

skin is not likely to be visible from the outside, nor is the ventilated surface of the inside sheathing likely to show signs of rot until it is far advanced. Kauri is conceded to be relatively durable when used intelligently, but both the mature resinous heart and the less-resinous material normally preferred for long-length planking will decay in positions where conditions are unfavourable. If non-durable timbers are to be used in ship and boat building, or if durable timbers are to be subjected to hazards as indicated, serious thought should be given to treating the timber with wood-preservedatives at the time of building.

(c) *Sporting Requisites* : Tennis and badminion racquets made in New Zealand have in the past been manufactured from Canadian ash or Australian leatherwood. The Forest Service assisted one firm in replacing those timbers with silver beech and mangeao, the latter being specially noted for its toughness and good bending properties. Rewarewa and tawa may also play a useful part in combination with other woods, but their bending properties are scarcely comparable. Supplies of willow have also been located for racket parts and possibly for cricket-bats. Pukatea has been shown to be satisfactory in place of willow in racket-manufacture. Locally grown ash, which on good sites produces an excellent timber, is curtailed in its use for sporting equipment by virtue of the limited supplies available. For vaulting-poles, experiments are being carried out with test lots of locally grown bamboo.

(d) *Handles* : Fulfilment of an UNRRA order for shovel handles has required large quantities of tawa. This involved investigations of a small percentage of the timber that gave a brashy fracture, the formulation of kiln-drying schedules, and the supervision of drying. Recommendations were made also for treatment of the tawa handles to avoid trouble due to attack by powder-post beetles. In studying brashiness, use is being made of toughness-testing equipment. Brashiness, in one or two instances, appeared to be related to the greyish discoloration that is difficult to avoid in air-drying of tawa. The kiln-drying schedule developed for this timber commences at lower temperatures than are normally employed, and, while mould growth is liable to occur in the early stages of drying, a short steaming treatment effectively kills the mould without detriment to the timber.

Additional uses of minor woods receiving attention included : tawa for caskets, transformer construction, motor-body work, and flooring ; willow for artificial limbs ; larch for rustic furniture ; and beech for bobbins and spools in textile mills.

83. *Timber Mechanics*.—The variation with height in the tree of the strength properties of insignis pine grown in Whakarewarewa Forest has been fully analysed for one of the trees for which average results were reported in last year's annual report. As indicative of the variability typical of this timber it may be mentioned that, whereas the general average for modulus of elasticity for the tree (green timber) was 925,000 lb. per square inch, the maximum and minimum for individual pieces tested were 1,714,000 lb. and 489,000 lb. per square inch respectively.

Tests on green material from three loblolly-pine trees have been completed. From one of them measuring 18 in. D.B.H., all 4 ft. bolts from ground-level to 48 ft. were used. The results compare poorly with those of similar tests on insignis pine, but are not yet available for publication.

Useful data on the toughness of numerous timbers are being assembled from tests on the Denison toughness machine. Toughness in wood is dependent upon the relationship of tensile strength to compressive strength, and where toughness is essential as, for instance in aircraft members, it is necessary that each piece of timber should be critically examined. Density is a good guide to strength properties, but may be misleading if incipient decay or minute compression failures are present in the piece. The purpose of the current experiments is to establish by tests on a wide range of material minimum and average toughness values for local species. They will serve as a useful supplement to standard strength-test data already established. The toughness values (relative to density) of red beech, locally grown elm, and mangeao are higher than those of any other species tested to date. Softwoods in general are poorer in this quality, larch giving the best values so far.