

field, though in all examples the implication is given that all multiple meaning problems have been resolved!) The rules for translation outlined in the Panov book and, for that matter, the rules presented elsewhere in the Russian literature do not even begin to explain how the sample translations could have been achieved. Since no other evidence to date supports the hypothesis that the Russians in 1956 were ahead of where the rest of the world is now, it seems reasonable to infer that the translation samples shown probably represent text that was studied beforehand in order to develop rules, the applicability of which was guaranteed by such prior analysis. The foregoing inference may not be justified but, in the absence of a detailed exposition of all rules used, it is difficult to conclude otherwise. (We of course assume that neither the original English text nor the final machine output of Russian text was in any way subjected to human editing.) Any thoughtful scientist will recognize that a sensationally elegant machine translation of a limited and specific body of text can be produced on the basis of prior study of that text by essentially anyone with a small amount of ingenuity plus the ability to program a general purpose computer. The only matter of real interest then lies in the question of the general validity of the rules when applied to text other than that used as a basis for developing the rules.

Chapter 10 of Panov's book contains a few pages of gratifying discussion, much more indicative than is the rest of the book of the depth and nature of the problems of machine translation. It is pointed out that machine translation is not solvable in a formal or mathematical sense, as is, for example, the problem of code breaking. Panov justifiably criticizes Weaver's analogy between machine translation and code breaking and points out briefly a few of the essential and profound differences between the two.

With all its shortcomings, the book by Panov should be of some casual interest to the layman for its presentation of an introductory, though quite superficial, account of the nature of an automatic translation process.

The field of automatic translation still awaits a book which presents the subject adequately and informatively to the scientific community.

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Cochiti. A New Mexico pueblo, past and present. Charles H. Lange. University of Texas Press, Austin, 1960. xxv + 618 pp. Illus. \$10.

The Pueblo Indians of the Rio Grande are visited by thousands of tourists every year and have been known to history ever since their discovery by Coronado in 1540. But Spanish attempts to obliterate their native religion in the process of Christianization led to the erection of a wall of secrecy, and until very recently little has been known of their inner life. Charles Lange's monograph on Cochiti, the first comprehensive account of the culture of a Rio Grande Keresan-speaking pueblo, will therefore be of great interest to all students of the Southwest.

We know from the archeological record that the Keres moved into the Rio Grande region from the west in the 13th century and formed a wedge among the Tanoan-speaking pueblos in the present vicinity of Santa Fe, N.M. In addition to mutual interaction and cultural exchange, all of these pueblos have been subjected to the impact of Spanish and, later, American culture over a period of some 4 centuries. For Cochiti there are only a few accounts from the Spanish period, but within the last century important observations have been made by a number of scholars, including Bandelier, Starr, Goldfrank, Benedict, Parsons, and Boas.

Lange has built his account, in part, on the work of his predecessors, but the bulk of his materials comes from his own researches covering the period 1946-53 and including three summers' residence in the pueblo with his family. He presents a balanced and satisfying integration of modern pueblo life, in the perspective of the last hundred years. On the other hand, comparative discussion is held to a minimum, in part because of the lack of comparable data from many of the eastern pueblos.

The volume is organized in terms of geography, history, resources, economy, political organization, ceremonial organization, and the social system; 44 appendixes cover a wide range of statistical and other data. Of particular interest is Lange's discussion of the political system, including the "progressive" and "conservative" factions, and his detailed account of the ceremonial organization, including the Katsina cult. While Cochiti is the most progressive of the eastern Keresan pueblos, social and cultural change has been gradual enough to make the author hopeful for

the future. But whether the pueblos can maintain a social and ceremonial system, geared to community values, in the face of electric power, farm machinery, modern schooling, and a growing dependence on wage work remains to be seen.

The University of Texas Press has produced a handsome volume that should have a wide appeal. It is also a volume in which the data for the author's conclusions are fully presented. Here we can see the effects of 400 years of contact with Spanish and American cultures and can begin to understand the complexities of social and cultural change in a society with values that are quite different from our own.

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Agriculture and Ecology in Africa. A study of actual and potential development south of the Sahara. John Phillips. Praeger, New York, 1960. 412 pp. Illus. \$13.50.

This book, written by a man with special competence in agriculture, is intended for scholars of other disciplines and for administrators and others concerned with economic development in Africa.

John Phillips' subject, the landscapes of Africa and man's use of them for agriculture, is a complex matter for analysis and one of importance. The vast, essentially rural continent is impoverished. Real levels of living, as measured by per capita food and shelter inputs, are among the world's lowest. Most of the population is dependent on subsistence rather than on cash-crop agriculture. Productivity per acre is low, and land deterioration, a forerunner of further decrease in yields, is widespread. These are the reasons why this and other books on the subject are needed.

African lands have been tilled for some thousands of years by indigenous cultivators of root and grain crops, using systems of shifting cultivation. They have been worked by European land-use techniques for as much as three centuries. Since World War I, European agricultural officers in colonial territories have had widespread influence on land use by Africans. These officers have brought to the task experience and training gained in mid-latitude agriculture. In the mid-20th

century, neither the indigenous African systems nor the grafted-on European systems are suitable, or even adequate, to continue to provide food and other agricultural products for this continent with its increasing population.

Land-use systems and techniques appropriate to the diverse and largely tropical landscapes of Africa must be developed. This is one of Phillips' main arguments. Suitable techniques can be evolved only through intensive study of the relationships of the elements of climate, soils, and vegetation in the areas to be used. The extreme diversity of climate, soil, and vegetation associations must be recognized by persons concerned with agricultural development.

Among the problems posed by these factors in Africa, Phillips cites the high humidity of the rain forests and its role in furthering plant and animal disease. High evaporation in the semi-arid lands and its limiting effect on plant growth is treated. This problem, so important over the vast savanna lands, should have been handled in more extended fashion, if it is to be understood by the government officials to whom the book is largely directed. Diagrams showing monthly precipitation, potential evapotranspiration, and water balance for several stations would have clarified the matter.

Among the vegetation problems treated is that of the annual grass burning of the savannah areas, its influence on soil fertility, and its relationship to thicket encroachment.

In all of these problems the stress is on study of the ecology of areas small enough to be relatively homogeneous from the viewpoint of the agriculturalist. On the basis of association of climate and vegetation, Phillips tentatively categorizes Africa south of the Sahara into more than 40 type-regions. The regional divisions are shown on an adequate map. The climate, vegetation, and soils of each region are described in some detail, as are problems of tree crop, tillage agriculture, or livestock keeping when appropriate. Present land use is described, and a statement of Phillips' evaluation of possible future use is made for each region. This part is really a handbook, and it should be read selectively. Its readability is not enhanced by the continued use of symbols or abbreviations for elements of climate, severity of ecological factors, and variations in vegetation and so forth. In this section the author brings together much material

previously available only in the reports published by the various agricultural research stations and colonial departments of agriculture, and in a number of journals. This is an important contribution. By bringing together this information Phillips forces himself and us to re-examine our earlier generalizations about African land use, which were based on less comprehensive data.

The latter third of the book deals with other factors influencing agricultural development, such as human health, livestock disease, and present agricultural productivity. There is a discussion of the large development schemes including the Gezira cotton scheme in the Sudan, the groundnut scheme in Tanganyika, and the proposed Volta River scheme in Ghana. Phillips argues that large schemes should be undertaken only after extensive examination of the ecological problems of the area to be developed.

This book could only have been written by an agricultural scientist with extensive field experience in Africa and a wide acquaintance with the literature from the numerous agricultural research centers in Africa. It should be of service to scholars of other disciplines and to the political leaders of the emerging African states.

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Wave Propagation in a Random Medium. Lev A. Chernov. Translated from the Russian by R. A. Silverman. McGraw-Hill, New York, 1960. viii + 168 pp. Illus. \$7.50.

This is the first more or less complete account, in English, of the theory of wave propagation in random media. The results are necessarily specialized to perturbation solutions of one kind or another since closed-form solutions of the equations are unattainable.

The many detailed calculations include solutions based on the ray theory, valid when the scale of inhomogeneities is large compared with the wavelength; first-order perturbation solutions of the wave equation; and the effects of fluctuations of the medium on the focusing properties of optical systems. Of special interest is a section on the deviation of rays treated by means of the Fokker-Planck equation, a technique developed by the Russian school. Many detailed results on the correla-

tion of fluctuations in the phase and amplitude of waves in inhomogeneous media are derived by means of a straightforward application of first-order perturbation solutions of the wave equation.

One chapter is devoted to experimental data; this is surely too little for adequately describing the wide range of potential applicability of this theory. Chernov mentions American contributions to the subject which were made up to around 1954, but there has not been much of outstanding interest published since that time. This book is at present the only one available in English on the subject, and it is a valuable account of a theory which is not widely taught in America.

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The Search for New Antibiotics. G. F. Gause. Yale University Press, New Haven, Conn. 1960. 97 pp. Illus. \$4.75.

This book is the record of the "Trends in Science" lectures given at Yale University, in December 1959, by Professor G. F. Gause (Institute of Antibiotics, Moscow). It consists of three lectures. The first, on the distribution of antibiotic-producing microorganisms, presents Soviet evidence that there are a greater number and a greater variety of kinds of microorganisms in the soils of the South than in those of the North, and discusses the idea that geographic factors are a controlling determinant of the distribution of antibiotic-producing organisms. The second lecture emphasizes the importance of the early classification of any unknown microorganisms producing antibiotics as an index of the type of antibiotic it is producing. The argument is less firmly grounded than that for distribution, and reflects a prevalent opinion in the Soviet Union on a somewhat controversial position.

The third lecture is on the use of microorganisms in cancer research. It is first concerned with the problem of whether "equivalents" to cancer exist in microorganisms. Such equivalents are thought to be found in certain (but not all) respiratory-deficient mutants of yeasts, molds, bacteria, and protozoa; methods are described for obtaining the proper types. While this approach is