

people now find this approach to the study of form difficult to understand owing to our changed outlook on natural objects. They may have read papers like the admirable address on the interpretation of plant structure delivered to Section K of the British Association in 1939 by Prof. D. Thoday, and cannot envisage a system of thought from which biological and physiological considerations are excluded.

A survey of the changes in outlook since 1851 seems to show that form and structure can be viewed from three separate aspects: the old, abstract and purely intellectual approach; the causal and developmental point of view; the objective and historical study of plant evolution, which is, perhaps, still undeveloped as a logical system of thought. While these three branches of study will probably be best developed as separate disciplines, I believe that their results will eventually contribute to a synthesis of far-reaching importance.

## GEOGRAPHY IN THE SERVICE OF MANKIND\*

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A LAYMAN is not the right person to review the academic evolution of geography or to put forward detailed proposals for its further development as a scientific study: such matters must be left to those properly qualified to deal with them. A layman, however, may quite properly examine the record of the services of geography to the common people, and, indeed, may also be a proper person to urge that geographical knowledge shall be more frequently and widely applied in the conduct of both national and international affairs.

It is commonly said that 'pure' scientists are not concerned with or about the use made of the knowledge which they accumulate. Results, in their case, are said to be sufficient if it can be proved that something has been added to the store of human knowledge. This familiar argument is, of course, basically sound; but it appears to overlook the fact that, in the last analysis, a man of science is a specialist or expert employed in the service of his fellow-men. That is to say, he is, directly or indirectly, a servant of the public. Now the public is accustomed to assess the value of any study or activity by an analysis of its observed or deduced results. If the results appear to be good, then the study or activity in question continues to command respect and support and the specialists and experts concerned enjoy a high reputation. If, on the other hand, the results appear to be unsatisfactory or if, after a reasonable time, no results can be seen or deduced, then the value of the particular study or activity becomes suspect and the support accorded to its practitioners is liable to be diminished. For these reasons it is submitted that men of science and particularly geographers cannot afford to remain entirely disinterested in the use made of their knowledge and ought to do whatever they can to encourage its useful application.

As has been said, the public tends to evaluate a study or activity by its visible, demonstrable or deducible results. In this connexion the words 'visible and demonstrable' are particularly important.

\* Substance of a paper read on August 10 before Section E (Geography) at the Edinburgh meeting of the British Association.

Remember the wisdom of those who insisted that justice must not only be done but must "manifestly be done". If public respect for scientific work is to be maintained at a high level and if financial support is to be forthcoming on an adequate scale, then the results of such work must be manifest. In this connexion the increasing dependence of our universities upon the public purse is not to be forgotten.

Results sufficient for the purpose need not, however, be directly produced by those who accumulate the required knowledge. It will serve well enough if they are usually produced by laymen who know how to use the knowledge or the techniques supplied by the professional experts, provided always that the experts receive adequate credit for the vital part they have played.

Compared with many other scientific workers or experts, the geographer is somewhat handicapped in the matter of producing visible or demonstrable results. The physicist, for example, lacks no publicity for the results of his labours, nor does the chemist or the engineer. The geographer, however, like the economist or the psychologist, deals largely in ideas which can rarely, if ever, be translated into anything which can be seen except upon paper. Perhaps he is a little better off than the economist and certainly he is better off than the psychologist, because the geographer at least has the solid earth as the subject of his study, whereas the psychologist is concerned with the invisible and intangible thought processes of the human brain. Nevertheless, the geographer creates few visible evidences of his work and it is not often possible for the layman to pause and point and say "that was done by a geographer".

Since geographers are not, in the ordinary sense of the words, either producers or administrators, since they do not till the soil, fish the seas, labour directly in industry, engage in trade or direct the energies of those who do these things, their contribution to the common effort and the common weal has to consist, on one hand, of learning and recording things about the earth as the home of man and, on the other, of teaching and advising. For visible results the layman has to be content with books and maps and things on paper: for other results he must rely on deduction rather than sight. In other words, he must look for abstract rather than concrete evidence. Naturally enough, he thinks of the geographer (when he thinks of him at all) as the informer, teacher or adviser, and he thinks he ought to be able to detect the influence of the geographer in many departments of human affairs. Nor is it unreasonable that he should do so. As practitioners of a subject which can claim no less than twenty-one academic chairs in Great Britain alone, as intellectuals equipped with special knowledge about the home of man, geographers ought surely to be found exerting a profound influence on the conduct of both national and international affairs. What are the facts?

Outside the universities and the schools, geographers are held to be of small account. In the departments of State, in local government, in industry and commerce and in the Fighting Services they are almost unknown. That surely must be very disappointing, if not humiliating, to professional geographers. Certainly it is a thought-provoking fact to laymen. Admittedly geographers have served on one Royal Commission (the Royal Commission on the Geographical Distribution of Industry) and may have served on others though not specifically as geographers. Some have served on the staff of the

Ministry of Town and Country Planning (now known by another name, but, like the rose, retaining the same odour), and a few have been appointed to similar posts in local government. A few may be serving in administrative posts in the Dominions and Colonies, and it is possible that one or two are to be found as advisers in industry and commerce. Some there are, of course, serving with distinction in the Fighting Services, but few of these serve as geographers. In truth, the number of qualified geographers employed as such in any sphere of administration or in any public service may fairly be described as negligible. Only as teachers in the universities and schools may the qualified geographer be found in fair numbers, and sometimes, even in such places, he still has difficulty in maintaining his status and dignity as an important specialist.

It is clear, therefore, that, if geographical influence has been brought to bear on problems of the day, it has been largely exerted by laymen. We know, of course, that laymen do apply geographical knowledge daily in matters great and small; but there must be very few laymen in positions of authority whose knowledge and appreciation of geographical principles are equal to the requirement. Unfortunately, also, laymen making use of geographical knowledge are often not very sure what sort of knowledge it is that they are using, and very few of them ever pay tribute to the people from whom they obtained it. Thus the professional geographer rarely gets any credit and, unless he is a school teacher, he remains in the background—a vague, shadowy figure whose function remains largely a mystery to the layman.

Are things any better elsewhere? Let us see what those who ought to know say about the state of affairs in France. M. Georges Chabot, professor of geography in the Sorbonne, agrees with M. Louis François, inspector-general of public education in France, that "The Public is largely ignorant of Geography and the Press is in the same state": and that in France, which has produced some of the greatest geographers of all time. In Germany, where geography was once held in the highest esteem, the subject is making progress towards revival but has had to pay heavily for having allowed itself prior to 1939 to become the tool of political gangsters. In the United States geography is alive, and geographers are more vocal than in Britain; but convincing evidence of intelligent application is lacking or difficult to find. As for American politicians, they pay lip service to geography but their actions sometimes justify doubts as to whether they fully understand what they praise. In other parts of the world the situation seems to be the same or not so good. The truth is that, although geography has marched forward in the universities and the schools of a great many countries, it remains barely noticed by statesmen and administrators and is largely ignored by the average, adult citizen.

In the British Commonwealth great problems arise almost weekly which demand the assistance of the best brains and the wisest heads; but though quite a number of these problems lie well within the legitimate field of the professional geographer, he is seldom consulted. What, perhaps, is more deplorable is that geographers themselves do not seem to exert themselves to make their influence felt. Far-reaching political and economic proposals are widely debated in Britain in connexion with which the qualified geographer could render signal services by contributing his knowledge and stating his convictions,

and yet never, or scarcely ever, is his voice raised loud enough or in time to affect the issue. Charged with indifference or sloth in these matters, some geographers have said that it is not consistent with their position or their dignity to join in political or other public controversies. It is here submitted that such an attitude is wrong. To remain aloof, withholding vital information or advice merely because no one has thought of asking for it, is equivalent to issuing an invitation to be ignored. Unfortunately, there are many who, for one reason or another or for no reason at all, fail to seize the opportunities for service which offer themselves. We may find in that fact one of the reasons why geography lacks its fair measure of public esteem and support and why so few geographers are to be found in positions of influence outside the academic field.

It is one hundred years since Section E of the British Association was established. By now geographers should be able to point with proper pride to the achievements of their kind in administration and public affairs. There should be trained geographers employed, at least as advisers, wherever geographical knowledge is essential to wise decisions and intelligent action. The simple fact that geographers are so rarely to be found occupying such posts is evidence enough that geography has not yet become the force which it ought to be. Geographers have knowledge which contains the seeds of a great power for good. Wisely disseminated and applied, that knowledge might yet do much for mankind and for the peace of the world. It is time that that knowledge became more widely known and used, and it is more than time that geographers took action to make it so.

That the study of geography has done good and has accomplished much would not and could not be denied by any intelligent person who cared to give the matter careful thought. The great wealth of information which has been so patiently collected, analysed and recorded in the forms of books, papers and maps is irrefutable evidence of the skill and industry of practitioners of the subject. In the practical sphere the record of exploration and of research work in the field is a record of which geographers may justly be proud. In the schools of Great Britain the teaching of the subject has been revolutionized, and slowly but surely it has gained status and respect despite many handicaps and a good deal of unreasoning opposition. In the universities, as we all know, the subject has advanced beyond the most sanguine hopes of those who laboured fifty or more years ago to obtain for it a bare foothold. Yet, despite these achievements we cannot pretend that things are satisfactory. The authors of the Unesco pamphlet entitled "Towards World Understanding" have felt obliged to write "... in spite of the progress of geography in methods of research and dissemination, the efforts of geography teachers produce disappointing results". Again, in the same pamphlet they go on to say, "... actually less is known of geography to-day than formerly". We may question the accuracy of these statements; but it is impossible to deny that the mere fact that a number of distinguished geographers and teachers can agree to make them is alarming.

Another thing which is disquieting is that, despite the brilliance of many of the teachers and the interesting manner in which the subject is presented in so many schools, pupils are not generally enthusiastic about geography. It is safe to say that, in most



cases, geography is the subject which promising pupils want to drop when they are approaching the period in school-life when something has to be given up to allow for more intensive study of other subjects. In this readiness to drop geography towards the culmination of the school course and in the desire to avoid taking it in the examinations, the more brilliant pupils are all too often encouraged by head teachers, who seem prone to share the pupils' lack of interest in the subject. What can be the explanation of this? It is submitted that the explanation is the same as that already suggested as being the cause of apathy in the adult citizen, namely, lack of evidence that geography is something applicable to life. Children can see daily evidence of the application of physics, chemistry, mathematics, biology and engineering, but they rarely see or hear anything in the world outside school which would lead them to believe that geography is something that really matters. As we have already said, geographers create few if any visible monuments, are rarely heard, seldom reported and are not often seen at work in a way which renders them recognizable to laymen as geographers. As more than one senior pupil has said to me: "You never hear of anybody *doing* anything with geography: it's just a school subject". Those pupils had the wrong idea, of course, but can we blame them? Geographers rarely speak in Parliament or in the local council chamber. Comparatively few of them give lectures to the general public on the problems of the day: very few are heard on the wirelegs, and then, as a rule, only on the Third Programme. They are practically never alluded to in films, even incidentally, and they almost certainly occupy less space in the newspapers than other scientific workers. Thus there is little indeed to indicate either to the adult or the adolescent citizen that geographers exert any influence or do any notable service.

To no one would this sorry state of affairs give greater distress than to that great geographer and public servant, Sir Halford Mackinder, were he alive to-day. Mackinder, perhaps more than any other great geographer, believed in the application of geography to world affairs; that is to say, he believed in it being not only studied but also used for helping to solve some of the problems of mankind. He saw it as a power for good and believed that, properly applied, it could help the statesmen of the nations to agree on wise and practical territorial arrangements which would remove some of the more potent causes of war. He saw it as at once both a science and a philosophy and also as a technique which could be applied to a great variety of human problems—local, national and international. Had geography been so used it could not now appear to so many ordinary people as the purposeless and almost barren study which to too many of them it seems to be to-day.

Fortunately, signs are not altogether wanting that some geographers of standing have at long last sensed the need to explain their purpose and demonstrate their techniques to educated laymen. Some also seem to be awakening to a more proper appreciation of their responsibilities as workers in the social and political fields. Even since the first draft of this paper was written there have been some significant developments in this direction, and they are to be welcomed. Unesco has done a service to geography by indicating its possible application to the problems of world understanding and by exposing the failure,

up to the present, of geographers generally to grasp their opportunities in this connexion. Finally, mention must be made of the Land Utilization Survey which, whatever criticisms may be justly levelled against it, represents a gallant and largely successful attempt to apply a geographical technique to a social purpose.

In regard to the application of geography, let us contemplate only a few of the things geographers could do now. They might, for example, turn their minds to some of the pressing territorial problems which threaten the peace of the world instead of concentrating their studies upon areas or regions which, however interesting academically or useful as subject for an exercise, are not in the minds of the public and are not storm centres of the day. They might usefully express views on the great problem of the production and distribution of raw materials. They might put forward a constructive scheme, based on sound geographical principles, for the amendment of the areas or regions of local government in Britain. They might give us soil maps. Other things in which we are all interested are (to take only a few instances at random): better plans than exist at present for the re-distribution of the urban population; the better development of Commonwealth resources; the future of Africa and particularly of parts of that continent; and the great problems of world over-population. Indeed, there are a score or more of golden opportunities for the geographer to make his mark and prove his worth in contemporary affairs. Cannot some of them be taken? Perhaps the answer will be given that they have been taken. If so, then the work which has been done must be hiding in the pages of some professional journal or in the archives of some university or learned society and has not yet been brought to the notice of the world at large.

As to the employment of geographers in the departments of State and in the public services, we cannot hope for much improvement in the present position until geographers have succeeded in establishing themselves more securely in public esteem; and they can only hope to do this by making themselves useful and by letting the world see or hear about their good works. In this connexion it would be helpful both to geographers and laymen if the great daily newspapers would appoint qualified geographers as special correspondents. If that were done, the views of geographers would be more often quoted and the value of their special knowledge would be more widely appreciated.

These latter years have witnessed the development of a number of geographical sects—each sect pre-occupied with one particular aspect of geography and each sect waging a kind of cold war against the others. Indeed, not infrequently of late, it has seemed that sectarian interests have been allowed to rise superior to the good of geography as a whole. That there should be some workers in the field who are more interested in one part than in the other parts is natural, necessary and good; but it is not good for such persons to be allowed to proclaim that the part in which they happen to be most interested is the part which matters most. Nor is it good that such persons should be allowed to pour contempt on the special work of others. The part cannot be greater than the whole, and when anything is compounded of parts, as geography is compounded, every part is essential, for, missing a single part, the whole cannot exist.

It is submitted that the professors, who are the academic leaders, would be wise to bring all their influence to bear against those who, either with intent or inadvertently, would break up the synthesis into its component parts and, this done, would seek to proclaim themselves the high priests of their particularly favoured mysteries. That way lies disintegration and disaster. Let there be controversy by all means; but let it be conducted in an atmosphere of mutual respect and always with the main object of furthering the study of geography as a whole, rather than of any one part of it. Let the elder statesmen of geography exhibit a unity of fundamental ideas and a determination to maintain an essential discipline.

In 1931 Mackinder forecast that, towards the middle of the twentieth century, geographers would have their golden opportunity. He said: "... then will be the opportunity of the geographer-statesman, for geography must underlie the strategy of peace if you would not have it subserve the strategy of war". Unheeded by too many, that hour has struck! The geographer, that is to say the person trained to think geographically, is better equipped than most other people to see through the fog of political propaganda and the mists of emotional nationalism and to discern the real, underlying causes of discontent and disturbance. Could the geographer but bring his influence fully to bear in the counsel of the nations, could he but gain for his knowledge and skill the respect which both so richly deserve, there would be at his command a power which might do much to ensure fair and just territorial settlements, bring about a more equitable distribution of the world's natural wealth, promote better understanding between peoples and remove some of the more potent causes of wars. That, indeed, would be service to mankind. That power, however, will not be granted to geographers until they have given more abundant proof of their qualities and capabilities and of the usefulness of their special knowledge.

## VARIATIONS IN BROOD-STRENGTH IN THE NORTH SEA HADDOCK, IN THE LIGHT OF RELEVANT WIND CONDITIONS

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MANY years of research into the biology of the haddock (*Gadus aeglefinus*) in the North Sea have shown that one of the major factors contributing to the short-term fluctuations in the fortunes of the commercial fishery for this species is the varying numbers of recruits entering the fishable stock from year to year. The importance of this phenomenon was firmly established during the early inter-war years by Thompson<sup>1</sup> (then of the Marine Laboratory, Aberdeen), who, from the results of extensive research vessel trawling surveys in the North Sea, was able to

relate the fluctuating yields from the fishery to this cause. These surveys, which were afterwards extended by Raitt and later by Parrish (of the same Laboratory), gave estimates of the distribution and relative density of each brood of haddock throughout its demersal life and thus gave measures of the relative stock strengths from year to year, and provided a means for forecasting, a year in advance, the relative success of the commercial fishery. The magnitude of the fluctuations in brood-strength over the period 1920-49, exclusive of the war years 1939-44, are illustrated in Fig. 1. This gives the mean annual catch per hour of fishing relative to that in 1923, rated as 10, taken with the trawl of the research vessel for each successive brood in its second year of life, by which time its members have become demersal.

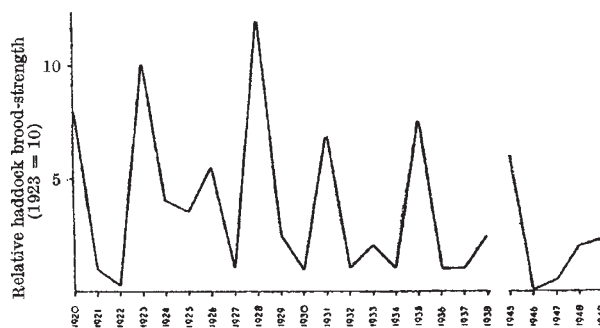


Fig. 1. Fluctuations in haddock brood-strengths in the North Sea, 1920-49

In an attempt to assess the factors causing these fluctuations, the first step which had to be taken was to determine that critical stage in the haddock's development, up to the end of its second year of life, during which the observed fluctuations in abundance may be experienced. The possibilities may be summarized as follows: (1) variations in egg production from year to year; (2) annual changes in the survival-rates of eggs, larvae and young fish during the pelagic phase; (3) annual changes in survival-rate after the demersal stage has been reached.

In a paper read before the Challenger Society in 1949 (now in preparation for publication in detail) an analysis was made of the large volume of data of the distribution and density of each brood in its first and second years of life, and of the egg production potential of the spawning shoals from year to year during the period 1920 to 1949. This has yielded the following results: (1) variations in abundance of successive haddock broods cannot be properly attributed to corresponding variations in egg production potential of the spawning shoals; (2) no large-scale differential mortality can be traced after the haddock become demersal and before they reach trawlable size.

These results lead to the important conclusion that the factors determining the level of recruitment are operative during the pelagic phase of the haddock's life-history. These factors must, therefore, be sought among the complexity of physical, chemical and biological features of the pelagic environment in which the eggs and larvae develop, and for most of which no serial observations over a wide enough area are available.

Of these features, one which has received much attention in the marine field and has been considered to be critical for the survival of many species of