

WEST COAST HILL-COUNTRY SOILS — THEIR POTENTIAL FOR CONVERSION OF INDIGENOUS FOREST TO EXOTIC FOREST

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SYNOPSIS

*In the region of New Zealand traditionally known as the West Coast, an estimated 10%—253,000 hectares—of the land may be suitable for growing high-yielding exotic conifers such as radiata pine (*Pinus radiata*) after the indigenous forest is harvested. About 175,000 hectares of this area may possibly be rated as site quality I, capable of producing 700 m³/ha in 27 years. Over 120,000 ha of this high site quality land is in State forest. A further 69,000 ha of allied soils under the same tenure could also be suitable for growing exotic conifer crops. Nearly a quarter of the indigenous forest on these soils has been logged, but only 5,600 ha has been reforested with exotic conifers.*

INTRODUCTION

The annual report of the Director of Forestry in 1939 had this to say about forest management in Westland: "From Ross northwards there is, amongst the remaining patches of bush, the usual picture of forest devastation—a wilderness of unsightly snags, blackened stumps, and noxious weeds, the usual results of fire following logging. As the remaining bush is so treated and the timber exhausted in North Westland, is this practice to continue southward? It is believed that Westland, no less than the rest of New Zealand, desires to avoid this."

The report also remarks on the sight of wanton exploitation of the rimu forests, which "... must arouse grave doubts in the minds of the public as to the protection of its assets and to the discharge of the Forest Service stewardship if such practices are to be perpetuated. The sawmiller is not to blame, nor the district, only the administration.

"Is North Westland to be duplicated? Is one crop of timber to be taken without regard to the future? Is subsequent burning, grazing, and mining to be allowed to develop another unsightly countryside, largely unproductive?"

The report acknowledged the undesirability of management practices in North Westland which had exploited the indigenous forest crop and left behind unproductive land. Of the 39,000 ha of hill-country State forest exploited on the West Coast, 5,600 ha have been reforested with exotic conifers. These hill-country soils (N.Z. Soil Bureau, 1968), on which there has been some establishment of exotic forests, cover 175,000 hectares, of which 123,000 ha are in State forest. Three-quarters of the forests on these soils are still virgin. The form of management proposed for these hill-country forests is conversion to exotic forest after removal of the indigenous crop.

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When considering the desirability and feasibility of converting cut-over indigenous forest of the West Coast to exotic forest, it is first necessary to look at the need for regional afforestation. When this has been determined, it must be shown that soils suitable for afforestation with exotic trees are available in the region. Thirdly, the practical aspects of establishing an exotic forest estate must be examined.

Molloy (1970) has set out the economic need for establishing exotic forests in Westland to sustain at least continuing forest production and forest based industries, and Day (1969) has described the feasibility of converting cut-over indigenous hill forest to exotic coniferous forest in the central part of the region, between the Ahaura and Hokitika Rivers. Since Molloy and Day have justified the first and third criteria for converting West Coast indigenous hill-country forest to exotic forest, there is a need now to justify the second criterion, the suitability of soils, and to determine the area likely to be available.

GEOMORPHOLOGY AND SOILS

The pattern of the West Coast lowland soils and topography has been determined by glaciation over the past 200,000 years. Survey and mapping have so far been done on an extensive, rather than an intensive, basis, which does not reveal the detailed mosaic of sites commonly encountered. First, the Waimaunga piedmont glaciation deposited the high terraces, which have soils of very low fertility. Then, two subsequent major valley glaciations, the Waimea and Otira glaciations, formed lower-altitude valley terraces, with their soils improving in nutrient content as the alluviums of the flood plains and river terraces are approached. On slopes greater than 15° between each of these terraces and extending to 400 metres above the piedmont terraces are the immature yellow-brown earth hill soils. A broad indication of soil types, related to topography, is given in Table 1.

EVIDENCE OF SOILS SUITABLE FOR AFFORESTATION WITH EXOTIC CONIFERS

Commercial afforestation began on the West Coast in the vicinity of Greymouth and Hokitika in the early 1920s. Radiata pine (*Pinus radiata*) was successfully established on soils at Dunollie which can be described as being between Matiri and Arahura hill soils and Karangarua gley recent alluvial soil. Subsequent planting carried out by the State Forest Service was concentrated for the next decade on readily accessible cut-over forest land which had been "repeatedly subject to fires in recent years" and had "acid soils" (N.Z. State Forest Service, 1925). By 1932, 1,300 ha of exotic forest had been established, most of it coniferous, and 98% of it in State forest.

The major planting site was Mahinapua Forest, an area of terraces and moraines with Waiuta and Okarito hydrous soils south of Hokitika. By 1931 some 683 ha had been planted and

TABLE 1: LOWLAND HILL AND GLACIAL TERRACE SOILS
(N.Z. Soil Bureau, 1968)

| <i>Soil Group</i> | <i>Soil Name</i> | <i>Topography</i> | <i>Altitude</i> |
|--|----------------------|---|-----------------|
| Upland and high country podzolized yellow-brown earths and podzols | Kaniere hill soils | Moderately steep with some steep | 90-1050 m |
| | Matiri hill soils | Moderately steep | 120-450 m |
| Lowland yellow-brown earths | Arahura hill soils | Moderately steep with some flat to rolling ridges and steep-sided gullies | 60-450 m |
| | Blackball hill soils | Moderately steep with narrow rolling ridge tops; steep-sided gullies | 60-540 m |
| | Runanga hill soils | Moderately steep with some rolling | Up to 120 m |
| | Ahaura soils | Flat to gently undulating terraces and sloping fans | Up to 240 m |
| Lowland podzolized yellow-brown earths and podzols | Okarito soils | Flat to very gently undulating intermediate and high terraces | Up to 450 m |
| | Waiuta soils | Rolling morainic downs and undulating terraces | Up to 360 m |
| | Kumara soils | Flat low terraces | Up to 150 m |

it appeared that western red cedar (*Thuja plicata*) was the most promising species. As a result, a further 448 ha of this species were planted. The failure of radiata pine to show promise in these early years, along with the great depression, contributed to a 14-year lapse in reforestation with exotic conifers, from 1933 to 1947.

A stand of radiata pine established in 1941 on Blackball hill soils of the Reefton Saddle in Nelson Conservancy showed such early promise that 40 ha of this species were planted on similar soils in Granville Forest in 1947, and small trial plantations were successfully established, over the next four years, on their more southern equivalent, the Arahura hill soils.

In Tawhai Forest, on Blackball hill soils, a stand of radiata pine planted in 1951 attained a mean height of 31.7 metres in 20 years (D. J. Evans, pers. comm.). Younger stands show similar growth trends. For example, sample plot Wd 97, on Arahura hill soils, had a mean height of 25.0 m at 16 years old; similar trends were found in stands in Nemona Forest at 12 years (R. E. J. Coker, pers. comm.). The evidence from stands of radiata pine, aged from 10 to 30 years, on both Blackball and Arahura hill soils, is that heights of 30 m may be expected at the age of 20 years, equivalent to a site index of about 100 ft (Lewis, 1954). A range of heights between 27 and 34 m can be considered site quality I (Fenton and Sutton, 1968).

THE INDIGENOUS FORESTS OF THE HILL SOILS

The natural forest of the lowland hill soils north of the Grey River and Nelson Creek (or roughly the Midland Railway Line), the Blackball, Matiri, and Kaniere hill soils, is composed of rimu (*Dacrydium cupressinum*), red beech (*Nothofagus fusca*), hard beech (*Nothofagus truncata*), miro (*Podocarpus ferrugineus*), kamahi (*Weinmannia racemosa*), quintinia (*Quintinia acutifolia*), and, particularly inland, silver beech (*Nothofagus menziesii*). South of this line the predominant hill forest is of rimu, miro, rata (*Metrosideros umbellata*), kamahi, and quintinia on Arahura, Runanga, and Kaniere hill soils.

A distinctive characteristic of these forests is their paucity of podocarps in the younger age classes. They are thus in marked contrast to the mixed-age podocarp forests of the terraces. When these hill forests are exploited for commercial species, the residual stand is of no present commercial value. Logged areas regenerate to hardwoods and can be expected to produce little of commercial value for a century or more.

EXTENT OF LAND SUITABLE FOR CONVERSION TO EXOTIC FOREST

Blackball and Arahura hill soils extend from the Buller to the Arawata Rivers, but nearly 80% are to be found north of the Waitaha River. Similar soils (Matiri, Kaniere and Runanga hill soils) are also found in the north. There are

few exotic conifer plantations on these latter soils, but the evidence suggests that their productivity may be slightly less. The total area of soils considered suitable for conversion to exotic crops is shown in Table 2.

TABLE 2: TOTAL AREA OF WEST COAST HILL SOILS SUITABLE FOR EXOTIC AFFORESTATION
(thousand hectares)

| <i>Hill Soils</i> | | | | <i>State Forest</i> | <i>Other Tenure</i> | <i>Total</i> |
|------------------------------|------|------|------|---------------------|---------------------|--------------|
| Arahura and Blackball | | | | 123 | 52 | 175 |
| Matiri, Kaniere, and Runanga | | | | 46 | 32 | 78 |
| Total | | | | 169 | 84 | 253 |

CONCLUSIONS

On the grounds that there is an economic and social need for afforestation on the West Coast, suitable soils are readily available, and conversion has been proven a practical proposition, a case exists for advocating reforestation of up to 170,000 ha of plantable hill country in State forest with exotic crops after the indigenous forest has been harvested. The evidence from radiata pine crops established so far is that a considerable proportion of this land may be of high site quality, with productivity equivalent to that of the Bay of Plenty forests. If this is so, a yield of some 700 m³/ha to a 25 cm top may be expected from rotations of 25 to 30 years.

That there is an immediate economic need for plantable land is emphasized by a shortage in many parts of New Zealand, one of them being Canterbury, the traditional market for West Coast timber and an area anticipating a timber shortage in the 1980s and 1990s. Proposals have been put forward (N.Z. Forest Service, 1971) to utilize some 26 to 34 million cubic metres of indigenous timbers from northern parts of the West Coast. The scheme includes converting some 97,000 ha to exotic crops, and this provides an added incentive to look at the wood-growing potential of the hill-country soils.

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