DISCUSSION

A paper entitled "Processes of Erosion on Steep Slopes of Oahu, Hawaii"; by Sidney E. White, was published in the March, 1949, issue of this Journal, pp. 168-186. This paper is a condensation of a thesis which briefly describes Oahu, its Koolau Range, and in particular gives a discussion of the factors thought responsible for the steep-walled, theater-like valleys on its leeward side. Manoa Valley is selected as typical and discussed in detail. Much of the article consists of quotations or rephrased statements drawn from Davis, Cotton, and Hinds on geography, Stearns, Vaksvik, and Wentworth on geology, Carson, Jones, and MacCaughey on meteorology, and MacCaughey on ecology. Nowhere in the paper is any statement as to how many trips were made by White or how much time over what period was spent in his study of Manoa Valley. The impression in Honolulu is that the period White spent in these field studies, while in war service, was brief.

An account of the vegetation of Oahu is given, by abstracting to two paragraphs, material from MacCaughey's report on Manoa (1917). White continues (p. 173), "Other leeward valleys may be divided into similar zones." Some may and some may not, due to the strikingly different microclimatic and corresponding ecologic zones on Oahu. It would have been better to refer to actual studies of such valleys, as that by Hosaka on Kipapa Gulch (1937), and that by Egler on arid southeastern Oahu (1947), instead of assuming that all leeward valleys of the Koolau Range had a similar ecologic zonation. His inference that they are all alike is far from the fact.

White's account of the general geology, and description, mapping, and figuring of the geography is largely drawn from dependable sources, and I will not challenge it. On the other hand, after twenty-one years of residence in Manoa Valley and much field work, research, and teaching of botany and ecology as evidenced in the Hawaiian Islands, I feel impelled to deny White's statements of ecological facts and to differ from his conclusions. His main thesis is that on steep slopes in the mountains in the high rainfall belt, the typical succession is (p. 182) as follows: "(1) fresh bedrock exposed; (2) the establishment and succession of mosses, plants, ferns, and trees to the culmination of maximum plant relationships possible, with accompanying soil development to great depths; (3) long and continued use of all available soluble minerals and organic matter; (4) final exhaustion of the soil mantle with deterioration of the plant societies, and alteration to a degenerate growth of grasses; (5) desiccation and hardening of the mass of soil, decaying litter, and rotting humus; (6) instability of the mass of debris produced during prolonged rainfall; and (7) catastrophic avalanching exposing fresh bedrock slopes again."

White's inspiration seems to have come from Freise, a geographer,

who announced in 1938 observing a succession from granite, to forest, to a decadent forest on exhausted soil, to grass,—then avalanching to bedrock. Not having visited the particular granite mountain in Brazil, I cannot express an opinion on its vegetational succession. However, in my own travels and explorations, and I have studied many granite mountains, I know of no place on granite or any other rock where an undisturbed natural forest exhausts its own soil and starves itself out, and is then replaced by grasses. Furthermore, it is not clear to a plant ecologist just what White has in mind when he refers to the grass stage as "a degenerate growth of grasses." A recent scholarly taxonomist, Hutchinson (1934, p. 7), places them at the apex of an upper branch of the family tree of the Monocotyledones. In growth and production, instead of degeneracy, they show great self-sufficiency and adequacy to perpetuate themselves, to nourish themselves, and largely to feed the human race and most grazing animals.

White does not state his reason for reporting in detail only on Manoa Valley. Other more remote valleys would have been more primitive. Of course, Manoa Valley is easy of access, with paved roads almost to the talus slopes, two bus lines for transportation, etc., but as it is near the center of the city of Honolulu, it has, in the last 150 years, suffered from the depredations of man and his domestic animals. The forests have been much reduced in area, depleted, invaded by weeds and exotics, heavily grazed by horses, cattle, and goats, and in areas deforested by the abundant feral pigs. Deforested areas, even on the high, rainy slopes, are often densely vegetated by grass and herbaceous weeds or ferns, but these do not play the important part in initiating landslides (soil avalanches) that White asserts.

White says (pp. 180-181) of the valley head, "Some parts of the slopes are mantled with a thick soil and well-developed plant society, other parts with thick soil and stunted, scrubby grass growth. Certain other sections maintain no soil at all, but instead are sheathed with yellow-brown mud so thin that layered volcanic cinders can be seen beneath. The soil and vegetation on the slopes are in various stages of development from youthful thin soil to maturely developed thick soil, and old thick soil. No ecologic zoning can be distinguished; distribution of variegated patches of vegetation has no obvious relation to topography or climate." White seems fond of an ecological approach, but seems to have little familiarity with its details or meaning. He certainly seems to dislike grasses, but it should be pointed out that a grassy growth can be a well-developed plant society. He does not explain his view that mud is not soil, nor how thin, transparent mud remains on top of bedded volcanic cinders. In reference to his concluding sentence of the paragraph quoted above, as to there being no zoning

and no relation between the vegetation and topography and climate, well—the only comment I can make is that it is not so.

Landslides on the steep forested slopes do occur and the figures quoted by White are striking and significant. They were published by Wentworth following eight years of intensive field work. Certainly landslides play a part in soil movement from steep upper slopes to the gentle valley floor below. The slides are seen in many places, mostly on steep slopes of 40° or more, but they often occur starting in and cutting a strip right out of a healthy, vigorous, virgin, climax forest. After the slide, the invading vegetation of the secondary succession is often rich in grasses, as *Paspalum conjugatum*, etc., but often of other weeds, as *Erechtites hieracifolia*, and *Cuphea carthagenensis*, or of indigenous vines, shrubs, or trees, as *Phyllostegia grandiflora, Perrottetia sandwicensis, Pipturus albidus, Dicranopteris linearis, Lycopodium cernuum, Scaevola mollis, Metrosideros collina*, etc., depending on the habitat, the surrounding vegetation, and source of seeds.

The conditions that cause landslides (soil avalanches),—probably a rainy period that has saturated the soil, followed by torrential rains (such as 5 inches per hour) and high winds, cause landslides on the very steep valley walls, whatever the vegetation, whether thin soil with little vegetation, grasslands, open forest invaded by weeds, or dense virgin forests which show no sign of self-starvation.

My final comment on White's paper is that it contains little original material other than his hypothesis on plant succession as the cause of avalanching on steep basaltic head walls of Manoa Valley. He gives no verifiable data of his own on plant succession or indication that he could recognize one plant from another of the list that he apparently compiled from MacCaughey, or that he has any competence to judge and interpret the stages of a plant succession in Hawaiian vegetation. His hypothesis that avalanching is the result of soil exhaustion by the rain forest which suffers self-destruction and is then succeeded by a "degenerate growth of grasses" which permits soil avalanching is, in my opinion, unproven and is contrary to all that is known of plant succession in Manoa Valley and the Hawaiian Islands.

References

Egler, F. E., 1947. Arid southeast Oahu vegetation, Hawaii: Ecol. Mon. 17, pp. 383-435.

Hosaka, E. Y., 1937. Ecological and floristic studies in Kipapa Gulch, Oahu: B. P. Bishop Mus. Occ. Papers 13(17), pp. 175-232.

Hutchinson, J., 1934. The families of flowering plants, II. Monocotyledons, Macmillan & Co. Ltd., London.

MacCaughey, V., 1917. The phytogeography of Manoa Valley, Hawaiian Islands: Am. Jour. Botany, vol. 4, pp. 561-603.

HAROLD ST. JOHN.

UNIVERSITY OF HAWAII
HONOLULU