

GREGARIOUSNESS AMONG TREES

BY

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In the animal world gregariousness may ordinarily be attributed to a desire among individuals, for one reason or another, to live in communities. In the vegetable kingdom we cannot credit individual members of a species with any such conscious desire for a communal life, and must seek other reasons to explain, why in some cases gregariousness is a characteristic feature of the vegetation, while in others it is strikingly absent. Gregariousness among trees is of special interest to the forester, since it may have an important bearing not only on silvicultural but also on economic questions. Foresters in northern latitudes are accustomed to forests which are pure or composed of only a few species, and they may not readily appreciate the difficulties encountered by those who work in the moister regions of the tropics, where the mixture of species is often bewildering, and where there may be only one or a few marketable species among a large number. In such cases the economic importance of increasing the proportion of valuable species is so great, that the study of the factors which promote gregariousness or the reverse is a matter of more than ordinary interest in tropical silviculture.

Gregariousness among trees is closely connected with conditions of seeding and reproduction as well as with the struggle for existence. As a rule it is brought about not by a single factor, but by a combination of factors, sometimes of a complex character. Among the more important of these factors are climate, soil and subsoil, conditions of seeding and seed dispersal, conditions for germination and the establishment of the seedling, power of regeneration by vegetative means, and capacity for survival in the struggle for existence against competitors or against external dangers such as fire, grazing etc.

As a rule severe climatic conditions promote gregariousness, because the number of species capable of surviving is small; thus gregariousness is far more general in cold or arid regions than in the warm equable climate of moist tropical regions, where the vegetation is luxuriant and there is an intense struggle for existence among individuals of many different species. Soil conditions may promote gregariousness in a somewhat similar manner, some soils being unfavourable to all but one or a few species, while the more favourable soils may stimulate a struggle for existence among many different species. Sands and gravels poor in mineral constituents and subject to rapid drying are often characterized by pure crops of pine of non-exacting species, whose seedlings are comparatively droughtresistant owing to the production of a long taproot. Many other examples might be quoted of gregariousness on particular types of soil or special situations which are unfavourable to most forms of tree-growth, such as the peat soils at high elevations in Europe, where *Pinus montana* grows gregariously, the chernozom soils (so-called »black cotton soils») which are often characterized in the tropics by a gregarious growth of thorny acacias, the dry saline soils of arid regions, on which *Tamarix* may be found growing pure, or the newly formed alluvial deposits of tropical tidal estuaries, on which species of mangrove (Rhizophoraceae) spring up gregariously. Similarly gregariousness is a common characteristic of fresh-water swamps, the alder (*Alnus glutinosa*) furnishing a good example.

Many examples might be quoted of gregariousness due primarily to favourable conditions of seeding, seed-dispersal and germination. Among the common trees of Europe the birch seeds abundantly from an early age and at frequent intervals, and the light winged seeds are dispersed far and wide by the wind, germinating readily on newly exposed mineral soil; hence, where land has been cleared, and particularly where fire has destroyed the existing vegetation and soil covering, the birch tends to spring up in gregarious masses. In the tropics there are many species with small light or winged seeds which similarly take possession of newly exposed ground. The effect of fire in stimulating

the germination of seed in large quantities at one time, and thus producing gregariousness, is well exemplified in certain pines, for instance *Pinus contorta* and *P. Banksiana* of North America. The cones are borne in large numbers on the branches, and may remain unopened for some years; if the old crop is destroyed by fire the heat causes the cones to open and shed the seed, with the result that seedlings spring up in large quantities, forming pure crops. The teak tree (*Tectona grandis*), which is ordinarily sporadic, may become gregarious in forest areas which have been cleared for temporary cultivation and abandoned, the seedlings appearing from seed which has lain dormant in the ground for many years.

Gregariousness is sometimes brought about by agencies which destroy all species except those which are specially adapted to resist extermination. Heavy grazing sometimes results in the survival of only those species which are distasteful to cattle, such as many tropical Euphorbiaceae, or those which are protected by formidable thorns or prickles. Annual fires, particularly in savannah tracts, may reduce the tree vegetation to one or a few of the most fire-resistant species. Strong powers of vegetative reproduction help greatly in the survival of a species under unfavourable climatic conditions or when subjected to burning and other forms of damage, and species possessing this advantage may tend to become gregarious. Thus in the dry plains of N. W. India *Prosopis spicigera* reproduces largely by means of suckers, and becomes gregarious by reason of this advantage. Some species of *Diospyros* become gregarious on land cleared for temporary cultivation, owing to the persistence of the rhizomes, which produce numerous suckers after all other species have been killed out. In some of the hill regions of Burma, where shifting cultivation has destroyed all the tree forest, extensive areas are covered with nothing but pure bamboo: this is due to the vitality of the bamboo rhizomes, which send up quantities of new culms after the forest has been destroyed by cutting and burning.

These few examples will show that the study of conditions producing gregarious or sporadic growth, as the case may be, opens up many

problems of a very interesting character, and deserves more attention than has hitherto been devoted to it. It should be noted that gregariousness does not necessarily indicate the most favourable conditions for growth. A species may be gregarious under some conditions and sporadic under others, but in the former case the growth may be poor owing to the fact that the gregariousness is due to an unfavourable habitat, while in the latter case it may be good owing to favourable conditions which encourage competition among several different species.

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