PRODUCTION VALUES OF NATIVE FORESTS — WATER, WOOD, ANIMALS AND TOURISM

C. G. R. CHAVASSE*

INTRODUCTION

My intention is to try to present a balanced account of the commercial values of native forests in New Zealand, as a background to discussions to be held at this annual general meeting.

In my view, most areas of native forest will in due course be managed for multiple use, albeit in the greater area there will be one over-riding use to which others will be subordinate. There are very few areas which can legitimately be set aside exclusively for a single use, however much some preservationists may desire this. For example, although the National Parks have a major use for recreation, they are also an important source of water; and, although the Act says that all exotic flora and fauna should be exterminated within them, some of them will continue to be a source of wild animal meat for export, simply because this is an efficient means of reducing animal numbers in the interests of forest, soil and water conservation. Forest Sanctuaries may be the only important areas preserved for a single purpose, but even they may have a value as landscape, while many so-called ecological reserves could be required by the public for recreational purposes.

I shall have to include a number of tables to put the various aspects of use of indigenous forests in perspective. Unfortunately, the published statistics do not all refer to the same areas, and several of them are well out of date.

In order to present the overall picture, Table 1 gives a broad picture of land use in 1977.

Table 1 shows that native forests occupy some 23% of the land surface of New Zealand; less than half of this (48%) is under the control of the Forest Service; 25% is in National Parks and reserves; 6% is unoccupied Crown land; and the remaining 21% is in other tenures, largely Maori land, most of which is subject to no management whatsoever.

Table 2 broadly defines land use in native forests. Over two-thirds of the total area (69%) is classified as protection forest. Of the remaining 1.9 million hectares, 11.5% are considered unmerchantable, and 37.5% have been logged. It may surprise

*Forest Research Institute, P.B., Rotorua.

TABLE 1: AREAS OF FORESTED AND NON-FORESTED LAND IN NEW ZEALAND, 1977

Land Category	*Area (1000 ha)*	%
FORESTED LAND		
Native forest:		
State forest	2 993	11.1
National parks and reserves	1 550	5.8
Unoccupied Crown land	361	1.3
Other tenures	1 342	5.0
Total	6 246	23.2
Exotic forest:		
State forest	406	1.5
Other tenures	297	1.1
Total	703	2.6
NON-FORESTED LAND		
Agricultural land	13 530	50.3
Scrubland and other non-forested land (includes high-altitude land)	6 121	22.8
Lakes, etc.	300	1.1
Total	19 951	74.2
Total — New Zealand	26 900	

Source: N.Z.F.S. (1975) amended (pers. comm. P. Berg).

TABLE 2: NATIVE FOREST LAND CLASSIFICATION BY TENURES (1000 ha), 1974

Category	*S.F. (a)*	*Parks, Reserves*	*U.C.L. (b)*	*Other*	*Total*	%
Protection forest:						
Upland (c)	924.5	518.4	114.5	126.3	1683.7	27.0
Lowland	1065.2	836.1	196.0	527.5	2624.8	42.0
Lowland forest:						
Logged	238.8	26.0	12.4	449.7	726.9	11.6
Merchantable	658.1	154.0	32.7	143.0	987.8	15.8
Non-merchantable	106.5	16.4	5.2	95.4	223.5	3.6
Total	2993.1	1550.9	360.8	1341.9	6246.7	
Percent	47.9	24.8	5.8	21.5		

(a) State Forest land.
(b) Unoccupied Crown land.
(c) Arbitrary division: forests above 910 m altitude north of the Manawatu Gorge; above 760 m in the rest of the North Island, Nelson, Marlborough and Westland north of the Arnold River; above 610 m for the rest of the South Island.

Source: N.Z.F.S. (1975).

some folk to find that 51% of non-protection lowland forest is still standing and is considered merchantable. Moreover, from a great deal of the logged forest only podocarps were removed, leaving large volumes of hardwoods of which tawa in the North Island, and red, silver and hard beech in the South Island are the most important.

In terms of human population distribution, the location of forests is more important than gross national areas. Population figures are given in Table 3. This shows that nearly 46% of the population live in the northern part of the North Island, over half of whom live in the Auckland urban area; about 27% live in the southern half of the North Island, about 40% of whom live in the Wellington urban area; and just over 27% of the total population live in the South Island, one-third of whom live in Christchurch. It is difficult to predict future population trends; present increase is about zero, but it is probable that a drift to the north will continue, and also an increase in urban, and a decrease in rural, populations.

TABLE 3: POPULATION DISTRIBUTION (1000s) — 1976 CENSUS

Locality	*Population*	*Main Cities*	
North Auckland	108	Auckland urban area	743
Auckland	798		
South Auckland/Bay of Plenty	472		
East Coast/Gisborne	48		
Hawke's Bay	143		
Taranaki	107		
Wellington	592	Wellington urban area	327
North Island	2268		
Marlborough	35		
Nelson	76		
Westland	24		
Canterbury	428	Christchurch city	295
Otago	189		
Southland	109		
South Island	861		
New Zealand	3129		

Source: *N.Z. Official Yearbook 1977.*

The distribution of forests is given in Table 4. This shows very considerable differences between the North and South Islands, whose total areas are 11 469 200 and 15 046 300 ha, respectively) excluding Stewart Island, Chatham and minor offshore islands). Native forests occupy 22% of the North Island and 25% of the South Island, while nearly three-

TABLE 4: DISTRIBUTION OF CATEGORIES OF NATIVE FOREST (1000 ha), 1974

National Forest Survey District (a)	Protection Forest Upland (b)	Protection Forest Lowland	Lowland Forest Logged	Lowland Forest Merch.	Lowland Forest Unmerch.	Totals
Northern N.I.	—	155.8	199.4	55.3	0.8	411.3
Western N.I.	2.7	275.9	77.4	64.0	52.0	472.0
Central N.I.	103.9	161.8	217.4	97.7	51.0	631.8
Eastern N.I.	77.9	566.4	33.4	37.7	6.9	722.3
Southern N.I.	60.3	108.6	37.6	30.3	55.4	292.2
Totals — North Island	244.8	1268.5	565.2	285.0	166.1	2529.6
Percent — North Island	9.7	50.1	22.3	11.3	6.6	
North/northwest S.I.	320.1	410.6	11.7	84.9	—	827.3
West Coast beech area	232.5	174.5	46.8	208.7	—	662.5
Western S.I.	167.4	125.4	40.4	197.4	—	530.6
Southwestern S.I. (c)	374.1	467.4	—	91.5	—	933.0
Eastern S.I.	325.5	102.0	1.0	10.4	6.0	444.9
Southern S.I.	19.3	76.4	61.8	109.9	51.4	318.8
Totals — South Island	1438.9	1356.3	161.7	702.8	57.4	3717.1
Percent — South Island	38.7	36.5	4.4	18.9	1.5	

(a) Areas do not correspond with N.Z.F.S. conservancies or with land districts.
(b) For definition see Table 2, note (c).
(c) Includes Fiordland.

Source: Kirkland and Trotman (1974).

quarters of the population lives in the North Island. The area of protection forest in the South Island is 85% greater than in the North Island (all accounted for by Fiordland). The South Island also has a much greater area of alpine country — scrub, tussock grasslands, barrens and permanent snowfields.

Another striking difference is the amount of logged forest in the North Island — three and a half times as much as in the South Island — and the corresponding area of remaining merchantable lowland forest in the South Island, which is three and a half times as large as the residual merchantable area in the North Island. Much of this is beech or beech/podocarp forest, mainly in Nelson, Westland and western Southland.

It is within the framework of the figures so far given that commercial products from native forests will be discussed. They will be presented in order of intrinsic importance (not financial returns) — water, wood, tourism and animals.

WATER

A study of the *N.Z. Official Yearbook 1977* reveals almost nothing about water use in New Zealand, by which I take it that the compilers regard it as a natural and costless asset, there for the taking. The only figure therein is a rough total of 400 million gallons used daily (they haven't caught up with metrication either!). Jellyman (1973) gives round figures for use: 50% for hydro-electric power generation; 23% for domestic purposes; and 27% for industry (of which forest industries must use a large proportion). The *Yearbook* states that 6500 litres are needed to produce $1 worth of steel, and 900 litres to produce $1 worth of paper (1976 figures). Much of the water is used several times (*e.g.*, the Waikato River power stations) or is available for other uses after generating power, so the net use of water is very small in comparison with rainfall in the catchment areas; this is usually in excess of 2000 mm/year (or 20 million litres/ha/year), and in some places (*e.g.*, south Westland) may exceed 10 000 mm/year.

Of major importance to the domestic and industrial well-being of New Zealand is generation of electric power by water, as shown in Table 5. The catchments for supplying the hydro-electric plants are almost all forested with native species.

TABLE 5: INSTALLED CAPACITY AND GENERATION OF ELECTRIC POWER, 1976

Type of Plant	*Capacity (MW)*	*Annual Energy Generation (million kWh)*
Hydro	3 625 (72%)	16 873 (84%)
Thermal	1 413 (28%)	3 198 (16%)
Totals	5 038	20 071

Source: *N.Z. Official Yearbook 1977.*

Table 5 does not tell the full story. Hydro-electric capacity in the North Island (omitting auxiliary plants operated by industry, etc.) is only 1460 MW, or 40% of the total New Zealand capacity. Similarly, energy generation in the North Island is 6315.3 kWh, or 37% of total generation from hydro-electric plants. Thermal stations are all in the North Island; this means that 53% of total energy generation is in the North Island, for nearly three-quarters of the population. Moreover, the greatest remaining undeveloped hydro resources (which are not inconsiderable) are in the South Island.

Industry (especially large-scale industry) is concentrated mainly in the North Island; it is there that major demands for power and water are to be found.

There is a popular belief that forests increase precipitation, although this has rarely been demonstrated. In some cases forests can increase the amount of water percolating into aquifers by trapping mist and by slowing down snow melt (King, 1970). However, Morris (1974) contends that all forest and scrub, however classified, is important for soil and water conservation, even though forested catchments yield less water (in relation to rainfall) than those in grass (Jellyman, 1973). In fact, maximum yield is obtained from a bare impervious surface.

The *N.Z. Official Yearbook 1977* notes that sedimentation, pollution and eutrophication are associated with land development for farming, not with forest cover, and that quality of water is often more important than quantity for domestic, industrial and hydro-electric plant use. Since there is no shortage of yield in New Zealand, there is no need to convert forest to grass to increase it. In easy country, in production forests, patch logging can increase yield while maintaining the desirable effects of forest cover on water supplies (King, 1970). These desirable effects are discussed by Jellyman (1973) who lists the following:

— Waters from forests are oligotrophic (low in nutrients) and "soft".
— Peak flows are diminished.
— Flows are more regular with less difference between low and high flows.
— Sedimentation is reduced (owing to less erosion under forest).

The effect of grassing a part of the Lake Taupo catchment has been shown by Ministry of Works figures. In 1950 the flood flow from Lake Taupo was 408 m^3/second. In the late 1960s, when some 520 km^2 had been developed from scrublands to grass, peak flood flow was 1350 m^3/second — an increase of 230%. King (1970) quotes two further examples. Clearing of two catchments in the Snowy Mountains in Australia by fire led to peak flows five times greater than those found when the catchments were under forest, and sediment load was probably 1000 times greater. In the U.S.A., a small valley studied by the Tennessee Valley Authority was contoured and planted in pines. Peak flows were reduced by 90%, sediment load by 96%, and total water yield by 46%.

In New Zealand, for most of the catchment areas, we have little option but to retain forest. Holloway (1960) stated: "New Zealand is an extremely mountainous land . . . all things that happen in the mountains impinge directly upon our comfortable lowland existence". He emphasized the vital

need to reduce erosion in the mountains as a prerequisite to water yield in its most useful form. Morris (1974) stressed the need for water of high quality, and regulation of the flow, which can best be achieved by fully intact forest with a deep litter layer. He pointed out that the mountain areas are ecologically delicate, characterised by: steep and very steep land; high altitudes where vegetation does not flourish; exposure to strong winds; high-intensity rainfalls; shattered and readily weathered basement rock, largely greywacke, giving rise to weak-structured soils; a high level of natural geological erosion; in some places large-scale burning by settlers together with grazing of domestic stock; and browsing on a massive scale by wild and feral animals.

The general public, and successive governments, have not really got to grips with this situation but as population has grown (and with it demand for water) it has become increasingly important. Money is mainly spent on controlling the lower reaches of rivers rather than the catchments. And yet the tacit assumption that water has no value is still maintained. Thomson (1970) pointed out, however, that water use is quantifiable, and should be paid for. Forests yielding water have to be protected from fire and animal damage, the costs of which are known, but other positive management practices will also be required in future. With these views I concur. For example, the generation of hydro-electric power uses some 900 million litres of water daily, or 328 thousand million litres/year. If there were a charge of one cent per 10 000 litres, the total revenue would be $3.28 million/year, or about $1 per head of population. If industrial and domestic water were included, this revenue would be doubled. This is a small amount when viewed against the figures given in Table 6,

TABLE 6: SELECTED ANNUAL COSTS, RELATED TO THE USE OF RIVERS ($ million)

Organisation	*Payments*	*Year*
Drainage boards:		
Payments	6.1	1974-5
Loans authorised	4.9	1975-6
Catchment boards:		
Payments	9.3	1974-5
Loans authorised	11.2	1975-6
Electricity Department and electricity supply authorities:		
National Development loans	29.5	1975-6
Works and trading account payments	275.1	1975-6
Interest on capital	58.7	1975-6

Source: *N.Z. Official Yearbook 1977*.

but a very large sum in relation to what is currently spent on maintaining the health and vigour of the protection forests, and on rehabilitation, in the catchment areas. It is of little use to say that the silting up of lakes behind hydro-electric dams, because of erosion and sedimentation, can be built into the cost of amortization, because once a lake has silted up the generation of power will cease.

Total expenditure on electric power supply up to 1975-6, by both the State and local supply authorities, amounted to $2179 million (historical dollars), and it seems probable that some three-quarters of annual costs relate to hydro-electric power. The use of water is thus not costless, even if the water itself is.

For domestic water supplies, the forested catchments are usually locked up for this single use. Many such areas (*e.g.*, in the Tararuas) are near centres of population and are eminently suitable for recreation. In view of experience overseas, and also at New Plymouth, where Lake Mangamahoe and its catchment are a multiple use area, this dog-in-a-manger attitude is becoming increasingly indefensible. Part of Lake Mangamahoe catchment is farm land, and part is used for production of timber, while the lake itself is a well-used amenity area for the enjoyment of the inhabitants of New Plymouth (Jellyman, 1973). If water catchments are used for several purposes (as I believe many of them should be) the cost of treatment plants should be weighed against the loss of amenity, should the catchments remain solely for water supply (Thomson, 1970), or the loss of production where such catchments could be used for productive purposes.

The question of multiple use will become of increasing importance is such areas. While it can be confidently predicted that true protection forest on steep lands with erodible soils will not at any time be required as a source of wood, there are many catchment areas on easier terrain, with little erosion hazard, that could in future be required to produce wood. In addition, there are areas currently being farmed which, because of a need to decrease soil loss and eutrophication of downstream waters, or to improve fishing, or to reduce peak flows, could in future be planted in trees. Such forested areas can be harvested without detriment to water values provided the harvesting is done with sufficient delicacy. Roading and logging, and preparation of sites for planting and replanting, would have to be conducted so as to reduce to a minimum any likely adverse effects; for example, small coupes would often be obligatory. Thus, the wood grown on such areas could be more expensive than wood produced from

areas classified solely as production forests. But how long will this distinction remain realistic? Already the W.A.S.C.O. "Forestry Guideline" (Chavasse, 1975; Priest, 1977) can be applied to any production forest area, while many of these may in future become more important for water yield — as witness, for example, the Rangitaiki-Whaeo hydro scheme now being developed in Kaingaroa Forest. There we have one of the most productive forests in the world, one of the best small fishing rivers in the world, and a valuable local body electricity plant, none of which appears to be seriously incompatible with the others. Indeed, other recreational values may also accrue there. This, I feel, may set the pattern for the future — an increase in the need for multiple use of forests.

WOOD

From the early days of settlement, successive governments have treated native forests of this country as mines for the extraction of building timber. Nevertheless, in the early days of settlement only a fraction of the merchantable timber was extracted, while the rest was burnt to make way for farm development. It was the export of timber, however, especially between 1860 and 1900, that provided the vital overseas funds for development of New Zealand, for it was the major export during that period (Lloyd and Guild, 1976). Since then the major reason for the overall policy was that housing should be cheap, and that the forests were in any case unmanageable for sustained yield.

In spite of this, by 1896 there were already some misgivings about future supplies, which resulted in calling the first timber conference. Little further action was taken until the Royal Commission in 1913 confirmed that native forests were not inexhaustible, and that planting of exotics should be undertaken as a conservation measure. Major conservation measures were eventually started in 1918, when the export of native timbers was prohibited, and when the decision was taken in 1919, largely on the initiative of Mackintosh Ellis, to expand greatly the rate of exotic forest establishment (Allsop, 1973). His propaganda was so successful, in both the public and private sectors, that the enormous forests of radiata pine, established in less than a decade, so taxed the attention, energy and initiative of foresters that the native forests were virtually ignored. So, while the exotic forests were utilised by larger and larger units, for a wide variety of purposes, the utilisation of the native forests continued in precisely the same way as 100 years earlier, with small, often inefficient, sawmills cutting largely rough-sawn green

building timber, irrespective of the intrinsic merits of the wood, and resisting such innovations as providing peeler logs, or increasing local processing.

Management of native forests has been applied only on a small scale: for kauri in Northland; for silver beech in Southland; and for rimu in Westland. No attempt has been made to manage the bulk of the rimu and beech forests, or stands of kahikatea, totara, tawa and other hardwoods. Stumpages have been low, and have only recently risen (see Table 14). Only recently have government attitudes changed (N.Z.F.S., 1977) with the promulgation of a new management policy for native forests. However, from 1948 the use of exotic timbers began to increase. By 1955 the volume of exotics used exceeded the cut of native timbers (1 854 000 m^3 compared with 1 610 000 m^3). From that date the cut of exotics increased rapidly (9 006 000 m^3 in 1974). On the other hand, use of native timbers declined slowly (918 000 m^3 in 1974) (N.Z.F.S., 1975).

The present position, with recent trends, is set out in Tables 7 to 13. Table 7 shows that in 1950 native timber made up 63% of total production, and that this had declined to 7% in 1977, with a complementary increase in exotic production from 37 to 93%. Leaving aside pulplogs, chips and export logs, the proportion of peeler logs from native forests was the same in 1977 as in 1950 (2%). The increase in pulplogs and chips was due to increasing utilisation of previously wasted and defective hardwoods.

TABLE 7: PRODUCTION OF NATIVE TIMBERS IN ROUNDWOOD EQUIVALENT (1000 m^3)

Assortment	*1950*	*1960*	*1970*	*1977*
Sawlogs	1531	1599	931	685
Peeler logs	34	37	34	14
Small wood	59	22	8	10
Pulplogs	—	—	51	138
Export chips	—	—	—	13
Export logs	—	—	8	1
Total indigenous wood	1624	1658	1032	861
Total exotic wood	934	1957	6778	10 640

Sources: N.Z.F.S. (1975), and N.Z.F.S. annual reports.

Table 8 illustrates the major differences in rough sawn timber production between the North and South Islands. In 1950 68% of the North Island production was from native species; in 1977 this had declined to 8.7%. In the South Island,

in 1950, native timber made up 66% of the total cut, but in 1977 it was still 36%. In other words, the amount of substitution of exotic for native sawn timber in the North Island was very substantial, but in the South Island it was modest.

TABLE 8: PRODUCTION OF ROUGH SAWN TIMBER (1000 m^3) FROM ALL TENURES

Year	North Island		South Island		Total
	Native	Exotic	Native	Exotic	
1950	514	240	250	127	1131
1960	536	658	264	180	1638
1970	269	1069	195	270	1803
1977	144	1514	199	355	2212

Source: N.Z.F.S. (1975), and P. Berg (pers. comm.).

Table 9 shows the sharp decline in production of rough sawn native timber from land other than State Forest. In 1951 State Forest provided only 31% of the total in the North Island; in 1977 this had increased to 58%. In the same time the contribution from Maori land had declined from 33% to 12%. In the South Island the trend is less marked because the proportion of Maori land is much smaller than in the North Island. Most merchantable podocarp forest on private and Maori land has now been logged, and the bulk of the remaining resources are in State Forest.

TABLE 9: PRODUCTION OF ROUGH SAWN NATIVE TIMBER (1000 m^3) BY TENURES

Year	North Island			South Island		
	S.F. Land	Maori Land	Others	S.F. Land	Maori Land	Others
1951	156	163	179	165	12	73
1960	132	217	188	149	24	91
1970	92	85	92	118	17	60
1977	84	17	43	140	18	41

Source: N.Z.F.S. (1975), and P. Berg (pers. comm.).

Table 10 shows the use to which some of the rough sawn native timber is put and illustrates the different proportions allocated to framing and finishing. There are clearly very marked differences in the pattern of use in the North and South Islands. Less than half the total is now used in the North Island and, of this, 64% is used for finishing. In the South Island only 32% is used for finishing.

TABLE 10: USE OF NATIVE TIMBER IN DWELLINGS (1000 m^3): COMPARISON OF PROPORTIONS OF FRAMING AND FINISHING GRADES, 1974
(figures in parentheses are percentages)

Region	*Framing*	*Finishing*	*Total*
Auckland	11 (7.2)	19 (12.4)	30 (19.6)
Rest of North Island	16 (10.4)	29 (19.0)	45 (29.4)
South Island	53 (34.7)	25 (16.3)	78 (51.0)
Total for N.Z.	80 (52.3)	73 (47.7)	153 (100.0)

Source: Gilbert (1974).

Table 11 shows market distribution of native timbers. This makes it clear that over 25% of all native timber sawn is used in Canterbury, and that 48% of the total New Zealand cut of native timbers is exported from the West Coast. This relationship is not fortuitous; the lavish use of rimu in Canterbury is related to low price and ready availability. In addition, a major proportion of the sawmilling industry in Westland is controlled by Canterbury interests.

Traditionally, grading of native timbers has been four-way — heart and sap, dressing and building. This is a very simple system based on the premise that the product would be used mostly in dwellings. Sawmillers have traditionally obstructed any move to change this system, even for such excellent

TABLE 11: MARKET DISTRIBUTION OF NATIVE TIMBERS (1000 m^3), 1974
(figures in parentheses are percentages)

	From			
To	*Central North Island*	*West Coast*	*Southland*	*Total*
Auckland	107.3 (18.5)		2.1 (0.4)	
Southland Auckland Bay of Plenty Taranaki East Coast Wellington	55.5 (9.6) 4.5 (0.8) 16.6 (2.9) 44.8 (7.7)	31.4 (5.4)		
Nelson Marlborough		21.3 (3.7)		
Canterbury		140.6 (24.3)	5.3 (0.9)	
Otago/Southland		68.2 (11.8)	25.7 (4.4)	
Local	33.8 (5.8)	13.7 (2.4)	0.8 (0.1)	
Export		2.2 (0.4)	5.3 (0.9)	
Totals	262.5 (45.3)	277.4 (48.0)	39.2 (6.7)	579.1 (100)

Source: N.Z.F.S. (1975).

TABLE 12: ACTUAL AND POTENTIAL GRADE OUT-TURN OF PODOCARP TIMBER (%)

Grades	North Island		West Coast	
	Actual	*Potential*	*Actual*	*Potential*
Heart Dressing A	17	17	7	7
Heart Factory	—	7	—	2
Dressing A	35	35	40	40
Sap Factory	—	15	—	19
Total — finishing	52	74	47	68
Heart Building A	14	7	8	6
Building A	26	11	45	28
Other	8	8	—	—
Total — building	48	26	53	32

Source: Chong (1975), and Page (1976).

cabinet-making hardwoods as silver beech. Two studies showed how far actual use was from a rational use based on the intrinsic merits of the wood. Chong (1975) studied grading of podocarp timbers in the North Island, and Page (1976) carried out a similar study for the West Coast. Their figures are presented in Table 12. Chong showed that in the North Island the finishing grades could be increased from 52 to 74% of output. The potential improvement on the West Coast was on a comparable scale — from 47 to 68%. When these figures are compared with Table 8 it appears that, in the South Island, there is gross misuse of high grade timber.

The figures for utilisation of beech timbers appear to be even less satisfactory. In Table 13, over 80% of the timber use shown is for silver beech from Southland. Of this, only 40% is used for finishing, while nearly 30% is used for house framing, a purpose for which untreated silver beech cannot be considered suitable.

TABLE 13: GRADE OUTPUT OF RED AND SILVER BEECH (1000 m^3), 1977
(figures in parentheses are percentages)

Grade	*Nelson/ Marlborough*	*West Coast*	*Southland*	*Total*
Clears	—	—	2.1 (9.3)	2.1 (9.3)
Dressing A	(0.03)	1.7 (7.6)	3.3 (14.7)	5.0 (22.3)
Dressing B	—	0.7 (3.1)	1.9 (8.4)	2.6 (11.5)
Building A	0.1 (0.4)	1.2 (5.3)	6.5 (28.9)	7.8 (34.6)
BB/Commons	—	0.1 (0.4)	0.8 (3.6)	0.9 (4.0)
Cut of log	0.2 (0.9)	0.4 (1.8)	3.5 (15.6)	4.1 (18.3)
Totals	0.3 (1.3)	4.1 (18.2)	18.1 (80.5)	22.5 (100)

Source: Foley (1977).

It is possible that, with the revised grading rules for native timbers (N.Z.S.S. DZ 3631: Part B, 1978), there will be some improvement in the use of native timbers. A "Clears" grade has been introduced for native softwoods and so-called minor hardwoods, while a "Factory" grade has been introduced for beech. But much will depend on how well these new grading rules are applied. Up to the present there have been two factors which militate against proper utilisation of native timbers based on intrinsic merits. The first is that they do not have to be treated, when used in buildings, to meet lenders' requirements, although the sapwood's susceptibility to rot and insect attack is no less than that of pine, and scantlings (even if graded as heart) often have some sapwood included. The second factor has been the lower stumpage paid by sawmillers for purchasing the standing timber. These rates are based on the mean selling price of grades as produced by sawmills, not on potential grades. Many sawmills have graded on orders, not on the intrinsic merits of the timber cut, especially in Westland where the major building market in Canterbury tends to dictate practice. Selling prices for sawn native timber have risen considerably recently, and this is reflected in current stumpages, as shown in Table 14. It will be clearly apparent that stumpages in the North Island are substantially above those in Nelson and (particularly) Westland. It seems that stumpages are closely related to usage (as shown in Table 10). Stumpages for beech remain low, reflecting the misuse shown in Table 13.

It is not possible to relate stumpages for radiata pine to those paid for native timbers without a detailed analysis of physical factors such as provision of roading, terrain and distance from markets. However, as a rough comparison, mean stumpages for radiata pine sawlogs are currently $8.74/

TABLE 14: SELLING PRICES FOR STANDING NATIVE TIMBER; SAWLOGS ONLY ($/m³), 1978

Date	*Conservancy*	*Rimu/Miro*	*Matai*	*Totara*	*Kahikatea*	*Tawa*	*Beech*
8/77	Rotorua	12.75				6.08	
10/77	Nelson	9.49		5.50	9.03		3.50
10/77	Auckland	12.19	8.53	8.04	7.24	5.71	
1/78	Westland	7.52		7.52	7.52		
4/78	Wellington	12.22		12.22	12.22	6.84	
4/78	Nelson	7.00			5.50		3.05
4/78	Nelson	8.59			8.09		3.50
4/78	Westland	5.85		5.85	5.85		
4/78	Westland	8.52			8.52		

Information supplied by R. F. Cooper, N.Z.F.S. Head Office.

m^3 in Auckland; $10.35/$m^3$ in Wellington; and $6.45/$m^3$ in Nelson: that is, slightly below stumpages for native timbers. However, the maximum radiata pine stumpage, in Wellington Conservancy, is $12.36/$m^3$ (R. F. Cooper, pers. comm.).

It should also be borne in mind that native timber stumpages are still subject to "Fifths" (*i.e.*, 20%) paid to local bodies — an imposition which exotic stumpages do not have to bear.

I have not dealt with kauri forests — a sad tale indeed, with enormous waste in the early days (Lloyd and Guild, 1976). The present position appears satisfactory since kauri timber is largely restricted to special markets and the cut is well below the potential sustained yield of areas which are now adequately stocked with young kauri.

The picture for kahikatea forests is much worse, as remaining stands are limited to the extent that there seems little justification for logging them, especially as radiata pine could be used for most purposes for which kahikatea is now used. Of all the podocarps, kahikatea is probably the most easily managed (on suitable sites) but no attempt has ever been made to manage such stands and no doubt large areas were destroyed during development of agriculture.

Totara stands have also largely disappeared and again no management has been attempted. It would now seem essential that remaining totara stands be reserved for future supplies for Maori arts.

The position of rimu forests in the North Island is also unsatisfactory. The time when management for sustained yield on a realistic scale could be introduced is long past. However, the increment of mature natural forests is probably nil or even negative and, for future value, the intensive management of part of the remaining areas in the central North Island could be justified. The annual cut would, however, be very small.

The position in the South Island is better. Management of a sort was introduced into Westland in 1958, with selection logging adopted for terrace forests in south Westland in 1964. However, in north Westland, Nelson and Southland, and on hill country in south Westland, podocarps have not been managed, so that the current cut is very large in comparison with the potential sustained yield. Moreover, the cut could be substantially reduced if the level of substitution reached in the North Island were to be applied in the South Island. There is sufficient exotic wood now available in the South Island to achieve this, but the vexed question of the economic viability of the West Coast appears to make such substitution impracticable at present.

For beech forests, management techniques are well understood and effective in western Southland, and sustained yield management at a reasonable level is indicated. The timber is, however, misused, and it is incongruous that, while 55% of the cut is used for building, North Island cabinetmakers cannot obtain it but have to rely on imported woods. The Nelson/Westland beech forests have been treated badly, with no attempt at management on any scale, although there have recently been a number of large-scale logging and management trials. Much of the beech forest there contained podocarps which were extracted, leaving behind damaged and disease-prone beech stands. The remaining forests offer the possibility of sustained yield on a reasonable scale, although methods have not yet been adequately demonstrated.

Tawa forests also have suffered from removal of podocarps and a complete lack of interest in sustained yield, although they cover a large area and could provide a reasonable annual harvest if properly managed. At a recent meeting to discuss the future of the west Taupo forests there was increased interest in managing tawa stands, but methods have not so far been demonstrated.

There is a curious attitude to native forests which ought to be buried — that is, that regeneration should be by natural means. Why this is so, when New Zealand foresters have acquired great skill in the artificial regeneration of exotic forests, is strange indeed. Work at FRI has shown that seedlings of all the major native species can be readily raised in nurseries by conventional means, and that re-establishment of native forests by planting is simple and cheap, provided the right techniques are adopted. There is, of course, much more to learn about these techniques, and care in selecting seed sources is likely to be of considerable importance.

In the long run, production of native species will be on a very small scale: kauri from Northland and perhaps the Coromandel; rimu from Westland and perhaps the central North Island; and beech from Nelson, Westland and western Southland. In order to eke out resources it is necessary, and urgent, that these timbers are used for the highest possible purposes, and to bring production down to sustainable yield.

TOURISM

The number of tourists enjoying New Zealand annually is difficult to determine. Indeed, New Zealanders on holiday constitute the greatest proportion of them; I define native tourists as those who cross from one island to another. Overseas visitors in 1976 (*N.Z. Official Yearbook 1977*) totalled some 385 000, of whom perhaps 313 000 could be considered tour-

ists. About 60% of these came from Australia, 16% from North America, 7% from Britain, and 17% from other countries (including an increasing number of Japanese visitors).

Broadly speaking, overseas visitors are mainly concerned with scenery, while a fair proportion of New Zealand tourists actually use forests.

The special provision for recreation in the form of National Parks, Forest Parks and Scenic Reserves is rather generous, as set out in Table 15, if one considers only gross area.

The figures in Table 15 should be viewed in relation to population distribution shown in Table 3. McKelvey (1974) pointed out that (apart from "user-oriented" areas) the land set aside for recreation is more than adequate. Taking the country as a whole, this may be true for some time to come, but enormous areas in the South Island are of little real benefit to people living north of (say) Taupo when travel costs are beyond the resources of the average family. Taking National Parks, Forest Parks, and Scenic Reserves together, they amount to an allocation of 0.42 ha/person in the North Island, and 31 ha/person in the South Island. Breaking this down further, people living in north Auckland, Auckland urban area, and the Bay of Plenty have only 0.13 ha/person. In comparison, people in Otago and Southland have 53 ha/person; and those living in Nelson/Marlborough have a lavish 65 ha/person — however, these forests are in reasonable proximity to the Wellington urban area.

We cannot tell where, and in what way, future pressures on the forests as tourist resources, will fall (Rennison, 1974), but we can be assured that these pressures will increase overall, and may become fairly heavy in proximity to the massive conurbations which seem to show no sign of slackening their growth. Thomson (1970) deplored the idea that people using forests for recreation (he does not specifically mention tourists) should have to pay anything, but I rather suspect that there will be a continued increase in tourists intent on fishing and on hunting. Such tourists will in the main be interested in the more accessible areas, including exotic forests owned by both the State and by private industry. It would thus seem equitable that there should be some recompense, in this case, for production forgone, for additional fire protection expenses, and for additional maintenance of assets such as roads. There is also the case of tourist use of domestic water catchment areas mentioned by Thomson, where additional expenses of water purification need to be met by some means. Where pressures build up, whether in native or in exotic forests, some form of payment becomes more likely. Already a parking fee is levied in Tongariro

National Park during the ski-ing season in order to raise money for the provision of facilities.

There need not be gross incompatibility between tourist use of forests and production of wood. There are many cases overseas where the possible areas of conflict have been resolved. In Britain the National Parks are largely productive land, including farm land and production forest. In France there are areas around several cities which are used principally for recreation, but from which mature timber is carefully removed, and the logged areas replanted with large sap-

TABLE 15: DISTRIBUTION AND AREA (HA) OF NATION

Location/Name	*National Parks*	*Forest Parks*	*Scenic Reserves*
NORTH ISLAND			
Auckland (province)	—	—	58 042 (a)
Coromandel		67 745	
Kaimai-Mamaku		37 141	
Pirongia		14 192	
Whakarewarewa		3 830	
Sub-totals	—	122 908	58 042
Central North Island			
Tongariro	76 198		
Kaimanawa		74 844	
Western North Island			21 517
Egmont	33 532		
Gisborne/East Cape			20 015
Urewera	205 852		
Raukumara		31 336	
Hawke's Bay			1 151
Kaweka		64 655	
Ruahine		90 259	
Southern North Island			29 230
Tararua		115 675	
Rimutaka		14 084	
Haurangi		15 147	
Sub-totals		144 906	29 230
Total — North Island	315 582	528 908	129 955

(a) North Auckland district 12 841 ha; south Auckland 45 201 ha. Area includes Bay of Plenty.

lings. And there is the well-known planted forest overlooking the city and fiord at Trondheim in Norway which has been managed carefully for wood production and amenity for more than a century. Areas are there clearfelled in such a way as to introduce new vistas of city and fiord, and these areas are provided (temporarily) with facilities for public use.

For most "tourist" uses, including landscape enjoyment, there is little possibility of recouping expenses. In relation to the small number of people actually using the greater area

ARKS, FOREST PARKS AND SCENIC RESERVES

Location/Name	*National Parks*	*Forest Parks*	*Scenic Reserves*
SOUTH ISLAND			
Nelson			59 643
Abel Tasman	22 139		
Nelson Lakes	57 470		
North-west Nelson		377 157	
Mt. Richmond		175 750	
Sub-totals	79 609	552 907	59 643
Marlborough			27 650
Canterbury			13 951
Arthur's Pass	98 405 (b)		
Mount Cook	69 957		
Craigieburn		4 451	
Lake Sumner		73 894	
Sub-totals	168 362	78 345	13 951
Westland			25 621
Westland	88 631		
Otago (less south Otago)			7 323
Mount Aspiring	287 253 (c)		
Southland/south Otago			25 534
Fiordland	1 212 000		
Catlins		49 101	
Totals — South Island	1 835 855	680 902	158 722
(b) (c) Parts of Arthur's Pass and Mount Aspiring National Parks lie in Westland.			
Totals — New Zealand	2 151 437	1 209 810	288 677

Source: N.Z.F.S. (1975) amended (P. Berg, pers. comm.).

of recreational forest (Rennison, 1974) the cost of supplying access, huts, etc., would be too great, while Scenic Reserves are more commonly being managed by boards or committees with some public money to provide facilities.

In a word, except for special cases, "tourism" is not yet, and is unlikely to be, a commercial forest product. However, the value of tourism to New Zealand in monetary terms cannot be ignored, if only to offset the high cost of overseas funds required by New Zealanders travelling abroad. Direct income from tourists in 1976 (*N.Z. Official Yearbook 1977*) was $143.1 million, but direct costs of N.Z. tourists going overseas were $193.4 million.

There would seem to be a case for managing most forests with a proper recognition of their amenity value, but this is yet far from being the case.

ANIMALS

Damage caused by wild animals, earlier introduced for sport, became steadily more apparent in the first three decades of this century. As a result, in 1930 the Government introduced a "killer" policy and for the next 30 years there were attempts to destroy or at least reduce the animal populations on an extensive scale. In 1956 the control of animals was taken over from the Internal Affairs Department by the N.Z. Forest Service. Shooting continued on a more selective basis in those catchments where the greatest economic assets were at stake. While this policy did prove more effective in the priority catchments, in less important areas the animal herds spread and increased.

In 1960 small-scale commercial meat-recovery operations began, but it was not until overseas markets had been found, and until helicopters were used for recovery operations, beginning in about 1963, that the game meat industry really got into its stride. Peak production was reached in the period 1970 to 1974, since when it has declined. Table 16 shows the production of the industry in 1976-7.

TABLE 16: GAME MEAT EXPORTS, 1976/77

Type	*Weight (1000 kg)*	*Value ($1000)*
Venison	2908	11 859
Goat meat	849	839
Pork	253	1 020
Totals	4010	13 718

Figures supplied by S. Fokerd (pers. comm.).

Throughout the period from 1963 to 1977, venison has been by far the most important product, and it has been estimated that some 1 245 000 deer have been killed over the 14 years. However, in critical catchments, it has been considered expedient to continue official hunting. In 1976-7 some 16 800 goats, 3300 deer, 950 wild pigs and a number of other animals were shot by Forest Service hunters (S. Fokerd, pers. comm.).

Figures for private hunters are less reliable, but hunters constitute a large proportion of people seeking recreation in forests, and many of them supply at least some of their kills to the game meat packers. To give some indication, partial figures are presented in Table 17.

TABLE 17: HUNTING PERMITS ISSUED BY N.Z.F.S. CONSERVANCIES, 1976-77

Conservancy	*Permits Issued*	*No. of Hunters*	*No. of Kill Returns*	*Kills (b)* *Red Deer*	*Pigs*	*Goats*	*Others*
Auckland	3 474	4 697	1 341	734	633	1 812	47
Rotorua	12 558	25 964	5 889	4 078	2 194	412	50
Wellington	13 161	13 427	2 515	1 839	394	944	—
Nelson	5 019	6 700	2 126	333	449	331	76
Westland	1 355	—	196	309	16	34	70
Canterbury (a)	3 837	7 238	1 882	672	278	—	260
Southland	5 138	5 827	1 274	2 000	359	12	39

(a) Includes N.Z.D.A. blanket permit figures.
(b) Excluding commercial kills.
Figures supplied by S. Fokerd (pers. comm.).

Thomson (1970) regards the harvest of animals from forests as an "uncomplicated case", and considered that hunters should pay either by way of licence fees or on the basis of animals recovered. However, to me, the matter is more complicated than this. There can be little doubt about the value of hunting as recreation, but the desire of the hunter is to maintain fine herds of animals, while the desire of meat recovery firms is no doubt to maintain an adequate breeding population. These aims could be entirely incompatible with the objectives (for example) of the Royal Forest and Bird Protection Society, or of catchment authorities who are charged with protection of soil and conservation of water; or indeed of foresters concerned with obtaining maximum wood production from the areas concerned. Furthermore, a great deal of meat hunting has been carried out in protection forests and in National Parks. This has had the effect of reducing animal numbers substantially, which is compatible

with objectives of management in these areas and, had there been no commercial hunting, there would have been a need for costly shooting campaigns by Forest Service staff. There is, however, incompatibility between the hunters (whether recreational or commercial) and the purpose of the 1956 Noxious Animals Act, which was to eradicate so-called noxious animals — an objective which would never have been achieved in any case.

One can only conclude that the introduced animals which have become established in this country must be accounted an asset (both for export of meat and for hunters, including tourists) albeit in need of strict control in order to protect other forest values. It would seem that, in many areas, a reasonable degree of control has now been achieved and can be maintained. Some form of zoning is required to keep sportsmen and commercial hunters out of each others' hair, and there are sensitive areas where animals must be kept to a very low level in order to preserve the protective or scientific values of the forests, but it seems that at length we are learning to live with both the animals and their human predators.

ACKNOWLEDGEMENTS

I am indebted to P. J. Berg for obtaining up-to-date statistics from N.Z.F.S. Head Office.

REFERENCES

Allsop, F., 1973. The first fifty years of New Zealand's Forest Service. *N.Z.F.S. Inf. Ser. No. 59.*

Chavasse, C. G. R., 1975. Forest Operations Guideline. *N.Z. Jl For., 20* (2): 296-301.

Chong, S. L., 1975. Better utilisation of indigenous softwoods through the introduction of a cuttings grade. *N.Z.F.S., U.D.D. Rep. 42* (unpubl.).

Foley, T. A., 1977. Existing West Coast patterns of utilisation. *N.Z.F.S. Seminar: The future of West Coast forestry and forest industries.* July 1977.

Gilbert, J. T. E., 1974. The production, usage and market for New Zealand indigenous sawn timber and veneers. *N.Z.F.S., U.D.D. Rep. 35* (unpubl.).

Holloway, J. T., 1960. Research in mountain-land management: New Zealand problems in the light of overseas experience. *N.Z. Jl For., 8* (2): 275-92.

Jellyman, A. W., 1973. Water as a forest product. *N.Z. Jl For., 18* (2): 211-6.

King, M., 1970. Forestry and water. *N.Z. Jl For., 15* (2): 184-8.

Kirkland, A.; Trotman, I. G., 1974. *Indigenous Forests of New Zealand, Part 2.* Forestry Development Conference 1974-5.

Lloyd, R. C.; Guild, D. W., 1976. The role of forestry in the development of the Northland region. *N.Z. Jl For., 21* (2): 175-84.

McKelvey, P. J., 1974. Environmental forestry in the 1980s. *N.Z. Jl For., 19* (2): 208-21.

Morris, J. Y., 1974. *Role of Indigenous Forests in Soil and Water Protection.* Forestry Development Conference 1974-5.

N.Z.F.S., 1975. Statistics of the forests and forest industries of New Zealand. *N.Z.F.S. Inf. Ser. No. 33.*

———— 1977. *Management Policy for New Zealand's Indigenous State Forests.* N.Z.F.S., Wellington.

N.Z. Official Yearbook 1977. Government Printer, Wellington.

Page, D. R., 1976. Cuttings grade recovery for West Coast rimu. *N.Z.F.S., U.D.D. Report* (unnumbered; unpubl.).

Priest, R. M., 1977. Water and soil conservation. *N.Z.I.F. For. Handbook*: 71-3.

Rennison, G., 1974. Forest recreation, with special reference to the proposed Westland beech scheme. *N.Z. Jl For., 19* (1): 67-74.

Thomson, A. P., 1970. Multiple-use forestry — who pays? *N.Z. Jl For., 15* (2): 213-21.