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**T A H A L
WATER PLANNING FOR ISRAEL LTD.**

**GOVERNMENT OF ISRAEL
UNITED NATIONS SPECIAL FUND - FOOD AND AGRICULTURE ORGANIZATION**

**JOINT EXPERIMENTAL COASTAL GROUNDWATER
COLLECTORS PROJECT
TECHNICAL REPORT No. 2**

**SAND DUNE STABILIZATION
FOR THE PROTECTION OF ENGINEERING STRUCTURES**

by

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28th February, 1963

Mr. P. C. Lindenbergh and
Mr. Y. Kahana
Water Planning for Israel Ltd.
Tel Aviv

Gentlemen,

I have the honour to submit herewith my report on Sand Dune Stabilization for the Protection of Engineering Structures, covering investigations carried out over the period March 1962 to February 1963.

Yours truly,

A handwritten signature in dark ink, appearing to read 'M. Saltiel', written in a cursive style with a long horizontal stroke extending to the right.

M. Saltiel, C. E.

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2. NEW ZEALAND

New Zealand can be quoted as a classical example for the stabilization of shifting sand dunes by gradual stages, comprising:

the creation of an artificial littoral dune according to the traditional method, i.e. by placing a shrub barrier line parallel to the sea and replacing it with a new one as soon as the old line has been covered with sand. When the littoral dune has attained the required profile it is stabilized by planting the seaward slope with *Ammophila arenaria* at the top and *Spinifex hirsutus* at the bottom.

The preliminary stabilization is achieved by planting the areas behind the sand dunes with *Ammophila arenaria*. The New Zealand foresters succeeded in mechanizing *Ammophila* plantation, thus drastically reducing sand dune fixation costs.

Permanent stabilization on the areas planted with *Ammophila* is done by sowing *Lupinus arboreus*.

After the lupine has developed, the sands can be utilized either for timber production, by planting *Pinus radiata* (*radiata* pine) or for pasture (the flat areas, east of the *Pinus radiata* plantations, are usually utilized for this purpose). (9) (10).

3. UNITED STATES OF AMERICA

Only two of the sand dune fixation methods now in use in the United States will be analyzed. The first along the North-West Pacific Coast and, the second along the shores of Lake Michigan.

Sand dune fixation along the North-Western Coast is done in three stages:

Two year old *Ammophila arenaria* culms are planted. In some cases it is necessary to form an artificial littoral dune. The second stage (after the planted grasses have stilled the sand) comprises sowing or planting leguminous plants, *Lupinus littoralis* Dougl. (littoral lupine) being the main plant.

The tertiary stabilization stage comprises the plantation of trees and shrubs. (27) (28).

Along the shores of Lake Michigan, the stabilization is carried out in two stages:

Preliminary stabilization either by mechanical or by vegetative means. Mechanical means consist of dispersing brush cover on areas to be stabilized, and sticking wooden pickets into the sand so as to form low square barriers that will break the force of the wind. The procedure is very expensive, so preference is given to the planting of *Ammophila*: two years old culms are planted in groups of two or three, or in patterns forming squares.

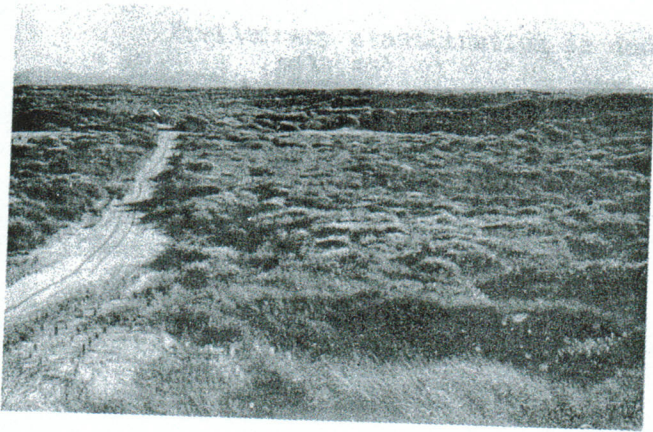
SAND DUNE STABILIZATION IN STAGES (NEW ZEALAND)



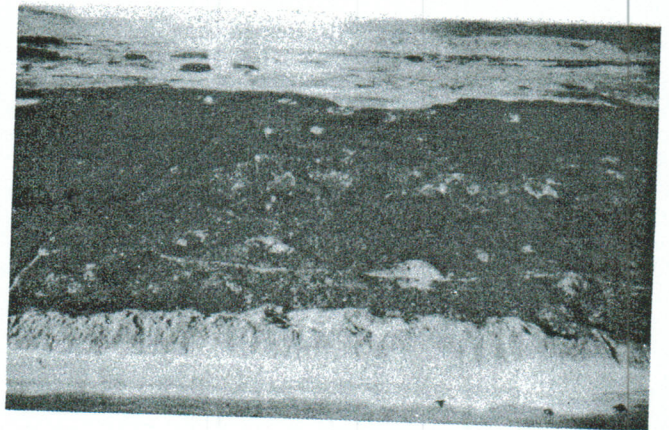
Waiterere - Dune complex before treatment. (Fenton - Sand dune reclamation in New Zealand. E. F. R., 1949)



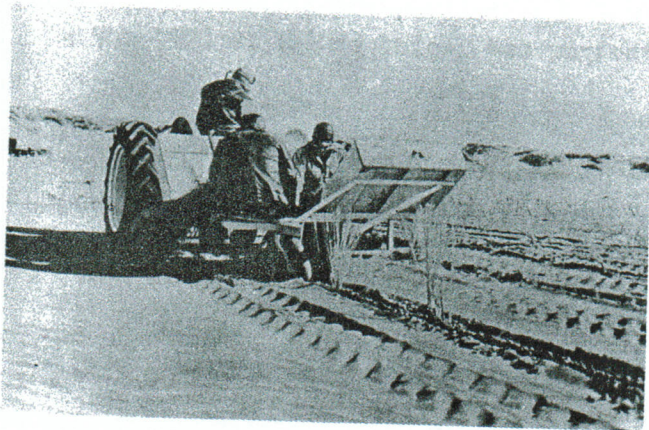
Waiterere - Untreated dune complex recently planted with Marram grass. (Fenton - Sand dune reclamation in New Zealand. E. F. R., 1949)



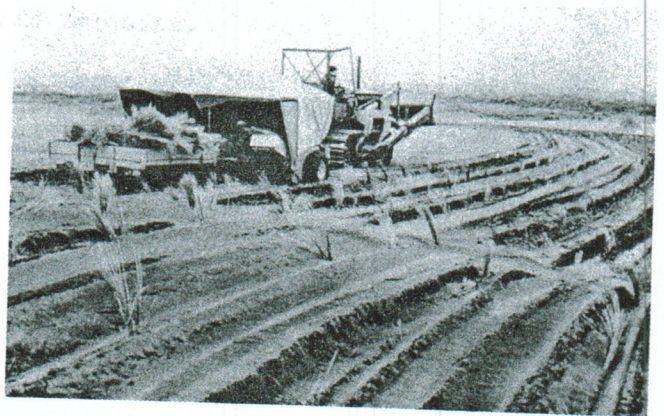
Waiterere - Secondary stabilization with *Lupinus arboreus* sown in Marram grass sand stabilized area. (Fenton - Sand dune reclamation in New Zealand. E. F. R., 1949)



Waiterere - Aerial view of Waiterere sand dune reclamation scheme comprising (from the sea landwards) littoral dunes, a Marram and Lupin strip, an afforested strip preceding agricultural lands. (Fenton - Sand dune reclamation in New Zealand. E. F. R., 1949)



New Zealand - Marram planting machine with two men team. (Conway - Mechanization in sand dune afforestation. E. F. R., 1956)



New Zealand - Marram planting machine with six men team. (Conway - Mechanization in sand dune afforestation. E. F. R., 1956)

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