properties of sea-water, but nearly all of them *can* be determined, a task which is well-nigh impossible in most other environments.

PROPOSED EXPERIMENTAL WORK

An apparatus is being developed which will pump and filter the plankton from measured volumes of sea water, and at the same time make a continuous record of temperature and salinity. Undoubtedly other physical variables will be involved, but already a number of interesting correlations are being found which it is hoped will eventually lead to further understanding of the spatial distribution problem.

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DISCUSSION

DR. R. M. WILLIAMS said that various distributions that are not normally negative binomial have a mathematical background, e.g., the number of insects jumping onto a leaf will be in proportion to the number already there. Ecologists should be aware that there are a number of reasonable mathematical models such as the model worked out for aphis. There could be all kinds of non-normal distributions which could be transformed to normal distributions by the use of mathematical models.

K. R. ALLEN said there were two basic types of explanation of non-normal distribution, one purely in the behaviour of the organisms themselves, e.g. the number of insects jumping on a leaf is affected by the numbers already there, the other, where distribution is affected by a non-uniform environment. The second type may approximate to the negative binomial distribution if organisms are randomly distributed in an environment in which the particular determining characteristic is also randomly distributed.

MR. CASSIE said there were causal reasons which could generate negative binomials. Biologists could not see any reason behind legitimate mathematical models because their ideas could not be fitted in with those of mathematicians. Another model worth exploring is provided by the known laws of diffusion from some focal point.

DR. WILLIAMS said the exact mechanism which could explain distribution should be considered and mentioned the case of rabbit droppings (e.g. in damp grass, which caused quicker decay).

Autecology and the New Zealand Flora

Barbara Croker

In the investigation and description of our native and introduced plant communities we are reaching the stage when there is need for more detailed knowledge of the actual species—that is their autecology. In his presidential address to the British Ecological Society Clapham (1956) pointed out that "it is the primary concern of a plant ecologist to explain why a plant of this species and not of that is growing in a given spot."

The New Zealand flora affords plenty of scope for autecological studies among the endemic species, monotypic genera, species of diverse life forms such as cushion plants, lianes and epiphytes and those with distinct juvenile and adult forms; but very few such studies have been published. Various aspects of the growth and ecology of the *Nothofagus* species have been admirably dealt with by Pool and Holloway, but there is very little of this type of information on the podocarps or other species of the subtropical rainforest and the symposium at the last meeting of this society emphasised the gaps in our knowledge of the life-cycle and growth of the species of the tussock grassland.

The purpose of this paper is not to introduce a new technique or even a new idea, but to point out what I consider a gap in our knowledge of the native flora with which we, as an ecological society, could concern ourselves. It is suggested that the Society could consider the possibility of assisting in the compilation and publication of autecological information on the native flora; perhaps in a form similar to that done for the British Isles by the British Ecological Society (see Biological Flora accounts in the Journal of Ecology). It is fully realised that New Zealand has not the numbers of botanists and ecologists that there are in England, but should that deter us from considering the need for the possibility of collecting such data and laying foundations for future work on our native flora? In fact I am sure many members already have much valuable and relevant information in the form of field notes.

Detailed description of the plant communities is not a necessary pre-requisite; as Clapham pointed out, there are two schools of thought in ecology, those who study vegetation in order to solve autecological problems and those who seek to solve autecological problems in order to understand vegetation.

The work need not be elaborate, and could be carried out in conjunction with other ecological studies, or could be a complete project in itself. The main requirements are the opportunity to observe the plants over several seasons in as many different habitats as possible. A small amount of garden or laboratory space is an advantage where plants from different habitats can be grown in a uniform environment.

Autecology can be described as the main morphological, ecological and biological characteristics of a species. It includes a study of the distribution, the range of tolerance of climatic and soil conditions and the pattern of growth in different communities. Not just the familiar life history of taxonomic theses, but the actual germination, establishment of seedlings, rate of growth, time of flowering and setting seed under different conditions of climate, soil and associated species.

Verification of the correct generic and specific name and status is essential. Allen (1954) pointed out that without correct specific identification results might be misleading or even contradictory when an attempt is made to apply the results of previous work or extend it to related forms. Subspecies, varieties or ecotypes should be described and the occurrence of hybrids determined.

A brief description of the morphology would include notes on the occurrence of juvenile forms and the range of variation in vegetative and reproductive characters.

The distribution of a species is described most clearly with the aid of maps; these can be compared with maps of such environmental factors as soil, rainfall and altitude. The critical point is what is the factor or factors limiting distribution, particularly when a species has a wide range of distribution and hence in all probability a wide ecological tolerance. During the discussion at this meeting on the determination of natural areas, maps of various types of distribution were shown and the need to decide the actual limits of distribution and the causal or limiting factor was emphasised. Cook Strait and Foveaux Strait are of little importance as barriers; local climate has a greater effect on plant distribution.

A plant may be confined to one community or it may be widespread with different status in several different communities. Changes in dominance or accompanying species may occur with changes in soil, altitude or latitude.

For the persistence and spread of a species germination must be followed by establishment of the seedling, continued growth of the plant, flowering, fruiting and the ripening of viable seed.

The percentage of viable seed depends on the effectiveness of pollination. In insect-pollinated plants this is closely correlated with the distribution and habits of the pollinating insects. Adverse weather conditions and/or parasites may destroy the developing flowers or fruits. In perennial plants the occurrence of "mast" years in seed production seems a more common phenomenon than generally realised. The effects of weather or fluctuations in parasite populations are usually not sufficient to obscure the periodic character of mast years.

Perennial plants can persist for a long time in conditions inimical to establishment from seed, but persistence in a given habitat depends on the ability of seedlings to establish. Successful germination depends on conditions of light, temperature and humidity; the existence, cause and duration of dormancy, and the type of seed bed. Seeds may germinate at any time of the year, total germination may occur in a few days or over a period of weeks, or intermittent germination occur whenever conditions are favourable.

Similar factors affect seedling establishment and the effect of competition from the existing vegetation must also be considered. Simple measurements can be made on the rate of growth in height, or the amount of spread of mat plants, or the rate of spread of annuals in each habitat. Differences in growth rate may be a direct response to the environment or may be genetically determined so that the differences are still evident when seedlings from different habitats are grown together in a garden.

Most New Zealand species are evergreens, but do they have a definite growing season, entering a period of physiological dormancy with cessation of active growth in height and production of leaves The time of cessation of active growth in some species can be critical for survival in areas subject to heavy frosts. There may be marked differences in time of flowering and fruiting with changes in altitude and latitude.

The effects of grazing and browsing animals; trampling and burning; plant and animal parasites and competition from other plants in the community should be noted.

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DISCUSSION

MISS R. MASON commented on the scarcity of botanists and said that in New Zealand they could not travel sufficiently to collect the necessary data.

DR. CROKER said there was a definite need for these data, and the Society might consider starting a scheme for compiling information on seed production and germination.

MISS L. B. MOORE said that this type of work was already being done, and 10-20 people had projects of this kind in hand, e.g., Miss Mason had information re water plants.

DR. CROKER said she realised information of this kind must exist in notebooks etc. but it should be published.

An Attempt to Measure Local Variations in Climate with Improvised Apparatus

G. T. S. Baylis

This paper is based on work carried out by two Otago University students Mr. P. Wardle and Mr. A. F. Mark, and a more detailed account of it is in course of publication.*

Over fifty improvised gauges read at monthly intervals were used to discover the rainfall pattern on the hill country near Dunedin. Funnels tall enough to hold 8 inches of snow were constructed from galvanised down-piping, and one-gallon paint tins with their lids sealed on were used as reservoirs. Freezing and undue heating of the water collected were avoided by setting the tin in the ground and building a stone cairn about the base of the funnel. The reliability of the results can be assessed from Table 1.

Table 1. *Annual rainfall in inches from gauges sited in pairs.*

Improvised gauges	*a*	*b*	*Diff.*
Various localities in the field	54.13	54.12	0.01
	43.17	41.87	1.30
	32.50	32.49	0.01
	29.08	29.73	0.65

	Official Gauge	*Improvised Gauge*
Musselburgh	31.62	29.40*
Lake Mahinerangi	31.18	31.54

*Reservoir unprotected.

*WARDLE, P. and MARK, A. F., 1956. Vegetation and Climate in the Dunedin District, *Trans. Roy. Soc. N.Z.*, 84: 33-44.