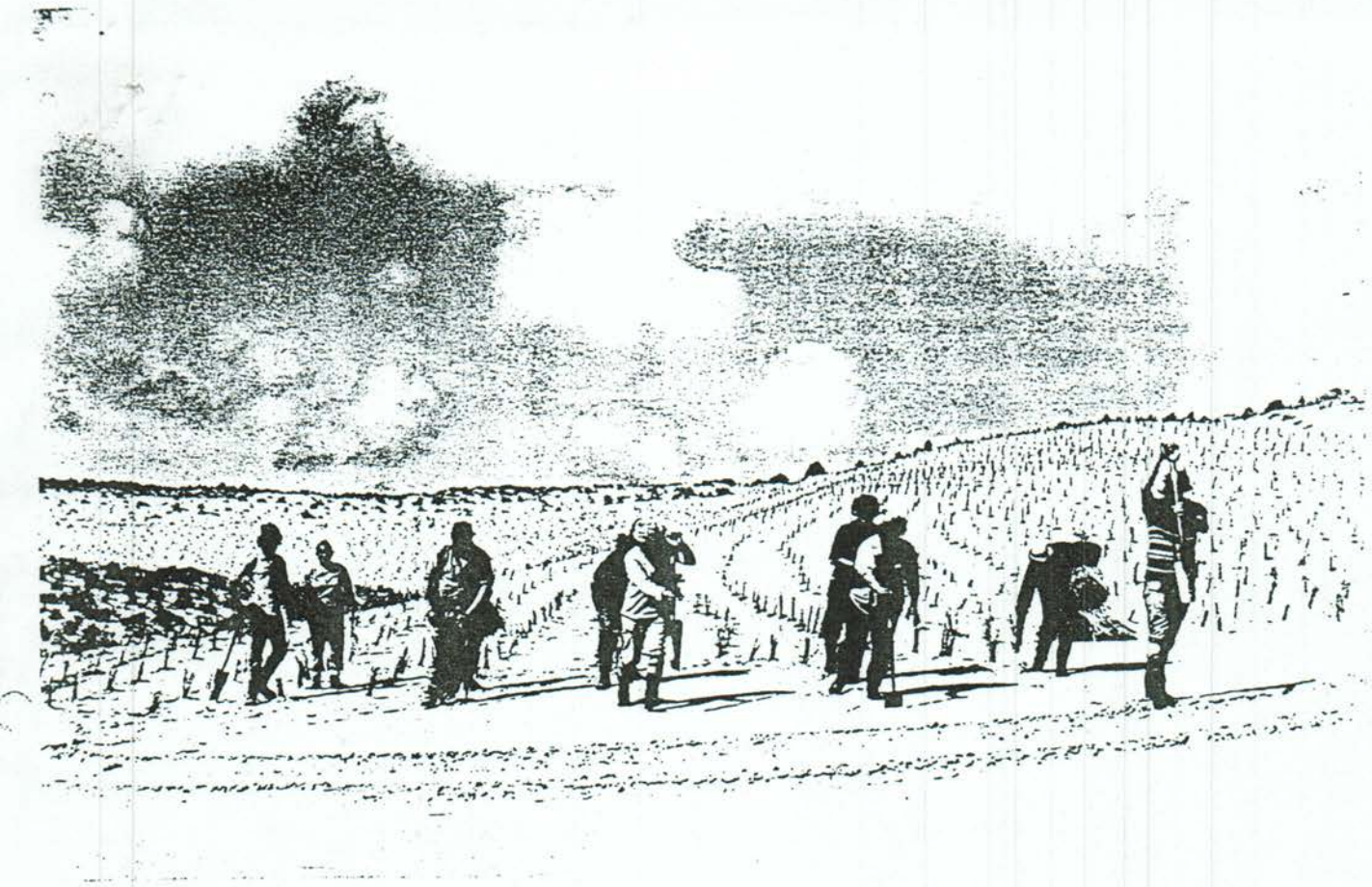


Marram grass planting on unstabilised sand dunes.

SAND DUNE FORESTRY

Introduction

Scrub burning and pastoral grazing by settlers last century initiated a continuing problem for landowners on the North Island's west coast with the movement of sand drifts inland.

A report headed "Sand Drifts" prepared by the Public Works Department in 1898 was the first indication of official interest, and revegetation was advocated as a form of control. The Sand Drift Act, passed in 1908, made provision for interested groups to petition the Crown to have an area declared a reclamation area.

The Lands Department was aware that very little was known about the dune areas and commissioned Dr Leonard Cockayne to make a survey. His report of 1911 entitled "Report on the Dune Areas of New Zealand" can be regarded as the turning point in official attitude. However, no tangible action took place until 1915 when the Forestry Branch of the Lands Department started foredune fencing and marram planting at Tangimoana near the mouth of the Rangitikei River on a former Crown Lease that had been devastated by grazing.

TREES & TIMBER

New Zealand Forest Service, Private Bag, Wellington

Forest Management Practices
Number 15

Since then the New Zealand Forest Service has assumed much of the responsibility for coastal sand dune protection. Along with other government agencies the Service has been effective in halting shifting sands along much of New Zealand's coastline.

However sand dune protection requires constant management of erosion-prone areas; any affected land owners, be they State, private corporation, or individual, have a responsibility to maintain this protection.

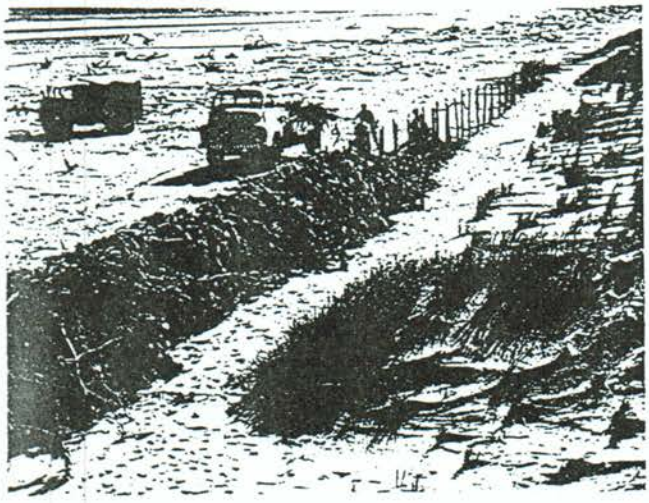
Sand dune forest management is geared to first stabilising the land and then establishing the crop. The most common species include *Pinus radiata, Cupressus macrocarpa,* and various *Acacia* spp. Well-tended radiata and macrocarpa have the potential to produce a valuable timber crop.

Even if a crop is not tended it still has the ability to offer protection, as well as contributing to soil development, by enabling fertility build-up and increased nutrient cycling to occur.

The following is an outline of management options. Your local NZ Forest Service forest advisory officers are also available to give advice. Discuss the options with them.

Stabilisation

Initially a foredune should be built up if one does not already exist. This will provide protection for the seaward area of trees and a base from which to start your stabilisation programme. A foredune can be built by machine or by providing a wind barrier. Machine constructed dunes are a similar cost to those formed by the construction of wind barriers and are completed more quickly.



Simple foredune fence constructed of posts and thinning/pruning slash.

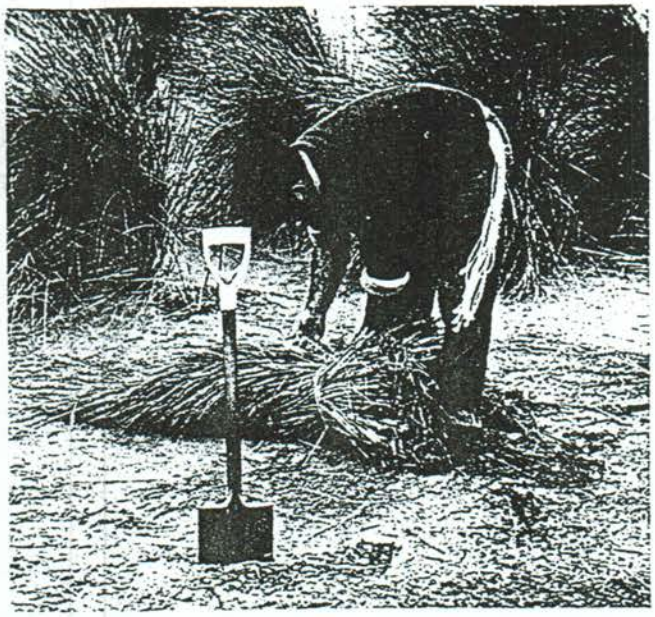
The major requirement of a dune is that it form a low raised area with smooth configuration that the wind will flow over rather than cut into and erode away. Once vegetation has been established the height of the dune will build up naturally.

The dune should be planted in Marram grass down to the high tide mark the winter after construction. Marram does not perform well on the seaward side of the dune but will provide stabilisation until spinifex establishes naturally. Spinifex *(Spinifex hirsutus)* is a sand binding plant which will grow in very exposed situations.

A marram nursery site should be selected and planted two years before the major stabilisation programme is to start. Ideally this should be on a sheltered site. To promote good growth the nursery site should be fertilised in the spring and autumn of each year with 50 kg of urea per hectare. After two years it will be ready for digging and planting out.

Marram is dug by cutting the grass about 5 cm below ground level with a very sharp spade. The clump of grass is lifted and all loose sand shaken from it. It is then tied in a bundle for transport. At the planting site the bundles are then broken into "sets", equivalent to a handful of grass, for planting out at 1 m × 1 m.

The marram sets are undercut by spade to obtain grass.



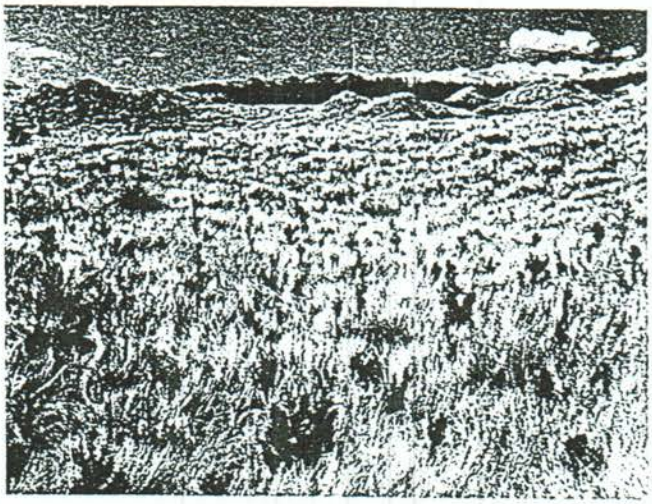
The freshly dug marram is then bundled for transporting and planting.

Main stabilisation is achieved with marram grass planted at about 1 m × 1 m. Care should be taken in digging, bundling, transporting, and replanting the grass to ensure that it does not dry out. Planting can be by hand, or machine, depending on the topography of the land and the size of the programme. The sets should be planted approximately 20 cm deep.

Looking across an area of sand stabilised by 3 year old marram and 2 year old lupin to a high dune which is yet to be stabilised.

Nutrients

Sand areas are generally lacking in nitrogen and, as a short term solution, marram requires a dressing of urea, at 50 kg per hectare, in the first spring and autumn to maintain healthy growth. Tree lupin is sown at approximately 5 kg per hectare to provide long term nitrogen in the autumn following marram establishment.



Two year old radiata pine in the lee of a foredune.

As the lupin plant grows, the roots develop nodules that help the plant convert nitrogen from the air to a form available to the plant through the soil.

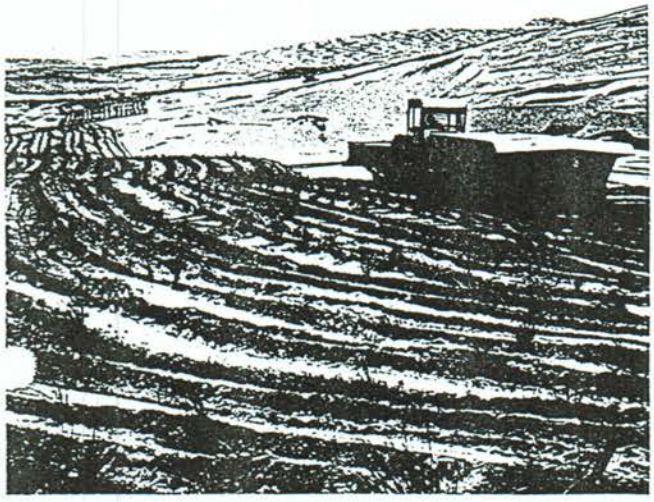
It usually takes four to five years for the marram and lupin to develop to a stage where sufficient shelter is provided for the establishment of trees.

Establishment

You, the grower, will have to decide which species will best suit your needs. Your choice will already have been limited by environmental factors. The most suitable species is *Pinus radiata*, however, it does not perform well right on the coast. *Cupressus macrocarpa* has been found to be the most suitable shelter species to use in coastal areas. This species will provide shelter for the other species planted further inland. Trees planted directly on the coast provide necessary shelter but, because they are affected by the salt-laden wind, they tend to be non-productive. Macrocarpa is well proven, having good timber qualities. Acacia species may also be planted but it is susceptible to rabbit browsing. All of the trees and shrubs planted in the foredune area will survive better if container grown seedlings are used.

Regimes will vary but generally a higher stocking will be required closer to the coast to allow for higher mortality and provide protection.

Planting can be done by machine or by hand. Machine planting is preferable as no preparation is necessary. If hand planting, lines need to be cut for access and to give light for the seedlings.

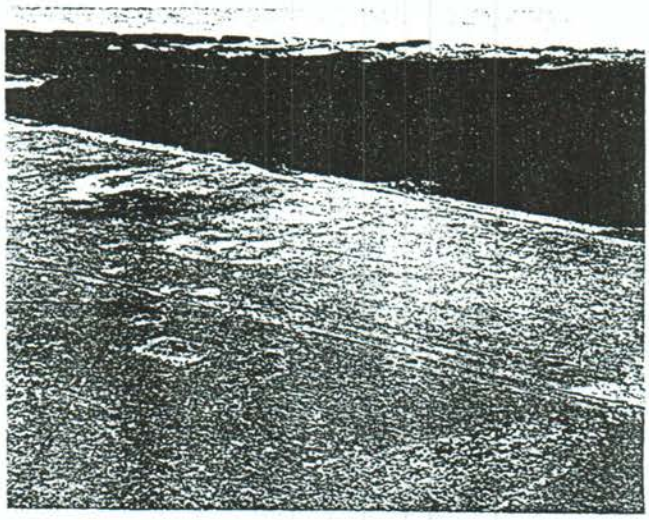


Marram planting by a 6 man planting unit towed by a bulldozer. This machine plants 3 rows at a time and is capable of a production rate of up to 1 ha/hr.

Once the crop has been established, releasing is the first priority. Two options exist, chemical or hand. Hand releasing is a time-consuming and continuing operation but it does contain the lupin crop. Chemical spraying controls lupin very quickly and cheaply but reduces the cover with some adverse effect on nitrogen production. The options need to be carefully evaluated before any decision is made.

Following releasing, your tending regime will generally follow that of a regular woodlot/shelterbelt. Thinning to waste and pruning should take place at about age 4–5 years to ensure the stem defect core is controlled and retained at an acceptable level.

Subsequent canopy closures assist lupin die-back which in turn increase the return of nitrogen to the soil. As progressive thinning operations are carried out, the lupin regrowth cycle continues. Crushing of the understorey during utilisation thinning operations assists the transfer of nitrogen. Pruning and thinning waste also contribute to the build-up of a viable soil type.



A protective belt of trees shelters reclaimed land.

Conclusion

Generally the tree crop growth cycle will take 30–35 years to reach economic maturity at which time final logging operations can be carried out and a start made on the next rotation.

If the original foredune, shelter strip, and stabilisation measures have been maintained, replacement of the crop will be straightforward.

The long term effect of chemical deficiencies is continually being evaluated. Some trees have developed twisted stems and branches, possibly due to a potassium imbalance. Small stubs and stumpy needle growth are caused by copper deficiencies. Aerial spraying of cuprous oxide may provide a remedy.

Light green foliage in a tree indicates a continuing nitrogen deficiency. Healthy trees have a dark green colour.

As well as providing essential protection to coastal areas and pastures, sand dune forests cater for ongoing employment and recreation needs.

Further assistance and advice on sand dune forestry is available on request from your local forest advisory officer, New Zealand Forest Service.

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Published by: New Zealand Forest Service
Private Bag
Wellington
New Zealand
1986

V. R. WARD, GOVERNMENT PRINTER, WELLINGTON, NEW ZEALAND—1986
54707D—86PTK