TRENDS IN SOUTH AMERICA'S CONIFEROUS FOREST RESOURCES

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Contents

1 Introduction

South America is one of the most extensively forested areas on the earth. It is sometimes looked upon as a potential source of timber in the event of a serious shortage of wood elsewhere. — By far the world's most important industrial wood supplies are in the coniferous forest belt of the northern hemisphere. Conifers offer superior technical properties in both the mechanical and chemical wood industries. They form large and dense stands with only few species mixed, and are favoured by long-lived traditions.

There are conifers also in the southern hemisphere, some of which are indigenous and others imported from their natural habitat. Some conifers are found in South America. As a forest resource they represent a minor proportion, but their significance in the South American timber economy is considerable. The purpose of this study is to attempt a survey of the factors determining South America's coniferous timber potential in the coming decades. Data and other sources of information for this kind of study may be inadequate and different conceptions about mere facts seem to exist.

2 Coniferous Forests

(An over-all picture of South-America's forest resources is given in Tables I—IV, pp. 32—35.)

21 Indigenous Conifers in South America

211 General Remarks

Contrary to the huge number of broadleaved species in South America, there are few coniferous species. Most important among these are of the *Araucaria, Podocarpus, Saxegothea* and *Libocedrus* genera.

In the absence of systematic forest inventories in South America, data on coniferous forest resources are scattered and contradictory. Yet they are the only starting point in evaluating the South American coniferous potential. If they are sufficient in revealing trends and relative magnitudies, their analysis is useful.

In South America different uses of land compete with each other in areas of best coniferous timber growth. The principal function of forest management tends to be exploitation. Under such circumstances, forest area is a sufficient indicator of the magnitude of forests. It is then not so relevant as elsewhere to speak of trends in the amount of stumpage because exploitation virtually means devastation of forests. Almost any index of their relative reduction represents trends in forest resources.

It is easier to secure reliable data on former forested areas taken over by agriculture than on the remaining forest area. This is one of the major ways of assessing trends in the reduction of South America's forest area.

212 Araucaria angustifolia

212.1 General Characteristics and Amount of Resources

The proportion of *Araucaria angustifolia* in the Brazilian timber exports in the 1940s was 70—80 per cent (Hueck 1952, p. 272), and it has been estimated to comprise a third of the coniferous stumpage in Latin America as a whole

(Rogers 1954, p. 16). According to Hueck (1952, p. 273), the first to deal with the paraná pine in literature was Bertoloni in 1819. He named this tree *Colymbea angustifolia.* In 1822, Richard called the same tree *Araucaria brasiliana*, unaware of the name given by Bertoloni. Later botanists have adopted the name *Araucaria angustifolia.*

Araucaria angustifolia is customarily referred to as a pine because of its appearance which reminds one of certain *Pinus* species. This subtropical conifer reaches, under best growth conditions, a height of 35 m., of which 20—25 m. are free of branches. The diameter at breast height is about 60 cm., but in exceptional individuals it may exceed 2 m. The branches are concentrated in the crown, developing dense bunches of needles at their ends. The crown of a mature tree becomes flat, its profile taking on the appearance of a parasol.

The technical properties of the Paraná pine were studied by Germans in the late 1930s. From the test report given it may be concluded that the strength properties of the Paraná pine are close to those of Scots pine, the latter being inferior in resistance to bending and in the modulus of elasticity but otherwise stronger. Scots pine is much more resistant to fungus attack and keeps its shape better in changing conditions. Therefore, the Scots pine is much to be preferred in structures which are exposed to changes in weather. The pulping properties of the Paraná pine are good because of its long and strong fibre and a small resin content (*Merkblätter* ... Nos 11—15/1939, pp. 4—10).

The range of the Paraná pine has perhaps been studied most creditably by Hueck (1952, pp. 272—289). He has also written sound criticism of views expressed by previous authors. We shall content ourselves here with pointing out certain misconceptions (*cf.* James 1953, p. 304, Streyffert 1931, p. 735, Woods 1951, map appendix, Record *et al.* 1947, p. 3).

Hueck has condensed his observations on earlier range studies in Fig. 1. Much to the point, he regards it as a »good example of the present uncertainty». His own view is set forth in Fig. 2, which probably represents the most detailed description available of the Paraná pine's natural range. Hueck refutes the assumptions that the range of the Paraná pine extends to Uruguay and Paraguay and curtails most of the ranges suggested earlier. He also maps out several large campo and other deviant vegetation areas within Araucarilandia. Nearly all the Paraná pine region falls within the Brazilian borderlines in the states of Santa Catarina, Paraná and Rio Grande do Sul. Minor occurrences are found in Rio de Janeiro, Minas Gerais, Espirito Santo, Goyaz and Matto Grosso (*cf.* Lehotzky 1953, p. 188, Allheimen 1947, pp. 290—291). In Santa Catarina and Paraná the Paraná pine has its greatest economic significance, and large scale exploitation of this tree is restricted to these two states. Even farther north the Paraná pine is well established in the local market, but its patchy occurrance there does not attract large export companies (Hueck 1952, p. 288).

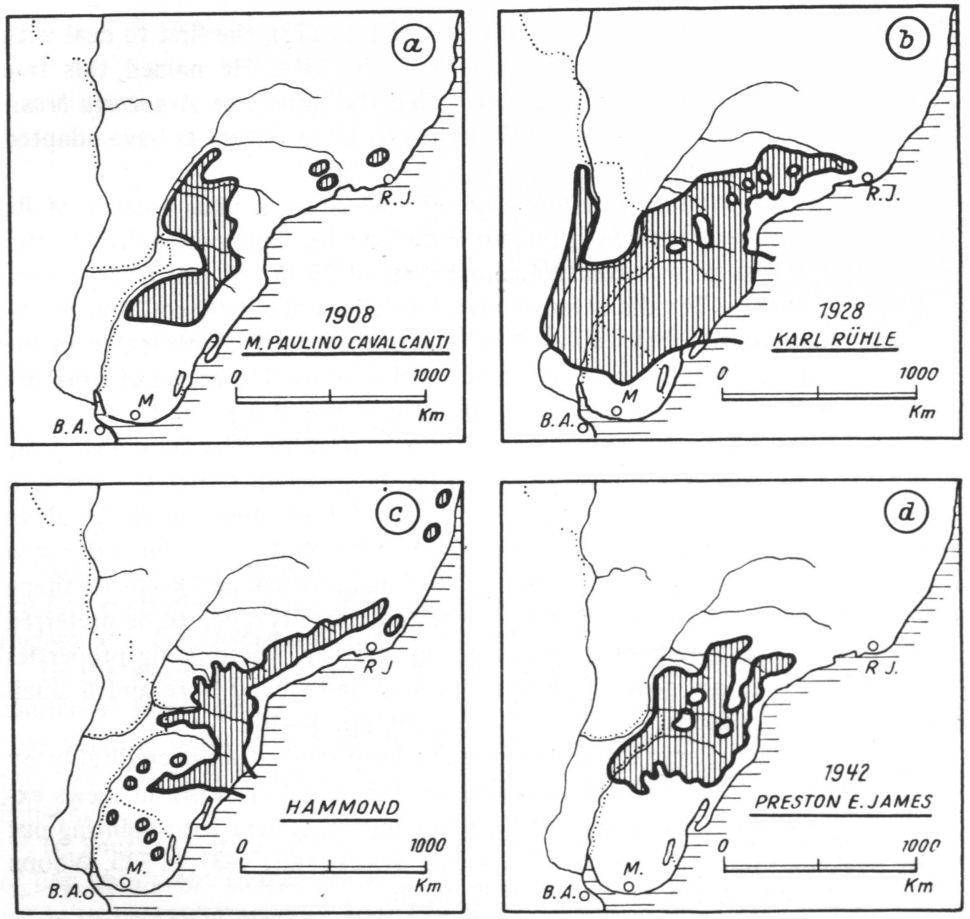


Figure 1. The range of *Araucaria angustifolia* according four authors.
Source: HUECK 1952, p. 274.

Data on the areal size of the Paraná pine forests are incompatible — obviously due to differing definitions of forest rather than differences in the dates concerned. Hence it would be useless to strive toward an absolute idea of the extent of forests. It would seem more worth while to gain an insight into the major changes in area.

About 1930, the area covered by the Paraná pine forests was estimated at 40 million hectares (LESCHNER 1949, pp. 25—30). By 1940 this area is said to have been curtailed through devastative cutting and clearing for agriculture to about 30 million hectares. The significance of these figures, however, is not clear; no characteristics of the forests counted are given. The devastated area may have been exaggerated.

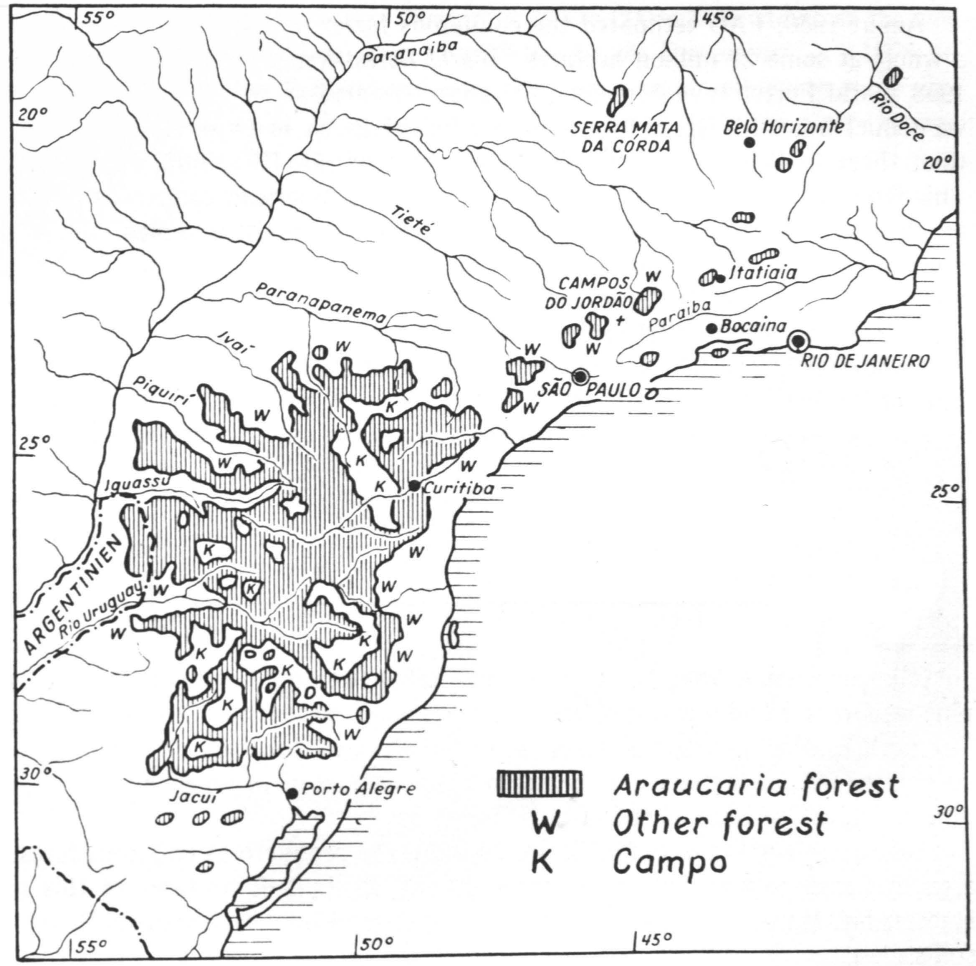


Figure 2. The range of *Araucaria angustifolia* according to HUECK (1952, p. 276).

PAULA (1951, p. 315) divides the Paraná pine forests into three categories according to occurrance:

1. Forests with a preponderance of Paraná pines;
2. Mixed forests including Paraná pines;
3. Fields with scattered Paraná pines.

In the three Paraná pine states proper there is forest belonging to the first category as follows:

Santa Catarina	4.8 million ha	(1945)
Paraná	6.3 » »	(1949)
Rio Grande do Sul	3.9 » »	(1949)

About 1950, FAO estimated the coniferous forest area in Latin America as a whole at some 27 million hectares (*World Forest Resources* 1955, p. 18). The 1958 World Forest Inventory by FAO gives this area as 16 million hectares. If we deduct from this figure the coniferous forests in use in Latin America, other than those in Brazil, 3.75 million hectares, we obtain 12.05 million hectares. This figure is further diminished, if all other Latin American coniferous forests are deducted from it. The area of these forests is not precisely known, but it is probably at least 5 million hectares. Thus the estimate, 15 million hectares, given by Paula for the three Brazilian states, would in FAO's estimates represent at least the total Brazilian Paraná pine area.

Maack (1953, pp. 33—41) gives an estimate of changes in forest area in the state of Paraná:

	Original area 1,000 ha	Area ca. 1952 1,000 ha	Devastated area 1,000 ha
Broadleaved forests	10,046	6,102	3,943
Paraná pine »	7,628	2,772	4,856
Total	17,674	8,874	8,779

It is conceivable that Paula's estimate (about 6.3 million ha) for Paraná's pine resources is badly contradicted by Maack's estimate (about 2.8 million ha). The authors obviously define forest in different ways. Maack's estimate, however, is beneficial in that it indicates relative reduction in forest area. Yet it does not give the date of the original forest area.

According to Paterson (1956, pp. 24—25), the productive coniferous forest area in Brazil is 8.75 million hectares. About 3.5 million hectares of this is inaccessible. Maack's estimate on the State of Paraná in a way supports Paterson's view.

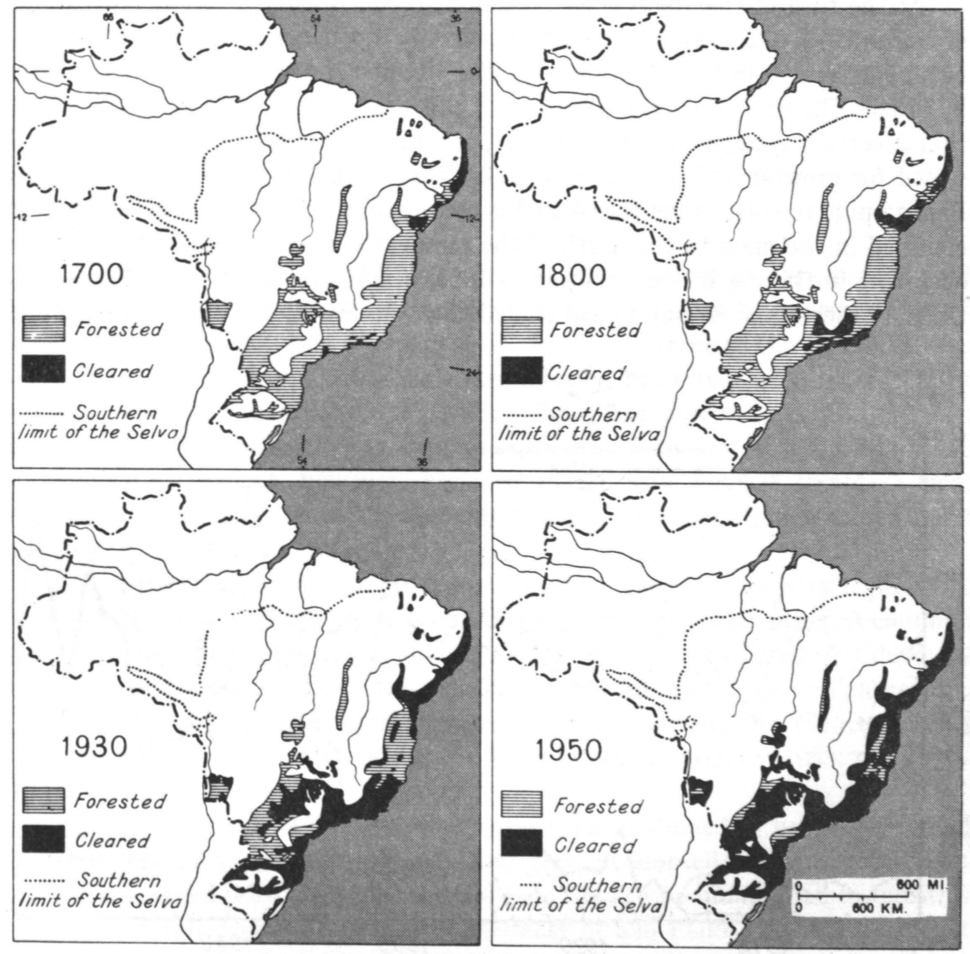
In this author's opinion, even the majority of the most recent estimates on Brazil's coniferous forest resources are exaggerated because they do not take due account of forest devastation. Clearcut but unregenerated areas may have been included in the estimates. This can hardly be done in the case of the Paraná pine because of its poor natural regeneration. On the other hand, Paterson's estimate is likely to be too pessimistic. The area aimed at by him is perhaps in the order of 10—15 million hectares. Glesinger (1955, p. 100) estimates the area of dense Paraná pine forests at about 10 million hectares.

In Argentina, the Paraná pine occurs in an area of about 0.4 million hectares in the province of Misiones. However, only 25,000—30,000 hectares are well stocked with this species. Scattered trees are found in areas not included in the above figures (*Unasylva* 1955, p. 141).

Like the estimates of area, the views concerning stumpage vary widely. The estimates of stumpage in forests dominated by the Paraná pine in Santa Catarina, Paraná and Rio Grande do Sul vary from 250 to 300 million stems at the end of the 1940s (Paula 1951, p. 315, *Possibilities for the Development . . .* 1954, p. 34), counting the trees of 20 cm and over. The mean trunk volume in these diameter classes is 2.2 cu.m. Thus the stumpage corresponding to the above figures ranges from 550 to 650 million cu.m. (round wood).

212.2 Factors Affecting Future Trends in the Paraná Pine Resources

The statements on the rapid reduction of the Paraná pine forest area as a result of heavy cuttings give cause for a closer examination of this phenomenon. The information used here is largely qualitative but not insignificant.



Figures 3—6. The clearing of forest for agriculture in Brazil.
Source: James 1953, p. 309.

Fig's 3—6 may be taken to represent a secular trend in the relationship between forest and agricultural land. The competition between different land uses has its origin in the agricultural development initiated by Portugese sugar farmers soon after the beginning of the 17th century. — Despite the historical cycles devoted to the production of a single commodity, agriculture, in one form or an other, has always occupied an important position in Brazil's industrial life. The still present shifting cultivation, favoured by the land ownership pattern, in itself leads to forest devastation (see JAMES 1953, pp. 302—303, *cf.* FREISE 1935, pp. 169—170, FRAGA 1950, pp. 89—96). The traditional belief that, unlike forest, campo is infertile supports this development (see WAIBEL 1948, p. 550). The misconception that all forest land — and only that — is fertile has brought about misuse of land in agriculture (STERNBERG 1955, p. 488).

At the turn of the 1940s coffee farming spread rapidly in the northern part of Paraná. In 1927—31 Paraná produced only 1.5 per cent of the total coffee output in Brazil, but by 1955 Paraná had become the greatest coffee producer in Brazil. The most important reason for this development was the observation that a certain type of soil *(terra rossa)*, abundantly found in Paraná, was best suited for growing coffee (STERNBERG 1955, p. 490). The loss of area from the Paraná pine to coffee thus occasioned is considerable. However, it is likely to be confined in the main to the north of the temperate zone because of night frosts occurring in the south (see STERNBERG 1955, p. 491, JAMES 1953, p. 302—303). On the other hand, it may be concluded that the loss of ground by the Paraná

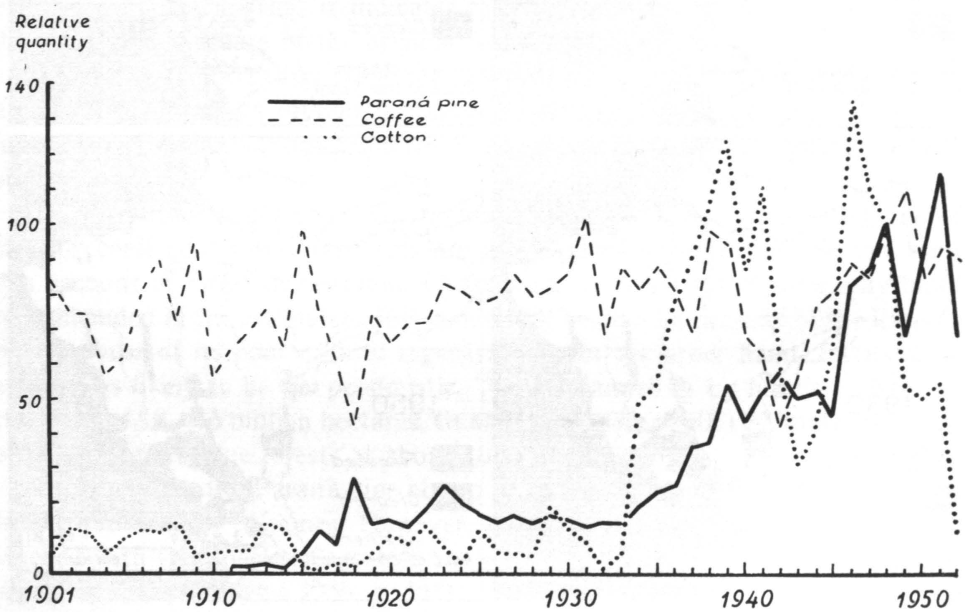


Figure 7. Trends in the exports of Paraná pine, coffee and cotton from Brazil, 1901—1951. Source: *Anuário estatístico* . . . 1953, p. 520; *Statistical Yearbook* 1953, p. 403.

pine to coffee is not due so much to an expansion in coffee farming as to its geographical shifts; the secular trend in coffee exports from Brazil in 1901—52 was only slightly upward (see Fig. 7). This conclusion is supported also by Table 1.

Table 1. Exports of coffee from São Paulo, Paraná and Brazil as a whole in 1935—55.

Year	São Paulo	Paraná	Brazil
	Thousands of 60-kilo sacks per year		
1935—36	13,522	613	20,927
1940—41	10,217	931	16,456
1945—46	6,101	674	12,700
1950—51	8,121	4,031	16,762
1952—53	7,057	4,947	14,926

Source: DOZIER 1956, p. 332.

The custom of offering cut-over areas to new settlers as agricultural land in almost all the Brazilian forest regions means gradual and permanent loss in forest area. It reminds one of the practice followed earlier in the United States (see LEHOTZKY 1953, pp. 190—191). Immigration has lately been increasing in certain parts of Araucarilandia, thus prejudicing the continuance of forestry in large areas (*cf.* JAMES 1953, p. 303, see also *Brasil constroi* V: 10, p. 42). The increase in settlement, however, has also advantages. Thus it creates a local market for timber, guides traffic and transportation facilities to new regions, and provides a forest labour force.

One of the most important guideposts for forest policy is forestry legislation. The forestry laws of the Brazilian states differ greatly from each other. A common feature is that they date back to about 1900. In those states where forest devastation has been most extensive the legal provisions have been carried rather far. Yet they have been in many cases unable to prevent devastation. Hence it seems that at least the preventive laws have little effect (LEHOTZKY 1953, pp. 191—194).

The mere content of the laws does not assume sustained or progressive yield forestry. The only provision on sustained yield attempted in some state forest laws is concerned with the proportion of land area to be maintained in forestry. The most detailed laws are found in the state of Sâo Paulo, where 10 per cent of the area of agricultural land holdings of 100 hectares and over should, according to the 1928 law, be kept in forestry (SOUZA 1935, p. 202, *cf.* LEHOTZKY

1953, p. 192). In Paraná and Rio Grande do Sul exploitation is restricted only in the so-called protection forests along big rivers and railroads in belts of 2—5 kilometres in width (Souza 1935, pp. 244—245, 325—326, 330, 333, 345; see also Lehotzky 1953, p. 194). Here the cutting is supposed to be confined to annual growth in order to secure a continuous supply of fuel for steam ships and locomotives. Also, it is thus endeavoured to prevent soil erosion. In Santa Catarina as well, the settlers have to maintain a certain proportion of their land holdings in forestry. For land holdings of 30 hectares and over this proportion is at least 5 per cent (Souza 1935, p. 296, Lehotzky 1953, p. 195). In Rio Grande do Sul one third or one half of the area is to be maintained in forestry, depending on how large an area of stocked or cut-over forest land in each case is available for a new farm.

A feature common to the forestry laws in Paraná, Santa Catarina and Rio Grande do Sul is that they endeavour to fix a lower limit for cuttings and to control the quality of sawnwood. According to them, the cuttings should satisfy sawnwood requirements in both quantity and quality. With a view to complying with this provision in Paraná, the felling of Paraná pines of less than 35 cm in diameter at breast height was prohibited in 1929. Moreover, the cutting period was restricted — with certain exceptions to the months from May to August (Souza 1935, pp. 277—278). Similar provisions are to be found in other states (see Lehotzky 1953, p. 195, *cf.* Souza 1935, p. 327).

A strict observance of the existing laws would obviously have saved many areas from devastation. In Lehotzky's opinion (1953, p. 197) the most likely reason for failure is that the laws may have been too advanced for the circumstances. The greatest problem has been how to obtain funds for the salaries of qualified personnel to supervise the enforcement of the laws. These duties have been assigned to administrative units with little interest in and ability for carrying them out. Hence the effect of forestry laws in the most important Paraná pine areas falls far short of that formally provided in the laws (*cf.* Dansereau 1947. p. 274).

The centralization of forest administration in 1934 removed some of the handicaps of forestry legislation. Yet the passing of the so-called *Codigo Florestal (Decreto N.* 23.793 . . . 1935, pp. 500—516) did not change forestry practices to any appreciable extent. But this law concerns private forests in the country as a whole, thus increasing the rôle of the federal government in Brazil's forest policy.

The absence of clear provisions for sustained yield in the forestry laws of the states with the most abundant Paraná pine resources would seem to be an essential factor in determining the future trends in Paraná pine stumpage. The fact that the cuttings should be large enough to satisfy the needs not explicitly defined in the laws may tend to hamper the achievement of a sustained yield policy.

Inadequate transportation facilities in a large part of Araucarilandia might likewise accelerate the clear-cutting of accessible forests. The transport roads then are extended farther like mining tunnels as the raw material becomes exhausted. This phenomenon has become established also elsewhere with the clear-cutting advancing in concentric zones (*cf.* Collardet 1951, p. 251).

Hueck (1952, p. 278) states that in 1938—52 in Paraná alone about 4.8 million hectares of forest were clear-cut, half of which was forested by the Paraná pine. In 1945, the saw-mills in Rio Grande do Sul used over 0.5 million cu.m. (solid measure), those in Santa Catarina nearly 0.6 million cu.m., and in Paraná almost 0.9 million cu.m. of roundwood (excl. bark) (Hueck 1952, p. 288). Obviously the cuttings have since increased considerably, as the figures on Paraná pine exports below would indicate *(Economic Survey . . .* 1951, p. 328).

Value of the Paraná pine exports at 1937 prices, 1,000 Cruzeiros

	Annual means			Percentage increase as compared with	
	1925—29	1945—49	1949	1925—29	1949
Parana pine	21 554	109 061	99 740	406.0	362.7
Other species	8 483	27 234	27 838	221.0	228.2

Apart from a rise in the amounts of timber cut, Table III (p. 34) shows that the largest consumer of coniferous timber in Brazil is industry. From table 2 it may be inferred that sawmilling and the plywood industry use at least 90 per cent of the total industrial coniferous wood consumption. Yet the proportion of fuelwood in total coniferous wood consumption in Brazil is larger than that in other coniferous regions in South America (see Table III, p. 34).

Data on reforestation are scattered. *Instituto Nacional do Pinho*, established in 1941, has assumed the task of taking care of Paraná pine forests, developing extraction methods and introducing regeneration. Certain results in planting are to be seen, but it is difficult to assess their significance[1] (see *e.g.* Hueck 1952, p. 288, Paula 1951, p. 315, *Possibilities for the Development . . .* 1954, p. 35). In the leading forestry countries of the world attempts have long been made to gauge the amount of timber to be cut in given future periods to permit a predetermined development of the growing stock. The variation of allowable cut as a function of age, growth, *etc.* is familiar to forestry experts, but the application of this knowledge to Paraná pine forests is impossible in the absence of relevant mensurational data. But this is not the real bottleneck in developing Paraná pine forests. More essential is the fundamental question of resource allocation. If it is comparatively more advantageous to keep soil, capital and

[1] The area planted by 1953 was about 4,500 hectares (*O relatorio Rogers . . .* 1953, p. 360).

labour in the production of coffee, cotton and cocoa than in forestry, there cannot be any economic logic behind the allowable cut calculations. Of course, we do not wish to belittle their significance from the mere forestry point of view.

Table 2. The amount of coniferous saw and veneer logs, logs for sleepers, and pulpwood cut from the Brazilian forests in 1946—60.

Year	Saw and veneer logs and logs for sleepers	Pulpwood
	1,000 cu.m. (solid measure) roundwood excl. bark	
1946	2,205	82
1947	2,590	103
1948	2,515	130
1949	3,035	160
1950	3,120	170
1951	3,200	180
1952	3,400	190
1953	3,600	110
1954	. .	. .
1955	9,500	400
1956	8,000	400
1957	7,400	400
1958	7,100	400
1959	7,100	400
1960	. .	. .

Source: *Yearbook of Forest Products Statistics.*

A drastic reduction in the Brazilian coniferous forest resources is so evident that it can be established without accurate calculations. Therefore, in 1955 into the Brazilian Chamber of Deputies was introduced a bill according to which the cuttings of Paraná pine were to be gradually cut down by 1960 to the amount of domestic consumption, *i.e.* cessation of exports (*O problema exportaçao . . .* 1955, p. 231, *Timber Trades Journal* 13. 8. 1955, p. 70). The bill is motivated by the continuous rapid reduction of stumpage and the relatively small plantings. A more detailed motivation of the bill was done by Rogers (1954, p. 15), who estimated that the Paraná pine stumpage will be exhausted in about 40 years unless the cuttings are heavily curtailed. In other words, this estimate means that after that period — assuming present cutting trends — there will be wide cut-over areas and young Paraná pine stands in Araucarilandia. Agriculture may ultimately occupy a part of forest land, although, according to Rogers, such a development cannot be justified on merely agricultural grounds.

The growth rate of Paraná pine is considered to be almost double that of Scots pine, although estimates on it vary (see *e.g.* Paula 1951, p. 315, *Possibilities for the Development . . .* 1954, p. 34). In the province of Misiones in Argentina the plantations of this tree are reported to produce 230 cu.m. (solid measure) in ten years per hectare, which means an annual average of 23 cu.m. per hectare.

The regeneration of Paraná pine has in the main taken place artifically because of its poor natural regeneration[1] (Rogers 1954, p. 15, Weger 1954, p. 328, *Unasylva* 1955, p. 141). Even so the Paraná pine resource can be saved from devastation by adopting a sustained yield concept more restrictive on the cuttings. A more complete utilization of wood would also mean a reduction in cuttings. In the 1950s, only about 46 per cent of the volume cut was processed by industry, while 54 per cent was burned as fuel and/or decayed in logging waste (Paula 1954, p. 315).

There is only one such policy measure as would decisively change the trends in the Paraná pine stumpage: the passing of a law in accordance with the bill which assumes termination of Paraná pine exports. The adoption of sustained yield management would at least temporarily curtail the industrial timber market, as an example from Mexico suggest (see *The Economic Development . . .* 1953, pp. 170, 245).

In Misiones forest exploitation seems to follow the principle of sustained yield more closely than in Brazil. Thus the interest in the regeneration of the Paraná pine there is considerable. The Argentine government gives both private people and companies long-term credit for this purpose through *Banco de la Nacion Argentina* and outlines planting programmes (*Unasylva* 1955, p. 141). In terms of the entire Paraná pine problem, however, any measures taken in the small areas in Misiones have little significance to the development of the Paraná pine resource as a whole. Doubts have also been expressed as to the biological suitability of Paraná pine under the present circumstances in Misiones (see Ragonese *et al.* 1952, pp. 73—78).

213 Other Coniferous Species in South America

213.1 Araucaria araucana

The other South American conifers represent smaller economic values than Paraná pine. This remark applies mainly to their occurrance in smaller stands, mostly in inaccessible areas. These species are reviewed here one by one, but no effort is made to put them into any order of importance.

A close relative to Paraná pine is *Araucaria araucana*. This tree reaches a height of 30—45 metres, in exceptional cases even more, with a breast-height diameter of 1—1.5 metres. When grown in an open space, the trunk is covered

[1] Dansereau (1947, p. 273) regards the natural regeneration of Paraná pine as being good in its own climatic zone, which he does not, however, demonstrate.

half-way by branches, but in dense stands the branches are concentrated in the crown comprising a third of the trunk length. The yellowish even-grained wood is used in housing construction in almost all structures, in joinery for doors, window frames, furniture, *etc.* (see Bernath 1937, p. 22, *cf. Madereras de Chile . . .* 1953, p. 2).

Araucaria araucana has two distinctly different geographical ranges, one of which is in the coastal Cordilleras between 37° 20′ and 38° 40′, and the other on the Andies between 37° 50′ and 39° 40′ (s.lat.) (see Bernath 1937, p. 21, *cf.* Stein 1956, p. 159). This species occurs in both Argentina and Chile.

Bernath (1937, p. 22) estimated the Chilean *Araucaria araucana* resource at 243,000 hectares, with 89 stems per hectare, on the average. He estimated the corresponding growing stock at about 34.5 million cu.m. (solid measure, excl. bark). A majority of the stands formed by this species, however, are thinner than the above average and situated in inaccessible mountains (*cf.* Elchibegoff 1941, p. 357).

The exploitation of *Araucaria araucana* is concentrated in the provinces of Malleco, Arauco and Gautin (*Madereras de Chile . . .* 1953, p. 2). This species has comprised the bulk of the Chilean coniferous timber exports and, in 1951—53, it comprised about 16.5 per cent of total timber exports from Chile (*La madera . . .* 1954, p. 31). Its proportion of total cuttings in 1951—53 was about 7.5 per cent, *i.e.* 1 per cent less than that of *Pinus insignis* (*La Madera . . .* 1954, p. 11).

213.2 Podocarpus sp.

Coniferous species belonging to the *Podocarpus* genus (*e.g. P. nubigenus, P. chiliana, P. andinus*, see Record *et al.* 1947, p. 24, Bernath 1937, pp. 19—20, Hueck 1954, p. 4) grow in the zone extending from southern Mexico to Chile and Argentina, following the South American Cordilleras in the western part of the continent. They do not in general form pure stands or uniform geographical ranges. They occur in a scattered fashion, seldom in majority in mixed stands. Among commercially valuable species only one, *P. Guatemalensis*, occurs in lower altitudes; others, like the South American conifers in general, grow on highlands and mountains (Record *et al.* 1947, p. 24). Since the geographical range of these species is broad, their popular nomenclature is highly varied. Similarly, there is some variation in scientific names, so that it is not always easy to determine whether the names used in different sources refer to different species or the same.

The *Podocarpus* genus as a whole is more significant to the local market than to timber exports. In countries near the equator, such as Venezuela, Colombia, Ecuador and Bolivia, where coniferous timber is a scarce commodity, this genus

satisfies most of the need for coniferous timber. In Ecuador it is the only conifer (Solis 1939, p. 3).

213.3 Saxegothea conspicua

A species much like *Podocarpus*, belonging to the same family, is *Saxegothea conspicua*. Its commercial and popular nomenclature thus consists largely of the same names as that of *Podocarpus* (see Bernath 1937, pp. 21—20). Its geographical range begins in the Rio Maule rain forests in Northern Chile, extending to 45° (s.lat.). The timber is used for purposes similar to those of *Podocarpus*. The number of technically valuable trees per hectare is often too small to permit economic exploitation. In any case, its significance, does not extend beyond the local market.

213.4 Fitzroya cupressoides

The best technical properties among the Chilean conifers are said to be found in a species reminiscent of the Californian redwood *(Sequoia gigantea)* — *Fitzroya cupressoides*. This tree attains a height of about 30, sometimes even 50 metres. The breast height diameter varies with site from 1 to 3 metres. The growth is slow and may continue up to 1,000 years (Bernath 1937, pp. 24—26).

The wood of *Fitzroya cupressoides* is even-textured, straight-grained, less solid than, for example, *Populus nigra*, strong and flexible in comparison to its weight. The white sapwood is not used, but the red heartwood is valuable because of its exceptional durability under varying circumstances. This species is cut throughout its range, but logs are not often transported to the mill. Instead, the local forest workers make boards by splitting the trunk with the aid of hardwood wedges. The timber thus converted is carried by manual labour over hardly penetrable paths to the local market. Despite the high intrinsic value of the wood, its economic exploitation is difficult because of poor access to its growth sites.

The geographical range of *Fitzroya cupressoides* extends from the north near the town of Valdivia (39° 45′ s.lat.) to the south near Rio Futalelfŭ (43° 29′). It is typically a species thriving on marshy lowlands, but is found also in higher altitudes, as in Isla de Chiloe and Aysen (Patagonia). A unique feature among the Chilean conifers is that this species forms almost pure stands over areas of thousands of hectares. But its proportion in Chile's total forest area in the province of Llanquihue — optimal range for *Fitzroya* — is no more than 5 per cent (Zon *et al.* 1923, p. 744). In 1951—53 it comprised about 2.5 per cent of Chile's timber exports (volume) and, in 1950—53, less than 1 per cent of total cuttings *(La madera . . .* 1954, pp. 11, 31).

213.5 Libocedrus chilensis; Pilgerodendron uviferum

Conifers belonging to the *Libocedrus* genus occur in different parts of the world. Only one of them, *Libocedrus chilensis,* is found in South America. In this context, we also deal with *Pilgerodendron uviferum*, which, by some botanists, is not considered as a separate genus (see BERNATH 1937, pp. 22—24, RECORD *et al.* 1947, pp. 9—10).

Both the appearance and technical properties of *Libocedrus chilensis* remind one of *Thuja occidentalis.* The wood is extremely durable against organic damages, but its strength properties are inferior. It occurs in the Andies and Cordilleras (in Chile and Argentina) between 34° 25′ and 44° (s.lat.). Quite frequently it occupies growth sites not suitable for other species. Poor access to the stands makes it commercially insignificant.

Pilgerodendron uviferum is so much like *Libocedrus* that it was for a long time regarded as the same species. It was not until 1930 that FLORIN (1930, pp. 132—135) suggested a different genus for *Pilgerodendron.* Geographically it ranges from 40° (s.lat.) to Tierra del Fuego, including certain islands and archipelagos. The technical properties of the wood are appreciated among the local population. It is used in floors, doors, furniture, *etc.* (see BERNATH 1937, pp. 22—24, RECORD *et al.* 1947, p. 10).

One old source gives the proportion of forest area in Llanquihue of both of the above species as 10 per cent of total forest area (ZON *et al.* 1923, p. 744).

22 Pinus insignis

221 General Characteristics

Apart from Paraná pine, the conifers indigenous to South America have little significance in regard to a growing timber economy. There is, however, an imported coniferous species, *Pinus insignis (= Pinus radiata)*, Monterey pine, which is biologically promising.

Pinus insignis comes from California in the United States, where its range and commercial value are insignificant. It was imported to Chile as late as 1885, and a few years later a coal mining company established plantations near the town of Concepcion. Ever since, and especially since 1938, this tree has been planted over wide areas (HARTMAN 1955, p. 140, *cf.* RECKE 1954, p. 191).

The volume weight of *Pinus insignis* with a 15 per cent moisture content is 500 kg/cu.m. It varies, however, within a wide range according to growth and the part of trunk represented (*op.cit., cf.* REID 1950, p. 6). The laboratory tests carried out with 30-year-old Monterey pine show that its strength properties are good. Thus resistance to bending and abrasion exceeds that of Scots pine. It is to be noted, however, that the sawnwood actually obtained from young *Pinus insignis* stands has much more knots than that used in the laboratory tests (HARTMAN 1955, pp. 140—142). Yet the knowledge of the strength properties of this species hitherto shows promising prospects where appropriate silvicultural techniques are adopted (*cf. Unasylva* 1956, p. 143).

Pinus insignis sawnwood can easily be dried both in the kiln and in the open. Fresh sawnwood becomes blue-stained rapidly, but this difficulty can be overcome. It does, however, restrict its utilization in certain end uses: it adapts better to interior finishing and covered structures than to surfaces exposed to variations in weather. The sapwood, in particular, is susceptible to tungus attack.

222 Factors Determining the Future Development of Pinus insignis Forests

Assuming that *Pinus insignis* is technically adequate in competition with other coniferous species, the future extent of the forests formed by this species will in the main depend on the following factors:

1. Public and private forest policy;
2. Biological adaptability of *Pinus insignis*;
3. Afforestation cost as compared with yield.

1. In Chile, where the plantations of this tree are concentrated, public and private forest policy are favourable to a continued expansion of afforestation. Thus the state has established a number of nurseries which provide planting stock at a low price (HARTMAN 1955, p. 143). Plantations are exempted from taxation for 30 years from their establishment. This has been a considerable stimulus for planting activity (RECKE 1954, p. 191). As a result, many of the plantations belong to private farms and companies. Still more active have been several planting corporations. The interesting practice of these is to plant large areas and offer them for sale to those who seek secure and profitable investments (HARTMAN 1955, p. 143). Credit is provided for about five years. It is generally admitted that this »deposit bank» method has greatly contributed to the creation of plantantions (*cf.* GILMOUR 1946, p. 191).

A forestry financing company, *Capitanac,* has been founded for financing private forestry. This company urges investors to avoid the risk of inflation to cash capital by monthly or half-yearly installments paid on afforestation bonds. A certain amount of sawnwood is guaranteed to the investor after a certain number of years (*Journal of Forestry* 1948, p. 686).

Apart from private sources of finance, government agencies have efficiently participated in afforestation. Among the most important of these are *Corporación de Fomento de la Producción (CORFO)* and several social security organizations *(»Cajas»)* (HARTMAN 1955, p. 143). Also, the Forest Service is active in planting. Indeed, one of the most outstanding plantations was established by Forest Service in the province of Maule, where the fixation of dunes by Monterey pine was initiated almost 60 years ago. The expansion of this plantation will result in a considerable increase of forest area during the coming decades.

The present total area of *Pinus insignis* plantations in Chile may approach 0.5 million hectares. At the beginning of 1950s it was about 300,000 hectares *(Possibilities for the Development* . . . 1954, p. 54). The major portion of plantations are in the so-called Concepción region where their distribution by provinces about 1950 was as follows:

Province	Hectares
Linares	4 400
Maule	34 700
Nuble	25 800
Concepción	82 900
Bio-Bio	30 000
Arauco	17 900
Malleco	15 700
Total	211 400

HARTMAN (1955, p. 144) gives the above area as about 173,500 hectares and the area of plantations in the other provinces as about 15,000 hectares. The difference between these estimates may be due to different dates of the inventories. *Pinus insignis* accounts for about 80 per cent of the total afforested area in Chile (*Aspectos* . . . 1953, p. 1).

Since the most important habitation centers using sawnwood, with about one half of Chile's population (WAGEMAN 1954, p. 31, GONZALES 1954, p. 39), are at a distance of 700—900 kilometers from sawnwood production areas, the railway transport rates for *Pinus insignis* sawnwood have been fixed lower than those for most of the other species (WAGEMAN 1954, p. 33). The long-distance reduction also is greater (*El tarifado ferroviario* . . . 1954, p. 9).

2. Biologically *Pinus insignis* possibly meets the most ambitious expectations. This species has been planted from the province of Valparaiso in the north (32° 40′ s.lat.) to Llanquihue in the south (42° s.lat.) (HARTMAN 1955, p. 142). These seven provinces, however, form a distinctly optimal region; the Monterey pine thrives best in regions with heavy winter rains. But it has been successfully planted also on sandy soils where heavy erosion after a few wheat crops had taken place. Thus its significance extends beyond forestry.

The average annual growth of *Pinus insignis* is about 20 cu.m. (solid measure, excl. bark) per hectare, but it can exceed 25 or 30 cu.m. (HARTMAN 1955, p. 144, *cf.* GILMOUR 1946, p. 192, RECKE 1954, p. 191). The diameter at breast height at 30—35 years of age can be about 0.5 metres. Regeneration after the first seed-tree cutting has been successful.

With due regard to many factors, the Chilean afforestation programmes concentrate on *Pinus insignis*. Among the hazards of such a bias has been mentioned the possibility of an attack by an epidemic forest injury. There has been no such attack to date, but the establishment of mixed stands has been claimed (HARTMAN 1955, p. 144, *cf.* RECKE 1954, p. 191).

3. Even by South American standards the afforestation cost is low. HARTMAN (1955, p. 143) presents three different estimates of the land value and planting cost:

	Minimum	Median	Maximum
		Pesos/ha[1]	
Land value	3,000	7,000	15,000
Planting cost	4,000	7,500	15,000

[1] US-$ 1 = 200 Chilean pesos (official rate of exchange)
» 1 = 280—300 » » (free » » »)

RECKE (1954, p. 191) has presented a somewhat different estimate:

	Pesos/ha
Land	3,000—4,000
Seedlings and planting	5,000
Net return without administration cost in 25-year rotation	500,000

23 Factors Affecting Economic Accessibility of Coniferous Forests in South America

Many of the conclusions about the South American timber potential may be overestimates. A large proportion of the forests at present are inaccessible to industry.

By inaccessible forests are meant forests, whether or not potentially exploitable, which are not yet within reach of explotation because of lack of a transportation system. Accessible forests thus are those within reach of explotation by existing waterways, roads, railways, or other means of transportation, or to which movable cableways can be constructed (*World Forest Inventory 1958* 1960, p. 123).

Sawmilling being the principal outlet for coniferous timber in South America (*cf.* Table 2, p. 16), we shall concentrate our attention on factors influencing the accessibility of sawlog stands. We must then recognize that any reduction in costs from the stump through the mill process to the market increases the amount of accessible forests.

There are indications that, for five years following the Second World War, the supply of Paraná pine for exports was on the increase (RIIHINEN 1957, p. 23). This gives rise to the assumption that the unit cost of sawnwood in Brazil declined from its wartime level. The reduction in costs may have been in part due to new imported machinery installed to replace the old (GILL 1947, p. 31). Since the war, also, simple wood industry machinery has been manufactured in Brazil (KLUG 1951, pp. 15—16). However, as late as 1950, the sawmilling cost seems to have accounted for a comparatively large proportion of the sawnwood price at the mill. At a certain mill with a distance of 35 kilometers to the railroad and another 235 kilometers to the harbour, the sawmilling and storaging costs together comprised 73 per cent of the price at the mill (*Conjunctura . . .* 1951, p. 12). Raw material thus accounted for no more than 27 per cent. The interpretation of these figures is difficult, because they are inversily proportional relative measures. In 1952—53 in Finland stumpage price alone accounted for 50—77 per cent of the mill price of spruce boards (*Maatalousväestön taloudellista asemaa . . .* 1957, p. 30).

More significant than the structure of cost price at the mill is the fact that, in 1950, the latter comprised only 39 per cent of FOB cost price. The proportion of transport costs of this was 29 per cent and that of miscellaneous costs arising at the harbour about 32 per cent (see *Conjunctura . . .* 1951, p. 12). In 1950—53, in Finland, the stumpage price alone comprised 32—45 per cent of the export price for battens (*Maatalousväestön taloudellista asemaa . . .* 1956, p. 41).

The poor transport efficiency of railroads in Brazil, as in most South American cointries, may in part explain the high cost of transport (see HANSON 1950, pp. 316—324, STERNBERG 1955, pp. 488—489, *etc.*). GILL (1947, p. 31) cites an example of a railway which, in 1947, had 20,000—25,000 car requisitions from sawmills alone. Transportation was 12—14 months behind the schedule. Right after the Second World War some of the Brazilian sawmills had to keep sawnwood in stock for as long as 2 ½ years. In the Paraná pine region the circumstances seem to have been worst. In 1947, at one time over 5,000 carloads of sawnwood were waiting for cars. Large quantities of sawnwood were spoiled because of slow transport.

A large part of the Paraná pine region, however, is still without a railway. It would be desirable to provide access for timber from inaccessible areas in order to avoid devastation of areas in the sphere of transportation (*cf.* p. 15, above).

Lack of railways also makes the companies resort to trucks in timber transport, although the cost thus becomes, on the average, 58 per cent higher than in railway transport (*Custo da produçao . . .* 1954, p. 359).

At the beginning of the 1950s in Chile the logging methods were still primitive. Thus felling and cross-cutting were done by ax and haulage to the long-distance transport road by bullock carts. Nevertheless the costs of extraction were low up to the piling stage of the sawnwood at the mill (KLUG 1950, p. 14). Two principal reasons for this are mentioned: 1. because of the seasonal nature of forest operations, there is no permanent corps of forest and sawmill workers, which tends to keep the wages lower than in the other industries; 2. the price for the right to cut is low: in general 4—10 dollars per hectare, or 25—30 per cent of sawnwood output, or a price obtained as a combination of these principles. A major portion of the costs are created in sawnwood transport. This is the main reason why the price of sawnwood in Santiago de Chile may be many times as high as that in the production areas (KLUG 1950, p. 15). The transport problem in Chile has also affected sawnwood exports. Thus the reduction of exports from 183,000 cu.m. (solid measure) in 1950 to 120,000 cu.m. in 1951 is said to have resulted mainly from the national transportation problem (RIVERA 1953, p. 2).

Productivity in the Chilean sawmills, however, has been on the increase since the middle of 1930s (see ELCHIBEGOFF 1941, p. 359). It must be borne in mind, on the other hand, that the number of small sawmills detrimental to overall productivity always increases as the building construction goes up.

The logging methods in Chile are in a state of revision. FAO, especially, has contributed to the adoption of more efficient tools and equipment since the early 1950s (*cf.* DUNN 1953, p. 134, *Unasylva* 1956, p. 9). Not merely costs, but also quality considerations speak for better logging practices. For example, rejection of two-wheeled bullock carts in log haulage would help to increase the average length of sawnwood which up to 1950s was only 10 ½ feet (HARTMAN 1955, p. 145, *cf.* *Forest Resources of Chile . . .* 1946, pp. 88—95).

3 Trends in Coniferous Timber Output, Trade and Consumption in South America

31 Trends in Brazil

There are only two commercially interesting coniferous timber regions in South America. One of these is the *Araucaria* region in Brazil, the other is in Chile. During the 1950s Brazil produced over 90 per cent of the total coniferous sawnwood output in South America, and Chile produced an additional more than 5 per cent.

The attempted cessation of Paraná pine exports from Brazil (see p. 16, above) does not seem to have affected later exports. On the contrary, we note from Table VI that the level achieved in both production and exports of Paraná pine sawnwood at the beginning of the 1950s was maintained through the decade. This observation may not conform to that made from Table 2 (p. 16, above), which suggests a drastic upsurge in the cuttings of saw and veneer logs and of logs for sleepers in the middle of the 1950s. There are at least two possible reasons for this jump: (a) the cuttings of veneer logs or logs for sleepers or both have heavily increased; (b) the saw log cuttings prior to 1955 have been reported too small, which is the most likely reason. It would therefore seem that the Paraná pine cuttings for industrial wood have not essentially changed during the 1950s. Table V (p. 36, below) shows that, since the beginning of the 1950s, the major country components of the Brazilian coniferous sawnwood exports have maintained their magnitude. Neither has there occurred any major change in the output or exports of broadleaved sawnwood during the same period (see *Yearbook of Forest . . .*). Hence it can be concluded that the Brazilian coniferous sawnwood production and exports have stabilized at a level which is far beyond the provisions of the suggested bill (see p. 16, above). The Paraná pine resource will continue to diminish rapidly, unless vigorous regeneration measures on a large scale are adopted.

32 Trends in Chile

The Chilean coniferous sawnwood production and trade deals with rather small quantities. These are easily subject to large changes in the short term.

Chile has not yet enough technically well-equipped sawmills in order to increase the utilization of Monterey pine. Table VII (p. 39, below) shows, however, that the coniferous sawnwood production is on a slight increase. The same is not true for exports. The domestic consumption in Chile would therefore seem to have gained in importance.

As in Brazil, sawmilling provides the most important industrial use for conifers in Chile. It is to be expected, however, that other wood-using industries, notably the pulp and paper industry, will expand in some South American countries. The impact on coniferous forest resources of this expansion is still unforeseen.

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SELOSTUS:

ETELÄ-AMERIKAN HAVUMETSÄVAROJEN KEHITYS

Etelä-Amerikassa on vain kaksi kaupallisesti merkittävää havumetsäaluetta: Parana-mäntyalue Brasiliassa ja Montereyn mäntyalue Chilessä. Paranamänty (Araucaria angustifolia) on nykyisellä levinneisyysalueellaan luontainen, Montereyn mänty (Pinus insignis = P. radiata) sen sijaan on tuotu Californiasta.

Parana-mäntyvarat ovat pienentyneet huomattavasti hävittävien hakkuiden, uudistamisen laiminlyönnin, pellon raivauksen ym. seikkojen vuoksi. Etenkin kiertokaskiviljely ja kahvinviljelyn maantieteellinen siirtyminen ovat supistaneet havumetsävaroja. Hakkuiden jatkuessa 1950-luvun laajuudessa Paranamäntyvarat vähenevät huomattavasti, ellei metsän uudistus tule entistä yleisemmäksi.

Chilessä teollisuuden puute on myötävaikuttanut Montereyn männyn istutusten säilymiseen. Ne eivät ole vähentyneet toistaiseksi, vaan päinvastoin lisääntyneet sekä alaltaan että puustoltaan. Kansainvälisessä metsäntuotteiden kaupassa niiden merkitys on kuitenkin vähäinen.

Table I. Forest area in South America by countries

Country	Year	Accessible forests	Inaccessible forests	Total	Forests, per cent of land area		Forest area, ha per head	
		Million hectares			All forests	Accessible forests	All forests	Accessible forests
Argentina	1958	60	10	70	25	22	3.5	3.0
Bolivia	1938	6*	41*	47	43	5	17.9	2.3
Brazil	1958	140	422	562	66	17	8.9	2.2
Chile	1958	10	10	20	28	14	2.9	1.4
Ecuador	1958	5	10	15	33	10	3.7	1.1
Colombia	1958	21	49	69	64	19	1.7	5.1
Paraguay	1958	6	15	21	51	15	14.3	4.3
Peru	1958	15	55	70	56	12	6.8	1.5
Uruguay	1956	1	—	1	3.3		0.2	
Venezuela	1958	8	37	45	49	8.3	7.3	1.2
British Guiana	1957	4	14	18	84	17	35.2	7.0
French Guiana	1958	1	6	7	80	17	233.3	50
Surinam	1953	1	11	12	84	7	51.4	4.4
Falkland Islands	1948	—	—	—	—	—	—	—
South America		277	680	957	54	16	7.3	2.1

* Unofficial figures.
Source: *World Forest Inventory 1958.*

Table II. Distribution into coniferous, non-coniferous and mixed forests, and open areas of the forests in use in South America.

Country	Forest in use	Conifers	Non-conifers	Mixed woods	Open areas	Proportion of conifers
	Million hectares					Per cent
Argentina	10.2	(...0.2	 7	..........)	3	2
Bolivia	6.0*	—*	(... 6*	...... —*	..........)	—
Brazil	40.0	(...6.0	.....32.5	...... 1.5	..........)	17
Chile	4.6	0.5	1.1	3.0	—	15
Ecuador	0.3	—	(...0.3	....	..........)	—
Colombia	6.8	—	5.9	—	0.7	—
Paraguay	5.0	—	5.0	—	—	—
Peru	..	..	..	..	..	..
Uruguay	0.5	0.0	0.5	—	—	2
Venezuela	..	..	..	..	..	..
British Guiana	0.3	—	(... 0.3	—	...........)	—
French Guiana	0.0	—	(... 0.0	—	...........)	—
Surinam	0.0	—	(... 0.0	—	...........)	—
Falkland Islands	..	..	..	..	..	..
South America	75.0	6.7	59.8	4.5	3.7	11

* Unofficial figures.
Source: *World Forest Inventory 1958.*

Table III. Average annual removals in forests in use in South America.
(Includes branches; excludes stumps)

Country	Period	All removals: Total	All removals: Conifers	All removals: Non-conifers	Industrial wood: Total	Industrial wood: Conifers	Industrial wood: Non-conifers	Fuelwood: Total	Fuelwood: Conifers	Fuelwood: Non-conifers	Industrial wood as percentage of total removals
		1,000 cu.m., solid volume, without bark									Per cent
Argentina	1957	12,937	332	12,605	3,324	332	2,992	9,613	—	9,613	26
Bolivia	1951	7,534	—	7,534	134	—	134	7,400	—	7,400	1.8
Brazil	1955—57	102,053*	28,720*	73,333*	12,053*	8,720*	3,333*	90,000*	20,000*	70,000*	12
Chile	1958	4,095	841	3,254	2,095	661	1,434	2,000	180	1,800	51
Ecuador	1958	2,200*	—	2,200*	140*	—	140*	2,060	—	2,060	6
Colombia	1957	12,662	56*	12,606*	3,443	56*	3,387*	9,219	—*	9,219*	27
Paraguay	1955—56	1,972	—	1,972	422	—	422	1,550	—	1,550	21
Peru	1955—57	4,294	24	4,270	364	24	340	3,930	—	3,930	8
Uruguay	1958	1,192	48	1,144	85	48	37	1,107	—	1,107	7
Venezuela	1955—57	4,256*	—*	4,256*	289	—	289	3,967*	—*	3,967*	7
British Guiana	1955—57	333	—	333	205	—	205	128	—	128	62
French Guiana		..	..	..	..	..	..	..	..	..	..
Surinam	1955—57	332	—	332	132	—	132	200	—	200	40
Falkland Islands		..	..	..	..	..	..	..	..	..	..

* Unofficial figures.
Source: *World Forest Inventory* 1958.

Table IV. Distribution into ownership categories of accessible forests.

Country	Accessible forests	Publicly-owned forests: State forests	Publicly-owned forests: Other	Publicly-owned forests: Total	Private forests	Private forests: %
	1,000 hectares					%
Argentina	60,000	(... 30,000	.........)	30,000	30,000	50
Bolivia	..	..	..	..	......	..
Brazil	140,000	(... 74,000	.........)	74,000	66,000	47
Chile	10,077	3,000	—	3,000	7,077	70
Ecuador	4,500	..	..	..	..	..
Colombia	20,600	16,800	—	16,800	3,800	18
Paraguay	6,272	439	—	439	5,833	93
Peru	15,000	..	..	..	..	..
Uruguay	554	16	—	16	538	97
Venezuela	7,600	..	..	..	..	..
British Guiana	3,626	3,367	129	3,496	130	3.6
French Guiana	1,500	1,500	—	1,500	—	—
Surinam	1,000	1,000	—	1,000	—	—
Falkland Islands	—	—	—	—	—	—
South America	243,630	130,120	130	130,250	113,380	47

Source: *World Forest Inventory 1958.*

Table V. Exports of Paraná pine sawnwood from Brazil, 1935—1960.

1,000 cu.m., solid measure

Country	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946
Argentina	204.6	215.6	277.2	242.2	328.1	270.2	358.2	438.6	360.7	374.4	326.3	529.5
Uruguay	5.8	1.1	11.7	22.7	51.2	55.9	67.6	55.4	59.3	50.8	52.6	72.6
Other countries..	..	..	..	..	..	..	..	..	..	..	..	..
South America ..	210.4	216.7	288.9	264.9	379.3	326.1	425.8	494.0	420.0	425.2	378.9	602.1
United States ...	—	0.2	2.9	0.1	0.8	0.8	2.5	0.0	0.0	—	—	21.6
Canada	..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom.	0.2	2.2	17.0	5.3	13.1	76.8	45.6	22.2	26.2	42.2	15.1	9.4
Germany (Western)	6.8	18.0	16.6	77.9	108.7	—	—	—	—	—	—	—
France	—	0.3	0.1	—	0.6	1.2	—	—	—	—	—	—
Netherlands	—	0.3	—	0.6	1.0	0.8	—	—	—	—	—	4.5
Belgium-Luxemb.	0.1	1.5	7.0	5.3	4.3	—	—	—	—	—	—	25.0
Italy	—	—	0.7	—	—	—	—	—	—	—	—	6.0
Denmark	—	—	—	—	—	—	—	—	—	—	—	39.2
Creece	..	..	..	..	..	..	..	..	..	..	..	..
Other countries..	..	..	..	..	..	..	..	..	..	..	..	..
Europe	7.1	22.3	41.4	89.1	127.7	78.8	45.6	22.2	26.2	42.2	15.1	84.1
Union of S. Africa	0.4	1.2	8.8	5.2	4.9	4.1	14.2	18.8	6.9	0.3	3.7	28.2
Australia	..	..	..	..	..	..	..	..	..	..	..	..
Total	217.9	240.4	342.0	359.3	512.7	409.8	488.1	535.0	453.1	467.7	397.7	736.0

Country	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Argentina	599.4	789.8	510.8	400.6	552.6	344.3	410.7	264.0	662.0	300.9	958.7	862.0	420.5	534.5
Uruguay	63.4	72.0	63.4	70.9	76.2	88.3	88.8	126.6	96.2	97.2	78.0	65.4	39.2	78.5
Other countries	..	..	..	..	..	..	..	..	—	0.9	—	1.9	0.5	
South America	662.8	861.8	574.2	471.5	628.4	432.6	499.5	390.6	758.3	399.0	1036.7	928.8	459.7	613.4
United States	5.1	28.0	4.6	102.2	95.8	50.9	57.9	33.2	33.6	21.0	16.8	17.3	16.8	15.9
Canada	..	..	..	..	..	..	..	..	10.3	8.4	2.8	7.0	1.4	1.4
United Kingdom	41.7	18.1	7.6	161.9	181.7	96.2	230.3	192.0	196.2	107.9	183.1	85.5	205.1	146.7
Germany (Western)	—	—	—	4.1	16.4	14.5	42.0	54.7	50.9	33.6	—	35.0	67.7	69.1
France	—	—	—	0.1	1.9	7.0	2.3	3.7	3.3	2.8	2.3	0.9	1.4	2.3
Netherlands	22.3	0.2	—	1.5	2.8	2.8	10.7	10.7	10.7	6.5	14.5	7.5	15.9	11.2
Belgium-Luxemb.	16.6	3.8	3.8	6.7	25.2	7.9	14.0	18.2	16.4	7.5	20.6	5.1	17.3	15.9
Italy	11.8	—	—	1.8	5.1	8.9	5.1	4.7	3.3	1.9	0.5	3.7	—	1.4
Denmark	0.5	—	—	—	—	—	—	1.9	—	—	—	—	—	1.9
Creece	..	..	..	..	..	..	..	..	0.9	—	—	0.5	—	0.5
Other countries	..	..	..	..	..	..	..	..	4.2	5.6	7.0	18.2	7.0	6.1
Europe	92.9	22.1	11.4	176.1	233.1	137.3	304.4	285.9	285.9	171.0	227.5	156.5	312.1	255.1
Union of S. Africa	9.3	14.0	8.8	11.1	14.9	4.2	8.9	6.1	5.6	3.3	2.3	2.3	2.3	1.4
Australia	—	14.7	20.2	51.8	97.2	5.1	35.5	26.6	19.6	18.2	8.9	2.3	5.6	35.5
Total	770.1	940.6	619.2	812.7	1069.4	630.1	906.2	742.4	1113.8	626.0	1302.6	1116.1	798.9	924.6

Source: 1935—50: *Conjunctura* . . . 1951, pp. 17—35.
1951—60: *Yearbook of Forest Products Statistics.*

Table VI. Output of Paraná pine sawnwood in Brazil and its exports, 1946—1960.

Year	Output	Exports	Exports / Output
	1,000 cu.m.		Per cent
1946	1,574	736	46.8
1947	1,811	770	42.5
1948	1,757	941	53.6
1949	2,124	619	29.1
1950	2,319	813	35.1
1951	3,130	1,069	34.2
1952	3,210	630	19.6
1953	3,032	906	29.9
1954	3,494	755	21.6
1955	3,710	1,114	30.0
1956	3,074	626	20.4
1957	3,252	1,356	41.7
1958	3,560	1,116	31.4
1959	3,205	799	24.9
1960	..	925*	..

* Unofficial figure.
Source: *Yearbook of Forest Products Statistics.*

Table VII. Output of coniferous sawnwood in Chile and its exports, 1945—1954.

Year	Output	Exports	Exports / Output
	1,000 cu.m.		Per cent
1945—46	75	1[1]	1.3
1946—47	61	26	42.6
1947—48	75	28	37.3
1948—49	93[2]	35	37.6
1949—50	80	66	75.0
1950—51	84	59	70.2
1952	70	28	40.0
1953	116	62	53.4
1954	252	102	40.5
1955	126	96	76.0
1956	206	95	46.4
1957	159	26	16.5
1958	..	49	..
1959	294	52	17.8
1960	458*	11*	2.3

[1] Includes broadleaved sawnwood
[2] Includes boxboards
* Unofficial figures
Source: *Yearbook of Forest Products Statistics.*