Preliminary Study

on

Stabilization of Sand Dunes

by

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INTRODUCTION

Sand dune ecosystems are fragile. Natural calamities such as fire, drought, animal grazing or rodent activity etc. have been known to destroy vegetative cover on sand dunes and set the sand in motion again. Heavy recreational use may also lead to similar consequences.

As soon as the vegetation is destroyed, its sand binding ability is lost and a bare area is created. The threshold wind velocity for sand movement is 4 meters/second (9 miles/hr). At or above this wind velocity sand starts to creep up the gradual windward slope of 5° and is dropped over the crest of the lee-ward slope (30°). The loss of sand exposes the root system of plants that are desiccated by high temperatures and high evaporative capacity of wind. A blowout is quickly created which continues to increase in width and depth. Erosion of sand may expose the capillary fringe so that flat moist slacks become visible among sand dunes. Such wandering dunes bury the live vegetation on the leeward side of a dune.

Primary bare areas created by wind erosion provide formid-able conditions for colonization of plant species. For success-ful colonization a plant has to pass through four biological processes; germination, establishment, growth and reproduction.

Germination and Establishment of Plants on Sand Dunes

Seed germination on the sand dunes frequently occurs after soaking rainshowers. Large number of seedlings of bugseed, cakile, wormwood, russian thistle, canada ryegrass, sandreed or

marramgrass appear during spring, summer, and fall after rains. The establishment of these seedlings is, however, very poor because of abrasion by sand, high evaporative capacity of wind, high soil temperatures, low relative humidity and burial by sand. The seedling establishment is confined only to prolonged rainy cloudy weather conditions.

Experiment 1. Germination of seeds and establishment of seedlings of sandreed (Calamovilfa longifolia L.).

The objective of these studies was to determine seed germination and seedling establishment on exposed and protected dune habitats.

Methods. Twenty lots of 50 seeds each were stratified in nylon bags under natural conditions for 3 months. The seeds were planted on the sand dunes in April 1977. The protected habitats were located under Juniper shrubs.

Results. Only about 2% of the seeds germinated. The germinated seedlings failed to establish themselves. A windy hot day following a rainy day eliminates all seedlings of Calamovilfa longifolia.

My observations showed that ryegrass (Elymus canadensis L.) seedlings survived because they germinate very early (mid April) in spring and the seedlings are already established before the onset of hot weather.

Experiment 2. Germination of seeds in growth chambers.

For good germination, seeds should be stratified at 5 C for a period of at least 2 weeks. After stratification seeds should

be placed in growth chambers maintained at 25 C during day (14 hr) and 10 C at night.

Experiment 3. Establishment of sandreed seedlings of different age groups.

The object of this study was to determine the success of seedlings of different ages in exposed and protected habitats on the sand dunes at Pinery Provincial Park.

Methods. Seeds were germinated in growth chambers as explained in Experiment 2. When the seedlings were 3 days old, they were transferred to 30 x 30 cm wooden flats filled with greenhouse soil. Plants were started in wooden flats at different dates so that three age groups, 4, 8, and 12 weeks were ready to be transplanted in the field on April 25, 1977. The detailed treatments are presented below.

Habitats 1. Protected

2. Exposed

Plant Age

4 weeks

8 weeks

12 weeks

Number of Seedlings per Clump

1 seedling

3 seedlings

6 seedlings

12 seedlings

25 seedlings

Plantings were done on four similar sites. Seedlings were

transplanted in rows 40 cm apart with 40 cm between plants within the row.

Results. Following conclusions can be drawn from the data in Table 1.

a. The percent survival of seedlings increased with age. The greatest success was obtained when 8 and 12 week old seedlings were planted. Seedlings 12 weeks in age were slightly better than 8 week old seedlings.

b. The success of seedlings was greater in protected sites than in the exposed sites. Protected sites were those where natural protection was provided by shrubs and other woody vegetation.

c. The percent survival of seedlings was greater on May 11, 1977 as compared to October 13, 1977. The high soil temperatures during summer were not favourable to the survival and establishment of seedlings.

Experiment 4. Establishment of vegetative shoots with attached rhizomes.

Clones of sandreed were split into smaller units each containing about 6 vegetative shoots. These clones were planted in the following habitats in October 1975.

1. Sloping sand dune ridges with about 20° slope.
2. Depositional terraces where sand was being deposited.
3. Flat surface areas with no sand deposition.
4. Flat surface areas with moderate sand deposition.

Results.

1. Sloping sand dunes. The plants are still surviving but the

Table 1. Survival rate of seedlings at va
on April 25, 1977.

Age of Seedlings	Protected Site	
	Number Planted April 25, 1977	Number Surv May 11, 1977 O
4 weeks	4	3(75)
	12	0(0)
	24	5(21)
	48	20(42)
	100	16(16)
8 weeks	4	2(50)
	12	8(75)
	24	17(71)
	48	29(60)
	67	42(63)
12 weeks	4	1(25)
	12	6(50)
	24	16(67)
	48	34(71)
	100	62(62)

[a]The numbers in parenthesis indicate % sur

growth is not very luxurient. The sand dune ridge slides downward due to trampling and the plants slide with it thus reducing the distance between plants. For the colonization studies on dune slopes the area will have to be fenced for a certain period of time.

2. Depositional Terraces. Success of plants on such terraces depends on the amount of sand deposition per unit time. Excessive sand deposition buries the plants which are killed in a few weeks.

3. Flat Surfaces with No Sand Deposition. Almost all plants survive in such habitats but their growth is rather slow. There is no appreciable increase in the number of shoots per unit time.

4. Flat Surface Area with Moderate Sand Deposition. These habitats provide ideal conditions for the growth and continued existence of plants. The plants are very vigorous and they extend vertically and laterally in such habitats.

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