AN ECOLOGICAL STUDY OF KAU Ri FOREST.

(H. B. Latter.)

(An abstract of a special study prepared for B.For.Sc. Degree, 1932.)

The study was made at Puketi near Hokianga, North Auckland, in hope of obtaining quantitative data on the composition of, and phases in the life history of the Kauri forest. The quantitative work was originally intended to be carried out in types defined by qualitative descriptions. Owing to lack of time, quantitative work was carried out in only one type, the Kauri consociation. The method used was that of the quadrat. On an area 100 yards by 50 yards all trees of 3 inches circumference and over were plotted and their D.B.H. measured. The outlines of the crowns of the dominants and co-dominants were plotted. It was thought that the quadrat was more suitable than the line transect, as the Kauri consociation occurs in groups. These groups usually occur on the white sand soils derived from a quartzite.

The following is a generalised summary of the results of the whole study of the quadrat.

In making the qualitative descriptions the vegetation was described by storeys or crown classes. In the Kauri consociation the storeys are clearly marked. These are:—dominant (about 120 feet high), sub-dominant (about 90 feet high), intermediate (about 60 feet high), super-kauri grass (about 20 feet high), and kauri grass (about 5 feet high). There is a considerable difference in height between the dominants and sub-dominants, but owing to their great height it is sometimes difficult to assign trees to their correct class. The intermediates, about 60 feet high and receiving no direct light, are clearly marked from the upper classes, but are less easily separated from the class below. The super-kauri grass class is characteristic of the Kauri consociation. It is a sparse storey of round-headed small trees or large shrubs about 20 feet high, whose crowns are completely visible between the kauri grass and the intermediates. It is the sparseness of this storey which gives the Kauri consociation its open appearance. The kauri grass is a dense mass of Gahnia xanthocarpa and Astelia trinervia about 5 feet high. This class includes partially grown representatives of other classes, very largely super-kauri grass species.

An attempt was made to amplify the common description of the light relationship of species as light demanding or shade
bearing by stating the crown class which fully grown specimens most often reach in this consociation. For example, species which reach the intermediate class are termed obligate intermediates. This merely gives the light relationship for adult individuals, and gives no information on the conditions necessary for the establishment of seedlings.

*Mida myrtifolia, M. salicifolia, Dracophyllum latifolium, Corokia buddleoides, and Leucopogon fasciculatus* are the chief obligate super-kauri grass species. In numbers these species form 86 per cent. of the obligate super-kauri grass trees, and the obligate super-kauri grass trees form 47 per cent. of this storey. By basal area the obligate species form only 35 per cent. of the storey, the immature obligate intermediates form 60 per cent., the immature obligate sub-dominants 4.5 per cent., and the immature dominants 0.5 per cent. The first three species mentioned may be classed as shade bearers as they are never found in full light, but the last two are often found in full light in second growth areas. The importance of the obligate super-kauri grass species lies in the fact that they are all berry-bearing and probably provide an alternative but essential supply of food for insectivorous birds living in the lower layers of the forest.

*Ixerba brexioides* is by far the most important obligate intermediate. In numbers it forms 82 per cent. of the obligate intermediates. In numbers the obligate intermediates form 64 per cent., the immature sub-dominants 14 per cent., and the immature dominants 22 per cent. of the storey. By basal area the figures are 62 per cent., 20 per cent., and 18 per cent. The immature dominants are all Kauris, of which there are only seven healthy straight trees out of the 42 present on the area to replace the 39 sub-dominants and 13 dominants.

Rimu is the most important obligate sub-dominant. Ten out of the twelve obligate sub-dominants are of this species. Other obligate sub-dominants are totara, miro, *Dacrydium Kirkii, Phyllocladus trichomanoides, and P. glaucus.* In number the obligate co-dominants form 24 per cent. of the storey. In basal area they form 22 per cent. The immature dominants present are all Kauris.

The dominants are all Kauris.

The percentages of this species in the different crown classes are as follows:

<table>
<thead>
<tr>
<th>Crown Class</th>
<th>In numbers</th>
<th>In basal area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominant</td>
<td>3</td>
<td>39</td>
</tr>
<tr>
<td>Sub-dominant</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Intermediate</td>
<td>45</td>
<td>26</td>
</tr>
<tr>
<td>Super kauri grass</td>
<td>40</td>
<td>2</td>
</tr>
</tbody>
</table>

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In considering the loss in numbers of kauri in passing from one crown class to another very contradictory results are obtained. There is a large gain in numbers between the super kauri grass and the intermediates, a loss of 8 per cent. between the intermediates and the sub-dominants, and a loss of 33 per cent. between the sub-dominants and the dominants. This is an exact reversal of what occurs in pure stands fully stocked in the seedling stage. Several even-aged patches of pole sized kauri were found, which were judged to be about the area of a mature kauri crown. Possibly a large proportion of the natural regeneration of the kauri takes place in these small even-aged patches formed by the fall of old kauris. Such a patch gives rise finally to one or two mature trees. However, there is also regeneration of the uneven-aged forest type, judging by the presence of healthy sub-dominant rikas in the mature area examined. These rikas cannot be trees of the same age as the dominants freed from suppression by the fall of these dominants, or they would occur in large groups. This is not the case, as they merely fill the gaps between the dominants. On the fall of the present dominants these sub-dominants will expand their crowns and become the dominants. The remaining area of the gaps will be filled by even-aged groups. The power of the kauri crowns to make full use of the available space is demonstrated by their interlocking, as shown on the quadrat map.

The seedlings necessary to fill the gaps caused by the death of old kauris are probably present before the death takes place. This statement is based on the seedling plot observations. These show that in full light *Gahnia xanthocarpa* is much more numerous than *Astelia trinervia* in the kauri grass, and that the former species is very unfavourable to kauri regeneration. On the other hand regeneration is favoured by the shade of kauri plus intermediates, such as *Ixerba brexioides*. Under these conditions there is a full stocking of kauri seedlings. The quadrat map shows that these conditions are available under the larger kauris. The shade of the podocarps appears to be unfavourable to kauri regeneration apart from the presence of *Gahnia xanthocarpa* or *Astelia trinervia*. The presence of *Astelia trinervia* does not in itself favour the regeneration. Patches of *Metrosideros* species (lianes) scrambling on the forest floor, *Dicksonia lanata*, suckering *Quintinnia serrata*, all hinder kauri regeneration.

In studying the individual kauri it was found possible to recognise stages of development based on the form of the crown. These stages are, young rika, old rika, young middle aged, old middle aged, young “old man,” and old “old man.”
concern the change from the conical crown of the young rika to the spreading crown of the "old man" form. An indication of the rate of diameter growth was obtained from the method of bark shedding. This indicates that diameter growth is most rapid in the young middle aged stage. This is often the period of maximum height growth. The length of the merchantable bole is fixed during the old rika stage. The young middle aged type forms roughly a quarter of the total kauri both in numbers and in basal area. The average D.B.H. of this stage is 19 in. (maximum 26 in., minimum 13 in.). All the trees of this stage are healthy sub-dominants. Again the old rikas form 25 per cent. by number and 7 per cent. by basal area of the total kauri, with an average D.B.H. of 10-5 in. About two-thirds of these trees are perfectly healthy.

Remembering that these measurements were made in a patch which contains a large number of old kauris, the number of young trees present seems to throw considerable doubt on theories postulating the decadence of the kauri and the temporary and non-climax nature of the association.

It is hoped that this study may provide information of silvical value to others engaged in the highly important work of investigating the life history of our native bush areas.

Editor's Comment:

It is no doubt dangerous to criticise from a summarised abstract such as this, but it seems that Mr. Latter's study is worthy of some attention. He has attempted to bring a quantitative approach into an ecological study. This is in itself a most desirable thing, for we have had in the past over-much work done in New Zealand in the expounding of theories, particularly in regard to plant succession, which the quantitative analysis of count and measurement has shown to be untenable. Ecological botany, in fact, has developed definiteness and foundation only since the technical forester has shown the botanist the use of the quantitative method.

The kauri is one of the most interesting of our native types, and fully warrants a detailed study of its development. The work here summarized is the first published attempt at a small phase of that problem, and while it rests on an extremely narrow base, so that its results are of indicative value only, it nevertheless contributes slightly to our knowledge of the type. For instance, it has been widely stated that the kauri is but a temporary type, which will not reproduce under itself. The generally accepted theory is that it
comes in after manuka, occupies the terrain for a generation, and is then succeeded by a taraire association. However, we have had in New Zealand extensive areas of kauri type, but little, seemingly, of taraire (other than as an under-storey to kauri), so this theory cannot be accepted as proven. Mr. Latter’s study would indicate that on the quadrat examined mature kauri is certainly reproducing its type over all age classes. No mention of taraire occurs in the abstract, however, and no indication is given as to whether taraire is practically absent from the Puketi forest as a whole, or only from the quadrat studied.

The use of the term “crown class” to indicate height tier; and of the terms “dominant,” “sub-dominant” and “intermediate” to identify the height tiers is hardly to be commended. These terms have special meanings in regard to even-aged pure stands, and should not be distorted in an application to a many-aged and mixed type. Criticism might also be levelled at the terms used to describe the various stages of development of the kauri. Surely a better term than “young ‘old man’” could be found. The word “rika” is generally known to all familiar with the kauri bush. It is simply the Maori word for a young tree, in the sapling to pole stages, having the pyramidal form, rather than the upturned head of the mature tree. It is more frequently written in the Anglicised spelling of “ricker.”

The description of the height tiers might be clearer, also, but no doubt this has suffered in abstraction. Diagrams and maps are essential to such studies, and finances prohibit us from reproducing the able delineations accompanying the study.

If Mr. Latter’s study does nothing more than focus attention on this type of study, it will have fulfilled the aim of its presentation here.