

first used by Johannsen in 1909. Yablokov develops the concept of the phene and phene pool and methods of studying them in chapters 4 and 5. It should be noted that he recognizes the endophenotype as well as the exophenotype, and includes electrophoretic variations, chromosome morphology, etc. among his examples.

Indeed one of the attractive features of the book is the combination of Soviet examples, not well known to most western biologists, and examples drawn from the western literature.

The final chapter of the book is entitled "Phenogeography." "Phenogeography is the analysis of the geographic distribution of individual traits—phenes and phene complexes, as a rule—within the limits of a species habitat, carried out while studying problems of microevolution, intraspecific systematics, and the development of biotechnical practices" (p. 109). This chapter discusses such questions as finding the boundaries of a population, and whether species are more variable at the center or the periphery of their range. The discussion is backed up by a number of interesting Soviet examples.

Although *Fenetika* was first published in 1980, the author has updated both the text and the literature citations for the English edition.

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The Sumatran Rhinoceros *Dicerorhinus sumatrensis* (Fischer, 1814) in the Gunung Leuser National Park, Sumatra, Indonesia; its Distribution, Ecology and Conservation.—Nico J. van Strien. 1986. *Mammalia Depicta*, Suppl. J. Mammalian Biology, No. 12, Verlag Paul Parey. vii + 200 pp.

How does one undertake research on the natural history of an animal that is solitary, silent, shy, nocturnal, and endangered; a wide-ranging mammal that lives in dense forests and uncharted terrain? In the case of the Sumatran rhinoceros, as the author of this book contends on p. 2, "it is impossible to attempt a field study of these animals without concentrating mainly on their tracks." Consequently, fully 75 of the 200 pages of this volume describe the author's technique for sorting and identifying footprints.

This could have been a book on morphometrics. It is not. Instead, this portion of the monograph records the methods through which one investigator became acquainted with his material, and came to recognize and distinguish tracks of different individual rhinos. Measurements played no role in the sorting process. Instead, plaster casts of the tracks (or stereophotographs of the casts) were compared and grouped, and later, tracings of the casts, transferred and flattened into a single plane with the help of a compass and contour gauge, were superimposed. Different sets of tracks were judged to have been made by the same set of feet if the outlines of a print "followed the same curve," allowing for a few millimeters' deviation (less

at each hoof; more around the soft parts of the foot), and some slight rotation or shift in the relative positions of the three hoofs. Van Strien was able to infer, and describes here, how the configuration of the print varies with soil type and moisture content, and also how it is affected by the animal's different modes of movement (turning; ascending or descending a slope).

We learn about the author's techniques through detailed descriptions of a few examples presented as case studies, and a large number of illustrations: stereophotographs and tracings of tracks from a single animal under different conditions, or from similar individuals eventually judged to be distinct. The author's account of his criteria and the sorting process are about as clear and explicit as one could expect for a procedure that is based upon judgement emerging from experience, trial, and error, and upon a certain amount of intuition. Lately, and with some good reason in this era of burgeoning sophistication in morphometrics, intuition as a scientific technique is viewed with scorn. One is nonetheless inclined to trust this particular intuition: van Strien's description is precise, three-dimensional, extraordinarily detailed, internally consistent, honest in its acknowledgment of complexities, and intelligent in its rationale. In morphology, technical virtuosity is no substitute for (and in fact depends itself upon) perceptive vision. Still, the author is overly (and disappointingly) negative about the prospects for a quantitative study of the tracks. Van Strien studied the osteology of rhinoceros feet, and by comparing prints from single tracks he was able to infer which portions of the foot were flexible, how they responded to extrinsic forces, and how the mark they make varies in different media. Why did he not bring these observations to bear on his selection of measurements? At the end of the study, five measurements were taken from casts and drawings of each print, and examined for their utility in distinguishing individuals. Width measurements employed by other workers apparently lack resolution, and underestimate the number of individuals in the sample educed by careful direct comparison of the plaster casts. The measurement that best (albeit imperfectly) characterized different individuals was width of front hoof. Yet this result is not surprising: all of the other measurements spanned the soft and more deformable portions of the foot. I wished that van Strien's observations had been verified experimentally: one could obtain tracks produced under various conditions from zoo animals, even if one had to use rhinos of other species. Measurements should then be selected carefully to separate variation associated with soil type, mode of locomotion, wear or growth of the hoof, etc., from the characteristics of a single individual. The possibility of a definitive, quantitative study of the tracks remains open.

I dwell on the tracks because the author's counts of the population and his conclusions on conservation rest upon their interpretation, and because he obtained higher estimates of population densities than others have working elsewhere. Through careful notetaking, one can extract a partial list of the most useful criteria for examining the prints, but the book

lacks the concise, synthetic statement that would make it most generally useful. Measurements, or combinations of measurements, are often the most efficient means of expressing the qualities of form that would otherwise require a highly-trained eye to see. I was charmed by the author's efforts to train the eye of the reader through stereophotographs, diagrams, and verbal description. With the information the author provides us, however, a replication of this study would be likely to take as much time as the original.

Viewed in the context of the logistical and practical problems the author's research team faced and rather heroically overcame, my complaints could sound peevish. During seventeen expeditions spanning four years, a total of 358 days in the study area (in a field camp whose wooden beams required periodic restorations from rot and the depredations of elephants), the team actually saw its study subjects a total of four times, and heard (without seeing) them an additional six. Access to the study area by foot involved a three- to four-day hike, carrying plaster and provisions. About one pound of plaster is required for the casting of a single print; the resulting cast is not only heavy, but fragile as well. The team's data were hard-won: an average of two days and 23 km patrolling the dense, sodden forest was required for the sighting of a single fresh track. The scrutiny this scarce material received is downright paleontological in its intensity, and from the spoor alone van Strien managed to make an impressive body of reasonable inferences on topics ranging from population density and the geographical distributions of age and sex classes, to mating systems,

breeding intervals, and nutrition. Parts of this book will appeal to paleontologists with interests in trackways of large terrestrial vertebrates. There is much valuable information here, but also much detail that will interest only the most dedicated of rhinophiles, or specialists in the management of the Upper Mamas study area. Van Strien was meticulous in recording the details of the work, and in many respects this monograph has the flavor of a dissertation, which it was.

In format, this volume is slim, compact, and sewn in signatures with a sturdy paper binding. It is printed in single columns with small, dense type similar in size to the text on this page, but with a spacing of nine rather than eight lines per inch. The stereophotographs and plates are decent in their clarity; the line drawings (presumably executed by the author himself) are beautiful. A foldout, full-color map of the study area is attached inside the back cover, and three-page summaries in Dutch and in Indonesian are included. The English text contains some idiosyncrasies in spelling and wording, but these are not common or serious enough to be distracting. In general, the writing is precise and clear. An index would have been useful, but the chapters are subdivided sufficiently (subheadings occur with a frequency of approximately one per page of text) to render the table of contents a helpful substitute.

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