

DENDROCHRONOLOGICAL STUDIES IN NEW ZEALAND

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Introduction

J. Golson (1955) has pointed out the possibilities of applying tree-ring dating to the solution of problems in New Zealand chronology. Several factors suggest that this method may be especially fruitful: 1) the time span of New Zealand prehistory is relatively short and is sufficiently recent so that master charts of only 200 to 300 years would be useful in dating archaeological materials, 2) there is an abundance of well preserved wooden artifacts available in the museum collections, and, 3) there should be adequate samples of old living trees within forest reserves or unsettled areas for the preparation of a master chart.

In the Spring of 1955, the Wenner Gren Foundation for Anthropological Research granted financial aid to the senior author to investigate the possibilities of applying dendrochronological methods in New Zealand. The research work was carried out in the period from August, 1955 to May, 1956. During this time a number of persons contributed time and information to the project. Acknowledgment is especially due to Messrs. Vic Fisher, Auckland Institute and Museum at Auckland; Roger Duff, Canterbury Museum at Christchurch; and Leslie Lockerbie, Otago Museum at Dunedin. Interviews and consultations were conducted with numerous botanists and foresters in an effort to secure background data and information on current research. Among those consulted were the directors and staff members of the New Zealand Forest Products Laboratories at Auckland, the New Zealand Forest Service at Wellington, and the Forest Research Institute at Rotorua.

A survey of the literature published in New Zealand indicates the paucity of research in dendrochronology. Lockerbie (1950) presented an estimated minimum age for some middens in Otago on the basis of average tree growth rate measurements. Oliver, at an earlier date (1931), suggested an age of more than 500 years for a Maori oven on the basis of an estimated growth rate of a large totara. Batley (1956) has studied scars on a number of mutilated trunks of totara to determine the date of bark removal. The Maori used tree bark for a number of purposes and many such mutilated trees are still growing. By ring counts of wood formed after bark removal, Batley has been able to estimate the approximate date for the scar.

Systematic tree-ring studies are beginning in this area, but most basic research concerned with tree growth and the various factors which influence tree growth have been neglected. Information which would be useful in dendrochronology, such as studies of annual rings, the formation and cause of false rings, duration of growing seasons, effects of rainfall, temperature, and runoff upon growth, is not available. The studies that have been made are limited, being chiefly confined to the "exotic" timbers imported from North America. Consequently, studies of the native New Zealand timbers remain a matter for the future. This deficiency in available botanical information has been a handicap to exploratory dendrochronological studies.

New Zealand Trees

Initial studies constituted an examination of a number of New Zealand timbers to see what species appeared to be most useful for tree-ring analysis. The following species were examined:

<i>Agathis australis</i>	Kauri
<i>Beilschmiedia tawa</i>	Tawa
<i>Corynocarpus laevigata</i>	Karaka
<i>Dacrydium cupressinum</i>	Rimu
<i>Elaeocarpus dentalus</i>	Hinau
<i>Knightia excelsa</i>	Rewa Rewa
<i>Laurelia novea-zelandiae</i>	Pukatea
<i>Litsea calicaris</i>	Mangeao
<i>Metrosideros robusta</i>	Rata
<i>Nothofagus menziesii</i>	Tawhai
<i>Olea cunninghamii</i>	Maire
<i>Paratrophis microphylla</i>	Towai
<i>Podocarpus dacrydioides</i>	Kahikatea
<i>Podocarpus ferrugineus</i>	Miro
<i>Podocarpus hallii</i>	Totara (Hall's)
<i>Podocarpus spicatus</i>	Matai
<i>Podocarpus totara</i>	Totara

Of this group, the kauri (*Agathis australis*) and totara (*Podocarpus hallii* and *P. totara*) appeared to offer the best possibilities. These were selected for several reasons: 1) the ring records are relatively clear, 2) the trees have a long life span so that it is possible to obtain lengthy ring records, 3) growing stands of these species are available for study, and, 4) both were utilized by the Maori, especially the totara. The kauri is restricted in its distribution, but grows to a much larger size and hence should produce longer ring records, providing the ring widths are generally much the same in size. The totara, more widely distributed if both species are considered, was preferred by the Maori for construction or carving; its life span is shorter, however.

Kahikatea (*Podocarpus dacrydioides*) and matai (*Podocarpus spicatus*) may offer possibilities, but were not fully investigated. Most of the other species appear unusable because of poorly defined rings, short records, eccentric or irregular growth, complacency, habitat, or some other feature associated with the trees of these species.

Collection of Specimens

Wood specimens were collected from four major localities on the North and South Islands. These were in the area around Auckland, including the Waitakere Reserve, and the Mt. Egmont region of Taranaki on the North Island, the Banks Peninsula in Canterbury and southern Otago on the South Island (see Figure 1).

Specimens were selected in the field according to principles already established in the United States (Glock, 1937); all specimens, together with their associated data, remain in the collections of the Auckland Institute and Museum at Auckland, New Zealand.

Analysis of the Specimens

A study of the various specimens by the use of skeleton plots and comparisons on the actual wood indicate that only a few samples from the Auckland area crossdate. It was not possible to crossdate specimens from Taranaki, Canterbury, or Otago; no similarities in growth patterns could be established between any two trees.

Within the Auckland district, specimens of kauri, totara, and white pine reflect similar growth patterns over a period of years. The patterns for kauri differ from those contained in the totara, although the totara and white pine are similar.

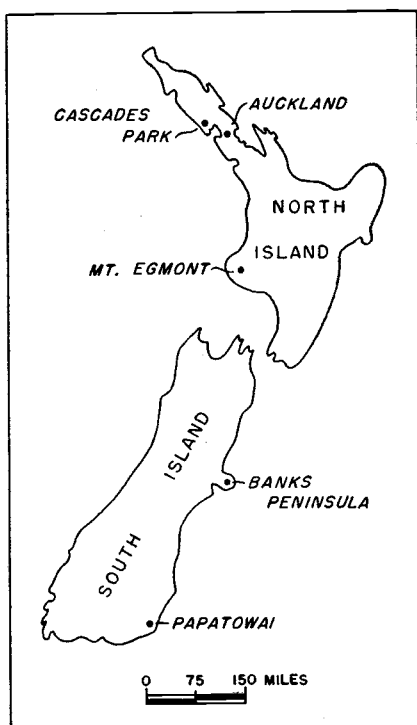


FIGURE 1. Outline map of New Zealand showing localities where tree-ring specimens have been collected.

Comments and Discussion

Crossdating of several kauri specimens from the Cascades Park area, about 20 miles north of Auckland, is indicated by the examples shown in Figure 2 (A). This suggests that it may be possible to build a master chart using kauri for dating archaeological materials. The kauri ring records are fairly clear, double rings are not especially troublesome, and trees with a long ring record can be obtained.

Two groups of totara exhibit similar growth patterns: one group is from the McKenzie area about 15 miles north of Auckland, Figure 2 (B), the other from the Auckland Domain in the city of Auckland, Figure 2 (C). Although these two groups are no more than perhaps 15 miles apart, different patterns are indicated for the two areas. This suggests that two tree-ring growth areas are involved, and that a separate master chart would be needed for each locality. With effort and careful selection of specimens, it may be possible to construct a master chart based upon totara. The totara ring patterns are difficult to read, however, confused by false rings, commonly distorted in growth, and often lacking in circuit uniformity. Work with totara should proceed by use of complete cross-sections rather than increment borings to facilitate detection of erratic growth.

Although little work was done with white pine, specimens examined indicate that further study should be done. One specimen crossdates with totara, suggesting that both species could be used for the construction of a single master chart which would apply to either tree. Moreover, the oldest ring record obtained (1438 to 1955) is a specimen of white pine.

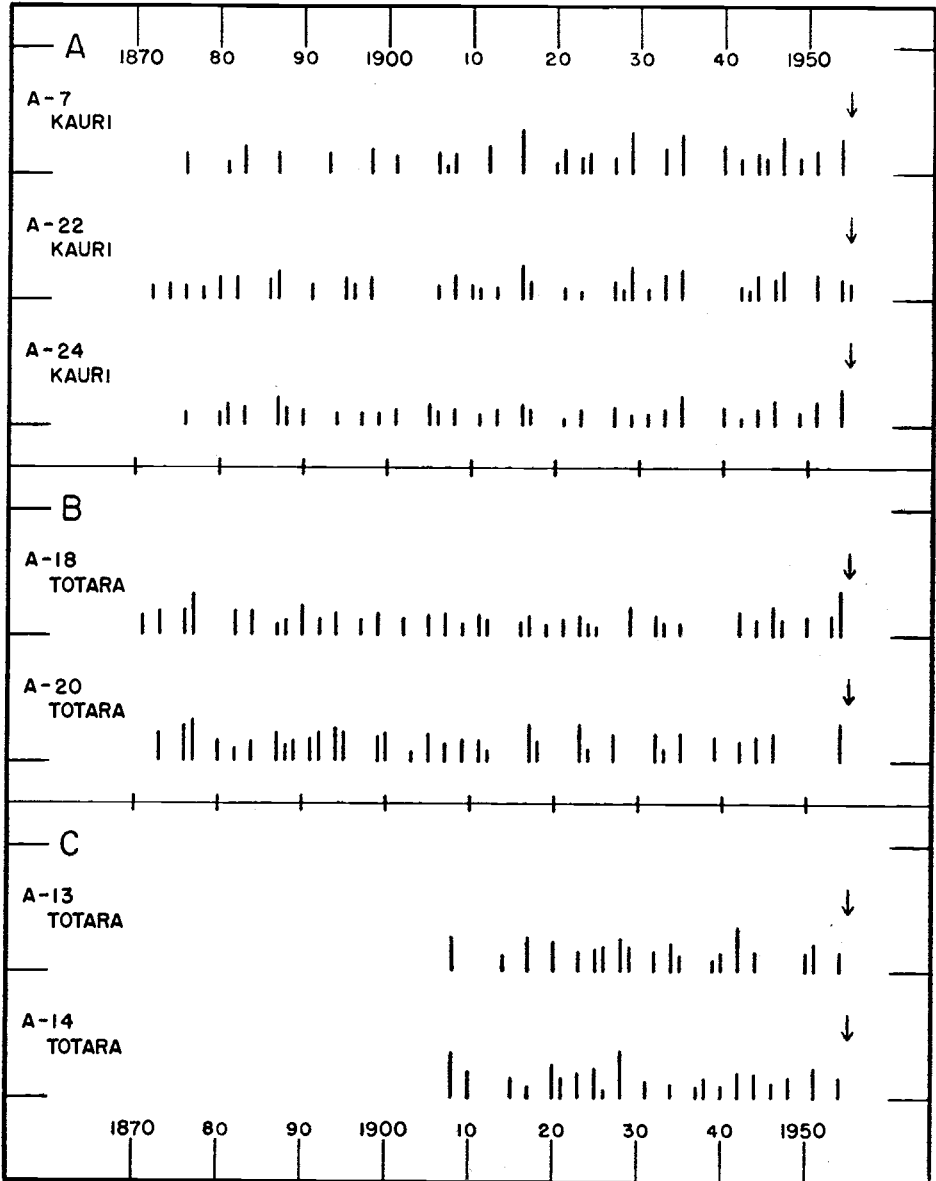


FIGURE 2. Skeleton plot crossdating in New Zealand specimens.

Summary and Conclusions

From a study of tree-ring specimens throughout New Zealand, it appears that it should be possible to construct master charts, for archaeological dating, of kauri, totara, and white pine for the Auckland district.

It is possible to establish a minimum age date for archaeological sites by ring counts from trees found growing on top of the sites. Samples have been collected from three such sites in Otago, and the following minimum age dates are indicated:

Hina Hina midden - - - over 240 years
Pounawea midden - - - over 219 years
Papatowai midden - - - over 256 years

It is also clear that tree-ring studies will progress slowly. Aside from the absence of basic botanical data which could be of considerable aid, crossdating is extremely difficult. Apparently local conditions are so variable that broader climatic factors become hidden or distorted so that crossdating is impossible in the majority of specimens. Many trees lack circuit and vertical uniformity, are subject to periods of compressed rings, or have ring structures which are difficult to read.

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