REFORESTATION IN THE BRANCH RIVER CATCHMENT

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SYNOPSIS

Exotic trees are being established in the Branch catchment in central Marlborough in an attempt to provide seed sources for the natural reforestation of eroding mountain land. In the four-year period 1965-1968, group planting, hand sowing, and aerial seeding were carried out within a gross area of nearly 13,600 acres. This paper describes the work and the techniques used, and gives a preliminary account of results achieved so far.

INTRODUCTION

The Branch River has a catchment area of approximately 75,000 acres of very steep mountain land, which rises from 1,500 to 2,000 ft along the valley floor to 5,000 to 6,000 ft along the watershed and major internal ridges. Scott Knob, the highest peak in the catchment, is 7,030 ft a.s.l.

An almost complete cover of beech *(Nothofagus)* forest formerly clothed the catchment to about the 5,000 ft contour, but many thousands of acres of forest and subalpine vegetation above the tree line were totally destroyed by indiscriminate burning during the early part of this century. Grazing by domestic stock, and subsequent depredation by wild animals, not only prevented forest regeneration but seriously depleted the fire-induced vegetation. Overgrazing, together with the inherent geological instability of the area, caused severe accelerated erosion over much of the catchment. A small part of the area is still grazed by domestic stock. Regular and intensive hunting by Forest Service hunters has reduced the population of red deer, chamois, goats, pigs, and wild sheep to levels which cause little damage to the present plant cover. With few exceptions the recovery rate of the depleted vegetation is very slow and widespread erosion is continuing. Reforestation was begun in 1965 after two years of preliminary planting trials.

Below 3,000 ft the present vegetation is bracken *(Pteridium aquilinum* var. *esculentum), Leptospermum* scrub associations or grassland dominated by browntop *(Agrostis tenuis),* Yorkshire fog *(Holcus lanatus)* or *Notodanthonia unarede.* Grassland composed mainly of *Notodanthonia setifolia* (Wraight, 1963) is the dominant vegetation between 3,000 and 5,000 ft while snowgrass *(Chionochloa)* associations predominate at higher elevations.

The Branch is a major tributary of the Wairau River (see Fig. 1), a river with a long history of severe flooding on the low-lying, fertile Wairau Plains (Cowie, 1957). The economic importance of the lower Wairau Valley is stressed by Davidson

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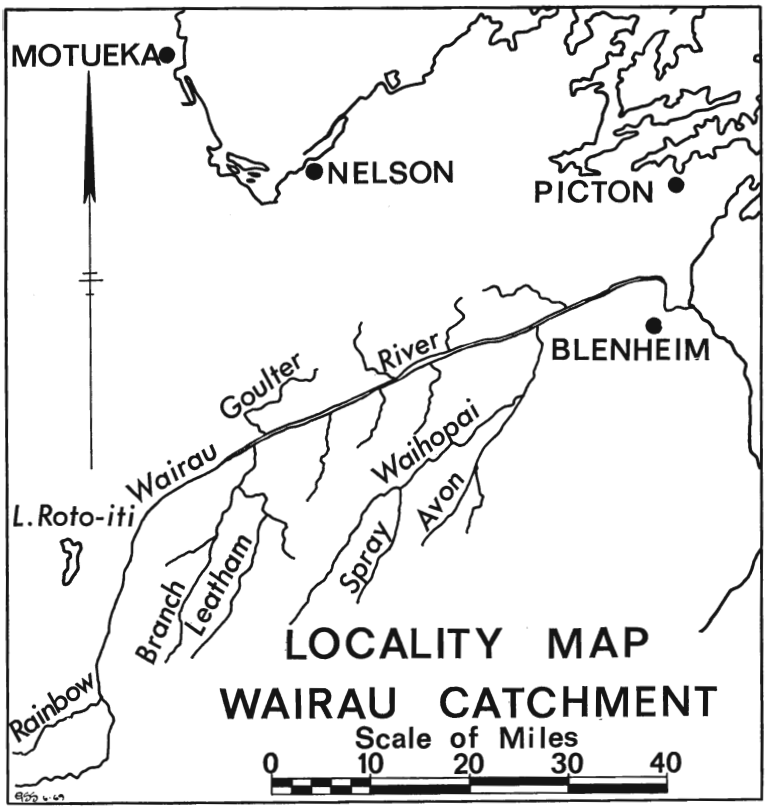

FIG. 1: *Locality map, Wairau Catchment.*

(1959). 115,000 acres of urban and highly productive agricultural land are subject to flooding or derive some benefit from engineering works carried out or planned by the Marlborough Catchment Board in the Wairau Catchment. The capital value of this land was over $NZ38,000,000 in 1963 (N.Z. Forest Service, 1964).

The natural vegetation has been depleted, considerably modified, or totally destroyed not only in the Branch catchment, but over much of the Wairau catchment as a whole (Holloway, 1961). Dunbar (1958) mapped the degree and location of erosion in the Wairau catchment. An analysis of these data (Macarthur, 1960) shows that seriously eroded areas, that is, areas with over 20% of the surface area eroded or bare of vegetation, occur within 427,000 acres or 41% of the total catchment area of 1,029,000 acres. Erosion is most noticeable in the Rainbow, Branch, and Leatham catchments and towards the headwaters of the Waihopai and Wairau Rivers. Thomson (1965) considers that the Branch and Waihopai Rivers are the major contributors to shingle deposition

in the Wairau River and to flooding on the Wairau Plains. The Branch catchment is largely State Forest and was therefore a convenient as well as a vital area in which to begin reforestation.

METHODS OF REFORESTATION

As previously mentioned, serious erosion occurs within 427,000 acres of the Wairau Catchment. The proportion of this area which will respond satisfactorily to pasture improvement techniques, reduced grazing by domestic stock, or drastic reduction of wild animals is unknown, but undoubtedly very large areas will need artificial re-establishment of a protective plant cover. Exotic trees are one obvious choice for revegetation work, because on some sites timber utilization may be possible in the future.

Normal plantation establishment techniques were considered inappropriate in the Branch catchment for two reasons. First, financial and material resources were quite inadequate to plant completely, within a reasonable period, all areas needing treatment and, second, an irregular and uneven-aged forest was expected to provide a more effective and desirable soil cover. It was decided, therefore, to plant or sow groups of trees spaced at strategic points throughout the catchment and to allow subsequent natural seeding to colonize intervening areas progressively.

Planting

Irregularly-shaped groups, containing approximately 150 trees, were planted at an average spacing of one group per 10 acres of land. The groups were sited on spurs and ridges and at other points from which the maximum dispersal of seed could be expected, but at the same time full use was made of pockets of undisturbed soil to take advantage of the best available conditions for tree survival and development. Within the groups trees were spaced at 8 ft × 8 ft, a spacing which, although too close for maximum seed production, was selected because of anticipated low survival rates. In fact, survival rates in most areas have been consistently high and, except at higher elevations, future tree spacing could be widened considerably.

Trees were packed in polythene-lined cardboard boxes and delivered by helicopter to pre-selected sites scattered through the planting area. Planting was interrupted periodically by heavy snowfalls at higher elevations and was delayed by frozen ground on shaded faces.

Hand Seeding

In 1966, 670 acres were spot sown by hand using the same spacing and group distribution adopted for planting. About 10 seeds were sown in each spot and covered. A wide range of microsite conditions was sampled, including (1) bare soil between tussocks of grass, (2) the shelter of charred logs and

stumps, and (3) close to large stones. Hand seeding was unpopular with the planting gang and did not appear to have any particular advantages over other methods of forest establishment.

Aerial Seeding

The first aerial seeding was carried out from a helicopter in 1965, when an attempt was made to direct the seed on to sites similar to those chosen for group planting. This technique proved impracticable and was abandoned in favour of a comparatively uniform distribution over the whole sowing area or of a series of wide swaths of seed parallel to the contour.

The area covered with 1 lb of seed varied between 9 and 20 acres and depended largely on seed availabiilty. The seed was coated with a fungicide, which was also intended to act as a bird repellent, or in the case of Douglas fir *(Pseudotsuga menziesii)* was treated with mycorrhizal material. Sowing took place when a helicopter was available to transplant tree stocks and stores into the catchment area. At higher elevations, some aerial sowing was made into a deep cover of snow.

Species

The lower slopes of the Branch catchment are no higher than many areas of commercial exotic plantations growing successfully in other parts of Nelson Conservancy. The same species and provenances could be expected to succeed in the Branch catchment, at least up to 2,500 ft a.s.l.; in practice they were planted much higher.

Planting stock was raised mostly in Golden Downs nursery, which lies at 500 ft a.s.l., and after lifting the trees were taken directly to the planting site. A high country nursery was not established.

Species were generally sited as follows:

Zone	*Approx. altitude (ft)*	*Species*
Lower slopes	1,800-3,500	*Pinus radiata* *Ps. menziesii* *Larix decidua* *L. leptolepis*
Middle slopes	3,000-4,500	*P. nigra, P. sylvestris*
Upper slopes	4,000-5,500	*P. contorta, P. uncinata*

With the addition of *P. ponderosa* to the middle slopes zone and small quantities of *P. coulteri* and *Cedrus deodara* to the lower slopes zone, the same species similarly sited were used for aerial seeding. Individual species were not sown separately, but were mixed together within each zone.

Planting Labour

Planting was carried out by Forest Service hunters and track cutters, in preference to more experienced workers from exotic production forests. The former type of labour, although initially less skilled at planting and handling young trees, was better accustomed to the arduous living and working conditions experienced in mountainous areas. The men readily accepted their new role and quickly became enthusiastic and competent tree planters.

COSTS

Summarized costs for group planting and aerial seeding are given in Table 1. In both cases the unit cost is based on the gross area treated within the catchment, and not on the actual extent of the planted groups or the pattern of seed fall. Present indications are that aerial seeding has resulted in a much higher stocking of established seedlings at a cost averaging about 60% less than the cost of group planting.

TABLE 1: REFORESTATION COSTS, BRANCH CATCHMENT

	1965	*1966*	*1967*	*1968*
Group Planting				
Gross area treated (acres)	1,730	1,220	1,720	2,260
	$	$	$	$
Trees and packing	788	292	1,070	1,070
Helicopter hire and vehicle running	772	462	832	665
Planting and supervision	2,202	876	2,288	2,448
Food, miscellaneous and overheads	766	564	787	886
Totals	4,528	2,194	4,977	5,069
Cost per acre	2.6	1.8	2.9	2.2
Aerial Seeding				
Gross area treated (acres)	1,120	1,620	1,680	1,560
	$	$	$	$
Seed	1,124	546	1,236	1,144
Helicopter hire	150	260	334	240
Miscellaneous and overheads		190	30	11
Totals	1,274	996	1,600	1,395
Cost per acre	1.1	0.6	0.9	0.9

PRELIMINARY ASSESSMENT OF RESULTS

No comprehensive assessment has been carried out over the treated area of 13,580 acres, but several thorough ground inspections have provided valuable preliminary data on survival and early growth.

Seedlings resulting from aerial seeding have been found over a wide range of microsite conditions, ranging from bare

subsoil and rock fragments to comparatively complete grass cover. Germination was high on patches of exposed subsoil but few seedlings have survived. Under these conditions rooting depth during the first growing season after sowing commonly exceeded 9 in. but many seedlings were broken off at the root collar by subsequent frost heave. So far seedlings have not been found above the 4,400 ft contour, but they may possibly exist on the most favourable sites. After two growing

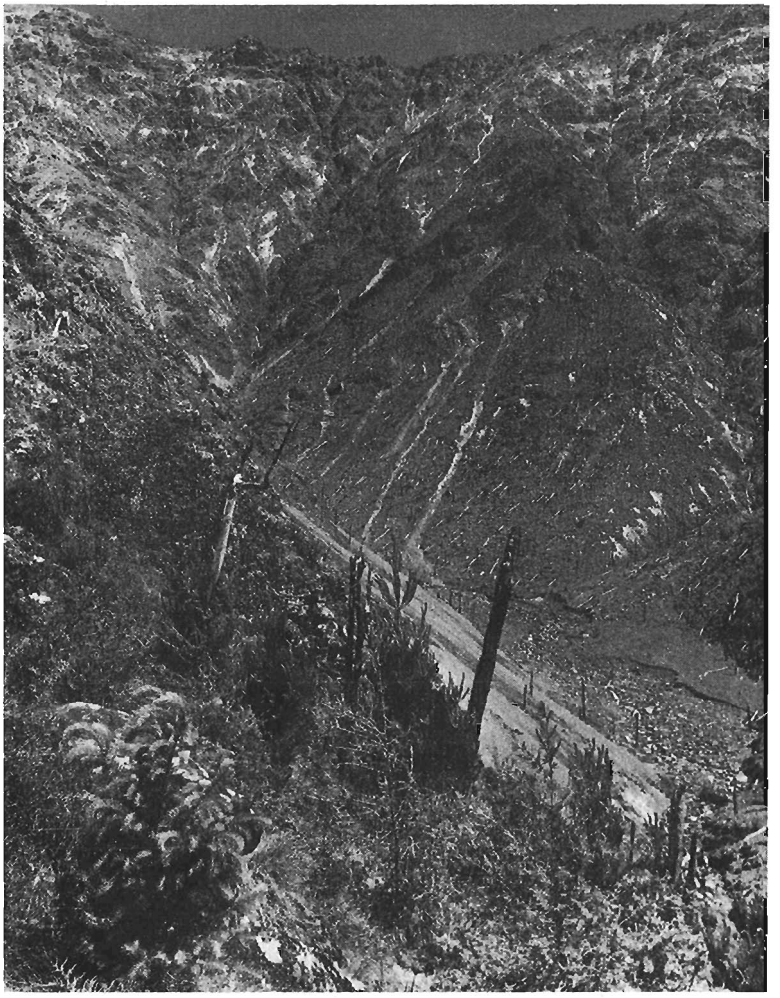

FIG. 2: *Scott Creek, Branch River Catchment, Marlborough, December 1968. Douglas fir, European larch and radiata pine, age 4 years, at 3,000 ft on eroding slopes formerly under beech forest.* (N.Z. Forest Service photo, by J. H. Johns, A.R.P.S.)

seasons, the taller *P. contorta* seedlings were 10 to 12 in. high at 3,000 to 3,900 ft a.s.l., *P. ponderosa* had attained 10 in. at 3,300 ft., and *P. nigra, Ps. menziesii* and *Larix decidua* were 6, 8 and 2 in., respectively, at 2,400 ft.

In planted areas *P. contorta* and *P. uncinata* appear healthy and reasonably vigorous on favourable sites up to an altitude of 4,800 ft. Above this level almost 100% mortality has occurred on exposed subsoil and scree slopes; trees planted on more favourable sites have not been examined. *Pinus nigra* and *P. sylvestris* show satisfactory growth up to 4,000 ft and *Larix* spp., *P. radiata* and *Ps. menziesii* up to 3,500 ft. Table 2 gives the average height of the tallest trees in some planted groups established from 1963 to 1966 inclusive. Many trees included in the measurements had been browsed by animals.

TABLE 2: HEIGHT GROWTH OF PLANTED TREES

Species	*Age (yr)*	*Altitude (ft a.s.l.)*	*Total Height (in.)*	*Appearance*	*Site Conditions**
P. uncinata	2½	5,200	9	Poor	Exposed subsoil
		4,500	17	Good	
		3,900	19	Good	
P. contorta	2½	4,900	18	Fair	Exposed soil and rock
		4,400	20	Good	
		4,400	29	Good	
P. sylvestris	2½	3,900	16	Good	
P. nigra	1½	4,400	9	Good	
		4,000	7	Fair	Bare soil, scattered grass
	3½	3,500	21	Fair	
	4½	3,200	46	Good	
L. decidua	2½	3,900	10	Poor	
	3½	3,500	38	Good	
	3½	3,200	66	Good	
L. leptolepis	1½	4,300	19	Fair	Bare soil, scattered grass
	3½	3,500	44	Fair	
	4½	3,200	68	Good	
P. radiata	3½	3,500	25	Good	
	3½	3,200	48	Good	
Ps. menziesii	1½	3,800	17	Fair	
	3½	3,300	38	Good	
	4½	3,200	41	Good	

*An almost complete cover of grasses unless otherwise stated.

The population of larger destructive animals in the catchment is now too small to cause any significant damage to the existing vegetation or to the exotic trees introduced by planting and aerial seeding. Whilst effective control of these animals was being achieved, the importance of hare and opossum control was largely overlooked, and consequently seedlings and planted stock have been severely damaged over wide areas.

Damage mostly occurred during the winter and early spring months. Various techniques to reduce hare and opossum numbers are being tried, but at present no real success can be claimed.

ACKNOWLEDGEMENTS

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