ECOLOGICAL DEVELOPMENT IN POLAR REGIONS: A STUDY IN EVOLUTION. By M. J. Dunbar. *Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968. 6 x 9 inches, 119 pages of text and black-and-white figures. $4.95.*

The present reviewer is in no sense a polar specialist; he writes here as a would-be general ecologist who, like many of his colleagues, is well aware that his discipline is largely the product of a temperate-zone environment, into whose Procrustean bed many of the facts of life in low or high latitudes do not fit with comfort. As long as there was a scarcity of information from tropical or polar habitats upon which to draw, the situation was not greatly disturbing, but the data accumulated during the past two or three decades are forcing us to reassess the validity of many allegedly *general* principles and concepts and to look at ecology from a new perspective. Therefore, whenever there is a serious attempt to do this, as in the present volume, it merits particular attention. We can be grateful to Dunbar not only for his concise and lucid interpretation of ecological phenomena in polar regions, especially those in marine arctic waters, but also for his efforts to place these phenomena within the framework of modern theory. His account is unpretentious and quite without pomposity, yet it is full of interest, and his reasoned and well-organized argument is highly stimulating; it is certain to evoke widespread attention, discussion, and further research. On these grounds alone, this can be considered a significant and successful book.

The clarity of Dunbar's presentation is well served by his careful distinctions, not only between factors or causes which are *proximate* (i.e. which relate to the immediate adjustment of the organism to its environment) and those which are *ultimate* (i.e. which are concerned with the evolution of responses under genetic fixation and natural selection), but also between explanations at the level of the individual or species and those at the level of the community ecosystem. Many ecological phenomena require explanation at both levels and consideration of both proximate and ultimate factors, but Dunbar has specified which are involved in each instance. By so doing he has succeeded in large part in avoiding the confusion of thought that marks much of the present-day literature.

A brief resumé is provided of the major characteristics, the duration, and the various theories of origin of the Pleistocene epoch. Dunbar concludes that the climatic change which produced the present polar conditions is best understood as the result of movement of the geographic poles from positions in the open ocean to their present locations in the more-or-less land-locked Arctic Ocean and in the continent of Antarctica. Although this has given rise, in both polar regions, to low temperature regimes, it has resulted in major differences with respect to other environmental factors. In the Arctic Ocean, it has brought a high degree of stability to the water column, so that little nutrient material from the ocean deeps is brought to the surface; as a result, primary production is low and both plants and animals are faced with a highly fluctuating food supply. In the Antarctic, on the other hand, coastal waters are characterized by considerable upwellings rich in nutrients, so that marine production is maintained at a high level for much of the year, and there is much less seasonal variation in available food. Thus, whereas ecologists have long adhered to the view of a polar environment in which low temperature was an overriding factor, it seems clear that, in marine situations at least, there are two quite distinct polar environments in which community ecosystems have evolved. In fact, the author makes quite a strong case for supposing that the low temperature of the polar regions has been accorded entirely too much importance in the interpretation of arctic and subarctic life. After a short but carefully selected review of the effects of temperature, and of changes in temperature, on metabolism, growth, and other aspects of activity, Dunbar reaches the conclusion that organisms have been able to adapt to cold without great difficulty or recourse to unusual mechanisms. His interest is therefore turned to consideration of those characteristics of polar environments which have had evolutionary significance in the development of ecosystems at the community level.

Current ecological thought supports the concept of ecosystem maturity, characterized in part by relatively high stability, which in turn is achieved through the greater complexity of interrelations that arises from an increased species diversity. In this context, Dunbar examines the hypotheses which have been proposed to account for the greater diversification found in some parts of the world than in others and concludes that in polar regions there are two major types of selective processes acting on the community: (1) those concerned with adaptation to an environment marked by great seasonal variation in productivity, and (2) those involved in the trend towards greater biotic stability. These two sorts of processes may have op-

posing influences on such characteristics as fecundity, body size, growth rate, the number of species present, and ecosystem complexity, and the condition of any polar community represents a compromise or balance between them. Although Dunbar maintains that adaptation to the fluctuating environment has played a considerably greater role in the development of high latitude ecosystems than has evolution towards greater stability, he devotes a chapter to documenting the occurrence of extensive polymorphism at these latitudes and suggests that the accompanying diversification is a step towards increased stability and maturity.

In the final chapter, consideration is given to climatic stability, habitat variety, high productivity, large standing crop, predation, competition, and time as the major factors which encourage an increase in species diversity. Of these, the last is held primarily responsible for the present state of development of polar communities: under Pleistocene conditions, these ecosystems have not had time to develop the complexity, stability and maturity that are held to exist in such other systems as the coral reef and the tropical rain forest.

Dunbar has chosen to refrain from speculation as to possible mechanisms for the selection of ecosystem properties, and while this may be disappointing to many readers I believe he is sensible in doing so. I think it entirely possible that in time an explanation for the evolution of these properties will be found that is not at variance with the neo-Darwinian point of view, and it does not seem to me that Dunbar has closed the door to such a possibility. In any case the book stands up well on its other merits and should hardly be faulted for what it does not attempt to do. It is well written, clearly illustrated, virtually free of typographical errors, and is reasonably priced. It should have a wide appeal and deserves a correspondingly broad circulation.

F. C. Evans

THE FLORA OF GREENLAND. By Tyge W. Böcher, Kjeld Holmen, and Knud Jacobsen, illustrated by Ingeborg Frederiksen. *Copenhagen: P. Haase & Søns Forlag, 1968. 8 x 5 inches, 312 pages, 66 figures, 2 colour plates and a map. 90 Danish kroner; £5 (bound).*

In these columns, eleven years ago, this reviewer greeted the publication of the first edition of "Grønlands Flora", noting that the urgent and long-felt need had now been met for a modern pocket guide to the flowering plants and ferns native to Greenland. In 1966 appeared a second and revised edition, also in Danish, of this now popular manual. Besides several new illustrations, the new edition recorded chromosome numbers for nearly all species, most of them based on Greenland material. Because the first and second editions of "Grønlands Flora" were also intended to be used in Greenlandic schools, both provided a brief introduction to botanical terminology, besides a short direction in Greenlandic, in the use of the manual. Throughout the text vernacular plant names in Danish and Greenlandic were added when they were available.

In the present English translation by T. T. Elkington and M. C. Lewis, of the 1966 edition of "Grønlands Flora", professional botanists outside the Scandinavian countries now will find a convenient and well illustrated guide to the vascular flora of Greenland. As with the earlier editions, the typography and printing are of high standard as is the reproduction of Miss Frederiksen's excellent drawings.

A. E. Porsild

FRONTIER ALASKA: A STUDY IN HISTORICAL INTERPRETATION AND OPPORTUNITY. Edited by Robert A. Frederick. *Anchorage: Alaska Methodist University Press, 1968. 9 x 6 inches. 172 pages, illustrated. $2.00.*

This volume consists of the proceedings of a Conference on Alaskan History held at Alaska Methodist University in June 1967. Perhaps the greatest tribute I can pay is to say that having read the proceedings I regret very much having missed the actual meeting. Such feelings are rare.

The opportunity seems unlikely to recur. It was a brilliant idea by Morgan Sherwood which brought together such respected historians as Jeannette Paddock Nichols, Stuart Ramsay Tompkins, Ernest Gruening and George Rogers, among others, and set them talking to an audience composed mainly of high school teachers from all over the state. It was also an idea which could have misfired, but the generation gap and the interest gap were bridged successfully and with humour. The result may not have been a major advance in Alaskan historiography, but it must surely have kindled enthusiasms for the future.

The various contributions are highly eclec-