BOOK REVIEWS

Energy, economic and ecological relationships for Gotland, Sweden-a Regional Systems study. By A. M. Jansson and J. Zucchetto. Ecological Bulletins Vol 28 (1978), 154 pp. Available from: Editorial ServicejNFR, Box 213136, 8-104 35 Stockholm, Sweden $16.00 ISBN 91-546-0256-7.

This monograph is a detailed account of the energy and nutrient budgets of a geographically isolated human community. The idea for this study was spawned in Florida, and indeed, the influence of H.T. Odum is apparent. I add this tag only by way of information; this work is sufficiently respectable to stand on its own laurels.

The authors and their co-workers have synthesized a dynamic picture of the resource use of some 54 000 people living on an island in the Baltic Sea, some 90 km from the Swedish coast. The island has a mixed economy-agriculture, industry, fishing, tourism (100000 tourists p.a.) and the military all play significant parts.

Gotland is part of Sweden. This means that the inhabitants expect to have a standard of living as high as their counterparts on the mainland. The question that comes to mind (in New Zealand of the late 1970s) is: where does the energy come from to allow the islanders to maintain their way of life?

This monograph is, in part, devoted to answering this question. The varied sources of energy and the network of its dissipation are described. Similarly, a total nitrogen budget has been drawn up and incorporated into a model, together with an analysis of the circulation of fresh water. These I found fascinating, but to relate to them totally one would have to be a Gotlander. However, their pertinence becomes apparent when they are compared to similar figures for the Swedish mainland.

A major reason for carrying out this study was to collect and assimilate data for the benefit of Gotland. A further aim (or group of aims-there are seven in all) was to demonstrate just how powerful a tool their approach is for describing the structure and the dynamics of the interstices of complex situations. In this case, the "complex situation" is a geographical region. If Sweden is anything like New Zealand, regional planning is an apparently haphazard affair based on historical precedent and bits of random information often readily available but not collated into a coherent framework. The Swedish authorities now have an accurate plan of how this region works. By that I refer to such matters as quantities of goods imported and exported and how they are transported around the region. All this is in units that should be understandable to Local Government officials.

In other words Drs Jansson and Zucchetto have taken the well-established (but not well-practised) principle of measuring the flow of resources through ecosystems and applied them to a system set up by *Homo sapiens*.

This monograph is written clearly and has a logical presentation. The illustrations are admirable, although my natural inquisitiveness demanded more plates of the island itself. I recommend it to students, teachers and high-echelon practitioners of geography, regional-planning, agriculture, economics, central and local government and ecology in its widest sense. Perhaps a picture of New Zealand's present state set out along the lines of this 150 page book should be commissioned and published in full before any further progress is made in commissioning our future.

John Wightman

Cass-History and science in the Cass district, Canterbury, New Zealand. C. J. Burrows (Editor). Department of Botany, University of Canterbury. Price $12.00.

A university field station, if well chosen, should provide virtually limitless fruitful avenues for scientific investigations in a wide range of disciplines and at a variety of levels. This publication fully attests to the wisdom of the original choice of Cass for the University of Canterbury's field station and to the co-operative spirit that has prevailed during its sixty years of operation.

The tenuous beginnings of the station and its history appropriately introduce the book. This is followed by a lucid account of the history of the Cass District and of the farming endeavour over 120 years of European settlement offered by members of two generations of the McLeod family which has been prominent in contributing to the evolution, at their nearby Grasmere Station, of an appropriate run management system for the South Island's delicate high country.

Chapters on pre-Quaternary geology, glacial geology and geomorphology outline the landscapes of the Cass District which is "rich in material illustrating the effects of repeated glaciations". Soil development and patterns in the District are

described following an equally polished account of its weather and climate.

Despite 19 contributors, the style is consistently easy and lucid-to cite but two: "There is some evidence that winter is the more important period of the year for most of the erosive processes, but at any season the observant visitor cannot but be impressed by the highly dynamic nature of the landscape, and become aware that constant change and adjustment is a fact of life amongst these 'Everlasting Hills'." "No small part of the beauty of the Cass Basin lies in the ever changing pageant of the skies constituting the day to day weather and its long term corollary, the climate. The clarity of air following a frontal passage, the crystal quality of a cold winter morning, a blanket of silent snow over the basin floor and hill side, the balmy quietness of a warm summer evening, all make it difficult to point to anyone weather situation as being most agreeable. Excitement is a further quality of the weather at Cass, as witness the power of a northwesterly storm or the vigour of a fast moving, southerly frontal system. Above all it is the changeability and variety of mountain weather experienced at Cass that is one of its most engaging qualities." And there are adequate data given to substantiate such claims.

It is not surprising to one familiar with research activities at the Station that the plants of the District, their post~glacial history, systematics and various communities, dominate the book since, as we are told, "from Leonard Cockayne on, botany students have gained intangible but nonetheless real insights into the New Zealand vegetation during their stay at Cass". The 12 botanical chapters are logical and consistently well presented by their six authors, with the editor, Dr Colin Burrows, demonstrating his ecological versatility and major contribution to our present appreciation of the District's ecology. Dr Brian Molloy's excellent account of the role of fire fully justifies his claim that "from the viewpoint of fire history alone, the Cass District, as part of the Waimakariri Basin, has become a classic site".

Chapters on the stream, lake and tarn, and terrestrial faunas maintain the consistently high standard of those preceding, with deficiences in the studies outlined, particularly in systematics and ecosystem functioning, and appropriately, avenues for future research suggested. Here again, one of the greatest values of the field station becomes apparent-it has provided information for a sufficient period to trace some significant changes in the District's natural features, in this case an increase in nutrient loading on the lakes associated with land development and agriculture.

The achievements of some 60 years of biological research become indisputable in the last two chapters, devoted to what is undoubtedly the most comprehensive checklists of flora and fauna yet published for any region of New Zealand-there are almost 1500 plant entries (excluding plant galls) of which about 44% are vascular plants, and some 1130 animal entries of which only 7 % are vertebrates. Unfortunately the region being documented here is not clearly defined-some descriptions extend to the upper Waimakariri Valley and even to Arthurs Pass-while another small but inexcusable defect in the faunal list is that the introduced salmon ids and mammals have not been so indicated.

Although published relatively inexpensively ($12.00 retail) the standard achieved is very high. There are generous ilIustrations, highlighted with an excellent reproduction of Rita Cooke's 1936 water-colour of the Station as a frontispiece, together with numerous helpful line drawings and a comparative list of references, including the 61 theses associated with the District to date. Typographical errors are rare, though a few of the numerous tables have apparent errors or omissions and some of the maps have suffered through being over-reduced to fit an A4 page. Perhaps unfortunately, the book wilI be oversize for library shelving as well as for many personal libraries, and with no title on the spine it will not feature as prominently as it should.

This book will prove invaluable on at least three counts, anyone of which would justify its purchase by field scientists: firstly as an excellent record, albeit extended summary, of past scientific research in the District; secondly as a detailed manual of the region's ecology; thirdly as a guide for future research centred on the field station. The latter should assure that CASS Field Station continues to maintain its unique role as a training ground and research centre for improving our understanding of the South Island high country.

A. F. Mark

Analysis of Vertebrate Populations. Graeme Caughley. John Wiley and Sons, London. 234 pp.

Recently there has appeared another book1 on ecological methods. It joins a distinguished group of books2.3.' which have concentrated on invertebrate animal ecology. Caughley's book is about average in terms of size but much more specific in its content, dealing with the analysis of vertebrate populations.

Field techniques are not covered. The style of writing is very casual and almost conversational in parts, to the extent that some will find it too loose. Separate chapters deal with aging, rates of increase, dispersal, fecundity, mortality, relationship of 1_x , m_x and r, mark-recapture and the use of population analysis in management. Population analysis is used to include all the numerical attributes of a population (numbers, sex ratio, rate of increase) together with the properties of the animal and its environment.

Caughley's approach to vertebrate population ecology is based upon the suspicion ". . . that the deepest insight into a population comes from studying how age-specific survival and fecundity are influenced by the conditions in which the animals live" (p. 2). Anyone who has read any of his papers will find this familiar. It also gives a clue as to the usefulness of this book which will find greatest favour among ecologists who study populations of fairiy long-lived animals (or plants for that matter) at or near equilibrium. The basic equation of Lotka

$$\Sigma l_x e^{-rx} mx = 1$$

requires that the population be reasonably stable, which in turn means that the environment must be fairly stable or that the animals must be able to cope with any radical changes in the environment. Caughley argues that even if fecundity and mortality schedules do not remain constant for long, or if age distributions are not stable because no population goes on increasing (or decreasing) for ever, Lotka's basic equation is still useful as a reference point to interpret deviations from the admittedly s:mplified model. Elsewhere the author states that a central aim of population studies is to establish ". . . what are the relationships between animals and the conditions in which they live?" (pp. 1-2). While this is an admirable aim, it does seem that using Lotka's equation and all the necessary assumptions is unduly restrictive in achieving this aim. How can we understand the effect of environmental conditions on the numerical attributes of a population when there is very little opportunity to incorporate such things in the basic model? This represents a major split in the pathways followed by different ecological researchers and one that students should be aware of. Even more important for those interested in evolutionary biology is the problem created in population analysis when individual differences are incorporated. Many of the inferences drawn from field data using the Lotka equation do undoubtedly make good sense, but Caughley could have made an excellent contribution by showing us under what circumstances an application of the model would be a waste of time. Perhaps as a consequence of the style of writing I foundsome examples of oversimplification that were largely unnecessary and could have been omitted. On p. 2 it is claimed that "Studies on population dynamics can be divided into three categories: . . . analysis of human populations and populations of insects. . . fish populations (plus whales) . . . studies on mammals and birds." Such a grouping must be based on a very narrow area of population dynamics. It seems artificial, especially when one is looking for methods and principles that transcend taxonomic boundaries. On the lighter side, I think that the reader could have been spared being told that ". . . the particular god ruling things ecological is not only subtle but frequently malign." (p. 2, line 5), 'Time flows for man" (p. 8, line 9), "Guesses are guesses" (p. 25, line 37) and "If I had a mistress named Mary, her name would begin with M" (p. 118, line 10)!

Undoubtedly the best chapters in the book are those on abundance, fecundity, mortality, relationships between 1_x, m_x and r and mark-recapture methods. I found it difficult to understand why so much space was devoted to mark.recapture methods when the author clearly thought that the results were very suspect. Such methods are based on assumptions to which few, if any, populations actually conform. In the other chapters, methods are well explained and numerous references to other literature leading to further refinements are provided. Caughley also gives us his personal impressions of the value of many of the methods.

Some comments about individual chapters are warranted. For a book containing so many things that depend upon accurate estimation of age, I found the chapter on age all too short. We are given references to follow up, but this is only satisfactory if these are readily available. The abundance chapter emphasizes the value of indices rather than absolute est:mates of abundance, which are often difficult and expensive to obtain. A rather unscientific section deals with something called "Guesses of absolute density" (p. 25). I thought that science was measurement, not guessing. Caughley rightly tells us that we should make more use of stratified random sampling techniques.

The rate of increase chapter provides a good introduction to the different rates of population growth but I did find the definitions of the different r-values (rm, r., rp, f) very loose and confusing. (p. 53). When writing of populations in general, Caughley places dispersal (p. 58) as being an alternative to genetic or phenotypic change and to being ecologically adaptable, which is, of course, all right for vertebrates but neglects all the different

resting stages of other animals and plants. In a somewhat simplistic way a population forced to maintain genetic variability is said to be inferior because most members carry sub-optimal combinations of genes, and also we are told that ecological generalists are doomed and hence dispersal is the great answer. If we believe any of this it is hard to account for "stay-at-homes", genetic variability and generalists, of which there seem to be ample quantities.

There is a very good reason why Chapter 7 should be entitled "Fertility" and not "Fecundity". Krebss, for example, makes a clear distinction between these two terms: "The fundamental notion of fertility is an actual level of (reproductive) performance in the population based on the numbers born. It must be distinguished from fecundity, which is the potential level of performance (or physical capacity) of the population. for example, the *fertility* rate for an actual human population may be only one birth per 8 years per female in the child-bearing ages, whereas the fecundity rate for humans is one birth per 9 to II months per female in the child-bearing ages." However, while this distinction seems desirable there is certainly no widespread support if we use several recent ecological texts as evidences-12. It is unfortunate that ecologists cannot agree on such a small but important distinction and so Caughley can be forgiven.

In modelling population growth (p. 126) there are two divergent kinds of models: general (or strategic) and special (or tactical) as Caughley terms them. He calls a model strategic when it ". . . dispenses with details of relationships within a population and between a population and its environment, concentrating instead on the dominant characteristics of the system." Conclusions drawn from a strategic model are qualitative, e.g., whether extinction or stable equilibrium results. Tactical models, on the other hand, are said to be designed to predict the detailed outcome for a ,bighly specified set of conditions: "They simulate the specific reality of a given population. . . but seldom provide general insights into ecological processes." The author's own leaning is quite clearly towards strategic models which are necessarily more abstract and rely upon their apparent generality for acceptance. There is a polarity in the field of ecological modelling with a wide gulf in between. The separation will probably persist simply because the two kinds of models seek to answer different kinds of questions. But if we are to achieve progress in establishing principles of population ecology, abstract models must be tested against real situations and specific models must somehow be generalized to see what features they have in common with other such models.

Despite my comments, which reveal obvious differences of opinion and reservations about some parts of the book, I still consider it to be of value and recommend it as a compendium of numerical techniques to all involved in population studies. To use the book in this way owners must make a number of corrections to the text and to some equations. The necessary corrections are reproduced below13. They were provided by the publisher with the review copy of the book.

C. L. McLay

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1. CAUGHLEY, G. 1977. *Analysis of Vertebrate Populations*. John Wiley & Sons, N.Y. 234 pp.
2. LEWIS, T.; TAYLOR, L. R. 1967. *Introduction to Experimental Ecology*. Academic Press, N.Y.401 pp.
3. PIELOU, E. C. 1974. *Population and Community Ecology*. Gordon and Breach Science Pub. N.Y. 424 pp.
4. SOUTHWOOD, T. R. E. 1978. *Ecological Methods*. Second Edition. Chapman and Hall, London. 524 pp.
5. KREBS, C. J. 1978. *The Experimental Analysis of Distribution and Abundance*. Second Edition. Harper and Row, N.Y. 678 pp.
6. PIANKA, E. R. 1974. *Evolutionary Ecology*. Harper and Row, N.Y. 356 pp.
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11. EHRLICH, P.; EHRLICH, A. H.; HOlDREN, J. P. 1977.*Ecoscience:Population. Resources.Environment*. Freeman and Co., San Francisco. 1051pp.
12. CLAPHAM, W. B. 1973. *Natural Ecosystems*. Macmillan Pub. Co., N.Y. 248 pp.
13. *Numerical and symbolic corrections*
    p.13, fig. 4.1-ln the boxes labelled "counts on unbounded transects", "aerial survey" and "bounded transect counts" change the number in parenthesis to 4.2.3.
    p.43, line 3-change to $C = C_x + C_y$
    p.75, table 7.2-ln the row for Jan. 31 change the last two numbers to 96 and 6.75 respectively.
    p.80, table 7.3-in the first calculation of chi-square change both values of 0.004 to 0.044, the total chi-square
    to 0.088 and the associated probability to 0.77.
    p.82, table 7.5-change second entry of last colu from 0.033 to 0.017.

p.89, table 8.3--<:hange the entry corresponding to x = 4 and r = -0.2 from 0.226 to 0.223.

p.111, line 7-change F to F_x in equation.

p.129, equation defining r_l-insert H between C_1 and the parenthesis.

p.13l, second equation-the second d should be subscripted 3.

p.138, second line after first equation-change x to $\bar{x}$

p.143- The second equation should read

$$N = \frac{n(M+1)}{m} - 1$$

and the denominator of the third:
m(M+2).
Ignore the last equation on p.143.

p.144-Same error as on p.143. Ignore all of p.144 because of corruption by the above errors.

p.150-About the middle of the page: the formula for $S.E._i$ lacks a pair of parentheses: change to

$$S.E._i = \sqrt{\left[\frac{M_i - m_i + R_i}{N_i(N_i - n_i)}\left(\frac{1}{M_i}\right)\left(\frac{1}{r_i} + \frac{1}{R_i}\right) + \frac{1-a_i}{m_i}\right]}$$

These parentheses are also missing from the equation below for S.E.4, which should equal 68.48 rather than 55.50.

p.154, line 11-change "Section 10.11" to 10.1.1.

p.155, seventh equation - change the denominator from X to $\bar{X}$.

p.164, table 10.11, second to last equation, defining n-change q in numerator to q.

p.184, last equation-change the numerator Nt + 1 to N_{t+1} i.e. subscripted.

p.186, line 17-change "18.6 million lbs (8.5 x 10^6 kg)" to 186 million lbs (85 x 10^6 kg).

p.2l9, reference to Caughley (1976)-delete all words after "populations" and substitute:
pp. 1 83-246 *in* T. H. Coaker (ed), *Applied Biology* Vol. 1. Academic Press, London.