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Anatomy of Dune Plants

Comparative Anatomy of Dune Plants. by Anna M. Starr

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ANATOMY OF DUNE PLANTS

Starr, Anna M. "Comparative anatomy of dune plants." *Bot. Gazette*, **54**, 1912, pp. 265—305.

An interesting study of the leaf and stem anatomy of various sand dune plants growing on the shores of Lake Michigan, including (1) accounts of the xerophytic forms and (2) comparisons of plants growing on the dunes with the same species growing in mesophytic situations.

The authoress gives an introductory summary of the ecological factors in the dunes, with reference to the work of Cowles on this region. (1) *Light and Heat*. There is direct illumination, increased by reflection from the sand; because of the scanty vegetation and the great exposure, the temperature of the air is higher in summer and lower in winter than in more protected localities; and owing to the high conductivity of sand, the same great divergence between extremes is present in the temperature of the soil. (2) *Wind*. This is the most potent factor in determining the character of the dune vegetation; the winds gather force as they sweep across the lake, and when they reach the shore they gather up sand and carry it along with such force as to carve and scar the bark of trees on the windward side, and even completely wear it away. (3) *Soil*. The soil is chiefly quartz sand, the particles being relatively large, hence it is extremely porous, and this has a great influence on the water and heat relations; sandy soils generally are poor in nutrient food materials, and they do not rapidly develop a rich humus because of the rapid oxidation of the organic matter. (4) *Water*. The surface layer of soil is very dry, the capillarity of sand being less than that of other soils; evaporation from a sandy surface is rapid; and precipitated water percolates quickly, the water capacity of sand being slight. On the other hand, a sandy soil yields its water to plants more freely than other soils, and below the surface layer of dry sand there is always a surprising amount of water; Fuller has found this to be more than double the wilting coefficient of dune soil. (5) *Biotic Factors*. The only biotic factors of marked influence in the dunes are those associated with the plants themselves when they are once established, humus, and shade. Humus influences the soil temperature and increases the water content, the number of soil organisms, toxicity, and aeration. Shade influences the germination of seeds and increases the accumulation of humus and atmospheric humidity, and so decreases evaporation. Fuller found that in the cottonwood dunes the evaporation is 21 c.c. per day, while on the pine dunes it is 11 c.c., in the oak dunes 10 c.c., and in the beech-maple forest 8 c.c.—a descending scale from the pioneer formation to the climax forest.

The conditions in dunes are severe for plant life, and their result is high evaporation. The response to these conditions by true dune plants is seen in the predominance of low vegetation, long roots, thick leaves (which may be reduced, evergreen, folded, etc.), succulence, hairs, thickened epidermis and cuticle, deep palisade tissue, sunken stomata, and well-developed mechanical and conductive tissues in all parts.

Plants generally growing in mesophytic situations, when found also on the dunes, show the following modifications. (1) Of the *leaf*: increased thickness, decrease in depth and increase in surface-extent of epidermal cells, increase in thickness of the outer wall of the epidermis and of the cuticle accompanied by ridging, increase in palisade tissue, in hairs, in conductive and mechanical tissues. (2) Of the *stem*: decrease in length of the internodes, increase in the number of vessels and in the area of their cross-sections, giving greater conductive space, increase in thickness of the walls of the vessels and of the fibres accompanied by decrease in lumen of fibres, giving more wood, increase in the number of annual rings in stem of a given size, showing slowness of growth, increase in mechanical tissues outside the wood, and increase in cork.

DROUGHT RESISTANCE IN PASTURE PLANTS

Stapledon, R. G. "Pasture problems: drought resistance." *Journ. Agric. Sci.*, **5**, 1912, pp. 129—151.

The author made use of the excellent opportunity presented by the exceptional drought of 1911 for studying the behaviour and power of resistance of the several species which contribute to