ECOLOGY OF PLANT COMMUNITIES IN KU-RING-GAI
CHASE NATIONAL PARK, NEW SOUTH WALES:
AN EXAMINATION OF VEGETATION AND
ENVIRONMENTAL PATTERNS

by

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STATEMENT OF AUTHORSHIP

I, Andrew Francis Le Brocque, declare that, except where acknowledged, all work presented in this dissertation is original. I claim full right of ownership of all intellectual property in relation to this dissertation. No part of this dissertation is to be copied without prior written consent.

I also certify that this thesis has not already been submitted for any degree and is not being submitted as part of candidature for any other degree.

With respect to originality, the multivariate classification system developed in Chapter 4 is, in part, the result of collaboration with Robert Fullerton, PhD student at the University of Technology, Sydney. The multivariate approach was developed independently; however, the final structural formulae presented is the result of discussions with Robert.

Signature of Candidate

Andrew F. Le Brocque  5/2/1995

Parts of the research reported here (sections of Chapter 3) have been published in the Australian Journal of Ecology:

'Trees seek the environment suited to them, and this does not only apply to rare and special trees ..., but even to common species which spring up everywhere. Some like dry places, others prefer wet or cold or sunny or shady places. Natural affinity draws each species to an appropriate and suitable locality when wild plants grow on their own accord.'

Theophrastus c. 320BC
ABSTRACT

Patterns in the floristic composition, stand structure, species richness and environmental characteristics of plant communities at a number of spatial scales were examined in Ku-ring-gai Chase National Park, New South Wales. Vegetation patterns in eastern Australia have often been related primarily to a single environmental variable, soil phosphorus concentration. This study examines the 'single-nutrient' hypothesis regarding the distribution of plant species. If soil phosphorus concentration is the major factor affecting the distribution of plant species, then this variable should be highly correlated with spatial patterns in the floristic composition of plant communities within the study area.

Floristic composition was determined as the frequencies of all vascular species occurring within duplicate 500 m² quadrats from fifty sites within the Park. Environmental data consisted of 21 variables, including soil physical and chemical characteristics, from each quadrat. The patterns in floristic composition and environmental factors are described and the relationships between composition and environment were examined through indirect and direct gradient analyses. The measured environmental factors showed strong correlations with floristic patterns; however, two scales of species distributions were apparent: between and within soil type. Direct gradient analyses of composition and environmental data showed soil phosphorus concentration was inadequate in explaining the observed patterns in floristic composition. An alternative hypothesis suggests that patterns in the floristic composition of plant communities are a response to complex multivariable environmental gradients.

The structural characteristics of vegetation stands were examined through the development of a multivariate approach to the classification of stand structure. This multivariate approach is essentially a modification of an existing scheme utilising foliage projective cover of various recognisable strata within the stands. Multivariate classification and ordinations of plant communities based on structural characteristics showed strong correspondence to that obtained by compositional analyses. The complex multivariable environmental gradient hypothesis is supported from results examining stand structure-environment relationships.

The relationship between species richness and richness of three growth-form types (trees, shrubs and herbs) and environmental variables were examined through
generalised linear models. The measured environmental variables showed strong relationships with species richness, consistent with the results found multivariately with floristic composition and stand structure. No single measured environmental variable adequately predicted the observed patterns in species richness, rather species richness showed strong relationships with complex multivariable environmental gradients.

This study clearly demonstrates that the 'single-nutrient' or 'phosphorus' hypothesis is inadequate in explaining all the patterns in the various components of vegetation within Ku-ring-gai Chase National Park. The complex multivariable environmental gradient hypothesis suggested by the relationships between floristic composition and environmental variables is supported by the relationships exhibited by two other attributes of vegetation communities: stand structure and species richness. Further studies testing the significance of the complex multivariable environmental gradient hypothesis are required.