THE INTERNATIONAL HYDROLOGICAL DECADE

By

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THE State of Primordia is seeking United Nations aid in a river development scheme that will provide better flood control, hydro-electric power generation and water for irrigation of food crops for export. Action has got to the stage at which consulting engineers are designing and costing a scheme, but after their on-site survey they, and the specialist experts from whom they have sought advice, are in great difficulty. The rainfall records they need are very scanty, and are neither continuous in time, nor adequately distributed in space: the river flow records are worse, and often the flow record is missing when the rain is there, and vice versa. Other contemporary weather records are poor, and almost non-existent where they are most important. How can an engineer design the management of a river when he has inadequate information on which to base his design? A cook faced with the similar problem of an almost bare larder can go out and buy food: an engineer cannot go out and buy hydrological information.

This is part of the background to an attempt at international co-operation in work on water. It began when a thoughtful American geologist saw that this kind of problem would occur more frequently as developing countries found that they needed more water for domestic use, for industry and for farming. The problems of the future had to be anticipated now, by action that would start the collection of the necessary basic information as soon as possible. This meant that governments must be educated to a new sense of priorities, and his idea was that this might be achieved by international action that would advise on what ought to be done, how it could be done, and, where necessary, by sending in experts and equipment to get things started and to provide the training and education needed to keep them going afterwards.

The other part of the background is complementary. The developed countries, almost without exception, are finding themselves in great difficulties over water supply, and the former happy-

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go-lucky guesswork in management is no longer adequate. So the second aspect of the idea was to consider whether these States might use their scientific skill and technical expertise to find out more about the behaviour of water in nature. In simple terms, the problem is what happens to the rain; in more academic terms, it is the need to know all about the hydrological cycle and to understand it in ways that will lead to safer exploitation, better prediction and more reliable control.

I—First Stages: 1963–1964

After discussions among world hydrologists, sponsored by the United Nations Educational, Scientific, and Cultural Organisation (UNESCO), the Director General of UNESCO decided, in 1963, that there seemed to be a prospect of getting some international work started, good enough for him to invite his General Council to pay for a ten-year period of work, provided that member-States of the United Nations would pledge their support. So, in the summer of 1963 our Government received an invitation to join in an International Hydrological Decade, starting with a plenary meeting in Paris in 1964 at which the formal decision should be taken, and asking them what they could contribute to the programme for the Decade. The British Minister of Education, then responsible for UNESCO business, called together an advisory committee to answer two questions: Is this a good idea? If so, what can Britain contribute? (With some changes in composition, the committee continues as the British National Committee for the International Hydrological Decade.) The response to the first question was a confident " yes "—later welcomed by the Foreign Office—and to the second question the committee deliberately adopted a thoroughly parochial attitude (and was far from unique in this). Most of its members had spent many years living with water problems, both in the field and in committees, governmental and non-governmental, and this seemed to be an excellent opportunity to put down on paper all the ideas for new scientific activity that would help, directly or in due course, to better understanding of the hydrological cycle in Great Britain, in the certain knowledge that most of our problems were common to many countries, and the belief that good science done for national purposes is international in its value. The Minister accepted the advice, and a strong British delegation of hydrologists went to Paris to declare British support for the idea, to discuss the possible form and content of an international programme, and to establish a Co-ordinating Council to

supervise a decade of activity to start on January 1, 1965. Fifty-seven governments sent delegations, with others supporting the idea but not represented.

Before the delegation left for Paris, there was some discussion of working papers with the Ministry of Education, and others, mainly about some of the political implications in the proposed constitution for the Co-ordinating Council. One piece of advice is worth putting on record. " You will be setting up technical panels and working groups, and we are pretty sure you will want to do what we have always wanted to do—choose the best man for the job. Do not try it on your own initiative, because you will always fail. Nearly all United Nations work of this kind is handicapped by those who want a balanced geographical national representation on such groups, with technical competence a secondary consideration." Regrettably, the forecast was accurate.

II—General Ideas and Organisation

At the plenary meeting all the expected decisions were taken so that later in the year the Director-General was able to ask for, and get, approval for UNESCO funds for a programme to be supervised by a Co-ordinating Council for the International Hydrological Decade (IHD). Part of the constitution of this Council is unwritten: explicitly it provides for changes in membership, on a geographical basis, every two years, but the four " veto " nations have served throughout. This is very valuable because of the continuity it provides, and also as a source of advice for the small bureau that has the task of keeping things moving between annual council meetings.

Except that the components can be put into groups, the programme has no firm cohesion. It is a collection of sixty-five resolutions of the Co-ordinating Council, drafted in 1965, and, after taking out the virtuous declarations of intent, there remain fifty-five or so that call for some action by national committees, by request, invitation, or urging. Many of the resolutions concern matters of technical interest to other organisations, governmental and non-governmental, including several other United Nations agencies, and associations of various kinds that come under the cover of the International Council of Scientific Unions: in Britain, this means the Royal Society. In its effort to get affairs organised the Co-ordinating Council invited representatives of the agencies and associations to join it, and in working groups these agencies are strongly represented. For some of the groups an agency took full responsibility, servicing the group out of its own funds. It makes

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good sense, for example, that the World Meteorological Organisation should take responsibility for a group with a dominantly meteorological problem (*e.g.* the design of networks for rain gauging), but good sense did not always prevail, and by mid-Decade inter-agency disagreement about " Who does what? " had led to some bitterness.

III—Education

In one aspect the collection of projects that makes up the Programme can be described as an attempt to recognise and then to close three kinds of gap. These, briefly, are in knowledge, ideas and communication. This philosophical division is not very helpful as a guide to action, and a more practical rearrangement is needed, but, before outlining it, two important aspects of communications deserve special comment. Sometimes formally, around the council table, more often informally outside the council chamber, the topic that provokes most earnest discussion is " education and training." That the Council quickly recognised the importance of education is not surprising: that the " E " in UNESCO has not take it over is surprising. The working group on Education, set up by the Council, was geographically selected and not very efficient. The education gaps occur at all levels of activity and responsibility, from observers and assistants, technicians and engineers, to university teachers of the subject, and an enormous amount of paper moved round the world in the attempt to find out what was needed, what was already available to meet the need, and what new effort was desirable. As a sample, for post-graduate training of hydrologists the first stage of the survey provided an estimate of the number of potential candidates that developing countries would like to have trained, and also an estimate of the number of places in the universities of the developed nations that could be allocated for IHD candidates. Fortunately, the second number greatly exceeded the first, leaving some freedom of choice in terms of language and ideological compatibility. The second stage was to invite sponsorship of candidates, and all participating governments were asked to state how many scholarships they would offer. The responses were characteristic. The Soviet Union and the United States were coy about naming a number until each knew what the other was offering, but in the end both were generous and few people know or care about which is the bigger number. British reaction was lethargic—static at first, refusing to act on a special case—but eventually the Overseas Development Ministry quietly announced that it would award scholarships to any suitably qualified candidate,

with no limit on numbers, and no specific title attached to the award (inquiries should start at the nearest British consulate or embassy in the candidate's country).

As one of its current activities, the working group on education in trying to track down the best textbooks on hydrology, and to decide into what languages they might be translated.

IV—Publications

The second aspect of communications is publication, covering an enormous range in objectives, and of intellectual difficulty within the objectives. Several manuals already issued, or in the press, range from one that includes simple instructions on how to read a rain gauge, to a discussion of how radioactive materials can be used in hydrological routine or research. There are pamphlets on the state of some part of the art, perhaps as a review of a special technique or, as a particular example that has needed a lot of patient work, an agreed list of symbols, names, and colours for the preparation of hydrological maps. Somewhat slowly moving—it is still rather more " intent " than achievement—a series of Year Books was planned, to include hydrological information of international importance. Two example are: (1) records of the flow of the major rivers of the world, first as long-term averages up to the start of the Decade, and then as a series of annual volumes. (We have no major river, but the Thames is included as an act of grace.) (2) annual reports from Decade stations, to be explained later. The other noteworthy set of publications is probably the most valuable of all for the advance of hydrology as an international scientific discipline, and the source may be UNESCO or one of the other agencies or associations involved in the Decade. Every year, in some part of the world, there are two or three symposia held on some aspect of the subject, either very limited in scope or very broad. As examples: in 1966 there was an excellent meeting, in Wageningen, concerned solely with water in the soil, and UNESCO published the 1,000-page, two-volume account of the proceedings, exposing in the course of it another minor difficulty in international co-operation. At least thirty of the papers, submitted in what purported to be English, had to be completely rewritten (in Australia, Great Britain and the United States) before they could be accepted as printable. This is a straightforward task for an account of an experiment, but it may be difficult when the paper is concerned with ideas that can be challenged. The second example, of a broad topic, was probably the most important held, or likely to be held, at any time during the Decade, and we were fortunate to be host country. The symposium, on "World Water balance," took place at Reading University in July 1970, and was attended by 150 hydrologists from forty countries overseas, plus varying numbers (50 to 100) of British workers selecting the sessions they wished to attend. Two volumes of papers were in print at the start, prepared by the International Association of Scientific Hydrology (an ICSU association) in collaboration with UNESCO under the guidance of a British editorial committee. The official languages were English and French and each paper has summaries in both, and in the other two used in IHD working papers and documents—Russian and Spanish. A third volume is in the press, consisting of a few papers received too late for the first printing, summaries of discussions of particular papers, and an account of the final, sweep-up, session that surveyed what had been achieved in the course of a week's work. Technically, the outcome was excellent (socially, even more so), not least because it revealed that the stage in development, as it might be defined by economic and social factors, is not a reliable guide to achievement, or freshness of ideas, in the study of water.

V—Practical Divisions of the Programme

All of this, so far, is concerned with transferring information, but the core of the International Hydrological Decade is to acquire facts for transfer, and the field programme of action falls into three parts. Starting in the middle, the ultimate objective of every country is to know what its water income is, how it varies seasonally and from year to year, and the hazards of getting too much (or too little) in the wrong place at the wrong time. The decade title for this group of projects is "Inventories and Balances," including resources and their disposal, floods and droughts. But, as already stated, there must be knowledge to put into an inventory; there must be facts to put into a balance; and there must be ideas to interpret a balance so that it becomes a reliable guide to engineering decisions. So the first part of the programme is the collection of basic facts, starting with the primitive essentials of rainfall and stream flow, and adding, where relevant and possible, groundwater records, evaporation, soil water and erosion. The work needs trained observers, reliable instruments adequately deployed, and maintained in good order, and although some of the developing nations have responded to UNESCO offers of help in getting started, several have not, and seem to be completely unwilling to do anything for themselves. The Co-ordinating Council of IHD is ready to send a study group to diagnose what needs to be done, and, from its

funds or from other sources of development aid, provision can be made for buying equipment, for installing it and for training people to use it. But still there is no response.

For the benefit of the science, the collection of basic facts has several ordered aspects, and two of these are concerned with basin hydrology. Every participating nation—when ready—was asked to select Decade stations distributed over the country so as to sample the internal range of climates. These stations are catchment areas in which at least daily records of precipitation and river flow are taken accurately (adding other parameters if possible), with some guarantee that the station will be permanent, that the high quality in records will be maintained, that every year a monthly summary of records will be sent to IHD for inclusion in a Year Book and that all the more detailed records will be available for any worker elsewhere in the world who asks for them through IHD channels. Britain has named twelve such stations. Another type, to be mentioned briefly, is the experimental basin. Here the collection of basic facts may be supplemented by intensive meteorological and biological measurements, and imposition of a change in land use (to be avoided for Decade stations) may be the important part of the experiment. Examples of such experimental changes are: from rough grazing to forest; from one kind of forest to another more valuable economically; from forest to plantation or agricultural crops; from scrub to managed grazing; peat clearance; agricultural drainage; engineering structures; mineral extraction; urban development. This sort of human activity, however desirable in its primary intention, may have important effects on the water harvest from the catchment, in the amount and seasonal changes in supply, on the quality of the water, on the flood risk and the extent of soil erosion. There are now many experimental basins in the world, some doing simple measurements only, so qualifying for the "basic facts" category, and others so complex that they more correctly come into the third part of the field programme—research.

There are many facets of research in hydrology, but most of them fall into two broad groups of topics. First, there is the quest for unifying ideas that will help in drawing up inventories and balances, and in interpreting them correctly enough to be confident about the possibility, or impossibility, of transferring experience from one place to another. Secondly, there is the search for improvements in techniques of measurement—so going back to the first part of the programme—or for the exploitation of scientific progress in finding new techniques as supplements or replacements. There are few States capable of doing such work, but what they

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are doing will help many more, and it is valuable international work.

VI—Working Groups

To help this three-fold activity along, the Co-ordinating Council set up working groups, geographically representative, of course, and though too numerous, a list will show the variety of topics that come within the scope of international hydrology: education; hydrological maps; world water balance; representative and experimental basins; floods and their computation; nuclear techniques; Karst hydrology (carbonate rocks); influence of man on the hydrological cycle; hydrological forecasting; exchange of information. There are several panels of experts too.

In choosing a few of these for comment—education has already been considered—there has been brief reference to hydrological mapping, and to the symposium on world water balance. The group on experimental basins held a successful symposium in New Zealand (December 1970), discussing results obtained and how to interpret them. Next on the list is a very important topic, the problem of water out of control, and the later addition of " hydrological forecasting " has part of its importance in the possibility of forecasting floods. Here good national experience, thoughtfully interpreted and shared with others can be of immense value internationally, and the Russians were hosts to a useful IHD symposium on the subject. Most nations with a flood problem did not need to be invited, requested or urged to do something about the problem as part of IHD, but, in time, Britain's effort is no older than IHD. It stemmed from a study by the Institution of Civil Engineers, which recommended that the Government might usefully support a three-year research effort to collect information about past British floods, to sort it out and analyse it in a way or ways that might guide future work on prediction and possible control. The suggestion was adopted, and within the Institute of Hydrology there is a team collecting and copying river discharge records from all over the United Kingdom. Thanks partly to the Decade, the Irish IHD National Committee has encouraged co-operation, already started, in making records available from the republic, and the floods team's survey will be for the geographical unit of the British Isles, not constrained by political boundaries. This is international co-operation as we want it and welcome it. When the study is complete, in about two years' time, its publication will be a major contribution to hydrological work done during the Decade and a demonstration of an earlier statement that good science done for national purposes is international in its value.

Of the others in the list of working groups, Karst problems are almost peculiar to the Mediterranean, and under IHD the countries concerned are co-operating more than they did before. Hydrological forecasting and exchange of information have had some comment, and there is no room for more.

VII—Human Activity as a Factor in Hydrology

The remaining working group is completely atypical, and probably has acted out of protocol too. It was set up by the Co-ordinating Council, with the Food and Agriculture Organisation (FAO) acting as servicing agency. Most exceptionally, the invitation to Britain to serve on the group was accompanied by the name of the expert the group wanted. The choice, Dr. H. C. Pereira, was enthusiastically approved by the British national committee, and the trail of good sense, so started, ran even farther: Dr. Pereira was appointed chairman of the group on the influence of man on the hydrological cycle. To the job he brought considerable field experience of the problem, gained first in east Africa and later in central Africa, and it fell out that political changes in central Africa deprived him of his job at a time when the working group was finding that its possible use to the Co-ordinating Council was limited by ignorance of what was happening in many parts of the world. At the invitation of the Council, with full support from FAO, Dr. Pereira undertook a rapid reconnaissance of the effects of land use on water supplies, and, with the help of national committees for the IHD, he spent a few months collecting facts from Australia, other parts of Africa, several States in South America, many parts of the United States and parts of the Soviet Union.

The result was a valuable report, presented to and welcomed by a mid-Decade plenary meeting convened in Paris in December 1969, to review progress to date (and consider the future). Its production was timely, for it came soon after another intergovernmental conference, also convened by UNESCO, on the scientific basis for rational use and conservation of the resources of the biosphere. As yet the report is still no more than a working paper for an IHD conference, but there are hopes that, in one form or another, it will be published to reach the wider public that is interested in the effects of irrational use of land on water and soil resources, a public that will include all who take part in the planned long-term international programme on the biosphere.

VIII—Taking Stock, and Forward Look: December 1969

At about half-way through the Decade, with 105 nations now formally working on the Programme, the plenary meeting in Paris was attended by representatives of seventy-five nations. The business of the meeting was in three phases: (1) survey of the first five years; (2) plans for the second five years; (3) what next? The conclusions from (1) and (2) can be fused. Amidst general recognition of positive achievement in stimulating more and better national work and in getting some useful co-operative work going internationally, there was almost equally general regret that the developing nations had gained least: the gap had widened. Thus, the important attitude in discussion of (2) was to put more emphasis on help to the backward, and, gently underlining a remark made earlier in this paper, "... that developing countries should take better advantage of IHD projects."

For the future, the plenary meeting was held within an ecstatic glow transmitted from the UNESCO General Council, which was so impressed by the success of the Decade that it had almost demanded that organised co-operative work in hydrology should continue after the Decade. The delegates were rather less emotional. It was taken as axiomatic that international co-operation was a good thing, but there was some serious discussion of whether it needed to be organised—all very friendly—and much more about how, and by whom—not always so friendly. Eventually the Co-ordinating Council, in consultation with the other agencies, was asked to prepare a continuing long-term programme, working to a time-table that will permit final decisions at a plenary meeting in 1974. The Council set up an eight-nation planning group with a composition based on competence—working lunches are valuable—and two of Great Britain's younger hydrologists are serving on the group. They will have to do the work involved, and they may as well plan their own future.

Harpenden.