tion from drowning, gas asphyxiation and electric shock. Dr. Hart E. Fisher, Chicago, chief surgeon of the public service company, was in charge. Other features of the exposition were free blood tests, medical examination of children, exhibits on "contact" diseases and nutrition. A motion picture program was presented daily.

IN the British Parliament Sir Thomas Moore recently asked the Minister of Supply whether he could give an assurance that in the limitation of paper supplies due regard would be had for the relative importance of various publications, and that reasonable preference would be given to the requirements of those publishing educational, scientific and technical journals and books. Mr. Harold Macmillan, parliamentary secretary to the Minister of Supply, replied: "While the Minister can not accept the responsibility for introducing in the allocation of the limited supplies of paper anything which might savor of a censorship, due regard will be had to the provision of reasonable amounts of paper for educational, scientific and technical publications."

ACCORDING to the London *Times* a new government technical school at Takoradi, West Africa, built on 30 acres of grounds at a cost of £37,000 has been opened. The school had to be removed from Accra, partly because the accommodation there was inadequate to meet the growing demand for technical training, partly because the new site is more accessible for the industrialized areas of the Gold Coast. The school overlooks Takoradi harbor and includes a long, single-story workshop with blacksmith's shop, a demonstration block of three stories, with classrooms, laboratories, drawing offices and assembly hall. Over 100 students can be housed in the dormitory block. The workshop provides for instruction in two sections: one for practical work in mechanical engineering, the other for practical woodwork. Both sections are fitted with electrically driven machinery and the usual benches for manual work. Two blocks contain quarters for African masters, and there is a bungalow for a European housemaster. The buildings are grouped around a sports ground of five acres. Most classrooms and the assembly hall are wired for reception of wireless programs from the Sekondi station. Present students include boys from all parts of the Gold Coast.

DISCUSSION

A STANDARD EXPERIMENTAL VEGETATION TYPE

THE increasing interest in land with its attendant problems of animal and plant ecology is emphasizing the long-felt need for outdoor and laboratory facilities "where the interactions of land plants and animals and their physiological relations to climate can be studied."[1] In an integrated investigation of this or a related nature, one of the essential parts would be an area sufficiently protected to permit development of the vegetation so as to form a standard and at the same time afford an experiment in itself.

The purpose of adequately protecting a plant cover over a long period can be stated as: What can the two, soil and climate, produce, given certain species of plants, if productivity is not upset by removal of vegetation? We can only guess at the outcome. What will the product be in a definite period of 5, 10 or 15 years or in an indefinitely long period of over 100 years and more? Will development proceed far beyond what we conceive of as the climax for the region? Will it be a more or a less desirable type than the accepted climax, either as forage or as a protective cover for the soil? How will it compare with areas continuously grazed by livestock for the same period and how will it compare with the vegetation on portions of such an area as mentioned by Shelford—"large enough to prevent domestication of plains animals and to be managed on a hands-off basis"?

Without proper protection outdoor studies dealing with the development of vegetation or with competition between plants may be upset at a crucial moment by the destruction of vegetation through one or another of many agencies. Plowing, fire, roadway construction, excessive grazing by livestock and the feeding of rodents or of insects such as grasshoppers or Mormon crickets, all take toll of plots situated in the open ranges and only by chance can a plot be expected to survive intact for long. Elimination of one or a few of the agencies, such as fencing to keep out large animals, may temporarily reduce the destruction of vegetation but it is no dependable solution. The accumulation of plant material on an area surrounded by land where such material is scarce is a stimulus for concentrations or for multiplication of the uncontrolled smaller animals. The resulting damage to the vegetation may be obscure and lead to erroneous conclusions. Sometimes the damage is pronounced. In two 40-acre experimental tracts[2] where fire and grazing had been prevented, jackrabbits suppressed an annual grass in the one, and in the other reduced a sparse vegetation to bare soil.

[1] V. E. Shelford, SCIENCE, 90: 2346, December 15, 1939.

[2] R. L. Piemeisel, U. S. Dept. Agric. Tech. Bull. 654, 1938; also unpublished data.

Some outdoor plant ecological investigations call for a place to work where the removal of vegetation has been reduced to such a low point that the experimenter can safely consider it negligible. The vegetation must remain intact or nearly so. This is not as unreasonable as it may seem at first glance. Fire can be prevented; adequate fencing can keep out the large animals; means of control are known for rodents and for the insects that cause mass destruction of vegetation. It would seem unnecessary to prevent either casual or slight though wide-spread loss such as a leaf or a few leaves taken off individual plants by a leaf-chewing insect or by a plant disease. At what point damage may be disregarded must at the outset be determined by extensive field experience but later may be aided by methods devised to measure and to record damage. Repeated inspections and a series of records for the season should give the amount of damage in any year and it may be hoped that in time the crucial point (at which damage can be considered negligible) may be stated as a definite figure and that control practices as required would become routine. In short, while the ideal would be to prevent all loss of vegetation, practically this is not feasible and perhaps not necessary, so that it is more important that the amount of deviation from the ideal should be known rather than that the minimal loss be prevented.

The question raised in the fore part of this paper, "What can the soil and climate produce?" would obviously be answered best by adequately protecting a community of perennials, one as near to the accepted climax as possible. However, it is equally desirable to adequately protect a vegetation area in a secondary succession stage so as to throw light on the nature and rate of development and also to serve as a comparison to other areas in a similar developmental stage. Moreover, since the early stages of secondary successions are composed of annuals and there is an exceedingly rapid turnover, a generation for each year, such communities are particularly adapted to some such investigations as were suggested by recent studies of semi-desert vegetation.[2] In these it was shown that the removal of vegetation has a pronounced effect on communities of annuals. Thus by preventing excessive removal of vegetation the development of the early stages of secondary successions proceeded from initial weed stages to a third or annual grass stage. But by inducing excessive removal of vegetation (as by enclosed stock) the process was reversed from the third stage to the initial weed stages. Also, by this same method the development was arrested and maintained at the initial weed stage. Although the gross effect of the removal of vegetation is known, a field of investigation is open to measure this effect on communities of annuals in terms of (*a*) number of animals, (*b*) length of time, (*c*) resulting vegetation, the latter measured by comparison with an adequately protected area.

Another important study is suggested by the severe competition and the very rapid turnover in communities of annuals which make them particularly suited to the study of competition in successive generations, that is, to determine the effect of competition in one year or generation and to follow up its results in the next generation and the next and so on. Outdoor statistical studies of such competition are lacking[2] and if carried out under conditions where destruction of vegetation is negligible might lead to the formulation of some fundamental principles underlying competition between plants in general.

In the past, protection has been directed at the elimination of one or more destructive agencies, but so far as the writer is aware there are no long-time records on protected plant communities where loss of vegetation which may have occurred from one cause or another was measured and shown to be negligible. Changes in plant cover on insufficiently protected or wholly unprotected areas can not be ascribed with certainty to differences in physical factors—drought, for instance—if the destruction of vegetation has been disregarded or unmeasured. The marked modifications of communities of annuals previously mentioned were produced, irrespective of any noticeable changes in physical factors such as "wet" and "drought" years, and the development through its stages was induced, was halted or was reversed merely by manipulating the removal of vegetation, that is, by preventing removal or by producing excessive removal. Since within specified limits we can mold communities of annuals as we wish, to what extent can we mold communities of perennials if given a proportionately long time?

Steenis[3] asks, "Is there any undisturbed vegetation on earth?" Whether we agree or disagree with him, the question remains a challenge to show by measurements in any particular region either that there has been no disturbance, or how much has occurred. Measurements can be obtained if there are "standard" vegetation types for comparison. The large tract mentioned by Shelford, and already referred to, should afford one kind of standard if it were maintained for a sufficiently long time so as to approach a natural balance between plants and animals. Another standard should be an area such as is here proposed, adequately protected and maintained for a long period. In short, in the former we would have a plant cover resulting from a "natural" removal of vegeta-

[3] C. G. G. J. Steenis, *Bull. du Jardin Botanique.* Serie III, Vol. XIV, December, 1936.

tion, in the latter, one resulting from the least possible removal of vegetation. Both of these could then be compared with other plant covers that had been used or treated in various ways under controlled conditions as well as under the existing land-use practices of to-day. From this we could in time obtain a series of values and so arrange a scale, for example, with bare soil as zero, then somewhat higher, the heavily-grazed type, and near the upper end, the standard types just mentioned.

In time such values would afford a basis for recommendations regarding sound land-use practices. How can we determine better the part that physical factors —drought, for instance—play and the part that destruction of vegetation (including disturbance caused by man) plays than by attempting to reproduce, through experiment, the effects we see and believe we understand? However, to achieve this there must be some standard for comparison.

R. L. PIEMEISEL
U. S. SUGAR PLANT FIELD LABORATORY,
TWIN FALLS, IDAHO

THE MUSEUM AS A POTENTIAL FORCE FOR SOCIAL ENLIGHTENMENT

ONE of the primary functions of the museum is that of education. Thus the schools usually have their children visit the museum more or less regularly, and the public at large is generally also permitted this privilege without charge. Considering the adult population primarily, several questions come to mind. First, assuming that a fair proportion of the adult community has been to the museum once, one wonders how many of this group *revisit* the exhibits and at what intervals? Second, what do the visitors actually see when visiting the museum, and how much of what is seen is remembered? And third, of what significance does it all seem to the general run of visitors?

I am not acquainted with the literature on museum administration, and research based on the above queries may already be available. In any case, my own observations (and the response of a number of other individuals with whom the subject has been discussed support these views), point to the following conditions: (1) Relatively very few in the community visit the museum (*i.e.*, the exhibits) more than once a year, if that often. (2) When the museum is visited, the usual thing is to try and see everything, and since observing all the exhibits in even a single hall in a large museum is physically fatiguing, an excursion through the whole museum is generally an exhausting experience. Indeed, as a result of these latter two considerations, the usual visit to the museum can scarcely be more than a superficial survey, at best. (3) With respect to significance of the exhibits, the attitude of the vast majority of the visitors would probably be that they were all curious and very interesting—but little more.

If the above observations are substantially correct, it seems to me difficult to escape the conclusion that the museums have in large measure failed to make any considerable or lasting impression on the thought or mores of the community at large.

It is not my purpose to belittle the cultural advantages of the modern museum of natural history. On the contrary, this note is prompted by the belief that the museum can and should be a definite and potent influence for tolerance and understanding among peoples, and the following suggestions are proposed with that end in mind.

In order to get the people, and by people I mean folk from all walks of life, not merely the "educated" groups, to come to the museum often and regularly, the exhibits should be imbued with *movement,* which tends to attract and hold the interest. Thus, the fascinating story of man's biological history, his ethnological and cultural differentiation, and the like, could be told by means of moving and talking pictures, in serial fashion, just as the modern planetarium each month relates a different chapter in the story of the heavens. As in the planetarium, also, the visitors would be seated comfortably for the "show," and the factor of fatigue would be eliminated. The latter, as well as the fact that attention would be focused on one exhibit story, and over a long period of time, should be conducive to retention of what was seen and heard. Perhaps of most importance, however, is that each science thus presented, and especially the anthropological and social sciences, could and must be intelligently related to the present, everyday world of the people witnessing the exhibits: otherwise, as now, the response would probably be mere esoteric interest. For example, combined with the exhibits and explanation of the material or social culture of the American Indian would also be an account of their contributions to our present mode of living, and what is more, how similar the fundamental drives and sanctions were for them as for us to-day, albeit expressed more or less differently as a result of another day and culture, a discrepancy which should also be noted with reference to our own behavior in the course of time.

It should also be noted that our great museums serve the large urban centers primarily. True, in these days of relatively easy travel, many persons from all over the country get to visit the large cities at one time or another, and these may go to the museum. However, there are probably millions of others in our rural sections of the country who have never had the opportunity of attending a good museum even once. Yet the cultural treasures of the greatest museums could be brought to all the people, in rural as well as in urban communities, by means of motion pictures.