Sand Country Agriculture

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Just as wind and water were the two important instruments in the formation of the sand country so are they two of the most important factors which have to be constantly borne in mind in its farming.

Whether or not sand country can be farmed profitably is determined by the ability of the farmer to establish and maintain useful pastures. That some sand country is unprofitable for farming is illustrated by the sight of fences which have been erected on it and which have not only been covered by wind-blown sand but also uncovered later by the wind. Farming of sand country can, therefore, commence only where there is a reasonable chance of there being a minimum amount of damage to pastures and crops from drifting sand.

Coastal protection with spinifex, marram grass and often trees, is usually necessary to form a protective screen to farms where there is a danger from drifting sand.

Farming of sand country, therefore, starts behind this protective screen.

As a general rule farming necessitates the replacement of an existing unpalatable or unproductive type of vegetation with one which will produce the maximum amount of feed for farm livestock.

Much of the sand country is covered by unpalatable shrubby plants and low-producing grasses which must be destroyed and replaced with something useful if farming is to be profitable.

From the farmer's point of view there are three main types of sand country, namely:

1. The swamps.
2. The sand plains and easy undulating land.
3. The dry sand ridges.

Each of these types of country requires different treatment and yet, unfortunately for the farmer, they are scattered throughout in more or less haphazard confusion.

The Swamps

Swamps are not only non-productive but are also a danger to stock which may be unwise enough to penetrate too far into them in search of feed. The drainage of these swamps presents several problems. The first is the location of main outlets to a river or permanent stream. This may necessitate a system of drains running through several properties and their regular maintenance to ensure the free flow of water.

The next problem is that of the draining itself. Draining of sand country, or any other country for that matter, should aim at the removal of only surplus water. Too often one sees land with deep drains which are so efficient that they remove too much water, with the result that the land becomes too dry to maintain good pasture as well as being liable to wind damage.

Another problem is that relating to the drains themselves. The conventional steep-sided narrow drain is almost useless, because the friable nature of the soil subjects it to rapid wear by the water and subsequent cave-in. Hoof damage by animals is also severe. It has been found that the best type of drain is one which is very broad, with gently sloping sides. Such drains can be grassed and are liable to little damage from either water or animals.

Country which is well drained but not overdrained can carry good pastures which carry a minimum of surface water in the winter and which do not dry out too much in the summer.

The Sand Plains and Easy Undulating Land

The sandy plains occupy the greatest area of the sand country and present a number of problems. They usually carry a shrubby vegetation often dominated by manuka. If this is very tall it is rolled, burnt and ploughed under in the winter. Shorter scrub is ploughed in with a swamp plough and chain. This is rolled on the furrow and surface-worked down to a seed bed without bringing up the buried litter. Usually some of this litter protrudes through to the surface and thereby performs a useful purpose in the reduction of sand blow. Such areas are sown in the spring, sometimes to pasture with a light seeding of a protective and rapid-growing cereal. Often the country is sown to a brassica crop such as chou moellier, rape or kale, which is fed off in the late summer and oversown in autumn with pasture seeds which are trampled in by sheep. The main object is to achieve consolidation and to eliminate cultivation with its attendant risk of damage from blowing.

The basis of all pasture mixtures sown for high production is a high-producing leguminous plant. Because of the great variation in the moisture content of the undulating sand country, it is necessary to employ three of these on much of the country. On country which is liable to be flooded repeatedly or for long periods in the winter, strawberry clover is the only one which can be relied on to survive. In the well but not over-drained areas, white clover is the most suitable. Because these two types of country often occur in small adjoining areas both clovers are sown overall. On country that is too dry for the permanent survival of white clover, the only useful legume is subterranean clover. This legume, valuable as it is, has the serious disadvantage common to all annuals of dying in the summer and leaving open spaces which can lead to severe wind damage.

The Dry Sand Ridges

The dry sand ridges are particularly prone to damage by animals. For example, a small scar caused by a burrowing rabbit on a poorly grassed ridge can rapidly develop into a major "blow."

Pasture improvement on the ridges consists primarily of the introduction of subterranean clover as the only useful legume. This is reasonably satisfactory if the accompanying grasses are able to provide protection from wind damage by being fairly tall, rhizomatous or stoloniferous. If, however, the accompanying grasses are shallow rooted and have no sand-binding properties, the use of subterranean clover can result in increasing damage as the stock-carrying capacity increases.

Spelling of pastures by shutting them up for hay or by growing lucerne on the flats can assist materially in repairing damage to ridges, provided the damage is not severe. Where it is severe it may be necessary to plant with marram grass, or to reduce sand movement by pegging down branches of trees and oversowing with grasses and clovers.

The planting of trees on the ridges also has the effect of stabilizing the sand. It also has the great disadvantage of requiring fencing which if the ridges are plentiful can be very expensive.

The Coastal Dune Lakes

B. T. Cunningham

New Zealand has no native fish of interest to sportsmen. Apart from eels, which are large and abundant, the native species are small and rarely occur in large numbers. Angling is for introduced species, mainly brown and rainbow trout or quinnat salmon and these fish are established in nearly all waters suitable for salmonids. Interest in angling is increasing rapidly and it is necessary to develop additional waters. One group selected for study was the western coastal dune lakes of the North Island.

There are about 170 dune lakes in two series between Otaki and Hawera, and Waiuku and North Cape. The lakes are small and shallow, usually being under 400 acres in area and less than 15 m. in depth. All lakes have a common feature of an impounding barrier of sand. The lakes are of two types—basin and dammed valley lakes. Basin lakes lie between the foreshore dunes and the consolidated sandstones (*e.g.*, Lake Kereta) or fill depressions in the consolidated dunes (*e.g.*, Lake Waingata). Streams draining the consolidated dunes have been blocked by moving sand to form dammed valley lakes (*e.g.*, Lake Herengawe). Water levels appear to be maintained by rainfall and seepage from the drainage basins. Levels fluctuate about two feet annually. Few have inflowing or outlet streams and outlet streams are often intermittent in flow. The mean annual rainfall varies from 30-50 inches, which is spread over the whole year, with a drier period over the summer. The mean monthly air temperatures range from 47° to 63° F. The majority of the lakes are exposed to the prevailing westerlies and water turnover occurs at all seasons. Less frequent eastern storms also assist water turnover.

Water temperature of the open water varies from about 9° C. to 24° C. The surface waters in the Northland lakes may be above 20° C. for four months. Temporary thermal stratification occurs in some lakes and temperature differences of 2° C. to 5° C. were found between surface and bottom waters. The maximum difference was 8° C. The thermocline is usually between