likely to offset the shrinkage of natural forests at present apparent and to produce a depreciated market in the future. But, as previously indicated, the present consumption of timber in other countries is very largely and increasingly not in sawn timbers, but in various forms of wood-pulp. Utilization of forest-products by pulping has three main features as contrasted with use for sawmilling: (1) Increasing demand, (2) an earlier harvest, (3) a more complete utilization.

(1) *Increasing Demand.*

The great increase in educational facilities and the growth of the newspaper press all over the world have produced a huge demand for paper in all forms. Almost all paper is at present made from wood-pulp, and at present no effective substitute in appreciable quantity is in sight. The tendency is unquestionably for this demand to increase as time goes on. In addition to its use for papermaking, wood-pulp is continually being put to new uses, while new inventions make it possible to render timber which was previously waste of economic value in pulp form.

(2) *An Earlier Harvest.*

The fact that timber of quite small diameter can be used for pulping lessens very greatly the time between the cost of establishment and repayment in harvest, and instead of large sums being locked up in forest plantations for forty or fifty years, the faster-growing exotics suitable for pulping can be grown in New Zealand sufficiently large for that purpose in half that time. A series of laboratory tests made in several countries and by various processes go to show that some New Zealand timbers, and also some species of planted timber, are suitable for the production of wood-pulp. In this connection we would call attention to the highly valuable report on the subject by Mr. A. R. Entrican to the New Zealand Institute Science Congress, Auckland (January, 1929). Further, newsprint of satisfactory quality has been manufactured abroad from New Zealand timber and used experimentally for newspaper work in this country.

(3) *More Complete Utilization.*

The use of timber in sawmilling operations at present entails a very great amount of waste, in scantlings, small limbs, &c. For pulping purposes no part of the timber, apart from the bark, of any appreciable size is wasted. The utilization of the crop in pulping is therefore much greater than in the production of sawn timber.

Given certain conditions it seems probable that the wood-pulp industry may be profitably introduced into New Zealand in the future. Consideration should be given to this in connection with any scheme of afforestation which it may be decided to enter upon. The Government might consider assisting the establishment of this industry by subsidy or some other method.

A most important point to be determined is the location of any future pulping plants, with a view to forest plantations being made as nearly adjacent to them as practicable. The cost of transportation of the raw timber material to the pulping plant and of the manufactured product to the available market will be a great and possibly a deciding factor in the success or otherwise of wood-pulping in this country, and if, with a view to future developments in this direction, plantations can be established near suitable locations for pulping plants, it is probable that in the comparatively near future New Zealand may produce a large part or the whole of the paper and wood-pulp at present imported, which has now reached an annual value of £1,000,000 and is increasing every year.

The prime importance of location with a view to minimizing transport charges is practically illustrated at the present time by the problem presented by the question of thinning the older existing plantations. In the earlier plantations in New Zealand trees were planted 4 ft. apart, but in later-planted areas they are spaced more widely. Upwards of 20,000 acres of State forest of the close-planted type are now sixteen years and upwards in age. For the production of commercial timber it is essential that much more space must be given at various stages of growth. Natural thinning by the death of a large proportion of the trees has not occurred to any great extent, and the consensus of expert opinion is that thinning is essential in these forest plantations at the present time. If this is not undertaken there is serious danger from delay in growth and deterioration of the whole of the trees, with consequent heavy loss to the undertaking.

The Committee on New Zealand Forestry of the British Forestry Conference, 1928 (pages 36–37 of Summary Report), stated that in these plantations "thinnings are urgently required," and that "this work should be pushed on to the utmost extent possible."

While practical unanimity exists as to the need for thinning, opinions differ as to the method to be adopted. One very serious aspect of the question is the fact that while it is dangerous to leave lying in the plantations the trees cut down for thinning purposes, the cost of removal would be high, and little if any market exists for this class of product.

If allowed to remain when felled the dried thinnings constitute a serious fire menace, and they provide also breeding-grounds for fungoid and insect parasites which, when their dead food is exhausted, may attack the living trees and ruin the whole forest. It is therefore desirable that, if possible, the trees thinned out be removed. There remains the important question of utilizing them so that at least a part of the cost of extraction will be recovered.

The question is complicated by the fact that the whole area ripe for thinning is not in one block or even in one area, but in widely separated districts—mainly at Tapanui (Otago), Hanmer (Canterbury), and Rotorua. The plantations also consist of several species of trees, thus rendering a common treatment difficult to arrive at.

The size of the undertaking and the amount of light timber which may have to be extracted is shown by the fact that to thin the State plantations at present requiring thinning in the Rotorua district alone from the present 4 ft. spacing to 12 ft. apart is calculated to yield not less than 22,000,000 cubic feet of timber more than 4 in. diameter.

Unless the cost of extraction can be met wholly or in large part by the sale of this timber, the operation of thinning will entail a very heavy charge against the undertaking. We recommend that