SPECIES PATTERNS IN A LEBANESE POTERIETUM

by

EDWARD W. BEALS

(Haile Sellassie I University, Addis Ababa)

I. INTRODUCTION

This paper presents a study of interspecific association in a stand of low-shrub vegetation in the central Lebanon. ZOHARY (1962) distinguishes two Mediterranean scrub formations, one which consists of shrubs about one meter high (garigue) and another which consists of subshrubs not exceeding 50 cm (batha). Admittedly these two formations include many species in common, and in some cases may both be successional stages of the same sere; thus they are not always discrete formations. Since there were rarely any plants higher than 50 cm, this particular stand was, however, distinctly of the batha type. It comes closest to ZOHARY’S Poterietum spinosi in Palestine, but with an abundance of Cistus spp., which are the dominant cover in places, and a large ruderal element. The presence of seedlings of Pinus brutia, Quercus calliprinos and a few P. pinea, indicate that it is probably a seral stage of the pine-dominated woodland characteristic of this general area.

The stand was located just west of the village of Mansourieh, 6 km ESE of the center of Beirut, at an altitude of about 300 m, on a northfacing slope averaging about 20°. The soil was shallow (mostly 2—25 cm deep) on red sandstone. The vegetation was badly overgrazed by sheep and goats, as everywhere in Lebanon.

GREIG-SMITH (1957, chapter 4) has discussed critically the use of $\chi^2$ on presence-absence data from quadrats, for detection of association between species. Although more refined tests based on quantitative data have been used (GOODALL 1954, KERSHAW 1961), the simplicity and efficiency of the presence-absence method make it a very useful technique, and it was used for the present analysis. Its major limitation lies in the effect of quadrat size on the detection and measurement of association.

The analysis of communities on the basis of interspecific association (with presence-absence data) has been carried out by several workers, e.g. GOODALL (1953), WILLIAMS & LAMBERT (1959, 1961), LAMBERT & WILLIAMS (1962), Agnew (1961, 1962), Kershaw (1961). In some instances the quadrats have been grouped by this method, in others the species themselves have been grouped. In the latter approach, Agnew diagramed his species groupings in two dimensions by trial-and-error inspection. WILLIAMS & LAM-
BERT’s method of grouping (1961) involves heavy computational labor, and even for their computer program was limited to 76 quadrats. The method included here diagrams species interrelationships in two dimensions with greater objectivity and with comparatively light computation.

FIELD METHODS

The field work was done in May 1962, while I was on the staff of the American University of Beirut. The area sampled was about 100 × 50 m. Two hundred quadrats, $\frac{1}{16} \times \frac{1}{16}$ m, were located on a stratified random basis. The area was divided into approximate 10 × 10 m squares, and 4 quadrats were located in each one by pairs of random numbers. The angle of slope was measured on two sides of each quadrat with an Abney level.

CHI-SQUARE TESTS

Tests of independence in a 2 × 2 contingency table were made on all pairs of species whose expected joint occurrence (product of the number of quadrats of occurrence for each species divided by the total number of quadrats) was greater than four. This arbitrary lowering of the arbitrary lower limit of 5 commonly used was done because it allowed comparisons between a considerably greater number of species. When comparisons with expected values 4—5 gave significant $\chi^2$s, FISHER’s exact method (1958) of determining probabilities was used as a check. Since in the diagramming, the less common species are related to four common species, any error introduced by the somewhat lower limit used is minimized. YATE’s correction for continuity was applied. The use of punch cards (COTTAM & CURTIS 1948) facilitated the tabulations.

II. INTERRELATIONSHIPS OF SPECIES

METHOD OF ANALYSIS

For a graphic representation of the interrelationships, a method similar to that published by BRAY & CURTIS (1957) for showing interrelationships of stands of vegetation was used. The species are placed in two dimensions so that positively associated species are close together and those negatively associated far apart. The construction of the graph utilizes four reference species. In the present case, these were selected from those five species occurring in at least 55 quadrats. Thus the 22 most common species can be located on the graph. The lower frequency limit for potential reference species is purely arbitrary, but the higher the frequency of reference species, the more species can be placed on the diagram. In this study, if a reference species with 46 occurrences had been