THE MAJOR NATURAL REGIONS: AN ESSAY IN SYSTEMATIC GEOGRAPHY.

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Those of us who teach geography in the Universities have constantly to answer the question, What is geography? and in preparing our work we have to be quite clear about its content and scope. In this country we are less tied by tradition than in some others, for there is practically no systematic geography to bind us. In Germany the Ritter and Humboldt traditions gave rise to two schools. To America the Ritter tradition was carried over by Guyot, but a new one developed by geologists has superseded it. For long in our country geographical progress meant exploration, mainly with a commercial or political bias, and descriptive and statistical geography was taught. It was only with the rise of an academic geography that the wider conception of geography as the science of distributions developed.

In studying distributions comparisons were inevitable between geology and geography, climate and vegetation, and so on, and we were led to think that there might exist definite natural divisions of our globe. This resulted in an attempt to replace the purely political divisions of the world by others based on configuration. At this stage both the teaching and text-books gave a rational analysis of the main-feature lines as a guide to the general build of the continents, and this was supplemented by a consideration of the climatic and biological elements also for the continents. In the detailed study of each continent, however, the descriptions were applied to the various political divisions. This is found to be unsatisfactory. Why should Southern Canada be treated separately from the Northern United States? Such separation involves much waste of time, which would be obviated by a more rational subdivision of North America.

How are we to go about making the more rational subdivisions? At the outset two difficulties present themselves: (1) What characteristics should be selected to distinguish one region from another? Size is not a sufficient guide, although it must not be neglected; neither is structure, nor even configuration, although this last suggests many important divisions of the Earth's surface, which must be taken into account in any rational classification. (2) How can we determine the different orders of natural regions? The British Isles, for instance, form part of

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a much larger natural area, that of North-Western Europe, while they themselves
can be analyzed into a number of sub-regions.

The recognition of geographical forms has gradually been taking place. It has
necessarily been late in the history of thought, first, because our knowledge of the
surface of the globe was insufficient until the explorations of the nineteenth century
had traced its fundamental features; and, second, because the specialist inter-
pretation of the accumulated data was a necessary preliminary to its utilization for
systematic geography.

The evolutionary ideas of the latter part of the eighteenth century were applied
to biological and human affairs in the nineteenth, and the fascinating work of
examining natural objects in their light absorbed the energies of the best workers.
All were forced to consider environment, and even its evolution. If Humboldt's
_Cosmos_ had no immediate successor, this was inevitable, as a period of intense
analytical specialization was a necessary preliminary to the more complete synthesis,
of which we now see the beginnings in all departments of thought. Speaking
generally, this synthetic work must have been carried far enough to permit of
at least rough mapping before the geographer can begin his part of the task.
In Berghaus's 'Physical Atlas,' and for meteorology in Bartholomew's volume, we
have the raw material for systematic geography as far as concerns the major forms.
These maps, however, unless it be in the case of configuration, are not drawn from
the geographical point of view, but from those of the various specialists who have
edited the volumes.

In what way is the geographer to use this raw material in working out a
systematic geography? This involves the question, what is the subject-matter of
geography? This I take to be the study of phenomena from the point of view
of their distribution on the surface of the Earth, in natural groups, and not as isolated
phenomena.

Geography is not concerned with distribution of one element on the Earth's
surface, but with all. If geographers first regard the distribution of different
phenomena separately, it is only in order to help them later to consider them
together more effectively. This is not to say that all these different distributions
are of equal importance, but that all must be taken into consideration before the
problem of systematic geography is solved. Some may bulk more largely in the
geographical consciousness than others, but all must be kept in view. Configura-
tion is necessarily the framework, but we must not think of it merely as a more or
less irregular surface; we must see it as part of a solid which comprises not merely
the soil beneath, but the air above, with relations to other parts of the Earth, and
also to the influences coming from outside the Earth. This gives a movement, a
life to the whole, and it seems to me useful and not altogether fanciful to speak of
this geographically discerned complex as a macro-organism.

A recognition of more complex units than the individual has gradually taken
place, and has grown more familiar in our own country in recent years with the
rise of such studies as those of plant associations, or in practical life with the
development of local self-government. One may not have the exact equivalent
of the biological species and genera, but it is useful to remember the existence
of these, which suggest different orders of geographical divisions.

The systematic botanist or geologist has no difficulty in defining the objects
of his investigation, although he may have many about their classification. The
systematic geographer has first to point out what he wishes to systematize.
This I believe to be definite areas of the surface of the Earth considered as a whole,
not the configuration alone, but the complex of land, water, air, plant, animal, and
man, regarded in their special relationship as together constituting a definite
characteristic portion of the Earth's surface. The question is, what are the characteristic and distinguishing elements of the areas which we may term natural regions?

While we may not be able to dissect our natural region or terrestrial macro-organism into the organs, tissues, and cells of the vital organism, we can find in this idea a useful hint. We may see in such a paper as that by Prof. W. M. Davis on the "Drainage of Cuestas," the beginning of monographs on the tissues of the Earth's surface. These will deal, however, not merely with the mutual adjustments of drainage and land forms, but also with the well-marked zones of climate, vegetation, and even human distributions which characterize such forms when situated in similar climatic areas.

The recognition of the possibility of dividing the lands into great natural regions I have found so useful both in investigations and in teaching, that I venture to bring it before you. I think it should prove a stimulus to geography, similar to that derived from the development of a natural systematic botany or zoology. This paper does not profess to present a complete solution, which cannot be arrived at in the existing state of our knowledge, but is intended to initiate a discussion on—

(a) The desirability of developing such a systematic geography.

(b) The major units with which that systematic geography would deal.

It is essential, first of all, to pass in review the areas determined by the distribution of one or other class of phenomena, before discussing the natural regions which can be outlined from a consideration of the distribution of all classes. The facts of configuration and of climate are of first importance, but the distribution of vegetation, and even of man, may also profitably be examined.

**Configuration.**

Two facts have to be considered—first, extension horizontally and vertically; second, the surface form, which is determined by structure, the nature of the transforming processes, and the time during which they have been active.

It is hardly necessary to refer to the vertical distribution of land. The 600, 3000, and 6000 feet (or 200, 1000, and 2000 metre) lines are perhaps the most valuable. Special terms for those different zones of height would be useful, but are difficult to select from our ordinary vocabulary; lowland, upland, highland are the least unsatisfactory for the three lower zones. Perhaps, following Wagner, "culminating land" or else lofty or upper mountain zone might be used for regions over 6000 feet (or 2000 metres).

This culminating land, above the 6000-feet line, is almost confined to a Pacific belt bordering that ocean, to a Mid-World belt from the East Indies to Iberia, to Greenland, and to eastern Africa. The lowlands are found mainly on the continental side of the Pacific lofty belt, and on both sides, but more particularly on the Arctic side, of the Mid-World belt.

The feature lines of both the high and low lands are varied, and depend in the first place on the structure of the crust. The accompanying morphological map is based mainly on Suess's classical work.

(1) The Pacific and Mid-World belts of lofty land coincide with the areas where the rocks of all ages have been folded into parallel ridge and furrow—the young folded mountains. The continuity is modified here and there by great lava flows and volcanic cones, or by raising or lowering of great blocks as a whole. The general features are all drawn out in the direction of the belts, which we might describe as the crests of major waves, of complex undulating character, bordered by
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two major troughs, the one deeper than the other. *Cf.* the Chilean deeps and the Paraguay plains.

(2) The intermediate heights are of two types. In both there are raised blocks bordered by sunken areas, the chief margins being determined by fractures, while the drainage systems are of great importance in shaping the superficial features. In one type the palæozoic rocks are folded, but not the younger ones. These we may term *denudation highlands*, because the main feature lines other than those determined by fractures are due to superficial erosion, which may, as in the Appalachians, or may not, as in the Central European Highlands, bring out very clearly the lines of crustal folding. The parallelism of ridge and furrow is on the whole rarely well marked. Young volcanic rocks are found along the marginal fractures both in this and in the next type.

(3) In the other type, even the oldest sedimentary rocks lie almost horizontally, with flexures only here and there, and form vast *tablelands*. The feature lines of these tablelands, where not determined by fracture, are river-valleys, which as a rule are steep-sided gorges—at least in the early phase of denudation.

(4) The *lowlands* consist of reduced forms of types 2 and 3, and, in addition, areas covered with recent deposits either of terrestrial or marine origin. These we distinguish as *denudation plains, tabular plains or platforms, and accumulation plains*.

The study of these types—young folded mountains, tablelands and platforms, denudation highlands and plains, and elevated and lower accumulation lands—suffices to give an idea of the main feature-lines of the lands of the globe. There is a very large number of varieties, partly due to the relative importance of fracturing and folding in a given area, partly to the nature of the transforming agents at work—ice, running water, or dry air. To the distribution of these processes the rainfall map is a key, and for the secondary division of land forms, a superposition of the orographical, tectonic, and rainfall maps is necessary. The rainfall map is important in other connections, and this leads to the consideration of the distribution of climatic forms.

***Climate.***

While the pressure and wind map is the key to many climatic peculiarities, for our present purpose the temperature and rainfall maps are of the greatest importance.

The isotherms available of most geographical importance are those of 32°, 50°, and 68° Fahr. (0°, 10°, and 20° C.) in the coldest, and 50° and 68° Fahr. (10° and 20° C.) for the warmest months, that for 50° Fahr. (10° C.) in the warmest month being perhaps the most significant. They indicate the succession of temperature belts, each with its own characteristics. These belts, as the map shows, are, owing to winds and ocean currents, narrowest in low latitudes in the west, and in the higher latitudes in the east of the continents. In these narrow parts the temperature conditions vary most within unit horizontal distance, whereas on the opposite sides of the continents they vary least. There is a contrast between the temperature conditions of east and west. This is part of the general climatic difference between east and west, which is of fundamental importance.

Rainfall maps are of even greater significance. The rainy season, as well as the quantity of rain, must be taken into account. A new map showing seasonal rainfall, based on Supan's seasonal rainfall maps, accompanies this paper. This permits the differentiation of regions which receive sufficient rainfall at none or one or more seasons, and the comparison between those regions where the rainfall is precipitated when temperature conditions are most and least favourable.
The first contrast is between the drier interior and the wetter coast; the second, between the drier lowland and wetter highland; the third, between the east and west coasts. On the east coast most coastal lands receive a fair supply of rain from equator to polar circles, but in the west, dry areas extend from the coast far inland around each tropic on the lee side of the lands in the trade wind belts. The temperate coastal lands receive most rain in winter, but nearly all other parts of the world receive most in summer. The northward and southward movement of the wind-belts determines areas on each side of the tropical deserts—the equatorial one with a summer rainy season, the polar one with a winter rainy season.

Combining these, we have the following climatic regions:

1. Polar, where the temperature is never high and the rainfall always low, most falling in the summer.

2. The cool temperate belt, with (a) a rainy west coast; and (b) a less rainy east coast—both with rain at all seasons, the maximum falling in autumn or winter; and (c) an internal area of great extremes of temperature, and a low and early summer rainfall.

3. The warm temperate belt, with (a) winter rains in the west; and (b) summer rains in the east. (c) The intermediate internal region, where it occurs, is one of great extremes of temperature and low rainfall, especially where mountainous.

4. The western tropical deserts, with great ranges of temperature, and little or no rainfall.

5. The inter-tropical regions, with one rainy season in summer.

6. The equatorial rainy areas, with two relatively drier periods.

The mountain areas partly help to define the limits of these regions, and partly introduce zones with successively colder climates and, up to a certain level, with wetter ones.

It will be seen from the map that most of these regions occur two or three times in each zone, and accordingly give the data for valuable comparisons.

Vegetation.

In its main outlines the vegetation map follows the climate map, and only in its secondary characteristics does it show the effects of the soil and drainage. If the existing plant-covering of the Earth is mapped, then the influence of man is a third factor, which in most botanic maps is eliminated. The vegetation map may be looked upon as a commentary on and a summary of the climatic ones.

Density of Population.

The mapping of human conditions has less significance in indicating the natural geographical regions, for the factor of human development has to be taken into account as well as the possibilities of the natural environment. The density of population map is the most direct expression of the actual economic utilization of the natural region. One has only to cite the central plains of North America before and after the introduction of railroads and the exploitation of minerals, to measure the importance of the human factor in determining this density. Each geographical region has its potentialities as well as its actualities, and a study of these is one of the most complex and fascinating the geographer can tackle. The necessary preliminary, however, is a just appreciation of the natural physical conditions of relief and climate.

Hitherto it has been customary to study the geography of the World according to political divisions. These, expressing the most complex and comparatively unstable of human conditions, must be eliminated from any consideration of natural regions.
SEASONAL RAINFALL
Based mainly on Supan's four Seasonal Maps
by A. J. HERBERTSON

William Stanford & Company Ltd., The Oxford Geol. Institute

The various cross rulings indicate the Seasons which have more than 6 inches of Rainfall
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In the determination of natural regions, climate and configuration must both be considered. Climate, because it not merely affects the physical features, but also because it best summarizes the various influences acting on the surface. Climate even more than configuration, for the great barriers of the lands are climatic—wastes of arid desert or ice mountains—for it is the climate more than the configuration which renders lofty mountains effective barriers. Only when minor forms are taken into consideration does configuration become the all-important factor. On the accompanying map I have ventured to outline the regions which the consideration of all factors seems to me to determine.

A natural region should have a certain unity of configuration, climate, and vegetation. The ideal boundaries are the dissociating ocean, the severing mass of mountains, or the inhospitable deserts. As a rule, save in the case of the shore, the boundary is not at all well marked, but the characteristics of one region melt gradually into those of another. Premising that the lines on the map are taken as the approximate central lines of the transition areas, we may divide the world up into the following types of natural regions:

1. Polar. (a) Lowlands (Tundra type); (b) Highlands (Ice-cap type).
2. The cool temperate regions. (a) Western margin (West European type); (b) Eastern margin (Quebec type); (c) Interior lowlands (Siberian type); (d) Interior mountain area (Altai type).
3. The warm temperate regions. (a) Western margin with winter rains (Mediterranean type); (b) The eastern margin with summer rains (China type); (c) The interior lowlands (Turan type); (d) and the plateau (Iran type).
4. (a) The west tropical deserts (Sahara type); (b) East tropical lands (Monsoon type); (c) Inter-tropical tablelands (Sudan type).
5. Lofty tropical or sub-tropical mountains (Tibetan type).
6. Equatorial lowlands (Amazon type).

The importance of regarding the Earth in this way can hardly be overestimated. Take, for instance, the application to education. Knowing each of the chief types, it is a simple matter to learn the peculiarities of each variety, and a great saving of time is effected, while the intellectual discipline of distinguishing the species and comparing the varieties is great. The application to economic and political affairs is even more obvious. Speaking generally, the permanent elements of each region are similar, and the history of the exploitation of the variety of any type of region where human development is most advanced should be of great profit to those interested in the exploitation or administration of the relatively undeveloped varieties of the same type. The recognition of natural regions gives the historian a geographical foundation for his investigations into the development of human society, such as he has not hitherto consciously possessed. By comparing the histories of the same race in two different regions, or of a succession of races in the same region, it should be possible to arrive at some knowledge of the invariable effect of a type of environment on its inhabitlants, and permit some estimation of the non-environmental factors in human development.

It would be difficult to exaggerate the importance of this investigation, which seems to me a fundamental one for all who have to deal with the study of man, or with his economic exploitation or his proper government.

No one is better aware than I of the incompleteness of the present communication, but I venture to make it in the hope that it may start criticism, and ultimately lead to a better understanding of one part of geography, and of its practical as well as its theoretical importance.

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In future papers I propose to deal in some detail with each type of natural region and its varieties.

After the reading of the paper, the following discussion took place:

Dr. Mill: I am much interested in this attempt of Mr. Herbertson's to introduce something more systematic into the classification of natural regions, but I have hardly given the subject sufficient attention to justify me in opening the discussion upon it. My own views on systematic geography I have already elaborated and set forth to the best of my ability in my address to the British Association in 1901. I should like to ask Mr. Herbertson for what purposes he proposes to use those natural regions? Are they to take the place of the old division of the world into continents, or are they to be used for such discussions as are concerned with the distribution of climatic and botanical phenomena?

Dr. Herbertson: The continents would be as at present. This is a cross-division trying to consider all the factors, classifying the natural regions of each continent, by means of which we can connect one continent with another, such as Europe and Asia, or Africa and South America.

Dr. Mill: Understanding that, I am confronted with this very serious difficulty. Whatever one of the many distributions we consider, we shall find that if there is a classification possible with regard to it, it will in some respects run counter to the classification required for the consideration of other phenomena, and it is quite impossible, as I know from an attempt that was made, to get a classification of the world in natural regions that would satisfy the workers in several branches of science. The only classification equally suited for all purposes is that of coast-lines and degree-net. And my feeling is, the more general we can make the physical classification the better. I do not think we require to go beyond the purely orographical. It seems to me that the science of geography has to do essentially with the action and reaction of the configuration of the Earth upon the many mobile distributions, and that one classification or another classification may be appropriately adopted when we consider one or another of these conditions. But my feeling is that for the general purpose we should stick to the degree-net, the coast-line, and the contour-lines, which are necessary and sufficient. That appears to my mind to meet the contention that such a larger subdivision is necessary, and I fear that as our knowledge of climate advances, the lines dividing areas will be continually modified. I remember once trying to draw a map of Africa treating of the relative climates, taking into account all the conditions, altitude, latitude, prevailing winds, etc., and it was most difficult and very unsatisfactory. We must have more knowledge than we now possess before such a map could be drawn; ultimately it might be possible. But it is desirable that an attempt should be made to extend our knowledge and widen our grasp of the inter-relation of phenomena, and in that direction I think this paper of Mr. Herbertson's is extremely suggestive and most valuable, and I am quite sure that if it is further considered and published with the maps which have been exhibited, it will exercise a very considerable influence in promoting interest in geographical science.

Mr. Douglas Freshfield: Dr. Mill has already said all, or almost all, that I should care to say very much better than I could have said it. It seems to me that this attempt to create what I think Mr. Herbertson called in his paper genera in regions is a very difficult one. You will only get your genera by disregarding certain points in which regions differ. It may be an instructive inquiry, but I am rather doubtful as to its usefulness in teaching. I am afraid that as we grow more and more scientific we are liable to mix up geography with every