leaving surface scrolled; inner bark a light-brown. Solution colourless, very faint green precipitate.
Wood.—Sap undefined, pale yellow. An oily, fragrant gum exudes from the wood, and this is much in demand for perfume among the natives.
Rays.—Clear, 140, yellow-brown, somewhat undulate, 1-60th inch deep, show up as minute brown specks on quarter. Pores.—Conspicuous, 3,800 single, rarely radially septate (2). Soft tissue.—Absent. General.—Bands of dark and light wood show up on cross section, otherwise mouse coloured. Solution wood colourless, very faint green precipitate. Cuts rather hard; weighs 45 lb. per cubic foot.
Locality.—Material collected on hills behind Veimauri Creek. It occurs in all parts of the Territory, and the scented gum is known to all natives I have met on the lowlands and foot-hills. Nowhere is it plentiful.
Date.—May, 1922.
Native name.—Manoi (Motu).
Material collected.—Wood and bark.

No. 14—

A medium to large tree, 6 feet girth, 45 feet of bole, and 70 feet over all.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 8 x 3 inches to 10 x 4½ inches; ovate, entire, acuminate, coriaceous; midrib and veins pubescent.
Bark.—So dark a brown as to be almost black; red-brown immediately below surface; inner bark yellow.
Wood.—Sap not defined; cream.
Rays.—200 to 220, do not show up on quarter. Pores.—Conspicuous, 1,800 to 3,100 in zones of thinly and thickly sown wood, singly and radially septate (2-4). Soft tissue.—Very fine close lines link up the rays, about 200 to the inch. General.—A grey wood which blues rapidly. Solution wood colourless, no precipitate. Cuts soft and clean; 41 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Maruruvani (Suku).
Remarks.—A straight-grained medium hard wood.
Material collected.—Leaves, wood, bark.

* These are arranged in numerical order.

No. 17—

A medium tree, 7-ft. girth, 35-ft. bole, and 50 feet over all; heavily buttressed.

Bark.—¼ inch thick, greeny-grey; green just below surface, pale yellow below that. Solution tawny, slight greenish-brown precipitate.

Wood.—Sap ill-defined, slightly lighter coloured than heart, and about 1 inch thick; heart a pale pink.

Rays.—Very fine, but not numerous; 60 to the inch; hard to see; fine lines on quarter. Pores.—Conspicuous, 3,000 to 4,000 single and radially septate (2), more or less evenly scattered. Soft tissue.—Absent. General.—A mouse-coloured timber. Solution wood colourless, slight greenish-brown precipitate. Cuts soft and clean; 25 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Marabo.
Remarks.—A general purpose hard wood, but the tree is rare.
Material collected.—Wood, bark.

No. 18—

A large-girthed tree, 16 feet, with a short bole, 30 feet, and with large buttresses.

Leaves.—Simple, alternate; petiole, ¼ to ⅜ inch; blade, 2½ x 1¼-2 inches; oblanceolate, entire, acute, rusty tomentose below, glabrous above.

Bark.—½ inch thick, scaly, grey-brown, rough, inner bark dark-brown. Solution tawny, blue precipitate.

Wood.—Sap, 1½ inch, light-yellow, heart light-brown.

Rays.—120, red-brown, very sinuous around pores; 1-60th inch deep, show up as specks on quarter. Pores.—Very conspicuous, 2,500 to 4,000 in less and more porous zones. Soft tissues.—These concentric continuous lines occur at irregular distances apart (about 5 to the inch). General.—Brown wood, with a walnut grain. Solution wood faint yellow, blue precipitate. Cuts soft; 41 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Kava (Suku).
Remarks.—A straight long-grained hard wood.
Material collected.—Leaves.

No. 20—

A large tree, 10 feet girth, 55 feet of bole, and 80 feet over all, very heavily buttressed.

Leaves.—Compound, alternate; stalk up to 15 inches, bearing opposite, subsessile leaflets; blade, 4 to 5½ inches x 1½ to 2½ inches; lanceolate, acuminate, shallowly crennate, glabrous.

Fruit.—A yellow drupe, 2 inches diameter, containing a fibrous nut. The pericarp is eaten, and is acid to taste, but not unpleasantly so.

Bark.—⅜ inch thick, rough, grey; inner bark pale yellow. Solution absinthe, no precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—Conspicuous; very dark brown, 90; sinuous where crossing bands of small pores, otherwise fairly straight; 1-30th inch deep, show up as dark-brown oblongs and specks on quarter. Pores.—Conspicuous, 4,000 to 7,000 in close and open sown zones septate radially (2-4), sometimes a group of 4 subdivided radially and tangentially. Soft tissue.—Absent. General.—A light-brown timber, showing mottled grain on quarter. Solution wood absinthe, no precipitate. Soft to cut; weighs 26 lb. sap and heart wood; heart wood alone, 38 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Kuli (Motu).
Remarks.—A medium soft wood.
Material collected.—Wood and bark and fruit.

No. 25—

A stout (9-ft. girth) short-boled (30-ft.) tree; heavily buttressed.

Leaves.—Simple, alternate; petiole, 3 to 7½ inches; blade, 3 x 2½ inches to 5½ x 5½ inches; cordate, acuminate, serrate; veins of lower surface tomentose.

Bark.—¼ inch thick, grey-green, fairly smooth, pale yellow below surface. Solution faint yellow, no precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—Clear yellow, coarse and fine, 85; show up indistinctly as very fine lines on quarter. Pores.—Clear, 2,000 to 2,500, evenly scattered, single and radially septate (2-3), show as brown streaks on back and quarter. Soft tissue.—Absent. General.—A grey-brown wood. Solution wood colourless, no precipitate. Cuts soft and woolly, hard to get a section; 17 lb. to the cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Homoda.
Remarks.—A soft wood, very similar to 188.
Material collected.—Leaves, wood, bark.

No. 32—

A large tree, 8 feet girth, 50 feet of bole. Not buttressed.

Leaves.—Simple, opposite; petiole, ¼ to ½ inch, blade, 3¾ x 1½ inches to 7 x 4 inches; ovate, acuminate, entire, thin, glabrous.

Bark.—¼ inch thick, greeny-brown, rough, scaly; inner bark pink. Solution colourless, no precipitate.

Wood.—Sap undefined, yellow-brown; dense interlocked grain.

Rays.—180, yellow, fine, sinuous around pores, not visible on quarter. Pores.—7,000 to 9,000, evenly scattered, single, exceptionally radially septate. Soft tissue.—Very hard to see; fine lines linking up rays. General.—Yellow close-grained wood. Solution wood colourless, no precipitate. Cuts firmly; 49 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Kia.
Material collected.—Leaves, bark, wood.

No. 35—

A large tree, without buttresses.

Leaves.—Simple, alternate; petiole, ¼ to ⅜ inch; blade, 6 to 7 inches x 2 to 2¼ inches; oblanceolate, entire, acute, glabrous, somewhat coriaceous.

Bark.—¼ inch thick, very dark brown, smooth; inner bark dead white; solution faint yellow, no precipitate.

Wood.—Sap undefined, pale yellow; grain somewhat twisted.

Rays.—250 to 300; very slightly, if at all, sinuous; broken by pores; very fine; invisible on quarter. Pores.—Clear, 1,400 to 2,000, unevenly scattered; single or radially septate (2-3), and here and there tangentially septate (2). Soft tissue.—Very fine indeed, linking up rays. General.—

A grey timber, subject to blueing; solution wood colourless, muddy discoloration; cuts soft; 29 lb. per cubic foot.
Locality.—Foothills behind Veimauri.
Date.—May, 1922.
Native name.—Kue (Suku).
Remarks.—A medium soft wood.
Material collected.—Leaves, wood, and bark.

No. 37—

A medium tree, 7 feet in girth with a bole of 35 feet. No buttresses.

Leaves.—Simple, alternate; petiole, $1\frac{3}{4}$ to 2 inches; blade, $10\frac{1}{2}$ to 12 inches by $3\frac{1}{2}$ inches; oblanceolate, acuminate, entire, glabrous, thin.

Bark.—$\frac{1}{2}$ inch thick, very rough; brown; scaly, scales longitudinal. Inner bark red, streaked with very dark red-brown kino. Exudes red-brown kino; solution colourless, no precipitate.

Wood.—Sap undefined, pale-yellow.

Rays.—190, yellow-brown, sinuous around and fine ones interrupted by pores, latter require transparent section to show them up. 1-50th inch deep; shows up as brown oblongs and specks on quarter. Pores.—Conspicuous, 900 to 1,700 single and radially septate (2-4). Soft tissue.—Irregular broken lines linking up pores; show up on translucent section. General.—A grey-brown timber, with a pretty enough quarter grain. Solution wood colourless, no precipitate. Soft to cut; 22 lb. per cubic foot.

Locality.—Foothills behind Veimauri.
Date.—May, 1922.
Native name.—Kibore (Suku).
Remarks.—The kino exuding from bark is said to blister the skin. The tree is rare.
Material collected.—Leaves, wood, bark.

No. 38—

A medium-sized tree, 7 feet in girth and a bole of 40 feet. Buttressed.

Bark.—1 inch thick, greeny-brown, rough. Inner bark pink.

Wood.—Sap undefined, saffron-yellow.

Rays.—170, bright yellow, very wavy, and very sinuous indeed. 1-60th inch deep; show up as oblongs on quarter. Pores.—Conspicuous, 2,500 to 5,000 irregularly scattered, some big, some small, single and radially septate 2-4. Soft tissue.—Absent. General.—A saffron-coloured, straight-grained wood. Solution wood faint yellow, no precipitate. Cuts firm; 35 lb. per cubic foot.

Locality.—Foothills behind Veimauri.
Date.—May, 1922.
Native name.—Hodi (Suku).
Remarks.—A hard straight-grained wood. A rare tree.
Material collected.—Wood and bark.

No. 39—

A large short-boled tree, 8 feet in girth and 30 feet of bole. No buttresses.

Rays.—250-300, brown, coarse and fine, latter require translucent section to show them up, 1-50th inch deep; show up as wavy lines on quarter. Pores.—1,900-3,900, irregularly sown in zones. Soft tissue.—About 40 to the inch, thin, somewhat sinuous lines crossing rays. Often two, three or more are close together with rows of pores between them. General.—A particularly pleasant timber; cuts into fine sections, has a pretty grain and should make a good cabinet wood. Its colour is a grey-mauve. Solution wood colourless, no precipitate. Cuts hard but very clean; 44 lb. per cubic foot.

Bark.—$\frac{1}{4}$ inch thick, brown, fairly smooth. Inner bark yellow.

Wood.—Sap undefined, yellow-brown.
Locality.—Veimauri foothills.
Date.—May, 1922.
Native name.—Pede.
Remarks.—A somewhat interlocked hard wood. The tree is rare.
Material collected.—Wood and bark.

No. 40—

A large tree, 8 feet in girth, with a bole of 30 feet. Buttressed.

Leaves.—Simple, alternate; petiole, $\frac{1}{2}$ inch; blade, 6 x $2\frac{1}{2}$ inches to 10 x $3\frac{1}{4}$ inches. Lanceolate, acuminate, glabrous, thin.

Bark.—$\frac{1}{4}$ inch thick, smooth, brown. Inner bark white, streaked with brown. Solution, no precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—Clear, 130, a green-brown. My specimen is from too near the buttresses so that rays are in wide curves. The individual ray is straight and unbroken, and very uniform; show up very little on quarter. Pores.—2,000 to 4,000 in thickly and thinly sown zones, single and radially septate (2). Soft tissue.—Absent. General.—A fumed oak colour; pores show up as dark streaks. A nice looking and nice working timber. Solution wood colourless, no precipitate. Cuts firm and clean; 37 lb. per cubic foot.

Locality.—Foothills of Veimauri.
Date.—May, 1922.
Native name.—Huroro (Suku).
Remarks.—A hard wood with a rather interlocked grain. A rare species.
Material collected.—Leaves, wood, bark.

No. 44—

A large tree, 11 feet in girth, with a bole of 50 feet. Small spur roots.

Leaves.—Simple, alternate; petiole, $\frac{1}{4}$ to $\frac{1}{2}$ inch; blade, 3 to 8 inches x 2 to $4\frac{3}{4}$ inches; oval, entire, apex sometimes acute, sometimes obtuse, pubescent below, glabrous above.

Bark.—$\frac{1}{2}$ inch thick, brown, rough. Inner bark red-brown. Exudes latex sparingly; solution colourless, no precipitate.

Wood.—Sap $\frac{1}{2}$ inch thick, pale yellow, heart a yellow-brown.

Rays.—250 to 300, pale, straight; do not show up on quarter.—Pores.—6,000 to 9,000, single, and here and there radially septate; evenly scattered. Soft tissue.—Absent. General.—A yellow-brown wood. Solution wood faint green, strong Prussian-blue precipitate. Cuts hard; 45 lb. per cubic foot.

Locality.—Foothills Veimauri.
Date.—May, 1922.
Native name.—Horoko (Suku).
Remarks.—A hard dense wood, showing little grain.
Material collected.—Leaves, wood, bark.

No. 45—

A large tree, 9 feet in girth and with a bole of 40 feet. No buttresses.

Leaves.—Simple, alternate; petiole, $\frac{1}{2}$ to $\frac{3}{4}$ inch; blade, 4 to $5\frac{1}{2}$ inches x $1\frac{3}{4}$ to $2\frac{1}{2}$ inches; oval, acuminate, glabrous, thin.

Bark.—½ inch thick, greeny-grey, pustular, otherwise smooth. Inner bark reddish-brown.

Wood.—Sap undefined, pale-yellow or white.

Rays.—150, dark, 1-20th inch deep; show up as oblongs and lines on quarter. Sinuous around pores and generally undulate. Pores.—800 to 1,300, single and radially septate 2-3. Evenly scattered. Soft tissue.—Absent. General.—A grey timber attacked by blue fungus. Solution wood discoloured, strong blue precipitate. Cuts very soft; 22 lb. per cubic foot.

Locality.—Foothills Veimauri.
Date.—May, 1922.
Native name.—Barikaba (Suku).
Remarks.—A soft, straight-grained timber.
Material collected.—Leaves, wood, bark.

No. 46—

A large tree with a short bole, 10 feet in girth and a bole of 25 feet.

Rays.—120, yellow, sinuous, 1-50th inch deep, but not very clear on quarter. Pores.—3,000 to 5,000 in very thickly and somewhat less thickly sown zones. Filled with white sparkling deposit. Soft tissue.—Absent. General.—A mouse-brown timber. Zones of darker wood show up on cross section, but no very distinctive grain shows up. A nice wood. Solution wood very pale yellow, no precipitate. Cuts hard; 44 lb. per cubic foot.

Bark.—¼ inch thick, light-brown, flaky. Inner bark lighter brown to yellow.

Wood.—Sap ½ inch, yellow-brown; heart light-brown.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Haki (Suku).
Remarks.—A good hardwood, fairly straight-grained, rare.
Material collected.—Wood, bark.

No. 48—

A large tree, 8½ feet in girth, with a bole of 40 feet. No buttresses.

Bark.—Less than ¼ inch thick, grey. Inner bark red-brown.

Wood.—Sap ill-defined, starting pink deepens to a light red-brown.

Rays.—260, very fine, yellow, sinuous around pores and broken by large ones; very hard to pick out on quarter. Pores.—Conspicuous, 1,200 to 1,600, single, fairly evenly scattered and conspicuous. Soft tissue.—Thin concentric wavy rings, 160 to 190 to the inch, some are double and some treble, but the bulk are single rings. General.—A pinky-yellow wood with a straight clean grain. Solution wood colourless, no precipitate. Cuts firm to hard and very clean; 46 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Fishua (Suku).
Remarks.—A straight-grained hardwood.
Material collected.—Wood.

No. 49—

A large tree, 8½ feet girth and a bole of 50 feet. Without buttresses.

Leaves.—Simple, alternate; petiole, ¼ to ½ inch; blade, 5 to 7½ inches x 2½ to 4 inches; ovate, acuminate, entire, glabrous, membranous.

Bark.—Red-brown, flaky. Inner bark a lighter red-brown; solution colourless, no precipitate.

Wood.—Sap ill-defined, deepening from a pale-red to a red-brown.

Rays.—200, yellow-brown, straight, 1-80th inch deep; show up on quarter as brown dots. Pores.—1,500 to 4,000 in thickly and thinly sown bands, single and radially septate (2-3). Soft tissue.—Conspicuous, very wavy, distinct rings linking up pores, 90-100 to the inch. General.—A pinky-yellow timber showing little grain back or quarter. Solution wood colourless, no precipitate. Cuts rather hard; 56 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Dekona.
Remarks.—A hard interlocked wood; a rare tree.
Material collected.—Leaves and wood.

No. 52—

A large tree, 7 feet in girth, with a 30-ft. bole. Not buttressed.

Bark.—A deep brown, very rough and scaly. Inner bark red-brown.

Wood.—Sap ill-defined, starting pale-yellow, gradually deepens through light red-brown to deep brown.

Rays.—170, red, very sinuous around and broken by pores, 1-60th inch deep; show up as reddish oblongs on quarter. Pores.—4,000 to 7,000; narrow bands of thickly sown, then wider bands of more thinly sown wood, single and radially septate 2. Soft tissue.—Narrow lines bounded by maximum pore density on one side, about two such lines to the inch. General.—A pinky-coloured, soft-grained timber. Solution wood copper, pale-green precipitate. Cuts rather soft; 52 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Remarks.—A hard, straight-grained wood.
Material collected.—Wood.

No. 54—

A large tree, 7 feet in girth, 30 feet high. Heavily buttressed up to 10 feet height.

Bark.—Scaly, pustular, grey, scales sometimes persistent in long plates about 9 inches wide; otherwise shedding in irregular roundish patches, leaving under-surface somewhat scrolled. Inner bark light-yellow, but turns brown on exposure. Exudes a pale latex scantily.

Wood.—Sap undefined, white with a pink tinge.

Rays.—Clear, 70 to 100, yellow, 1-80th inch deep; show up as specks on quarter, undulate but not sinuous around pores. Pores.—9,600, evenly scattered, generally single, but here and there septate radially (2-3). Soft tissue.—Absent. General.—A pinky-grey timber with good appearance. Solution wood colourless, no precipitate. Cuts rather hard; 50 lb. per cubic foot.

Locality.—Veimauri.
Date.—May, 1922.
Native name.—Hoi-ata.
Remarks.—A somewhat interlocked-grained hardwood.
Material collected.—Wood.

No. 59—

A large tree, 7 feet girth, and 40 feet of bole.

Leaves.—Simple, alternate; petiole, ¼ inch; blade, 4 to 6 inches x 1¼ to 2 inches; lanceolate, acuminate, entire, glaucous, thin.

Fruit.—A green fruit, 1¼ inches diameter; pericarp, ¼ inch, green and stringy; nut, rough, brown, hard, divided into four; rats fancy it.

Bark.—¼ inch thick, grey-brown, smooth. Inner bark red-brown; solution colourless, no precipitate.
Wood.—Sap ill-defined, merging from pale-yellow to a pinky-red.
Rays.—170, yellow, sinuous around pores, 1-100th inch deep; show up as thin lines and specks on quarter. Pores.—Clear, 3,000 to 4,000 single, evenly scattered. Soft tissue.—Clear, close, rather thick, very sinuous lines. Here and there they double up; usually average ten to the inch. General.—An even-grained, brownish timber, smooth working and straight-grained. Solution wood faint green, strong prussian-blue. Cuts hard; 55 lb. per cubic foot.
Locality.—Veimauri; also found on foothills up the Vanapa.
Date.—May, 1922.
Native name.—Waranoka (Suku).
Remarks.—A hardwood.
Material collected.—Leaves and wood.

No. 62—
A large tree, 9 feet in girth and 45 feet of bole; spur roots up to 2 ft. 6 in.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 9 to 15 x 3¾ inches; lanceolate, entire, acute, glabrous, coriaceous.
Fruit.—Mango-like, 5 x 3½ inches, purple spotted with brown; kernel contained in fibrous, woody covering; eaten by cassowary.
Bark.—½ inch thick, smooth, grey, inner bark brown.
Wood.—Sap undefined, yellow; exudes a pale-yellow jelly-like gum from cambium layer.
Rays.—280, pale-yellow, sinuous around and broken by pores; show up very little on quarter, shallow. Pores.—Clear, 600 to 2,200 in close and scattered bands. Soft tissue.—Thin lines, about two to the inch. General.—A grey timber lined with dark-pore channels on back and quarter. Solution wood colourless, faint green precipitate. Cuts soft and woolly; 23 lb. per cubic foot.
Locality.—Veimauri foothills; also Vanapa.
Date.—May, 1922.
Native name.—Monato (Suku).
Material collected.—Leaves, wood.

No. 64—
A large tree, 11 feet in girth and a 50-ft. bole; narrowly buttressed up to 8 feet.
Bark.—¼ inch thick, light-brown, scaly; scales papery; inner bark brown.
Wood.—Sap ill defined, pale-yellow deepening to darker yellow.
Rays.—170, yellow, exceedingly sinuous around and very much broken by pores; do not show up on quarter. Pores.—About 5,000, but very hard to count, single and radially septate (2–3), very crowded; here and there bands of less porous wood occur, followed by bands of very porous wood. Soft tissue.—Absent. General.—Mouse-grey, straight-grained wood. Solution wood colourless, faint green precipitate. Cuts rather hard; 38 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Yata-ata (Suku).
Remarks.—A hard, straight-grained timber.
Material collected.—Wood.

No. 65—
A large tree; unbuttressed, but with root swellings.
Bark.—½ inch thick, grey, smooth, except for brown pustules; inner bark light-brown.
Wood.—Sap ill defined, pale-yellow, deepening to yellow.
Rays.—110, clear, wavy and more or less sinuous around pores, but unbroken; a number of fine, very shallow ones occur; do not show up on quarter. Pores.—5,000 to 6,000, single, a few radially septate (2), rather evenly scattered. Soft tissue.—Conspicuous, thin lines, about 14 to the inch. General.—A yellow-grey wood, with a straight grain. Cuts firm; 39 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Material collected.—Wood.

No. 69—
A large tree, with medium buttresses up to 5 feet.
Bark.—Grey-brown, more or less scaly, longitudinally lined; inner bark pale-yellow; rapidly changes on exposure to a dirty green.
Wood.—Sap ill defined, merging into heart; pale-yellow, deepening to a darker yellow.
Rays.—200 to 250, grey-yellow, wavy and somewhat sinuous here and there, 1-50th inch deep; clear on quarter, showing up as lines. Pores.—9,000, very minute, single and septate, regularly scattered. Soft tissue.—Absent. General.—A pale-yellow wood, very porous. Solution wood colourless, no precipitate. Cuts rather hard; 49 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Remarks.—A hardwood.
Material collected.—Wood.

No. 70—
A large tree; narrow buttresses up to 7 feet.
Bark.—Fairly smooth, grey-brown. Inner bark a pinky-yellow; exudes a milky resin scantily.
Wood.—Sapwood ill defined, pale-yellow deepening to a reddish-yellow.
Rays.—130, coarse, yellow, sinuous around pores, 1-50th inch deep; show up as specks and lines on quarter; in addition, there are some very fine rays which are not countable. Pores.—5,000 to 6,200; single, less often radially septate (2), rarely (3); evenly scattered. Soft tissue.—Absent. General.—A grey timber with a pink tinge, straight grained. Solution wood colourless, no precipitate. Cuts rather hard; 39 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Agadave (Suku).
Material collected.—Wood.

No. 71—
A medium-sized tree, unbuttressed.
Leaves.—Compound, alternate, stalk 5 to 9 inches, leaflets alternate, blade 3 to 5½ inches x 1¼ to 1¾ inches; lanceolate and oval, entire, acuminate, glabrous, asymmetrical, thin.
Bark.—½ inch thick, ridged, light-brown, inner bark red-brown; exudes latex from next cambium.
Wood.—Sap ill defined, deepening from pale-yellow to a yellow-brown.
Rays.—220, yellow, with a shade of pink; fine, close-set and very sinuous around pores, but not broken; between 1-80th and 1-100th inch deep; show up as fine lines on the quarter. Pores.—8,500 to 15,000, in zones of more or less porous wood, very minute, some single, but mostly radially septate (2-3-4-5). Soft tissue.—80 to 160

lines to the inch, exceedingly wavy, thicker than rays, visible to the naked eye, very crowded in porous wood; here and there globules of yellow resin show up in pores. General.—A beautiful light-brown straight-grained wood, works easily, and has a penetrating fragrance like Teneriffe cedar. Solution wood colourless, no precipitate. Cuts firm and clean; 47 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Motulu.
Material collected.—Wood.

No. 72—

A large tree, 8 feet in girth and 70 feet of bole, slight root swellings.
Leaves.—Simple, alternate; petiole, ¼ inch; blade, 6 to 10 inches x 2 to 4 inches; lanceolate, glabrous, entire, acuminate, thin.
Fruit.—A drupe, 1½ on 2 inch, peduncle.
Bark.—½ inch thick, smooth, grey, inner bark yellow, spotted and streaked with red; solution colourless, no precipitate.
Wood.—Sap undefined, yellow.
Rays.—80 to 100, grey-brown, two-thirds coarse and one-third fine; straight, except for slight undulations up to 1-10th inch deep, showing up as grey splashes and oblongs on quarter; narrow streaks on back. Pores.—5,700 evenly scattered, single and some radially septate (2). Soft tissue.—Exceedingly fine lines linking up rays like ladder-rungs, about 320 to the inch. General.—Fumed-oak-coloured timber, with a very loud quarter grain. Solution wood colourless, no precipitate. Cuts soft; 37 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Kebo.
Material collected.—Leaves, bark, wood.

No. 73—

A large tree, with a girth of 8 feet and narrow buttresses, diminishing until they become grooves high up the bole.
Bark.—Less than ¼ inch thick, light-brown, shallowly ridged, stringy; inner bark pale, with yellow streaks below; solution yellow, no precipitate.
Wood.—Sap 2½ inches thick, yellow; heart dark-brown.
Rays.—190, grey, sinuous around pores; owing to colour hard to distinguish on the quarter; about 1-80th inch deep. Pores.—4,000 to 6,000, mostly single; some radially or diagonally septate. Soft tissue.—Exceedingly thin lines 7-10 to the inch; very wavy, but continuous. General.—A grey timber, with a wavy grain, contains strong yellow dye. Solution wood yellow, dark maroon precipitate. Cuts rather hard; 49 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Native name.—Moso.
Material collected.—Wood and bark.

Nos. 76 and 149—

A large tree, lightly buttressed to 3 feet.
Leaves.—Simple, opposite; petiole, 2 to 3 inches; blade, 6½ to 10½ inches x 3½ to 7½ inches; ovate-cordate, acute, entire, pubescent below and slightly so above; stem and petiole tomentose.
Bark.—Scaly, slightly ridged, brown; inner bark yellow, streaked with orange. Solution faint yellow, no precipitate.
Wood.—Sap undefined, light yellow.
Rays.—90, yellow, coarse, sinuous around pores, yellow specks on quarter, 1-60th inch deep; between the coarse are a number of very fine rays. Pores.—1,300 to 5,600 in zones of very porous and slightly porous wood; mostly single, but some radially septate (2). Soft tissue.—Absent. General.—A pale yellow and grey wood. Solution wood colourless, no precipitate. Cuts soft and woolly; 27 lb. per cubic foot.
Locality.—Veimauri; Suputu, near Buna.
Date.—May, 1922; July, 1922.
Native names.—Tavili (Suku); Boan (Buna).
Remarks.—A soft wood.
Material collected.—Leaves, wood, bark.

No. 77—

A large tree, unbuttressed, but with small root swellings.
Bark.—½ inch thick, fairly smooth, brown, exudes latex; inner bark yellow, spotted with orange.
Wood.—Sap undefined, yellow.
Rays.—120, grey brown; wavy, and somewhat sinuous around, but not broken by pores; 1-50th inch deep; showing up as dots and thin lines on quarter. Pores.—500 to 800, single and radially septate (2), surrounded by soft tissue. Soft tissue.—Clear; in very wavy and broken lines linking up and surrounding pores; about 20 such lines to the inch. General.—A grey wood, streaked with grey brown pores. Solution wood colourless, no precipitate. Cuts soft and woolly; 31 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Remarks.—A straight-grained softwood.
Material collected.—Wood.

No. 78—

A large tree, 8 feet in girth and a 50-ft. bole; lightly buttressed to 5 feet.
Leaves.—Compound.
Bark.—¼ inch thick; scaly; bright brown. The scales shed in irregularly circular patches, leaving the trunk mottled and somewhat scrolled.
Wood.—Sap ill-defined; starting pale-yellow, it deepens to a red at heart.
Rays.—210, red, exceedingly sinuous; 1-30th inch deep; very hard to see except in transparent cross section; show up as dots on the quarter. Pores.—Clear; 2,800; single, and radially septate (2-4); evenly distributed, filled with red deposit. Soft tissue.—Very hard to see owing to its colour—red; fine, very wavy, very broken and discontinuous lines. General.—A timber of a good red colour and a straight grain; pores show up as dark red streaks on back and quarter. Solution wood colourless, faint green precipitate. Cuts hard; 38 lb. per cubic foot.
Locality.—Veimauri.
Date.—May, 1922.
Remarks.—A rare tree yielding a straight-grained hardwood.
Material collected.—Wood.

No. 83—

A large tree, 10-ft. girth, 40-ft. bole, with medium buttresses.
Leaves.—Simple, alternate; petiole, ¼ to 1 inch, twisted; blade, 3 to 5 inches x 2½ to 3½ inches; obovate, glabrous.
Bark.—Flatly ridged, brown; inner bark light brown.

Wood.—Sap ill-defined; yellow, deepening to a light brown.
Rays.—260, brown, very fine; 1-100th inch deep. In my specimen very wavy in sweeping curves. Individual rays are sufficiently sinuous to go around large pores. On a quarter they show up as thin brown lines. Pores.—2,600 to 9,000, in zones of thinly and thickly sown wood; single and radially septate (2). Soft tissue.—Irregular; short, thin, tangential lines link up pores and surround pores here and there. General.—A mouse-coloured wood with a nice grain. Cuts hard and clean; 52 lb. per cubic foot.
Locality.—Veia Creek, alluvial flat.
Date.—May, 1922.
Native name.—O I (Suku).
Material collected.—Leaves.

No. 86—

A large tree, 8 feet in girth, with a bole of 50 feet; unbuttressed.
Leaves.—Simple, alternate; petiole, 1 to 3½ inches; blade, 6 to 14 inches x 2½ to 4½ inches; oblanceolate, coriaceous; upper surface light-green, shiny; glabrous, except midrib, which has scattered hairs; and lower surface, midrib, petiole, main veins, rusty tomentose; fine veins rusty pubescent; margin wavy. The leaves of young saplings are many times greater, and the young trees have the appearance of Pandanus, with its tuft of long leaves hanging down from the summit. In large trees the leaves are bunched at the end of the branches.
Bark.—½ inch thick; smooth, save for pustules; grey; inner bark red; exudes a colourless or pale yellow sticky gum; solution colourless, faint green precipitate.
Wood.—Sap undefined, white.
Rays.—180, fairly uniform, here and there a very coarse one, really a double one; sinuous around pores; 1-50th inch deep; show up plainly as straight lines and specks on quarter. Pores.—Conspicuous; 2,500, single and radially septate (2-3), evenly scattered. Soft tissue.—Absent. General.—A pale timber with a straight grain, very light. Solution wood colourless, no precipitate. Cuts soft and woolly; 24 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Bovida (Suku).
Material collected.—Leaves, wood, bark.

No. 88—

See No. 298.
Rays.—Clear, 100, red, coarse, and fine, sinuous around pores; up to 1-5th inch deep, the average is much less. Pores.—4,000, evenly scattered, single and radially septate (2, 3, and 4). Soft tissue.—Thin lines, about three to the inch. General.—A brown, straight-grained timber. Solution wood colourless, no precipitate. Cuts fairly soft; 41 lb. per cubic foot.
Bark.—Solution colourless, absinthe precipitate.

No. 94—

A large tree with a 10-ft. girth and a 50-ft. bole, with most symmetrical buttresses up to 12 feet.
Leaves.—Simple, opposite; petiole, ½ to 2 inches; blade, 11 x 5 inches; oblanceolate, broadly acuminate, entire, thin; glands at axils of main veins and midrib.
Bark.—Scaly, brown; inner bark white, changing on exposure to a dirty green.
Wood.—Sap undefined; heart a slightly darker shade of yellow than sap.
Rays.—160, pale yellow; generally rather straight, here and there a kink to round a pore; 1-20th inch; show up as lines and oblongs on quarter. Pores.—10,000 to 12,000 large and small mixed; single and radially septate (2) appear rather evenly scattered; here and there zones of more porous wood occur; the pores here are very small, and the zones so narrow as to look like soft tissue. Soft tissue.—Absent. General.—A yellow wood. Solution wood colourless, no precipitate. Cuts fairly soft; 40 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native names.—Arubi or Arupi (Suku); Ohe (Ointatandi).
Remarks.—A dense hardwood.
Material collected.—Leaves and wood.

No. 99—

A large tree, 8 feet in girth, with a bole of 60 feet; unbuttressed.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 4 to 5 inches x 2 to 3 inches; oval to ovate, entire, acuminate, thin, glabrous above; veins beneath sparsely pubescent.
Flowers.—Not seen, but said to be very fragrant, and used by Samoan Mission teachers to scent coco-nut oil.
Bark.—1 inch thick, grey-brown; inner bark yellow-brown. Solution very pale yellow, no precipitate.
Wood.—Sap undefined, pale yellow.
Rays.—65, of which 45 are coarse, conspicuous, and up to 1-10th inch deep, showing up as oblongs and lines on quarter, and 20 are fine. The latter are sinuous, the former straight, or nearly so. Pores.—Conspicuous; 1,000 large, single, and radially septate (2-4), evenly scattered. Soft tissue.—Exceedingly fine, close lines, 160 to the inch, link the rays like rungs of a vintner's ladder. General.—A very pale yellow or white timber. Solution wood colourless, no precipitate. Cuts soft and woolly; 29 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native names.—Keroni (Suku), Inono (Doura).
Material collected.—Leaves, wood, bark.

No. 100—

A large tree, 8 feet in girth, with a bole of 55 feet; medium buttresses.
Leaves.—Simple, alternate; petiole, ¾ to 1¼ inches; blade, 9 x 4 inches; lanceolate, entire, broadly acuminate, thin, green, shiny above, glaucous to fulvous beneath.
Bark.—½ inch thick, grey-brown, shallowly fissured; inner bark pink-brown; exudes resin very slightly; solution colourless, no precipitate.
Wood.—Sap undefined, pinky yellow.
Rays.—370, very fine, yellow, wavy; broken by, and sometimes somewhat sinuous around pores; 1-70th inch deep; specks on quarter. Pores.—5,000 to 6,000, evenly scattered, single, and radially septate (2-3-4). Soft tissue.—Absent. General.—A pinky, yellow wood. Solution wood colourless, no precipitate. Cuts very hard; 41 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Asi Magani (Suku).
Material collected.—Leaves, wood, bark.

No. 101—

A large tree, 8 feet in girth, with a bole of 55 feet; narrow buttresses to 7 feet.

Leaves.—Simple, opposite; petiole, $\frac{1}{4}$ to $\frac{1}{2}$ inch: blade, $3\frac{1}{2}$ to 5 inches x 2 to $3\frac{1}{4}$ inches; ovate, acuminate, entire.

Bark.—$\frac{1}{4}$ inch thick, ridged, grey-brown; inner bark cream; solution colourless, very faint green precipitate.

Wood.—Sap undefined, yellow to pinky-white.

Rays.—240, yellow, exceedingly sinuous around pores; very shallow and hard to pick out on quarter. Pores.—9,000 to 10,000; here and there zones of less porous wood, but for the most part evenly scattered. Soft tissue.—Absent. General.—A close and straight-grained, good-looking yellow wood. Solution wood pinky yellow, no precipitate. Cuts very hard; 45 lb. per cubic foot.

Locality.—Vanapa.

Date.—May, 1922.

Native name.—Wasina (Suku).

Material collected.—Leaves, wood, bark.

No. 106—

A large tree, 10 feet in girth, with a bole of 80 feet; unbuttressed.

Leaves.—Simple, alternate; petiole, $\frac{1}{2}$ inch; blade, 6 x $3\frac{3}{4}$ inches, 6 x 3 inches, 5 x 2 inches; very variable; lanceolate to ovate, acuminate, entire, venation very prominent below; margin somewhat recurved; lower surface pubescent; main veins, midrib, petiole densely pubescent.

Bark.—$\frac{1}{4}$ to $\frac{3}{8}$ inch thick, grey-brown; inner bark light-brown; solution colourless, no precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—200, yellow, sinuous and somewhat wavy, coarse and fine, latter broken by pores; less than 1-100th inch deep; show up as very fine lines on quarter. Pores.—5,000 to 5,500, fairly evenly scattered, single. Soft tissue.—Concentric, thin continuous lines or groups of 2, 3, and 4; such lines occur at irregular distances from each other. General.—A mouse-coloured wood with a straight grain. Solution wood colourless, no precipitate. Cuts hard; 37 lb. per cubic foot.

Locality.—Vanapa.

Date.—May, 1922.

Native name.—Atu-Ia-Biahuna (Dora).

Remarks.—A very useful hardwood with a beech quarter-grain.

Material collected.—Leaves, wood.

No. 107—

A large tree, 11 feet in girth, and a bole of 40 feet.

Leaves.—Compound, alternate; stalk 9 to 11 inches, bearing 4 to 5 pairs of opposite leaflets and a terminal leaflet; petiole, $\frac{1}{4}$ inch; blade, $3\frac{1}{2}$ to 7 inches x 2 to 3 inches; oblanceolate, entire, acuminate, glabrous, thin.

Bark.—$\frac{1}{2}$ to $\frac{5}{8}$ inch thick, brown, more or less ridged; inner bark red-brown, streaked with white.

Wood.—Sap ill-defined, pale yellow, deepening to a red-brown.

Rays.—160-170, red, very sinuous round, and fine ones broken by, pores; 1-60th inch deep; pink oblongs on quarter. Pores.—Conspicuous; 1,500 to 2,500, single, and radially septate (2, rarely 3), evenly scattered; filled with sparkling deposit. Soft tissue.—Conspicuous; concentric, irregularly spaced, somewhat broken, red lines, linking up pores, and sometimes surrounding them; about 60 to the inch; three times as thick as rays. General.—A nice red wood with a mahogany grain, but harder and heavier. Solution wood: colourless; no precipitate. Cuts hard; 46 lb. per cubic foot.

Locality.—Vanapa.

Date.—May, 1922.

Material collected.—Leaves and wood.

No. 108—

A large tree, 7 feet in girth, with a 60-ft. bole, and very narrow buttresses.

Leaves.—Simple, alternate; petiole, $\frac{1}{4}$ inch; blade $5\frac{1}{2}$ to 8 inches x $2\frac{1}{4}$ to 4 inches; lanceolate, entire, glabrous, thin.

Bark.—Grey, smooth, except for pustules; inner bark white, spotted with yellow; solution colourless; absinthe precipitate.

Wood.—Sap undefined, yellow.

Rays.—254, very fine pale-brown; more wavy than sinuous, broken by large pores; very fine, scarcely distinguishable lines on quarter. Pores.—2,500 to 6,000 in closely and more lightly sown zones. Soft tissue.—Thin, irregularly spaced (about 8 to the inch), brown concentric undulate lines. General.—A mouse-coloured, smooth, interlocked grain wood. Solution wood pale brown, mirky-brown precipitate. Cuts hard; 56 lb. per cubic foot.

Locality.—Vanapa.

Date.—May, 1922.

Native name.—Fitogo.

Remarks.—A heavy, dense wood, with a very interlocked grain.

Material collected.—Wood, leaves.

No. 114—

A large tree, 9-ft. girth, with a 70-ft. bole, and spur roots rising to 5 feet.

Leaves.—Simple, opposite, stipulate; petiole, $\frac{3}{4}$ to 1 inch; blade, $1\frac{1}{2}$ to $3\frac{1}{4}$ inches x $3\frac{1}{2}$ to $7\frac{1}{2}$ inches; oval, acute, shallowly serrate, glabrous, thin.

Bark.—Smooth, grey, finely fissured; inner bark red-brown.

Wood.—Sap undefined, white.

Locality.—Vanapa.

Date.—May, 1922.

Native name.—Godita (Suku).

Material collected.—Leaves.

No. 118—

A large tree, 7 feet in girth, with a bole of 60 feet, unbuttressed.

Leaves.—Simple, opposite; petiole, $\frac{1}{4}$ inch; blade, $4\frac{1}{2}$ to 7 inches x $2\frac{1}{2}$ to $3\frac{3}{4}$ inches; obovate or oblanceolate, entire, obtuse, glabrous, thin.

Bark.—$\frac{1}{2}$ inch thick, scaly, grey; inner bark yellow.

Wood.—Sap ill-defined, starting a pale yellow, deepens to brown.

Rays.—150, yellow, very sinuous around, and broken here and there by pores; up to 1-40th inch deep; clear lines on quarter. Pores.—Conspicuous; 5,000 to 6,000 crowded between rays single and radially septate (2-3). Soft tissue.—Absent. General.—A reddish wood with close interlocked grain. Solution wood a faint yellow, no precipitate. Cuts hard; 52 lb. per cubic foot.

Locality.—Vanapa.

Date.—May, 1922.

Native name.—Supu (Suku).

Material collected.—Leaves, wood.

No. 119—

A large tree, 9-ft. girth by a 60-ft. bole.
Leaves.—Simple, alternate; petiole, ¾ to 1 inch; blade, 4 to 7 inches x 2 to 2¾ inches; oval to lanceolate, acuminate, entire, few scattered hairs on midrib (lower surface), otherwise glabrous, thin.
Bark.—Dappled grey and brown, with a streak here and there of red; inner bark pale yellow.
Wood.—Sap undefined, yellow.
Rays.—Clear, 100-110, yellow, sinuous around pores; 1-100th inch deep; show up as fine lines and little specks on quarter. Pores.—3,000 to 4,000, variation depending on degree to which pores divide; radially septate (2-4), but here and there they might be termed reticularly septate (3 to 9); encrusted with sparkling deposit. Soft tissue.—Thin, concentric rings, about 5 to the inch, sometimes only ⅓ inch apart, at other ¼ or ½ inch from each other. General.—A mouse-grey timber. Solution wood faint yellow, green precipitate. Cuts firm; 36 lb. per cubic foot.
Locality.—Vanapa.
Date.—May, 1922.
Native name.—Tikona.
Material collected.—Leaves and wood.

No. 124—

A large tree, 8-ft. girth, with a bole of 60 feet, unbuttressed.
Leaves.—Clustered at the end of the branches, simple, alternate; petiole, ¾ to 1¼ inches; blade, 3½ to 5 inches x 1¾ to 2½ inches; obovate, obtuse, glabrous, entire; exudes milky sap from every broken vein.
Bark.—1¼ inch thick, regularly pustular and scaly, the curved back edges of the scales break the smoothness of the trunk; greeny-grey; inner bark white, spotted with yellow; exudes a milky sap. Solution yellow, muddy precipitate.
Wood.—Sap undefined, yellow.
Rays.—Clear, 140, white, sinuous round pores, very hard to see on quarter. Pores.—Conspicuous, 600-1,200, large, evenly scattered, differing in density due to number of septate pores; radially septate (2-4, rarely 7, 8, and 9). Soft tissue.—Conspicuous; short thick lines surround pores and link them up in a wavy, zig-zag manner. General.—A white wood, much attacked by blue fungus. Solution wood colourless, no precipitate. Cuts soft and woolly; 37 lb. per cubic foot.
Locality.—Aroa.
Date.—22nd May.
Native name.—Ivina (Suku).
Remarks.—A hardwood.
Material collected.—Leaves, wood, and bark.

No. 129—

A large tree, 10½ feet in girth, and a bole of 80 feet, with small buttresses up to 4 feet. It reaches 120 feet in height.
Leaves.—Compound, alternate; stalk 12 to 23 inches, bearing 4 to 6 pairs of leaflets; these are alternate; petiole, ½ inch; blade, 3 to 4¾ inches x 1 to 1¾ inches; lanceolate, acuminate, glabrous, membranous.
Bark.—Grey-brown, 1 inch thick; inner bark yellow, streaked with brown.
Wood.—Sap yellow, 5 inches, heart light brown.
Rays.—200, very sinuous; up to 1-50th inch deep; showing up as fine lines on quarter. Pores.—Clear, 2,000 to 3,000, large, radially septate (2-4); the divisions are irregular, and sometimes a further septum divides a group of 2 in 4 radially. Certain of the pores filled with yellow deposit. Soft tissue.—Clear; lines thicker than the rays, and 150 to the inch; run more or less continuously and concentrically. The lines are wavy and link up the pores, sometimes surrounding, sometimes tangential to, and sometimes crossing them along septa. General.—A very pretty brown wood, with a delightful cedar fragrance. Solution wood colourless, no precipitate. Cuts hard; 49 lb. per cubic foot.
Locality.—Aroa.
Date.—22nd May.
Native name.—Koka (Suku).
Remarks.—A hardwood.
Material collected.—Leaves, wood.

No. 140—

A large tree, 8 feet in girth, with an unbuttressed bole of 70 feet.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 7 to 8½ inches x 2½ to 3 inches; lanceolate, acuminate, glabrous above; midribs and veins rusty, pubescent below; exudes latex from every broken vein.
Bark.—1 inch thick, grey, flatly ridged; inner bark red-brown; exudes latex; solution orange, sage-green precipitate.
Wood.—Sap undefined, pale yellow.
Rays.—200, yellow, very sinuous, crushed together here and there around pores; 1-60th inch deep; indistinct on quarter; faint speckles. Pores.—2,000 to 3,500 in zones of more porous and less porous wood; single and radially septate (2 sometimes 3), encrusted with sparkling deposit. Soft tissue.—Short, broken lines, 170 to inch, about same thickness as rays, link up the latter. Sometimes continue across 2 or 3 rays, sometimes break off at first ray, and start again afresh at the other side. General.—A pale, yellow wood, clear and straight-grained. Solution wood pale yellow, green precipitate. Cuts firm; 39 lb. per cubic foot.
Locality.—Suputu, near Buna.
Date.—22nd July.
Native name.—Nambo.
Material collected.—Leaves, wood, and bark.

No. 143—

Large tree, 8-ft. girth, with a bole of 90 feet, and narrow buttresses up to 10 feet.
Leaves.—Simple alternate; petiole, ½ to ¾ inch; blade, 6 to 9 inches x 2½ to 3 inches; lanceolate, acuminate, glabrous, thin. The veins on lower surface are prominent, regular, and yellow.
Bark.—¼ inch thick, flatly ridged at butt, longitudinally lined further up; brown, dappled with grey; inner bark brown, streaked with white; exudes latex. Solution colourless; very pale blue precipitate.
Wood.—Sap undefined, white.
Rays.—280, white, very fine, slightly sinuous round and broken by pores; 1-40th inch deep; show up as lines on quarter. Pores.—2,500 to 3,000, evenly scattered, single, and radially septate (2-4). Soft tissue.—Fine, broken, irregular lines link up rays. General.—A pale yellow or white wood with a wavy grain, works smoothly enough. Cuts soft and clean; 32 lb. per cubic foot.
Locality.—Suputu, near Buna.
Date.—May, 1922.

Native name.—Dibaba (Buna).
Remarks.—Resembles 140 very markedly.
Material collected.—Leaves, wood, and bark.

No. 151—

A large tree, 7 feet in girth, with a bole of 50 feet, having medium buttresses to 6 feet.
Leaves.—Simple, opposite; petiole, ½ inch; blade, 6 to 7½ inches; lanceolate, acuminate, glabrous; more or less coriaceous.
Bark.—Yellow to red-brown, scaly, scales papery; inner bark yellow-brown.
Wood.—Sap ill-defined, starting pale yellow next bark, darkens to a deeper yellow at heart.
Rays.—160, yellow, exceedingly sinuous; 1-60th inch deep; show up clearly on quarter as lines and oblongs; very inconspicuous on back. Pores.—8,000 to 9,000, single, and radially septate (2), evenly crowded into all available space. Soft tissue.—Absent. General.—A brown wood with a pink tinge, straight-grained. Solution wood colourless, blue precipitate. Cuts rather hard; 42 lb. per cubic foot.
Locality.—Suputu, near Buna.
Date.—July, 1922.
Native name.—Lala.
Remarks.—From an outward appearance very easily confounded with Lalagi, 226, and Lala, 221. Lala, 221, may prove to be a mountain variety. Lalagi, 226, has alternate leaves with deciduous ligules:—(Wormia quercifolia.)
Material collected.—Leaves, wood, bark.

No. 152—

Large tree attaining 14 feet in girth, 100 feet of bole, and 150 feet over all; spur-rooted to a certain extent. A handsome, straight-growing tree.
Leaves.—Simple, whorled; petiole, 1¾ inches; blade, 7 to 9½ inches x 2¾ to 3 inches; oblanceolate, acute, coriaceous; pinky below; exudes latex at all veins.
Fruit.—Only old germinating fruit seen; 4 inches x 1½ inches diameter.
Bark.—¾ inch thick, red-brown, scaly, longitudinally lined; exudes latex; inner bark white, streaked with yellow. Solution colourless, no precipitate.
Wood.—Sap ill-defined; starting pale yellow, deepens to pinky yellow.
Rays.—350, yellow, sinuous around pores; 1-50th inch deep; show up as lines on quarter. Pores.—2,500 to 3,000, single and radially septate (2, rarely 3), evenly scattered. Soft tissue.—Fine, irregular lines link up rays. General.—A yellow-brown wood with a straight grain; a useful wood. Solution wood colourless, faint green precipitate. Cuts firm and clean; 37 lb. per cubic foot.
Locality.—Buna District. Best forest near village between Gona and Ointatandi.
Date.—Collected in June.
Native name.—Borua (Buna).
Remarks.—A medium softwood of good colour; polishes well, and is worth attention. Heavy, small, pure stands met with in northern division.
Material collected.—Leaves, old fruit, wood.

No. 154—

A large tree, 7½ feet in girth, with an unbuttressed bole of 55 feet.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 5½ inches x 2 inches; lanceolate, acuminate, glabrous, thin.
Bark.—Pustular, brown; inner bark cinnamon-brown, streaked with lighter brown.
Wood.—Sap undefined, white or pale yellow.
Rays.—90, coarse yellow, sinuous around big pores; 1-60th inch deep; show up as light-brown lines on quarter. In addition, there are a number of very fine rays, too fine to count. Pores—2,500 to 3,500, single, and radially septate (2-3). Soft tissue.—Very fine lines about 14 to the inch radius, unevenly spaced, somewhat undulate. General.—A mouse-coloured wood, straight-grained. Solution wood colourless, no precipitate. Cuts soft, but clean; 48 lb. per cubic foot.
Locality.—Saputa, near Buna.
Date.—July, 1922.
Native name.—Akoua.
Material collected.—Leaves, wood, bark.

No. 155—

A medium tree, 5½ feet in girth, with an unbuttressed bole of 45 feet.
Leaves.—Simple, alternate; petiole, ½ inch to 2 inches; blade, 4 to 6 inches x 1¾ inches to 2½ inches; lanceolate, acuminate, broadly serrate, glabrous, thin. The leaves are crowded at the end of the branches.
Bark.—Pustular, dappled grey and dark brown; inner bark streaked light-brown and yellow; exudes abundant flow of latex.
Wood.—Sap undefined, white or pale yellow.
Rays.—400, grey, fine, wavy, and sinuous around the few pores; 1-50th inch deep; show up well on quarter as straight lines. Pores.—1,500 to 2,000, single and septate (2). Soft tissue.—Very fine, short, broken lines, irregularly spaced, about 170 to the inch radius link up the rays General.—A grey wood with a pretty maple quarter-grain. Solution wood faint yellow, faint dirty green precipitate. Cuts firm; 41 lb. per cubic foot.
Locality.—Saputa, near Buna.
Date.—July, 1922.
Native name.—Bouye (Buna).
Material collected.—Leaves, wood, bark.

No. 156—

A medium to large tree, 8 feet in girth, with an unbuttressed bole of 30 feet.
Leaves.—Compound, alternate, stipulate (3 in 1); stalk up to 18 inches; leaves alternate, increasing in size from base to the terminal one; the last pair are opposite; petiole, ¼ inch; blade, 2 to 8 inches x 1 to 2 inches; lanceolate, acuminate, glabrous, thin.
Bark.—Dappled grey and brown. Longitudinally lined. Inner bark streaked red and white. Solution orange brown; green precipitate.
Wood.—Sap undefined; pinky yellow.
Rays.—Conspicuous, 140, brown, wavy, and slightly sinuous around pores; 1-15th inch deep; show up as oblongs on quarter. Pores.—1,500, rather evenly scattered, single and radially septate (2-3), sometimes diagonally septate. Soft tissue.—Thin, concentric lines or rings unequally spaced, about 8 to the inch. General.—A pale wood with pink tinge, with a pretty quarter-grain. Solution wood faint pink, faint green precipitate. Cuts soft; 27 lb. per cubic foot.
Locality.—Soputa, near Buna.
Date.—July, 1922.
Native name.—Tongoli.
Remarks.—A medium soft timber.
Material collected.—Leaves, bark, wood.

No. 157—

A large tree, 8½ feet in girth, with a 60-ft. bole, furnished with small buttresses up to 4 feet.
Leaves.—Simple, alternate; petiole, ¼; blade, 2¼ to 3¾ inches x 1½ inches; lanceolate, acuminate, glabrous, thin.
Bark.—½ inch thick, delicately scaly, grey-yellow; inner bark white to yellow, finely streaked with darker yellow. Solution pale yellow, no precipitate.
Wood.—Sap undefined, straw-yellow, soft, light wood.
Rays.—Clear, 140, yellow-brown, sinuous around pores; 1-30th inch deep; show up as dark-brown oblongs on quarter. Pores.—Conspicuous, 2,000 to 3,500, single, but as often septate ((2-4), in zones of porous and less porous wood. Soft tissue.—Short, broken lines join up rays; they are very fine, about 200 to the inch. In addition to these ladder rungs, there are about 10 fine rings of soft tissue to the inch radius. General.—A grey timber, with fine brown figure on the quarter. Solution wood colourless, no precipitate. Cuts soft; 25 lb. per cubic foot.
Locality.—Soputa, near Buna.
Date.—July, 1922.
Native name.—Goro (Buna).
Remarks.—A light softwood with a straight grain.
Material collected.—Wood and bark.

No. 159—

A large tree, 8 feet in girth, with a 60-ft. bole, having small buttresses up to 5 feet.
Leaves.—Simple, alternate, and sub-opposite; petiole, ¼ inch; blade, 3½ to 6 inches x 1½ to 2 inches; lanceolate, acuminate, glabrous, thin.
Bark.—Pale yellow-brown, almost cream; deciduous, leaving scroll-like markings; inner bark lighter brown. Solution old gold, Prussian blue precipitate.
Wood.—Sap undefined, red-brown.
Rays.—90 to 100, dark red-brown, very sinuous around pores; 1-50th inch deep; show up as brownish lines and oblongs on quarter. Pores.—4,500 to 6,500, closely squeezed in between rays in zones of less and more porous wood. Soft tissue.—Absent. General.—A red-brown wood with a sheen on the radial surface. Cuts rather hard; 40 lb. per cubic foot.
Locality.—Soputa, near Buna.
Date.—July, 1922.
Native name.—Moi-I.
Remarks.—A hard timber with a straight grain.
Material collected.—Leaves, wood, and bark.

No. 184—

A large tree, 8 feet in girth, with a 70-ft. bole, heavily buttressed up to 12 feet.
Leaves.—Simple, alternate; petiole, 1¾ to 3½ inches; blade, 4 to 13 inches x 3 to 7 inches; oval, acuminate, stiff, short, scattered hairs below; glabrous above, thin.
Bark.—Pustular, longitudinally lined, otherwise smooth; inner bark yellow, streaked with white.
Wood.—Sap, ½ inch, white, heart a pinky-yellow.
Rays.—Coarse, conspicuous, 60 to the inch, yellow, straight; 1-10th inch deep; show up on quarter as broad bands and oblongs. Pores.—Conspicuous, 2,500 to 3,000, single and irregularly septate (2), sometimes the septum is tangential, sometimes radial, and often diagonal. Soft tissue.—Very fine, continuous concentric lines occur at irregular distances, about 6 to the inch. General.—A straight but coarse-grained wood, light. Solution wood colourless, no precipitate. Cuts soft and woolly; 31 lb. per cubic foot.
Locality.—Soputa, near Buna.
Date.—July, 1922.
Native name.—Hangeni (Kumusi, near Oitatandi).
Remarks.—A light, soft, open-grained timber, like a Sterculiaceae.
Material collected.—Leaves, wood.

No. 186—

A medium tree, 6½ feet in girth, with a more or less buttressed bole of 55 feet.
Leaves.—Simple, opposite; petiole, ½ to 1 inch; blade, 5¾ to 11 inches x 4 to 8 inches; obovate, acute, pubescent below, glabrous above, veins prominent below, coriaceous.
Bark.—Light-brown, longitudinally scaly, scales divided by more or less vertical pustular lines, inner bark pinky-yellow, very fibrous. Solution yellow, no precipitate.
Wood.—Sap undefined, dark-yellow.
Rays.—340, yellow, sinuous around and broken by pores, about 1-120th inch deep; show up as fine white lines on quarter. Pores.—4,500 to 6,000 single and radially septate (2). Soft tissue.—Absent. General.—A yellow-brown wood. Solution wood colourless, no precipitate. Cuts hard; 51 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Wuwura (Ointatandi).
Remarks.—A dense, hard, close, interlocked-grained timber.
Material collected.—Leaves, bark, wood.

No. 188—

Large tree, 10 feet in girth, with a heavily-buttressed bole to 10 feet.
Leaves.—Simple, alternate; petiole, 1¼ to 4 inches; blade, 3 to 7 inches x 2½ to 5 inches; cordate, acuminate, bristly hairs below, glabrous above.
Bark.—¾ inch, grey, pustular, longitudinally lined; inner bark white, turning mauve next cambium. Solution yellow, no precipitate.
Wood.—Sap undefined, pale-yellow.
Rays.—Conspicuous, 100; wavy, but very little, if at all sinuous; 1-40th inch deep, showing up as shiny lines and oblongs on quarter. Pores.—Conspicuous, 2,000 to 3,000, single and septate, (1 to 4). Soft tissue.—Exceedingly minute, fine lines link up rays. General.—A straight-grained, open, porous wood, very light. Solution wood colourless, no precipitate. Cuts soft and woolly; 24 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Nahihi (Ointatandi).
Remarks.—A soft, light wood with an attractive quarter grain.
Material collected.—Leaves, bark, wood.

No. 193—

A large tree, 8 feet in girth, with a bole of 70 feet, heavily buttressed to 7 feet.
Leaves.—Simple, alternate; petiole, ¾ to 1½ inches; blade, 5 to 10½ inches x 2 to 4 inches; oval, acuminate, glabrous, thin.
Bark.—Pustular, grey, scaly, inner bark speckled cream and white. Solution colourless, slight cloudy precipitate.
Wood.—Sap ill defined, pale to deeper yellow.

Rays.—Clear, 140, coarse, yellow-brown, wavy and moderately sinuous around pores; show up as specks on quarter; very fine rays exist between coarse ones. Pores.—4,000 to 5,000 in less and more porous zones; single and radially to diagonally septate, 2–3. Soft tissue.—Hard to see, but occurs in rather broken, thin, concentric lines, generally in pairs and one pair to the inch radius. General.—A mouse-grey wood, straight-grained. Solution wood colourless, no precipitate. Cuts firm and rather hard; weighs 39 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Busa or Pusa (Buna).
Material collected.—Leaves, wood, bark.

No. 195—

A large tree, 7½ feet in girth, with an unbuttressed 90-ft. bole. The branches are crowded at the summit of the bole, forming a crown of about 30 feet in height.
Leaves.—Simple alternate; petiole, 5-16th inch; blade, 3 x 1¼ to 5½ inches x 1½ inches; oblanceolate, acuminate, glabrous, glaucous below.
Bark.—Grey-brown, smooth except for a few horizontal wrinkles; the upper part of the bole, where exposed to light, has a red to salmon colour; inner bark pale-brown, speckled with white. Solution pale yellow, no precipitate.
Wood.—Sap undefined, while or pale-yellow.
Rays.—Conspicuous, 80, yellow; coarse, straight or a little wavy, ⅕ inch deep, silver lines on quarter, lozenges on back. Pores.—1,300 to 2,000 small and few single, irregularly scattered. Soft tissue.—Very fine, 250 to the inch in ladder-rungs across the rays. General.—A white, light wood with a pretty quarter grain. Solution wood very pale yellow, no precipitate. Cuts soft; 29 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Onga.
Remarks.—A soft, light timber. The rays show up well on the quarter.
Materials collected.—Leaves, wood, bark.

No. 196—

A large tree, 9 feet in girth, with an unbuttressed bole of 50 feet.
Leaves.—Simple, alternate; petiole, 1⅛ to 1¼ inches; blade, 6 to 10½ inches x 2½ to 3¾ inches; oval, acuminate, pubescent below and on petiole and twig, above a few scattered hairs, margin fringed with hairs, glaucous below, thin.
Bark.—½ inch thick, scaly, scales shedding in irregularly-shaped plates, 1 foot across, grey and yellow-brown, inner bark pale-yellow; solution pale-yellow, no precipitate.
Wood.—Sap, 2¾ inches, pale-yellow; heart a good brown.
Rays.—Clear, 120, yellow, sinuous around pores, depth about 1-100th inch, fine lines on quarter. Pores.—Conspicuous, 4,000 to 4,500, rather evenly scattered, single but more commonly radially septate, 2–4. Soft tissue.—Thin, concentric, more or less continuous lines, often double, 8 to 12 to the inch radius; also very indistinct short or broken concentric lines. General.—A yellow-brown straight-grained wood. Solution wood colourless, no precipitate. Cuts soft; 26 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Bofere (Ointatandi).
Remarks.—A medium hardwood; should work up well.
Material collected.—Leaves, wood, bark.

No. 198—

A large tree, 7 feet in girth, with an unbuttressed bole of 60 feet.
Leaves.—Compound, alternate, stalk 16 inches, leaflets alternate; petiole, ⅜ to ½ inch; blade. 3½ to 7½ inches x 2¾ inches; lanceolate, somewhat asymmetrical, glabrous, stiff, thin.
Bark.—⅜ inch thick, scaly and pustular, red-brown and grey-brown, scales shedding off in irregularly circular patches, leaving bark a fresh red-brown; inner bark yellow, streaked with white. Solution golden-yellow, no precipitate.
Wood.—Sap straw-coloured, 2½ inches; heart a fine red-brown.
Rays.—170, yellow, less than 1-100th inch deep, fine lines on quarter. Pores.—Clear, 2,500 to 5,000 in less and more porous zones, more often radially septate (2) than single; filled with sparkling deposit and some with a red resin. Soft tissue.—Clear; exceedingly wavy, broken concentric lines about twice as thick as rays, about 80 to the inch radius; in addition, five or six continuous—sometimes double or treble—lines occur to the inch radius. General.—A good-looking red-brown wood with a straight grain. Solution wood very pale yellow, no precipitate. Cuts very hard; 46 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Kimina.
Remarks.—A good-looking, straight-grained hardwood, used by natives for axe-handles.
Material collected.—Leaves, wood, bark.

No. 200—

A large tree, 8 feet in girth, with a bole of 75 feet, heavily buttressed to 6 feet.
Leaves.—Compound, alternate. Stalk, 10 to 22 inches; leaflets, alternate; petiole, ¼ to ½ inch; blade, 4 to 10 inches x 2 to 4 inches; very asymmetrical; one side of leaf terminates higher than other on petiole; oval to lanceolate, acuminate, glabrous, thin; juvenile leaves attain 5 feet in length, while the leaflets have petiole ¼ inch; blade up to 11 inches x 4 inches, and the stalk is buttressed to the branch, making an axil ½ inch deep.
Bark.—¼ inch thick, grey, pustular; longitudinally lined, otherwise smooth; inner bark white.
Wood.—Sap undefined, pale-yellow.
Rays.—120 to 160; cream, wavy, but not sinuous to any degree; 1-100th inch deep; fine, wavy lines on quarter. Pores.—Clear, 1,000 to 1,500, small, rather evenly scattered, more often single than radially septate (2). Soft tissue.—Conspicuous; numerous coarse, white, wavy, broken and continuous concentric lines; about 50 to the inch radius, often run together. General.—A white, straight-grained wood subject to attack by blue fungus. Solution wood colourless, no precipitate. Cuts firm; 37 lb. per cubic foot.
Locality.—Kumusi, near Ointatandi.
Date.—July, 1922.
Native name.—Ondodo.
Remarks.—A hard timber with well-defined rays of soft tissue. The wood is very similar to No. 201, and in general appearance the tree is very easily confused with No. 190. *Polyscias* sp.
Material collected.—Leaves, wood, bark.

No. 201—

A large tree, 10 feet in girth, with a bole of 30 feet, heavily buttressed. The buttresses extend up the trunk, rendering it grooved and generally asymmetrical.

Leaves.—Compound, alternate. Stalk variable up to 3 ft. 9 in. long; large swelling at junction with stem; leaflets, 6 to 10 pairs, and no terminal one; opposite; petiole, ½ to 1 inch, much swollen; blade, 5 to 6 inches x 2¾ to 4½ inches; oval or lanceolate, acuminate, glabrous, thin.

Bark.—½ inch thick, mottled grey and red-brown; scaly, scales shedding in small, irregular patches; inner bark streaked light and dark yellow. Solution tawny, no precipitate.

Wood.—Sap undefined, yellow, rings of soft tissue very regular and distinct.

Rays.—170, cream, wavy and sinuous around relatively large pores, 1-100th inch deep, fine lines on quarter. Pores.—Clear, 1,000 to 2,000, fairly evenly scattered, single and radially septate; some large pores occur, though most are of medium size. Soft tissue.—Conspicuous; numerous coarse, white, wavy broken or continuous lines, about 50 to the inch radius, sometimes run together. General.—A white wood which has a pretty back grain owing to the bands of soft tissue, hard to tell from 200, not attacked by blue fungus. Solution wood colourless, no precipitate. Cuts firm to hard; 47 lb. per cubic foot.

Locality.—Kumusi, near Ointatandi.

Date.—July, 1922.

Native name.—Asawa (Buna).

Remarks.—A hardwood, difficult to separate from No. 200.

Material collected.—Leaves, bark, wood.

No. 205—

A medium to large tree, 6 feet in girth, with an unbuttressed bole of 50 feet, and attaining 85 feet over all.

Leaves.—Simple, opposite; petiole, ¼ inch; blade, 4½ inches x 2¼ to 2½ inches; oval, acuminate, coriaceous; venation very distinct and midrib prominent below.

Bark.—⅜ inch thick, scaly, yellow; scales shed in rather large plates and leave bole scroll-marked; inner bark red-brown; solution pale yellow, strong green precipitate.

Wood.—Sap ill defined; yellow, darkening to red-brown.

Rays.—130, red-brown, very sinuous, 1-120th inch deep, fine lines and specks on quarter. Pores.—Clear, 5,000 to 7,000 in zones of less and more porous wood, single and radially septate (2-3). Soft tissue.—Absent. General.—Grey-brown wood with a close, straight grain. Solution wood pale yellow; pale-green precipitate. Cuts very hard; 43 lb. per cubic foot.

Locality.—Sagari, Northern Division.

Date.—July, 1922.

Native name.—Gasara.

Remarks.—A hard, straight-grained timber.

Material collected.—Leaves, bark, wood.

No. 220—

A large tree, 13 feet in girth, with a heavily-buttressed bole of 60 feet and a wide-branching crown. Its height over all is 120 feet.

Leaves.—Compound, opposite. Stalk, 4½ inches; leaflets, 3 to 4 pairs and a terminal one; opposite; petiole, 3-16th inch; blade, 3 to 4½ inches x 1¼ to 1¾ inches; oval to lanceolate, acuminate, serrate, glabrous, thin; very shiny above, dull beneath; veins very regular and distinct.

Bark.—¼ inch thick, very light brown, scaly and pustular; inner bark red-brown.

Wood.—Sap, 2 inches, yellow; heart a red-brown, dries to a light yellow-brown.

Rays.—240, of which 120 are coarse and 120 fine, red-brown, very sinuous, 1-80th inch deep; show up as wavy lines on quarter. Pores.—Clear, 3,500 to 4,500 in zones of less and more porous wood; single, but more often radially septate (2–4); some are filled with a ruby deposit. Soft tissue.—Very faint, broken lines connect up the rays like rungs of a ladder. General.—A dark-brown, very heavy, hard, straight-grained wood. Solution wood colourless, blue precipitate. Cuts hard; 62 lb. per cubic foot.

Locality.—Hydrographer's Range, above Pernambata.

Date.—July, 1922.

Native name.—Siri (Pernambata).

Remarks.—A hard, close-grained wood.

Material collected.—Leaves, wood, bark.

No. 221—

A medium tree, 5½ feet in girth, with a bole of 50 feet, and attaining 75 feet over all.

Leaves.—Simple, sub-opposite; petiole, ⅜ inch; blade, 2¼ to 3¼ inches x 1 to 1½ inches; lanceolate, obovate, acuminate, glabrous.

Bark.—Yellow-brown, scaly, scales papery; inner bark red-brown, streaked with white. Solution sherry; strong blue precipitate.

Wood.—Sap ill-defined, straw, deepening to a jarrah-red.

Rays.—300, sinuous and wavy; 1-90th inch deep; fine lines on quarter. Pores.—8,000, very small, and evenly scattered. Soft tissue.—Clear, short, broken lines coarser than rays link up and surround pores. General.—A red-brown wood, hard, dense, showing little grain. Solution wood colourless, green precipitate; cuts very hard; 58 lb. per cubic foot.

Locality.—Hydrographer's Range, above Pernambata.

Date.—July, 1922.

Native name.—Lala.

Remarks.—From a general outward appearance this tree is hard to separate from Lala of the plains, and Lalagi. A dense hardwood.

Material collected.—Leaves, wood, bark.

No. 229—

A medium tree, 5 feet in girth, with an unbuttressed bole of 50 feet, and attaining 75 feet over all.

Leaves.—Compound, alternate; stalk, 3 inches; leaflets, 2 pairs and a terminal one, ½ to ¾ inches; blade, 2 to 4½ inches x 1¼ to 2¼ inches; oblanceolate, acuminate, glabrous, thin; midrib and veins prominent; yellow; twigs grey, slightly pustular.

Bark.—3-16th inch thick, grey, scaly, scales small, pustular; inner bark yellow.

Wood.—Sap undefined, pale yellow; exudes a resin.

Locality.—Embi, in Hydrographer's Range.

Date.—August, 1922.

Native name.—Painga.

Remarks.—A straight-grained, useful-looking wood. The resin is used by the northern division boys for tattooing. See No. 7.

Material collected.—Leaves.

No. 240—

A large tree, 8 feet in girth, with an unbuttressed bole of 75 feet, and reaching an over all height of 120 feet.

Leaves.—Compound, alternate; stalk, 6 to 12 inches; leaflets, alternate; petiole, $\frac{1}{8}$ inch; blade, $2\frac{1}{4}$ to 4 inches x 1 to $1\frac{3}{4}$ inches; asymmetrically ovate, acuminate, glabrous, thin; twig grey-brown, covered with small, red-brown lenticels.

Bark.—$\frac{1}{4}$ inch thick, nigger-brown, scaly, scales shedding in fairly large plates made up of numerous thicknesses of papery scales; inner bark yellow; solution colourless, faint green.

Wood.—Sap 2 inches, white; heart light yellow.

Rays.—290, very indistinct, owing to white colour, show up very little on quarter, sinuous. Pores.—Clear, 13,000, very small, immersed in soft tissue; more often radially septate (2-5) than single. Soft tissue.—Surrounds pores. General.—Though a pale yellow when wet, it is almost ivory white when dry; rather cross-grained; solution wood colourless, no precipitate; cuts rather hard; 48 lb. per cubic foot.

Locality.—Hydrographer's Range, below Embi Village.

Date.—August, 1922.

Native name.—Pohana (Horonda).

Remarks.—A medium, hard, straight-grained wood.

Material collected.—Leaves and bark.

No. 272—

Large tree, 8 feet girth, 100 feet over all, and bole of 70 feet. Unbuttressed.

Leaves.—Compound, alternate, exstipulate. Stalks, 12 inches; brown, white, or light-brown lenticels. Leaflets simple, sub-opposite, and a terminal one; petiole, $\frac{1}{2}$ to $\frac{5}{8}$ inch, rusty hairs; blade, $2\frac{1}{2}$ to $5\frac{1}{2}$ inches x 2 to 3 inches; ovate, acuminate; midrib and veins covered with rusty hairs below; upper surface glandulous, scabrous; leaflets increase in size from base to tip of stalk.

Flowers.—Buds; heavy, terminal erect cymose panicles.

Bark.—$\frac{1}{4}$ inch thick, grey, inner bark red-brown; solution yellow, pale green precipitate.

Wood.—Sap undefined, white to rose coloured.

Rays.—Clear, 80, yellow; a little sinuous, but chiefly when crossing soft tissue lines; 1-15th inch deep, showing up well on quarter as wavy satin lines. Pores.—Conspicuous; 1,500 to 2,000; single and radially septate (2). Soft tissue.—Short, broken, very indistinct lines join up rays; sometimes they are so close as to give the effect of a continuous zone or narrow ring of sofe tissue. General.—A pleasing mahogany-grained wood, light and soft, and very fissile along lines of soft tissue. Solution wood colourless, very pale green precipitate. Cuts firm; 28 lb. per cubic foot.

Locality.—Uberi Rest-house, 2,500 feet.

Date.—August.

Native name.—Taubobu (Seligina).

Remarks.—A very soft, open-grained timber.

Material collected.—Leaves, flower buds, wood, bark.

No. 276—

Large tree, $6\frac{1}{2}$ feet girth, 50 feet bole, 100 feet over all. Small buttresses or spur roots.

Leaves.—Simple, alternate; petiole, $\frac{1}{2}$ inch, swollen; blade, 5 to $8\frac{1}{2}$ inches x 2 to $3\frac{1}{4}$ inches; elliptical to ovate, acuminate, glabrous; midrib and veins minutely warty.

Bark.—3-16th inch thick, mottled grey and brown, scaly; scales coming off in irregular patches 8 inches across, leaving the surface more or less scrolled; inner bark red, streaked with white; exudes latex sparingly; solution colourless, faint green precipitate.

Wood.—Sap ill-defined, about $1\frac{1}{4}$ inches; white, merging to light red, then dark red.

Rays.—370, a dark red-brown; very sinuous indeed around pores, and broken by them. Pores.—Clear, 2,500 to 3,000, more often septate (2) than single; 300 to 500 pores to the square inch are filled with red resin. Soft tissue.—Red-brown lines, coarser than rays, link up the pores; they are very wavy, average 170 to the inch, and are much broken; here and there about one to the inch, two or three continuous concentric lines occur close together. General.—A dense red-brown heavy wood, showing little or no grain. Solution wood colourless, faint green precipitate. Cuts very hard, leaving shiny surface; 64 lb. per cubic foot.

Locality.—Baroe, Delta of Purari.

Date.—Collected in October, 1922.

Native names.—Ulawaipa (Vailala), Ara (Evara).

Remarks.—A sound constructional timber, and possibly good for cabinet work if it dries light enough. Being used in the construction of mill on Wami. Mr. Bethune suggests calling it Red Damoni.

Material collected.—Leaves, bark, wood.

No. 277—

Large tree, 9 feet in girth, 60 feet of bole, and 120 feet over all. Small buttresses up to $4\frac{1}{2}$ feet.

Leaves.—Simple, opposite; petiole, $\frac{1}{4}$ to $\frac{1}{2}$ inch; blade 4 to 7 inches x $2\frac{1}{2}$ to 3 inches; elliptical to obovate, acuminate, entire, glabrous. A double marginal vein. Twig attacked by gall insect at axils of leaves.

Bark.—$\frac{1}{2}$ inch thick, yellow-brown; scaly; scales for the most part papery, though here and there they shed in fairly large stiff pieces. Inner bark immediately below the scales, bright green; within yellow. Solution pale yellow, muddy blue precipitate.

Wood.—Sap ill-defined, starting yellow, deepens for 4 inches to a yellow-brown, then comes the heart, which is a very dark brown.

Rays.—230, brown; sinuous around pores; do not show up on the quarter. Pores.—5,000 to 6,000, single and radially septate (2). Soft tissue.—Short broken lines link up the pores indistinctly, while here and there rather more definite lines occur, which give the illusion of continuous rungs, but are really much broken. General.—Mouse-brown wood, rather cross-grained. Solution wood colourless, brown precipitate with a blue tinge. Cuts hard; 25 lb. per cubic foot.

Date.—Collected October, 1922.

Native name.—Harikou (Vailala), Kaipa (Evara).

Remarks.—A medium hard wood. Works easily, and should prove a useful cabinet wood, as it shows a pretty grain. When first cut it has a smell similar to *Ocotea bullata*.

Material collected.—Leaves, bark, wood.

No. 278—

Large tree, 10 feet in girth, with a bole of 50 feet, and 100 feet over all. Large buttresses up to 15 feet.

Leaves.—Simple, alternate; petiole, $\frac{3}{4}$ inch, curved and twisted; blade, 6 to 8 inches x $2\frac{1}{2}$ to $3\frac{3}{4}$ inches; ovate to lanceolate, acuminate, glabrous, thin.

Fruit.—A large fruit, $5\frac{1}{4}$ to $5\frac{1}{2}$ inches long, $2\frac{3}{4}$ inches diameter, terminating in a blunt point. Surface grey, with a texture of the grain side of pigskin. Pericarp, $\frac{1}{4}$ to $\frac{1}{2}$ inch thick, containing the seed. The seed is covered with a testa 1-16th inch thick, the surface of which carries six ribs, and when dry is somewhat woody. The seed is eaten in the same way as many other vegetable products, as an accessory to the vice of betel-nut eating.

Bark.—$\frac{7}{8}$ thick, grey, smooth except for slight horizontal wrinkles at butt; inner bark pale yellow-brown. Solution colourless, no precipitate.

Wood.—Sap undefined, pinky yellow.

Rays.—260, brown, sinuous around and broken by pores; less than 1-100th inch deep, and showing up faintly as specks on quarter. Pores.—Clear, 2,000, very evenly scattered, single and radially septate (2). Soft tissue.—About 10 undulating, thin (finer than rays), usually in pairs, concentric, continuous lines to the inch. General.—A mahogany type of wood. Solution wood colourless; no precipitate. Cuts firm; 37 lb. per cubic foot.

Locality.—Baroi River.

Date.—October, 1922.

Native names.—Haikaka (Vailala), Mori-a (Evara).

Remarks.—A soft light wood, good for internal work.

Material collected.—Leaves, fruit, bark, and wood.

No. 280—

Large tree, 10 feet girth and 80 feet bole. Not buttressed.

Leaves.—Simple, alternate; petiole, 5 to 9 inches; blade, 6 to 9 inches x $4\frac{1}{2}$ to 8 inches; cordate, acute to somewhat acuminate, glabrous, thin.

Bark.—$\frac{3}{4}$ to 1 inch, grey; scaly; scales papery; inner bark yellow; solution faint yellow, no precipitate.

Wood.—Sap yellow, $1\frac{1}{2}$ inch; heart red.

Rays.—Clear, 160, very dark brown, 1-40th inch deep; show up well as fine lines on quarter. Pores.—Clear, 2,000 to 3,000 in less and more porous zones; single more often than radially septate (2); about 500 to the square inch; are filled with a ruby resin. Soft tissue.—Absent. General.—A red-brown wood between a cedar and a mahogany, but not too straight in the grain. Cuts soft to firm. Solution wood faint yellow, no precipitate; 38 lb. per cubic foot.

Locality.—Baroi River in Purari Delta.

Date.—October, 1922.

Native names.—Medupu (Vailala), Oi-ekono (Evara).

Remarks.—A good hard wood, with a more or less interlocked grain.

Material collected.—Leaves, bark, wood.

No. 281—

Large tree, 9 feet girth, 60 feet bole, and 120 feet over all. Not buttressed.

Leaves.—Compound, alternate; stalk, 9 to 15 inches; leaflets simple, alternate; petiole, $\frac{1}{4}$ inch; blade, $1\frac{3}{4}$ to 6 inches x $\frac{7}{8}$ to $2\frac{1}{4}$ inches; lanceolate, acuminate, asymmetrical, glacous, thin.

Twig.—Grey, covered with brown lenticels.

Bark.—$\frac{1}{4}$ inch thick, purple-brown; scaly; scales papery, but shedding in fairly large pieces; inner bark dark brown. Solution colourless; pale green precipitate.

Wood.—Sap undefined; pale yellow, deepens to a pink after exposure of a few weeks.

Rays.—400, white, sinuous, broken, hard to see, do not show up on quarter. Pores.—9,000 to 10,000, rather evenly distributed; single and radially septate. Soft tissue.—More or less conspicuous, wavy, broken lines in zones closer and wider set. General.—A white or very faint yellow wood, showing little or no grain—the sap wood, which first deepens to a pink, finally turns to a brown. Solution wood colourless, no precipitate. Cuts rather hard; 47 lb. per cubic foot.

Locality.—Baroi River in Purari Delta.

Date.—October, 1922.

Native name.—Averavu (Vailala), Pai-ake-a (Evara).

Remarks.—Hard wood, with a dense interlocked grain.

Material collected.—Leaves, bark, wood.

No. 283—

Large tree, 9 feet in girth, 60-ft. bole, and 100 feet over all.

Leaves.—Compound, alternate. Stalk, 9 to 15 inches, bearing four to six pairs and a terminal leaflet; leaflets opposite; petiole, $\frac{1}{4}$ inch, very thickened; blade, 4 to 11 inches x 3 to 5 inches; glabrous; midrib very stout and prominent; base of main stalk much swollen; branches covered with scars of fallen leaf stalks.

Bark.—$\frac{3}{8}$ inch thick, brown, pustular, faintly longitudinally lined; inner bark cream, streaked with white; solution pale yellow; absinthe precipitate.

Wood.—Sap undefined, pale yellow.

Rays.—180, very sinuous around and often broken by pores; 1-50th inch deep, but hard to see on quarter. Pores.—Clear to conspicuous, 1,400 to 3,000, irregularly scattered, single and septate 2–5. Soft tissue.—Clear, wavy lines thicker than rays, continuous, 80 to the inch. General.—A pale wood streaked with brown-encrusted pore channels. Solution wood colourless, no precipitate. Cuts soft and woolly, 37 lb. per cubic foot.

Locality.—Baroi River (Vanapa).

Date.—October, 1922; May, 1922.

Native names.—Pa-uka (Vailala), Makai-i (Evara), Namuta (Suku).

Remarks.—The bark makes a strong fibre. The wood is straight-grained and free-splitting, moderately hard.

Material collected.—Leaves, bark, wood.

No. 284—

Large tree, 9 feet in girth, with a 60-ft bole and 100 feet over all; narrow buttresses up to 8 feet.

Leaves.—Simple, alternate. Stipules, $\frac{1}{4}$ to $\frac{3}{8}$ inch, auricled; petiole, 5-16th inch; blade, 2 to 4 inches x 1 to $1\frac{1}{2}$ inch; ovate or lanceolate, serrate, pubescent on midrib and veins, and rough generally below; somewhat rough above; acuminate.

Bark.—½ inch thick, brown; scaly, scales thick; inner bark rose. Solution colourless, faint green precipitate.
Wood.—Sap ill-defined, starts pale-yellow and deepens through rose to a pink.
Rays.—280, yellow, wavy and sinuous; less than 1-100th inch deep, but visible on quarter as short yellow-brown lines. Pores.—Clear, 3,500 to 4,000, single and radially septate 2. Soft tissue.—Absent. General.—A cream-coloured wood, straight-grained and yellow-streaked. Solution wood colourless, faint green precipitate. Cuts firm; 32 lb. per cubic foot.
Locality.—Baroi.
Date.—October, 1922.
Native names.—Upia (Vailala), Oni (Evara).
Remarks.—The bark yields a strong fibre, used for making nets. The wood, though soft, is appreciated for canoe making.
Material collected.—Leaves, bark, wood.

No. 286—

Large tree, 14 feet in girth, with a bole of 70 feet and 100 feet over all. Not buttressed.
Leaves.—Crowded at end of branchlets, simple, alternate; petiole, 2¼ inches; blade, up to 18 x 7½ inches; obovate, obtuse; pubescent below, glabrous above; coriacious; midrib stout, rusty tomentose below; branchlets stout.
Bark.—Grey, mottled brown, very finely longitudinally lined; inner bark red, streaked with yellow. Solution pale-yellow, no precipitate.
Wood.—Sap undefined, cream to pink.
Rays.—140, pale yellow, a little wavy, up to 1-40th inch deep; showing up as specks on quarter. Pores.—Clear, 1,000, single and radially septate 2-3; sometimes tangentially septate. Soft tissue.—Absent. General.—A pale or white wood, rays showing up yellow, pore grooves lined with blue fungus. Solution wood cloudy, no precipitate. Cuts soft; 23 lb. per cubic foot.
Locality.—Baroi.
Date.—October.
Native names.—Here (Vailala), Imou (Evara).
Remarks.—A very light, soft wood, used for canoes. The young leaves are used for cigarette paper.
Material collected.—Leaves, bark, wood.

No. 288.—

Large tree, 9 to 10 feet in girth, 75 feet of bole, and 120 feet over all. Buttressed to 8 feet and grooved beyond that height.
Leaves.—Compound, sub-opposite to opposite. Stalk very variable from 2¼ to 7 inches. Three bud-like glands below the axils; 5-9 pairs of opposite, or sup-opposite leaflets, no terminal one; petiole, ⅛ inch, bud-like gland in axil; blade, 2 to 3 inches x 1 to 1½ inches; very variable in size and shape; glabrous, thin.
Bark.—¼ inch or less, grey-brown, smooth except for irregular scales still adhering; inner bark white, streaked with yellow.
Wood.—Sap ill-defined, starting pale, darkens to yellow and on to an olive-brown; pores numerous—the larger ones in more or less concentric rings, joined up by soft tissue; rays invisible even magnified ten times.
Locality.—Baroi.
Date.—October, 1922.
Native names.—Buru-buru (Vailala), Koma (Evara).
Remarks.—A sound, dense, straight-grained, hard timber, suitable for heavy work.
Material collected.—Leaves, bark, wood.

No. 292—

Large tree, 10 feet in girth, with a bole of 80 feet, and 130 feet over all. Narrow buttresses extend up the bole, rendering it fluted to 25 feet.
Leaves.—Simple, opposite; petiole, stout, ⅜ to ¾ inch; blade, up to 11½ x 7 inches; tapering to base; obtuse at apex; margin recurved; veins and midrib prominent below; coriaceous.
Bark.—½ to ¾ inch thick, grey; scaly, scales more or less papery; at butt usually not scaly; inner bark pale-yellow, deepening on exposure. Solution amber, green precipitate.
Wood.—Sap undefined, pale-yellow; a medium, hard, close-grained timber.
Rays.—200, white, sinuous, 1-30th inch deep, but not very clear on quarter. Pores.—Clear, 9,000, rather evenly scattered, single and radially septate (2). Soft tissue.—Absent. General.—A cold yellow wood, straight-grained. Solution wood colourless; pale-green precipitate. Cuts firm to hard; 44 lb. per cubic foot.
Native name.—Komara (Evara).
Material collected.—Leaves, bark, wood.

No. 293.

Large tree, 9 feet in girth, with a 60-ft. bole, and 110 feet over all.
Leaves.—Compound, alternate. Stalk 3½ to 6 inches, bearing 1-3 pairs of alternate leaflets, the last pair are often opposite, and a terminal one; petiole, ¼ to ½ inch; blade 4 to 6 inches x 1¾ to 3½ inches; lanceolate, acuminate; midrib and veins minutely warty; glabrous, thin.
Bark.—⅛ inch thick, grey-brown; outside appearance very like No. 276, but inner bark cream; Exudes latex sparingly; solution yellow and no precipitate.
Wood.—Sap ill-defined, white merging into light-red, and then darker red.
Rays.—270, red-brown, sinuous around pores, very shallow; show up as fine specks on quarter. Pores.—Clear, 3,000 to 5,000, single and radially septate, some filled with red resin. Soft tissue.—Exceedingly wavy broken lines twice as thick as rays, about 11 to the inch radius; in addition, about 7 to the inch, concentric, continuous, often double or treble lines. General.—A good-looking, dark red-brown wood with a straight grain, very like 198. Solution wood pink, green precipitate. Cuts very hard; 47 lb. per cubic foot.
Locality.—Baroa, Kumusi, near Ointatandi.
Date.—October.
Native names.—Loloke (Vailala), Ipu (Evara), Uwore (Buna).
Remarks.—The inner heart wood is not so red as that of No. 276.
Material collected.—Leaves, bark, wood.

No. 294—

Large tree, 9 feet girth, with a 75-ft. bole, and 100 feet over all. Narrow buttresses up to 8 feet.
Leaves.—Compound, alternate; stalk, 4 to 9 inches, carrying 2-4 pairs of leaflets. (No terminal one on these specimens.) Leaflets opposite; petiole, 3-16th to ¼ inch, swollen; blade, 3½ to 6½ inches x 1¾ to 3¼ inches; ovate, oblanceolate, and elliptical; somewhat asymmetrical, acuminate, glabrous, thin.
Bark.—⅜ inch, mottled dark and light brown, latter colour due to irregular shaped scales falling off and exposing light bark below; inner bark red, streaked with white; smells of turnips. Solution colourless, cloudy precipitate .

Wood.—Sap undefined, white, deepening to a straw yellow.

Rays.—240, pale-yellow, sinuous, less than 1-100th inch deep; little specks on quarter. Pores.—3,000 to 3,500, single and radially septate (2-3). Soft tissue.—Close wavy lines thicker than rays, continuous and few broken, about 120 to the inch radius. General.—A grey timber, showing a nice walnut grain on back, which is caused by the alteration of hard and soft tissue. Solution wood colourless, no precipitate. Cuts firm; 33 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native names.—Haiaka (Vailala), Amane (Evara), Bakuma (Buna).

Remarks.—Worth attention; a useful wood.

Material collected.—Leaves, bark, wood.

No. 295—

Large tree, with a girth of 9 feet, a bole of 60 feet, and standing 100 feet over all. Buttressed up to 10 feet.

Leaves.—Apparently deciduous.

Bark.—$\frac{1}{8}$ inch thick, red-brown; scaly, scales papery, no thickness of layers; inner bark orange. Solution amber, green precipitate.

Wood.—Sap undefined, yellow and brown rings.

Rays.—240, yellow, some quite coarse, others fine; up to 1-50th inch deep; show up as specks on quarter. Pores.—Conspicuous, 1,500 to 2,000, single and radially septate (2-3). Encrusted with bright yellow deposit. Soft tissue.—Conspicuous, 60, very wavy rather broken lines to the inch radius; they are coarser than the rays, and cross the pores frequently along septa. General.—A grey-brown wood, with a pretty speckled quarter grain and walnut grain on the back due to soft tissue. Solution wood colourless, very pale-green precipitate. Cuts firm; 43 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native names.—Hiri or Hidi (Vailala), Ururo (Evara).

Remarks.—The brown rings show up well when timber is cut on back and give an oak-grained appearance.

Material collected.—Bark, wood.

No. 298, see 88—

Large tree with a girth of 9 feet, a bole of 70 feet, and 110 feet over all. Unbuttressed.

Leaves.—Compound, trifoliate, stalk to junction of lateral leaflets 2 to $3\frac{1}{2}$ inches, rarely 4 inches; petiole of lateral leaflets $\frac{3}{8}$ to $\frac{1}{2}$ inch, of terminal leaflet $\frac{3}{4}$ to $2\frac{1}{4}$ inches; blades of all three, $3\frac{1}{2}$ to 4 inches x $4\frac{3}{4}$ to 5 inches; ovate, acuminate, serrate, slightly coriaceous, glabrous; midribs and veins a yellow green; exudes a pale-red gum.

Bark.—$\frac{1}{4}$ inch thick, grey-brown, somewhat stringy and scaly, outside traversed with longitudinal white fibres; inner bark streaked pink and red. Solution colourless, precipitate a little cloudy.

Wood.—Sap undefined, pale yellow deepening to a red-brown.

Rays.—220, coarse and fine, red-brown, very slightly sinuous, generally speaking straight and regular, 1-90th inch deep, show up as nice, long, thin lines on quarter. Pores.—Clear, 4,500 to 5,000, rather evenly scattered, single and radially septate (2-4). Soft tissue.—Absent. General.—A pink wood with a contorted grain. Solution wood colourless, slightly discoloured precipitate. Cuts firm; 37 lb. per cubic foot.

Locality.—Baroe.

Date.—October.

Native names.—Koraikavivi (Vailala), Tumunu (Suku), Timé (Doura).

Remarks.—Sound for constructional purposes in round or large-sectioned timbers. Very prone to warp and twist when cut into quarterings. Apparently durable. A log on Mr. Lett's plantation that has been down 7 years is still sound.

Material collected.—Leaves, bark, wood.

No. 299—

Large tree with a girth of 10 feet, a bole of 75 feet, and 110 feet over all; no buttresses, but spur-rooted.

Leaves.—Bunched at end of branches, simple, alternate; petiole, $3\frac{1}{2}$ inches stout, curved down, and then curved again where it joins the leaf, bringing the latter horizontal; blade, up to 8 inches x 5 inches; obovate, thick, very coriaceous, covered with a grey down below, glabrous above.

Bark.—5-16th inch thick, reddish brown, pitted and scaly, surface is corky; inner bark streaked yellow and white. Solution very faint yellow, no precipitate.

Wood.—Sap undefined, white or pale-yellow.

Rays.—Clear, 200, pale yellow or white, more or less sinuous, less than 1-100th inch deep, just visible as specks on quarter. Pores.—Conspicuous, 9,000, more or less evenly scattered, single and radially septate (2-4). Soft tissue.—Fine white lines ladder-rung the rays. For the most part they start at one ray and stop at the next, but here and there continuous lines occur about 4 to the inch. They are a little finer than rays. General.—A white, light, soft wood, attacked by blue fungus which streaks the pore grooves. Solution wood colourless, no precipitate. Cuts soft, but rather clean; 28 lb. per cubic foot.

Locality.—Baroi.

Date.—23rd October, 1922.

Native names.—Horahora (Vailala), Pu-Iri (Evara).

Remarks.—A light, soft, porous wood.

Material collected.—Leaves, bark, wood.

No. 302—

Large tree, $7\frac{1}{2}$-ft. girth, 75-ft. bole, and 100 feet over all; narrow buttresses to 7 feet.

Leaves.—Crowded at extremities of branches, simple, alternate; petiole, 1 to 2 inches; blade, $3\frac{1}{2}$ to 6 inches x 2 to $2\frac{1}{2}$ inches; oblong to elliptical, serrate, acute, midribs and veins yellow, prominent; base of leaf slightly cordate.

Bark.—Grey, pustular, otherwise smooth; inner bark yellow; solution tawny, muddy precipitate.

Wood.—Sap undefined, white or pale yellow.

Rays.—350 to 450, about 60 coarse, conspicuous, wavy, and kinked here and there around a pore; 1-80th inch deep; remainder very fine and broken by pores. Pores.—Conspicuous, 1,500 to 2,500, single and septate (2-5). Soft tissue.—Absent. General.—A pale wood with brown pore grooves. Solution wood colourless, no precipitate. Cuts soft; 38 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native names.—Huda-Hu (Vailala), Ourkapu (Evara).

Remarks.—A soft, open-grained timber, useful for cases.

Material collected.—Leaves, bark, wood.

No. 309—

A large tree with a girth of 8 feet and a bole of 70 feet. More or less spur rooted.

Leaves.—Simple, alternate, subsessile; blade 8 to 11 inches x $1\frac{3}{4}$ to 3 inches; lanceolate acute; midrib and veins below covered with rusty brown hairs; also twig. Upper surface of blade in very young leaves is tomentose; in older ones it is glabrous.

Bark.—Red; covered with small $\frac{1}{2}$ to 1 inch scales which lie unevenly, giving the bole a pimply appearance; inner bark red-brown; exudes a red kino or gum, freely. Solution colourless, slightly cloudy precipitate.

Wood.—Sap undefined; yellow, with a tinge of pink caused by gum impregnating the pores.

Rays.—210, brown, wavy, 1-30 inches deep; show up as brown specks on quarter. Pores.—Clear, 1,700 to 2,000 single and radially septate (2). Soft tissue.—Brown, thin (but thicker than rays), very wavy lines; they are broken; here and there where two lines are so close as to appear to be one they may be continuous. General.—A straight grained brown wood—a brown satin wood; solution wood colourless, no precipitate; cuts firm; weighs 31 lb. per cubic foot.

Locality.—Baroi.

Date.—October.

Native name.—Buhu (Vailala) Awopo (Evara).

Remarks.—A softish wood. The winter (?) wood is red, and gives timber cut on back a pretty grain, which is accentuated by the kino impregnated pores which show up as fine reddish streaks.

Material collected.—Leaves, bark, wood.

No. 321—

A large tree, 12 feet girth, 50 feet bole, and 100 100 feet over all. Not buttressed, but gnarled, grooved and twisted with pronounced root swellings.

Leaves.—Simple, opposite; petiole $1\frac{1}{2}$ to $2\frac{1}{2}$ inches; blade 5 to 10 inches x $1\frac{1}{4}$ to 3 inches; lanceolate, acuminate, glabrous, thin; young twigs are flattened to a square section and are grooved.

Bark.—Yellow-grey; scaly, scales papery; inner bark white, streaked with orange; solution colourless, no precipitate.

Wood.—Sap $1\frac{1}{4}$ in., yellow. Heart a very dark-brown indeed.

Rays.—Clear, 200 to 270, brown, wavy turning around pores and here and there running together, shallow about 1,100th inch; showing up on quarter as fine dark-brown streaks. Pores.—Clear, 3,500 to 3,600, glistening deposit visible both back and cross. Soft tissues.—Absent. General.—A dark-brown wood with bands of light-brown, smells like *Ocotea*. Solution wood colourless, no precipitate; cuts hard but cleanly; 54 lb. per cubic foot.

Locality.—Baroi and Vailala Rivers.

Date.—December, 1922.—

Native name.—Baiah (Vailala).

Remarks.—A hard sound wood, having a faint scent like *Ocotea*. It is used to make paddles.

Material collected.—Leaves, bark, wood.

No. 322—

A large tree, 9 feet in girth, 80 feet bole, and 120 feet overall. No buttresses, but the bole is grooved at butt.

Leaves.—Compound, alternate, trifolate; main petiole $2\frac{1}{2}$ inches, lateral petiole $\frac{1}{4}$ inch; terminal petiole $1\frac{1}{8}$ inch; blade 4 to $5\frac{1}{4}$ inches x $2\frac{1}{4}$ to $2\frac{3}{4}$ inches; terminal one sometimes attains 6 inches x $3\frac{1}{2}$ inches. Elliptical, acuminate, thin, glabrous.

Rays.—160-180, slightly sinuous; brown, 1-80 inches deep; shows up as wavy short brown lines on quarter. Pores.—30,000, single and radially septate (2). Soft tissue.—Fine lines extend from each side of the pores sometimes linking up a few tangentially, sometimes stopping short at next ray. General.—A light-brown to pink timber with a pretty quarter figure and a fragrant perfume like cedar. Solution wood colourless, very faint precipitate. Cuts soft to firm; 33 lb. per cubic foot.

Bark.—$\frac{1}{2}$ inch thick; smooth, except for pustules. grey brown, inner bark red, streaked with white; solution of faint old gold; a faint precipitate.

Date.—December, 1922.

Native name.—Horopo (Vailala).

Remarks.—A soft timber, with a faint cedar like perfume. Used for canoes.

Material collected.—Leaves, bark, wood.

No. 324—

A large tree, 9-ft. girth, a bole of 50 feet, and 90 feet overall. High buttresses up to 15 feet, and a crooked bole.

Leaves.—Simple, alternate, stipules $1\frac{1}{4}$ inch; petiole, $1\frac{1}{4}$ to $1\frac{3}{4}$ inches; blade, $3\frac{1}{4}$ to $7\frac{1}{2}$ inches x $1\frac{3}{4}$ to $3\frac{3}{4}$ inches; ovate; margin serrate, tapering to acuate point; base more or less cordate; petiole, midrib and veins below, pubescent; scattered hairs on midrib and veins above; texture of the leaf is thin.

Bark.—$\frac{1}{2}$ inch thick, smooth, grey-brown; inner bark red; solution pale brown, blue precipitate.

Wood.—Sap undefined, pale yellow, deepening to pinky-yellow.

Rays.—Clear (1), coarse 40, (2) fine 220-230. The coarse ones are slightly sinuous, the fine ones more so, but are broken by pores. Coarse ones show up on quarter as brown streaks, and oblongs up to 3-10th inch long and 1-30th inch deep. Pores.—5,000 to 7,000; here and there radially septate (2), fairly evenly scattered. Soft tissue.—Absent. General.— A grey-brown wood with a pretty enough quarter-grain, very fissile along rays, narrow bands of darker wood show up on cross section. Solution wood colourless, purple precipitate. Cuts soft and clean; 26 lb. per cubic foot.

Locality.—Vailala.

Date.—December, 1922.

Native names.—A-uakou (Vailala).

Remarks.—A medium hard wood.

Material collected.—Leaves, bark, wood.

No. 326—

A large tree, 11 feet in girth, 55 feet bole, and 90 feet over all; wide buttresses up to 12 feet.

Leaves.—Simple, alternate; petiole, 7-16th to $\frac{7}{8}$ inch; blade, $3\frac{3}{4}$ to $6\frac{1}{2}$ inches x 2 to $2\frac{3}{8}$ inches; elliptical to oblanceolate, acuminate, glabrous, more or less coriaceous.

Rays.—170-200, fine, brown, wavy, twisting to turn around pores; very shallow, mere wavy lines on quarter. Pores.—Conspicuous, 2,000 to 2,800, fairly evenly scattered, a few radially septate (2). Soft tissue.—Absent. General.—A uni-

form brown wood with a pleasant grain. Solution wood colourless, blue-black precipitate. Cuts medium hard; 34 lb. per cubic foot.
Bark.—½ inch thick, scaly, scales thick and longitudinally arranged so as to make bole appear ridged; inner bark cinnamon brown; solution pale red, strong blue-black precipitate.
Wood.—Sap ill-defined, about 4 inches, yellow to pale pink, heart red-brown.
Locality.—Vailala River.
Date.—December, 1922.
Native name.—Koboharua (Vailala).
Material collected.—Leaves, bark, wood.

No. 329—

Large tree, 8-ft. girth, 60-ft. bole, and 100 feet over all; no buttresses, slight root swellings.
Leaves.—Simple, alternate; petiole, 1 to 1½ inch, pubescent; blade, 6 to 7¾ inches x 3 to 3½ inches; ovate, acuminate; midrib and veins prominent and pubescent below.
Bark.—½ inch, grey, smooth, except for numerous small pustules; inner bark light brown, streaked white; solution colourless, faint precipitate.
Wood.—Sap undefined, pale yellow.
Rays.—143, yellow, 1-40th inch deep, show up a little on quarter. Pores.—Clear, 2,000 2,500. scattered evenly, mostly single, but here and there septate radially or tangentially, or diagonally. Soft tissue.—Absent. General.—A pale, light timber. Solution wood colourless, no precipitate. Cuts soft, but woolly, hard to cut a section; 29 lb. per cubic foot.
Locality.—Vailala.
Date.—December, 1922.
Native name.—Opa (Vailala).
Remarks.—Soft, light, straight-grained wood.
Material collected.—Leaves, wood, and bark.

No. 330—

Large tree, 8½ feet in girth, 90-ft. bole, and 115 feet over all. A tall, graceful tree, with small flattened crown. No buttresses, but the bole is much grooved and channelled.
Leaves.—Simple, alternate; petiole, 3-16th inch; blade, 3¾ to 6¾ inches x 1¾ to 2¾ inches; elliptical, acuminate, thin. The twigs and leaves arise from branches in such a manner as to lie flat in one horizontal plane.
Bark.—½ inch thick, brown, longitudinally lined, otherwise smooth; inner bark light brown; solution colourless, no precipitate.
Wood.—Sap undefined, saffron.
Rays.—200 to 240, brown, about 1,20th inch deep, show up poorly on quarter. Pores.—2,500 to 3,000, evenly scattered, but hard to see; radially septate (2-3). Soft tissue.—Very fine lines of soft tissue link up rays. They run about 200 to the inch, and make section cutting difficult, as the wood breaks up along these lines. In addition, the pores are immersed in soft tissue, which now and then joins 3 or 4 pores together. General.—A pale yellow wood, showing little or no grain. Solution wood colourless, no precipitate. Cuts soft and woolly; 37 lb. per cubic foot.
Locality.—Vailala.
Date.—December, 1922.
Native name.—Korau.
Remarks.—A firm, straight-grained, dense wood.
Material collected.—Leaves, bark, wood.

No. 331—

Large tree, 8 feet in girth, 90-ft. bole, and 120 feet over all.
Leaves.—Simple, alternate; petiole, ½ inch, stout, grooved; blade, 8 to 14 inches x 3¾ to 4-7 inches; shape variable, elliptical, oval, obovate, ovate; midrib wide, grooved, yellow, prominent, lateral veins very distinct and regular, acute, thin, glabrous.
Bark.—¾ inch thick, grey, smooth, except for small pustules which form faint longitudinal lines; inner bark white, speckled with yellow; solution colourless, no precipitate.
Wood.—Sap undefined, yellow.
Rays.—Clear, 70 to 100, light brown, some coarse, some fine, 1-40th inch deep, conspicuous on quarter. Pores.—3,000, single and radially septate (2), evenly scattered. Soft tissue.—Very fine lines linking up rays about 320 to the inch. General.—A pale timber with a mottled quarter-grain. Solution wood colourless, no precipitate. Cuts soft and woolly; 28 lb. per cubic foot.
Locality.—Vailala.
Date.—December, 1922.
Native name.—Deke (Vailala).
Remarks.—Soft, straight-grained timber, with a lace grain on the back.
Material collected.—Leaves, bark, wood.

No. 337—

Large tree, 9-ft. girth, 60-ft. bole, and 100 feet over all; buttresses to 6 feet.
Leaves.—Simple, alternate, petiole, ½ to ⅝ inch; blade, 5½ to 8 inches x 2¼ to 2¾ inches; oblanceolate and lanceolate, acute, finely serrate, glabrous, thin.
Bark.—Brown, smooth, except for longitudinal lines of pustules; inner bark yellow-brown; solution colourless, faint precipitate.
Wood.—Sap 5 inches, pale yellow, heart walnut brown.
Rays.—70 to 80, distinct and between them a large number of very faint rays too fine to be counted. Pores.—Conspicuous, 1,500 to 1,800, radially septate (2-3), evenly scattered. Soft tissue.—Absent. General.—A pale timber. Solution wood colourless, faintly precipitate. Cuts soft and clean; 37 lb. per cubic foot.
Locality.—Vailala.
Date.—January, 1923.
Native name.—Abaobua.
Remarks.—A soft, straight-grained timber, used for canoes.
Material collected.—Leaves, bark, wood.

No. 553—

A medium-sized tree, 7 feet in girth, with a bole of 45 feet, and 60 feet over all.
Leaves.—Compound, 1 to 2 pairs and a terminal one; rachis, 2½ to 3½ inches; petiole, ½ inch, terminal one longer; blade, 2 to 4 inches x 1 to 2 inches; lanceolate, acuminate; with prominent warts at the axilla of many of the veins and the midrib; thin.
Bark.—¼ inch thick, grey-brown, scaly, pustular, scaling in irregular patch; its greyness is due to lichen; inner bark red-brown; solution colourless, blue precipitate.
Wood.—Sap ill-defined, pale yellow at first, deepening to a pink.
Rays.—240 to 250 to the inch, pale, 1-70th inch deep, very inconspicuous on quarter. Pores.—Distinct, 5,500, single and radially septate (2-4), show up as dark grooves on longitudinal sections. Soft tissue.—Absent. General.—A pale pink open-grained wood; solution colourless, blue precipitate; cuts easily.

Locality.—Ogeramnang, 6,000 feet.
Date.—23rd November.
Native name.—Kuvi.
Material collected.—Leaves, wood, bark.

No. 555—

A medium-sized tree, 6 feet in girth, with a bole of 40 feet, and 60 feet over all.

Leaves.—Simple, opposite; petiole, 3-16th inch; blade, 2 to 2½ inches x ¾ to 1½ inch; obovate to equally tapering at both ends, obtuse, rather coriaceous.

Bark.—½ inch thick, grey, finely lined, and covered with minute pustules; inner bark a pale yellow, streaked white; solution colourless, pale brown precipitate.

Wood.—Sap undefined, white.

Rays.—Conspicuous, 150, pale, 1-50th inch deep, but indistinct on quarter. Pores.—Conspicuous, 4,800 single. Soft tissue.—80 to the inch, fine lines broken by pores or linking them up. General.—A pale yellow wood, cuts rather hard, and shows little grain; solution colourless, no precipitate; 53 lb. to the cubic foot.

Locality.—Ogeramnang.
Date.—23rd November.
Native name.—Ngangi (Ogeram).
Material collected.—Leaves, wood, bark.

No. 559—

A large tree, 8 feet in girth, 60-ft. bole, and 100 feet over all.

Leaves.—Simple, opposite; petiole, ¼ to ½ inch; blade, 3 to 5 inches x 1¾ to 2½ inches; elliptical, acuminate, rather coriaceous.

Bark.—A pinkey-grey, scaly; shedding cleanly, and leaving bole smooth, but slightly scrolled; inner bark dark brown; solution tawny, strong blue precipitate.

Wood.—Sap ill-defined, white, deepening to a light brown.

Rays.—180, distinct, wavy around pores, do not show up on the quarter. Pores.—3,800, single and radially septate (2). Soft tissue.—Fine, wavy, irregular spaced lines of soft tissue link up the pores. General.—A brown, hard, close-grained timber, hard to cut, with an interlocked grain. Solution pale yellow, blue precipitate; 57 lb. to the cubic foot.

Locality.—Ogeramnang.
Date.—23rd November.
Native name.—Sali (Ogeramnang).
Material collected.—Leaves, wood, bark.

No. 578—

A large tree, 10 feet in girth, with a bole of 75 feet, and attaining 110 feet over all; root swellings and spurs slightly developed.

Leaves.—Simple, opposite; petiole, ¼ inch; blade, 2½ to 4 inches x 1½ to 2 inches; ovate, obtuse, coriaceous.

Bark.—¼ to ½ inch, a bright yellow or red-brown, with papery scales; inner bark mouse-coloured; colourless solution, blue precipitate.

Wood.—Sap ½ inch, yellow, heart a red-brown; a hard, interlocked wood.

Rays.—320 to 350, distinct, straight except round large pores, 1-16th inch deep, show up as rather long, narrow bands on ¼ inch. Pores.—9,000 to 10,000, distinct, single, and radially septate (2). Soft tissue.—Broken thin lines link up rays and surround pores. General.—A pink to red hard wood, hard to cut, has an interlocked grain. Solution colourless, strong blue precipitate; 56 lb. to the cubic foot.

Locality.—Joangey.
Date.—December, 1923.
Native name.—Swaing (Joangey).
Remarks.—Compare with Pap. 221.
Material collected.—Leaves, wood, bark.

No. 583—

A large tree with a girth of 8 feet, a bole of 65 feet, and attaining 90 feet over all; small buttressed to 4 feet.

Leaves.—Simple, alternate; petiole, ¾ to 1¼ inch; blade, 2¼ to 5 inches x 1¾ to 3½ inches; obovate, thin, obtuse, margin wavy.

Flowers.—Axillary, greenish cream; pedicel 1 inch, usually in pairs. Pentamerous.

Fruit.—A woody brown fruit, 3 inches long, on a stout peduncle 1 inch long, opens into 4 segments to release about 24 seeds; seeds black, ¼ inch, with red aril.

Bark.—Grey, smooth, except for longitudinal lines of rather prominent, though not numerous, pustules; inner bark speckled yellow. Pale yellow solution and strong blue precipitate.

Wood.—Sap undefined, axes easiler.

Rays.—30 to 40, conspicuous, white, and 250 fine ones, all rather sinuous, and some of the fine ones broken by pores; 1-40th inch deep, conspicuous on quarter. Pores.—Distinct, 2,000 to 5,000, in thickly and thinly-sown bands, single and radially septate (2, sometimes 3, rarely 4 and 5). General.—A white or pale yellow wood, cuts soft and clean, straight-grained; solution colourless, blue precipitate; 43 lb. to the cubic foot.

Locality.—Yunzain.
Date.—December, 1923.
Native names.—Galan (Yunzain), Bakan (Waria).
Material collected.—Leaves, flowers, wood, bark, fruit.

No. 591—

A large tree, 10 feet in girth, with a bole of 80 feet, and attaining 120 feet over all. Root swellings, but no buttresses.

Leaves.—Compound, opposite, and sub-opposite. Rachis, 5 to 9 inches. Leaflets:—Petiole, ¼ inch; opposite and sub-opposite, and a terminal odd one; blade, 3 inches to 6 feet x 1¼ inches to 2¼ feet, increasing in size from basal to terminal pair. The rachis is swollen at junction with twig, so is the petiole at junction with rachis.

Bark.—½ inch, brown to grey-brown, pustular; inner bark mauve, streaked white; pale brown solution, faint blue precipitate.

Wood.—Sap ill-defined, ½ inch, white, then deepens to a red; axes easily splits well.

Rays.—170, indistinct owing to colour, 1-80th inch deep, but show up clearly as brownish streaks on the quarter. Pores.—1,400 occasionally filled with greenish resin; single, more rarely septate (2-4). The septum is often diagonal, or even radial; show up brown grooves on both longitudinal sections. General.—A pinkish wood with a pretty satin sheen on the quarter; soft to cut, and works up well. Solution colourless, no precipitate; 29 lb. to cubic foot.

Locality.—Finsch Haffen.
Date.—December, 1923.
Native name.—Ke Sang-Sang (Yabim).

Remarks.—Used for cases by the sawmill here; worthy of a better use.
Material collected.—Leaves, bark, wood.

No. 600—

A medium tree, 6 feet in girth, 40-ft. bole, and 60 feet over all; buttressed to 3 ft. 6 in.
Leaves.—Compound, alternate. Rachis, 11 inches, swollen at base, bearing 4 to 6 pairs of alternate and sub-opposite leaflets, the terminal pair are opposite. Petiole, ½ inch, swollen; blade, 4 to 6 inches by 2¼ to 2½ inches; lanceolate, acuminate, glabrous, thin.
Bark.—⅜ inch, grey-green to red, scaly, shedding cleanly and leaving bark smooth to slightly scrolled; inner bark red, streaked with white; solution pink, cloudy blue precipitate.
Wood.—White, deepening to light pink; axes easily, but does not split, being interlocked.
Rays.—280, disitnct, pale, sinuous, do not show on longitudinal sections. Pores.—1,500, distinct, radially septate (2), reddish grooves on quarter. Soft tissue.—Conspicuous, 80 to 150 lines, thicker than rays, sinuous. General.—A soft, open, easily cut woolly timber; solution colourless, no precipitate; 32 lb. to cubic foot.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Narunkuf (Yalu).
Material collected.—Leaves, bark, wood.

No. 604—

A large tree, 7½ feet in girth, a bole of 60 feet, and 80 feet over all; wide buttresses extending to 15 feet up.
Leaves.—Compound, alternate; rachis 2 to 2 ft. 6 in., bearing 7 pairs of opposite leaflets and a terminal one. Leaflets—Petiole, ¾ inch; blade, 5 to 12 inches x 2 to 3¼ inches; acuminate, glabrous, thin.
Flowers.—Axillary panicles of white flowers.
Bark.—3-16th inch thick, brown and grey, scaly, shedding in irregularly circular plates leaving bark below a light brown; inner bark white, streaked with faint yellow; exudes latex. Solution colourless, pale blue precipitate.
Wood.—Sap undefined, pale near bark, but deepening rapidly to a pink or red.
Rays.—170. Pores.—Conspicuous , 1,200 to 3,600, in thickly and evenly sown bands, single and radially septate (2-4, but more usually 2). Soft tissue. General.—A soft, woolly, pink wood; cuts soft. Solution pale pink, blue precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native names.—Timbong (Yalu), Quonzong (Sattleberg).
Material collected.—Flowers, wood, bark.

No. 605—

A large tree, 12 feet in girth, with a bole of 80 feet, and attaining 110 feet over all. Pronounced buttresses which extend in heavy grooves up the bole to the crown.
Leaves.—Simple, alternate; petiole, ½ inch; blade, 4½ to 7½ inches by 1½ to 3 inches, or even 3¾ inches; usually lanceolate, more or less hastate leaf bracts at base of young leaves soon fall off.
Bark.—Grey to yellow-brown, scaly, on edge of buttresses ridged; inner bark white; used for constructing temporary houses and hunting huts; solution colourless, no precipitate.
Wood.—Sap undefined, white; axes easily splits better on the back than on the quarter.
Rays.—130, pale, sinuous around pores; up to 1-40th inch deep; show up as bands on quarter. Pores.—600 to 1,000, in bands of very thinly and more thickly sown tissue; single and radially septate (2-3, rarely 3). General.—A white wood, showing little grain; cuts soft; solution colourless, no precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Amint (Yalu).
Material collected.—Leaves, wood, bark, and dry seed vessels.

No. 615—

A large tree, 9 feet in girth, 90-ft. bole, and 120 feet over all; not buttressed, but grooved at the butt.
Leaves.—Compound, alternate, in false whorls at end of branches; rachis 17 inches, bearing 5 pairs of opposite leaflets, but no terminal one; petiole, ⅜ inch; blade, 3 to 8 inches x 1½ to 3 inches; lanceolate, glabrous, thin, oblique, reaches further down one side of the petiole than the other.
Bark.—¾ inch thick, grey, pustular, otherwise smooth; inner bark speckled white and yellow; solution a little discoloured, no precipitate.
Wood.—Sap undefined, pale yellow; axes easily, splits easily; smells of linseed oil.
Rays.—Conspicuous, 100, straight, or only very slightly kinked around pores, show as shining bands on quarter; 1-20th inch deep, conspicuous. Pores.—1,000, conspicuous, single and radially septate (2-5), often septum is diagonal; show as darker grooves on longitudinal section. General.—A white wood, showing some grain on the quarter; soft to cut, splits very easily. Solution colourless, no precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Kuwi (Yalu).
Material collected.—Leaves, wood, bark.

No. 616—

A large tree, 10 feet in girth, 90 feet of bole, and 115 feet over all; buttresses well developed, 10 feet high.
Leaves.—Simple, opposite; petiole, ¼ to ½ inch; blade, 4 to 8 inches x 1⅓ to 2 inches; lanceolate, acuminate, glabrous, thin; the axilla of most of the veins is pitted.
Bark.—⅜ inch thick, yellow, brown, scaly; the scales adhere partially in an untidy manner; inner bark red; exudes gum from inner layer; solution faint yellow, no precipitate.
Wood.—Sap 2½ inches, yellow, heart a good brown; axes easily, splits well. Rays.—Clear, 125, sinuous around pores, pale; 1-40th inch deep, conspicuous red-brown bands on the quarter. Pores.—Conspicuous, 1,800 to 3,500, in thickly and thinly sown bands, single and radially, or diagonally septate (2, more rarely 3), show up as brown grooves on longitudinal sections. General.—A brown, open, but straight-grained wood; solution colourless, no precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Tizo (Yalu).
Material collected.—Leaves, wood, bark.

No. 618—

A large tree, 8 feet in girth, with a 60-ft. bole, and 80 feet over all; spur-rooted.
Leaves.—Compound, alternate; rachis 4 ft. 9 in., swollen at base, bearing 7 to 15 alternate leaflets; petiole, 3-16 inch; blade $2\frac{3}{4}$ to $3\frac{1}{4}$ inch; ovate, margin wavy, pointed, asymmetrical at base and oblique throughout; thin, glabrous.
Flowers.—Only buds seen; axillary panicles of white buds.
Bark.—Grey, smooth, except for minute pustules and fine longitudinal lines; inner bark salmon, with faint white lines; solution colourless, cloudy; green precipitate.
Wood.—Sap ill-defined, white deepening to a pink; axes and splits with difficulty, better on the quarter than on the back.
Rays.—270, very sinuous, fine, pale; 1-50th inch deep, showing up faintly on quarter. Pores.—Clear, 1,200 to 2,000, single, and radially septate (2-4). Soft tissue.—Wavy lines 60 to the inch, also immersing pores, also very fine broken lines, ladder-runging rays. General.—A pale, pink wood, dense, hard; cuts hard; solution slightly pink, very faint mauve precipitate.
Locality.—Yalu.
Date.—December, 1923.
Native name.—Angawu.
Material collected.—Leaves, wood, bark, buds.

No. 656—

A large tree, 8 feet in girth, with a 30-ft. bole, and reaching 60 feet over all; not buttressed.
Leaves.—Simple, alternate; petiole, $\frac{3}{4}$ to $1\frac{1}{2}$ inch, swollen and black for $\frac{1}{2}$ inch; blade, 4 to 6 inches x $1\frac{1}{2}$ to 2 inches; elliptical, more or less coriaceous.
Bark.—$\frac{3}{4}$ inch thick, dark-brown, and slightly scaly; inner bark just below scale bright yellow, then pink yellow; exudes latex; solution red-brown, green-brown precipitate.
Wood.—White, sap undefined, axes hard.
Rays.—270, straight, here and there broken by pores 1-150th inch deep, show up as lines on quarter. Pores.—200 to 1,000, in very thinly and somewhat more thickly sown bands, single and radially septate (2). Soft tissue.—Numerous irregularly spaced thin lines; also surrounds pores; is attacked by fungus which turns the tissue around black. General.—A dense wood, cuts firm. Solution colourless, green precipitate; 58 lb. per cubic foot.
Locality.—Hanep (hills of Upper Ramu), 2,400 feet.
Date.—April, 1924.
Material collected.—Leaves, wood, bark.

No. 795—

A small tree, 12 to 20 feet high.
Leaves.—Simple, alternate, opposite and sub-opposite. Petiole, $\frac{1}{4}$ inch, twisted; blade, 6 inches x 4 inches; acuminate, glabrous, thin, soft.
Fruit.—Red, when fully ripe.
Bark.—Grey, very tough.
Locality.—Mogendo (Lower Sepik).
Date.—24th July.
Native name.—Humbatoi.
Remarks.—The bast yields a fibre much in demand for making the jolly net-bags so much worn by ladies.
Material collected.—Leaves and unripe fruit.

No. 788—

A small straggling tree with a stem 3 to 4 inches in diameter, and attaining 15 to 20 feet in height.
Leaves.—Simple, whorled, subsessile, or shortly petiolate, very swollen; blade 10 to 16 inches long x 4 to 6 inches wide; lanceolate, oblanceolate, oval, elliptical, acuminate, under surface pubescent.
Flowers.—Axillary heads of conspicuous salver-shaped, flannel-textured, sweet smelling, pale cream flowers.
Fruit.—Not seen.
Bark.—Grey.
Locality.—Abunti (Middle Sepik).
Date.—12th July.
Material collected.—Leaves, flowers.

No. 783—

An epiphytic orchid.
Leaves.—Very fleshy in tufts at the end of swollen stems.
Flowers.—Large, showy, purple and white, in 18-in. spikes, on long—up to 3 feet—swollen stems, standing out at right angles to the trunk of the host.
Locality.—Kaduba.
Date.—May.
Remarks.—A handsome orchid.
Material collected.—Leaves and flowers.

SECTION D.

MINOR FOREST PRODUCTS.

Tannins.

While tannin-bearing products are very common in the forests of the Islands, the largest source of this important commodity is in the mangrove forests. A recent analysis of the barks of the three principal species found in these associations, which was made by the Forests Products Laboratory—a department of the Commonwealth Institute of Science and Industry—gave the following results:—

Species.	Tans.	Non-tans.	In-solubles.	Mois-ture.	Colour on a 5 per cent. Solution.	
					Reds.	Yellow.
No. 212, *Bruguiera Rheedii*	31·0	11·2	46·8	11·0	11·7	23·2
No. 213, *Rhyzophora mucronata* ..	18·0	6·8	63·4	11·8	13·5	30·0
No. 343, *Xylocarpus granatum* ..	24·1	16·1	48·7	11·1	9·5	17·8

The percentage of tannin is satisfactory, and compares favorably with results obtained from barks of the same species gathered elsewhere in the tropics. As they had a long journey to make before reaching the laboratory, it is probable that some fermentation had taken place, and this has always the effect of lowering the tannin content. It is quite possible that fresh barks, examined in Papua, would yield still higher results. How serious is the trouble of fermentation is shown by the analysis of equal quantities of the barks taken at the same time from the same trees, but which were, instead of sun-dried, partially dried in the water-jacketted drier. The idea of so drying them out was suggested to me by the officer-in-charge of the Forests Products Laboratory, the object being to dry so quickly as to prevent any enzymic action, which not only destroys the tannins, but produces colour. Unfortunately, my drying was not carried sufficiently far, and the partially dried material, sealed in tins, was in an ideal condition for the enzyms to act; and they did, with the result that all the alleged oven-dried material, instead of showing less colour and more tannin, showed the reverse. Here are the data:—

No. 212, *B. Rheedii*: 29% tannin; 33.1 reds and 23.5 yellows.

No. 213, *R. mucronata*: 14.5% tannin; 11.7 reds and 25.6 yellows.

No. 343, *X. granatum*: 16.4% tannin.

The experiment of sending oven-dried bark from Papua to the Perth laboratory, though a failure from the point of view of obtaining optimum results, has at any rate proved quite definitely that fermentation has the effect of destroying the tannin, and increases the objectionable red colour. This theory has been held for some time, but I think the experience just quoted places the matter beyond further argument.

That no colour data is furnished in regard to No. 343 is due to the saponaceous body that the bark contained. I will quote the explanation of the officer-in-charge of the Forests Products Laboratory, Mr. D. Coghill, in full:—

> "It would appear that the fermentation changes, which have occurred in this sample, have been responsible for a dispersion, different in degree from the sun-dried sample. This dispersion would seem to have been protected by the presence of this saponaceous body. It looks as though a selective absorption of this saponaceous body has occurred, resulting in varying the peptisation of the dispersion by water. The particles, then, pass quite easily through the filter papers used, with the object of filtering the solution optically clear for examination in the Lovibond Tintometer."

The red colour trouble with mangrove bark is a very serious one, and has prevented its use to a great extent. Any means that will reduce this colour are to be welcomed, and among them the obvious one is to treat the bark on the spot, instead of exporting the raw bark as has so often been done, and which has resulted in financial loss. The price of the bark is so low, and shipping freights are so high, that the bark cannot be profitably stripped and exported. That it can be treated locally, and the extract exported profitably, is shown by the Borneo experience, where extract works are operating. These are often called cutching mills, mangrove bark cutch having superseded the Indian acacia dye. It, in turn, was superseded by the aniline dye, so that to-day mangrove cutching mills turn out tannin extract.

The chemical reduction of the objectionable colouring matter is a problem still awaiting satisfactory solution. Queensland is also interested in the tan bark of her mangrove swamps, and a committee was appointed under the Institute of Science and Industry to investigate the question of decolouration. The two barks dealt with were *B. Rheedii* and *R. mucronata*. This committee succeeded in preparing a good brown leather, lighter in shade than the ordinary red of mangrove-tanned leather, but not a light-coloured leather, such as wattle tannage produces. Nor was it able entirely to eliminate the smell which is another objection to mangrove leather. The process did not alter the colour of the solution used, but the leather produced was lighter in colour. Work was also done by the Forests Products Laboratory of the Institute of Science and Industry on the decolouration of the tannage derived from the mari gum (*Eucalyptus calophylla*) of Western Australia, and possibly the process used in that case might help with mangrove tannage.

Failing a chemical correction, the best thing seems to be to extract the tannin as soon after cutting the bark as possible, which means the establishment of extract works at the place where a large supply exists. In the Mandated Territory the areas of mangrove are small, but in the Territory of Papua they are very large indeed. No one, who has travelled from the Alele mouth of the Purari delta right through to Kikori, will have failed to appreciate this, for the waterways are white ribbons in a dense mass of mangrove forests. This area, though large, is, I am told, exceeded by the large mangrove formations on the tidal reaches of the Omati, Turama, Bamu and Fly rivers. Galley Reach, too, offers a very large supply of mangrove indeed, and there are doubtless many other mangrove swamps of that type that I have not had the opportunity of seeing. The bark of the first two mangroves runs about 9 tons to the acre. With the great increase of the use of tanning extract for

leather making, the use of mangrove extract must become more and more prevalent. It is probable too, that Papua possesses, among the long list of tannin materials, some which, when blended with mangrove, would make it satisfactory for the production of bright leather. How much objectionable colour and smell are questions of prejudice remains for others more experienced in the technicalities of the business to say. It does seem curious that the colour of leather used for making the sole of a boot should be an important matter. That scientific investigation of tan barks is necessary is shown by the fact that West Australia failed to sell her mallet bark (*Eucalyptus cornuta* var. *astringens*) in Australia and in England, but found so profitable a market for it in Germany that her forests of this tree were reduced to a negligible quantity in four years. The German leather chemists extracted the tannin and blended it and sold it to England and to Australia in the form of tannin extract, which was readily purchased.

The import figures into Australia of tannins, supplied by the Board of Trade, are instructive, and would lead me to think that Papua has a good opportunity of developing the manufacture of extract to sell to so good a buyer next door.

IMPORTS OF TANNING SUBSTANCE, 1922-23.

	Cwt.	£
Natal—		
Wattle bark	93,666	37,301
Other bark	103	48
Wattle extract	—	2,967
South America—		
Quebracho extract	...	14,209
Other extract	...	—
Valonia myrobalans	...	10,662
Cutch, etc.	...	28,358
Total	...	£93,545

OTHER TANNING MATERIALS.

The natives of New Guinea have not discovered the art of tanning, so that I am unable to point to any proved tan barks. In the examination of material I have, however, tested the reaction to iron salts of all the barks that I was able to save, and all the woods that were brought back. The information is contained in the description of specimens (*see* section C., under the heading of "Barks") and in the descriptions of wood under the sub-head "General." Solutions of both barks and woods were made, and iron salts added. The nature and colour of the precipitate, if any, was recorded. I have not tested any of the fruits, and certain genera should receive attention, of which *Terminalia* is certainly important. The common tannin agent for brightening the colour of leather is obtained from the fruits of *T. chebula* of India, and they are known to the trade as *Myrobalans*. There are several *Terminalia* in Papua, and both barks and fruits are worth investigating. The bark of the three common oaks was submitted to the firm of Michaelis, Hallenstein, who kindly allowed their chemist, Mr. J. H. Boas, to examine them. Here are the results:—

—	Tannins.	Non-tannins.	Insoluble.	Moisture.
No. 1.—*Quercus Junghuhni*	16·3	5·0	16·7	10·8
No. 2.—*Quercus spicata* Smith, *var. depressa* King	17·0	5·7	65·3	10·9
No. 3.—*Quercus camponga* Miq. ..	18·0	4·5	65·5	11·1

The first is the oak without a true acorn, the second is the small acorned oak.

As for colour, the first gave a very dark reddish colour, the third also gave a bad colour, but the second gave a yellowish fair colour.

All compare favorably with the European oak so far as percentage of tannin is concerned, and practicability of establishing extract works to treat their very common bark is worth serious consideration. For the same reason as in the case of mangrove bark, the export of the raw material is not to be recommended.

These oaks have a wide range in the foot-hill and lower mid-mountain forests all round New Guinea proper, but I did not come across them in New Ireland, New Britain or New Hanover.

ALCOHOL.

The proposal to manufacture alcohol in the Territory is regarded with a certain amount of disapproval. The danger is, of course, that the native may become addicted to the abuse of this stimulant. Everywhere, I think, where very primitive people dwell, it has been admitted that the free manufacture and sale of intoxicating drinks is harmful. Many Crown Colonies have faced serious financial crises through the falling off of revenue, due to the prohibition of the entry of spirits. Primitive man, together with certain more highly civilized people, would appear to come within the second category in the clergyman's quotations from Scripture in the matter of the use of alcohol. While not wishing to make any definite pronouncement as to prohibition of alcohol, he quoted: 1. "Wine maketh glad the heart of man"; 2. "The wild asses came down and drank of the water." To give them anything stronger would certainly be madness. But the use of alcohol is not solely for stimulating a jaded civilization; it is used in a number of industrial pursuits, and as time goes on this distilate will become a more and more important factor in the progress of Australia. She has within her borders but scant supplies of mineral oil, and in spite of the many inducements and rewards offered for the discovery of new sources of petroleum, to date only indications have been met with. The tremendous development in the use of the internal combustion engine, requiring oil as the fuel, means that very heavy imports of this commodity are made by Australia. In 1916 to 1917 the imports were $20\frac{1}{4}$ million gallons,* and this quantity has increased, and must continue to increase year by year. Last year it rose to 46,809,212 gallons, valued at £3,485,228. The world's supply of motor fuel is finite, and the consumption is very heavy. It is only a matter of time for a serious shortage of supplies to occur, and Australia will feel the pinch particularly. The heightened cost of motor fuel will act as a serious brake to industrial development, and the absence of adequate local supply, would cripple Australia were a war to cut her off from petroleum. The solution lies in the development of another motor fuel, and alcohol is one which offers every promise of taking the place of petrol at an early date.

Alcohol is an excellent liquid fuel, and it is more satisfactory than petrol, for, according to the authorities, a thermal efficiency of 30 per cent. can be obtained against 20 per cent. for petrol. This means a reduction in the quantity of fuel used, and the cost of running the engine. While Australia has no prima facie cheap source of industrial alcohol, her molasses, now wasted, is the best, but is not large enough. Papua has in her Nipa palm a very large source of this motor fuel. It has the advantage that it has been used for the manufacture of alcohol in other countries. In the Philippines† not only is the sap collected from the forests of wild Nipa palms, but this species is cultivated for its sap, which is distilled into alcohol. It has an advantage over grain, as it does not require milling. It is a short palm, so that the fruit is at a

* Power alcohol. Bulletin of the Advisory Council & Industry. Government Printer, Victoria, Australia.

† Brown, W. H., *Minor Products of Philippine Forests*. Vol. 1, p. 220, Agricultural Bureau, Manila.

handy height; it only takes four years to develop from seed. The production of alcohol exceeds 10,000 litres a year. The yield per year of the sap from one palm is 43 litres, and they count on 750 fruiting palms to the acre, or a yield of sap per acre of 32,250 litres. This is taken to the distillery, and a yield of from 4.1 per cent. to 7.5 per cent. is obtained. The average yield from 33 distilleries was 5.6 per cent. According to the estimates of Gibbs, from whose work* the above has been extracted, Nipa is the cheapest known source of alcohol. Just as I was unable to give exact figures of the area of mangrove swamps in Papua, so am I unable to give an estimate of the area under Nipa. It is a social species in the mangrove swamps, of which vast areas exist between the Alele mouth and the Fly river. The development of this industry looks very promising, and with proper regulation and control, and the denaturing of the product, to make it unfit for consumption by natives, there seems little possibility of it becoming a beverage. A careful study of the Philippine industry should be undertaken before a beginning is made in Papua. It might be necessary to import a few Philippinos to teach the labour here how to tap the fruiting stalk. The opportunities of establishing this industry in the Mandated Territory are not so good, the areas of Nipa swamps being very restricted.

Paper Pulp.

With the growth of democratic eduoation the use of ephemeral reading matter, printed on the lowest grade of paper, the life of which need only be twenty-four hours, has developed to a monstrous extent. It is stated that it takes 15 acres of spruce to supply pulp enough to produce one issue of the Sunday edition of the *New York Times*. I have no statistics of the quantity of "newsprint" imported by Australia. The item "Paper, etc.", which includes stationery, is shown in the Commonwealth *Year-Book*, 1921-2, on page 485. The average annual value of the imports for the war period, 1914-5, to 1918-9, was £3,378,667, and for 1920-21 £8,978,897. Efforts are being made in the direction of producing chemical pulp from certain hardwoods, and these have met with great success. It is quite possible that, among the many fast-growing tropical weed trees that grow to pulping size in one-quarter the time it takes a Canadian spruce, there may be found a good wood for the production of mechanical pulp. A very careful search should be made, the various trees being examined to determine their length of fibre and other pulping qualities. Should satisfactory material be met with, then the growing of it should prove a very simple matter.

Matches, Veneers, and Three-Ply.

The manufacture of wooden matches is an industry of considerable importance, and while the best match splints are made from aspen, the dearth of this wood has forced manufacturers to other woods. Hoop pine, for instance, is used, which makes a coarse, brittle splint, which burns rather poorly. The method of manufacture is usually to cut veneer of the thickness desired from the circumference of the log, paring it down against a knife, and to cut this wide sheet into widths and dock them to the required lengths. The boxes are also made from the sheets. While many of the Papuan timbers would appear to have the necessary qualities for match splints, only careful testing can prove them. The advantage of such tests is that they can be combined with tests for veneer and three-ply wood. The demand for veneers and three-plys is increasing annually, and the testing of Papuan wood does not offer much difficulty. Both a rotary veneer cutter and machinery to saw or slice ornamental woods should be installed for testing the woods. Thus, not only match-ply and cheap three-ply could be tried out, but the beautiful figured woods could be cut into thin veneers and the markets tested.

For match splints and boxes No. 13—*Pterocymbium*, sp.—is worth attention. A species of this genus has been used in the Philippines for this work.

Fibre Plants.

The enormous number of fibre trees or plants in New Guinea strikes the least observant traveller. Ropes, string, nets, bags, armlets and leglets, are made of fibre, and the fibres used in one district differ from those used in the next. A very large number of these are bast fibres, derived from the layer of bark next to the cambium layer. The number of string fibres, however, capable of holding their own with the standard fibres of the world, is very small. There is no strong musa (manila) fibre, and the palms do not appear to yield anything in the nature of the piassava of tropical Africa. None has, as yet, been put to a commercial test, and such manufacture as has been done at mission schools has been in the direction of matting for floor coverings. The natives make their net bags, their fishing nets and the large hunting nets for their own use, but there has not sprung up any business in the gathering or the weaving or netting of fibres. Some of the fibres are strong and sound, and deserve careful investigation with a view to their collection and marketing. One of the strongest, yet it is a fibre that is little used, is that derived from the bast of the cabbage tree—*Gnetum* sp. The Motuan people use it occasionally for making fishing lines and rope. Another tree which yields a very strong, hard fibre, used in preference to all others by the Motuans for rope and the heavy nets which they use to catch turtle or dugong, is *Vanea* (*Sterculia* sp.). In this case the bark is used. After the bark has been soaked for some time in water, it separates in an extraordinary manner into layers. The sheets of fibre have the appearance of cream muslin, and are very thin. These are cut into convenient widths for twisting, and are made into stout string with the thigh twirl, wihch, I suppose, is the earliest rope-making plant exstant. The spring is twisted into cord or rope, and the latter is netted into very large seine nets. It is said that they are better for use in water in catching dugong—big fish—than on land for catching pig. In any case, the fibre is obtainable in quantities, for the tree grows to a large size, and is by no means rare. It is curious that it is only the Motuans that I have found using this fibre; other tribes use other materials to make heavy ropes, usually *Hibiscus tiliaceus*.

The fibre derived from the leaves of all the screw pines makes a very useful cordage, but is more satisfactory for netting manufacture. The common species of the coast, probably *Pandanus tectorius*, is the one generally used, though the mountain species, which may prove to be *P. simplex*, seems to carry better fibre. It is a mountain species, and there so many other bast fibres occur that Pandanus has probably been overlooked. Hat-plaiting might be introduced with advantage, for excellent light panama-like hats can be made from the *Pandanaceæ*. Quite a number of climbers of the Arum family drop aerial roots and these are fine and very strong. The natives esteem them as the best armlet and leglet fibres. When writing of these monocotolydenous plants, one is naturally surprised at the absence of the pineapple and bow-string hemp fibres, also the banana. Some of the wild Musa might well be tested, for another source of manila hemp would be of great importance.

Of figs there are numerous fibre-bearing trees. I have not attempted to collect full material of this big

* H. D. Gibbs, *Alcohol Industry of the Philippine Islands*.

genus. The bark of nearly all of them is used for fibre or cloth, and of some the finest aerial roots are collected for armlet weaving. Brousonettia yields a good strong cloth from its beaten bast—better, I think, than any of the figs; though the mountain folk make very jolly boudoir caps from a fig bark, and the Kuku-kukus, at the head of the Purari, affect opera cloaks of a similar material. I have seen the bark of the bush bread-fruit—*Artocarpus* sp.—used for a similar purpose, but it is generally too loved for its nuts to be sacrificed for mere clothing. One of the farm wood trees—a Trema—yields a bast that is prized for tying bundles, but that of the common *Hibiscus tiliaceus* is generally preferred. A number of the mallow family are as good, if not better, than this pretty flowering tree, but it is so common, and yields such nice wide strips, that it is most frequently used for odd jobs.

Practically all light vines are used for tying purposes, and the methods the native uses is one of trial and error when he picks his vine. The mountain fern —*Gleichenia* sp.—which springs up like braken on burnt country, and clambers over everything, like a briar, yields a strong fibre, also. I pass over grasses, of which a number seem really good flax fibres, for I have collected no botanical material from them. "Job's tears"—*Coix lachryma-jobi*—are often strung on threads made from grasses and sedges.

An investigation of the various fibres is necessary before their value can be proved. Fibres used for cordage are not difficult to test; it is merely a matter of making a small rope walk, and trying out the strength of ropes made of the different materials. Best manila has a tensile strength of about 15,500 lb. to the square inch, and lower-grade material runs about 13,000 lb. Any fibre that will make a rope of a tensile strength of over 10,000 lb. to the square inch is worth very careful attention. It is necessary to test the ropes after they have been soaked in water. Some fibres become stronger after wetting; others weaken. The latter are obviously not so valuable. Fibres used for spinning into thread and weaving into material are more difficult to test, and these should be submitted for investigation to competent authorities.

Australia imports the whole of her fibre requirements. As is to be expected, the heaviest items are flax, hemp and jute. Here are the figures for 1922-3, kindly furnished by the Commonwealth Board of Trade:—

IMPORTS OF CORDAGE AND TWINES.

1922–23.	Quantity.	Value.
		£
Cotton Twines	206,914 lb.	18,918
Twines, other than Cotton	483,019 lb.	47,349
Other Cotton Cordage and Rope ..	655 cwt.	10,357
Other Cordage and Rope	..	70,442
Reaper and Binder Twines and Yarns	4,895 cwt.	26,441
Silver, Cordage with Metal Core, Halters, and Articles, n.e.i., manufactured from Cord and Twine	..	4,761
Fibres—		
Bass	2,026 cwt.	5,866
Coir	..	12,604
Cotton, Raw	689,023 lb.	31,139
Cotton, Waste (Engine-cleaning) ..	..	55,826
Cotton Waste (Axle)	..	3,015
Flax	1,563 cwt.	2,273
Flock	176 cwt.	208
Hemp (including *Phormium tenax*)	141,760 cwt.	258,788
Jute	8,931 cwt.	20,268
Kapok	6,735,884 cwt.	394,471
Oakum and Tow	34,637 cwt.	38,726
Other Fibres	15,427 cwt.	35,187
Total	..	£1,036,639

Australia offers a good market for some of the New Guinea fibres, and the cost of a thorough investigation should soon be paid for by the establishment of a commerce in the better ones.

RATTANS.

From fibres, such as I have described, one passes naturally to rattans. These are the stems of long, climbing palms of the genus *Calamus*, commonly known as lawyer cane or lawyer vine. The leaflets and young stems are armed with recurved spines which catch on anything and enable the palm to climb to the tops of the highest trees. The number of species is exceedingly large—Beccari[1] records 22 species and varieties in the Philippines, and there are probably as many in New Guinea. I have made no attempt to collect and classify them. The great value of rattans lies in the fact that long lengths can be obtained of the same, or practically the same, diameter from end to end. The natives use it for every conceivable purpose, both in the round and split. In the round it is preferred for suspension bridges and rope generally. Split, it is used for tying up all the component parts of houses, and all purposes for which a strong, fairly durable, pliable tying material is required. At times the native's confidence in lawyer cane as a universal mender is misplaced, as in the case of the native linesman who inserted a length of it in a broken telephone line. The supply is large, and the quality of many of the species seems to be as good as the material imported into Australia. While no figures are available in Papua as to the yield of rattan from an acre of rain forest, according to Brown† 6.700 feet per acre of rattan of commercial grade is obtained in the Philippines. How well the Papuan yield compares remains to be seen. As one rises from the lowlands, through the foothills, the lawyer canes decrease in number, until, in the end, at about 5,500 feet, on the edge of the coniferous belt, they are reduced to one species—a mountain variety, No. 395, of which I collected botanical material for identification by Mr. White. It is the thinnest of all the rattans, only attaining a diameter of $\frac{3}{8}$ in., and long lengths of very much thinner material are obtainable in quantities. I found that it made a lighter and more serviceable 5-chain surveyor's tape than the larger lawyer cane I had been using at lower elevations, and which had to be split for the purpose.

The Australian imports are of interest; they include other material than rattan, but this must be the main cane export of the countries, except those that I have marked wih an asterisk:—

Bamboo, clouded; Canes and Rattans, and Bamboo, unmanufactured.	Value.
Imported from—	£
*United Kingdom	378
Borneo (British)	85
Ceylon	244
Hong Kong	187
India	753
Malaya (British)	13,177
*New Zealand	364
China	7,360
Japan	826
*France	151
*Netherlands	299
Netherlands East Indies	26,960
Philippine Islands	21
*Sweden	385
*United States of America	118
Total	£51,308

Unfortunately the Commonwealth Board of Trade, which kindly furnished this data, has no information as to quantities. Rattan, in Australia, is the basis of a very large wicker work industry, it being preferred to osier, owing to the attacks of borers to which the latter material is subject. From those with whom I

[1] *Palme Nuovo Papuane. Estratto della publicagione.* U. Martelli, *Webbia*, pp. 281–359.

* Brown, W. H. *Minor Products of the Philippine Forests.* Bureau of Forestry, Manila.

have discussed the question of why Papua, with her great supplies of rattans, is not exporting this material in large quantities, I have gathered that the preparation of the cane is the difficulty, and that some curing or seasoning process is necessary. In the literature I have perused on the subject I have failed to find any reference to any such process. The canes, cleaned of their loose skins, are cut into convenient lengths and bent hairpin-wise, and then bundled together and shipped. As far as I am able to find out, any preparation they receive is done by the manufacturer of basket work. The trouble, I think, lies in another direction—that of grading. There are so many different species of Calamus, and some are doubtless more brittle when dry than others; some retain a nice shiny, varnished look; others become drab and grey. I am not aware as to the grades desired by Australian importers, and the Director of the Institute of Science and Industry (Sir G. H. Knibbs, K.B.E., C.M.G.), has also been unable to get detailed information. He writes:—

> "It is difficult to obtain definite information re desirable properties. The canes must not be too hard, too brittle, the smaller diameters, in particular, must be flexible. They are used in all sizes, from those of 3 mm. diameter to those of 33 mm. All the importers approached would like samples submitted to them."

All this points to a careful investigation of our rattan supplies, and to the systematic determination and the grading of the different species. If botanical material and canes were collected of each species, and all information included in field notes, the botanical material could be then submitted to Mr. White, and the canes to the Director of the Institute of Science and Industry, who has kindly expressed his willingness to have the material examined. Duplicates of material should be kept in the Agricultural Department, so that when the canes are graded it will be possible to advise collectors as to the kind that is wanted by the trade.

A promising development of an export trade awaits the satisfactory grading of Papuan rattans.

Resins, Gums, Kino, Gutta and Rubber.

A number of Papuan trees yield resins and a number yield gums, while No. 4 Nara—yields a good kino. The natives use the resins of several trees for lamp black for tatooing. The resin is set alight and a leaf held over the smoke, and lamp black is thus collected. The kino of Nara is used to fasten the skin of the iguana to the drum head. Resins are used to fasten arrow heads. Generally speaking, however, resins are little used by natives, and the only one that has to-day been exported by white people is that obtained in the island of Sudest. I have not visited this island, and so can give no information as to the quantities available. Specimens of the leaves, fruit, wood and bark were kindly submitted to me, and the botanical material was identified by Mr. White as *Vatica papuana,* herbarium No. 435. A small business has developed in the export of this gum, which appears to be collected at the base of the trees. The specimens I have seen consist of clear, yellow, brittle lumps, up to 7 lb. in weight, and in appearance compared well with Kauri, but are not so clear as the gum copal of Sierra Leone. Samples of this gum would, I think, interest the large varnish firms of the United Kingdom. The prices obtained up till now appear to be around £20.

The species is by no means confined to Sudest, but occurs all over the Territories, and I found it particularly plentiful on the hills above the Vailala, where it is called Kokolaka. Resin from that district was sent to Sydney some years ago, but no business came of it. All the *Dipterocarpuceæ* are resinous, and *Anisoptera*, sp. No. 136, so common in the northern division of Papua, yields copious supplies of a very inferior gum. Resins of this family are usually traded in under the name of Damar, and are used for making spirit varnishes and such like purposes.

There being no other resin used, it will be a question of investigating the resinous species that occur. Mention is made of this characteristic wherever it occurs in the species, material of which has been collected, but I do not pretend to have done more than collect the most obvious and common trees. For instance, going along Turner's Bluff, in the East Central Division, I came on some *Agathis;* the trees were small and not in flower or fruit, so I did not collect them. This genus yields good resin, and if there are any large trees, a search should be made for resin. This is the only locality that I have seen them, and they were mixed with *Quercus Junghuhnii,* the altitude being only 2,500 feet. *Wormia* and *Anisoptera* abounded there also, so it is probable that this *Agathis* will be found elsewhere at quite a low altitude. Of gums, there are a number used by natives, mainly for scent. The common occurrence of aromatic gums is rather a feature of the Papuan forest. The *Semecarpus* yields a dark-brown, almost black, gum, which is worth examination. Some trees of this genus supply a basis for marking ink.

The red kino of No. 4—Nara (*Pterocarpus*)—is already on the market, but it is an Indian trade, and, as far as I know, it has not been exported from Papua.

The family *Sapotaceæ* contains a number of genera yielding a white milk which coagulates into gutta percha. The family is well represented, and trees belonging to it are to be found at all elevations, from sea level to 7,500 feet. No. 204—*Payena*. sp. —is certainly worth attention; also Nos. 227, 325 and 391, which have not been determined.

In the Mandated Territory in German times, much exploring for "gutta" was carried out, and the best was said to have been obtained from 386, *Sideroxylon novo-guineense*, K.Sch.

Of the many trees that yield a rubber bearing latex, none is, I think, sufficiently important to compete successfully with the Para rubber that is being grown in plantations in the Territory. One *apocynaceous* vine, and the common fig (*F. rigo*) are the best yielders I have met, but neither is really worth much attention, having regard to the cost of collecting.

Oils.

With the exception of coco-nut oil,* which is sometimes made on the coast, the natives seem to subsist without vegetable oils, either for cooking or for burning. So there is no oil-bearing tree I can directly point to as useful. A large number of nuts are decidedly oily, and should be investigated; some of the leguminous beans are large and plentiful. Also the wood oil family—*Euphorbiaceæ*—requires searching for linseed-like oil. The fruits of *Calophyllum inophyllum*, which is so common a tree along the beaches, yield udilool, which is exported from Burma for medical purposes. The kernels of the nuts of *Terminalia okari*, and its brother *Terminalia,* are all oil-bearing and worth investigation. Of essential oils, again I can say little, as the time at my disposal has been too short for such investigations. Essential oils, comprising as they do, all the best scents, it is quite possible that among the Papuan ones some oils of value will be discovered. Again the cultivation of essential oil plants,

* I am making no reference to the products and by-products of such trees as the coco-nut and the rubber (*Hevea brazilienxis*), for they are cultivated in plantations, and all data concerning them are obtainable from the Department of Agriculture, Port Moresby.

which has proved so lucrative an industry in Southern Europe with the delicate flower scents, would seem to be a profitable pursuit in a tropical place like Papua. The heavy scents of the tropical flowers have, to many, an attraction equal to that of the rose and violet, and many perfumes of European fame have as basis a tropical oil. Of these, Ylang-Ylang is worth cultivating. It is one of the *Anonaceæ Canangium odoratum*, and some trees closely resembling it occur in Papua.

The *Rutaceae* should also be examined for oils. One is commonly used by natives, who tuck the leaves into their armlets. It is, I think, an *Evodia*. There is an *Alphitonia* which has a scented bark, and several other trees whose barks or leaves carry essential oils.

The cinnamon tree, *Cinnamomum massoia*, and which turns out to be identical with Beccari's *Massoia aromatica*, and which is called Api-Api by the Motuans, is common, and grows large and yields a spicy bark.

Specimens of the bark were forwarded to the Imperial Institute, London, and the following report was furnished by the Director:—

—	Present Sample.	Previous Sample.	Oil from New Guinea "Massoy" Bark.
Specific Gravity at 15/15°C	1·064	1·060	1·04 to 1·065
Optical Rotation D ..	—0·34°	—0·90°	..
Refractive Index nD20°C	1·536	1·534	..
Phenols (expressed as eugenol) per cent. ..	79	60	70 to 75

An examination of the phenolic portion of the oil showed that it consisted mainly, if not entirely, of eugenol.

After the removal of the phenolic portion, the residual oil had the following constants:—

Specific gravity at 15/15°C., 1.035.
Optical rotation D., minus 1.40°.
Refractive index nD20°C., 1.522.

This non-phenolic portion of the oil, on repeated fractional distillation under atmospheric pressure, furnished the following fractions:—

Fraction.		Boiling at—		Per cent.
1	..	175° — 225°C	..	25
2	..	225° — 236°C	..	68
3	..	236° — 240°C	..	5
Residue	..	..	..	2

Fraction No. 1 was evidently composed largely of terpenes.

Fraction No. 2 was found to consist almost entirely of safrole, and on redistillation almost the whole of it boiled at 229°—233°C. The congealing point of this fraction was +7°C., as compared with +11°C. recorded for pure safrole.

The foregoing results show that the approximate composition of the volatile oil from the present sample of Massoi bark from Papua was as follows:—

Eugenol, 79 per cent.
Safrole, 14 per cent.
Other constituents (principally terpenes), 7 per cent.

Commercial Value.

The oil was submitted to importers in London, who considered that the only commercial outlet for the oil in this country would be as a source of eugenol, for which purpose it would have to compete with such products as clove, cinnamon, and pimento oils. The firm were of opinion that the nominal value of the oil from this point of view would be about 4s. per lb., ex-wharf, London (April, 1925), but they pointed out that it would be difficult to create a demand for it unless manufacturers could be assured of regular supplies in shipments of at least 1 ton at a time.

The firm suggested that the oil might be distilled in Papua and shipped to the United Kingdom in drums, and added that, although this might cause the oil to become darker in colour, it would not affect its value as a source of eugenol.

Essential oil distillers, who were consulted, also estimated the current value of the oil at about 4s. per lb. On this basis, the oil obtainable from a ton of bark of the quality of the present sample, would be worth about £28.

The question of planting sandalwood has been dealt with under the section "forest policy." The Papuan sandalwood yields good oil, as is shown by the following analysis, which was kindly carried out by Mr. H. V. Marr, of the firm of Plaimar & Company, the largest sandalwood oil distillers in Australia:—

Optical rotation, minus 37° 24′.
Refractive index, 1.505.
Alcohols as santalol, 84.3 per cent.

Mr. Marr comments on these results:—

> "The high optical rotation obtained from this wood is remarkable, the normal rotation of oil of sandalwood being usually between the limits of —16 to —22, these being the figures provided for in the various pharmacopœia."

I have found great difficulty in obtaining any reliable information regarding the trade in sandalwood. At one time it was the most important export of Papua, but supplies were cut from all easily accessible country in the central dry belt, and to-day it is said to be two days' bad carrying to bring logs to the sea-board. Prices have ruled as high as £40 per ton for 4-in. wood and over, in Thursday Island, and £20 to £30 for smaller stuff. The wood went to Hong Kong, where it was again shipped to other parts of China. The smaller wood was probably used like the Western Australian sandal—purely for joss sticks,, and the larger logs. for ornamental knick-knacks, chains, toys, &c. In appendix will be found a list of forest exports since the beginning of shipping entries in Papua, and British rule in the sister territory. Much must have been exported before 1886, as there is evidence of Chinese visiting these waters for bêche-de-mer and sandalwood in very early times.

With the manufacture of sandalwood oil in Western Australia, there offers a sound continuous market for Papuan wood, and steps should be taken by merchants interested to arrange contracts ahead, and quietly open up the sandalwood industry again. It is a matter of organization, for in Western Australia, wood is brought through 60 miles of waterless country by camel teams, and put on rail for £8 a ton. Two days porterage should not make sandalwood inaccessible in Papua.

The trees represented by No. 304 *Near-Pentaspodon Motleyi*, and 785 *Campnospermum brevipetiolata* in the herbarium are of special interest, and the oils yielded are being investigated. I have not met with such a case as No. 304 before, and the yield seems to be so good that, if the oil has a value, its collection should prove a profitable business. It is most unfortunate that I was unable to get fruit or flowers of so interesting a specimen. Now, however, that a saw-mill has opened on the Wami, there should be little difficulty in obtaining material to enable the identification of so interesting a tree.

No. 785 has an advantage over No. 304, for the oil is in daily use by the natives, who have perfected a tapping system. There is not the same copious yield, but the supply is sufficient for the requirements of a fairly large population.

Mr. S. G. H. Jones, of the Department of Chemistry, Brisbane University, kindly undertook the examination

of the oil obtained from No. 304. The quantity obtained was not sufficient for a very full examination. The work done so far shows that it is of scientific, if not commercial interest, and a further supply of the oil is being obtained. Mr. Jones writes a preliminary account:—

> "The oil consists almost exclusively of acid substances molecular weight about 400. These appear to be liquids with iodine absorption values of about 280. The acids form soaps with sodium hydroxide solutions, and are evidently of the nature of higher unsaturated acids. The oil does not contain any glycerine or esters, and is somewhat of remarkable nature in being exclusively acid in character. Further investigation will be continued along the lines of isolation and identification of the individual acids (if more than one is present as seems likely)."

Ebony.

A small trade exists in the export of a dark wood that is found on Woodlark. I have not had the opportunity of visiting the island, and so am unable to give any particulars of the tree. The wood is very dark—almost black—and is probably a true *Ebenacea*. It often carries brown streaks, which is an objection.

Ivory Nuts.

The seed of a species of *Phytelephas*—a palm—is exported from certain parts of the islands, and coming as it does from wild forests, may be included among the minor forest products. I have seen this palm growing in the British Solomons, and it seems as luxuriant as the *Nipa*, and might prove of value as a plantation species.

Dye Plants.

While I have made notes of several plants used for dyeing tapa cloth, nets, &c. I have not personally witnessed and colouring process, except the use of the imported and widely cultivated Annatto (*Bixa orellana*). This is more aften used as face paint than dye for materials, and little or no preparation is used. The Indigo plant occurs, but is not used by the natives. If it is thought worth while to experiment with any of the Papuan colour-yielding trees, I would suggest the following:—

No. 10	*Afzelia bijuga*	Yellows.	Wood.
No. 4	*Pterocarpus indicus*	Reds.	Wood.
No. 32	*Morinda citrifolia*	Reds.	Roots.

I think, however, that the chemical dyes have proved so very satisfactory for all general purposes that such an inquiry would have more a scientific than a commercial value.

Garden Plants and Shrubs.

The introduction of the more beautiful of the Papuan flowers to temperate or sub-tropical regions is difficult, unless the plants or shrubs come from high altitudes. Fortunately it is here, to my mind, that the most beautiful flowers are found, and while no great monetary benefit would be derived by the collection and export of some of them, great pleasure would be given to many nations through horticulturists acclimatizing the species. While none of the orchids I have seen is very striking, many are interesting enough for cultivation. They are mostly epiphytes on trees, though a few high altitude ground orchids are pretty.

The numerous melastoma shrubs, which exhibit every variety of leaf and flower—the *Medinellas*; the beautiful *Hoyas*, and the resplendent *Agapetes moorhousiana* are well worth growing. The *Rubiacea* of the moss forests should thrive in a sub-tropical climate, as should the *Impatiens* of higher altitudes. The Papuan *Rhododendrons* have, I believe, already been cultivated.

There is a wealth of ferns, and some of them stand frost, for they grow at very high elevations.

Medicinal Plants.

No research has been carried out on the medicinal properties of the numerous forest products of a minor nature that go to the making of the countless medicines used by natives for real sickness. To one who has had no knowledge of any of the native languages, and no time to get into more than very distant relations with any of the people, it was quite impossible to distinguish plants that were regarded as potent for good from a medicinal point of view from those that wrought their cure through the imagination and superstition of the patient and his friends. There seems little doubt that the power of suggestion to effect a cure is as thoroughly recognized in Papua by the natives as it is in Nancy by Dr. Coué; it is unfortunate that the power of suggestion to effect a death seems to be more commonly noticed by Europeans in Papua, so the good done by the herbalist is overlooked. Of the many alleged poisonous leaves, barks and fruits I have been shown, none has been obnoxious at all. Even No. 227—*Achradotypus* sp., Jaruka—of the Buna people, a sapotaceous tree, which was regarded with such awe that the botanical material I brought back to the rest house in Embi Village caused a panic in that hamlet, appears to contain no toxic properties. The fruit is not good to taste, being astringent and the latex very sticky, but I do not think it, or the leaves or bark, would cause more than the indigestion that would follow a meal from such parts of any tree. Should the examination of this tree for gutta percha be undertaken, it would be well to go into the legends that surround it before starting work, lest some entirely innocent natives suffer by auto-suggestion, from the experiments that must be made with this Puri-Puri tree. Only in one instance, at the request of the Magistrate, did I seriously attempt to obtain information regarding drugs. It was a question of the use of certain plants as abortificiants. I came to the conclusion that the physical pounding, rolling and digging that the unfortunate female had to suffer was more likely to be the cause of abortion than the alleged drugs she swallowed, or the fumes of vegetable decoctions she assimilated by dark age's methods. I have, of course, only been shown that which natives desired to show me, and for all I know they may have a vast store of valuable drugs, as well as good simples. While recognizing the fact that we to-day owe most of our common and most useful drugs to herbalists, and to natives of other lands, e.g., quinine, it is curious that his own "boys" will run to master for a dose of epsom salts, and that these people appear to have no cure for malaria, except to lie in the sun, and they always ask for quinine.

Even should the native method of cure and the drugs used turn out to be all mumbo-jumbo, an investigation into plants belonging to families already yielding useful official drugs would be advantageous. In this investigation the Netherlandish *Pharmacopœia* might be of assistance. The cultivation of the quinine plant—*Cinchona officinalis*—and other species has not been attended with success to date in Papua. In Java, not only is quinine grown, but it is manufactured, and bottles of quinine bi-sulphate in five grain doses are now obtainable in Port Moresby. I have been unable to find out the reason for the unprofitable nature of a similar venture in Papua.

Food Plants.

It is extraordinary how very few palatable fruits the tropical jungles yield. The best green fruits are, I think, maita-maita (*Eugenia* sp.) and bio-bio (*Gar-*

cinia). There are two species of *Garcinia*—one with a fairly large, and the other with a plum-sized fruit. Neither is really pleasant, though one can imagine that the bio-bio, with a century or so of cultivation, might become another mangosteen. The bread fruit (*Artocarpus incisa*) of the forests has large nuts embedded in the fruit, and when roasted they have a chestnut-like taste. The nutless cultivated variety has been introduced here and there, but is not common.

The natives eat the fruits of the cycad (*Cycas media*), but they have to prepare them by letting them stand in running water for some weeks. They do the same with the fruit of No. 12—hodova (*Terminilia* sp.), and the kernel has a rather pleasant taste. But these are really more or less dried nuts, and there is no doubt that of all the nuts, okari comes first. This is the fruit of *Terminalia okari*, which yields a big nut containing a fine almond-flavoured desert kernel. Its habitat is low down on the flats. It has two species closely allied to it—*Terminalia catappa*, often called galep nut, Java almond, or plain almond tree. It grows wild behind or in the beach forest, and is also cultivated in Port Moresby, Samarai, and other divisional headquarters, and at Finsch Rafen. Its nut is not as good as the okari. The other is No. 36—*Okaka*—which yields a small edition of the okari nut, with the same taste.

The cabbage tree, No. 80 (*Gnetum* sp.) not only yields an edible leaf, which is a substitute for cabbage if picked young enough, but also a fruit which the natives like. I have already mentioned that this species yields a good bast fibre, so it is a valuable little tree.

Betel nut.—*Areca* sp.—should be regarded as a stimulant, not food. It is universally chewed by the natives, and while they prefer the introduced species, which is cultivated all round the coast, they seem to derive much pleasure from the indigenous betel, of which there are certainly two species, if not more.

I have seen one edible fig, and that was not very nice, though the natives seemed to enjoy it.

One of the climbers yields nuts that have walnut-like kernels which are good eating.

The fruits of the raspberries—*Rubus moluccanus* and *R. rosaefolius*—and allied species are edible, and that is all. *R. moluccanus* is found more plentifully in the lowlands, and *R. rosaefolius* in the openings of the upper foothills and lower mid-mountain forests, from, say, 4,000 to 12,000 feet. Others occur in the alpine grasslands, and were collected by Sir William MacGregor.*

The two wild oranges described by F. M. Bailey (*see* Annual Report, 1900-1901) *Citrus papuana* and *C. Warburgiana*, and which are common enough in the lowlands might prove good stock for better fruiting species. Their fruits are not nice to eat. The fruits of No. 27—*Uri*—is quite appreciated around Port Moresby. It is said to be a lady's fruit, but I have seen male natives enjoy it too. The wild cucumber is about the only salad fruit obtainable in the bush. The wild mangoe—*Mangifera minor*—yields the usual stringy and turpentine-tasting fruit like all uncultivated mangoes.

Durable Timbers.

No comprehensive tests having been carried out on the timbers of Papua to prove the degree of resistance that they possess to destruction by insect and fungus attack, I must fall back on the inadequate trials made with certain woods by natives, whose word has been accepted by white men. There are four woods accepted as durable in Papua, and they are:—

1. Melila, *Afzelia bijuga*.
2. Kasi kasi, possibly *Xylocarpus* sp.
3. Paper bark, *Melaleuca* sp.
4. Mangroves, *Rhyzophora* sp. and *Bruguiera* sp.

* *Kew Bulletin*, 1899, Nos. 151–152; also Annual Report, New Guinea, 1897–1898, pp. 47–50.

Of the above, melila is reputed durable in the ground. Kasi kasi has a tremendous reputation for resisting shipworm, but this seems confined to the eastern end. It grows equally well in the west and in the north, but the two common mangroves are usually preferred by the natives, and in the Central Division the paper bark of the swamps is esteemed by the Motuan though he will usually build his villages on the sea on props of mangrove. He is not a very energetic being and the mangrove is close to hand, which may account for his custom. The resistance that melaleuca shows to the shipworm may be due to its layers of bark, which seem to adhere very firmly. In the absence of comparative tests of barked and unbarked piles it is impossible to prove this point. In the case of kasi kasi I have been shown piles which have been twelve years in harbour works and were still sound. I have also been shown others riddled with shipworm after three years.

It may, I think, be generally accepted that while many timbers are durable in the ground ashore, none is really durable in harbour works. Some are slightly resistant to shipworm, and that is all one can say. The general practice is to substitute soft woods which can be heavily impregnated with creosote rather than rely on the inherent hardness or other natural durable qualities of a wood. Unfortunately even the alleged durable salt water timbers are of little service, for they grow to no length, and are therefore of use only for small jetties and shallow harbour works generally. Long timbers suitable for Port Moresby jetty are not procurable in the Territory except at a much heavier cost than the piles bought in Australia. This is, of course, due to an entire absence of timber organization for the 80-feet piles are in the forest, but there is no means of getting them out except by the brute strength and awkwardness of gangs of natives.

All harbour work wood should be sheathed with metal however durable the timbers are said to be, and in waters such as these the sooner permanent stone and concrete harbour works are substituted the better.

In the Mandated Territory *Afzelia bijuga*, under the name of kwila or ironwood, is considered very durable, and next to it, *Pterocarpus indicus*, which is certainly lasting in the ground though subject to dry rot between wind and water.

The mangroves are not counted as durable as piles, and so the harbour works of Rabaul are built of New South Wales woods. Paper bark does not occur in the Territory, nor did I see any kasi kasi.

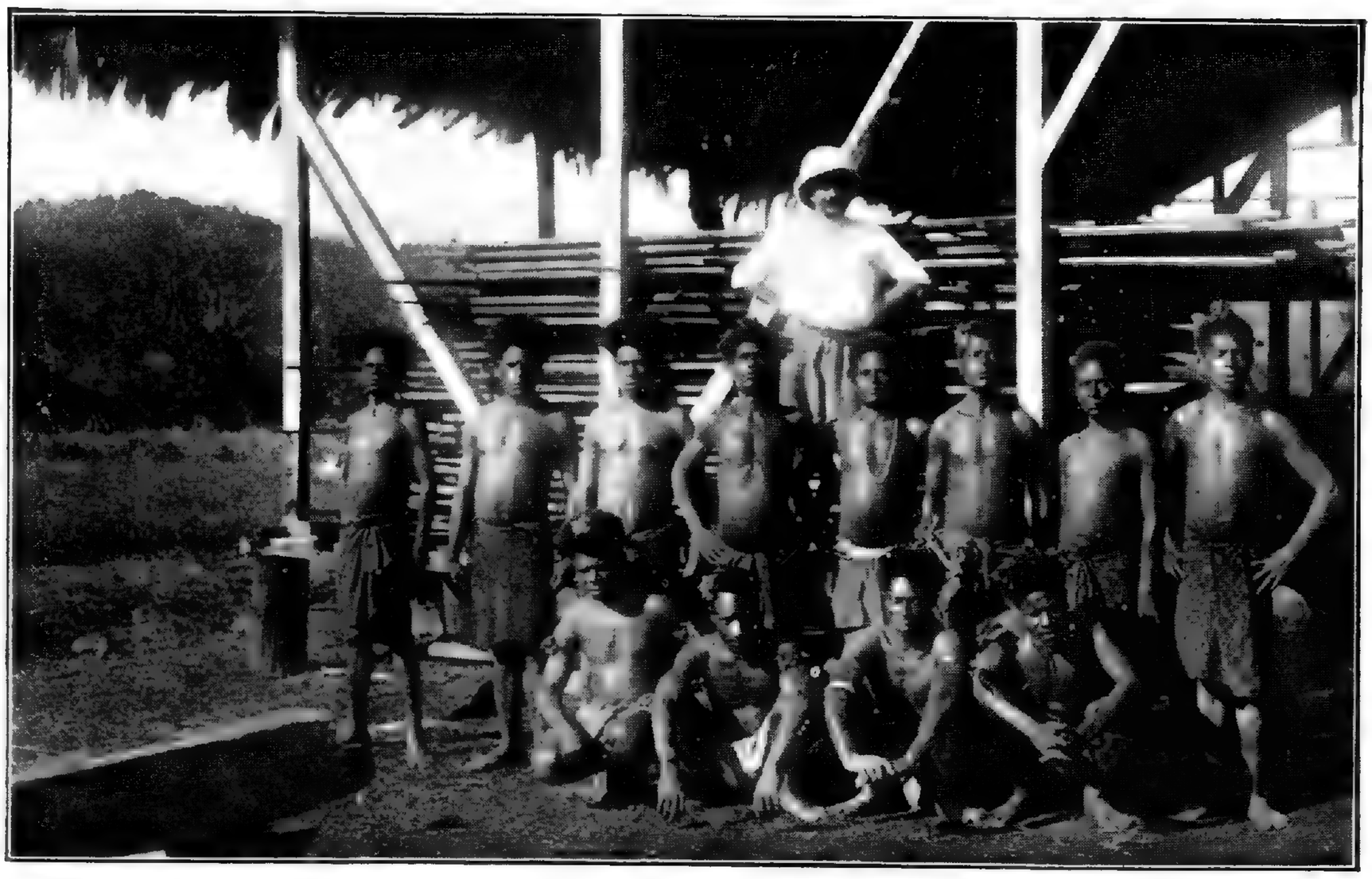
For home props, ahsang, *Vitex cofassus*, is used in Lavongai and New Ireland, but elsewhere this excellent canoe paddle and oar wood is not deemed durable.

Gnetum gnemon affin. is counted durable in river water, I saw it so used in the Markham for a jetty.

On land the tests of melila seem to be generally accepted, and house props of this wood are always used by white people, if procurable at all. It is highly probable that there are large numbers of woods that resist the white ant and fungus disease as well as melila. Their discovery would be a boon to planters as at present there is often some trouble to get the necessary poles, piles or beams. I would recommend that test pieces of the more common woods be planted in a position well known to be subject to attacks, and they be examined from time to time. Certain plantation managers have discovered durable pole woods, and these might be tested also; e.g., the wood used for house props in the Sogeri district, and the one used by Mr. McDonald on the Vailala. Botanical specimens should be collected from the same tree from which the specimen was cut so that the tree may be identified and scientifically fixed. Natives' views regarding durability must be accepted with caution, as in the matter of the number of trees on an area of reputed forest he will say "plenty" meaning more than he can count conveniently, say three, and so with the years that a pile will stand.

Finsch-hafen Sawmill.

A log of *Ayzelia bijuga*.



Mill manager and his hands.

[*To face page* 171.]

SECTION E.

THE COMMERCIAL OUTLOOK.

While Papua and the Mandated Territory, with all the islands, are geographically well placed for the development of a timber industry, having a large market at their doors, no one has, up to date, been able to establish a profitable export trade either of round logs or in sawn timber. Small contractors have made profits in getting cedar (No. 9—*Cedrela australis*) from the bush to the coast, but rarely have the larger contractors found anything over when they have paid the cost, including freight, and been paid the Queensland prices for their wood. At no time was the business developed sufficiently to enable a ship to ply constantly between New Guinea and Sydney, loaded with timber. Enough cedar was brought down from the Upper Vailala to fill several ships of moderate tonnage, but over a year elapsed before a ship came out for the wood, and by that time many rafts of fine cedar logs had been washed out to sea, and a large quantity, stacked on the beach, had depreciated in value through attacks of fungus and insects, and through cracking. Attempts to cut mixed timber, instead of mining the forests for one precious one, have been equally unsuccessfull; and while mismanagement and lack of organization may have had something to do with one or two of these enterprises, the real reason lies, I am afraid, in the poverty of the forests, and the mixture of species that compose them.

Subjoined is a summary of all the surveys that I have made of the rain forests of the lowlands of Papua. Except the forests near Sagari, which is only a scrap, and those around Embi Lake, which are not large enough for the development of a big milling business and should, I think, be reserved for future Government requirements, the forests of the lowlands carry an exceedingly low volume of timber. This, combined with the fact that no single species occurs in sufficient numbers on any area to make the sawing of one timber possible, has made profitable saw-milling difficult, if not impossible. The requirements of the Territory itself are small, and could be served without difficulty by pit-sawyers. A development in the consumption of wood is not at all likely, for many generations—until, in fact, the Papuan native acquires tastes in architecture which are euphemistically called European. Yet in their lowland forests there are a host of beautiful timbers, precious woods which should command a price if carefully sawn and placed on a market where aesthetic taste in panelling and general indoor decoration prevails. In Australia, people are still too busy carving homes out of national resources to really develop a large demand for the very beautiful in the decoration of home life. They are too busy painting the picture to worry about its framing. For the beautiful Papuan timbers to reach a larger market means a heavy freight-cost, and unless there is a bread-and-butter line for the saw-miller to fall back on, such cutting of the forest for its precious woods cannot possibly pay. Is there any common stuff within reach of every one's pocket that can be cut in quantities? I fear not. What has been written regarding Papua is equally true for the Mandated Territory. There are no areas of immediately accessible and obviously profitable forests for the saw-miller. Thanks to the eucalyptus forests close to the capital, and to the splendid conservative cutting of the Mission folk, there has been a small but continuous supply of good sound timber for Rabaul, but it has never been sufficient to fill the demand, which has been supplied from Australia. So one finds baltic, oregon, Australian hardwood entering into the construction of buildings; and there is, except in the houses and churches of the Mission Societies, very little local timber.

On the main island of New Guinea, the Lutheran Mission at Finsch-hafen has been cutting mixed woods for many years, but it has been a case with them of picking the eyes out of the tropical forest, and *Afzelia* and *Pometia* have supplied their main mill logs with a sprinkling of *Pterocarpus*, *Vitex*, and a case timber for making trade boxes. Elsewhere, I have explained the reason for not using the soft woods which has made their saw-milling so very difficult. The mill is heavily handicapped now for want of logs and is faced with road-making or tram-laying to open new forest, both very expensive operations.

At Alexishafen, the R.C. Mission is faced with the same difficulty, only here it is more serious as there is no forest to open up, and it will be necessary to shift the mill altogether to a new site. The choice of the new site is causing much anxious thought, and I am afraid that some difficulty will be experienced in finding anything suitable within the region of this society's influence, viz., from Madang to Aitape. This statement makes the poverty of the country from a ordinary standpoint pretty clear. In addition to the forest jungle woods already enumerated, the Alexishafen

SUMMARY OF RESULTS OF SURVEYS OF ALL LOWLAND RAIN FORESTS.

	Number of Species.	Number of Trees.	Cubic Contents.			Trees per Acre.
			Total.	Per Acre.	Per Tree.	
			Cubic feet.	Cubic feet.	Cubic feet.	
Table No. I.—Veimauri River, C. D.	68	437	35,209	325	80	4
Table No. IV.—Venapa River, No. 1 Camp, C. D.	45	308	35,873	577	125	4·4
Table No. VII.—Venapa River, No. 2 Camp, C. D.	54	268	45,326	435	169	2·6
Table No. X.—Soputa, N. D.	35	223	26,826	344	120	2·8
Table No. XIII.—Kumusi River N. D.	47	398	55,137	551	138	4·0
Table No. XV.—Sagari Village, N. D.	27	173	30,561	764	176	4·3
Table No. XVII.—Embi Lake, N. D.	8	840	113,918	813	135	10·5
Table No. XVIII.—Baroi River, Ua Camp, D. D.	28	144	17,962	598	124	4·8
Table No. XX.—Baroi River, Camps 2-5, D. D.	35	193	25,527	591	132	4·5
Table No. XXII.—Vailala River, Camps 1-6, G. D.	69	485	65,434	383	135	2·6

mill cuts some nice *Calophyllum inophyllum,* which is found useful in shipbuilding, and for panelling. This is purely a shore-growing species, and it leans out over the sea at an extraordinary angle. Long straight pieces take some getting, but good knees and crooks are easy to find.

The Chinese have always carried out a fair amount of wood-working and contracting; to build plantation bungalows is one of their specialities. They pit-saw the timber in the forest, and generally rely on Afzelia and Pometia for their main structural pieces and fill in their linings with other woods of a softer nature.

Summing up the position in the Mandated Territory: There are four saw-mills running at present. Two on the island of New Britain with a total output of 3,000 feet of sawn Eucalyptus timber a day, and two on the main island which are not running full time owing to shortage of logs, and in any case can really only fill Mission Station requirements. The Eucalypt forests have a very restricted life, and, as far as I know, there is only one untouched patch of this species left in Britain when the two present mills have cut out their supplies. The use of the pit-saw should be encouraged at all district stations. Pit-sawing is good prison labour, and imports of timber from overseas could by this method be kept within limits. It will be seen that the outlook, so far as saw-milling is concerned, is not attractive. What possibility is there, then, for a commercial development of the forests of the Territories? To my mind, the only way is to found the business, not on timber, but on the minor forest products. Regard timber as a by-produce of a well-organized industry depending on the minor products of the forest, and there seems a great promise of development in the tropical possessions. In the section dealing with "Minor Forest Products," I have pointed out some of the very obvious directions in which commercial enterprise is required. If the captains of industry will realize that the Territory offers a fine field for their efforts, and is not a mere mine of wealth to be emptied by the first comer, then there will be a great awakening to the solid riches of New Guinea. There is much capital in Australia waiting for a sound investment, but the type of company promotion that has been the rule in the past is not such as to attract these solid investors. New industries will not be established easily, and I think that very serious research work on the minor products of the forest must be undertaken by men with the knowledge of the subject, and who, besides having all the necessary academic qualifications, have the experience of applied science, which is almost as important, before any business can be done.

Paper pulp, alcohol, fibres, match splints, tannins, oils, resins, gums—these are the products to concentrate on. Without full scientific and practical information as to the possibilities of the development of each, and all, of the above, it is not possible to dogmatize as to the commercial outlook of any one of them. The scientific investigator will be able to show where probabilities of industrial profit lie. I have put them in the order which I regard as merit from the point of view of market. Few are produced in Australia, and all are much needed. As a side-line to the tapping of Nipa for alcohol, or the manufacture of newsprint from the weed re-growth forest, or the reeling of match ply from logs of No. 13—*Pterocymbium*—might come the cutting of beautiful furniture woods for special markets and special buyers. With the wonderful sun and splendid rains, the systematic cultivation of the most profitable drug plants is indicated, and just as New Guinea can grow wood for pulping in a quarter the time it takes Canada, so she can grow alcohol and all other minor products that depend merely on rapid growth, large storage capacity, and heavy fruiting. What we have seen in the banana and coconut occurs with oil, starch, and resin-secreting trees. In tannin alone the Territories offer a new field, for the dabbling in mangrove bark that has taken place cannot be regarded as a serious attempt. The establishment of forest industries in the lowlands depends, therefore, primarily on the reports of the industrial chemists who must first investigate the field. It is to be hoped that this work will be undertaken at an early date, for I am confident that the results will be such as to assure the development of one or more minor forest product companies in the Territories.

Passing over the foothill country again, I come to the mid-mountain coniferous belt.* What opportunities offer to the saw-milling company? To the saw-miller used to the conditions obtaining in the south of Australia, I say "None." To the New Zealand timber man, or, indeed, any lumber jack who has had to wrestle timber out of really mountainous country, the forests of hoop pine and other conifers at the head of the Kemp Welch would be regarded as difficult, but not as inaccesible. At present Queensland prices and considering the small areas available, and therefore the small cut that must pay all overhead charges, I think these forests are to-day commercially inaccessible. The timber can be got at without any great engineering difficulties, but it would not pay its cost of cutting and transport. The dwindling visible supplies of United States pine and Canadian fir (they are both oregon pine, really), and the paltry efforts made by all States of the Commonwealth to anticipate the shortage that stares them in the face, by planting pines, makes nothing more certain than that the cost of common softwoods will increase in the near future.

I am not in a position to say to what price oregon must soar before the hoop of Papua and New Guinea becomes a possible saw-milling venture. In the Mandated Territory on the mountains on each side of the Markham and the upper Ramu, this species is found at a lower elevation than in Papua, and hand in hand with a large planting scheme this supply of softwood might be made available for public work and local use generally. It is certainly to be hoped that before the coniferous areas attract the saw-miller that forest policies in both Territories will be established, so that when the exploitation begins, regeneration of the forest may be at the same time undertaken.

I would refer those who wish to go further into the possibilities of the development of forest industries in Papua to the *Handbook of Papua*, and the reports to the League of Nations on New Guinea, which give much valuable information as to the labour conditions and regulations governing the employment of natives. Sufficient to say here that the employer of labour is dealt with as sympathetically as the labourer. Wages in Papua are 10s. a month, and in the Mandated Territory 5s. a month, but the legal food-rations bring the cost per unit of labour to a much higher figure. The native is very apt so far as mechanical work is concerned, and I have seen a full-blooded native do as good breaking down through twin saws, and benching over a 6-feet saw, as a white man. More supervision is required, but with tact and patience excellent work can be got from these native tradesmen.

I am indebted to the official secretary, Mr. Leonard Murray, for the following notes on the Harbours and Anchorages of Papua. Mr. Murray, who is a yachtsman, has for some years navigated the Governor's yacht through all the waters that surround the Territory and its islands. He is the author of "Sailing Instructions" for the Papuan waters, and so is an authority on such a subject as Harbours and Anchorages. Starting in the west there is Daru, which is a port of entry, and offers good anchorage for ships drawing up to 18 feet. The next

* For data as to surveys, see pp. 38–71.

[*Photo by J. Burdon.*

Raft of Ilimo Logs reaching the Manu-Manu Mill Pond.

[*Photo by J. Burdon.*

Ilimo Logs at the Manu-Manu Mill.

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shelter, going east, is Goaribari, but this is not too good in the south-east season, for in that bottle-neck of a gulf the rollers in that monsoon make 4½ fathoms —the official depth—unsafe. The mouth of the Era River and Port Romily offer good anchorages, but of the two the Era is deeper. Port Romily shallows in places to 2½ fathoms. It is, however, the more satisfactory port, as it is served by a large number of waterways. The next anchorage is behind Yule Island. This is a capital Sound, and has the advantage of being accurately charted. It will take any sized ship. The next shelter is the Redscar anchorage; this has the advantage, if the navigator knows it, of being a good anchorage, both in the north-west and south-east monsoon. Anchoring behind Vari Vari Island in the south-east, and under Redscar Head in the north-west season, gives a ship good shelter. The Vari Vari's would make a good dépôt for Galley Reach products. From Redscar to Bona-Bona stretches the Barrier Reef, within which there is good shelter for any ship, except where openings in the reef occur. Also a number of excellent ports occur, of which Port Moresby, with its harbour improvements, comes first. Then Bootless Inlet. Then come a series of bays which make good anchorages. Two fine ports, that will take ocean-going vessels, are Milport Harbour and Port Glasgow. All the way to Samarai there is no shortage of anchorages. Samarai itself offers a good anchorage. This port, Moresby, Woodlark, Misima, and Daru are the five official ports of entry into Papua. Passing Samarai we reach that deep indentation of the coast line, Milne Bay; here several anchorages exist. From East Cape to Cape Vogel there are only two anchorages—Chad's Bay at one end, Rawdon Bay at the other. Jasi-Jasi is a good anchorage, and there are numerous anchorages in Collingwood Bay, if you know them; but it is a foul bay, and without sailing instructions or previous experience it is not safe.

At and around Cape Nelson occur wonderful fiords, but they are too deep for anchoring. Anasari Harbour and Porlok Harbour, particularly the latter, are good anchorages. Like Collingwood Bay, Ora and Buna Bay are foul; but if you know them good anchorages exist. Mambare Bay is the last anchorage on the north coast line, and is a good clear shelter in the south-east season, and moderate in the north-west weather. A hard northerly blow would, however, drive you out.

Compare the above shipping facilities with those of almost any part of the coast-line of Australia, and I think it will be admitted that the advantages in favour of Papua are great. In the case or those bays which are foul, it is only a matter of beacons and buoys to make them safe, and should any industry develop behind such waters, the channels of navigation would at once be well buoyed.

There is no readily available information regarding the harbours of the Mandated Territory. For medium-sized steamers there are numerous good ports, while quite a number exist capable of taking really large ships.

APPENDIX I.

Description of Method Employed in the Forest Surveys, including the Collection of Botanical Material.

A general idea of the nature of the country, the position of the various forests worth investigating, having been obtained from natives who had previously lived in them and others who had traversed the district, I selected areas for close investigation. A preliminary inspection to get the topography, the natural divisions of forest types and general view of the work, is first made. This enables one to lay out the direction of the traverses that must be opened, so that they may include all the types of forest within the area. Everything is now ready for the survey of the forest. A certain traverse, say at right angles to the course of the river, having been selected, it is opened—a narrow path being cut sufficiently wide to enable chaining to be carried out. Its direction is kept on the bearing already selected by means of a prismatic compass. Readings are taken at intervals of 15 chains, when the direction is corrected if necessary, and between these points the line is merely "boned." Numbered sticks are put in every five chains. With one intelligent boss boy, who can write figures and take charge of the boys, this work of traverse cutting can be done by raw natives. It is advisable to have a prismatic with a dial on which the course can be set out by means of a mark; this makes large errors impossible and makes it easier for the native to pick up his figure through the prism quickly. Also I found it best to label the sticks consecutively, rather than 5, 10, 15 chains, etc. The gang required is three boys cutting, two boys chaining, one boy chosen for his climbing capacity, two carrying herbarium box, specimens, etc.; a boss boy takes charge of the traverse cutting and chaining, while I follow with the herbarium boys and climber.

The traverse is regarded as the centre of a strip of forest 2 chains wide, and all the trees within a chain of this cut line which come within the category of mill logs are measured in girth, and the length of saw-mill bole is estimated. Except in cases of trees that yield useful timbers but do not grow beyond 5 feet, only trees 6 feet and over in girth were measured. The measurement of girth was made at breast height of those trees which have neither buttresses nor root swellings, and immediately above in the case of those which have such protuberances. The bole was taken as the length from the point of girth measurement to the springing of the crown.

Thus, strip by strip, the whole forest is criss-crossed, and an estimate is arrived at of the following information:—

1. Total number of trees of each species.
2. Total cubic contents of each species.
3. Cubic contents of each species per acre.
4. Cubic contents of the average tree of each species.
5. The cubic contents of each species, expressed as a percentage of the total cubic contents of the forest.
6. The number of trees of each species expressed as a percentage of the total number of trees in the forest
7. The number of acres to one tree of a certain species. (This looks unusual, but is a necessary inversion, for in the mixed forests of Papua, the cases are rare where you can find several trees of one species on one acre).

It would have been most interesting to obtain a full census of three stories and so their relation with each other, but the time available was so little that so comprehensive an undertaking was not possible. My attention was, for the most part, devoted to the top story, though wherever even third-story trees or soil covering plants were found in flower, botanical material was collected.

The botanical work in so mixed a forest is of first importance. The trees are all so alike outwardly, their flowers are so hard to get, that no opportunity must be lost in obtaining all material possible. To that end, as every fresh species is encountered, an axe cut is

taken from the bole. In buttress-rooted trees this means erecting a staging, for both wood and bark of the buttresses differs from the main trunk, and samples of them are, therefore, not satisfactory. The axe cut is made deep enough to make sure that the timber has differentiated heart wood or not. In some trees with very deep sap woods this means cutting a large piece out of the bole. In any case, the sample should be a deep one, and if the carriage of material is difficult, which is often the case, it can be cut down so as to include those portions only that are necessary for later examination. The bark must be tied on, as it usually detaches itself when the wood dries out. While the axe cut is being obtained, twigs, leaves, and if possible, flowers and fresh fruits are obtained from the crown of the tree by the climber, or, if, as often occurs, the tree is unclimbable except at the expense of much time in building ladders of cane, by means of a .44 rifle with—in my case—much cost of ammunition. Dry or half-decayed fruits can often be picked up on the ground; these are a help in identifying the tree. As full a description of the tree is written as is possible, on the spot. Examples will be found in section C. With the exception of the macroscopical details of the wood, the information included in the descriptions was taken in the field. At the beginning, before I quite understood the Papuan's breadth of intelligence, I made errors, with the result that the descriptions of some of the earlier trees met with had to be greatly revised. Particularly was this the case regarding leaf measurements when leaves were brought to me by the climber from a younger tree of the same species. Such leaves, if they approach to the juvenile at all, may, in certain species, be five to ten times the size of those of mature trees. It was found necessary, therefore, always to obtain the material from the crown of the same tree from which the axe cut was taken, and to do the whole collecting and write the description on the spot. The details of measurements are entered in a separate field book, the species being given a number, with the local native name or names against it. The description is recorded in another note book, which is continually being referred to from day to day to prevent duplication or entering a new species under the old number and name. The bush native has a really wonderful knowledge of his trees, compared with which the ordinary white man in his Australian forest is an ignorant person. But the Papuan is not infallible, and is prone to give you an answer which will please you, instead of contradicting you, as he should, when you guess a tree's name wrong. The full written description, at any rate of the less common species, is necessary in any case. After months of continuous field work, even with this, and the help of the natives, I brought back duplicate material of the same species from different regions. The material thus collected is chalked with the same number as that recorded in the books. The leaf, twigs and flowers go at once between newspapers in the herbarium box; this is a light ilimo box 6 inches high and 18 x 12 square, with a painted canvas, ship-shape cover tacked on the lid to keep out the wet. Material in such a box keeps in good condition and can be transferred quickly to the drier on getting into camp. The box is usually not so crowded but that note books, pencils, foot-rule, lense, and other necessaries can be fitted in, and kept dry when not being used. A grummet at each end enables a pole to be run through along the top of the closed lid; and thus the two boys carry it, together with axes and knives, from tree to tree and camp to camp. Instead of the usual herbarium press for drying botanical material, a method which entails continual changing of papers and which, even with every care, is too slow to prevent the attacks of moulds, in a tropical climate. I had a drier made which consists essentially of a galvanized iron box, large enough to take the material in its folios of newspapers comfortably, viz., 12 x 18, and high enough to take several hundred specimens, viz., 2 feet; round this, another galvanized iron box is fixed so that there is an intervening space of 2 inches. There is a hole to enable this jacket to be partially filled with water, otherwise it is joined up to the inner box at the top. A lid fits down over the inner compartment. This drier, elevated on two logs with a fire underneath, will dry out a day's collection of material, however wet it may be, in the course of 24 to 36 hours. This system has proved very satisfactory after a year's trial. The drier looks cumbersome, but is really light, and when filled with 20 lb. of newspaper and material makes a load for two boys, carried in the usual manner on their shoulders from a supporting pole. It has accompanied me throughout my travel, even when traversing the very mountainous country from Kokoda to Port Moresby, and from Mt. Obree to Kagi, up Sarawaket and to the Ramu. When cutting tracks in unexplored country in the mountains there is this objection to the drier: that it is somewhat broad, and it is, therefore, necessary to cut the track a little wider than usual. To obviate this, which is a serious objection, I had a second drier made which is only 10 inches high, and can therefore be turned on edge for carrying through pathless country. When dry, the material is transferred to the usual herbarium press and this is carried in a painted canvas bag to protect it from damp. Even so, and to prevent the attacks of insects, I found it advisable to put all the material through the drier from time to time until it could be poisoned and housed in iron boxes at headquarters. The data collected regarding stands of timber, the measurements of trees and all other information relative to them which is not descriptive, is transferred to sheets so that the computation of cubic contents and other necessary figures may be made.

If I have gone into detail regarding the method of conducting my examination, it is because, in the first place, I wish to make the limitations of the system quite clear; in the second place, I hope that my method, at any rate as far as collecting is concerned, may be of assistance to other foresters who may explore the forests I have strip-surveyed.

The limitations of a system of survey which is based on the measurement of strips of forest 2 chains wide, taken in as many directions, and therefore through as many different parts of the forest as possible, must necessarily depend on the relation between the area of such strips when added together and the area of the forest under investigation. Unfortunately, time did not permit me to make as many traverses as I should have liked in any of the forests, except, perhaps, in the Delta division. I give the percentage of strips to the total area of the forest embraced in the survey in each case, so that an estimate may be made of the relative value of the survey. Ten per cent. may be taken as the relation to be aimed at, and the efficacy of the survey is greater or less as it approaches or recedes from that figure.

In the matter of computations of volume, a "form factor" of 0.5 was taken. Most of the trees that comprise the rain forests have a lower taper than half the volume of a cylinder of the same basal area. On the other hand, the results approximate to the quantity of sawn timber that a well-worked mill would recover. When the forests came to be carefully examined, it will be possible, perhaps, to apply the correct form factor, and to do this the present use of 0.5 will be found to be a convenient factor to alter. In the meantime, it may be taken as an estimate of the sawn timber. The following comparative computations make the matter clear, I think:—

Given an even tapering *Octomeles* tree with a 12 feet girth above the buttresses, and a length

of 80 feet, my computation would give it a content of 456 cubic feet. If it were felled, and found to measure at the middle of the 80 feet bole, 10 feet, then the solid contents would be really 632 cubic feet. The form factor is close on .7, instead of .5, and the loss by my computation is 176 cubic feet, or 27 per cent. The "quarter girth system"—an old method of measurement, which, curiously enough, is still in use for felled timber in most parts of Australia—gives our log 500 cubic feet, a difference of 44 cubic feet compared with mine. It is clear the less the taper, the greater the under-estimate, and the greater the taper, the nearer the form factor approaches .5, and therefore to my figure. To convert my estimate when a true form factor is obtained, all that is necessary is to multiply by 2, and apply the new form factor.

APPENDIX II.

Expedition to Sarawaket.

The object was to investigate the country lying between the coast and the highest point of the dividing range which lies between the Markham and Ramu on the west and the sea on the east. The range is generally called Finisterre, but the mountain Sarawaket, though apparently the south-eastern end and highest peak of the Finisterre is in reality separated from that range by a deep valley. By ascending the mountain from the Finschhafen, I hoped not only to cover all the possible regions of vegetation from mangrove to "Alpine grass," but I expected to find my road fairly easy, thanks to the work of the Lutheran Mission, which has its head-quarters at Finschafen.

I landed at Finschhafen on the 4th November, 1923, and was made welcome by the Rev. Flier, the senior of the Mission, and his colleagues at the Mission Station. I interviewed the Rev. J. Philhofer at Helsbach, who has an intimate knowledge of the interior, having carried out several arduous explorations right over the main range into Papua. Although he had not visited Sarawaket, he was able to give me very valuable information regarding the route, and an excellent map prepared by the Rev. Keysser, who had himself reached the summit. Also he gave me a letter to all native Mission teachers, or helpers as they are called, so that I should obtain the necessary carriers to enable me to get through, not only the populated but the high, uninhabited region.

Until Tuesday, the 6th, I was engaged in repacking stores and making up shoulder and back loads, and arranging to get 35 carriers to take them. I had taken the precaution to have a number of canvas swags sewn in Rabaul, and in these I packed 35 lb. of rice and other perishable stores, I met with some difficulties in the matter of payment, for instead of the usual payment in sticks of American twist tobacco, I found I should have to pay in money, for the natives grow a much superior tobacco, the seed having been introduced by the missionaries, and they have no need for the usual trade stuff, while with money they are able to buy many commodities that the missionaries have taught them the use of. The difficulty was finally overcome, the head of the Mission financing me for the expedition.

Wednesday, 7th November.—Started off by boat to Helsbach, 29 carriers going by land with two police boys in charge. At Helsbach, where the road begins which leads to the Sanatorium at Sattleberg, I obtained six more boys, and at 1.45, saying good-bye to the Rev. Pilhofer, started the climb. The road is still in the course of construction, and is therefore rather heavy. It is 8 miles long and well graded, rising as it does from sea level to 3,000 feet. The usual delays caused by carriers occurred on the road, so that we arrived at Sattleberg at 6.15, where Mr. Helbig made me welcome, giving me one of the cottages for the night. The formations passed through consisted at first of coraline limestones, which at 1,000 feet gave way to chalk, and this persists to the top. The usual weed tree re-growth covered the slopes for most of the way, though in the gullies the mixed rain forest type still persisted. *Pometia pinnata, Alstonia scholaris, A. longissima, Pterocarpus indicus, Artocarpus* sp. No. 6, *Celtis philippinensis, Terminalia okari, Vitex* sp., and *Vitex cofassus, Octomeles sumatrana* (one tree only), several *Eugenias, Garcinia* sp., a number of the genus *Ficus, Lianes* and *Rattans* were well represented. The crimson D'Albertis creeper (*Mucuna Bennettii*), was in full bloom, also the coral pink Freysinettia. The two common screwpines (*Pandanus* sp.) were conspicuous. The crowns were festooned with orchids, bird's nest and elkhorn ferns.

There were some trees I did not recognize, but nowhere did I see a stand which was worth stopping to make a strip survey. At about 2,000 feet the foothill forest began to be met with. *Quercus junghuhnii* Miq., and soon several old friends appeared belonging to this upland region, and finally the big and then the small acorned oak were seen (*Q. spicata and Q. lamponga*). The common raspberry (*Rubus mollucensis*) was plentiful in open spaces, and here and there a very tall treefern made a distinct third story. Medinellas and Balsams gave colour to the undergrowth, as did the variegated-leafed Aralias.

Sattleberg consists of a collection of cottages for the use of the missionaries who come up for a change once a year. There is also a school where the children of these missionaries are educated. There were 26 children at the school. The climate is very much cooler than at sea level, and so this sanatorium offers a fine bracing change in the dry season. In the south-east monsoon, which was still blowing at the time of my visit. Sattleberg gets too much mist; it is just on the edge of the cloud belt.

Thursday, 8th November.—Leaving Sattleberg, we pushed on with fresh carriers, and passing through the village of Bolengbangeng, reached Nganduo, where we camped for the night. The bush passed through had been much farmed, and weed tree re-growth was common. The rain forest species were not lost, and *Alstonia scholaris* was common close to oaks and tree fern, and finally hoop pines and the "pig tail" *Dacrydium elatum,* while on several crests I noticed *Araucaria klinkii.* Otherwise the nature of this foothill country was much as yesterday. *Agapetes moorhousiana* was a beautiful addition to the high creepers. Whenever I meet this glorious climber I stand amazed at the wealth of rose-coloured bell-shaped blossoms which literally envelope the twining stems.

Friday, 9th November.—Carriers were short this morning, but women with excellent "billum," as the net-bags are called, came to the rescue and cheerfully walked off with the loads. They are better carriers than men, being more accustomed to it, and carrying as they do with the loop of the string bag across their brows. The bags are capacious and are made of twine from the bark of *Gnetum gnemon,* a common enough tree hereabouts. Packed with a 35-lb. swag of rice and several articles of feminine use, the load is swung on the back, the brow band adjusted, and then a baby is perched on the top who retains his balance by a grasp on mother's wool. The young *Dacrydium elata* around here look just like young spruce, and at first I found it hard to believe that the elder trees were of the same species. No wonder the missionaries send up here for their Christmas trees. We reached Junzaign by lunch-time, and then climbed along a knife-edged ridge that divides the valleys of the Mape and the San. The mist

unfortunately blotted out the view, which on my return journey I found was wonderful. On the ridge was some mossy forests. The *Dawsonia* moss covered the ground, tree ferns formed a second story, while filmy ferns were to be seen on all sides. *Dacrydium elata* was very common. A curious sight was a D'Albertis creeper on a *Dacrydium*. In Papua one regarded this as a riverside tree creeper in low country, and here it is growing in mid-mountain forest, if not mossy forest. The real creeper of these forests, however, is the port-wine-coloured trumpet flowered climber, *Dichrotrichum Chalmersii* F.v.M. Pure stands of the two oaks *Q. spicata and Q. lamponga* occurred here and there on the less steep slopes, while *Q. junghuhnii* was very common though usually well mixed with other species. The trees, however, were small, and nowhere did I encounter good forest. The clearings for farms were confined to small areas around each village; in between the forest was virgin. A tree which is prized by the natives is Hodu (*Himantandra belgraveana* (F.v.M.) which yields them the split planks for building their Mission schools, churches, guest homes and their own houses. Every village has a guest house, and the mission teacher makes one at home in it. The building of board houses is becoming a practice, and there are several in each village replacing the low eave-to-ground rough pole hovels of the past. I am now quite beyond the sphere of Government. The District Officers' patrol finishes at Nganduo at furthest, and all the progress now is due to missionary effort. The trail since leaving Sattleberg has been a good one for the bush—the grades have been well picked out and the trail kept clean.

Saturday, 10th November.—Left Junzain and arrived at Joangey, the next village, where I camped. It is a five and a half hours' march with loads, and is thoroughly enjoyable, owing to the splendidly cut track. Pick and shovel work was to be seen, and some of the side cuts down the zig-zags were 8 feet high. Compared with the so-called roads in the mountains of Papua, particularly the track that leads from Port Moresby to Kododa, these trails made under the peaceful sway of the missionary are wonderful examples of roads. The zig-zag is so foreign a method to the native, who, like the Roman, is prone to drive his track straight on over hill and dale, that I was very surprised to see it an accepted method in these parts.

We crossed Hondang creek and later Ngacgnac, both flowing east, to join the Mongi. Before falling to the Ngacgnac, we pursued a high crest from which we overlooked the deep valley of the Mongi and the villages on either side. Alas, the mists were down on the heights to the north-west, so I did not catch even a glimpse of my destination. Although we did not rise higher than 4,500 feet, the ridge was slightly mossy in character, but the main type was foothill forest. The two acorned oaks were common, but *Q. junghuhnii* was absent, the common *Myristica* and *Wormia* were numerous. Several *Medinella* and *Impatiens* and *Begonia*, in full flower, made the undergrowth very attractive, while a *Gleichenia* and the white bracted *Mussaenda* covered openings. In such holes, too, one found the little tree *Homalanthus populifolius* Grah., with its decorative crown of spade-shaped leaves, which are quite red when young. Deming, the native boys call it, and they ascribe evil properties to the milk that flows when the bark is cut into.

Since leaving Sattleberg, the formation seems to have been mudstone, with chalk or limestone showing wherever a big land-slip had occurred. A big earth tremor, which threw the main building at the sanatorium off its piles, seems to have caused a number of these slips.

I decided to leave the careful examination of the forest until my return journey. Not only is it a question of conserving supplies for the climb up Sarawaket, but the choice of a representative sample of this type of forest must wait until I have seen more.

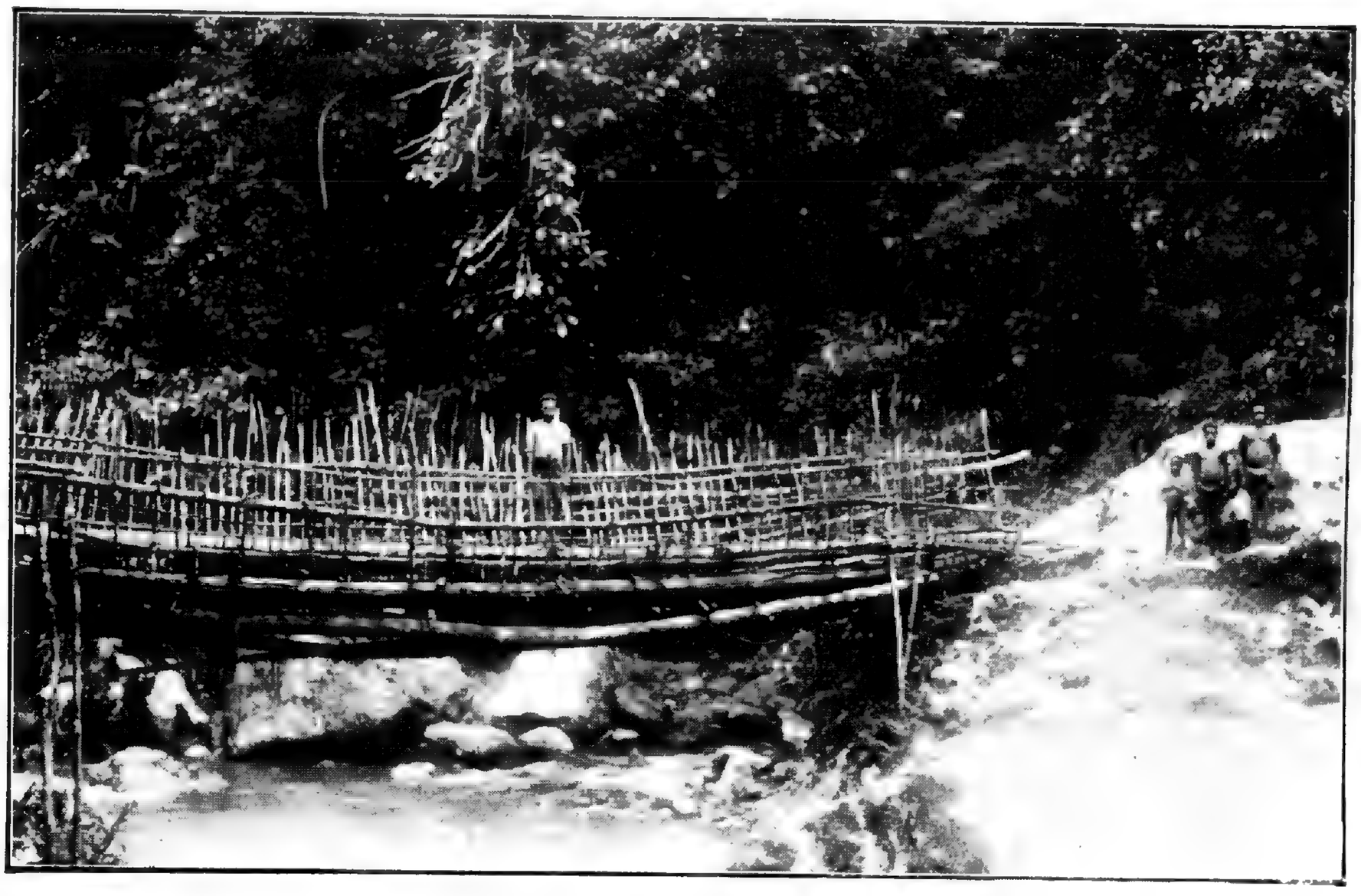
Picked up time from Manila (Cavite N.P.O.) at 3 a.m. GMT or 1 p.m. zone time and rated my watches.

Sunday, 11th November.—Stayed at Joangey all day and fixed azimuths of surrounding peaks and of Sarawaket, which was just visible over the top of two ranges that lie between. It is grass-topped, and in the full sunlight, shines out very clearly above the dark forest-clad lower peaks. Brought in Cavite both at 1 p.m. and at midnight very clearly, and took stellar observations for latitude and longitude; also took boiling-point height, 4,240 feet.

Monday, 12th November.—Left Joangey at 6.30 a.m. and arrived at Kuluntufu at 9.30. It was so short a distance that I wanted to push on, but the Mission teacher prevailed on me to stop. He said that it would take me to 6 p.m. to reach Tobu, which is the next place of call on my march. Mapped and botanized. This village is separated from Joangey by the deep gorge of the Mongi, which the B.P. height makes 1,679 feet deep, while the villages have only 39 feet difference in height, Joangey being the higher. They are just within shouting distance of each other, and yet it takes three hours to climb down and up from one to the other, and it would have taken all day had it not been for the excellent zig-zag trail that the natives have cut. The river Mongi is a turbulent rushing white torrent which seems to have torn its way down through chalks and mudstones to a hard rock. I crossed it on a picturesque bridge. At first, going down to the water, *Quercus, Eugenia* and a *Calophyllum* marked the country as mid-mountain; before I got to the river, however, I was among ordinary rain forest trees, *Pometia*, *Pterocarpus*, *Terminalia okari*, and others of the low country. For the first time since leaving the Owen Stanley Range in Papua, I met with the rose-leafed raspberry (*Rubus rosaefolius*). The whole valley, except where the slope is too precipitous, has been farmed, and there are numerous villages scattered about.

Tuesday, 13th November.—A five-hours' march brought us to Tobu. It was hard going. First we climbed the divide separating the Mongi from the Kuak. From the top the trail switch-backed its way along the side of the valley, gradually dropping and crossing several confluents and passing through Kapagu village and so down to the bridge (2,494 feet), a wide crossing necessitating two spans, an immense boulder serving as a central pier. Then up to the other side, zig-zagging up 1,800 feet past the village of Korombu and so up to Tobu. The geology of the country is changing. We have left the chalks, and hard limestones have taken their place. Here and there I noticed dykes of what seemed to be basalt. The farming, if anything, has been more severe. Walls to hold up the soil and enable the cultivation of steeper land are common. As time goes on this system will develop into terracing, such as one sees in Italy. Volcanic light soil and lava occur here and there. There is a grand view before me, and the range to the north stands out very prominently, its slopes being almost precipitous and its crests almost alpine. The line of demarcation between farm and forest is very high; the natives have saw-edged the higher mid-mountain forest, and some of the villages are on the edge of the perpetual cloud belt and moss forest. On the bank of the Kuak were some *Casuarina nodiflora*, and the steep hillsides, once forest, are now covered with weed-tree growth and lots of *Damnaropsis*. The planks used to make the square-built houses are here also made of the *Magnolia*. Away down the valley I can see the sea. I made Tobu 4,449 feet above the sea.

14th November.—Left Tobu at 6.40 and reached Ogeramnang at 11 a.m. The rise from the village was arduous and the crest of the divide was 6,761 feet.



Bridge over the Bulung River.

An Ogeramnang urchin with the edible fruit of a screw-pine. Pandanus sp.

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This ridge separates the Kuak from the Bulung river and the path, after crossing it, skirts the knife-edge top after passing along the face of a precipice. Nowhere, however, is there any difficulty, for the natives have made deep side cuts and have sunk piles into the faces of precipices and built the pathway on this foundation. So down to the village, which is 5,851 feet above the sea, where I was well-received by the mission natives and given a hot lunch of boiled fowl, potatoes and cabbage. Such diet is practically unknown, even at sea level, except where there is ice, and to find it back in the mountains speaks volumes for the civilizing influence of the Lutheran mission.

Looking back on Tobu, it seemed smothered in bamboo. These bamboos had been planted to serve as a supply of buckets to the village. All about New Guinea a length of bamboo, with all but the bottom node knocked out, seems the usual container for water, and little boys think nothing of dropping a thousand feet down to the river in the gorge and bringing up full pipes of water. Further up on the divide, I met more bamboos, but it was the small mountain variety, and was growing in among the usual mid-mountain forest surrounded by such ground cover as *Elatostema* and with *Agapetes* growing in the branches of the oaks overhead. There was a good patch of forest just before I reached Ogeramnang, and I hope to make a survey of this on the way back, if I find no better of the type between here and Sarawaket. Had a good talk with the people here, who make it a two-day trek to Sarawaket and so spending a day on the top, I should be back here in five days. The view from here is spoilt, for the clouds come down to the village edge and all one can see is the bright sunlit valley of the Bulung, which is very steep and is slashed here and there with rock exposures and scarred with land slips where the formation is shale. Here and there patches of farm lands show up, with their lower edges retained by stone and post fences. As in the valley of the Kuak, terracing will become more and more necessary. I am surprised at the small amount of grass lands. Here and there patches of grass occur, and all through the weed regrowth a sprinkling of grass is to be found, but nowhere are there large areas of savannah forest. At sunrise on the 15th, the crest of Sarawaket could be seen some 30 miles to the west—a rounded grass-covered hump above the dark green moss forest of intervening mountains, and in this bright dawn all the valley and the sea coast itself was clear, and I was reminded of the valley of the upper Kemp Welch in Papua. It was more mountainous, and the sides were more precipitous, but the great difference was the total absence of large grass lands. There is no dry belt influence in the Bulunb. No Eucalyptus vegetation and no Savannah forest. Ogeramnang is a pretty village, and the natives have shown taste with their tree fern fences and borders of scarlet balsams. While the temperature at noon was 61 deg., it grew cold as the clouds came down and a Scotch mist drove through the village. The male natives looked cold sitting on their hunkers, mouth on knees, dressed in tapi cloth pereneal bands, gazing at me. I was glad I brought up some heavy flannel clothes. They stuff the band up with padding fore and aft for some reason which I thought hardly discreet to inquire, otherwise, they are quite naked. The women wear "grass" skirts and come in late from working on their plots of garden land, carrying the usual net bag from their foreheads. This is stuffed with food supplies and firewood, and the baby sits on top—a naked, brown, happy little person till he sees me. I have re-packed up my gear, and am leaving everything at this village not actually wanted for my five-day trip up Sarawaket and back. I stored the extra rice and gear in the mission boys' house.

15th November.—Cheered by the glimpse of our destination, we left Ogeramnang early and, following a splendidly-cut trail, dropped down to the Bulung river (2,878 feet) almost 3,000 feet below. We are to follow up the Bulung, leaving the big valley with the confluent Jameng on the left (right bank) and then follow up—having crossed the main stream—the westerly head water which is called Nomi, leaving the Galep to our right. All this the guide explained quite lucidly. After crossing the Bulung, we climbed up to the village of Zaring which is the end of the graded track. From there on began the dear old Papuan scramble up hill and down dale following a hunting pad which always took the worst grades up the steepest slopes. Nowhere was the comparison brought home to me so clearly. A few minutes before I had been jogging along a good zig-zagged track, and suddenly I was clambering and hanging on, often on my hands and knees, dragging myself up a 45 deg., slope. Yet this method of getting about is the usual one in all the mountain country in all other parts of Papua and New Guinea I have visited. After a thousand feet of scramble we reached a farm hut and there decided to camp. A heavy mist-rain hastened the decision and I was glad when I had my tent up. This is the first time it has been pitched since I started out, for I have slept in excellent guest-houses in the villages. I had counted on village "kai kai" tonight for the boys, but the rain prevented any being brought up to us, and I had to open our precious rice supply, which I must depend on from now on to Sarawaket and back. I have a day's extra supply in case something goes wrong and the trip takes longer than three days there and three days back, which is a small reserve in this land where the unexpected is the only certain event.

Of forests, to-day we saw none, for all the valley was farmed and hereabouts the grass has taken a big hold. The terracing is good, but they will soon have to put more stones and less sticks into their retaining walls. *Dammaropsis* was the most conspicuous tree on the 45 deg. slope, and except for leguminous annuals and a few bushes, the rest of the vegetation was grass. This would be a pretty camp, starred as the grass and bracken are with all colours of balsams. One white and pink is new to me, but they are all probably crosses for the shades vary from white through mauve to scarlet. The scarlet one may be a separate species, for its leaves differ. My tent and fly are very little protection in this driving mist-rain, and I wish I could get the contractor to spend a night in it up here. The boys are better off for, if crowded, the farm hut keeps out the wet. Temperature at 5 p.m. was 48 deg. Fahr., and the boiling point thermometer made the camp 6,076 feet.

16th November.—I was fortunate in getting a clear sky and good atmospheric conditions and so rated my watch and approximately fixed the camp, which is called Kudungeng. The day dawned overcast and we started off at 6.15 in a mist, which promised as soon as the south-east trade got up to turn into rain, and it kept its promise. We rose very steeply 2,000 feet, and then followed a divide running south-westerly and westerly, possibly between two arms of the Bulung. All was covered in cloud, and so I could only guess the topography. We were right in the true moss forest and chilled to the bone, so at 1 o'clock, having reached a running brook in a little dip, I decided to camp in this disagreeable region. The carriers were divided into two lots, those in front with me wished to push on and up to a grass patch they knew of, but the rear guard, which was some time arriving, were so dejected and weary, and as half of them were women carrying native foods, who had to get back again to their homes several thousand feet below by nightfall, I decided to camp. Several of the dauntless ones pushed on in front with rice and stores not immediately required, and the wise ones made a camp as best they could in

the soppy forest. The forest passed through to-day was, at first of mossy character, but the absence of pronounced aerial roots and spring-mattress effect under foot, showed that we were still at the lower limits of the mossy forest; by 11 o'clock, however, the conditions became more mossy, and conifers, *Eugenia* and *Colophyllum* became plentiful, taking the place of a curious pole wood we had passed through till now. All the trees were now enveloped in thick moss and made to look twice their diameter. Aerial roots were common and some *Dacrydium* stood up on these, like mangroves. The springiness of the filmy fern-covered forest floor increased; here and there areas of it were covered with a dense carpet of dawsonia moss standing like seedling pines. The boys showed me a trick with the aerial rooted trees. By filling up the spaces between the prop roots and making a rough mountain bamboo or twig door to shut one opening, they soon had a good shelter for half a dozen boys. Dryish wood could also be found under these propped boles and soon fires were going. At night these red glows, issuing from the roots of grotesque gnarled trees, gave a weird look to the camp. The best camp tree was the celery top (*Phyllocladus*); this, even in the mossy forest, makes a bole of 2 feet in diameter, and is perched on such a network of aerial roots that quite a number of natives can camp under one of them.

17th November.—The morning broke cloudy, and we struck camp in a white clinging mist at 6 o'clock. I pushed the carriers on, and remained behind to bake bread. By 7 a.m., the sun pierced the clouds, and the temperature rose to 55 degrees Fahr., and the piccinin kept to help me, and I felt less depressed. By 8.20 we were off with a somewhat depressed loaf to catch up the loads. The boiling point height of last night's camp was 8,727 feet. First we climbed some 1,500 feet, rising and falling, and meeting no change in the character of the forest. It was all decidedly mossy. Then we reached the first patch of grass, a little hole in the mossy forest, obviously the result of fire. Here a number of *Libocedrus* and *Dacrydium* were trying to restore forest conditions. They were some 40 feet high, and looked most ornamental in their grass setting, the picture being rendered quite park-like by a large bush of port-wine flowered *Rhododendron* in front of them. Two sclerophyllus shrubs, one of the *Rhododendron* family, and the other an *Epacridaceae,* also another hard-leafed shrub,* 20 feet high, a large vernonia, 25 feet high, completed the woody growth on this grass island. A few tree ferns that had escaped the fire stood 30 feet high, and gave the formation a permanent appearance. This grass patch will grow, and every fire will eat into the surrounding forest, where the dead trees and undergrowth of sclerophyllous shrubs mark the limit of the last conflagration. Crossing a brook, one of the heads of the Bulung, we came to a succession of grass islands, separated by moss forest, and one grass patch was a largish valley, and the last fire was not more than a year old. The encircling skeleton *Dacrydium*, *Podocarpus*, *Libocedrus*, and *Phyllocladus* were still blackened, and here and there stood little patches of burnt sapling conifers. The forest had tried to re-establish itself, but had been beaten by the hunters' fire. All over the open land were bushes of red rhododendron in full flower. The valley proved to be a succession of deepish holes in the limestone formation, and some are filled with water, making miniature lakes, the largest of which the guide called Topizan. Into these holes would bubble a stream, only to disappear and reappear lower down in another depression. Rising slightly, we crossed the divide between the Bulung and the Mongi, and then dropped steeply down to the head of that river. After a scramble along a pig track of a path, we suddenly came out from mossy forest to a long grassed valley, with the river flowing rapidly down the middle of it. The bush came down on each side to a fringe of dead burnt trees and tall tree ferns with scorched tops. The fires here can only have been a month old, for the young grass on its blackened raised rhizomes is only a few inches high and of a vivid green colour. There is no doubt that periods of intense drought occur at this altitude. Yet to-day it started raining at 10 a.m., and only ceased at 6.30 p.m.; the forest was so wet as to be for the most part marshy. The last part of the journey was through forest which was not quite mossy in character, or perhaps I should say, was not the mossy type of Mount Obree, in Papua. The trees are larger—50 feet high, and up to 2 feet in girth. There are aerial roots, but not to the degree that one walks on an elevated mass of roots. The whole is thickly clothed in moss except for some of the smoother stemmed conifers. Big *Podocarpus* were rare; two *Dacrydium* and *Phyllocladus* and *Libocedrus* taking their place. I was surprised at the number of medium sized lianas that hang about the crowns; also at the entire absence of mountain palms, rattans, bamboos and pandanus. We followed up the pretty grass valley and pitched camp close to the junction of the Mongi and Busu. The guide calls this Mongibus, which may be a corruption of Mongi bush. We are a few hundred feet (8,550 feet) lower than last night's camp, and being open country it is warmer than in the dripping moss forest. Still, the weather is disagreeable, and my view is bounded by the mist-hung forest skirting the grassed area and every now and then the valley itself is blotted out by a bank of mist rolling down over everything. This is a settled native camping ground, and here the people from Ogeramnang meet the people of Kombo when they go hunting; all beyond to the west and south-west is the Kombo people's hunting country, and in old days trespass by Ogeramnang folk would have meant death. Mission influence has brought these two warring tribes into friendly relations, and so the Kombo men and women we found in a camp on the Busu did not run away when our large party arrived, but came out to welcome us. Late this afternoon I noticed our neighbours making off, and I asked the guide what was the matter and why these people were going, and it turned out that they were all going to Kombo to get food for me and my carriers, so that when we returned from Sarawaket we should find a plentiful supply. The hunting had not been very successful, for my boys only managed to bring in two opossum-like animals—grey-blue fur above and white underneath, and a white tuft to their tails. I find I have a growing army of camp followers, who, armed with bows and arrows, are taking the opportunity afforded by my visiting these heights to combine hunting with the pleasure of seeing what the white man is doing. They are sponging on the hard working carriers, who cheerfully divide their little ration of rice with the loafers. I explained to the guide, who is a mission teacher of Ogeramnang, that on present rations I could feed twenty men, and that was all I could take with me.

18th November.—A glorious day of cloud-flecked blue sky. It rained hard all night, not a light mist, but a solid thunder rain. So bright a day was a great surprise. The boys had got very cold in the night, and they were hard to start at 6.15 a.m., but we got away eventually, I bringing up the rear and shooing back camp followers. Rising from the valley of the Busu we crossed a divide. The forest here was of good coniferous type, the trees had boles of 2ft. 9in. in diameter, and a large percentage were *Libocedrus*. *Dacrydium* came next, but *Phyllocladus* were scarce. Just on the top was a burnt patch of forest from which I caught a glimpse of the summit of Sarawaket, only a few miles to the west. This burnt patch is an excellent example of how the destruction starts. The trees had all been

* Subsequently identified by Mr. C. T. White as *Rhododendron communis Diplycosia* sp., *Styphelia* sp., and *Eurya* sp. nov.

killed, but the forest conditions are not destroyed. The seedlings of the conifers are sprouting creepers such as the three *Rubus* (by the way, this is the highest level I have known *Rubus moluccensis* to grow), and the climbing *Gleichenia* and polypods. A few tufts of grass appear. All is sopping wet, and that a fire could run in such dank vegetation seems impossible. There is enough debris from the skeleton conifers above to make a big blaze, and all the natives are waiting for is a spell of dry weather to reduce everything to tinder dryness, when they will put a fire stick in. It is seldom that one sees the grass land in its earliest stages, and I was glad to take a good look at this.

Dropping down the other side we came on a stream which I was assured was the Busu, which seemed impossible, as I had crossed a ridge of 2,000 feet which now stood between me and the valley of the Busu. Afterwards, on my way down from Sarawaket, I investigated this and found that while I had been labouriously clambering over the divide the river had gone to ground and burrowed its way under. This disappearance of rivers is a common feature of limestone formation, but never have I known so remarkable a tunnelling. We followed up the river which meandered through a succession of depressions which at times were deep and precipitous enough to call gorges. The rock faces exposed showed limestone everywhere. The coniferous forests were now rapidly disappearing, and the grass areas were becoming large. The same leathery leafed shrubs already mentioned were found also; the tree fern and rhododendron, a small shrub (identified later as *Diplycosia*) was common, and a daisy (*Brachycome* sp.) starred the young grass. Another of the heath family grows in the *Dacrydium Libocedrus* forest, and it seems to stand fire and so remains in the open grass land. When the trees have gone this is *Vaccinium blepharocalyx*. It was near the top of the Busu that I came on a couple of mountain wallaby, and was fortunate enough to knock one over with police boy Jack's service rifle, much to the admiration of my-bow and arrow follows, and no little surprise to myself. This animal weighed a round 56 lb., and had a thick heavy dark red brown fur. I had hopes of getting the skin down to Mr. Helbig, the missionary at Sattelberg, who is so interested in such things, and makes good leather. This I explained to my guide, but evidently my words were not understood, for he later in the evening brought me a shrivelled burnt up peau de chagrin. It seems that, native fashion, they roasted the kill whole complete and with its hair on, and to carry out my wishes went to the trouble afterwards of skinning it for me. I could only laugh. I hope I will get another. I set up my aerial to bring in Cavite's 1 p.m. signal, but failed to pick it up. This is the first time I have failed to get time. We waited for the laggards, for news came through that four had died on the road—a pidgin expression for fallen exhausted. Later on they all turned up rather tired, but with several kangaroo rats, which explained their lateness and weariness. Two hours' further going took us to the foot of the last climb. The crest of Sarawaket stands now right over us, and I estimate it to be only 2,000 feet higher. Here at 11,752 feet we camped.

19th November.—I was up till well after midnight shooting stars for position. Unfortunately, as at 1 p.m. I failed to get time, so my longitude was not fixed. The atmospherics were not bad enough to drown so strong a signal as Cavite's, besides I could get snatches of N.P.O. and N.P.N.'s traffic, but the signals were always wiped out unless I earthed the grid. It was cold work at the theodolite and I wished for gloves. Though the temperature at this altitude at midnight was only 33 deg. Fahr., and there was not a breath of wind, I felt so cold that it might have registered zero. One's blood gets thin down below, and the clothes I had brought up were really only what one would wear in summer in Melbourne. A big fire outside my tent did not seem to make much difference, and I turned in all-standing, with every article of clothing I could find piled on top of me. The boys would have suffered still more, I imagine, had they slept under canvas, but fortunately there was a sod hunting house into which they all managed to squeeze, and there they kept perfectly warm till morning. All the country was white with hoar-frost as five of us made our way towards the crest. All the other boys had a holiday to hunt and do as they liked. The three that came with me were my guide and two boys carrying the instruments, and police boy Jack. All the lower shoulder is grass country with rhododendrons and the same sclerophyllous bushes and tree ferns. Limestone outcrops all over the steep slopes, and the country, until the last climb, is very up and down. The grass is quite yellow and ripe for the fire. By 8 a.m. we were on the top of the crest, only to find that another crest, a higher one, lay to the north, and in between was a deep ravine. On this, the lower crest, we found a mark left by the Rev. Keysser, consisting of his umbrella. The guide said there was another mark below ground, but this we did not investigate, for I was anxious to get on to the other peak before the clouds came down. So I took a round of angles with the theodolite, and some notes of the topography and the boiling-point height, 12,484 feet, and at 9.30 started for the real peak. These two crests are divided by a deep precipice at the bottom of which, 4,000 feet below, runs the Ogai River, which flows south-west, debouching into the sea in the Huon Gulf, near Lae, where it is called the Adler, I believe. To circumvent this valley and climb the higher peak meant dropping down again to the shoulder from which we had climbed, and then making a detour to round the head of the precipice. It was clear that the climb I had done was quite unnecessary, for I had to descend to but a few hundred feet above the camp where I had passed the night, and had I known there were two crests I might have entirely avoided the first by steering a straight course to the head of the precipice. That the higher peak is not visible from camp is due to a little rise that stands between. It took an hour to come down from the lower crest and work our way round to the head of the valley. Here we found a very pretty little lake with fern trees about it, which seemed to be the source of the Ogai; behind was a rather large area of moorland of a wet to boggy nature. From the head of the valley to the top of Sarawaket took another hour. This crest is less rounded, and is covered with large limestone boulders. Like the south-east crest, the limestone strata terrace the slope at intervals all the way to the top, but on the north-west crest these form quite high cliffs, so that one has to choose the way up to avoid the worst of them. Nowhere, however, is the climb in any way arduous. The boiling-point height (subsequently corrected to sea level barometer) worked out at 13,454 feet).

A magnificent but very short-lived view was obtained from the highest boulder on which I set up my theodolite. Then down came the clouds. The lower crest, though about 2 miles distant, seemed but a stone's throw away. The whole valley of the Markham looked like an inland sea, and it was hard to credit the fact that it was all grass land. The clouds came down before I had completed my round of angles, and when next they blew away for a minute, all but the highest peaks were blotted out, and below and around were tumbling masses of white clouds, through which the very high mountain tops stood like islands in the sea. Sarawaket is separated from the Finisterre proper by a valley, yet they are sufficiently continuous, and so it is regarded as the south-eastern end of that range, of which it is the highest peak. My journey back to camp took 1½ hours. The country between, once I

had regained the source of the Ogai, was all grass land dotted with treeferns and the Sclerophyllous bushes met with yesterday. Even on the top of the south-east crest and within 100 feet of the top of the north-west, one of these heath shrubs flourished (*Diplycosia mundula*, F.v.M.). Here and there were fine clumps of *Rhododendron*, all in flower, mixed up with the taller leather-leafed *Styphelia*. The grass that flourishes here and on the crest of the mountain is the same as what I met with at 7,000 feet. It's rhizomes stand out from the ground, black and branched. It was subsequently identified by Mr. C. T. White as *Deschampsia caespitosa*. The annual fires of the natives kill the shrubs, but the grass survives and takes the place of the woody plants.

Failed again to get the 1 p.m. signal, so must face another cold watch to try and bring in the midnight signal. Spent the afternoon collecting botanical material and fixing position of camp with regard to the crests. The boys hunted and got a poor bag—one opossum-like animal and a few kangaroo rats. I questioned them as to wild dogs which have been frequently recorded at great heights in similar grass land in the Owen Stanley Range, but they had never heard of any dingo. I found many hunting tracks, and these heights are obviously visited, not only by the Komba people, Ogeramnang folk, but by villagers on the Ogai and along the Finisterre. I pursued a valley dropping to the north-east, through which there was a beautiful view of the sea towards Long Island, but it grew too precipitous and so I returned to camp. At 4 p.m., the temperature, which at noon had been 68 deg. Fahr., dropped to 49 deg. Fahr., and we were glad to start good fires going. A plentiful supply of wood is at hand on the edges of the forest, where past fires have killed but not entirely consumed the trees. There is no doubt in my mind that, except for the very marshy land and the actual cliffs and outcrops of limestone, the whole of this mountain top was under a forest of conifers and myrtles. As I write now, the south-east crest wears a halo of fire, which is slowly burning its way up to the top. It has been lit, so I am told, by the Ogai folk, who are up hunting and preparing for a bigger hunt to come.

Took observations for time and latitude, but again failed to bring in Cavite's midnight signal. My aerial seems to be in a perpetually charged state. Guam, Honolulu, and Cavite, all such clear stations, were wiped out. Just after midnight a strong rainstorm swept the mountain, accompanied by hail, but there was no lightning or thunder near us, though down 3,000 feet below the lightning flashes all the evening had been visible, and the growl of these distant discharges was strong in the ear pieces, but not so bad as to make signals unreadable, if I could have brought any in. The rainstorm did not make the reception any better, and I turned in puzzled by the "radio" conditions. The night was much warmer, and the thermometer did not sink below 45 deg. Fahr.

On 20th November we started back, for our food supplies were running short, and so botanizing as we went, returned to Sattelberg. Halts were made at various places where the forest proved interesting, and details of the results have been given in that portion of this report dealing with the various forest regions. Certain incidents of the journey down are, perhaps, of interest, and so I have culled them from the diary. On reaching my old camp on the Busu I found a large gathering of Komba natives bearing fruits, tobacco, and meat; these I bought gladly. A better cabbage I have rarely eaten than this one brought up to me to a camp at 8,500 feet, and there were tomatoes and cape gooseberries, French beans, and floury potatoes and a fowl. It is not with the idea of recording the gluttony of my followers and myself that I give the above menu, but to show the wonderful civilizing influence of the Lutheran Mission, who without the help of, one might almost say in spite of the past Governments and the present one, have taught these savages—for, after all, it is only fifteen years since they were marauding wild men of the mountains—to grow European vegetables and fruits, good tobacco, and to rear sheep, cattle, and pigs of fair breeding. These simple teachers of the Gospel have raised the standard of living in every way, and besides bringing religion and education to the tribes have shown them the value of village sanitation and the benefits of a sound system of graded roads. The work of the white missionary has been so well done that to-day the native teacher can continue it under light supervision, and yearly the "helper stations," as these native-taught stations are called, are being established further afield. At present the mission stations, worked from Madang, are only five days from the furthest back station on the Upper Ramu, and in a few years the two organizations will be linked, and that country between, which to-day is not under any control, will, I hope, be brought under the same enlightening influence as the mountainous country I have been describing. I had no difficulty in picking up time by wireless at the Busu camp, and was fortunate in getting a good clear view of both crests of Sarawaket from here, and was able to carry out a small triangulation to fix their position. I left all collecting till this return journey, and I append a list of the material collected, and subsequently identified by Mr. White. We avoided a night camp in the Moss forest, making a very hard day's march from the Busu camp to the Nomi. The last part of this journey was down a 30 deg. limestone slope and landslide; we slept by the banks of that river at 5,000 feet. We had travelled from 6.30 a.m. to 5.30 p.m., with a short stop in the middle of the day to boil the billy, and so were very tired by the time the camp was pitched. We reached Ogeramnang early next day and in the forests near that village a survey was made. I was lucky in getting a good night for astronomical observations, and so fixed Ogeramnang and checked Sarawaket by azimuth. I had no trouble with the wireless time signals. I wish to record the great assistance rendered me by the mission teacher, Ngezienuc. He it was who accompanied me to Sarawaket, making all the carriers' arrangements and smoothing my path as far as it was possible to do.

I stopped at Joangey on the way back and made a survey of the forests about there also. There is a glorious view from the high crest before I reached Junzain turn-off. When coming up this trail, the mists were down and I saw nothing, but going back all was clear. The road does not actually rise to the highest point of the divide, but skirts it with 10 and 12 feet side cuts some 200 feet below the top. From here one sees the whole land mapped out to the west and south-west. The height is 4,900 feet, and I took some prismatic angles which are of interest, showing as they do the wide expanse of county in sight:—

	°	′
Sarawaket, N. crest	270	0
Sarawaket, S. crest	272	30
Wooded Peak	270	30
Kulintufu	261	0

Precipitous rock face on divide between Buling and Kuak close to the junction of those two rivers, 267 deg.

Highest point on Mongi divide, 293 deg. 0 min.

Nandidiu village, above Kulintufu, 258 deg. 30 min.

Joangey Tobu and Ogeramnang were hidden by the ranges. The way I had taken was quite clear, and in the bright sunlight of that fine day the burnt cap of the southern crest of the big mountain looked blue above the yellow grass which itself was only a narrow strip of light above the dark conifer forests. The forests between Junzain and Ngonduo yielded some interesting botanical material; and so I returned to the kind mission folk at Sattleberg, who hospitably entertained

me in one of their comfortable guest-houses, where I wrote up my notes and examined and dried out my material.

LIST OF MATERIAL COLLECTED ON THE SARAWAKET EXPEDITION.

Herbs. No.	Genus.	Species.	Family.
501	*Styphelia* ..	sp. ?	*Epacridaceae*
502	*Rhododendron* ..	*communae* Forster	*Ericaceae*
503	*Deschampsia* ..	*caespitosa* Beauv.	*Graminae*
504	*Diplycosia* ..	*mundulata* Fv.M.	*Ericaceae*
505	*Eurya*	sp. nov. ..	*Theaceae*
506	*Zoellera* ..	*procumbens* Warbg.	*Boraginaceae*
507	*Libertia* ..	*pulchella Spreng.*	*Indaceae*
508	*Polypodium* ..	sp. ?	*Polypodaceae*
509	*Vernonia* ..	*affin. V. arborea* ..	*Compositae*
510	*Rubus*	sp. ?	*Rosaceae*
511	*Rubus*	sp. ?	*Rosaceae*
512	*Rubus*	sp. ?	*Rosaceae*
513	*Brachycome* ..	sp. ?	*Compositae*
515	*Pilea*	sp. nov. ..	*Urticaceae*
516	*Schefflera* ..	*setulosa* Harms. *affin.*	*Araliaceae*
517	*Drapetes* ..	*ericoides* Hook F.	*Thymelaeaceae*
518*	*Phyllocladus* ..	*hypophyllus* Hook.	*Coniferae*
519*	*Dacrydium* ..	sp.	*Coniferae*
520*	*Libocedrus* ..	*papuana* F.v.M...	*Coniferae*
521	*Vaccinium* ..	*blepharocalyx* Schlecter	*Ericaceae*
522	*Elatostemma* ..	sp. ?	*Urticaceae*
523	*Dawsonia* ..	sp.	*Musci*
524*	*Podocarpus* ..	sp. ?	*Coniferae*
525*	*Semecarpus* ..	sp. ?	*Anacardiaceae*
526	Indet.	.. ..	*Orchidaceae*
527	*Rhododendron* ..	*carringtonae* F.v.M.	*Ericaceae*
528	*Saurauja* ..	*Roemeri* Laut. *affin.*	*Dilleniaceae*
529	Indt.	.. ..	*Orchidaceae*
530	*Impatiens* ..	sp. ?	*Balsamaceae*
531	*Rhododendron* ..	*Hansemanni*, Sch. Warb.	*Ericaceae*
532	*Rhododendron* ..	*Warianum* Schlector	*Ericaceae*
533	*Fagraea* ..	*obovata, affin.* ..	*Loganiaceae*
534	*Metrosideros* ..	sp. nov. ..	*Myrtaceae*
535	*Medinella* ..	sp	*Melastanaceae*
536	*Medinella* ..	sp.	*Melastanaceae*
537	*Emilia* ..	*prenanthoidea D.c.*	*Combretaceae*
538	*Saurauja* ..	*conferta* Warbg. ..	*Dilleniaceae*
539	*Elatostemma* ..	*macrophyllum* Brong var. *majusculum* K. Sch.	*Urticaceae*
540	*Pilea*	*pellis-crocodili* H. Winkl. ..	*Urticaceae*
541	*Elatostemna* ..	*sesquifolium* Hask.	*Urticaceae*
542	Indt.	.. ..	*Umbelliferae*
543	*Impatiens* ..	.. ..	*Balsamaceae*
544	*Solanum* ..	*aviculare* Forst. ..	*Solanaceae*
545	*Piper*	sp.	*Piperaceae*
546	*Schefflera* ..	sp.	*Araleaceae*
547	*Cyholophus* ..	*pachycarpus* H. Winkl.	*Urticaceae*
548	Indt.	.. ..	*Celastrinae ?*
549	*Gleichenia* ..	*dichotoma* Hook.	*Gleicheniaceae*
550	*Damnaropsis* ..	*Kingiana* Warb.	*Moraceae*
551	*Muhlenbeckia* ..	*platyclada* Meiss..	*Polygonaceae*
552*	*Podocarpus* ..	*amara* Blume. ..	*Coniferae*
553*	Indt.	.. ..	Indet.
554	*Podocarpus* ..	*cupressina* R. Br.	*Coniferae*
555*	Indt.	.. ..	Indet.
556*	*Himantandra* ..	*Belgraveana* Schl.	*Magnoliaceae*
557*	*Calophyllum* ..	sp.	*Guttiferae*
558*	*Kania*	*eugenioides* Schl.	*Saxifragaceae*
559*	Indt.	.. ..	Indet.
560	Indt.	.. ..	*Burseraceae*
561	*Dodonea* ..	*viscosa* ..	*Sapindaceae*
562	*Oenanthe* ..	*Schlechteri* Wolff.	*Umbelliferae*
563	*Gnetum* ..	*gnemon affin.* ..	*Gnetaceae*
565	*Mussaenda* ..	*frondosa* Linn. ..	*Rubiaceae*
566	*Hoya*	sp. nov. ..	*Asslepiadaceae*
567*	*Dacrydium* ..	*elatum* Wall ..	*Coniferae*
569	*Cyrtandra* ..	sp.	*Gesneriaceae*
570*	*Quercus* ..	*Junghuhuni* ..	*Fagaceae*
571*	*Alstonia* ..	*macrophylla* ..	*Apocynaceae*
572	*Dichrotrichum* ..	*Chalmersii* F. v. M.	*Gesneraceae*
573*	*Celtis*	sp ?	*Ulmaceae*
574*	Indt.	.. ..	*Lauraceae*
575	*Agapetes* ..	*Moorhousiana* ..	*Ericaceae*
576	*Homalanthus* ..	*populifolius* Grah.	*Euphorbiaceae*

List of Material collected on Sarawaket Expedition—continued.

Herbs. No.	Genus.	Species.	Family.
577	*Blumea* ..	*chinensis* D.C. ..	*Compositae*
578*	Indt.	.. ..	Indt.
579*	*Eugenia* ..	sp.	*Myrtaceae*
580	*Schurmansia* ..	*Henningsii* K. Sch.	*Ochnaceae*
581*	*Anoniodes* ..	*pulchra* Schltr. ..	*Flaeocarpaceae*
582*	*Quercus* ..	*spicata* var. *depressa* King	*Fagaceae*
583*	Indt.	.. ..	Indt.
584	*Garcinia* ..	sp.	*Guttiferae*
585*	*Quercus* ..	*lamponga* Miq. ..	*Fagaceae*
586*	*Pometia* ..	*pinnata* Forst. ..	*Sapindaceae*
587*	*Pterocarpus* ..	*indicus* Willd. ..	*Leguminosae*
588*	*Afzelia*.. ..	*bijuga* A. Gray ..	*Leguminosae*

Those marked with an asterisk are large forest trees. It will be seen that the material contains a great number of non-arboreal and shrub species. I gathered material of them, because I thought that they would have a botanic interest, for these parts are so rarely visited by persons equipped for collecting and drying leaf and flower specimens. So on the high mountains I collected anything that I saw in flower. Some of the material has not been fully determined; that is no fault of Mr. White or his able assistant, Mr. Francis, but is due to incomplete material. The conifers are, it will be seen, well represented, there being no less than seven different specimens, not counting the two large *Araucaria*, material of which I did not gather. The range is wide, for genera of the Philippines, of Queensland, of Tasmania, and of New Zealand are represented among these conifers.

Field notes describing the appearance and macroscopic details of the woods will be found in Section C of the report.

GEOGRAPHICAL DATA.

Sattleberg ..	3,240 feet	Ogeramnang ..	5,851 fee
Bolingbangeng ..	3,522 ,,	Bridge of Bulung	2,878 ,,
Nanduo ..	3,140 ,,	Kudungeng Camp	6,076 ,,
Janzain (*a*) ..	4,493 ,,	Camp on Mossy Forest ..	8,727 ,,
Joangey (*b*) ..	4,240 ,,	Busu Camp ..	8,550 ,,
Divide on road between (*a*) and (*b*)	4,958 ,,	Top Camp ..	11,752 ,,
Bridge over Mongi	1,679 ,,	South Crest of Sarawaket ..	12,484 ,,
Kulintufu ..	5,313 ,,	North Crest of Sarawaket ..	13,454 ,,
Bridge over Kuak	2,494 ,,		
Tobu	4,449 ,,		
Divide of Kuak and Bulung ..	6,761 ,,		

	Longitude.	Latitude.
Sarawaket ..	147° 5′ 28″ ..	6° 20′ 43″
Ogeramnang ..	147° 27′ 45″ ..	6° 28′ 8″

APPENDIX III.

EXPEDITION TO THE BISMARCK RANGE FROM MADANG.

This expedition ended rather badly, and I lost my herbarium assistant, all my specimens, and a very large portion of my notes, including my diary covering the early part of the journey from Stephanshort to the Ramu. The next diary opens on the 6th February at "Swamp Camp," a mile from the Ramu, and so I can but briefly describe from memory the four days previous, during which I traversed the intermediate or coastal range and dropped down to the plains of the Ramu.

A glance at the map will show that the shortest route from the coast to the Upper Ramu and Bismarck is from the old German Government head-quarters of Stephanshort. Captain Tutton, A.D.C., Madang, had travelled from the Ramu to the coast, so I decided to follow his trail back and across the river, and so reach the Bismarcks.

My object was to so traverse the country from sea level to the highest possible point as to embrace as wide a range of forest regions as possible.

From Madang I made my way along the coast to Erema Hafen and then turned up to the Dividing Range, and after a short climb, reached Keku, a mission station of the Madang Lutheran Society. This took me two days, and the country passed through was nearly all under cultivation. Here and there patches of beach forest remained. Giant *Colophyllum inophyllum*, yellow-flowering *Pterocarpus*, the large white-flowered *Barringtonia speciosa*, and the mangroves were met with. Of rain forest there was none, and as one rose the 1,300 feet to Keku, the sides of the range were covered with weed tree second growth that had sprung up on old farm lands. From Keku I proceeded west, passing through Agjuai, Jabbia, Nauna, and Usina, and thence down to the Ramu. This took me three days, and I passed over very broken country indeed. The trails were exceedingly bad, and the natives backward and difficult to deal with. The timber was not destroyed to any extent, for the population is too small to have much effect, but the broken nature of the country and the consequent succession of very steep slopes and the light soil made the tree growth poor. No great height was reached in crossing this range; at the highest point it is only 4,200 feet, and the trail from Keku goes over a saddle which is only 2,100 feet. One is therefore in rain forest region all the time, yet the type of timber is poor foothill forest. Certainly species of the rain forest are met with, but they are not numerous, and in diameter and height are of very poor quality. Mudstones, sandstones, shales seem to predominate among the rocks, with big boulders of soft limestone in places, and a great collection of many-coloured stones in the waters of the numerous streams. The mudstone country never seems to carry much forest, and in travelling across this area I was reminded very much of the country lying between the Purari and the Era River in Papua, which proved so disappointing from a timber standpoint. When the hills were left behind we dropped down to a still more depressing country—the valley of the Ramu. Hereabouts and for miles below, probably to the mouth, lies a wide stretch of low-lying country. Much of it is swampy all the year round, and the remainder, except for a few little islands of high land, is under water in the rain season (north-west monsoon). In February it was ankle deep in water, and streams after leaving the hills, where they were white torrents, spread out over the land for half a mile or so, making it impossible to trace the main course of any but the biggest. On the little rises which are only reached in exceptional floods, native communities shelter. Fixed abodes seem to be rare, and the people, who struck me as a low type, are nomadic in their habits. They can make only very small gardens on the pimples of land, and they seem to subsist on what they can kill, and such edible plants as are to be found growing wild.

The tree growth in this swampy area is wretched, and quite useless as timber; botanically it is very interesting, and it is most unfortunate that all specimens collected hereabouts were subsequently lost when my camp was destroyed. From memory I can give but a poor account of this vegetation. It was a pole growth of rain-forest species with a large mixture of the weed trees that spring up on old farm lands in rain forest. Evodias, for instance, were very common and very beautiful, for several species were in full flower. Many colofloral trees occurred, and among them a *Baccaurea* was very common; its presence could be detected 50 yards away owing to the very heavy perfume given out by its wealth of flowers which festoon the trunk. A *Sarcocephalus*, probably *S. cordatus*, was the largest tree met with, but even this was only 10 to 15 inches in diameter. Several little trees of the nutmeg family were common, as were the wide-leafed pretty-flowered *Barringtonia*, of which a pink and white variety were seen; several *Eugenias* and two *Garcinias* were noticed. Many species of *Lauranthus occurred*, but epyphitic plants were not common. The staghorn fern and a few birds' nest ferns were seen, but for the most part the trees were rather bare of ferns, orchids, and climbers. Of the last the *Mucuna* genus seemed most common. The genus of tree best represented was *Ficus;* there were every kind of fig from those bearing fruit, scarcely $\frac{1}{4}$ inch in diameter to trees carrying figs a good 4 inches across. *Pandanus* sp., both with and without prop roots, were very common, as were *Macaranga, Saurauja, Geunsia, Pipturus, Alphitonia, Sterculia.*

Diary.

6th February, 1923.—From Usina to the Ramu proved six hours away, in fact, the carriers did not reach it but halted in a grass patch on the edge of the Biraka (Bilak of Captain Tutton) River. It was the only dry spot we had seen to-day, and so I decided to pitch the camp there. I was soon to be disappointed, for down came the rain just as we got everything snug, and to our dismay in one hour we were flooded 4 inches deep, and the water was rising rapidly. All hands turned out to dig a drain to the river, and we managed to carry it off. My guide, a native whom I found at Usina, who spoke pidgin, had been to work for white men, and looked rather dressy (in a singlet) next to his naked countrymen, tells me that I shall be flooded right out here, and cut off from Usina and the coast.

7th February.—It rained all night, but the drain saved the camp. Out at 5.30 in a heavy mist with Police-boy Angep, the guide Singlet, and some boys to beat down the tall grass (*Imperata* and *Sacharum*), so that we might make our way to a little knoll a mile away, where Singlet said we would find a better camp. From there we watched the rising sun suck up the enveloping valley mist. Little by little the foothills of the Bismarcks became plain, and then the peaks, the midmountain country being still bandaged with cotton wool. The crest of the Bismarck Range is very sawtoothed indeed, far more than anything I have seen in the Owen Stanley Range, except possibly the main three peaks of Mount Victoria. As a camping ground this knoll is excellent, except for the difficulty of fetching water. Returned to camp, and casting round up the Biraka, found a good dry spot which has never, I think, been flooded. Put boys on to make a good hut, for this must be my base camp, and from here on I must go very light. While this work was going on I went down stream to the main river, and there at the junction I found the poles of Captain Tutton's tents. He was there in dry weather, for the site of his camp is now deep sucking bog. The Ramu is a deep, muddy river. It makes a bid U-bend at this point, and is 80 to 120 yards wide, and by means of floats I found its surface rate to be 10 to 11 miles an hour. The clouds were right down on the Bismarck, but the foothill and lower slopes up to 3,000 feet were plain, and these appeared to be well inhabited, for I noticed large areas under crop, and the smoke of villages arose from many ridges. The story that there is no communication between tribes across the river and those on this side seems hard to believe. Police-boy Angep is despondent about crossing or breaking the river as he calls it. "Five feller canoe" he thought might do the work, but they would have to be big, and some would upset on the snags. This bank carries a few big Octomeles which could answer well for the purpose, but I have no adzes, and in the end I decided to try a raft, and, failing that, explore the river up and down for a crossing while boys went back for more supplies and adzes.

Returned to camp to find the buildings grass-thatched, practically finished. Went down with fever, and so sent off the boys I no longer required—42 in number—to Madang, and twenty are to return with more rice. I turned in and ran a temperature up to 105.4 before I broke the fever.

8th February.—The boys had a very bad night, for the country hereabouts is infested with mosquitoes, and this pest is in such numbers as to make sleep without the protection of a net, impossible. Even so, any net made of anything less fine-meshed than cheese-cloth will not keep this species of mosquito out. The police (I had three armed police boys with me), are all right, for I saw that they had fine nets before we started, and though theirs are much smaller than mine, they are safe from bites, which I am not, for there seemed more mosquitoes insde my net this morning than there were outside. He is a long sharp-headed, meagre mosquito, brown in colour, with grey wings, and his skin is tough. They are so desperately persistent in their search for food, and so wholly oblivious of all but their craving for blood, that you literally wipe them off arms and face, and their thick hides break with a crack as you wipe. They will penetrate thickish khaki, and I was very thankful I brought flannel trousers and mosquito boots with me. The eight boys I had kept were very dull and lethargic when I started them on the job of making a big raft. I had to turn in again to get my temperature down to normal, which I did by evening, when the boys reported that the "big feller bed" was finished.

9th February.—Viewed the raft, and Angep demonstrated to me the method he thought would get the raft across and back. It would hold at most four boys and Kanta (rattan) was to be used as rope to pull the raft back after each journey across. So all boys were sent off to make good paddles, and get long lengths of Kanta while I settled down to my survey computations which are in arrear

Sunday, 10th February.—I had served blankets out to the boys in which they roll themselves to keep out mosquitoes. The blankets were for the high mountain work, and, as will be understood, are pretty hot covering for this level (the height of the camp is 260 feet, and it is 10 feet above the Ramu River), so the boys lie and sweat until they can bear the heat no more, and then throw off their blankets, and suffer the attacks of the mosquitoes until the blankets seem more bearable. All night they toss and turn and flick themselves with their loin cloths. Some have made little platforms, about 5 feet off the ground, and on these they sleep with a smudge of fire burning underneath. I gave them a holiday to-day, and they are now all asleep, and their plans of going after pig and cassowary have been abandoned. I botanised a little, read a little, and managed to get my temperature right down at last.

11th February.—Found that the rattan obtained on Saturday was not long or strong enough and sent boys for more while I examined the country up the main stream. There was no difference in the class of trees and the country was of the same wet nature. On the bank itself, some high forest occurred and *Octomeles*, *Pometia*, several *Ficus*, *Planchonia*, *Dractomelum*, *Pterocarpus*, *Laportea*, *Pterocymbium*, *Sarcocephalus*, several *Garcinia*, *Horsfieldia*, *Alstonia* occurred. There were big breaks of rattan forming dense, almost impenetrable jungle and stands of bread fruit trees; convex bends were grassed with wild sugar and here and there a bread fruit or young *Octomeles* was shooting up. The land was reticulated with streams the direction of which was generally parallel with the Ramu for some way until a depression in the bank gave an opportunity for their outflow into the main stream. All afternoon we spent trying to get the raft across the river and failed. The current was altogether too swift and the efforts of the paddling natives, too puny to work the raft across. Time after time we tried. Started it off down the tributary with four boys paddling hard and boys on shore paying out the rattan tail rope. The raft would get out well into the stream, helped by the flow of the Biraka, but then the big river would catch hold and away she would go like a streak—the boys on board paddling madly and the boys on shore desperately paying out and running down the bank to take the weight off the tail rope. So fierce was the current that all attempts of the boys aboard to drive the unwieldy craft over to the other side, failed and then the weight of the tail rope would drag her back. Finally she would be brought up against the same bank from which she started, but 200 yards down. Then would start the laborious task of getting her back to the tributary, which was obviously the only place from which to restart her with a fresh crew on board. After I do not know how many attempts, the tail rope parted and our raft careered down stream with 100 yards of rattan following behind and four somewhat frightened natives sitting on board wondering where they would stop, while the rest of us panted after them along the muddy bank. We found them all safe in the next bend and on our side of the river. That finished the attempt and we all got back to camp. The river at this place is impossible to cross with a raft at this season and even with canoes it would be very difficult. So I have decided to return to the village on the hills called Nauna, there to get further information as to crossings, for I feel sure that somewhere about here there must be communication across the river.

February 12th.—Sent police for carriers while I set up wireless and made ready to get observations to-night. Packed gear. The boys are glad that it is their last night here.

February 13th.—Got good sigs. at midnight, and good sights of Beta Leonis and Alpha Orionis before and after the time signal; also good N. & S. stars for latitude.* Got away late, as carriers from Usina didn't turn up till 10.30 and there were not enough of them. Going back took only three hours, which shows what a difference a cut track makes. On reaching Usina, we found 36 wild looking devils waiting and apparently very pleased with themselves. They had run away and then thought better of it and returned to see the white man. I only hope they will be here to-morrow, for the police boys had to carry the heavier loads from the river. Police boy Jack is ahead at Nauna getting more boys, so that we may start off with a fresh lot. Usina consists of two large houses and boats, a Luluai, who was given his authority and the red-band hat that is the insignia of office by Captain Tutton. The people, however, count him small beer and so live scattered around without any definite or central village. They are unprepossessing people and their lack of looks is rather accentuated by their facial ornaments—save the mark. The Kuku or Papua wears two long fibres struck in his nostrils like antennae of some great coleoptera, but the upper Ramu dude has his nose bristling with short spines. It is fortunate that greetings in New Guinea are not accompanied by nose rubbing as in other lands.

February 14.—They didn't run away and we got off at 7.15 and made Nauna at 11.30. Jack had failed to get carriers and Nauna was deserted, the inhabitants having gone bush, all except some old men and a very explanatory Tul Tul,† so I sent Jack and Angep to Mountung whence they eventually got the boys back. It seems they thought I was a recruiter. There is a grand view of the valley of the Ramu and of the Bismarck range and the grass land at the foot of the subsidiary range below. Particularly plain is a grass triangle, the apex going up into the forest country some 2,000 feet, while the base comes down to the swamp land opposite my old swamp camp. The grass knoll near that camp bears 172 deg. magnetic from this village. A

* The calculations and other data of this position were lost. I remember, however, that I made this camp only a very little south of the old German camp (Lager B, 5° 35′, 30° S. Lat.), which makes the present position as marked on Mr. Tutton's map too far north.

† A Luluai is the headman of the village, and though chosen by the Government, is the accepted leader. The Tultul is chosen by the Government for his usefulness as a go-betweee and interpreter. The Luluai very often cannot speak English, the Tultul always can.

mission boy called Tommy brought some elderly men to see me and they gave me to understand that if I went south-east to a village called Hombagede, which is near the Ramu, I could find there a place where boys crossed and had canoes to do it in. The whole matter was discussed with bated breath, why I cannot conceive, but they all seemed to regard the business as a mysterious one. That they admit a road south-east is extraordinary, for up to now they have only shown me tracks to the sea coast. I will speak to them again to-night.

15 February.—Discussion last night ended in the Tultul of Mountung admitting that he had been to Hombagede and that although he had not been to the Ramu, he learnt from the people that they frequently went down there, made gardens on the bank and visited folk on the opposite bank. The river was known down there as the Keneya.

Much heartened and with sufficient carriers, we set out at 6.45 and reached Mountung at 7.30. It consists of a group of ten small huts whence eleven of my fresh carriers came. It is situated south, south-west of Nauna and I crossed the Ere and rose up the range again to reach it. From Mountung we travelled south-west dropping off the hills into the plains and passing a little hamlet called Tuganuna, crossing the Wariup at 10.45 and the Casiner at 11.30 and at 12.30 we reached a hut with a lean-to with a hot hearth. Sending boys forward we found a native who took me to a hamlet of two huts and so to a garden of ½ an acre and another hut. These scattered huts constitute Hombagede on the Guragen (further up it is called the Yakumba). Here the ground being high I decided to camp and soon after my tent was up three old men came to see me with two women and four children. I reassured them with trade goods and they explained by sign that the Keneya was a good way on and that we would pass Ionomba before we reached the main river. We are short of rations—40 lb. and 26 cups of rice—but the boys I sent back should be on their way to Nauna by now. Anyway it means sending the Mountung boys back, for I must reconnoitre and that will take a day or so.

The forest around Mountung was decidedly better, though that is not saying very much. It is the usual rain forest type, though the presence of *Impatiens*—a rather loud pink species—is misleading, this being more a foothill and mid-mountain genus. *Pometia* was the commonest species, though *Evodia* and other regrowth trees were very numerous. It was much less swampy country than that met with towards Usina, in fact, it was not until noon that we met with mud. The vegetation has the same appearance as country cleared for cultivation and grown over again. Here and there areas of grass land appear and there are signs of the drier portions going to grass. *Sacharum* is a more common genus than *Imperata*. With so small and so nomadic a population, some other explanation than cultivation must be found, for this vegetation which looks so like a second growth.

16th February.—Left camp at 7.15 and crossing the little river were soon entangled in a swamp a mile wide with a sluggish stream flowing through the middle which was shoulder deep. Then we came to drier swamp country, and crossing three streams, Basen, Kantabehembwe and Gesamhombakene we reached the firm bank of the Boku, and following this up for an hour, reached the hamlet of Tonomba on the other side. There we found twelve natives, who, not hearing us arrive, had no time to run away. Two had been to work, and through them we learnt that the village had been "recruited" by a Chinaman and four had not come back. It seems this happened during the war period. They all denied any knowledge of canoes or a crossing, and they made out that the Kenya (Ramu) was far away and there was no road to it. They were obviously very frightened people, who were unable to believe that what happened to the village some years ago would not occur again. I reassured them sufficiently for them all to come back with me to my camp at Hombagede, where we slept.

There was no forest between the two places, the nature of the country being frankly swampy. *Sarcocephalus* and *Barringtonia*, also the big *Planchonia* were the most common trees, and their stems were covered with twining ferns with a tangle of creepers such as rattans and the crimson D'Albertis (*Mucuna*) knitting all together. Where the land was dry enough, *Scitaminae* flourished, also the large leafed white lily that resembles a Hipiastrum. The tree lily (*Dracaena*) grows quite big hereabouts, and its hanging cream flowers are quite conspicuous along the track we cut. The higher banks of the Boku had been farmed, and here a well-worn path was met with. That high rain forest had occurred here was plain, for the following were seen:—*Octomeles*, *Pometia*, *Alstonia*, *Pterocymbium*, *Vitex* sp. *Gmelina*, *Celtis*, *Kleinhovia hospita;* the doubtful Sapotacious tree which may be a Payena, several *Barringtonia*, *Eugenia* (two species), *Myristica*, several figs, and both the bread fruit and the big timber *Artocarpus*, *Pterocarpus indicus*, *Afzelia*, *Bijuga*, *Cinnamomum massoia*, *Gentum gnemon*, *Baccaurea*, *Sloanea*, *Terminalia* sp. near *T. okari*, *Cordia* sp.

The climbers were well represented and the branches were festooned with epiphytes. Also mistletoe was common. These trees were, however, but remnants of the forest which had long since been converted into yam and taro farms and which is now, for the most part, covered with weed tree regrowth, *Evodia*, *Macaranga*, *Breynia*, and such like trees. The children in the village were playing ball with the fine orange fruits of *Voacunga papuana*. Grass is appearing among the weed trees, and a little larger population would soon turn it all into savannah forest. Already *Albizzia procera* is forming pure stands over *Sacharum*, mixed with *Zingiberaceae* and a few dry shrubs such as *Clerodendron*.

17th February.—Confidence was not restored, for all the Ionomba boys ran away during the night. Started off at 7 a.m. with my eight boys, all fully loaded; also the Tultul of Mountung and his mate, who professed to be an interpreter. Left a great deal of gear behind under a fly. Reached Ionomba in three and a half hours—it took me two and three-quarters yesterday. Being Sunday, gave the boys the rest of the day off. Ionomba was quite deserted, the folk evidently having made off last night, leaving all standing. In the afternoon boys from villages further up the Boku came in and said they had heard that the people of Ionomba had bolted. A white man had never been there before, and they were all very frightened. Two boys had been to work, and so my uncertain interpreter's services were replaced by one of them. He related that he and his mate and some more from his village had been tied up and carried off to Bogadjim by the same Chinaman as raided Ionomba, and that they had worked two contracts of three years before they returned; that they were not frightened, but those who had not seen white men were alarmed, fearing that they would be carried off; that the Ionomba boys who had run away last night were labouring under the same delusion. A sore-covered native and his woman, also much afflicted with ulcers, crawled in, having been found by my boys hiding in the grass by the water. They were fed and reassured—all denied any knowledge of the Ramu or of a road leading towards it or south-east at all. Yet I know that the Ramu cannot be more than 2 miles away, and the Boku must flow into it. I learnt that the villages whence my visitors came are Kirike or Krip, Korone or Korop.

18th February.—Sent our visitors to Hombogede to bring the remainder of my gear along. The three police boys, Peter (herbarium assistant), and I took a track going south past four old coco-nut palms, through a garden to a wide pandanus swamp. This was waist-deep and running slowly in a north-easterly direction. Before we were half-way across we could hear the roar of a large river, and, on scrambling out of the water, found ourselves on a high bank with only a large, well fenced yam garden separating us from the Ramu. So much for the truthfulness of the inhabitants. The distance from Ionomba to the river is barely a mile, and the yam garden is obviously the property of the villagers, whose tracks are quite clear. The river here is 70 yards wide, and running quite as swiftly as at Swamp Camp. Logs, masses of grass, and islands of bank vegetation were hurtling down. Returned to camp, where I found some of my Hombagede loads had arrived, but three still remained to come to-morrow. Two of the Ionomba runaways came back, and I sent them into the bush again to bring all the people in. They still denied all knowledge of the Ramu and of a road south-east. An exasperating people!

19th February.—Returned to the Ramu and started my boys track cutting, one gang down the river and the other up my idea being to discover, if possible, a track leading to the water or any signs of life on the opposite bank indicating a crossing. I have hopes that this occurs at the mouth of the Boko. I then spent the morning putting up my aerial and opening up a place for night observations. Picked up time from Manila at 1 p.m. satisfactorily. In the afternoon pushed on up the Boku and found a well-beaten track leading up to a little two-house hamlet, and then crossing the river it went to Kirike, which boasts eight houses.

20th February.—Went up stream (Ramu) and found the four boys I had put on the work had done three miles. The high bank soon finished and the ground grew wetter and wetter. Islands appeared in the river, and the overflow of the banks became more and more marked. The going was very bad, especially through *Sacharum spontaneum*. Not only was there the usual trouble of breaking this tough 15-feet high grass down by means of poles, but the boys were bogged calf to waist-deep all the time. We came on the tracks of a party of natives with women and children, and judged them to be the runaway Ionomba people. No tributaries were met with, and, having reached 7 miles up, I turned north and cut a track towards the hills; a sugarloaf peak of one being clearly visible, made a good mark. The reason for no confluents was soon apparent, for all the country for 2 miles deep was under water, which was flowing slowly, parallel with the main river. The smaller streams clearly empty into this trough and so reach the larger tributaries like the Boku which, doubtless, empty direct into the Ramu at breaks in the banks. This inundated country varies from 3 inches to breast-deep, and carries a vegetation consisting very largely of a *Pandanus* without prop roots. This and *Sacharum* cover large areas, with scattered *Sarcocephalus* and a prop-rooted tree like *Soneratia*. I saw very few prop-rooted screw pines, which is curious, for this is usually the commonest species. Both occurred in the first swamp we crossed below Ionomba. Climbing ferns made the stems nice and green, but except for staghorn, the crowns of the trees carried no epiphytes. Game was very plentiful, cassowary, hornbills, pigeons innumerable, including the crested Goura. There were also plenty of birds of paradise about. I had hoped to reach high ground and so push on parallel with the main stream, but I had to abandon the attempt and we returned to camp muddied from head to foot and very tired.

The river at 7 miles was 150 to 170 yards wide, and made a bend north, and there were more islands in sight. The Bismarcks were very plain, with the south-easterly peaks, which I took to be Mounts Otto and Helweg, standing out very sharply. From here one looks up the great valley between the true Bismarcks and the subsidiary and much lower mountain mass known as Hagen, that confronted me at Swamp Camp and which carries the big grass triangle. The big valley should prove the best route up to the main range, and judging by the areas under cultivation, the population must be heavy. On returning to camp I found my carriers back from Madang with rice. They have taken a week to do a five days' march. From my experience since first seeing the Ramu, I consider that I may expect the same impassable swamp conditions for many miles up stream. The river is quite impassable, except by big canoes, hereabouts, but the presence of islands inclines me to think that a widening is taking place. I decided to circumvent the swamp by climbing to the hills again and thence zigzagging down to the river till I found a crossing.

21st February.—Left Ionomba at 7.15 and forded the Boku $2\frac{3}{4}$ miles up, passing the two-hut hamlet, then followed the Boku up—east—until we reached Kirike (Krip). Here the river turned north-east and we followed it only a little way to the village of Munowana, leaving a village of Korona somewhere on our left. Pushing on up a small track we reached the Yakumbu, which turns out to be our Guragan of Hombogede. The track, as is the mountain trick, took to the river, and so, paddling up the very rocky, swift-running river for one hour, we reached a tributary on the right and, leaving the main stream, we climbed a hill as steep as a house and reached Ongoruna. A seven and a half hours' march, but the distance would not be more than 19 miles, for the going was bad. The bed of the Yakumba was littered with rocks of all sizes and colours, some soft, smooth and rounded, others hard and angular. Everything seemed there, from mudstone and sandstones to quartz-veined crystalline rocks and volcanic agglomerates, and great white masses of rather soft limestone. The forest on the plan was a poor type, the country being too low-lying, and so subject to inundation. Had I penetrated any way on either side of the Boku or the Yakumba, I should, I know, have found swamp such as I waded and cut my way through yesterday. Further up, the land was high enough, but it rose too rapidly and soon was too steep to carry anything but the pole woods. It came on to rain hard as we climbed the last slippery piece of the track, and when we reached Ongoruna the mountain mist came down and blotted out the view. I noticed, however, two *Araucaria*, which I took to be hoop pines. The height works out at 1,813 feet, which is very low for araucarias. The village is divided into two, and is the largest I have seen in these parts.

22nd February.—In a country so thinly populated it was good to see so large a roll-up of natives as occurred this morning. Still, the food supply is meagre, and I had to send ten boys back to Madang for further rations. The difficulty of travelling in New Guinea in unpopulated or hostile country is that your carrier eats himself out of rice in 18 to 21 days, and unless you can make a base camp within easy reach of the supplies, with a friendly population in between, who will supply food to the carriers, penetration inland with instruments, collecting gear, tents, &c., becomes impossible. The people of Ongoruna, except the old men, had all been to work on plantations and spoke pidgin, yet they have never been visited by Government officers. A missionary once came to them, and a recruiter. Chinese, however, seem to have begun the recruiting, and subsequently the natives went over the range themselves at the call of their brothers to work on plantations close

to the Bogadjim. More or less civilized as is that little community, they proved just as prelogical* as my friends at Hombogede, Ionomba, and Kiri. They had never heard of these places, and denied the presence of any track except the one leading to the sea, and in the same breath pointed out the various places on the plain which shone below us in the sun, and traced the track we had followed all yesterday. They still held that there was no communication to the south-east, and all the hills to the south were uninhabited. I went out in search of a high point from which I could view the country to the south and south-east, and found a splendid little grassed peak with a precipitous slope falling down to the Boku head waters. This river makes a tremendous bend round into these hills, and the grass peak is situated on the south-west side of its mountain basin. I got a good round of angles to a number of villages, and was able to get the natives who accompanied me to admit that there was communication to these places. Daguba and Doriba are situated on the hilltops to the south-east, and through these hamlets I propose travelling till I get high enough up the Ramu to be above the swamp land. This swamp area was clearly visible, and it is little wonder I was unable to force my way along the river bank. Further up it seems to divide into many streams with islands between. The whole width of the waterway must be 1,000 yards there. Probably this is the swelling marked in the old German maps which has always intrigued me. The mist came down early and blotted out the view, but I saw enough to convince me that there was a trail up the Ramu. The forests of these mountains are of the foothill to the mid-mountain type. The small and large acorned oak occur, and both Araucarias (*A. Cunninghamii and A. Klinkii*). I was surprised to see no *Quercus Junghuhnii*. Several *Eugenia* and Guttiferae of the mountain species were met with, but no Podocarps. Evidently the only conifers that grow as low as 2,500 feet are the Araucarias. The cultivation of the Boku basin is extending, and with the advent of peaceful conditions which would follow Government control, one may expect to see a larger population in these hills. At present, they go in fear of their lives, and are afraid to venture into a village a day's march away.

23rd February.—Leaving Ongoruna at 7 a.m., we struck south-east along a very poor trail, and rising to the Araucaria ridge at about 2,500 feet we dropped switchback fashion over the spurs of the range till we met the Boku. This we crossed at 9.30 a.m., and rising abruptly on the other side, reached Doguba at 11 a.m. A few hovels with their eaves down to the mud constituted the hamlet, and the population took to the bush, fearing I had come to recruit them, I suppose. Two had been to work, forunately, and they induced some of the others to return, and so we went on with the new men as guides. One was painted a nice terra-cotta red, and had a very ornamental bone stuck through the septum of his nose. We continued south-east. The bush was dense, but every now and again a sharp spur or some fallen trees opened the view to the plain. We were approaching the river more and more, and the valley here cannot be more than 12 miles across. Mt. Otto showed up very clearly to the south, and later on I caught a glimpse of the Ramu, a mass of silver ribbons threading grassed islands, while the country rolled down to the water in pure savannah-covered foothills. Still switchbacking up and down along a pig track of a trail, with three boys cutting ahead to enable the carriers to get their loads through, we reached a good camping ground, and there pitched our tents at 4 p.m. in a downpour of rain. We have been travelling all day, but the trail was so bad that we have not done more than 10 miles. On questioning the boys, I learnt that a German D.O. had cut his way down the Boku to the Ramu, and then returned. I do hope he did it in the dry season, poor man. This camp is 1,940 feet high. Between Ongoruna and the Boku the forest is fair in places, but after that the slopes are far too steep to carry big timber. The large Eugenia, with the armadillo bark, was common, also the following:—The mountain *Albizzia, Casuarina nodiflora, Quercus spicata, Q. lamponga,* two *Colophyllum,* the mountain *Freycinetia,* Bamboos, *Elaeocarpus*, &c. The *Araucaria* occurred in rare clumps, and always on the sharpest ridges.

24th February.—Left camp at 7 a.m., and caught glimpse of Mount Otto across the Ramu, bearing 200 degrees Mag.; dropped precipitately down to the Haile River, where she tumbles over a fall of 100 feet. This waterfall I had heard roaring in the night, and taken for the main river the boys call the Solu, and which we found a little beyond. It is a strong running stream that would be hard to cross in flood, but easy to-day, being only thigh-deep. We then climbed a 45-degree slope to Doriba, which we found, if possible, more squalid than Doguba. Six hovels, scarcely 5 feet high, with their grass thatch down to the mud all round, and a hole blocked with bark as door. All around the mud was calf-deep, and the whole place gave one the most dismal idea of the people. These had run away into the bush, except a few old men. I took the oldest, who years ago in German times had worked on a plantation, and, ignoring his desire to lead us all north-west to the sea, induced him to show us a trail going south-east along the range. The going had been exceedingly bad up to now, and it seemed impossible for it to be worse; yet when we left Doriba we clambered down a precipice to the Solu, and then using that as our roadway made up this torrent, which was running half flood between high walls of rock. It started raining heavily, and I wondered what would happen if the river rose any more; already the carriers were having difficulty in stemming the current, so I was very glad when I found a ledge some 50 feet deep well above high-water mark, and there I camped. The boys had done six hours, but it had been such arduous travelling that they were unable to go much farther. From last night's camp we have not done more than 6 miles. The height of this camp, which I call Solu camp, is 1,564 feet. The valley rock cliffs have an almost vertical dip and a south-east to north-west strike. They appear to be a hard granite. Except for *Araucaria* on the skyline, I saw no timber of note to-day.

Monday, 25th February.—Leaving camp in pouring rain at 6.45, we went up the Solu for half a mile, then leaving it on our left, climbed and paddled up a tributary bearing south-east, then leaving it and ascending a very sharp rise, we reached a group of huts called Wanese. Four boys from this hamlet had been to work, and stood their ground while the remainder of the village "went bush." With these four boys to help carry and act as interpreters, we pushed on, ignoring their protests that there was only one road, and that led to the sea. We followed a small well-beaten track that led us through another tiny hamlet, all deserted, called Asias, thence we passed over the crest of the hills, and dropped down on the south side into the Ramu valley proper. All was covered in mist, so I got no view, but from the direction we were travelling the Ramu lay before us. Soon we reached streamlets all flowing south-west, and paddling down one, came to a larger river called the Giagolo. This we followed down a little way, crossed and climbed up into artificially-created grass land to a ridge, where we camped. The rain ceased, and the mist rose sufficiently to give me a wonderful view of the valley. Such a splendid sight one rarely gets in the tropics, where dense vegetation as a rule blocks the vision. Here there was nothing to obstruct

* Professor Lucien Levy-Bruhl, in his *Primitive Mentality*, uses this term to denote the mind which is capable of believing two contradictory statements at the same time.

the view of the whole valley and the rolling, tumbling, grass-covered hills that lined it. In front lies a clear pad in the grass, and it leads down and up over hill and dale till it vanishes in a little patch of bush near the border of the river lands. These river lands are a curious sight, for they occupy some 4,000 yards of the valley, and look as though the river from time to time had altered its course backwards and forwards across this width. There are confluents and swamps shining white in this area, while in the middle is the river proper, which is a network of waterways and islands. The islands are very green, and the river, though it must be a yellow flood, shines very bright in the sunlight that is now falling on it. Fields under cultivation can be seen through the glasses on the flat land bordering the river area, and also on the high range we have just come down; and down the Giagolo, also, the dark-green of a wild potato crop shows up very clearly. Across the river, too, which is 3 miles away, one can see the smoke of a village, and an old chap we found taking water at the creek tells us that there are many people there, and every year they come across to hunt pig, burn the grass, and fight the inhabitants. I asked him about some coco-nuts I had seen on the way down, and from which I had got a green nut for breadmaking, and he said his father planted them from seed got from the trees that grew along the Ramu. One wonders how the coco-nut originally got as far inland as this. The old man also said that in time gone by there had been many people hereabouts, but they had died out, except a very few. Passed some good oak and some Araucaria, and a large tree like a Calophyllum was very plentiful. Sago, too, was common, and the making of the food was known to the natives. It would take a fairly large population to convert as big an area as this into grass land.

The top of the divide is 2,200 feet, and I estimate the distance from last night's camp to here is 7 miles.

26th February.—Leaving boys to fix up camp, I went off to investigate the country along the range to the south-west. I had no interpreter for the lower land, and if, as the Wanese boys state, the population is large and warlike, it is as well to reconnoitre. The country from here on up the Ramu appears to be Savannah with clumps of bush in gullies and around villages. These grass lands are the result of clearing, and they reach up to 1,500 and 2,000 feet on the mountain side. The valley is no longer a vast swamp, but the grassed foothills come down to within a mile and a half of the present watercourse. We found Araucaria, both Hoop and A. Klinkii that is like Bunya. I also collected some herbs and grasses for identification, and added three new tree species to my collection. We found little patches of cultivation, and a village called Hanep perched on the end of a razor-backed ridge overlooking all the lower land. The people were timid and retired into the grass land and approached with spears, bows, and arrows. When the Wanese boys called to them that there was no danger they laid down their arrows in the end and made friends, bringing me food in the shape of bananas and sweet potatoes. They seemed glad to get tobacco in payment, and an old man who had had elephantiasis seemed delighted with a "lap lap." A number of natives came to see me in the afternoon and seemed friendly. All who were questioned warned me against proceeding to the Ramu; the Kasowai people who occupied the country were hostile to strangers, and that I must bring many guns if I am to enter their villages. What interested me was that these Kasowai people speak the same "talk" as those on the other side of the river, and there certainly is communication across the water which is all split up with islands. Asked how they crossed, the boys said walk and swim, using a log to help them. That every time the hill people attacked the Kasowai, these t'othersiders would send reinforcements over the river and always win the fight. "That is why we live on the mountains," said the old man in his new red "lap lap."

27th February.—Sent fourteen boys off under Police boy Moron with two "tucker" boxes and all the empty rice swags I could muster. They are to go to Madang and bring fresh supplies both for the boys and for me. I have now six boys and three police boys and the Tultul of Bili-Bili, who seems a stout fellow and puts confidence into the six boys who came from his village; also Peter the herbarium boy. Leaving the boys in camp and taking two police boys and an old man as interpreter and a Wanese boy, we followed the track down to the Kasowai village, which I had caught sight of yesterday when returning from Hanep. I found a little collection of houses all freshly deserted. The village which appears to be called after the Kohu stream that bubbles down between the hills here consists really of three hamlets well hidden in a clump of bush. There was no sign of a large population, and I concluded that the stories I had been told were all the usual native moonshine. After much shouting a native named Sarawai and another came in and explained that every one had run away very frightened. We pushed on up the valley along a well-beaten path through the grass, and in an hour came to a river called Efabia, a 300 yards wide bed of stones with a 30-yard wide river running in the middle. An excellent example of torrential conditions following forest denudation. On the other side we found a little hamlet called Koaki, seven houses in all, quite deserted. Sarawai shouted himself hoarse, but none of the inhabitants appeared, so we left some tobacco and a red "lap lap" at the closed door of the biggest hut, and returned to camp leaving Sarawai at Kohu, telling him to bring his people up to see me to-morrow. Sarawai confirmed the story that boys crossed the Ramu here—the river cannot be more than a mile away from Kohu village—but said that it was only when making raids that the villagers of Waimeriba on the opposite bank were at war with the Kasowai people. On returning to camp I was surprised to find Police Boy Moron, whom I had sent to Madang this morning, waiting at the salute. He told a horrible story of a fight in the mountains beyond Wanese. It appears that after passing Wanese and dropping to the Solu and then taking the new trail pointed out by a Wanese guide I had chosen last night, which led up the river, they heard Kanakas in the bush. The carriers became frightened at the blood-curdling yells of the natives, and the police boy was unable to hold them, though he bunched them together and presented his rifle at the enemy. The carriers dropped the boxes and ran, reaching camp by a circuitous route and short, one boy called Waitim, who they averred was cut off and killed. They were all positive they heard him scream, and then followed the howls of the Kanakas as they despatched him. This is a perplexing incident, and while I don't believe that anything worse than cockatoos were heard, the loss of a boy in the bush and the panicking of the carriers is serious. The boy will get through all right, but the carriers' fright is very difficult to calm. They came in a body to me after dark and said that they could not stay; that there was a bottom road to Ongoruna, and they would go back that way; that a Wanese boy would show them. I pointed out that none of the thirteen boys had a scratch; that the police boy had not fired his gun; that only three of the boys had seen the natives, and they all disagreed as to the number; that they were a pack of cowards to leave their mate to be scuppered; and, generally speaking, I told them off. Later the four police boys came to me, and it seems that Moron, who is evidently an old woman, has affected two of the others, leaving Angep as my only staunch boy. The tale of the fight, as the flight is called, had now deve-

loped into a magnificent episode, and Moron acts the various incidents with dramatic effect. A spear passing between his legs is his latest piece of embroidery. The number of the attackers is now "two fella line," which is pidgin for quite 200 boys. I cursed the camp to silence if not to sleep, and now I must think what is best to be done. We are running short of food, and that is obviously our immediate need.

This grass land between camp and Kohu village is exceedingly hilly, and it took me one and three-quarter hours to traverse the distance. The tree that persists in the grass land is *Sarococephalus* sp., probably S. cordatus, which is very fire resistant. *Albizzia procera* is common, as is a small tree that looks like a Verbenaceae, but is not a *Clerodendron*. Ground orchids and numerous annuals make a fine show in the grass, which seems to be at the end of the season, for it is all in seed. The gullies in places carry remnants of forest, but it was only in the immediate vicinity of Kohu that really big rain forest trees were met with. I found two citrus trees, the same species as I have seen everywhere in Papua and New Guinea. A poor fruit, but might prove good stock for grafting. Along a stream on the flats where we had lunch was a row of *Erythrina* with glaucous leaves with *Hibiscus tilliaceus* and *Myristica* as an understudy. The *Erythrina* I could see from my camp, for the blue-grey underleaves glistened in the sun with every puff of wind.

28th February.—The upshot of my thoughts was the decision to return with the carriers to Madang to get my supplies myself. To send boys back again would mean that they would scatter back to the villages once they had crossed the range and would not return with the food. I did not dare leave the boys in camp and go up to the scene of the panic with Angep, for they would surely run away during my absence. To take them through the same route was not possible, for they refused to go that way, and though I could have forced them they might panic, and my police, except Angep, are unreliable. So at 7 a.m. we started back taking the new bottom track that will lead us to Ongoruna, the Wanese guide says. We made camp for the night on the Solu, somewhere below the camp on the 23rd to 24th February. We would have made better going, but the path was not much better than a pig-track, and three boys were constantly at work opening it up. I wouldn't have got so far only the boys moved rapidly, being thoroughly frightened with "Police boy belong runaway," as I have christened Moron bringing up the rear. The Solu where we crossed was a big river, and two carriers were washed down; fortunately the rice they carried was in painted swag bags, and only the top got a few cups wet, and this we cooked for lunch. Police boy Petini did good work rescuing the boys and giving me a hand too when the river threatened to carry me off my pins. The track took us through islands of grass land and patches of bush rich in *Afzelia*. We are now on the edge of the great swamp lands of the Ramu, and will turn up to Ongoruna tomorrow.

29th February.—Left camp at 6.45, and with carriers pushing along at yesterday's pace reached the Boku at noon, leaving there at 2 p.m.; reached Ongoruna at 4.30. We passed through two villages, Saleba and Kaduba, where the people were quite friendly and helped with our loads. The going up to Saleba had been pretty level, but from there on to the Boku it was very hilly, and we took to the watercourses and paddling up and down them, but maintaining a general north-west course. The low-lying country between the Solu and the foothills is much the same as has been described near the Ramu. A few sago palms were seen, and last night's camp huts were thatched with the fronds of this tree. *Afzelia bijuga* was common, and showed up brightly in what seemed a spring dress of green leaves. Some fine big *Semecarpus* were seen, and on one the beautiful creeper *Hoya dimorpha* was growing. The seed vessel of a *Pithecolobium* or allied genus of tree was common in water-courses, but I did not find the tree. It is pouring rain, and has rained almost continually since leaving the grass knoll camp, and all our gear is sopping wet. I want to leave it here and go light to Madang for the supplies.

1st March.—A sunny day and all gear was out drying before being packed away in the head man's (Tumurro) hut. I got specimens of Araucaria Klinkii and some other botanical material of this mountain silva. Tumurro says that Ongoruna and all it contains is mine, and anything I leave with him will be as safe as if I put it in my own vilage. So that is all right. Rain started at 2 p.m. in torrents, which seems usual in this cloud-belt country.

2nd March.—Left Ongoruna at 6.30 a.m., and striking generally north-east traversed the basin of the Boku, crossing its innumerable headwaters and passing the villages of Asake Kessa and Bieli, we climbed to the top of the Dividing Range between the Remu and the sea. Thence we dropped in a north-easterly direction along a very convenient spur to the junction of the two main tributaries of the Ioworo, which falls into the Gori near the sea. This river we followed down, paddling our way in the swollen current, crossing and re-crossing it to zones of safe bank and now and then leaving it for half-an-hour to circumvent a precipitous rock cliff or short-cut a spur. Finally led by a little boy of seven, whose father was clearing bush, we reached Kwata in the dark. An eleven and a half hours' trek and we were going very light indeed. The heights by aneroid were as follows:—

Ongoruna	...	... 1,800	
Biele ...	...	... 1,600	
Lunchplace	...	... 3,300	last headwater of Boku
Top divide	...	... 3,750	
Head of Iworo		... 2,420	
Kwato	...	... 1,550	

Geologically, the country was very similar to that encountered between Keku and Nornu. Shale was very much in evidence, as was sandstone. The forest between Ongoruna and Bieli had all been farmed. The bright flowered *Evodia* and other weed trees were common. This *Evodia*, by the way, exudes a gum which the natives use as a glue. I managed to get specimens of the fruit and leaves of the palmato-leafed weed tree that has been bothering me. It is one of the *Schefflera*, and sometimes makes a lank sapling and sometimes a creeper. The large acorned oak was common, as was *Sloanea paradisica*. The loud pink-coloured balsam was the only species of *Impatiens* that grows on the Divide. On reaching Kwato I found the Luluai apparenly very perturbed regarding my welfare. It seems that Waitim, the boy who was supposed to be murdered, had arrived three days before having made his way through the bush, and he had brought a fearful tale with him to the effect that he was the sole survivor of our party. He got to the next village just as the boys carrying rice from Madang arrived. These were those I sent back from Ongoruna on the 14th February. They promptly dumped their loads into a house and sat down to wait, refusing to go a step further till news arrived. I never had much doubt of Waitin's safety, but I thought he would have pitched a better yarn.

3rd March.—Left Kwato, and crossing a small tributary regained the Ioworro and pursued it down, crossing and recrossing it to Adjau, where I found the boys with the rice and a case of tobacco, and my English mails and Waitim. He stuck to his story of the fight, and gave a most graphic description of his flight, pursued by a herd of whooping savages. How much of the story is auto suggestion and how much fact, is hard

to know. I still think it was a flock of cockatoos that panicked the crowd. When asked why he spread the story that all the boys and I had been killed, he replied that that was what natives always did to strangers. We pursued our journey down the Ioworro, crossing and recrossing it, and narrowly escaped being washed down. Peter, the herbarium expert, is one of those gorilla-like Rabaul natives, all belly and reach, and a perfect fool in water. I had to wait for him at all crossings, as the others took a delight in letting him down in the worst places. One crosses the river eighteen times in all, and shorts and gymnasium shoes are the only kit for this march. Arrived at Erema plantation that afternoon. The diary goes on to relate how I reached Madang next day, and gives the details of supplies, and recounts the usual little trouble over getting new carriers.

Tuesday, 11th March, saw all ready, and my goods on the cutter *Madang*. The Rev. Blume, of Madang, was kind enough to call on me and warn me of the country I was visiting. According to him, all those who had tried to get across the Ramu at the Kassowai crossing had either got scuppered by the natives on the other side or else had to make tracks for the hills, leaving their gear in the hands of the Kassowai. He had a particularly dramatic story of a German who crossed successfully, and was met by apparently friendly people, who shook him by the hand with such warmth that they did not let go, holding him fast while others axed his head off. I left Police-boy Moran behind, and took another boy instead, also a corporal of police, whom it was thought would exercise some authority with carriers and police boys, and so prevent a repetition of the panic which I have related. I had now the largest force of police boys that has ever accompanied me, viz., four and a corporal.

12th March.—Left Madang at 7 a.m. in the auxiliary cutter *Madang*, and steered south to Bogadjim. My intention this time was to cross the Dividing Range by ascending the Mindjim, thus going back along the trail which the carriers should have taken had they not been scared into bolting back. We arrived at Bogadjim at noon, and it was 1 o'clock before everything was ashore and safe. I decided not to push on to-day, it being late and the river up.

13th March.—Leaving Bogadgim at 6.30 I retraced my journey up the Ioworo, through Adjau, and then on to Kwato. Leaving Kwato at 2 p.m. I went on to Yauri, three quarters of a mile farther on, and 900 feet higher—2,400 feet. It came on to rain hard, and I decided to camp there rather than start tent work that night.

14th March.—It rained hard all night, and I was awakened several times by the roar of the river below. At dawn the Tul-tul of the village brought news that the Mindjim was up in full flood, and that we could not possibly get up it. I went on to see, and leaving my loads at a little hamlet called Mabelubu on a confluent, I crossed a mile of flat lands and came to the Mindjim, which is a bed of stones 150 yards wide with a boiling torrent 20 yards wide, tearing down the middle. It was far too swift for us to cross it, but it was going down, and to-morrow, if we have no rain, we should be able to start up it.

The forest on each side of Yauri is fair rain forest, and I noticed a few new species, but they were not in flower. I spent the day surveying the area, and the following trees* were noted:—*Afzelia bijuga, Octomeles sumatrana, Pometia pinnata, Spondias dulcis* in full fruit, *Wormia* sp., *Sterculia*—three species—and *Kleinhovia, Vitex cofassus, Sarcocephalus, Canarium* sp., *Dysoxylon* sp., *Elaeocarpus*—several species—*Eugenia* sp., *Celtis philippinensis, Alstonia scholaris, Terminalia* sp., near *T. okari C.T.W.*, *Evodia* sp., *Ficus*—a number of species, *Hibiscus* sp., *Sloanea paradisica*. The pretty clematis *C. Fickeringii*, that I had not seen since leaving Papua, was common, as was the large-leafed raspberry, *Rubus muluccensis*. Mistletoe was common, as were the many epiphytes that form the characteristic aerial gardens of these forests. A gutta-percha tree was well known to the natives, the German administration having made a definite expedition from here to the Ramu to explore the range and available quantities of this tree. Unfortunately, it was not in flower, but it was evidently the same as the common Sapotaceous tree I found growing near Finsch-hafen and all over the lowlands and foothills of Papua. It may be a Payena, according to Mr. White. At present prices, and taking the lack of collectors into consideration, the product has no value.

15th March.—Left Mabeluba at 6.45, and crossing the mile of flat land, reached the Mindjim, which though a foot down was still too high to use as a highway. There was nothing for it but to zig-zag up it, taking advantage of every beach and crossing, following the tortuous river course. Soon the banks grew precipitous and rock faces closed in the valley. We had then to clamber up the sides of the ravine and cross to the next bend, letting ourselves down on roughly improvised rattan ladders to the next promising beach, only to find after reaching the next bend, that our gravel beach was at an end, and precipitous rock walls faced us. By midday we had gone, I reckoned, 3 miles, and every one was done up, and two boys were injured, having slipped down a rock face, so I camped on a rocky bank which was wide enough to take us all, and high enough to be safe from flood, I hoped.

At 3 p.m. it came on to rain again, and by 5 p.m. the river was up 4½ feet, and rising. We were now cut off from below, and the outlook upstream was by no means cheering. To climb the mountains and steer south by compass was, according to the guide and other cognoscenti, to court disaster, for up there were precipices, and the tops were all rocks. I wonder. Any way, I will give this water trail another day's trial. I wore out a pair of boots in six days on the trail from Keku to the Ramu and back to the hills, but these gymnasium shoes stand the water and stones excellently.

16th March.—The river came down a banker, and was a fine sight in the flashes of lightning. By midnight the rain had ceased, and by dawn the water had abated to 3 feet above yesterday's level. After a desperate march up the river, which we found we could not cross anywhere, and so could not take advantage of the short lengths of beaches that occurred at times on the other side, we reached a widening in the valley and found a good camping ground in a thicket of *Casuarina*. The river is now wider and less rapid, and opposite is a hill on which a taro patch advertises a village in the neighbourhood. Two boys came down to see us, and told us the name was Tamani.

Monday, 17th.—Yesterday's march was not more than 6 miles, so we pushed on early to-day to try and make up for lost time. We kept to the right bank, thereby avoiding a gorge, and after three-quarters of a mile, came to a vast extent of tumbled rocks and boulders. There had been a great landslip, and half a mountain, quite 2,500 feet high, had slid into the valley. So the boys were right in dissuading me for leaving the valley of the Mindjim. After crossing this we came to where the valley widened still more, and wide sandy beaches were exposed to view. Here we crossed, and from the other side looked back on that vast cut in the mountain side from crest to valley and the great mass of tumbled boulders. The river here makes a big bend, coming as it does from a gorge to the S.E., or even S.S.E. We left it and followed up a tributary called Kolebi. It was a small river, but at an "S" bend, where two rock masses confined the stream in a narrow deep channel, it was necessary to get rattan and

* The survey of the forest was lost on the Ramu.

make a rope to enable the carriers to stem the current. Angep won through and got the rope, letting it float down to us round the bend. Further up where the Kolebi turned west, we left it, and going still approximately south, we came to the village of Borcai, 1,760 feet, whence my guide and interpreter Kogi came. There we lunched, and pushing on south reached the crest of the main divide between the sea and Ramu, 2,600 feet, and caught a glimpse of the silver ribbons and islands in the distance. Keeping as general southerly direction as the ridge would permit, we dropped down past the first trickles of water that flow into the Solu, and catching a glimpse of the *Araucaria* of Wanese on the way, we reached a river called Kobole, and a little farther were forced to pitch our camp, as a severe thunderstorm, accompanied by a deluge of rain, made further progress impossible. There is no doubt but that the track over the divide is a good one, but the Mindjim is the difficulty, and to take this trail in the wet season is madness. There must be some track in between the Mindjim and the Ioworo, which is safe at all seasons. I stayed behind a few minutes at Boroai to examine the old men as to the story of the "fight." They knew all about it, and volunteered the information that the Segeli people had the boxes, and were going to keep them; that they had barried the road, and with the help of the men of Kassowai were waiting behind their defences to deal with any intruder bold enough to dispute their possession of the boxes. I left Kogi to get more information, with orders to catch us up at dawn. The story would make one pause were it not obviously a pure piece of invention from start to finish. The geology from the river up to the Divide and down to this camp (2,100 feet), differs from the Mindjim Valley, which was mostly sedimentary. To-day I have been meeting crystalline rocks and much volcanic agglomerates. It was the same country as I saw between the Ramu and Daguba and Ongoruna. Limestone, sandstone, and shales were present, but unlike the Mindjim they were not the predominant rocks. Of forests I can say little of interest. Oaks occurred on the Divide, but the timber-yielding *Artocarpus* and the common wild mango were by far the largest species seen. A few decent *Afzelia* reminded one of the Hydrographers, but nowhere was there a stand of them.

All the poor weed trees were well represented, and of these the *Erodia*, with the pink flower, was most conspicuous. A large *Semecarpus* must not be overlooked, while the loud pink *Impatiens* covered damp places. I call this "Bird of Paradise camp." There is a dance tree over my tent, and after the rain just at sundown there were six of them playing in it. All the pale-yellow plumed type.

18th March.—Kogi was there before we started, and he regarded the story of hostile natives as "all gammon, fashion belong Kanaka." We followed down several streams to the Teihile, and here a little waterfall occurs, and just beyond on the side of the trail lay my two boxes. Except that the padlocks had been stolen and a hasp broken, and the few books that were inside had been tampered with, they were as the boys had dropped them. The Kanakas of hereabouts were evidently afraid to incriminate themselves by carrying off the abandoned boxes to their hamlets. We left the hamlet of Segeli on our left, and came eventually to the Solu; we paddled down this in a northerly direction, passing an island 500 yards long, and then followed a convenient south-east tributary, which led up to Wanese and Asias. I found both hamlets deserted, and young grass growing on the thresholds of the huts. We passed our old camp in the grass land, and arrived at Kohu in the afternoon. Found a few people in the village, who took to the bush, but Sarawai later brought them back and sold us a pig for a tomahawk and a red "lap lap."

I have carriers of Bogadijim, Yaura, and Adjau, and these go back under police boys Jack and Petine, via Ongeruna, and the police boys will return with the gear I left at that village.

19th March.—Kohu is 700 feet above the sea, and the Ramu here cannot be more than 660 feet. I dispatched carriers, and then tried to buy some native food. In the end Sarawai brought in seven boys carrying taro and bananas, and I purchased these. As I was doing this some boys from across the Ramu, headed by a very old man, Fiele by name, ran into the village bearing food and green branches. Fiele squatted down and told a harrowing story of how his village of Waimeriba, and the one beyond called Koromo, had been raided by a Chinaman with many boys and guns, and all the young men they could catch had been carried away, and not one had come back. Kogi, who is invaluable, as he talks a little Kassowai language, and the Kassowai hear Fiele's talk, made out that they were afraid I wanted to buy boys, and he was making it clear that there were none left. I corrected the impression, and explained my purpose in coming here, but I fear it was little understood. However, Fiele and his people liked the trade goods I gave them. Some old men from Koaki came in, too, to make my acquaintance. I have seen no young men, and except for two women who went bush when we arrived, there are no females in the village. The hiding of women and boys is always a sign of suspicion, and judging by Fiele's talk, I am not surprised that the inhabitants are suspicious.

As I must make my base camp on this side of the river it is essential that friendly relations are established with the people.

20th March.—Mosquitoes are a plague here, but not by any means as bad as my swamp camp on the Ramu lower down. Still the boys did not get their full measure of sleep, and they are, in consequence, tired this morning. Leaving them to put up a sound camp, I left at 7.30 with the corporal Sarawai and Kogi for the Ramu. We followed the Kohu River down, wading knee-deep, and then when it turned north-west, we left it and went west, crossing another stream also running north-west. As was the case with the Boku, and indeed all streams I have met running into the Ramu, these rivers make elbows as they leave the hills, and turn and try to run parallel with the big river. It is just as though some geological change had taken place, and all the land was tilted south-east north-west, so that while the stream and rivers in the deep valleys of the hills held to their courses, they turned with the slope as soon as they got clear of the last foothill. I do not advance this as a scientific explanation, but merely to explain the effect it has on my mind. We continued west, and crossing a large flat intersected by only one stream, which was very narrow but breast-deep, we gained the bank of the Ramu proper. The Ramu divides here into numerous arms or channels, wth low islands of gravel in between. From shore to shore it is 800 yards across, but of this less than half is water. At first the crossing of so subdivided a river seemed simple, and the smoke of Waimeriba across the way, and its waving coco-nuts, were a strong inducement to ford at once. Sarawai and the other local boy from Kohu held back, saying the river was too strong. This seemed queer, as Fiele, who is an old man, crossed yesterday, when, if I am a judge, the river was higher. We started off, leaving the Kohu folk behind, and without difficulty crossed the first two arms; then we faced a deeper, stronger channel, and, try as we would, we could do nothing We might, perhaps, have swam it, but certainly could not take any gear over, and it was a mystery to me how Fiele and his friends got themselves over until the Kohu people said there was a crossing lower down.

Boys on the other bank who had come out from the village in response to Sarawai's yells, were now plainly visible through my glasses, and I noticed that they were

armed with bows and spears, but there is nothing unusual in this. All our shouting to them to come over and make friends had no effect, except to make them run up and down their bank distractedly. It came on to rain, and a freshet coming down warned us to get back to our bank, for we were still on an island which was quickly becoming a rapid. Angep, who has ideas and initiative, tried to swim over to say how-do-you-do. but was washed down and landed fortunately on our side half a mile below. On reaching camp we found Fiele and his boys still sitting there, and I asked him to bring over some more of his people to-morrow, and I would return with him and sleep at his village.

The Kohu boys have pearl-white teeth, and do not chew betel-nut; they are the first people I have met of New Guinea who regard white teeth as fashionable. The grass country of the Ramu flats consists of a gravelly soil, and on this grows a poor kangaroo grass from 2 to 3 feet high. Wherever the flat is intersected by a stream wild sugar takes the place of this grass. Also, among the grass are some shrubs of the Legume family and many annuals; few of the latter were in flower.

I made a good collection, and the Kohu people were much interested when Peter got his boiler going under the eave of a hut, and put the day's material in to dry.

21st March.—Went down to the lower ford, but it had rained all night, and the river was running a banker. Only the highest islands were uncovered, and practically an unbroken reach of dark-yellow brown swirling water stretched from bank to bank. One of our guides gave a demonstration in crossing to convince us of its impossibility, and was soon neck deep. The method is interesting, and is worth detailing. The boy chooses a shallow place and wades in, and running with the current and leaning back against it, he edges over to the other side, his rate increasing till he is doing almost the same pace as the river—about 10 miles—and by then the water is well up to his middle; he still maintains his more or less vertical position, and lets the river carry him down, but all the time he is edging over. When he is neck deep he obviously has little control over his direction, yet he still seems to be able to keep upright, and hold his pereneal band dry over his head. Soon his head only appears now and again, and his hands are all that are visible; finally he appears again still dancing down stream, but evidently in shallower water, for every second more and more of him is visible, and now he is standing calf-deep on what was yesterday an island, gesticulating and shouting and waving his pereneal band at us. His gestures are as clear to me as his demonstration was; they both convince me that it is altogether impossible to take loads over to where our friend stands, and that he himself, naked and embarrassed only by the strip of bark cloth in his hand, cannot go any farther. While all this has been going on the people of Waimeriba have collected on the bank opposite. We cannot make ourselves heard across the 700 yards of swirling water, but their gestures are quite plain.

They say, don't come over in every wave of their spears and bows, and in no hostile intent do they mean this, but the river is too high.

Investigated the country north-west, i.e., down the Ramu and 2 miles deep from the river. This gravelly grass and shrub-covered flat is evidently ancient river bed, and doubtless the Ramu has changed its course many times across some 5 miles of country. Nowhere is there a sign of permanent vegetation; all is of the transient river-bed type. As I got nearer to the hills, I found the distinct lie of the old river bank, and above that rose the hills, which are here forested for 100 feet and then rise, grassed, to the cloud line and *Araucaria*. I found a well-beaten pad going north-west and a little hamlet of four huts called Ainape, deserted, except by pigs. Sarawai said they feared me too much, and the people had gone to Waimeriba. I wonder when they crossed, and how they got on. The pad was so heavily trodden that my boys were at a loss to understand, and Sarawai showed much astonishment. We traced it back to our camp, and signs all the way showed that a big crowd had passed. The explanation did not occur to me till we got near camp, when I remembered the loads at Ongoruna were due to-morrow, and quite likely Jack had rushed them through to-day. They were all there when we reached the village, and Tumurro had his boys all drawn up in a line with—of all things in the world—bows, arrows, and spears in their hands. They demurred when I made them put them down, Tumurro vowing that the Kasowai were a bad lot and would kill and eat them all. They would not stay in camp for the night, and when they had had their pay they dashed off back to Ongoruna. I made Tumurro shake hands with Sarawai, and I never saw such a reluctant attempt at friendliness. Sarawai said, when they had gone, that the Ongoruna people often came down and ate the people of Kohu. They are all liars.

22nd March.—The night was clear; the first clear night since I left Bogadjim. I got my latitude—α Geminorum, γ Orionis, ϵ Ursae majoris and κ Argus, gave me a mean of 5.45.3 S. I have had the bad luck to blow out my D.E.R. valve, and the spare W.D. 12 I had in reserve, and the box of which had never been opened, turned out to be a dud: so ends all hope of longitudes from now on. Developed films and got some good results of forest country over the divide. Sent police boys down to the Ramu to try and cross, but they brought back the news that it was not possible. No signs of Fiele and his villagers. Decided to give the river time to go down and in the meantime to explore the upper waters on this bank to as far as the Finsch-hafen Mission folk have penetrated from the Markham side. When I told Sarawai of my plans and asked him for boys to go with me, he showed his horror of my proposal and refused point blank. Kogi and a Wanese boy in the end interpreted his objection, which was that the people who lived at Amage, up the river, were as big as trees and had tails like dogs, and always ate strangers.

23rd March.—Leaving a police boy—Peter, and a boy who hurt himself on the Mindjim and was still unable to carry loads—we left Kohu at 7.15, and reached the Efabia River at 8.25. There, took a round of bearings while waiting for some boys to come along with us from Koaki village. Made the village of Arosia at 10.15 (1,200 feet) and got a round of bearings here while the rice was cooking. There is a hill south-east of Waimeriba on that side of the river with a conspicuous single tree on the top, which makes an excellent mark; while above rises the two peaks, Mt. Otto and Mt. Helweg, which are the last of the Bismarck Range at the S.E. end. Further up the valley, and on the opposite side, rise a number of small, steep, rock-spattered grassed hills, whose feet are washed by the Ramu. Some have precipitous falls to the river; others merely very steep slopes; all show strata of grey rock, and their summits carry outcrops. One hill has two peaks or crests, and offers a splendid landmark. On this side, the valley widens and the hills are of an easier gradient and rise to the forests 1,000 to 2,000 feet above. Just behind Aroisa village there is a semi-detached clump of sugar-loaf topped hills, round which the Efabia River makes its course; but, generally speaking, subsidiary or separate hills are all on the other side of the river. The river itself continues wide—a series of channels and islands. The Efabia, too, runs more straightly into the main stream, probably because the hills here come so close to the Ramu and there was no opportunity for the tributary to turn.

An hour's march from Aroisa brought us to the Yoge River, which, when in flood, must be troublesome, for the banks are 150 yards apart. When I crossed, the river was confined to a 10-yard stream, knee deep, running in the centre of this stony waste of river bed. One hour and ten minutes more walking, and we reached the Mene River where it flowed into the Ramu. We had been following the bank of the big river for an hour with no track to guide us. It is probable that the river—it is 400 yards wide here—is used as the road in the dry season. We continued up the bank of the Ramu, now on a bed of gravel, now cutting our way through tall wild sugar until after an hour's rather slow progress we met the Mosea River, which we followed up and saw in the distance, rising from a clump of trees in the plain, the smoke of a village. This was Amage—our destination—and our guides, having shown it to us, put down their loads and bolted, all except a rather old man, whom I persuaded to come on by offering him a tomahawk. We soon met a well-beaten pad leading from a yam garden to the water, and following this through the crop, reached Amage in one and a quarter hours.

We had learnt to approach strange villages very quietly, so as to surprise the inhabitants and make friends with them before they had time to think about running away. A country which has been subjected to all the horrors of unregulated "recruiting," naturally does not welcome strange people. We surprised eight old people in the village and the men ran for their bows and arrows, which were leaning against the doors of their huts; but when they saw I had no arms—my three police boys were well in the background and my carriers were without bows and arrows, and one of them talked their language, they were less afraid, and by the time my tent was up and the cooking started, bananas and taro were being brought to us.

In the end, the oldest of the inhabitants sold us a pig, and while the young people of the village did not show up, the elderly people, including three women, stuck to the place all night.

There is a patch of forest all round Amage, and it boasts also a fine clump of coco-nuts, which have been planted in the opening just round the houses. The bush is typical rain forest ,and is a remnant of the forest that must have once stretched from the foothills right across the Ramu valley. This little clump is probably preserved as protection for the village and a sanitary dépôt. The rest of the country is Savannah, the only trees scattered through it are *Sarcocephalus, Clerodendron,* and *Albizzia procera.* There are two grasses, one is Kunai or Kurakura—the Lalang of the east and *Imperata* of botanists—and this confined to the deep alluvial soils; the other, a kangaroo grass, which takes the place of the first as soon as there is a heavy mixture of gravel in the alluvium. The valley is widening rapidly, and the distance from foothills to river is quite 7 miles now. Above, on the hills, stand out fine ridges of hoop pine and Araucaria Klinkii. I judged these groves to be 1,500 feet higher than the plain, which is 1,100 feet at Amage. The people here are of a different type; their houses are better, and they only carry bows and arrows, no spears. The women wear grass skirts, hung lower than I have ever seen them, reminding one of the tapi cloth worn by the Binendele maiden. I am now opposite "Twin Mountain," and so only one peak is visible; observation of four stars put Amage 5 deg. 53 min. 52 sec. south. What a nuisance having no wireless.

24th March.—Our only local carrier bolted during the night, leaving the tomahawk at my tent flap. However, I had no trouble in getting four men from Amage to come along, and so we set off, and crossing the Faria River we pursued our journey across a vast grass plain, dotted with *Albizzia* and *Sarcocephalus.* A good view was obtained of the country to the south-east, and Zoller Berg and Winter Berg showed up very well. An hour and a half brought us to the Uria River, and on the other side a patch of old forest and lots of coco-nuts, and beyond, in the grass, the large village of Koromo. This consists of 42 beehive houses in two divisions. There is a tree in the middle, and a watchman on it had announced our coming, so that, except for a circle of old men sitting under the tree, the place was quite deserted. These proved very timid, but they were induced to take in the Amage boys' loads, and we went on through a banana garden and across more Savannah and a little river called Tumerumo to the large river Mimea. This was 300 yards wide from bank to bank, and was running in full flood; all attempts to ford it failed and so we had lunch by the bank, and later decided to camp there as we must wait for the river to go down or find a crossing above. With two Koromo boys as guides and Jack, I went up to the Mimea and found a bad crossing near where it debouches from the hills. One Koromo boy got over but only by the skin of his teeth, so we continued up our side while the other boy went off to a village called Sawasa, which was now clearly visible a little further up on the other side. What was equally clear was the stampede of the inhabitants, who could be seen running up the foothills, which had been recently burnt and were covered with short, young, wonderfully green grass. My ambassador managed to restore some confidence, and by the time I was opposite the village some ten or twelve boys had come down to the cliff—the river is here torrential, and shut in between steep walls—and were gesticulating. Owing to the loss of my first guides, I have had no interpreter for a day, and I had to make my needs known by signs. This was not difficult, and soon some of the boys were off to get food for us. Others made it quite clear that to attempt to cross there was madness, and that the crossing by my camp was the only possible one. There is no doubt that I can fight my way up the foothills and cross higher up still, but it is doubtful if it will not take longer than waiting for the river to go down. I returned to camp while boys bearing food came down the other bank and managed in the manner already described on the Ramu to dance their way over. I noticed, however, that the maximum load they would take was two bunches of taro, and then one boy was washed down and lost his bundle. They did not go back, but camped with us for the night, and were most interested in the whole camp, particularly in the pots and the food cooked. There was not enough taro to go round, and I supplemented it with rice, which they, of course had never seen, and they watched my boys eating it by the handful out of the kerosene tin I used as a saucepan, and after a little while were induced to try some, only to make sour faces and spit it out. They seem to me more the Papuan type, while the Koromo men and those from Abage were obviously of a more Melanesian breed. I was suprprised at the depth of soil that is shown in every deep cut the Mimea has made. In one bank—48 feet high—I took a note of the strata exposed, which were as follows:—1 foot of dark brown, almost black, loam; then 5 feet of red loam and gravel, then 15 feet of an agglomerate—the river is full of boulders of this—below 15 feet of gravel, and between these two a seepage of discoloured water occurs; then comes 7 feet of sand and gravel, and finally at base and down to the water, which was rapidly eating into and undermining the cliff, was 6 feet of the same dark red loam as was found in the second stratum.

I noticed villages up on the hills, and got the names of five of them. I was also pointed out the general direction of the native Mission Station, which lies on the bank of the Ramu on my side and under a biggish hill I have been taking bearings to. To go there I have to go out of my way to Sawasa and then back, why, I cannot say, though the natives have made this quite

clear by gesture. Some of the people have made a camp on the other side opposite mine, awaiting, doubtless, the return of the food carriers. It occurred to me to send a note to the mission teacher, and so I enclosed it in a Kodak film tin, and sealing it with the adhesive tape I bribed a boy with a 4-in. knife to take it over, making signs to him to take it on to the Mission—the only word we both understood. He managed to get over without any trouble, and set off in the dusk for Sawasa. The camp fire of the others now shone brightly across the river, which was rising rapidly, due, no doubt, to heavy rains at its source in the Finisterre. I got a good round of angles, including Mt. Helweg in the distance, but when darkness came on the heavens were obscured very soon by clouds, and I was only able to get one star for latitude.

25th March.—Up at dawn, and found the river down a great deal—indeed, it was now divided into several streams with stony islands between. The Koromo boys —I still had three with me—got over all right with the light gear, but then I found that my own boys could not tackle the crossing. They had no experience of the dancing step required, and Jack was bowled over and over and had to be bandaged for superficial cuts, and was much bruised. Angep and I got over, helped by a giant Koromo, but nothing would induce any of the other boys to venture and so there we were on the wrong side wtih some of our kit and the remainder and all the boys—eight in all—on the other side. There was nothing for it but to go back again and wait for a still greater fall in the river. I set up camp again and then I explored the country all round and followed the Mimea down to the Ramu. It enters the big river almost at right angles, and though the Mimea is the biggest tributary I have yet met, it is a great deal smaller than the Ramu. At the junction the Ramu, which all the way up from Kohu and beyond was spread out with innumerable waterways, and sometimes was over 900 yards wide and seldom less than 400, is confined in a very narrow channel only 30 yards wide, crushed in by a rock-faced hillock opposite where the Mimea River rushes out to join the main stream. Except for *Casuarina*, which I should have mentioned, growing all along the Ramu, there was practically an unbroken expanse of Savannah right up and down the Ramu Valley. Even *Albizzia procera* has become a shrub, and *Sarcocephalus* has almost disappeared, though burnt stumps still attest the fact that all was once rain forest.

The promise of fine weather was not fulfilled, as it came on to rain heavily at 9 p.m., and a thunderstorm developed, and I am somewhat worried about tomorrow.

26th March.—It rained hard all night, and the river raged at 10 a.m. worse than two days ago. I had a yarn with some of the Koromo pople, who came down to see what we were at, and would not approach the camp, though we still had two of their community with us. So I went over to them, and half a mile back we had our talk, if signs can be so called. They showed clearly that my people were old women, and they would take us all across if they had to carry us and our goods. So we returned to camp, and I told my precious corporal that the boys could all stay behind, and the Koromo chaps were crossing, and they would take all the gear over, and I could go on to the Mission and send back for it if I could get carriers. The idea of being left behind near the Koromo people, who, if they had no tails must at any rate have seemed to my carriers man-eaters incarnate, was too awful, and they very soon had the camp packed up. The Koromo boys —twelve in number—made light work of dancing over with the stuff, and I, helped by another of the Koromos, who held firmly to my elbow, followed with Angep, who always kept up. Curiously enough, though the river was higher, the passage was easier than yesterday, for a new channel had been cut which was not so deep, and the one that had been Jack's undoing was silted up a little. One by one the carriers were helped over, sometimes by one, and sometimes two Koromos, and all came safely through. It is all custom, and I feel like Jack, who in the end went over and back to show off, that I should like this sort of thing after a year or two of practice.

The Koromo boys would not come a step further, however, and made signs that the people beyond Sawasa were quite impossible, with dreadful habits in the matter of food. So we lunched, and as the Koromo chaps would not even come across to be rewarded, I left packets of trade on a rock, from which as we wended our way up the left bank, one of their number retrieved them. These people are a fine type, and that they should have been so badly treated by recruiters in the past is a dreadful thing. The Papuan method "Government first, missionaries, recruiters, and others afterwards," is the only way to open up country. The German administration would appear to have encouraged any form of recruiting in country far beyond Government control. On our way up to Sawasa, we met the mission teacher with a number of natives—he was readily distinguished at a distance by his wearing trousers and a waistcoat. He spoke only the natives' tongues of the district and of the Markham, but we got on, and he wanted at once to take a load from one of my boys. It was nice to feel that I was once more within the sphere of influence of the Finsch-hafen Lutheran Mission, and I knew that from now on my road would be made smooth. Being late, we did not go into the village of Sawasa, but turned off a few hundred yards before reaching it, pursuing a general south-easterly direction along the base of the mountains. That we were making a big detour was obvious, for the mission teacher pointed out the big tree over his house, and it was away down on the Ramu, just where the Koromo boys had indicated. I was not sorry that we were going round three sides of a square, because it brought me close to a grove of Hoop pines that I had been looking at through my glasses from my last camp. Though it was late, I decided to make a rapid inspection of this forest. This necessitated turning up and making a way up the steep mountain side for 1,000 feet, first through grass. However, it was not bad going, and the ridge at the top repaid me the effort. On a chain wide strip 60 chains long, I found 300 logs of fine proportions. Alas, here the grove ended in a burnt-out farm land. The valley of the Ramu is already 1,000 feet above the sea, and the Hoop pine in this region, come down lower than anywhere in Papua, so the native in his farming operations, soon reaches the conifer belt, and plays havoc with it.

Returning to the trail, we continued in a south-easterly direction, and reached Wampun, we then turned south-west, and in one hour reached Waigulin on the Ramu. The width of the valley on the right bank is therefore approximately $3\frac{1}{4}$ miles. Turning up the Ramu for 15 chains, we reached a double village called Entapotowup, with a large mission house standing a little back from the huts of the village. I had thus reached my objective.

The height of the mission station where I slept was 1,000 feet, and its latitude from four stellar observations worked out at 5 degrees 58 minutes 39 seconds.

Since leaving Sawasa I have been treated with great kindness by the natives. The influence of the teacher here is rapidly spreading, and he hopes to reach Koromo next year. The difference on entering the village was extraordinary—not one ran away, and while women and men naturally showed great curiosity in me and my belongings, they showed none of the fear that was the dominant feature in all the villages from Kohu to Sawasa. No Government officer had reached here before, though white men from time to time must have

passed this way. The white missionary has his station at Azera, some two days further up the Ramu, and I sent him and my friends at the mission at Finsch-hafen notes to tell them what a comparatively easy trek it is from Madang to here. With the pushing forward of mission work to, say, Amage on this side, and to Kohu from the Madang controlled mission at Keku, connexion could be made. During the dry season a horse could be used from Kohu to the mouth of the Markham, and only three days of foot work over the hills would be necessary. On foot all the way, and with loads, I reckon the journey from Madang to Lae, at the mouth of the Markham, should take—

Madang to Bogadjim—7 hours, 1 day.
Bogadjim to Kwato—6½ hours, 1 day.
Kwato to Boroai—7 hours, 1 day.
Boroai to Kohu—6 hours, 1 day.
Kohu to Amage—6 hours, 1 day.
Amage to Entapotowup—6 hours, 1 day.
Entapotowup to Azera—2 days.
Azera to Lae—3 days.

These would be dry-season times. In the wet season mails could be got through successfully without delay, the Mimea being the only river up here that is really difficult. A white man travelling with loads must expect some difficulty and possibly a hold-up for some days at this river when it is in flood.

27th March.—The night was a dreadful one, the rapacity of the Entapotowup flea being greater than any pulex I have encountered in the three continents I have travelled in. Had great difficulty in starting off, as all the natives who were crowding round me last night have vanished, hearing that instead of going on to Azera I was going back to Koromo. They have precisely the same opinion of the Koromo people as the Koromo people have of them:—Anthropophagi of the most bloodthirsty kind sums it up. They are of a different race, I think, smaller built and with different architecture, but whether they are Papuan or Melanesian or a mixture I leave to others to say. Anyway the young men bolted, and we had to rope in the older men to take some of the loads. My own six boys could have done it, but I had the Mimea to cross, and we wanted all the help we could get there. The mission teacher was very anxious to help, but it was quite clear that his influence was not yet strong enough to make the boys volunteer. In the end we had four men with us, and taking the direct road down the bank of the Ramu we were soon up to our waists in mud, and water, splashing down the shallowest parts of the side streams and bilabongs we could find. The reason for the detour ysterday was now apparent, for the Ramu in the dry season is the roadway and the upper track in the wet. However, we got through all right, and reached the bank of the Mimea about ¼ mile below our old camp. Fortunately, it was down, and we crossed with only one casualty—a boy lost his footing and was swept down some distance before we could pull him out. Luckily he was only carrying a bag of taro, which he let go of. Once across all but the mission boy and one old man, who had accompanied us all yesterday, ran back. We made Koromo in one and three-quarter hours and found the place deserted. The mission teacher did not want to go any further, so I said good-bye to him, giving him my mail for Finsch-hafen, and set out for Amage, which we reached in one hour. As we got near we heard the hills echoing with warning shouts, and except for one lady, who must have been deaf, and was busily filling her bamboo jug in the river, and who took to her heels screaming when she saw us, there was not a soul in Amage. We camped there again. The shallows so distinctly marked on the old German and some of the British maps as only extending for a few miles opposite Kohu, really extend with one contraction up to Entapotowup and beyond. How far beyond I cannot say. The only gut is at the junction of the Mimea where the Ramu narrows to 30 yards. The average width up to there is over 400 yards, and in places it widens to 900 yards.

28th March.—Collecting all the way we reached Kohu without incident. We were delayed a little owing to the Ramu having risen, and we had in consequence to take to the tall wild sugar betwen the Mosea and Mene Rivers. I found everything correct in camp, and the two police-boys, Petine and Morunga, reported that the people had brought them food, and had not attempted to interfere with the goods in the store tent. I found three young boys in the village—a good sign, for up to now they have kept the youths out of sight fearing recruitment.

29th March.—Developed photographs, washed clothes, and made and mended. Went over collection; one tree bearing a walnut is interesting; this must be the Juglans reported by German travellers in New Guinea. I am afraid it is no Juglandacea, however. I have the latitude now of the main points along the Ramu, and while the boys are building a canoe to cross the river—for it has rather come up than gone down—I will make a triangulation. Possibly by the time I get back from the Bismarcks the spare valve will arrive, and I will be able to fix this place in longitude.

30th March.—Sent corporal, one police boy, and interpreter to view ford. They returned in the afternoon reporting that they could not cross, so I started on the canoe, felling a nice *Octomeles* for the purpose. Picked out my base line and points C. D. and E. of triangulation.

31st March.—Went up to Hanep and fixed that ridge and made friends with people. There is not enough native food coming in, and the Hanep crowd promised to bring some in. Collected specimens from a new tree and some good material of undergrowth species. A small *Garcinia*, with fruits as large as a cherry and as green as a greengage, and tasting rather nice, was new to me. The nights have been too cloudy for Azimuth. It has rained every afternoon and all night. The village of Kohu is like a cowyard, deep in mud. The mosquitoes are more persistent than ever, and there is a lot of fever among the boys.

Tuesday, 1st April.—The canoe is progressing well. I went off with a couple of boys and fixed point F. at Koaki. Managed at last to get Azimuth observation for Kohu. Four observations—two east and two west stars—gave me a good mean.

2nd April.—I was awakened at 4.30 a.m. by an invasion of small black ants, who took possession of my bunk and evicted me very suddenly. It was a wonderfully clear night, and I got some further observations which altered my Azimuth of point D. by 17 seconds. So I shall have to get some more stars. The blue night sky, paling to dawn, was a very wonderful sight, and I do not think I have ever seen Mt. Otto look so sharp and precipitous.

The canoe is nearly finished. The outrigger and paddles are ready, and there now remains but the making of holes to take the lashings Curious how once natives have taken to our tools how utterly lost are their old methods. The making of holes through the gunwales (if canoes may be said to possess such things) beat my boys entirely. I presume the native in his raw state used a small stone axe for the job Dozens of them are to be found in the Kohu huts, for the people about here are quite primitive stone-age folk. When I suggested to my sophisticated corporal that the tool his father used was just the thing for the job, he was quite definite that he could not use it, so I made a poor substitute for a mortising chisel out of an 8-inch file. It is curious that the people of the Ramu do not know canoes. The old men sit all day round ours and watch every stroke of the adzes, of which I have kept five going. Food is scarce, and

it looks as though we had outstayed our welcome. Some came down from Hanep, but the boys I sent to Koaki returned empty, the inhabitants having run away when my messengers, Kogi, the interpreter, and a police boy returned. They did this yesterday, but I got them back, including a woman, and had a talk to them at Point F. They promised me a pig and much taro, and I said they would get a tomahawk and two plane irons for the pig, and cloth and salt for the taro; but they never came, so I have had to work into my rice. I calculate that if we get the canoe down to-morrow and cross next day, I have food enough to see us up Mt. Otto and back to the coast, allowing for no delays or accidents.

3rd April.—Finished canoe and got it down to Ramu with awful labour. First, down the Kohu River, which was easy, then across to the intermediate stream over the wide stretch of grass land, and then having crossed another little stream we had the wild sugar and grass land of the last lap to drag and push the big canoe over. It was not till 5 p.m. that we got her alongside the big river. It was too late to put on the outrigger and launch her, so, leaving a guard of two police boys to watch till dark in case the Waimeriba people took it into their heads to play up, we all returned to camp. I think had it not been for police boy Angep, who yelled himself so hoarse that he can now only speak in a whisper, we would never have got that canoe down. The local population gave us no assistance, and it was sheer physical brute force and awkwardness that had to be applied. It is only by making much noise that natives can move heavy objects great distances, and in this Angep showed himself a king. What a noisy job pyramid building must have been. I got a good round of bearings from the launching place, which is practically the lower ford.

4th April.—I got my final Azimuth observations. which enabled me to correct one of the old figures and strike a sound mean of 23 deg. 17 min. 5 sec. The corporal and four boys went down at daybreak and fixed the outrigger. We all followed, including most of the male inhabitants of Kohu, and launched the canoe in the side arm of the Ramu. I got washed away, taking a photograph, standing waist-deep in the stream, and had hurriedly to wind off the film and put the camera out to dry. My watch got waterlogged for the third time. The crossing of the second arm was done easily, but the third beat us for a while. Time after time the current took the canoe and spun it down stream to bring it up half a mile below. Then followed the wearisome job of dragging it up by a rope against the current. We managed to get two cargoes across by 11 a.m., and there were two more to go; the boys and I could swim and get no wetter, for the canoe was always full by the time it reached the other bank. Meantime the cook was told to cook rice on the island of stones where we were marooned, and on which, fortunately, there was plenty of dry driftwood. The boys on the other shore had collected in force during our aquatic sports, and finally when they saw the smoke of our fire and recognized a number of Kohu people with us, they came dancing through the flood to us, crossing arm after arm. Often all that could be seen of the native was his two hands out of the water. How he keeps his perpendicularity below water I could not see. I was to learn. After a few more failures to get cargoes across, the boys of Waimeriba, of whom some seven had come over, volunteered to carry our goods right across. While I could not see how it was to be done, I gladly acquiesced in the suggestion, for I did not see how we were going to cross the central arm if the smaller one in front of us had almost beaten us already. So we had lunch, and, making up the loads into the smallest possible bundles, we gave the Waimeriba crowd the signal to pick them up and carry them over. Crossing the minor arms was child's play to these boys, and I stood amazed at the edge of the central arm as they danced their way obliquely down stream. For half the distance across this flood they were submerged except for their hands and a swag of rice or a kerosene tin of gear dancing its way across, supported by two brown hands, was a spectacle I shall never forget. With all my practice of flood dancing at the Mimea, I confess I stood on the edge of that central channel and could not bring myself to take to the water. I was very glad in the end of the help of a young man who firmly grasped my arm; even so, I could not keep my feet and swam the middle stream, the boy easily leaning back against the force of the current and running with it. I calculated that the distance across of the whole river here was 618 yards, while the central channel or arm was barely 60 yards. It was flowing 9½ miles an hour, and when I was crossing it it seemed several miles wide. Jack stuck to me and managed to cross the last channel in front of me—my helper had deserted me—and I lost my footing and naturally began swimming when I found how useless was such a method of progression. I was rolled over and over, and that I came out on the oppostie bank was mere luck. Jack had stuck to a Waimeriba boy and to his rifle, and there we were, two dripping objects, Jack in particularly undress uniform for a police boy, and I in a shirt and belt. The Weimeriba people collected on the bank had watched our performance with interest, and doubtless regarded my ducking as part of the usual procedure of white men crossing the river. It would have been more like a sports meeting had the crowd not been so very well armed with bows and arrows, and I should have felt more cheerful had I a dry pair of shorts to put on and had the rest of my party not been standing on the opposite side of that central arm, too far away to be cursed at effectively. I picked out Feile from the mob, and got some of the gentry to put down their arms, and then by signs showing that I had no weapons, induced the rest to do so. I then spent two hours trying by signs to get the people to send back for the remainder of my gear and for my boys. By 5 p.m., they were all over, and, headed by Feile, we marched off to a hut and a lean-to shed, which I was assured was Waimeriba. Kogi as an interpreter is a failure here, as the language is different from the Kohu "talk," and he could induce no Kohu boy to come along.

Lost four 18-in. knives, which is mysterious. I fear they have been stolen. The whole attitude of these people is quite different from anything I have met. There were 52 boys on the beach, and they showed no fear of me or my boys, and they have young boys among them, so do not fear recruitment. They look like "fight" at the least provocation. They have only brought us a little kaikai, which, coupled with the loss of the knives, is suspicious. My own people are scared, but then they are always so. A serious mishap occurred crossing a creek the other side of the Ramu this morning. My little iron box, containing papers and other valuables, was dropped and swamped. Nothing was said at the time, and the corporal only reported the event to me at noon. When I opened it there was still 3 inches of water in the box, and the condition of my note-books, &c., can be imagined. I had everything out in the sun to dry, including the watch, which started bravely ticking again at 2 p.m. Fortunately, my spare watch and most of my gear I have left at Kohu, and I am travelling as light as possible. As a rule, that box contains films and prints. What an escape! My camera I sent back with Peter, who is to dry it out again, and he and the police boy, Marunga, and Ulem, the boy with the bad foot, will stay behind to look after camp and dry out botanical material. The watch is going all right, which is as well, as I borrowed it from H——, in Madang.

5th April.—Left Waimeriba at 7 a.m., and made south-west till we struck the Marea, which is a big river

300 yards wide, and running strongly parallel with the Ramu and about 1 mile inland. The country passed through was of the slushy, muddy type met with around Ionomba. Goura pigeon, cassowary, and wild pig were plentiful. The going was very soft. We followed the Maree down, and then leaving, it went west and finally north-west, through occasional flooded grass and *Albizzia* patches. The Marea must be a terrible river in full flood, for there is flooded country for a mile even now. Entering rain forest again, we came to a doubtful village called Korike; the places are separated by about three-quarters of a mile of bush and grass lands. There we found many of the people who had watched us yesterday. Our guide to here was Kusige, a good chap who gave orders yesterday, and was obeyed by Waimeriba people. We had three boys, too, helping to carry, and all armed to the teeth.

At Korike, I met an old man who was light-headed, but who spoke smatterings of pidgin, picked up years ago at Bogadjim. So boys have ventured from here across the river and range to white men, but I gathered that while a Chinaman had been here before, and him they killed for some reason not divulged, no white man had visited these folk. To go further than Korike was not possible; the people made this quite plain by determined signs, and when I pointed out the smoke of villages high up on the shoulder of Mount Otto, they said that was a place called Sahi, and, judging by the gestures, the people who lived in Sahi were no better than they should be. However, by dint of waving my arms, I got them to guide me to the Marea, where a better view was obtained, and beyond which I found we certainly could not go owing to the deep, broad flood that was coming down. I gathered, however, that there was a place called Koromo at the foot of the mountains and higher up the stream, and if I would only be patient and sleep at Korike I could go there to-morrow. As there was lots of food readily obtainable, with salt, I "sat down" at Korike. The bush around yielded nothing new. Around Waimeriba there were some fine *Octomeles,* and the rain forest in the early part of the journey consisted of the *Pometia* type. Rattans were very plentiful, and soon the bush deteriorated, and muddy swamp forests took its place.

The presence of obviously planted flowering shrubs around Waimeriba was noticeable, Crotons, *Poinceana pulcherrima, Hibiscus* sp., and, over all, lot of coco-nuts. Korike, on the other hand, boasts no adornments, and has only one coco-nut.

The wing covers of the large green beetle are here sewn on "tapi cloth" tapes and worn as bandeaux, and very effective they are. The boys also wear a piece of tapi cloth, gaudily coloured, shaped like a sailor's collar, but much longer, reaching at times to their buttocks. The hair is worn long, and is twisted into a thousand tails, and intertwined with fibre, which dangles beyond the tails, making the hair look longer and straighter than it really is.

6th April.—Leaving Korike at 7.30, reached Koromo at 11 a.m.; lunched there, and pursued the river Kirei for one and a half hours; then camped.

The height of this camp was 1,230 feet. For the first part of this journey we retraced our steps of yesterday to where we first struck the Marea; we then followed this river up to its bifurcation, and leaving it on our left we followed up the Kirei. The day was arduous, for the Marea is a hard one to follow up, and the rivers here are the only roads. Between the Kirei junction and where one turns to Waimeriba the river divides into a number of arms, and spreads itself in rushing torrents over a mile of country. It is rocky grass and *Albizzia procera* country, and has a good slope, so the streams which now make up the Marea are pretty swift. The course once more becomes defined as one reaches the foothills, and here the bifurcation takes place. The Marea apparently rises in Mount Helweg, while the Kirei, its main confluent, rises in Mount Otto.

A curious incident occurred this morning. We had encountered much delay and great difficulty in fording and refording the Marea. Our supposed guides—Korike boys—were apparently at fault in finding a good crossing below the junction, and giving them a lead I got over safely and without much trouble a little higher. I was sitting on a rock on the other side washing out my gym shoes—an operation that had constantly to be repeated, as small gravel brought down by the river collects between foot and shoe—and rebandaging a sore on my ankle, when happening to look up stream I saw an oldish native drawing his bow. For a fraction of a second I did not realize that it was bent at me, when I did I made myself as small on that stone as I possibly could. I do not think I ever felt so large or wanted to feel so small in my life before. He let go and missed me by quite 10 yards. Jack and the Tul-tul—the latter carried my rifle—were 50 yards behind, and only came up in time to help search for the arrow. I had a wish to recover the only missile that has been fired at me in New Guinea. The enemy, having loosed his shaft, made such good pace up stream that he literally faded away. Just at this point we came on fish traps and two huts, and little taro patch, and later three natives armed with bows and arrows barred the highway, which was now the Kirei torrent. At the urgent shouts of our Korike guides, they put down their weapons and came and made friends. Half an hour later we were joined by some dozen more boys who, when I signed I would not go with them unless they left their arms, tied up their arrows with bits of bark fibre. I couldn't get them to unstring their bows, however. Thus well escorted, we reached Koromo—curiously enough the same name as the village already referred to near the Mimea high up the Ramu. There I lunched and made friends with the people, who made no difficulty about letting me write down their names (such data were collected for the information of the District Officer). I bought food, and gave a present of a red "lap lap" to the head of the village. I saw only men and boys, the women had evidently been hidden in the bush. It was after lunch, and we were packing up to go on, and I was trying to induce some Koromo boys to go up with me to Sahi, that I saw a struggle going on on the outskirts of the little village. I pretended to take no notice, and after much shouting and noise, an oldish native was brought before me, or, perhaps, I should say dragged, for it took three of his people to push and pull him along. I recognized him at once as the person who had let drive at me that morning. His friends let him go when he was fairly close to me, and seeing that there was no escape, I suppose, he made a dive at me, and clasping my knees with one arm and grovelling on the ground, he stroked my limbs with his other hand. When he at last desisted and sat back, he made a voluble explanation, aided by the most lucid gesticulations, as to his conduct. From the signs he made, it seemed he had gone down to hunt and fish at the river, and had seen a new and strange creature and shot at it. While we parted the best of friends, and he was delighted with a piece of red calico, he would not accompany me up to the Sahi, and I could not induce any one else to come. So we went on without guides. I noticed, however, that the Koromo folk followed us at a distance, and when we made camp they turned up from all sides and stayed watching our camp business till dark drove them home.

The Kirei tears its way through what seems to be the same geological formation as in the Owen Stanley Range, and the bed of the river is littered with the same boulders and stones as I remember seeing in the upper Kemp-Welch. The slopes of the hills are desperately steep, and the forest in consequence is of the

poorest type of the foot-hill regions. Any mild slopes have been taken for taro and sweet potato lands, and there is in consequence little high rain forest left. There were enough species, however, to mark the type such as *Pterocarpus indicus, Pometia pinnata, Alstonia sp., Sloanea paradisica, Celtis, Vitex, Wormia* (the small species with enormous leaves bearing the queer ligule when immature). The shell pink bracts of *Pongamia glabra* are very conspicuous at this season.

7th April.—Left camp at 7.30 and followed by one Koromo boy, we started up the Kirei once more. It rained hard between midnight and 4 a.m., so the river was up, but still manageable. At 8 a.m. a Scotch mist which we had been enduring turned into solid rain, which, together with the arduous rock climbing and painful wading, so dispirited the carriers and me that at 10 a.m., meeting ten fearful yet combative natives of Sahi, we decided to make camp. Here we lunched and reconnoitred, and gave the strangers time to look us over. We were all cold to the marrow, and I was glad of a cup of cocoa and a change. At noon we continued our journey, accompanied in the rear by six Koromo boys, who expressed by signs their entire pessimism regarding the outcome of our foolish visit to Mount Otto, and the probable consequence of our venturing among the Sahi was clearly a horrid death.

They merely came to assist at the spectacle as it were. Their pantomime was so realistic as they gave representations of our party being one by one pierced by arrows that it affected my carriers considerably. My laughter cannot altogether have been sincere, for the carriers held back all afternoon, and so doubled their chances of misadventure. At 2 p.m. we came up with the Sahi folk, now reduced to a scanty party of four. They were all violently waving green leaves of the big wild ginger. Green leaves are a sign of peace all over the upper Ramu and all over the world as far as that goes. They were obviously much alarmed, so armed with a very fine specimen of Zinziberaceae, I left my carriers and went forward and soon made friends with these people. The Koromo people then came up, and there was the usual noise. I noticed that the Koromo, Korike, and Waimeriba boys when they met actually kissed; I was surprised for I have never met kissing among raw native people. The Koromo boys when they met the Sahi chaps did not kiss, but merely held each other round the waist and gave a nice squeeze. We continued up the river in the best of spirits, and Sahi people came tumbling into the ravine from the heights from which they had been watching us until we had a biggish crowd of them, and I thought it best to get my carriers together and distribute three police boys among them while I went a little ahead; the corporal brought up the rear, separating the six Koromo folk from my boys. Farther on, all but one Koromo melted away. The one that was left needs special remark, for he was of such small stature as to be almost a dwarf. Round his neck he had two dried human hands taken from children, probably his own. It is the custom among certain Papuan tribes to thus preserve the hands of departed loved ones. This gnome, with his long hair and an expression of diabolical happiness, chuckled and laughed and chewed betel nut all day, and seemed delighted with some great joke of his own. I could not help thinking that his joke was probably on me. At 5 p.m. we came to a place where the side of the gorge had slipped down into the torrent. The formation was shale and quartz, and large and very beautiful crystals of this stone were embedded in the greenish mud made by the washing of the shale debris. I had noticed these clear-as-glass crystals tied with fibre and worn as ear drops of some of the Sahi boys, and wondered what they were. Above the slip, which we had some trouble getting over, was a bridge made of poles set across the stream. There were two spans supported by an immense central rock. The river made a bend here, and the crest of the hill beyond, carrying a fine row of hoop pines, stood out clear against the evening sky, with the crest of Mount Otto cowled in cloud, rising abruptly on the right. Here a path crossed the river, and a larger party of natives awaited us, and barring the road up to the left, showed us that we were to take the way over the bridge. This we did, and found ourselves in a very large sweet potato farm. It must have been some 25 acres in extent, and except for some women who fled shouting over the edge of the hill, it was deserted. We climbed to the top of this farm land, and then on the edge of the bush we set to work to make our camp. From here, which proved to be 3,020 feet, I can see the valley below and Mount Otto above. I am in the hoop pine belt, but alas, most of these trees have been destroyed to make farm lands, and there are certainly not enough to make this part of the country interesting to timber men. I worked out the height of Mount Otto at 9,500 feet, so I have 6,000 feet to climb to-morrow. The natives at first kept far away in their villages, which are two in number, and quite clearly visible from here across the ravine. After a little while they crept up, and at dusk I went out of our camp with green branches and got them to tie up their arrows, and some of the more venturesome men came into the camp and watched our doings. The rest, instead of returning to their village, made a camp 200 yards away, built a big fire, and made a noise all evening. Some, however, brought us food, and when they were paid they were so pleased with the trade goods that they promised more to-morrow. The gnome has camped with them, too.

8th April.—Left camp at 6.30 with Angep, two carriers (theodolite and lunch) to climb Mt. Otto. Found all the natives around their camp and tried to get guides, and failed. Eventually climbed the farm fence and found a trail which led up hill through old farm lands. We had not gone 100 yards when we were met by four natives, who effectually barred our progress by standing across the road and waving us back, saying at each gesture "Koromo." It took me half an hour to explain by signs that we intended no evil to the villagers, but wished to pass quietly up the hill and away to the tip top of the mountain. Finally six boys were told off to accompany us. Holding to a fairly straight course about south-west, we rose 500 feet, when we left old farm lands covered with weed-tree re-growth, *Gleichenia* ferns and tree ferns, *Macaranga* and other poor types, and came into virgin forest. The ascent now grew steeper, and the forest was very poor. I noticed *Eugenia* and *Colophyllum,* the large acorned oak. *Agapetes Moorhousiana* and the port-wine coloured trumpet creeper (*Dichrotrichum*), a Hoya but not *H. dimorpha, Elatostema,* and the beautiful *Medinella.* The *Metrosideros* of the Owen Stanley Range was common; it evidently flowers much later here. At 5,000 feet mossy forest began, and it continued to the top, which I reached at 2 p.m. It is generally stated that it is easier to climb the Alps than a hill in New Guinea. I think D'Albertis was the first to start this impression. It is a myth. The last 500 feet of Mt. Otto are almost perpendicular; its height worked out at 10,190 feet, and in any temperate climate it would have been a question of ropes, ice axes; and all of the thrills of the ascent of one of Switzerland's dreaded peaks. Here, although the slope was too near the perpendicular to carry trees, it did carry dwarf pandanus; and though we suffered desperately from cold and wet—the temperature was 42 degrees—there were no snow avalanches or other thrills.

A very uncomfortable climb, and I would suggest to any one desirous of repeating the performance to climb up through Sahi, and so avoid a particularly deep gorge and precipice that I had to get around. As luck would have it, the climb was rendered rather abortive through

the downpour of rain and the closely enveloping mist. These weather conditions made any surveying observations impossible, and so for the last lap I left the utterly done carriers with the theodolite and went up with Angep, who observed: "On top belong mountain he no stop," which I was beginning to think was true, but at last we reached the top rocks. The little triangulation of the country must therefore be taken as only approximate, for the apex of my first major triangle was calculated and not observed. We got back to camp in three and a half hours, and I went down with fever at 6 p.m.

All in camp was right, and the only complaint was that a boy had taken my mosquito boots, and footing them had shown off before his friends for some time before Jack, by tact and a gift of salt, recovered them. Salt is much in demand, and the boys brought me their own substitute—a potash obtained by burning the stem and twigs of a young tree. Unfortunately, it was too late and I was too tired to inspect the growing tree and collect material. This method of obtaining saline for food has been recorded in Papua, I think.

9th April.—Thirty grains of quinine killed the fever, and rising at dawn we struck camp in a heavy Scotch mist and set out for warmer levels below. As soon as our intentions were clear, the men of the villages turned out to see us off. There was no spirited demonstration of regret, but they lined the path and the approaches of the bridge and silently watched us go, and only the gnome, who still chewed betel nut, laughed as he hugged a very large roasted taro to his bosom. There were 51 at the bridge, and they must have feared an assault on their village, for they all had their arrows loose and their bows strung. I decided that it would be discreet not to cross the bridge, but to go down the river on the side we were on, and the general unbending of the inhabitants who followed our movements in this direction showed that they were all much relieved. By 11 a.m. we had reached the camping-place of the night of the 7th, and while till now there had been quite a tail of Sahi boys, these had all vanished and Koromo people came up the river to meet us. So down we went, and we did not even call at Koromo but passed on to the Marea. The last sight I had of Koromo people was the gnome sitting on a rock which was quite red, for he was still chewing betel nut. The villagers never wished us good-bye or good luck, and the last sound I heard was the gnome's laugh. I expect he is still telling the tale of his journey among the man-eaters of Sahi, and is spitting betel juice and chuckling away while, with a gem of a little stone axe that even a twopenny mirror would not buy, he whittles away at a well-cooked taro.

Arrived at Waimeriba at 5 p.m., and was astonished at the reception we got. Faile affected great joy at our return, stroked us all over and bought us a pig. I decided to camp there, and sent Jack and one boy over to tell Peter and police boy Marunga that we were arriving. In the morning the two were to go on to Ongoruna, and bring back carriers to take all our gear and collections back to Madang. Faile detailed two strong men to guide the two boys over the Ramu. The reason for Faile's extraordinary behaviour became clear when the interpreter Kogi, after much talk, disentangled a fairly continuous story, which was:—My base camp at Kohu had been attacked while I was away and completely looted. On cross-examining several boys, I gathered that Peter, Marunga, and the other boy had got away to Ongoruna in time; that the raiders came from Kaiserup, on this side of the Ramu, and that they had the police boy's rifle and ammunition. That they came from this side is absurd, and merely a blind. The possession of the rifle is not very serious, as they cannot know how to use it, though they may kill each other. I unfortunately had left everything not utterly necessary in my ascent of Mt. Otto behind me at the camp, and if the story is true I have lost irreplaceable material, notes and photos.

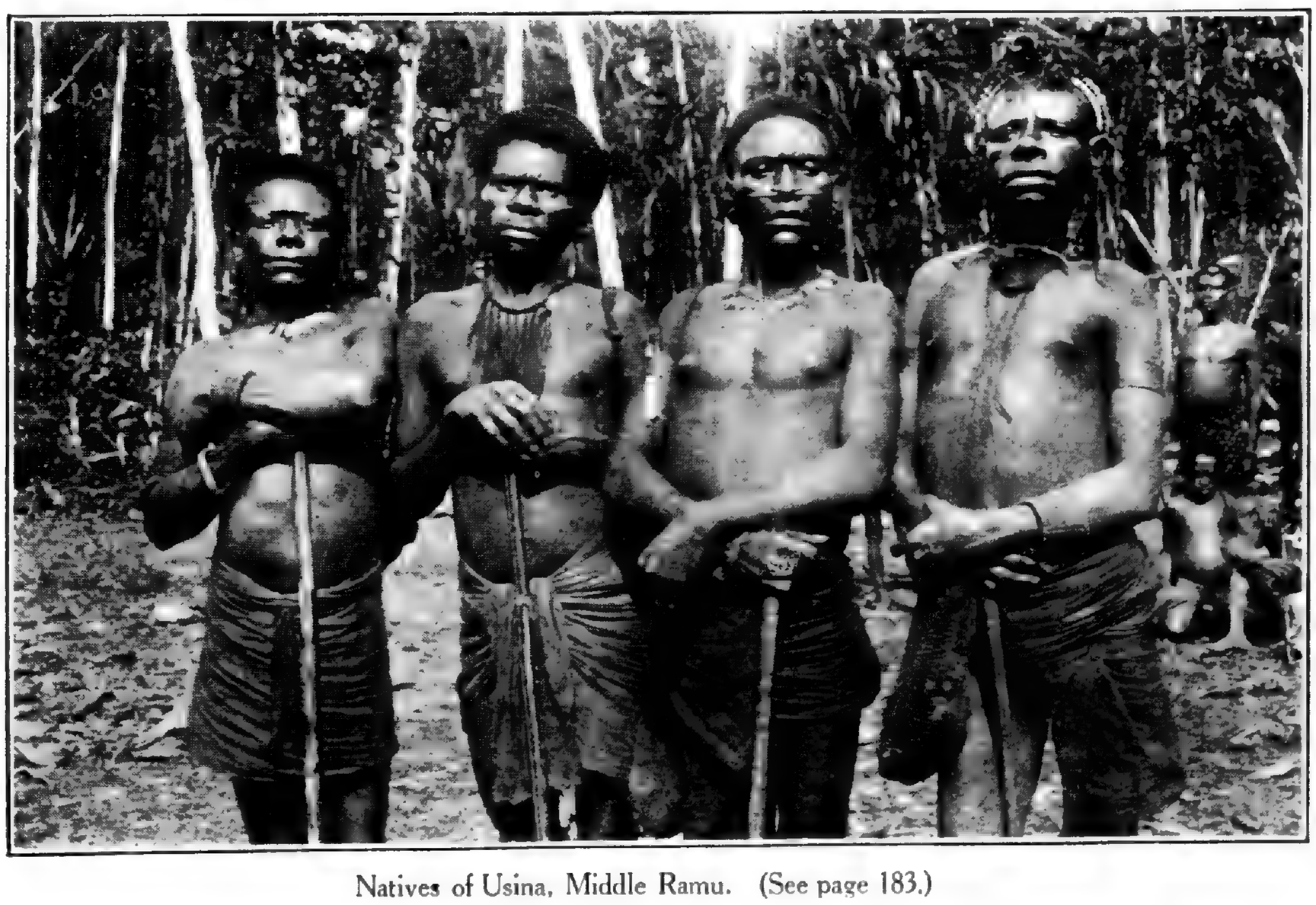
10th April.—Jack and his mate got back late and confirmed the news that my camp had been gutted. Also, they heard a rifle shot. We got off at 6.30, and crossed the Ramu, which was not quite so difficult this time as it was down a foot; and moving as silently as possible we entered Kohu village at 5 a.m., and found things as had been described, only worse. Everything had been gone through, and what the natives did not want they smashed. I kept my people off the centre of the village and spent an hour going over the scraps of paper that literally strewed the ground. I recovered some of the Ogeramnagn Joangey notes and a few astronomical observations, but, alas, my diary had gone with all other papers and books, and my negatives and prints I found stamped into the mud of the place, ruined beyond hope. Coming to the boxes, they had smashed the lids and taken what they wanted and thrown the rest away. They put an axe through my wireless set and disembowelled my spare watch. They emptied the medicine chest—I only hope they ate all the mercury perchlor. Tent flies and 12-bore ammunition they ignored, contenting themselves with throwing the cartridges out into the wet. I found the back of my camera and later recovered the lens and shutter, which was lucky; they must have opened it with an axe and torn the front from the back. My aerial wire did not appeal to them, for they left it coiled in its reel, but the 5-chain tape had disappeared. I thought the botanical material would be safe, as it was so uninteresting to natives, but I had forgotten the newspapers which enveloped the specimens, so when I opened the iron drying box, which was in no way damaged, I found it empty, except for a few broken twigs and leaves. The herbarium had been taken out, and later we found pieces of the newspapers in every hiding place. I had left three 40-lb. bags of rice behind, just enough to see me and a large gang of porters to the sea. The Kohu people do not eat rice, but they scattered the food about the village square, and all over the desolation of my looted camp hangs the heavy stench of rotting grain. The loss of herbarium specimens and of the wood specimens too—for these had disappeared—and of my notes, negatives and diary, were the most serious.

A thorough search was made in the bush around the village, and soon a number of objects were found of which the most important was the spare .303 ammunition which when counted was only three short. There remains the police-boy's pouch which should be on his belt. That rifle shot last night is disquieting. The other finds were bits of wireless gear and a slide rule in pieces.

Jack has developed ulcers and so he can't move fast; I left him to guard the carriers and my gear, and with the other police-boys I set out to hunt up the inhabitants, and search the hidden huts of the rogues for loot. We have seen no women of the Kohu people, except by accident, when they have always run away, and I judged that the loot would be hidden wherever the women were.

We were not long finding tracks which led up to huts where we found an old woman from whom Kogi could get no information. The huts yielded bundles of newspapers—my drying paper; the bottom part of my aneroid; some wire, and odds and ends. Using the old woman as a guide we found more hidden huts, but recovered nothing of any value. There was evidence everywhere that everything of value to me had been smashed. While in a European house in civilization it would be hard to find hidden loot, in a native hut of the stone-age period every little scrap of civilized gear shines out and is recognized at once. Having finished our search, we went back over the trail and

The writer's wireless set after the natives of Kohn (Upper Ramu) had done with it.



Natives of Usina, Middle Ramu. (See page 183.)

[*To face page* 198.]

picked up the signs of the deserting population, and following these up came out on the grass lands above. The inhabitants had left hastily that morning, and they had dropped taro, bananas, &c., on the way, which helped us considerably. We travelled fast, but the hills are steep, and we were very much out of breath when we sighted a party of eight natives 2,000 yards away. We gave chase, but were unable to gain on them; at the same time a party appeared on the hill we had just left, and another on our right. They all were about the same distance away now—1,500 yards—and we stopped to see what they would do; but they only stood and shouted and danced and waved their spears and bows. Whenever we moved towards a party they moved on, and so it was necessary to divide our number, and I was just arranging to do this—the corporal and I to go one way and the two other police-boys to go another—when we discovered two natives in a gully 550-600 yards away. They were in long grass, and were making up the gully as fast as they could without giving themselves away. I sent Angep to cut them off, and taking the corporal's rifle I put four shots round these natives, which had the effect of making them lie down tight, and making the other parties on the hills around dance the harder. Angep got round all right, but one native managed to elude him by sneaking up a gully. He couldn't find the other for a long time, but at last we saw him drop his rifle and jump on something. His prisoner turned out to be a woman, and although we had all had a bad time, and felt rather sore, we laughed uproariously at the sight of the very heroic Angep returning with a female prisoner.

The parties on the hills around had all increased. I judged that there were not only Kohu people, but those of Hanep and Koaki. They were obviously very anxious to fight something, but apparently not people with rifles, for I could get no nearer than 1,500 yards, and I decided not to divide my party of four as I could not trust my police, except Angep, not to shoot indiscriminately, once trouble started. Kogi translated some of the shouts that came to us, and which made him angry. Gibes at the morals of our female relatives, as far as Kogi could explain them. Angep's prisoner could tell us no more than we had already heard, viz., that the three boys had got safely away to Ongoruna. Questions aimed at getting some idea of the motive behind the needless destruction, produced nothing but protestations and laments. Kogi had great difficulty in understanding her at all, and it seemed to me that he caught only a word or two here and there. She seemed to say that Sarawai was badly wounded, which is queer, but when asked to take us to him, she became hopeless again. I haven't supplies now to wait a day longer here, and it would take three weeks to get the people in hand again, and another three police-boys would be necessary. There is a serious risk of our being waylaid when strung out on the march home, and so I decided that I had better give the inhabitants a good fright and pull out as quickly as possible. So with the corporal's rifle I put several bullets as close as I dared to the various parties on the hills. The result was as I expected, they ducked and ran, and soon we had the whole expanse of those grassed foothills to ourselves, and not a native was in sight anywhere. We searched on through other little huts, but except for the find of the 5-chain tape, recovered nothing of importance, and pretty well picked up bits of everything I had owned. We continued the search all afternoon, but found nothing, and only sighted four natives towards Koake. The fortunate thing is that the three boys got away. That the police-boy ran for it may have been the best thing he could do. The loss of over 200 specimens, both leaf, flowers, and timber, is the most serious, and like my diary photographs, and notes of longitudes and latitudes, cannot be replaced. The rest is a monetary loss, and fortunately it is not very heavy considering everything, for I am at the end of my journey, and my supplies in any case were low. Listed everything, and then set a guard and arranged relief through the night.

11th April.—We had to abandon two empty boxes, and some worn rice swags, otherwise, thanks to the natives, our gear was light enough for my eight boys and our prisoner—who carried a precious remnant of a swag of rice—to manage. We left Kohu at 7 a.m., and reached the Giagolo River without incident, and taking a fairly well-beaten trail through very muddy country, reached the Solu, where we lunched. We had been lucky in coming across wild pig at the Giagolo, and Jack, forgetting his swollen leg, managed to shoot a young one. I missed a big one. So we had roast pork for lunch, and the boys had taro we had robbed from the Kohu gardens, and I had rice. At the village of Saleba, we got news of the police-boy who passed through on Tuesday, I think, without his rifle or belt, and of the boy with the bad foot who passed through Boroai, our old route, on the same day. Of Peter I can get no news at all, which disquiets me. We let our prisoner go back at Saleba, the people there being friendly to her, and promising to get her home safely. I had now volunteer carriers, so did not require her service, and from an intelligence stand-point she was useless. We made Kaduba at dusk where we were well received. A clear night. Latitude 5 degrees 40 minutes 36 seconds (mean of three observations). Found a very beautiful tree orchid.

12th April.—Made Ongoruna in four hours; there we were welcomed by Tumurro and his people. The police boy left two days ago for Kwato, so we are close on his tracks. We pushed on and camped near Bieli. On my last journey I suggested to Tumurro that while the trail was a good one for pigs, it might be improved for human use. Much to my astonishment, he has cleared a good ½ chain right through, and tried here and there to pick a gradient. A nasty wet camp. No news of Peter and the other boy.

13th April.—Left camp at 7 and, taking a new trail through Madeloi, which took us up and down a good deal, and crossed the two largest heads of the Boku, we finally climbed to the divide, and from there dropped down a cleared track to Kwato. This track was made by the German administration, which intended setting up a sanatorium on the divide at about 3,500 feet. It is curious that the people of Kwato and Yalu never mentioned this excellent old trail, which is, in the wet season, the best and quickest route from Bogadjim to the Ramu. The road comes down a long spur which divides the Mindjim from the Ioworro. The Mindjim route is the shortest in the dry season, but I do not recommend it to anyone in the wet. At Kwato, I found all was excitement. The police boy had gone through, but said nothing, except that master has sent him with a paper to Madang. In not talking, he showed a very commendable discretion. At Madang, however, he reported matters to the D.O., with the immediate result that every Luluai and Tultul was warned to hold himself in readiness; and the patrol officer (Captain Ellis) and as large a force of armed police as could be spared was sent out to my rescue. The party arrived at Kwato an hour after I did, which was very quick work. I was very glad to see Ellis and his tucker box, for I was a little hungry. The other native had got through all right, but there was no news of Peter. What has been puzzling me all along was now explained, and that was the motive behind the useless destruction perpetrated by the Kassowai people. Police boy Malunga has told the story, and it appears that my corporal of police and another police boy and my interpreter Kogi, had on the 30th March, when returning from the Ramu to report on the possibility of fording, had come across huts where some of the women of Kohu were living. One woman was raped. Interference with women is, as is well known to every one followed by

reprisals; and so, putting aside the breach of hospitality, the offence committed by my corporal and the other two boys was the most serious one that could be committed. Indeed, that a loss of life—I feel sure Peter will turn up—did not result is exceedingly fortunate; and the loss of my gear may be regarded, on the whole, as a mild reprisal for such a crime. It is very unlucky that I had no other interpreter, for I feel sure that had Sarawai been able to talk to me, he would have told me what had happened, and I could then have meted out summary justice. As it was, my only interpreter, Kogi, was one of the culprits, and the carriers and other police were too frightened of the corporal to tell me anything. My experience among natives everywhere has been that an attack on exploring parties is due in almost every case to some offence on the part of the explorers against the code of the people, and the commonest code broken is the moral one. That I thought the attack on my camp was unprovoked, was because the women of Kohu were never seen, and there could, I thought, have been no trouble of that sort. I never allowed any party of boys to go out of camp without the N.C.O. and one police boy; and while the corporal seemed hardly the type to carry a stripe, I thought him trustworthy.

Ulem arrived in the evening and reported having parted company with Peter. This was two days after they left Kohu, so I feel sure Peter is all right. Ellis has warned all the Luluai around, and the last place Peter was seen is to be visited and an attempt made to pick up his spoor. I expect we will find him turning out my store room in Madang when we get there.

14th April.—Made Bogadjim. Jack's leg is pretty bad, and an ulcer on my ankle is becoming bad again. I had cured it on the Ramu, but, coming over the divide, a leech got on the old sore, and it has started off again. Sent runner forward to send radios for spare wireless parts and microscope lenses. I cannot get on without these.

15th April.—Reached Madang, making the journey by whale boat. No news of Peter. Jack's leg is worse; so is mine.

Not a trace of Peter was found, though a search of the mountains was carried out for over a month. It is quiet impossible to do more than guess what happened to him in that sparsely inhabited and very broken country. I was laid up for six weeks with tropical ulcers, for which there appears to be no sound treatment or certain cure.

APPENDIX IV.

NATIVE NAMES OF TREES.

Botanical Name.	Motu.	Binandele.	Vailala.	Suku.	Ungoruna.	Rabaul.	Yalu.	Yabim.	Ogeramnagn.
Gnetum gnemon affin...	..	Genda	Doro	Tu-a	..	..	Suffitz	..	..
Podocarpus neriifolius	..	Rasara	Hera Kaika	..	..	..	..	..	..
Dacrydium elatum ..	..	..	..	..	..	..	..	..	Belitzi
Dacrydium falciforme	..	..	..	..	..	..	..	..	Olong
Libocedrus papuana ..	..	..	..	..	..	..	..	..	Kumtsu
Araucaria, Klinkii ..	..	..	..	..	Rassu	..	..	..	..
Phyllocladus hypophyllus	..	..	..	..	..	..	..	..	Dede
Freycinetia, sp. ..	..	Anderi	..	..	..	..	..	..	..
Caryota, sp. ..	..	..	Aporo	..	..	..	..	..	..
Arenga gracilicaulis ..	..	..	Kurabea	..	..	..	..	..	..
Calyptrocalyx, sp. ..	..	..	Apu-me-here	..	..	..	..	..	..
Livistona, sp. ..	..	..	Poioro	..	..	..	..	..	..
Palmae indt. (311) ..	..	..	Di-hi-hu	..	..	..	..	..	..
Palmae indt. (315) ..	..	..	Doporo	..	..	..	..	..	..
Panetta platyclada ..	..	Guguma	..	..	..	..	..	..	..
Sarcocephalus (624) ..	..	..	..	..	..	..	Aruntimf	..	..
Sarcocephalus cordatus	..	Tiga	Pepoia	Sabi	..	..	..	..	..
Rubiaceae indt. (137)..	..	Dandike	..	..	..	..	..	..	..
Quercus pseudo molucca	..	Hobaba	..	Koroba	..	..	..	..	..
Celtis philippinensis ..	..	Hanuma	Ha-adi	Wai-am-a-hasi	..	Got-got	..	..	..
Celtis, sp.	..	..	Boru (95)	Namoa (94)	..	..	Mougong(603)	..	Boiso (573)
Artocarpus, sp.	..	Ogadi	Durarabo	Menaia	..	..	Nom	..	..
Artocarpus incisa ..	..	..	..	Sekeri	..	..	..	..	..
Ficus, sp.	..	..	Koredapu (290)	Iowa (97)	..	..	..	..	..
Ficus, sp. (42) ..	..	..	..	Mohu	..	..	..	..	..
Ficus, sp. (341) ..	..	..	Hewara	..	..	..	..	..	..
Ficus, sp. (111) ..	..	Niningi	..	Neseki	..	..	..	..	..
Ficus, sp. (189) ..	..	Behoro	..	..	..	..	..	..	..
Ficus, sp. (194) ..	..	Au-u-jo	..	..	..	..	..	..	..
Ficus, sp. (593) ..	..	..	..	..	..	..	..	Otzob	..
Antiaris toxicaria ..	..	..	Boa	..	..	..	..	..	..
Cyphologhus pachycarpus	..	..	..	..	..	..	..	..	Embalema
Laportea gigas ..	Kabo	..	Kua	..	Koroki	..	..	..	..
Pipturus incanus ..	..	Gurega	..	..	..	..	..	..	..
Urticaceae indt. (75)..	Kabo	..	..	..	..	..	..	..	..
Pisonia Brunonia ..	..	..	..	Kuve	..	..	..	..	..
Himantandra Belgraveana	..	..	..	..	..	..	..	..	Mang
Cyathocalyx, sp. ..	..	Kesa	..	..	..	..	..	..	..
Chisocheton Biroi ..	..	..	..	..	..	..	Woro	..	..
Myristica, sp. (153) ..	..	Bara	..	..	..	..	..	..	..
Myristica, sp. (43) ..	..	..	Bokene	Kwara	..	..	..	..	..
Hernandia peltata ..	..	Kuyuyu	Baraida	Kerea	..	..	Aputz	..	..
Cinnamomum, sp. (319)	..	..	Kirabu	..	..	..	..	..	..
Cinnamomum massoia (592)	..	..	..	..	..	Musa	Woutu	Musi	..
Cinnamomum massoia (57)	Api-api	Pausa	Pai-isa	Asiru	..	..	..	..	..
Cryptocarya, sp. (192)	..	Mongua	..	..	..	..	..	..	..
Cryptocarya, sp. (79)..	..	..	..	Tokobio	..	..	..	..	..

Appendix IV.—*continued.*

Native Names of Trees—*continued.*

Botanical Name.	Motu.	Binandele.	Vailala.	Suku.	Ungoruna.	Rabaul.	Yalu.	Yabim.	Ogeramnagn
Litsea grandifolia ..	..	..	..	Toranu	..	..	..	..	..
Rubus moluccanus ..	..	Kurere	..	..	..	..	..	..	..
Kania eugenioides ..	..	..	..	..	..	..	..	..	Sumut
Adenanthera pavonina	..	Gigino	..	..	..	..	..	..	..
Albizzia procera ..	..	..	..	..	..	..	Minzimb	..	..
Albizzia, sp. (96) ..	Mokeke	Gemona	..	Berekeke	..	..	..	..	..
Albizzia fulva ..	..	..	Haiede	..	..	..	..	..	..
Afzelia bijuga ..	Melila	Bendora	Pira	Bedira	..	Kwila	Ombong	Kaboing	..
Kingiodendron, sp. ..	..	..	Opepeia	..	..	..	..	..	..
Maniltoa, sp. nov. ..	..	Kaira	..	..	..	..	..	..	..
Pongamia glabra ..	..	Jambo	..	..	..	..	..	..	..
Pterocarpus indicus ..	Marava	Paoro	Apa	Aiamaui	..	Nganga	Ngafir	Kalelong	..
Leguminosae indt. (215)	..	Bindjopa	..	..	..	..	..	..	..
Evodia Bowickii ..	..	..	..	Kolina	..	..	..	..	..
Evodia hortensis ..	Ebala	..	Bopa	..	..	..	..	..	..
Evodia lamprocarpa ..	..	Gareba	..	..	..	..	..	..	..
Flindersia, sp. ..	..	..	Auria	Pedina	..	..	..	..	..
Garuga, *sp.* ..	Uri	..	Kakikaki	..	..	..	..	..	..
Canarium Lineistipula	..	Sisera	Wairo	..	..	..	..	..	..
Canarium grandi-stipulatum	..	..	Mahei	..	..	..	..	..	..
Aglaia elaeagnoidea ..	..	..	..	Uva	..	..	..	..	..
Aglaia sapindina ..	..	Digisi	..	..	..	..	..	..	..
Cedrela australis ..	..	..	Kapere	Epi	..	..	Mufus	..	..
Dysoxylum caulostachyum	..	..	Buria	..	..	..	..	..	..
Dysoxylum ucettigrewianum	..	..	Dorokea	..	..	..	..	..	..
Hibiscus tiliaceus ..	..	Wariso	..	..	..	..	..	..	..
Hibiscus d'Albertisi ..	..	..	..	Variva	..	..	..	..	..
Thespesia populnea ..	..	T2	..	Toto	..	..	..	..	..
	..	Kuyuyu	..	..	..	..	..	..	..
Bombax malabaricum	Vari	..	..	..	..	..	..	Woif	..
Heritiera littoralis ..	..	..	Pai-iru	Napera	..	..	..	..	..
Pterocymbium, *sp.* (13)	..	Husisi	E-a	Sihu	..	Awalgi	Wisawis	..	..
Kleinhovia hospita ..	..	Ombora	..	..	..	..	..	..	..
Pterygota Forbesii ..	..	Tomberu	Hokeia	Kobura	..	..	..	..	..
Sterculia affin. ..	..	..	..	Bakua	..	..	..	..	..
S. Edelfeltia ..	..	..	..	..	..	.	..	..	..
Sterculaceae (53) ..	..	..	..	Minhihi	..	..	..	..	..
Sterculaceae (74) ..	Vanea	..	..	..	..	..	..	..	..
Wormia quercifolia ..	..	Lalagi	Hokore	..	..	Epenge	..	..	..
Schurmansia Hemmingsii	..	Kembusa	..	..	..	..	..	..	..
Calophyllum inophyllum	..	Otai-i	..	..	..	..	..	..	..
Calophyllum, sp. (239)	..	Guti	..	..	..	Baia	..	..	..
Guttiferae (116) ..	..	..	..	Noru	..	Kai-u	..	..	..
Garcinia assuga ..	Bio-bio	..	..	..	..	..	..	..	..
Garcinia Hollrungii ..	..	..	..	Moka	..	..	..	..	..
Anistopera polyandra	..	Garawa	Kokalaka	..	..	..	..	..	..
Dipterocarpaceae indt. (112)	..	..	..	Demo	..	..	..	..	..
Vatica papuana ..	..	..	Kokalaka	..	..	..	..	..	..
Homalium pachyphyllum	..	..	Kavea	..	..	..	..	..	..
Octomeles sumatrana ..	Ilimo	Benumba	I-ohea	Ilimo	..	Erima	Usa	Kakerim	..
Bruguiera Rheedii ..	Arara	Bagoia	..	..	..	Kurong	..	..	..
Rhizophora mucronata	Totoa	Kamo	..	..	..	Tongong	..	..	..
Terminalia catappoides	..	..	..	Okaka	..	..	..	..	..
Terminalia, sp. (12) ..	Hodava	..	..	..	..	Talisa	..	..	..
Terminalia foveolata ..	..	..	Kovo	..	..	..	..	..	..
Terminalia, sp. (340) ..	..	..	Idare	..	..	..	..	..	..
Barringtonia calyptrocalyx	..	Sesewa	..	..	..	..	..	..	..
Eucalyptus naudiniana	..	..	..	..	..	Kamarere	..	..	..
Eugenia, sp. (287) ..	..	..	Hekakoro	..	..	..	..	..	..
Eugenia, sp. (89) (131)	Maita maita	..	..	Fotai-a	..	..	..	..	..
Eugenia, sp. (92) ..	..	..	..	Luvutate	..	..	..	..	..
Eugenia, sp. (88) ..	..	..	..	Bado	..	..	..	..	..
Eugenia, sp. (317) ..	..	..	Ai-i-hi	..	..	..	..	Abaru	..
Dysoxylum, sp. nov.	..	..	A-o-ubu	..	..	..	..	..	..
Dysoxylum, sp. (66) ..	..	..	..	Ha-wa-ra-lavea	..	..	..	..	..
Dysoxylum, sp. (620) ..	..	..	..	..	..	..	Kusud	..	..
Dysoxylum, sp. (148) ..	..	Susa	..	..	..	..	..	..	..
Dysoxylum, sp. (308) ..	..	..	Ba-hi-a	..	..	..	..	..	..
Dysoxylum, sp. (612) ..	..	..	..	..	..	..	Ebeve	..	..
Dysoxylum, sp. (127) ..	..	..	..	..	..	..	..	..	..
Meliaceae (296) ..	..	..	A-a-wu	..	..	..	..	..	..
Xylocarpus granatum	Kaipu	Laure	Apura	Kiloe	..	..	..	..	..
Glochidion globosum ..	..	..	..	..	..	..	..	Seep	..
Aleurites moluccana ..	Omo	..	..	..	..	..	..	..	..
Baccaurea papuana ..	..	Meima	..	..	..	..	Timong	..	..
Baccaurea, sp. (55) ..	..	..	..	Veri Veri	..	..	..	..	..
Breynia cernua ..	..	Gi-ira	..	..	..	..	Bundur	..	..
Endospermum formicarum	..	..	..	Kerea	..	..	..	..	..

Appendix IV.—*continued.*

Native Names of Trees—*continued.*

Botanical Name.	Motu.	Binandele.	Vailala.	Suku.	Ungoruna.	Rabaul.	Yalu.	Yabim.	Ogeramnagn.
Macaranga chrysotricha	..	Gega	..	..	..	..	..	..	..
Macaranga riparia ..	..	Gibore	..	..	..	..	..	..	..
Glochidion globosum ..	..	..	..	..	..	..	..	Seep	..
Dracontomelum mangiferum	Damoni	Onomba	Aua	..	..	Lup	..	..	..
Dracontomelum, sp. ..	..	..	Urau	Habere	..	..	..	..	..
Mangifera minor ..	..	Ewa	Auroro	Ihara	..	..	Dua	..	..
Campnospermum brevipetiolata	..	Siruga	..	..	..	Singawa	..	..	..
Pleiogynium solandra	..	..	..	Vasapa	..	..	..	..	..
Semecarpus, sp. ..	..	Duduge	..	..	..	..	..	..	..
Spondias dulcis ..	..	..	Iopeia	..	..	Ourlas	..	..	..
Pentas podon Motley ..	..	..	Auro	..	..	..	..	..	..
Semecarpus australiensis	..	..	..	Huna	..	..	..	..	..
Celastraceae ..	..	..	..	..	..	..	..	..	Kuset
Gamaphyllum faleatum	..	..	Aberabu	..	..	..	..	..	..
Lucuma, sp. ..	..	..	..	Yokokoro	..	..	..	..	..
Pometia pinnata ..	Okamu	Koiawo	Ohabu	..	..	Tun	Tze	Cutting	..
Alphitonia moluccana	..	Oiela	..	..	..	..	..	..	..
Slonea paradisiarum	..	Oh-e	..	Otuni	..	..	..	..	..
Elaeocarpus affin. E. novo-guineensis	..	..	..	Sigore	..	..	..	.	..
Elaeocarpus sepikanus	..	Tangere	..	..	..	..	..	..	..
Elaeocarpus, sp. (336)	..	..	Lara	..	..	..	..	..	..
Plunchonia timorensis	..	Bibira	Puri-iki	Kaeda	..	..	Aruntem	..	..
Horsfieldia silvestris ..	..	Kore	Dabaukiba	Aremore	..	..	..	..	..
Polyxias, sp. ..	..	..	..	..	..	..	..	..	Gongofo
Schefflera, sp. ..	..	Tikina	..	..	..	..	..	..	..
Schefflera, sp. ..	..	..	..	..	..	..	..	..	Gombera
Aegiceras majus ..	Hudikudi	Monoko	..	..	..	..	..	..	..
Chrysophyllum Roxburghii	..	..	..	..	..	..	Mafungafung	..	..
Illipe, sp.	..	..	Baiabu	..	..	..	..	..	..
Achradotypus sp. ..	..	Jaruka	..	..	..	..	..	..	..
Sideroxylon anteridiferum	..	Pako	..	..	..	..	..	..	..
Sideroxylon, sp. (325)	..	..	Kuakeia	..	..	..	..	..	..
Sapotaceae (120) ..	..	..	..	Ooka	..	..	..	..	..
Diospyros, sp. (33) ..	..	Gah-a	Ka-uka	Bara	..	..	..	..	..
Couthovia brachyura ..	..	Pegamba	..	..	..	..	..	..	..
Fagraea racemosa ..	..	Simbe	..	..	..	..	..	..	..
Alstonia scholaris ..	Devoru	Didima	Aijapo	..	..	Sawa	..	..	..
Alstonia longissima ..	..	Ewura	..	..	..	..	Ambund	..	..
Cordia myxa ..	..	..	..	..	..	..	..	Ampoing	..
Cordia, sp. (63) ..	..	..	..	Amausi	..	..	..	..	..
Clerodendron tracyanum	..	Penbagi	..	..	..	..	..	..	..
Geunsia farinosa ..	..	Ongesa	..	..	..	..	..	..	..
Gmelina fissilis ..	..	..	Ah-ko	..	..	..	..	..	..
Vitex cofassus ..	..	Tato-o	Bai-ah	..	..	Ah sang	Afas	Ka-ar	..
Acanthus ilicifolius ..	..	Seseko	..	..	..	..	..	..	..
Indt. (3)	Medobi	..	..	Medobi	..	..	..	..	..
„ (7)	Namanu	..	..	Okoia	..	..	..	..	..
„ (11)	Manoi	..	..	..	..	..	..	..	..
„ (14)	..	..	..	Maruruvani	..	..	..	..	..
„ (18)	..	..	..	Kava	..	..	..	..	..
„ (20)	Uri	..	..	..	..	..	..	..	..
„ (35)	..	..	..	Kue	..	..	..	..	..
„ (37)	..	..	..	Kibore	..	..	..	..	..
„ (38)	..	..	..	Hodi	..	..	..	..	..
„ (40)	..	..	..	Huroro	..	..	..	..	..
„ (44)	..	..	..	Horoko	..	..	..	..	..
„ (45)	..	..	..	Barikaba	..	..	..	..	..
„ (46)	..	..	..	Haki	..	..	..	..	..
„ (48)	..	..	..	Fishua	..	..	..	..	..
„ (59)	..	..	..	Waranoka	..	..	..	..	..
„ (62)	..	..	..	Monato	..	..	..	..	..
„ (64)	..	..	..	Yata-ata	..	..	..	..	..
„ (70)	..	..	..	Agadave	..	..	..	..	..
„ (76)	..	Boan	..	Tavili	..	..	..	..	..
„ (83)	..	..	..	Oi	..	..	..	..	..
„ (86)	..	..	..	Bovida	..	..	..	..	..
„ (94)	..	Obe		Arubi or Arupi	..	..	..	..	..
„ (99)	..	..	..	Keroni	..	..	..	..	..
„ (100)	..	..	..	Asimagaui	..	..	..	..	..
„ (101)	..	..	..	Wasina	..	..	..	..	..
„ (114)	..	..	..	Godita	..	..	..	..	..
„ (118)	..	..	..	Supu	..	..	..	..	..
„ (124)	..	..	..	Ivina	..	..	..	..	..
„ (129)	..	..	..	Koka	..	..	..	..	..
„ (143)	..	Dibaba	..	..	..	..	..	..	..
„ (152)	..	Borua	..	..	..	..	..	..	..
„ (155)	..	Bouye	..	..	..	..	..	..	..
„ (157)	..	Goro	..	..	..	..	..	..	..
„ (184)	..	Hangeni	..	..	..	..	..	..	..
„ (186)	..	Wuwura	..	..	..	..	..	..	..
„ (188)	..	Nahihi	..	..	..	..	..	..	..

Appendix IV.—*continued.*

Native Names of Trees—*continued.*

Botanical Name.	Motu.	Binandele.	Vailala.	Suku.	Ungoruna.	Rabaul.	Yalu.	Yabim.	Ogeramnagn.
Indt. (193)	..	Busi or Pusi	..	..	..	..	..	..	..
,, (196)	..	Bofere	..	..	..	..	..	..	..
,, (201)	..	Asawa	..	..	..	..	..	..	..
,, (276)	..	..	Ulawaipa	..	..	..	..	..	..
,, (277)	..	..	Harikou	..	..	..	..	..	..
,, (278)	..	..	Haikaka	..	..	..	..	..	..
,, (280)	..	..	Medupu	..	..	..	..	..	..
,, (281)	..	..	Ayeravu	..	..	..	..	..	..
,, (283)	..	..	Pa-uka	Namuta	..	..	..	..	..
,, (284)	..	..	Upia	..	..	..	..	..	..
,, (286)	..	..	Here	..	..	..	..	..	..
,, (288)	..	..	Buru Buru	..	..	..	..	..	..
,, (293)	..	Uwore	Loloke	..	..	..	..	..	..
,, (294)	..	Bakuma	Hai-aka	..	..	..	..	..	..
,, (295)	..	..	Hiri or Hidi	..	..	..	..	..	..
,, (298)	..	..	Koraikavivi	Tumuna	..	..	..	..	..
,, (299)	..	..	Horahora	..	..	..	..	..	..
,, (302)	..	..	Huda-hu	..	..	..	..	..	..
,, (309)	..	..	Buhu	..	..	..	..	..	..
,, (321)	..	..	Baiah	..	..	..	..	..	..
,, (322)	..	..	Horopa	..	..	..	..	..	..
,, (324)	..	..	A-uakou	..	..	..	..	..	..
,, (226)	..	..	Koboharua	..	..	..	..	..	..
,, (329)	..	..	Opa	..	..	..	..	..	..
,, (331)	..	..	Deke	..	..	..	..	..	..
,, (551)	..	..	..	..	..	..	..	..	..
,, (559)	..	..	..	..	..	..	..	..	Ngangi
,, (591)	..	..	..	..	..	..	..	..	Sali
,, (600)	..	..	..	..	..	..	..	Ke Sang-sang	..
,, (604)	..	..	..	..	..	..	Narunkuf	..	..
,, (605)	..	..	..	..	..	..	Timbong	..	..
,, (615)	..	..	..	..	..	..	Amint	..	..
,, (616)	..	..	..	..	..	..	Kuwi	..	..
							Tizo	..	..

APPENDIX V.

Exports of Timber and Minor Forest Produce from Papua.

Year.	Bark.	Gum.	Sandalwood.	Cane.	Timber.	Total.
	£ s. d.	£ s. d.	£	£	£ s. d.	£ s. d.
1886*	..	..	..	..	4,328 0 0	4,328 0 0
1888–1889	..	53 0 0	..	..	..	53 0 0
1889–1890	..	30 0 0	..	..	..	30 0 0
1890–1891	..	137 0 0	..	..	..	137 0 0
1891–1892	2 0 0	145 0 0	290	..	120 0 0	557 0 0
1892–1893	5 0 0	40 0 0	7,183	28	66 0 0	7,322 0 0
1893–1894	12 0 0	61 0 0	1,896	10	..	1,979 0 0
1894–1895	1 0 0	41 10 0	2,568	..	..	2,610 10 0
1895–1896	..	41 0 0	4,035	..	..	4,076 0 0
1896–1897	..	7 0 0	2,323	..	..	2,330 0 0
1897–1898	..	..	2,940	40	100 4 0	3,080 4 0
1898–1899	..	10 0 0	2,920	15	24 0 0	2,969 0 0
1899–1900	..	..	8,698	7	..	8,705 0 0
1900–1901	..	12 0 0	2,957	31	..	3,000 0 0
1901–1902	..	..	8,353	..	..	8,353 0 0
1902–1903	..	11 10 0	4,494	..	267 0 0	4,772 10 0
1903–1904	..	..	8,382	..	10 5 0	8,392 5 0
1904–1905	19 3 6	50 0 0	7,873	35	2 0 0	7,979 3 6
1905–1906	..	..	2,522	..	..	2,522 0 0
1906–1907	..	..	3,932	..	..	3,932 0 0
1907–1908	..	..	6,346	..	..	6,346 0 0
1908–1909	..	..	2,701	..	488 0 0	3,189 0 0
1909–1910	..	..	4,628	..	263 0 0	4,891 0 0
1910–1911	..	..	190	..	681 0 0	871 0 0
1911–1912	..	..	259	..	2,685 0 0	2,944 0 0
1912–1913	..	..	74	..	340 0 0	414 0 0
1913–1914	..	..	85	..	365 0 0	450 0 0
1914–1915	..	..	1,363	..	623 0 0	1,986 0 0
1915–1916	..	..	1,416	..	168 0 0	1,584 0 0
1916–1917	4,423 0 0	..	633	..	438 0 0	5,494 0 0
1917–1918	7,228 0 0	..	252	..	584 0 0	8,064 0 0
1918–1919	4,847 0 0	..	704	..	162 0 0	5,713 0 0
1919–1920	2,686 0 0	184 0 0	2,071	..	529 0 0	5,470 0 0
1920–1921	1,468 0 0	2,963 0 0	222	..	190 0 0	4,783 0 0
1921–1922	752 0 0	1,787 0 0	609	..	673 0 0	3,821 0 0
1922–1923	..	529 0 0	282	..	3 0 0	814 0 0
1923–1924	..	1,193 0 0	585	..	2,352 0 0	4,130 0 0
Totals	21,383 3 6	7,295 0 0	93,786	166	15,461 0 0	138,091 12 6

* Assuming that the value per foot being the same as the quantity exported 1892–1893.

APPENDIX VI.

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