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SANDALWOOD SEED NURSERY AND PLANTATION TECHNOLOGY

PROCEEDINGS OF A REGIONAL WORKSHOP FOR PACIFIC ISLAND COUNTRIES

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Preliminary Results of Sandalwood Inventory on Ile des Pins

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Introduction

A meeting of the chiefs and councillors was held at Vao during the workshop at which the preliminary results for the recently completed sandalwood inventory on Ile des Pins were presented. This paper summarises, in tabular and figure format, those results. Two types are recognised the normal, erect tree and the "creeping" form.

Results

The first item presented is a summary of exploitable heartwood weight (Table 1). The following quantities (kg) are classed as dead and diseased, theoretically not exploitable:

Dense forest	-	6,480
Secondary vegetation	-	36,840
Plateau	-	1,560

giving a total of 44,880 kg (40% error). The amount at Vao of this material is 5,220 kg and the minimum estimate for the whole island is 32,148kg.

TABLE 1. Exploitable heartwood weights (kg)

Strata	(a) Normal or true santal				(b) "Creeping" santal			Total Weight
	Mean per tree	Sound trees	Dead and disease	Total	Sound trees	Dead and disease	Total	
Dense forest	180	32,300	0	32,300	0	0	0	38,780
2º vegetation	241	263,186	21,172	284,358	35,433	7,087	42,520	363,718
Plateau		0	0	0	12,540	1,560	14,100	15,660
Total		295,486	21,172	316,658	47,973	8,647	56,620	418,158
% error				32			41	
Vao	249	18,028	5,408	23,436	360	120	480	29,136
Minimum				238,763			33,886	304,797

The "Dead and disease columns" correspond to exploitable dead and diseased trees. *(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).*

A comparison of the 1988 and 1994 inventories is presented in Figure 1. The upper charts are for estimated numbers of santal plants with girths at 130 cm over 50 cm and 10 cm. The lower charts provide estimated numbers of plants per hectare.

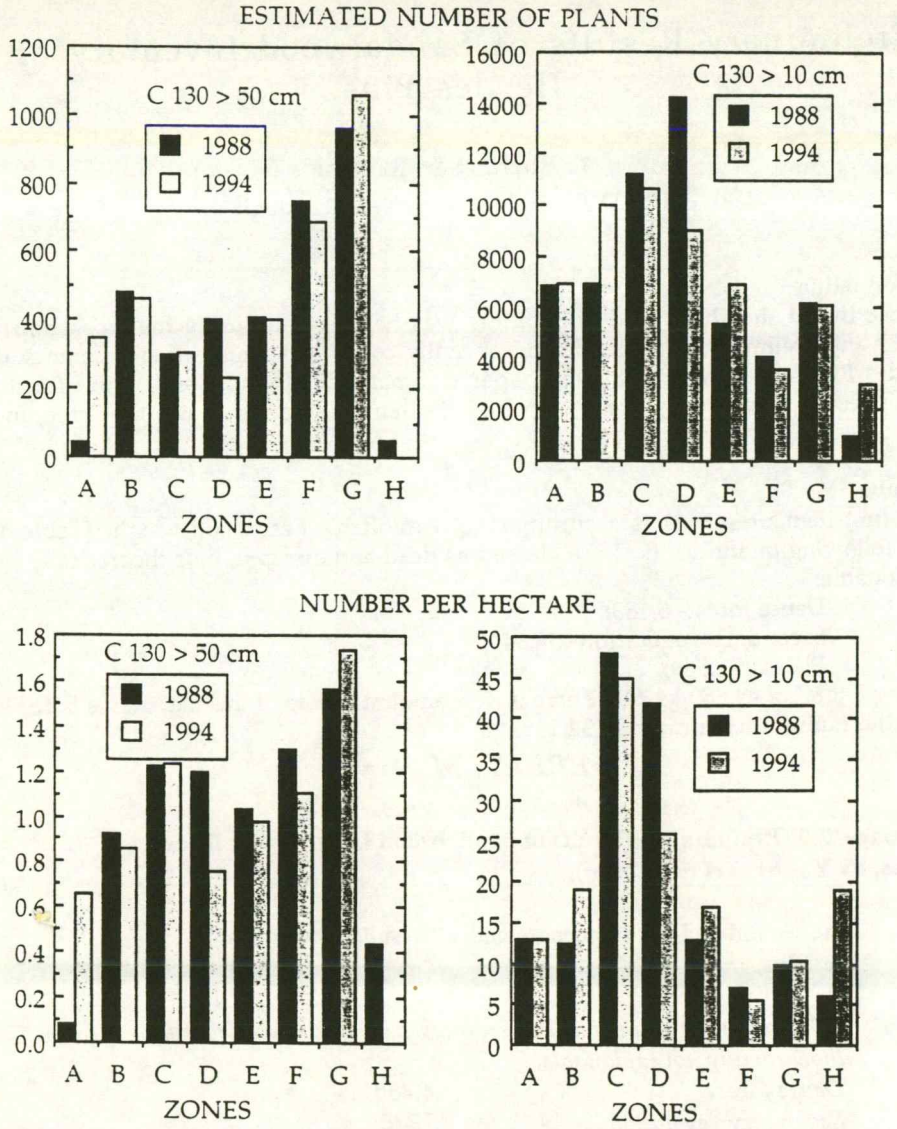

FIGURE 1. Comparison of 1988 and 1994 inventories
(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

In the Vao area a total (*i. e.* 100%) inventory was made in January 1994. This covered an area of 110 ha. Table 2 enumerates numbers of trees by girth classes on 3 soil types. These data are illustrated by a histogram (Figure 2).

TABLE 2. Distribution of sandalwood by soil types in the Vao area

Girth class at 20 cm (cm)	Soil type			Total
	Rocks	Soil < 10 cm	Soil > 10 cm	
0 - 10	36	98	26	160
10 - 20	193	410	106	709
20 - 30	200	337	111	648
30 - 40	114	239	119	472
40 - 50	69	207	124	400
50 - 60	46	94	101	241
60 - 70	24	60	59	143
70 - 80	8	41	53	102
80 - 90	3	19	20	42
> 90	4	10	23	37
Total	697	1515	742	2954
Percent	23.6	51.3	25.1	100

(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

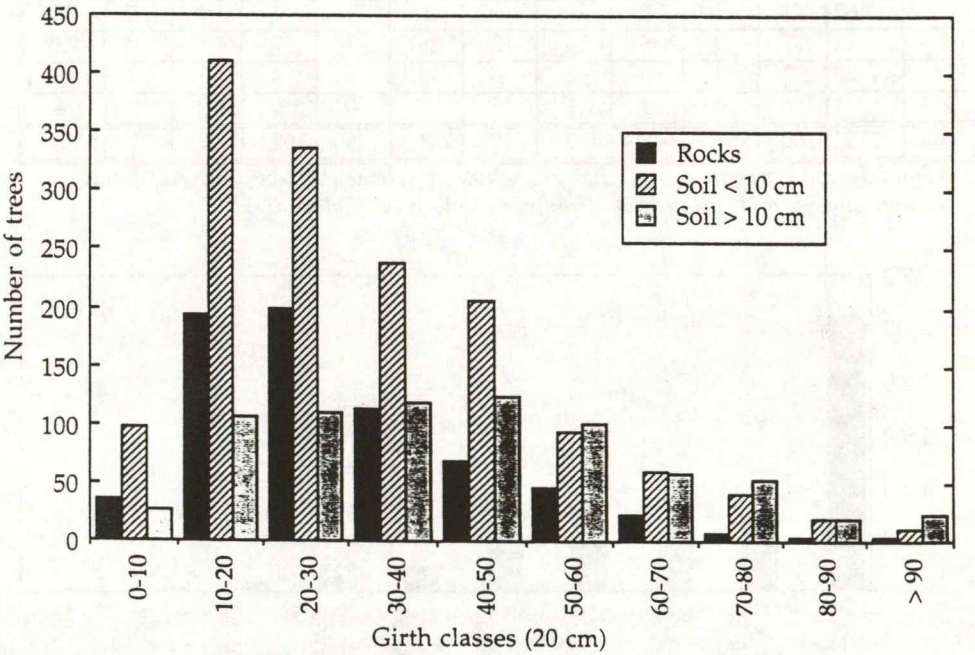

FIGURE 2. Stems by size classes on 3 soil types (girth at 20 cm from the ground). *(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).*

The distribution of enumerated trees by size classes within 13 zones in the Vao area showed different proportions of regeneration (Table 3). Small regeneration not measurable for a girth totalled 2,452. Of these, 1,525 were estimated to be of seedling origin and 927 to be suckers or coppice. Combining the smallest girth class with regeneration suggests that the population is capable of replacement (Figure 3).

TABLE 3. Distribution of sandalwood at Vao by zones (Rg = regeneration not measurable for girth).

Zone	Rg	Girth classes taken at 20 cm from the ground										Total
		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+	
1	13	0	17	10	7	8	2	2	2	1	2	51
2	644	46	158	185	112	103	52	15	12	6	2	691
3	372	42	160	115	70	22	7	5	2	1	0	424
4	460	32	122	107	64	45	22	19	13	3	4	431
5	465	12	102	89	85	87	46	30	19	8	7	485
6	210	9	60	49	53	55	34	15	10	6	6	297
7	40	3	40	40	28	21	22	13	7	1	2	177
8	1	0	0	2	0	5	1	2	1	0	0	11
9	128	7	33	36	25	33	19	20	19	5	6	203
10	62	1	4	8	12	9	15	12	6	4	6	77
11	32	7	9	6	14	12	16	7	7	5	0	83
12	22	1	4	0	1	0	3	3	4	2	2	20
13	3	0	0	1	1	0	2	0	0	0	0	4
Total	2452	160	709	648	472	400	241	143	102	42	37	2954

(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

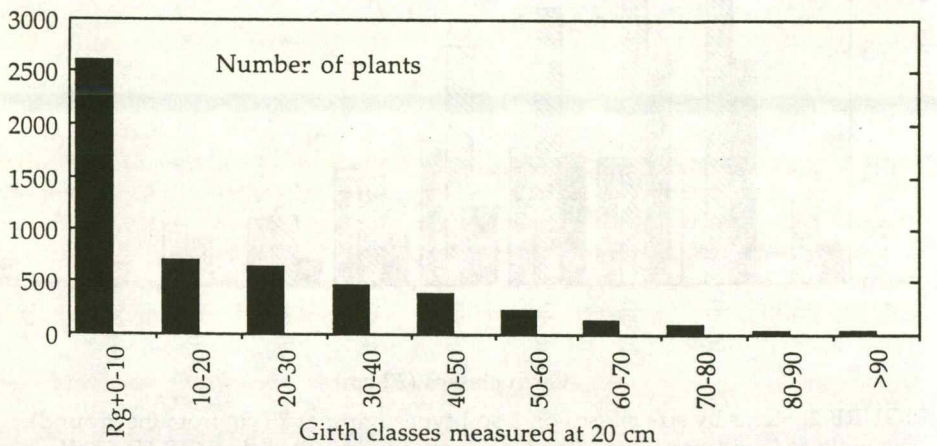

FIGURE 3. Stand by girth classes, regeneration combined with the smallest class. *(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).*

The total area sampled of secondary vegetation containing sandalwood was 3,070 ha. This was sampled at an intensity of 4.2 % (128.56 ha). Of the regeneration counted, below the girth class table (Rg, Table 4), 1351 were suckers or sprouts and 405 were of seedling origin. This represents a seedling proportion of 23 % in secondary vegetation contrasted with 62 % in the Vao area. The "creeping' form accounted for 40 % of all stems enumerated. The pattern of the stand table for the total estimated population (Figure 4) is similar to Vao, suggesting adequate recruitment for sustained yield.

TABLE 4. Sandalwood sampled in secondary vegetation

Item	Rg	Girth classes taken at 20 cm from the ground										Total
		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90+	
No.	1756	175	881	676	483	316	172	104	59	30	21	2917
Density	13.66	1.36	6.85	5.26	3.76	2.46	1.34	0.81	0.46	0.23	0.16	22.69
Σ no. est'd	41933	4179	21038	16143	11534	7546	4107	2484	1409	716	501	69658

(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

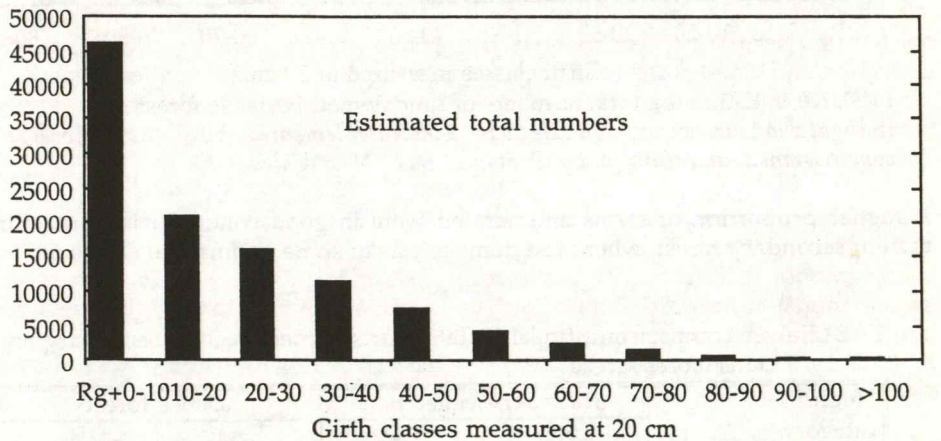

FIGURE 4. Estimated total numbers of sandalwood in secondary vegetation
(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

In addition to the secondary forest, sandalwood was also enumerated in dense forest. A total are of 5,340 ha was sampled at an intensity of 2.72 %. Table 5 summarises these data. In the dense forest all regeneration was of seedling origin and the overall density of sandalwood was much lower, at 1.00 stems ha^{-1} compared with secondary forest at 22.7 stems ha^{-1}. The stand table indicates a bulge in the size class distribution in the middle of the range (Figure 5).

TABLE 5. Sandalwood sampled in dense forest

Item	Rg	Girth classes taken at 20 cm from the ground									Total
		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80+	
No.	28	11	19	23	37	27	15	8	4	4	148
Density	0.20	0.07	0.13	0.15	0.25	0.18	0.10	0.05	0.03	0.03	1.00
Σ no. est'd	1028	395	683	827	1330	970	539	287	144	144	5318

(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

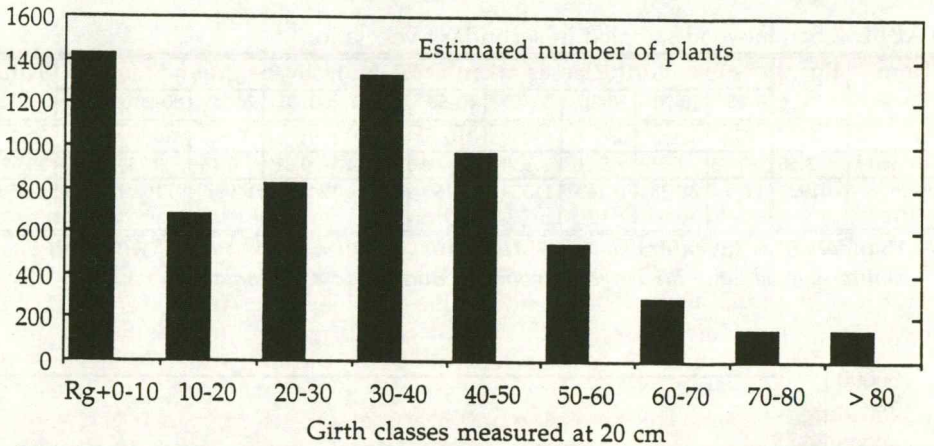

FIGURE 5. Estimated total numbers of sandalwood in dense forest
(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).

A higher proportion of stems enumerated were in good condition in dense forest than in secondary forest, where fire damage was of some importance (Table 6).

TABLE 6. A comparison of health status for sampled trees in secondary and dense forest areas

Health category	Secondary vegetation		Dense forest	
	Total	%	Total	%
1. Good	1,611	55.4	99	66.9
2. Diseased	194	6.7	6	4.1
3. Injured	772	26.5	36	24.3
4. Dead	226	7.8	7	4.7
5. Burnt	33	1.1	0	0
6. Fire injury	50	1.7	0	0
7. Broken	22	0.8	0	0
Totals	2,908	100	148	100

(Sandalwood inventory on Ile des Pins, implemented by CIRAD-Forêt, commissioned and funded by Province Sud, New Caledonia).