The wind factor acts as follows :—

(1.) It moves the sand, laying bare the roots of plants, and causing damage or destruction.

(2.) It causes sand-drifts or a dune to advance, thus overwhelming whole plant associations.

(3.) It makes the surface so unstable that none, or only a few species specially endowed, can gain a footing.

(4.) Sand carried by wind strikes on the plants, cutting, bruising, or otherwise damaging their tender parts. How damaging such sand-laden wind can be is amply shown by its eroding and cutting action on rock (as shown in Photo No. 31, taken high up on the dunes of Reef Point, north-west Auckland). The size of the wind-borne grains of sand is a matter of great importance, large grains being much more destructive than small ones. At Tarras, in Central Otago, an oat-crop facing the drift is frequently cut for many feet as if with a stripper.

(5.) Plants not actually broken are bent in a direction contrary to the wind, and their foliage is "wind-shorn," but this is no more marked than on non-sandy coasts or in exposed alpine localities.

(6.) The soil is cooled (this frequently beneficial), and rapid evaporation takes place from the ground.

(7.) Transpiration is much accelerated, thus leading to desiccation (Warming, 63, p. 38), and strong xerophytic structure is thereby demanded, or plants may be wholly or in part killed.

(8.) Various plants depend for their pollination on the wind; also seeds are carried in the air or blown with the sand-grains along the ground. This may lead to the irregular planting of tussocks, &c., and so indirectly to dune-movement.

The wind-shearing mentioned above is in part due to the mechanical action of the wind, and in part to the physiological conditions induced by excessive transpiration.

The salt gales of the coast of part of Wellington and Taranaki, which occur every few years, make their effect felt at more than twelve miles inland by damaging deciduous trees, *Eucalypti*, and some conifers, while other species, especially Norfolk Island pine (*Araucaria excelsa*) and African boxthorn (*Lycium afrum*) are undamaged. How far the salt carried by the wind has a physiological effect I do not know, but the chief damage is probably due to the quite abnormal transpiration from the leaves during such gales.

The average number of days per year during which strong gales occur on all parts of the coast are comparatively few; were it not so, many of the species of the exposed dunes, where the rainfall is not excessive, could not exist. In the south of the South Island, and especially in Stewart Island and Auckland Island, strong gales are much more numerous than elsewhere, but their effect is, to a greater or less degree, modified by the excessive number of rainy days.

(β.) *Heat (partly considered in Conjunction with the Soil).*

The climate of the whole sand-area is distinguished by the absence of extremes of heat and cold. Certainly there is a gradual decrease of temperature in passing from north to south, but even in the Auckland Islands the difference between winter and summer is comparatively insignificant. Auckland and Dunedin, the latter being 630 miles south of the former, have, according to Marshall (119, p. 229), a difference of 8·7° Fahr. in their average mean temperature. The average temperature of the hottest month (December) in Auckland is 65·5°, and of the coldest (July) 51°; and in Dunedin the hottest (February) is 57·2°, and the coldest (August) 40·5°. More than a few degrees of frost are quite rare on all parts of the coast, excepting that of Canterbury, where, owing to the cold air sinking from the Southern Alps, the temperature may occasionally drop to 15° Fahr. Were it not, indeed, that the summer climate is remarkably low, if the latitude be considered, a considerable portion of the coast-line would be truly subtropical. As it is, one can hardly apply that term to any part, unless it be to the coast north of Hokianga and to the Kermadec Islands. But the lack of frost in the north and the equable climate certainly permit a considerable selection of what may be called subtropical trees for purposes of afforestation.

Notwithstanding what is said above, sudden changes of temperature are not uncommon in some parts. This is especially the case in Canterbury, where the well-known hot wind coming from the north-west is suddenly succeeded by a cold and violent wind from the south-west, perhaps accompanied by rain. In such a case the temperature may drop in a very short time some 30°.

Sand has a low specific heat. The upper dry layer becomes excessively hot under a cloudless sky. At Levin, on the surface of the foredune, on the 4th February, at 11.30 a.m., an ordinary mercury thermometer registered 120° Fahr. to 127° Fahr.; and on the black ironsand of the Nukumaru dune-complex, on the 16th December, at 11 a.m., the heat at a depth of 3 in. was 92° Fahr., while the air-temperature was 66° Fahr. The daily variation must also be considerable, since the rapidly heated surface layer will cool very quickly when the sun goes down.

The colour of the sand is a matter of ecological importance; the black sand of Taranaki, the yellow sand of eastern Canterbury, and the dazzling white sand of north-east Auckland differ considerably in their powers of absorption and of radiation.

The wet sand absorbs heat much more slowly, and as at a depth of a few inches below the surface the sand is always moist, the plant-roots descend into cool soil very quickly. This is a most important matter, since it renders possible the cultivation in pure sand of quite short-rooted plants.

The heat is rendered still more powerful by the strong reflection from the sand, so vegetative parts high above its surface are, during sunshine, exposed to a much greater heat and also more powerful illumination than are denizens of a meadow with the same air-temperature. This has an effect on increasing transpiration, and also on ripening fruits and accelerating flowering.

The general dryness, in conjunction with heat and intense light, leads to rapid oxidation of all dead organic matter, and prevents the formation of humus. The common belief that all dune-plants are "making soil" is to some extent unwarranted.