Discussion

P. C. BULL said that, of the animals he had worked with, hedgehogs were relatively scarce, except in the vicinity of built-up areas. His own work had been largely concerned with the distribution of a nematode parasite of the rabbit. Too great an agreement between the distribution of the animals and the outline of the ash showers should not be expected. This parasite has a free-living stage which it spends in the soil, and may be influenced by some factor in it. He also mentioned the great lack of information on many of the other animal groups, particularly the invertebrates. He wished to elaborate on one point mentioned in Mr. Lee's paper; the weka was reported from this area about 1936, but has not been seen since, and its presence is doubtful. The same can be said of the native crow, which has been reported from further north, but has not been confirmed from the West Taupo area.

PROF. V. J. CHAPMAN said he had several questions he would like to ask. Mr. Poole had mentioned that the forest was advancing, beech on the southeast and podocarp forest on the northwest. Would they eventually meet and eliminate the tussock and scrub country? Regarding the relationships of the two types of forest, beech or podocarp, is there any correlation here with two different types of climate? He then asked Mr. Taylor whether, generally speaking, podsolisation is a normal effect where there are ash showers. He had noticed the remarkable and puzzling sharpness of the boundary between grassland and beech forest. It had been mentioned that the forest was progressing into the tussock grassland. At the Chateau, a zone at the edge is dominated by *Dracophyllum,* and underneath that are beech seedlings. These are not to be found in the tussock grassland, out in the open. He wondered if it was due to the effect of deer and rabbits, or whether the covering of the grassland may be such that the seedlings cannot get established. The progress of the forest is presumably going to be very slow indeed if it depends on only marginal growth. Referring to the soils near the Chateau, some of the grassland ones are relatively immature. Climatically it is apparently possible to have beech growing there. Since the 250 A.D. major ash-shower that killed vegetation there should have been adequate time for beech forest to have developed over the whole area. Either there must have been other smaller showers, or there was burning by the Maoris, and forest has been unable to develop. The possible sequence is grassland, and then forest, but in point of fact the area is maintained as tussock, depending upon the frequency with which it has been fired. At the Chateau the rainfall may not be sufficient to maintain forest; the failure of the beech to advance may be due to inadequate rainfall during the summer months. It is possible that these light pumice soils may have a vegetative pattern cycle: a certain type of vegetative cover develops; owing to various factors the vegetation may become undermined or destroyed, and later it gets built up again. It is possible that this is happening in this central area.

MR. TAYLOR, in reply, said that there is a certain pattern of similarity of weathering throughout the world. Superimposed on that there is a conditioning of weathering by soil life, of which vegetation is a very important part. This introduces a new source of energy into the process. Of Taupo ash we would say it would follow the pattern described, but podsolisation is a different story. If these conditions stayed long enough podsolic soils would develop owing to a quick conditioning of the weathering. Taupo is in a very early stage, regarded as 10 per cent. weathered. He then went on to say that there is some soil evidence about the Maoris firing the grassland. There is fairly reliable evidence that some areas were once under forest, and have been burnt back; there is also some soil evidence that the forest would eliminate the tussock.

MR. POOLE said he thought that forest would occupy the whole of the area in the course of time; primarily there is a forest climate there; there may possibly be a non-forest climate east of the mountains with a lower rainfall. From the Chateau, across to the western boundary of the ash showers, there is a cedar forest, and the forest is creeping out from it too. On the Kaingaroa Plains there are pockets of forest all round the edge. As far as the rate of spread is concerned, beech and podocarp forest are very different. The beech advances only through a very narrow ecotone—and the ecotone must advance first; the podocarp has a wide belt of migration. Attempts had been made to establish beech seedlings outside the ecotone, but had failed. Another factor influencing migration in some areas was the nature of the soil, which could be very difficult for the forest to migrate on to; it managed to cross in some places however.

PROF. G. T. S. BAYLIS then asked what factor might lead to the destruction of beech seedlings, and suggested drought. PROF. CHAPMAN said he was thinking largely of animal effects.

MR. BULL did not consider that rabbits were a significant factor. The size of the population appears to be subject to some sort of cycle. He referred the question of deer to T. RINEY, who said that he had not visited the area, but that to the north of Taupo the populations were naturally controlled by an unknown cause, similarly in the Urewera. He would suggest to Prof. Chapman that at the edge of the forest and grassland there are many kinds of country where one would not expect rapid movements of the forest.

A. P. DRUCE said he had seen an example in the Kaimanawas recently where there was plenty of regeneration inside the forest, but it was not advancing significantly at the present time. He thought that the most important factor now retarding the advance of forest is fire. Grazing has been carried on for some time, and regular burning is still taking place. After a fire the edge of the bush is sometimes only scorched, but this retards the advance. In the Rangitaiki area, where the rainfall was only 39 ins., the beech forest is advancing; at the Chateau there is 69 ins. In the areas south and west of Taupo we are dealing with two different forest migrations. There is a recent one coming down from the north, following the Tarawera eruption, and two from the south. There was tussock grassland there before the Tarawera eruption—it was not forest. At the time the pumice fell the forest was advancing slowly northward, both beech and cedar. Most of the area where there is pumice has become forest. Pumice has enabled forest to start in the valleys and gradually spread out.

Can anybody tell why, when tussock is destroyed, it tends to go to manuka. Why did not manuka come in after the pumice eruptions as it does now after the tussock is burnt?

R. I. KEAN, speaking of the spread of beech, cited an example from the catchment area of Lake Coleridge. The head of the valley was mountain beech and the lower end was burnt off early in the present century. There is good regeneration in some places. The lower portion of the valley is tussock but there are small groups of beeches. Their age is uncertain but they are not survivals from a former bush covering. The beech is at present unable to regenerate in the tussock, but the presence of these scattered trees is evidence that at one time solitary beeches were able to colonise the area. This would appear to indicate that there has been some change in the soil. At the edge of the beech forest seedlings are dense, beeches can grow beyond it for a distance of one or two chains. This is the effect of deer; also sheep, rabbits and opossums prevent any spread of beech over the marginal area of regeneration. These animals all concentrate in this area—it is a matter of soil fertility. There are more species in that narrow band on the margin of forest and grassland. Beech regeneration is now impossible in such places because of the animal pressure. In another area, on land recently cleared by avalanches, regeneration is scattered, but is all through the area. There are not many browsing animals.

MR. TAYLOR, speaking of beech migrations, said that there was beech growing over the National Park area in pre-Gisborne times. It grew on the Upper-Tongariro ash, as shown by accumulations of beech leaves.

In closing the discussion the Chairman (PROF. BAYLIS) said that they had a somewhat similar problem in the South Island in the 30-40 ins. rainfall belt. There was tussock grassland with forest pockets, which we expect to invade fairly rapidly, and which in fact put out the few odd seedlings, and fire removes them. Maoris and fire in the South Island make up for the volcanic fire factor in the North Island.