it was found that combinations of tawa (hardwood) sulphite and groundwood pulps, with a small amount of insignis-pine (softwood) sulphite, produced a satisfactory paper.

The experimental products made were sufficiently promising, and their economic prospect, on the basis of future market conditions in New Zealand, favourable enough to warrant a recommendation to the co-operator that they be verified by a mill-scale demonstration. Such a course was decided upon and arrangements accordingly made with two Wisconsin mills—the Great Western Paper Co. of Ladysmith, and the Consolidated Water-power and Paper Co. of Wisconsin Rapids—for facilities to carry on the work. The pulp- and paper-mill trials carried on by courtesy of these two companies confirmed the laboratory semi-commercial tests, and yielded valuable data as to the design and operation of equipment required for the production of such newsprint. The results of the laboratory semi-commercial tests and the mill trials are discussed concurrently.

STANDARDS OF COMPARISON.

For purpose of comparison constant reference is made throughout the report to the standard North American pulpwoods. Of these, the white and black spruce (*Picea canadensis* and *P. mariana*) are easily the most important, followed by hemlock (*Tsuga canadensis*), jack-pine (*Pinus Banksiana*), and aspen (*Populus tremuloides*). The spruces are commonly used for the production of groundwood sulphite and sulphate pulps, hemlock for sulphite and sulphate pulps, jack-pine for sulphate pulps, and aspen for soda pulp.

MATERIAL FOR TEST.

SELECTION OF WOODS.

In the selection of woods for testing, the New Zealand State Forest Service was guided by the following considerations: (1) Pulpwoods should be available in large quantities and in fairly heavy stands per acre; (2) pulpwoods should be as whitish in colour and as free from resin as possible, thereby increasing the range of usefulness of their fibres.

Of the six woods selected for testing, the two native species (rimu and tawa) and the introduced softwood (insignis pine) were studied accordingly more intensively than the others, the rimu because it is the most widely distributed and commonly used softwood in New Zealand, and the insignis pine since it is the most widely propagated species in the intensive man-made forests established by Government and private interests. The tawa was studied not only as the principal hardwood of the North Island forests, but as being typical of a group of hardwoods—they all have the same type of fibre—such as blue-gum (*Eucalyptus globulus*) and Tasmanian stringybark (*E. obliqua*). All three woods—rimu, tawa, and insignis pine—are referred to throughout this report as the "major" species.

The remaining three species—Corsican pine, Austrian pine, and European larch—are referred to as the "minor" species. The Corsican pine, although one of the principal species in the Forest Service planting programme, was classed as a minor wood; this because it was known to have a resin content sufficiently high to limit its usefulness to kraft papers and boards, &c. Other species of importance in the Government forestation programme are Douglas fir (*Pseudotsuga Douglasii*) and western yellow-pine (*Pinus ponderosa*), but in view of the experiments* already carried out by the Madison Forest Products Laboratory further pulping and papermaking tests on these woods were considered unnecessary.

COLLECTION.

The woods used in the experiments were collected under the personal supervision of technical officers of the New Zealand State Forest Service, details of the forest stands from which they were selected being given in the shipment and forest descriptions attached as Annexure I of this report.

First Shipment for Laboratory Tests.

The first shipment consisted of material representative of all six species, and originated in the Rotorua Forest Conservation Region, from which it was railed to Auckland and despatched by the S.S. "Canadian Challenger" on the 30th April, 1927, to Montreal, Canada; thence by rail, via Port Huron, U.S.A., arriving at Madison, Wisconsin, on the 9th July.

The woods as received at the laboratory consisted of some 301 logs, 12 ft. in length and from 5 in. to 14 in. in diameter, and of 20 bundles of slabs in cord-wood length (about 4 ft.), making a total of 11 cords of log wood and 1 cord of slab wood. As soon as possible after their delivery on the laboratory skids, the logs were sawn into 4 ft. lengths and cross-piled in the standard manner, the stacks being raised slightly off the ground. The various species are identified in the records according to Table No. 1. The shippers identification marks were stencilled on the ends of the logs, and, while these were decipherable, better results would have been secured by the use of hammer-marks. Accordingly, after sawing into 4 ft. lengths, all bolts were marked with hammer brands.

All logs arrived at Madison in a fairly green state, varying from 14 to 111 per cent. of moisture, based on the oven-dry weight, and with few signs of checking, which, however, developed rapidly in

* "The Suitability of American Woods for Paper Pulp." U.S.A. Department of Agriculture, Bulletin No. 1485. 1927.