A SIMPLE METHOD OF INDICATING GEOGRAPHICAL DISTRIBUTION

There are two ways in which the distribution of plants and animals on the surface of the earth may be expressed. The first is in terms of countries or provinces or their subdivisions. To this there are several objections: (*a*) The boundaries of a country or province or county are frequently very irregular and do not follow any definite direction. These areas are, moreover, as a rule, very unequal in size. (*b*) The boundaries of countries which have a different form of government are unstable and are liable to change. This has frequently happened already within the memory of men still living and is likely to happen again in the near future. (*c*) The method is only applicable to land areas. It can not be applied to the fauna and flora of the oceans.

The second method is one which has not been much used so far but is much more scientific and exact. It is that of indicating the range of a plant or animal in terms of latitude or longitude. However important international boundaries may be from the human standpoint they have no meaning to plants and animals—unless indeed they should happen to coincide with some natural boundary, such as a mountain range or an expanse of water. But the parallels of latitude and the meridians of longitude are so numerous that it is difficult to remember the particular countries traversed by any one of these in its course. While most people know that the forty-ninth parallel forms the northern boundary of the western half of the United States, very few indeed could name the states traversed by the fortieth parallel.

The method suggested here is a modification of the second of the above. It is proposed to divide the whole earth's surface into a series of areas bounded by the parallels and meridians. Each of these areas will be more or less rectangular, but only two of the four sides will be actually parallel. The size of the areas will gradually diminish towards the poles, but those within the same latitude will be of equal area. Each "merosphere" will have a definite number attached to it and will be capable of division into smaller areas, each of these ultimate units measuring one degree of latitude by one degree of longitude. The size of these proposed primary areas or "merospheres," as I have called them, will be a matter for legitimate discussion. If too small they will be so numerous as to have no advantage over the method of expressing distribution in terms of latitude and longitude. If, on the other hand, they are too large they will be useless for indicating distribution. The actual size proposed here measures six degrees of latitude by nine degrees of longitude. The reason for the adoption of these figures is twofold. It is true in a general sense that isotherms or lines of equal mean temperature run for the most part east and west unless where deflected by mountain chains or sheets of water when they may run in any direction, even north and south. It is also true, in a general sense, that the temperature falls steadily from the limits of the tropical region towards the limits of the polar regions. While there are wide variations in different continents, I have taken the rate of fall as being on the average about 1½° F. for every parallel of latitude. Six degrees of latitude will therefore correspond to about 9° F. or 5° C.

If the width of the proposed areas were 6° of longitude instead of 9° these areas in the neighborhood of the equator would be approximately squares, but would be narrow towards the poles. By making the width of the proposed areas 9° instead of 6° squares will occur about midway between the equator and poles and the number of areas or "merospheres" will be proportionately reduced.

The details of the proposed scheme are as follows: Beginning at the equator, the northern half of the earth is divided into fifteen parallel belts, each comprising 6° of latitude. These are numbered consecutively from N 1 to N 15. The southern hemisphere is divided similarly into belts S 1, S 2, etc. Each belt is divided into 40 divisions beginning at the meridian of Greenwich, the numbers running consecutively westwards until the meridian of Greenwich is again reached. As mentioned above, each division comprises 9° of longitude.

The belt number can conveniently be distinguished from its division numbers by a dot placed between them. Thus the state of Georgia would be included for the most part in N 6.10 with the extreme eastern area in N 6.9. The island of Tasmania would be comprised in S 7.17 and S 8.17.

Subdivided in the above manner, the United States would be comprised in belts N 5 to N 9 and would be contained in 29 divisions.

The above-defined areas, though large, are sufficient to indicate in a general way the distribution of plants and animals. But where greater exactitude is required, as, for example, where it is desired to indicate the most southerly point reached by a typical northern species or *vice versa* they are rather vague. Accordingly each "merosphere" may be again divided into smaller areas, each consisting of one degree of latitude and one degree of longitude. As will be seen from the annexed figure the east and west sub-belts are numbered from 1 to 6 and the nine strips running north and south are marked from A to I. By the combination of a number and letter the position of each of the 54 subdivisions can be indicated, thus N6.10.5E will include the northwest corner of Georgia. One advantage possessed by the system of numbered areas herein described is that it can be used alone or in conjunction with the name of the state or province where fuller information is desired. Thus Georgia (N6.9.3I) will indicate the area around Savannah. Altogether this state contains twenty-four of these smaller subdivisions.

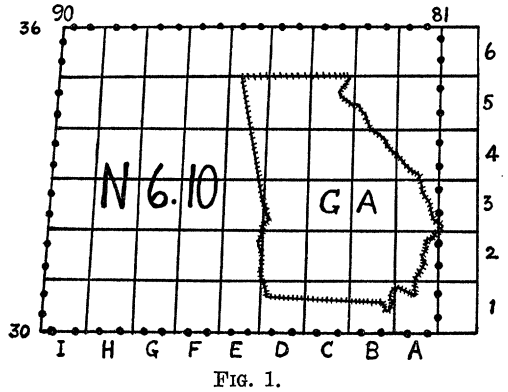

FIG. 1.

If some such scheme of uniform subdivisions were adopted in the case of a "flora" which deals with a single state or country the separate units of adjacent states or countries could readily be grouped into the larger areas mentioned.

It must, of course, be borne in mind that some such scheme as the above is intended to indicate only the *geographical* range of species. The division of the earth's surface into *biological* provinces, each with its characteristic assemblage of plants and animals, is a different matter. Before we can divide the earth satisfactorily into biological areas we must know first the actual limits of distribution of each species as well as something of the climatology in the widest sense of the proposed areas. At present we have not amassed sufficient data to enable us to make these wide generalizations, though several persons have made the attempt with varying success.

The need for some such division of the earth's surface, as I have attempted to outline above, is not so evident in the United States as it is further north. Such terms as Labrador, Alaska and Ontario, referring as they do to very large areas, are too indefinite to indicate with exactness the distribution of the fauna and flora. Labrador formerly had a different meaning from what it has at present, the greater part of the territory formerly called by that name being now part of the province of Quebec, and even yet the boundary line is not properly delimited.

The distribution of a certain species is given in the "North American Flora" as "Nova Scotia to Georgia, Tennessee and Michigan." Presumably it occurs in Ontario, as a line drawn from Nova Scotia to Michigan will pass through the province of Ontario. But it is not by any means certain whether the species occurs in the southern parts of New Brunswick or Quebec. According to the method outlined above the distribution would be N6.9–10, N7.8–10, N8.8–10.

Another species is mentioned as extending "from Newfoundland to Florida, Alabama and the Mackenzie." As this river has a course of over 1,000 miles in length it will be

evident that it is a somewhat indefinite boundary line.

To express the distribution of any species it ought to be sufficient to enumerate the divisional numbers of the areas in which it occurs and its ultimate limits to the north and south and in an easterly and westerly direction. Range of altitude in each division, or at any rate in each belt, is of as much importance as range in latitude.

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The Committee of One Hundred of the American Association for the Advancement of Science

Report of the Subcommittee on the Selection and Training of Students for Research

At the meeting of the Committee of One Hundred of the American Association of Scientific Research in April, 1914, the chairman was authorized to appoint a subcommittee on the Training and Selection of Students for Research. He subsequently appointed the following members: Professor R. A. Harper, Columbia University; Professor R. G. Harrison, Yale University; Professor G. A. Hulett, Princeton University; Professor W. Lindgren, Massachusetts Institute of Technology; and Professor E. W. Brown, Yale University, chairman. This subcommittee has conducted its discussion mainly by correspondence, but held a meeting on May 14 last at which four of the members were present. The report which follows is signed by these four members of the sub-committee; Professor Harper, being absent from the meeting and being unwilling to sign the report, resigned.

The education of students naturally is divided into school, undergraduate and post-graduate instruction. The first of these is too large a question to touch on in this connection. The third on the whole is well organized, and at the present time practically consists only of students intending to take up research or those needing the higher degrees for educational careers. Hence most of the work of the sub-committee was in the direction of considering what might be done to further the interests of the abler students in their undergraduate careers. In using the phrase "abler students" the subcommittee had in mind the upper twenty to thirty per cent. of the classes.

In order to find out what was done in the various colleges and universities of the United States a circular was sent out to about forty, which were considered representative of the various systems of instruction throughout the country. This circular inquired what facilities were provided for the more able amongst the undergraduates for furnishing them with a better and more rapid training than the ordinary student. If such facilities were offered, inquiry was made as to what form these facilities took. It was also asked whether any money rewards were given for high attainments, and whether the institution had any knowledge of the results obtained from these facilities. About thirty of the forty selected institutions sent replies sufficiently detailed for the subcommittee to obtain a fair idea of what was being done throughout the country in this connection. It appears that five universities have specially organized courses in which the better students are able to have greater facilities for progress than the majority. Two others have courses laid out without, however, appearing to put much stress upon them. The remainder have little or nothing organized. These organized courses are generally referred to as "honors courses." Practically all of the institutions adopting them use the same methods, consisting of segregation into separate classes, extra work in connection with the ordinary courses, a limit for admission to such courses, a general final examination, less class-room work, and a complete program for junior and senior years. These different methods depended on the particular department, much freedom being given to the various departments. A fair idea of the various plans adopted may be gathered from the catalogues of the universities of Columbia, Minnesota, Princeton and Yale. Princeton has the preceptorial system in addition, but the expense of this makes it of doubtful value for