

THE NORTH AMERICAN BUFFALO: A CRITICAL STUDY OF THE SPECIES
IN ITS WILD STATE. By FRANK GILBERT ROE. viii and 957 pp.; bibliogr., index.
University of Toronto Press, Toronto, 1951. \$12.00. 9½ x 6 inches.

Roe's approach to buffalo ecology is strictly historical. Each aspect is treated by quotation from source after source, mostly the early travel literature of North America, and the quotations are evaluated as to credibility and probable trustworthiness.

The 22 chapters can be classified as dealing with the characteristics of subspecies of buffalo, their habitats and geographic extent, their numbers and the causes for extermination, and, finally, their movement or migration. The 34 appendices occupy some 200 pages and might well stand alone; they include a discussion of nearly everything related to the buffalo, and particularly the human ecology of the Indian.

The first few chapters are impressive primarily in their coverage of an enormous literature. As one proceeds, the cumulative impact of the facts results in a new view of buffalo history—a view that gives substance and reality to the geologic and ecologic evidence on which the picture of the buffalo and its drama is based. This picture, however, is created less by the author's organization of material—indeed, there is a great deal of geing and hawing in the development of ideas—than by his careful analysis of each shred of evidence and his accumulation of references.

Three specific concepts are woven through the book, which is, in fact, an argument in support of them. First, the buffalo population was extremely large and therefore variable in nearly every physical, mental, and habitual aspect. Second, there are important and characteristic differences between the northern woods buffalo and the buffalo of the plains. Third, buffalo did not migrate in the accepted meaning of the word; they moved, but the movements were essentially random, though large masses had the appearance of an organized group traveling a definite route. These three propositions appear logical, but one learns early in the book that the foremost authorities on buffalo lore disagree with all of them. Despite great pains to show the authorities in error, Roe is generous in his defense or approbation of them when the occasion warrants. In his dissection of each assertion, however minor, he is thorough to the point of overemphasis, but he is also modest, and though critical, eminently fair and certainly convincing.

The book varies in forcefulness, clarity, and interest. The treatment of climate is less comprehensive than one might wish. The chapter on "The Climates and Topography of the Buffalo Habitat" is not what the title implies and leaves something to be desired both by the plant ecologist and by the meteorologist. On the other hand, the chapters on "The Numbers of Buffalo" are both effective and fascinating. Many of the footnote discussions seem nearly equal in content to the general text; their volume is distracting, and the reader often feels that they would better have been worked into the text or

omitted altogether. The book is not easy reading. One serious fault is the lack of summary statements at the ends of the chapters. For example, after an extended discussion of the geographic range of buffalo and suggestions for correcting the habitat limits stated by previous investigators, Roe gives no map nor does he summarize his findings. In spite of these shortcomings, however, a picture of buffalo characteristics and ecology is graphically conveyed.

One might not judge from the title and table of contents that Roe's book is indeed a *sine qua non* for the late-Pleistocene geomorphologist, climatologist, and plant ecologist. Under the stimulus of reading it a number of questions come to mind.

Rivers in the plains area and the Southwest are flanked by systems of alluvial terraces, the stratigraphy of which records late-glacial and postglacial climatic shifts. The alluvium contains faunal remains, of which bison bones constitute an important part. While working on these terraces, one constantly has the bison and its history in the back of one's mind as part of the fabric of topography, river regime, plant ecology, soil development, and early man. At the present stage of knowledge of the late Pleistocene, it may tentatively be stated that bison species now extinct were present in Mankato time but apparently did not survive the warm period of the Megathermal. The present species of bison is not commonly represented in alluvium believed to be of Mankato age, even in areas geographically central to its modern range. *Bison bison* apparently either developed as a species during late Mankato or early post-Megathermal time in North America or migrated into the continent then. Assume for the moment that the modern buffalo did not exist in North America in any appreciable numbers before the Megathermal. During approximately 4000–5000 years the population increased to 40–60 million in the early nineteenth century (Roe seems to favor 40 million but admits the 60 million estimate by Seton as well within reason). That a large herbivore could increase to such an extent in such a length of time argues for a migration into North America during the Megathermal. There is no geomorphic or climatic reason to think that prairie and prairie-woodland borders constituting suitable buffalo range did not exist in late Mankato or in W_2/W_3 interstadial. That the modern prairie was admirably suited to buffalo is attested by the population achieved in the nineteenth century. Roe's discussion of fossil bison is adequate as an introductory statement, and he does not pretend it is more than that. He makes no definitive statement on the place or time of origin of the modern buffalo, recognizing this as a paleontologic question. Such a question is also beyond the purview of the present review but is an example of the paleoecologic problems that the book brings to mind.

Considering the enormous buffalo population, one who has worked with the post-Megathermal alluvium of western river valleys is filled with wonder that an even larger number of buffalo bones are not found buried in it. The reviewer has recently searched for bones along roughly 20 linear miles of vertical wall of river-terrace scarps. Perhaps 50 bison bones were seen, and only about three bones of other animals were collected. Such a measurement technique might be developed to aid in estimating relative numbers of different species, using the estimate of presettlement population of buffalo as a rough yardstick.

Roe discusses the industry based on the sale of buffalo bones for fertilizer, which flourished in the period 1870–1880. The organized collection of bones must have been concentrated in areas relatively near the railroads; certainly bones are nowhere to be

seen on the ground surface now, but the bones buried in alluvium are generally well preserved.

The book strongly supports the idea that buffalo wandered in groups or herds over the plains seeking adequate pasturage; though at times there was system in their movements, there was not the seasonal, repeated peregrination implied by the term "migration." The paleoecologist is led to wonder about the mechanism of mutual adjustment between buffalo population and the grazing range. Did the 60 million buffalo constitute an average population, or was it greater or smaller than the grazing capacity of the range? The book suggests another line of inquiry also. What mass characteristics of buffalo populations dictated so high a density? Is it possible that the buffalo was analogous to the passenger pigeon, which apparently required a high population density for successful continuance of the species? That the book stimulates thinking about diverse questions of population characteristics, geomorphology, and range ecology recommends it to a reading audience much larger than the specialist in mammalogy.—LUNA B. LEOPOLD