POUTO FOREST FARM
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Abstract

Pouto Forest Farm is being developed as a large-scale forest farm project on the Pouto Peninsula. The farm occupies 3200 ha of marginal, exposed sand country of which 1640 ha are now planted in Pinus radiata. This paper reviews the objectives behind the project and examines the development of the farm. The paper also outlines the forest management schedule through which an open stand is maintained by a heavy pruning and thinning operation, thereby ensuring the additional yields of pasture and livestock production. Brief consideration is given to the experimental work being carried out.

INTRODUCTION

Pouto Forest Farm occupies some 3200 ha of marginal land on the lower half of the Pouto Peninsula of the Kaipara Harbour. This large-scale working model of one form of forest farming has been in operation since May 1970; some 1640 ha are planted in Pinus radiata and the farm is presently (1 June 1976) carrying 3000 head of beef stock of all ages. The company's work force consists of a resident forest farm manager, five resident workers, seven local workers and one resident scientist.

DESCRIPTION

The general surface form of the farm is one of rolling hills of consolidated sand, broken only by large, steep-sided gullies which dissect the eastern boundary (Farnsworth et al., 1976). Towards the southern end of the farm the strong, prevailing, southwesterly winds have caused an area of wandering dunes.

The Peninsula receives some 1400 mm of rain which falls on an average of 170 to 180 days a year. There is a distinct winter maximum of rainfall and the summers are often marked by long droughts. The mean winter temperature is 7°C and the mean summer temperature 18.5°C. The mean spring and autumn temperatures are 13 and 15°C, respectively.

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(Burridge, 1964). On the Peninsula most of the winds come from the south-west and west and only a quarter of all the days are calm.

The soils of the farm are all of the Pinaki suite which have been derived from sand deposits of varying age and consolidation. The soil types in order of importance are the Pinaki sands, Redhill sands and Tangitiki sands. In 1964 a soil conservation study classified the areas of Pinaki sand and Tangitiki sands as being Class VII and the areas of Redhill sands as being Class IV (Burridge, 1964).

OBJECTIVES

The general philosophy behind the project is to make marginal land more economic, to improve the physical environment, and to foster the concept of multiple land use in its widest sense. The stated prime objective of the company is one of environmental betterment, not only of the physical but also of the social environment (Farnsworth et al., 1976).

DEVELOPMENT PROGRAMME

The development programme commenced in June 1970 with the planting of 400,000 1/0 seedlings of Pinus radiata at 4 m x 2 m spacing; and in June 1971 a further 1 million 1/0 seedlings were planted at the same spacing. A summary of the subsequent planting and land acquisition is given in Table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Land Purchased (ha)</th>
<th>Land Planted (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>716</td>
<td>283</td>
</tr>
<tr>
<td>1971</td>
<td>764</td>
<td>490</td>
</tr>
<tr>
<td>1972</td>
<td>1108</td>
<td>50*</td>
</tr>
<tr>
<td>1973</td>
<td>612</td>
<td>59*</td>
</tr>
<tr>
<td>1974</td>
<td></td>
<td>328</td>
</tr>
<tr>
<td>1975</td>
<td></td>
<td>320</td>
</tr>
<tr>
<td>1976</td>
<td></td>
<td>110</td>
</tr>
<tr>
<td>Total</td>
<td>3200</td>
<td>1640</td>
</tr>
</tbody>
</table>

*High tree failure rates due to two prolonged summer droughts were recorded.

Up to 1974 a number of various planting espacements were used experimentally, but the majority were at 4 m x 2 m spacing. In 1974 those areas in which the pasture could be economically forage-harvested were planted at 5.5 m x 3.5 m spacing. This was changed in 1975 to 5 m x 2 m spacing.
Initial plantings (1970, 1971) were in partly developed country covered in low scrub, rushes and low-fertility grasses. In these areas it was decided to develop the pasture and establish the trees at the same time. Following planting, coarse grass growth and volunteer growth of manuka and rushes were regularly rotary slashed. This policy of rotary slashing, combined with fertilising and limited oversowing of pasture species, has resulted in an increase in the palatable high-quality grasses and legumes, especially in the 1970 plantings. The rapid legume growth was of great assistance in the early introduction of stock. A factor which greatly aided the development of these initial plantings is that more than 60% of the total area of the farm can be traversed by tractor.

Although the initial plantings were made in partly developed country, it is the present intention that all potential forest farm land before planting will be improved by cleaning, fertilising and sowing to establish a grass sward.

Tree planting is carried out principally by machine but in places by hand. Planting in a rotary-hoed dish or pit is used in those areas dominated by Kikuyu grass (*Pennisetum clandestinum*) and/or exposed to the salt burning westerly wind (Farnsworth and Male, 1975). The pits reduce tree root competition with the pasture, conserve soil moisture and supply the young trees with shelter. The control of grass competition during the tree establishment phase is critical. Rotary slashing the pasture between the establishing trees has been used extensively, and in some areas releasing has been carried out, by chemical application or by hand.

Hay crops were cut between the rows of developing trees in the summer of 1972-3; and in 1974 pasture forage-harvesting was introduced between the recently planted trees. November 1974 saw the harvesting of 1000 tonnes of silage between the rows of trees planted in June of that year; in November 1975, 1500 tonnes were harvested.

**TREE MANAGEMENT**

The tree crop is managed with the objective of obtaining a timber crop of maximum volume and quality, consistent with the greatest development of the multiple land use concept. The prescription used is a "direct regime" (Fenton and Sutton, 1968), and Table 2 outlines the tending schedule.

This regime will give a project target crop of sawlogs without production thinning. By adopting such a regime it is possible to maintain the open type of stand necessary for continued pasture production, because nearly full light penetration will be maintained well into the rotation.
TABLE 2: TENDING SCHEDULE
(After Fenton and Sutton, 1968)

<table>
<thead>
<tr>
<th>Mean Tree Height (m)</th>
<th>Approx. Tree Age (yr)</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4-5</td>
<td>Plant 1000-1250 stems/ha.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prune the best 500-625 stems/ha to 2.5 m. Thin all the others.</td>
</tr>
<tr>
<td>8</td>
<td>5-6</td>
<td>Prune the best 300-350 stems/ha to 4.5 m. Thin all the others.</td>
</tr>
<tr>
<td>11</td>
<td>7-8</td>
<td>Prune the best 200-260 stems/ha to 6 m. Thin all the others.</td>
</tr>
<tr>
<td>14</td>
<td>9-10</td>
<td>Prune all stems to 8.5 m.</td>
</tr>
<tr>
<td>17</td>
<td>11-12</td>
<td>Prune all stems to 11 m.</td>
</tr>
</tbody>
</table>

PASTURE MANAGEMENT AND GRAZING

During the initial 18 months to 2 years of the young trees' establishment, grazing is not allowed. The Pouto grazing operation is based on beef; we lack the facilities and fencing to run sheep successfully, although we recognise their place in the forest farm grazing regime.

In grazing the forest areas, experience has shown that Angus, Hereford and dairy beef weaners can be successfully grazed amongst 18-month-old trees with little damage. The best results have been achieved with cattle which have been tree-trained to avoid browsing the forest species — i.e., weaner cattle would first be introduced to 3-year-old and older stands to get them accustomed to grazing through the trees. For successful grazing the trees need to be at least 1.5 m to 2 m high and careful stock management with good judgement is needed. When the forest stands are 3 years old they can be successfully grazed with other cattle. By year 4 the forest stand can be included in the normal rotational grazing cycle.

There is much to be learnt about the grazing behaviour of animals of different ages and breeds in a forest farm environment; what has been found suitable in one area may not necessarily suit another. To avoid unacceptable tree damage during the initial tree establishment years, careful "on the spot" livestock management is needed.

During the period when grazing cannot be undertaken, the pastures are maintained by regular rotary slashing and/or forage harvesting. This prevents costly deterioration in quality.

In some areas where rotary slashing cannot be undertaken, bracken has flourished, but can eventually be brought under control by grazing pressure. Pouto lacks many of the noxious weeds (e.g., gorse, blackberry, ragwort) that plague other
areas, and this has greatly aided the development of the pastures, both in the forested areas and in open areas.

Grazing will continue until clearfelling although it is expected that grazing intensities will peak some time in the first 10 years of the rotation when shading by the tree overstorey will cause a fall in pasture production.

Where plantings have been on rough, partly developed country, pasture dry matter production has been raised since planting with rotary slashing, topdressing and trace element correction. From the beginning of the third year after planting, stock carrying capacity has increased 4 to 5 times with maintenance topdressing and rapidly improving clover, lotus and serradella (*Ornithopus sativus*) growth (Cumberland, 1976).

All open pasture land which has not as yet been considered for planting is undergoing active development. Areas of tree lupin (*Lupinus arboreus*) are being suppressed by an aerial application of a mixture of 2,4,5-T and 2,4-D, and many of the poorer quality pastures are being upgraded by the undersowing and oversowing of high quality grasses and clovers. Many of the well-developed pastures are dominated by Kikuyu grass and special management techniques have been employed to farm them.

From 1972 to 1974 a heavy topdressing programme was instituted for all areas (including the tree planted areas). In 1973 all were treated for trace element deficiencies, especially boron, cobalt, copper, iron, molybdenum, sulphur, and zinc. This was temporarily suspended in 1974 to reduce costs.

Each year some 12,000 bales of hay are cut in addition to the silage cut between the rows of establishing trees.

**HORTICULTURE**

Early in the development of the project it was recognised that the microclimate changes resulting from the vigorous tree growth might create an environment suitable for the growth of exotic fruit and subtropical horticultural crops.

This third-tier development at Pouto is now in the experimental stages. In October 1974 a large tamarillo (*Cypomandra betacea*) and feijoa (*Myrtaceae sellowianus*) nursery was established with the help of local Ministry of Agriculture and Fisheries horticultural advisory officers. The first tamarillo seedlings have been planted out between the pines in the 1970 stand. The stocking in that area is between 1000 and 1250 stems/ha; the trees have an average height of 6 m and have all been pruned to 2 m.

The experimental tamarillo plantings have been made in the following ways:
(1) Interrow — where the pines have been thinned down to 500 stems/ha.

(2) Two rows of tamarillo at $4 \times 1.5$ m spacing in an area where either one, two or three rows of pines have been line-felled. Three rows of thinned pines are left between each of the line-felled areas.

Posts have been recovered from the line-felling operation. By spraying selected insecticides, with low residual toxicity to sheep, it may be possible to graze amongst the tamarillos once they have attained enough stature. The expected lifespan of the tamarillo crop is between 6 and 8 years. By this time it is expected that shading by the pine overstorey will be affecting tamarillo production.

**RESEARCH**

As with any developing concept, research occupies an important place. In December 1973 a research division was set up by the company, and emphasis to date has been placed on environmental research, especially the influence of a forest farm plantation on local microclimates (Farnsworth, 1973, 1975; Farnsworth and Male, 1976). Trials have also been designed to test the relationship between animal liveweights, tree densities, grass growth and microclimate. Other topics currently under consideration include establishment and growth trials (for both trees and pastures); trees releasing trials; and use of infra-red photography for pasture growth studies (concentrating on Kikuyu grass).

**DISCUSSION**

Throughout the development of the Pouto project it has been recognised that forestry and farming can be complementary, and this is reflected in the management structure of the farm. The farm is run by a forest farm manager who oversees both the farming and forestry aspects.

Dr K. B. Cumberland, in his opening address to the 1976 Farm Forestry Conference, outlined the many advantages and benefits which could be derived from multi-tiered farming. He noted that there are vast areas of marginal farm land in New Zealand that could be made more productive and profitable, as well as scenically and environmentally more attractive, by at least a simple two-tier form of forest farming.

At Pouto we are demonstrating the complementary nature of multi-tiered farming and we believe that the concept provides an answer to the problem of achieving more effective use of marginal farm land.
REFERENCES


——— 1975. The forest farmer and his physical environment. Farm Forestry, 17: 91-5.


