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*"To the solid ground
Of Nature trusts the mind that builds for aye."*—WORDSWORTH.

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River Gauging and Flood Prevention

THE recent floods in the Midlands, with their resultant enormous material damage and, in one or two localities, regrettable loss of life, have again directed public attention to one of the most serious and difficult problems connected with the efficient drainage of inland districts, namely, the regulation of river flow. Rivers, as a class, are notoriously erratic in their behaviour. Sometimes, in seasons of prolonged drought, they scarcely provide sufficient water for the minimum requirements of trade and agriculture; at others, they transform themselves into raging torrents sweeping everything before them in an orgy of havoc and ruin. The control of such violent natural forces is an essential duty of civilised communities, in the interests not only of farming and transport but also of public safety. It is characteristic, however, of British methods, that, hitherto, there has been no properly organised or systematic study of the range and extent of river floods, and no national or authoritative collection of stream-flow data upon which reliance could be placed for a scientific investigation of their incidence. Certain important bodies (few in number), such as the Thames Conservancy, have carefully maintained an efficient service of river gaugings—the records at Teddington Weir are admirable—but, generally speaking, Conservancy Boards have had few or no resources available for expenditure of this kind. It is quite true, also, that, in a number of instances, individual initiative has set on foot the compilation of local data and the taking of observations which, within their limitations, are, no doubt, capable of affording much serviceable information, but these efforts are regrettably

spasmodic, and, unless carried on under supervision of unimpeachable reliability, call for careful scrutiny and independent confirmation.

As an outstanding instance of competent individual enterprise may be instanced the operations during the last few years of the private organisation known as River Flow Records, promoted by Capt. W. N. McClean, who, himself an authority on the subject, has at his own expense maintained a staff of operators to gauge and record the flow of streams in the Ness Basin, Inverness-shire. That the cost of obtaining and collating such records for public service should come out of the pockets of individuals is manifestly unfair, and, indeed, it constitutes a financial burden such as cannot generally be borne, nor, if taken up, can it be sustained for any length of time. The organisation in question was undertaken for the purpose of giving practical illustration of the manner in which gauging records of the principal water areas of Great Britain may be kept, and it has issued a series of quarterly reports giving the readings taken, with a statement of the difficulties encountered and the means by which they were overcome. New bodies, responsible for the carrying out of such duties, will do well to acquaint themselves with the methods employed in connexion with the gauging of the Ness, the Garry, and the Moriston.

Other work, of a collective nature, has been done under the auspices of the leading technical institutions, not strictly confined to the question of flood prevention, since river-flow records are essential to a number of objects: irrigation, transport, water supply, etc. The Institution of Civil Engineers in March 1931 appointed a Committee "to examine the present state of knowledge in regard to the magnitude of floods in relation to reservoir practice in Great Britain and to make recommendations on the best methods of dealing with them in that connexion". During the past twelve months, this Committee has been pursuing inquiries in order to discover the evidence available, and the information, when published, will undoubtedly be of great value. The Council of the Institution of Water Engineers, in pursuance of a resolution passed at a general meeting of the Institution in December 1927 directing attention to "the urgent need of an organisation which will ensure a continuous record of the flow and storage of surface and underground water", appointed a Committee on Stream Flow and Underground Water Records. This Committee presented its report to the annual meeting of Dec. 6, 1929, and was reappointed as another Committee on Stream Flow Gauging, authorised, if invited, to

act with and assist a Governmental Department Committee on River Gauging which had been formed as a Sub-Committee to the Standing Advisory Committee on Water, comprising representatives of the Ministries of Health, Agriculture, and Transport. After sittings extending over a year, the Government Committee in the autumn of 1931 suspended or curtailed its investigations, on the ground of economy. It took the view that river gauging was a function of the new Catchment Boards set up by the Ministry of Agriculture and Fisheries under the Land Drainage Act of 1930.

Although not specifically laid down in the Act, it is obvious that a systematic determination of the range of flow in each river basin must be a primary duty of the authorities called into existence for the express purpose of coping with problems of land drainage. It is a fundamental consideration in regard to the utility of river-flow measurements that, if these are to afford reliable guidance, they must be continuous and of prolonged duration. Casual readings are quite inadequate for the preparation of plans of river improvement or control. The Committee of the Institution of Water Engineers, previously referred to, has laid it down that records should be carried on continuously for a period of between five and ten years. Most engineers with river experience will agree that the latter limit is not a day too long, and that, even then, there may be substantial variations in comparison with readings over longer periods. But, since in regard to flood prevention it is the exceptional not less than the average experience which is required, and as abnormal events occur only at long intervals, it is obvious that a much more extended range of gaugings is imperative. The memory of the oldest inhabitant of a district will often furnish instances of inundations so greatly exceeding the normal as to tax the credulity of listeners. Not infrequently, of course, there is an element of exaggeration in these recollections, such as can only be eliminated by careful and painstaking investigation. Ordinary members of Catchment Boards, without special knowledge, can scarcely be expected to appreciate the fundamental importance of continuous and prolonged as well as of precise records. It is the duty of their technical officers to emphasise these essential requirements.

A feature of the case which should not be overlooked is the change which is insensibly being brought about by the increasing extent of impervious surface, especially in urban districts, due to the rapid spread of building operations and road construction. The effect of this is to produce an

appreciable augmentation of the run-off immediately after rainfall.

Some of the forty-six new Catchment Boards, with commendable zeal, have realised their responsibilities, and have appointed special staffs to undertake the work of river survey and gauging in their areas. But this cannot be said, as yet, of the majority. It is to be hoped that lack of co-ordination of effort and uniformity of method may not render the results of variable value. As is evidenced by the earnest discussion in the House of Commons on June 15, and the pressure on the Government to provide financial assistance, flood prevention is a matter of urgent and vital importance to the community as a whole. It would be extremely unfortunate if there should be any avoidable delay in starting the preliminary investigations and any failure to pursue them on the right lines.

The Science of Peace

The Causes of War: Economic, Industrial, Racial, Religious, Scientific and Political. By Sir Arthur Salter, Sir J. Arthur Thomson, G. A. Johnston, Alfred Zimmern, C. F. Andrews, Frederick J. Libby, Henry A. Atkinson, Wickham Steed, and others. Edited by Arthur Porritt. Pp. xxix + 235. (London: Macmillan and Co., Ltd., 1932.) 7s. 6d. net.

ONE of the most significant and hopeful features in the international situation is the growing extent to which, in the last ten years, attention has been directed not merely to the prevention of war by such efforts as the scaling down of armaments and the provision of alternative methods of settling international disputes, but also to the discovery of the underlying causes of international friction and misunderstandings. This is a positive contribution to the building of a new world order, and is akin to the method of inquiry adopted in all scientific investigations. Too often in the past pacifist and politician alike have been superficial in their methods and inquiry, too eager to get a vexed problem out of the way to care whether the so-called solution or settlement was based on definitely ascertained facts impartially considered, or whether, on the contrary, it did not contain the seeds of a future and more dangerous dispute. The machinery for examining and removing the causes of war which the League of Nations has brought into being, and of which its expert committees form such an admirable example, has probably made the greatest contribution towards the establishment of what may be justly termed a science of peace.

No more authoritative discussion of the causes of war has yet appeared than that contained in the Report of Commission I. of the World Conference for International Peace through Religion. The Commission has called to its aid experts in the fields of economics, industry, racial problems, science, politics, etc., and accordingly we have an analysis of the economic causes of war from Sir Arthur Salter; the cultural causes from Prof. Arthur Zimmern, political causes by Mr. Wickham Steed. Industrial and labour influences are discussed by G. A. Johnston, racial influences by C. F. Andrews; André Siegfried contributes a section on the influence of tariffs, and Moritz Bonn one on migration.

Sir J. Arthur Thomson contributes a rather disappointing chapter on "Science and War" which will, we fear, leave many people wondering on which side scientific workers stand in this matter. It is not sufficient to plead that the blame for the use of knowledge for evil purposes lies in our imperfect human nature and not on the science which has evolved the new weapons of war. Discovery should not be blamed for the abuse of inventions based on it, but the scientific worker will be condemned by world opinion if he does not offer some contribution towards showing the way to the control of the forces his discoveries have released. Our present intolerable situation is due to a wholesale disregard of patent facts, to powerful political prejudices, to a widespread ignorance of social and economic relations in the modern world. We need, as Sir Arthur Thomson admits, a science of society, a true science of economics. It is only as scientific research and scientific methods are patiently and honestly applied in these spheres that we can develop adequate world planning of our industrial and economic resources, greater equilibrium between production and consumption and distribution—the absence of which, as both Sir Arthur Salter and Mr. G. A. Johnston insist, is a potential source of international rivalry and conflict. Similarly impartial scientific inquiry forms the only adequate basis for administration wise enough to eliminate the numerous points of friction which such matters as racial relations, religion, tariffs, migration, or national monopolies still present.

The absence of accurate knowledge in the field of racial relations and the power wielded by ignorance and prejudice are a further danger to peace, and Mr. C. F. Andrews' analysis is supported by a weighty recommendation from the Commission for the voluntary study of race relations as they affect world peace and to promote efforts to remove causes