which is found breeding both on North and South Island and on the Snares south of New Zealand was recorded rather near land along the coast of both the north and the south island. Furthermore, it may be mentioned that the Sooty Shearwater (*Puffinus griseus*), which is known to breed on both the New Zealand islands, on the south-going trip was seen about 44° south latitude, but during the following part of the route, as well as in Cook Strait, the species was observed daily and sometimes in large numbers.

To complete the list of more oceanic birds which were observed and determined with certainty during this cruise, it may be mentioned that several specimens of the Fairy Prion (*Pachyptila turtur*) and the Little Penguin (*Eudyptula minor*) were observed during the passage through the Hauraki Gulf as well as in Cook Strait.

Competition between Plants.*

THE recent publication of the work of Clements, Weaver, and Hanson, on "Plant Competition" reports the results of numerous experiments designed to analyse the competitive functions in plant communities. Many of these consisted of transplantations of species characteristic of one phase of a succession into a type of vegetation representing an earlier or later phase. In view of the fact that the major mortality amongst plants would appear to be in the juvenile stage of development (cf. NATURE, May 31, p. 817), conclusions based upon transplantations of established plants must obviously be accepted with considerable reservation when evaluating the competitive relations between species, but recognising these limitations such have considerable value.

In a recent address (*Journal of Ecology*, August 1929) the reviewer, dealing with the biological equipment of species in relation to competition, emphasised the importance as factors in the competition struggle of such features, *inter alia*, as potential height, rate of growth and spread, development of the root system, capacity for reproduction, and the mode and percentage of germination. The experiments of Prof. Clements and his collaborators furnish additional corroboration of these conclusions. They state that practically all the advantages or weapons of species are epitomised in the two words amount and rate. In competition between short and tall grasses the latter were successful under moist conditions, but under dry conditions or when the herbage was grazed the shorter grasses, as might be expected, more than held their own. *Sporobolus asper* was successful in competition with *Andropogon furcatus*, despite its shorter stature, a result attributed to its more efficient root system. *Elymus canadensis* is the victor in the struggle with *Panicum virgatum* owing probably to the earlier and more rapid growth of the former.

The importance of percentage germination was shown by cultures of *Andropogon glaucum* with *Andropogon scoparius*, in which it was found that either species became the dominant when the number of its seedlings had been considerably in excess of those of the other. The advantage of priority of occupation was shown by transplantation experiments, in which it was found that the species already established were almost always victorious over those introduced—a conclusion which supports the contention that mass migration rather than random inoculation is the important factor for successful establishment.

Experiments upon the competition between forest and prairie show the importance of moisture in favouring the arboreal vegetation. The transition zone between the grassland and forest is a broad one of fluctuating extent, and the hypothesis is put forward that the advance or retreat of the forest margin respectively corresponds to the wet and dry climatic phases which coincide with the sunspot cycle.

The observations of Cockayne in New Zealand, and of other experienced field botanists, have emphasised the absence of naturalised species from virgin climax communities in regions where disturbed vegetation has become invaded by an extensive alien flora. Denudation experiments also bear witness to the importance of priority of occupation in the plant world. Cornfields which have passed out of cultivation may still show remains of the weed flora thirty-five years after they have ceased to be arable land, whilst wood-anemones and other members of the shade-flora will persist long after a woodland area has been converted into pasture. Such persistence is indicative of the comparative stability of plant communities and shows that the pressure of competition may operate over a considerable period before its effects are manifest. For this reason the drastic changes involved in many competition experiments, such as those here considered, which operate within a brief period of but a few years at most, are probably not directly comparable to the competitive processes of Nature, which if sure in their outcome are often extremely slow in their manifestation. Nevertheless, the amount of experimental work bearing on the phenomenon of competition is so meagre that we welcome the publication of any such studies whilst recognising the caution necessary in applying conclusions based on these artificial conditions to the explanation of competition phenomena as they occur in Nature.

The work is more of a very detailed account of the experiments than, as might be inferred from the title, a general résumé of the subject, and indeed one is conscious of a sense of inadequacy due, in part, to a lack of coherence in the method of presentation and, in part, to the omission of data necessary to the proper appreciation by the reader of the real significance of these experiments.

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* Plant Competition: An Analysis of Community Functions, by F. E. Clements, J. E. Weaver, and H. C. Hanson. Pp. xvi+340, with 32 Plates, 30 Figs., and 133 Tables. (Washington, D.C.: Carnegie Institution, 1929.)