A SURVEY OF RESEARCH AND SCIENTIFIC SERVICES IN EAST AFRICA, 1947-56

by

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PREPATORY NOTE

This "Survey of Research and Scientific Services in East Africa 1947-1956" has been prepared by Dr. E. B. Worthington, who held the post of Scientific Secretary in the Office of the Chief Secretary to the East African Governor's Conference and subsequently in the Administrator's Office of the East Africa High Commission during the period January, 1947-May, 1951. Dr. Worthington is now Secretary General of the Scientific Council for Africa South of the Sahara.

The expressions of view contained in the "Survey" are Dr. Worthington's own, and do not necessarily represent the policy of the High Commission. It is thought however that the views of a distinguished scientist who was, for more than four years, closely associated with the planning and organisation of much of the scientific research at present being undertaken in East Africa will be of interest to the public and, more particularly, to all those concerned with the development and administration of research, especially since the years during which Dr. Worthington held the post of Scientific Secretary saw great development and rapid progress in the scientific field in East Africa and were the period during which most of the Scientific Services at present administered by the High Commission were brought into existence.

ADMINISTRATOR,
East Africa High Commission.

FOREWORD

This booklet describes the organisation of the inter-territorial research and scientific services in British East Africa (Kenya, Uganda, Tanganyika, and Zanzibar), particularly those which are responsible to the East Africa High Commission, as they have been developed up to the end of 1951. Some opinions are recorded as to how these services should develop during the next five years within the limited financial provision which is foreseeable to-day. Whereas the description of things as they have been and as they are may be regarded as reasonably authoritative, the opinions about the future are my own, and do not necessarily have the support of the departments concerned, or that of Territorial Governments or of the East Africa High Commission.

This account may be useful to three groups of people: firstly, to scientific workers who sometimes have difficulty in keeping up to date with developments outside their particular fields and of seeing their own work in relation to the whole; secondly, to Government officials and others who are concerned with the adminstration of science and in ensuring that available funds are spent in the best way and results are used to advantage in economic and social development; and thirdly, to the lay public who, in East Africa, show a healthy interest concerning the place of science in the modern world.

In August, 1947, soon after my secondment as Scientific Secretary to the then Governors' Conference, which became the East Africa High Commission in January 1948, I prepared a report (unpublished) entitled "Regional Research in East Africa—a Draft Development Plan". This provided a framework for the development of regional research services intended to cover the period up to March, 1956, during which funds were provided from the United Kingdom Treasury for research in the colonies under the Colonial Development and Welfare Acts of 1945 and 1950. A development plan which is worth preparing is also worth revising; hence, this account serves both as a report on four years' progress and as a revision of the plan.

Although finance is a dominating factor in conditioning how much scientific work can be undertaken, there are few references to it, except in tables in chapters III and X. The reason is that the financing of those services responsible to the East Africa High Commission up to and including 1952 is covered fully in the High Commission's annual estimates, while the financing of most of the other inter-territorial services is arranged by the Colonial Office and is no direct concern of East Africa. Finance in the future, up to March 1956 when funds available under the current Colonial Development and Welfare acts are due to expire, is still under active discussion. There is brief reference to it in chapter X.

In some directions progress has been good in the provision of facilities and staff for scientific work and in the results obtained. There are, however, still some serious gaps. In no subject can we be satisfied that the arrangements are yet adequate to meet future needs.

I wish to record acknowledgement to a number of persons who have assisted in the preparation of this booklet by commenting on the first draft, namely to Sir Robert Scott, C.M.G., Sir Bernard Keen, F.R.S., Mr. H. R. Binns, O.B.E., Mr. R. S. A. Beauchamp, Dr. J. F. Wheeler, Lt. Cdr. G. F. Cole, Mr. H. B. Stent, Dr. K. A. T. Martin, Dr. E. H. Horgan, Lt. Col. W. Laurie, D.S.O., Dr. D. Bagster Wilson, Mr. D. A. Davies, Mr. C. J. Martin, Dr. Audrey Richards and Dr. L. S. B. Leakey. A number of their comments have been incorporated, but this does not of course, imply any responsibility for or agreement with any statement in the following pages. My thanks are due also to Miss S. Welch who has done most of the clerical work and prepared the appendix.

E.B.W.

Muguga, Kenya,
December, 1951.

Postscript:

During the year which has elapsed between the completion of this survey and its being sent to press various developments have taken place in the East African research and scientific services. Some of those which happen to have come to my notice have occasioned minor alterations to the text; but in general the statements should be regarded as applying up to the end of 1951, not 1952.

E.B.W.

Muguga, Kenya,
December, 1952.

I. SCIENCE AND DEVELOPMENT

It is often questioned in East Africa, not only informally, but sometimes even in Legislative Councils, why we require all this science. It is pointed out that development has taken place for many years without much scientific background, that there is little money to spend except on forms of development which can actually be seen on the ground, and that, if we must have science, we want to see practical results, not a lot of people working in laboratories. There is no short answer to this question. Some of the reasons for the need of science in the modern pattern of colonial administration are contained in the following pages, but many more of them are found in the day to day work of the administrator, agriculturalist, engineer or industrialist when his progress is retarted through lack of some knowledge or a ready means of finding the answers which he requires. A great deal of development in the past has taken place in the wrong way and has been unduly expensive because there was insufficient knowledge to go on, or it was not available at the right time; and the more development takes place the larger is the crop of problems which it throws up, of a kind which only scientists can solve.

The assistance which Governments give towards development can be divided into three main categories. First are productive services, including geology and mining, water supply, agriculture, animal industry, forestry, fisheries, and secondary industries, and also tsetse flies and locusts which are two of the main factors limiting primary production. Second are social services, which include medicine, education, social welfare and labour. Third are what may be called the common services, which provide both for production and social progress; they include administration, law, defence, police, transport and communications, building, electricity, urban development, printing and a number of lesser services. In every one of these activities which are designed to serve the community as a whole, science and research have an evergrowing part to play.

In East Africa primary production from the soil and from the rocks below the soil has to provide the primary force which sets the whole economic and social system in motion, and it has to provide most of the finance for nearly all Government services and a large part of commerce and industry. It is right therefore that the main scientific effort should at the present stage be directed mainly towards increased productivity. In designing how much and what kind of science is required, we have to bear in mind both production for export and production for subsistence. The values of the chief articles of export from East Africa as a whole are in the folowing order of importance: cotton, sisal, coffee, hides and skins, oil seeds, wattle, diamonds, tea, gold, pyrethrum. Of these ten, seven are plant products, one an animal product, and two are minerals. A list of articles produced for consumption within East Africa has of course a different order: food from the plant industry, animal industry and fisheries are of prime importance, minerals less so except for building

and road making, while secondary processing industries, especially of plant and animal products, are taking an ever more important place.

Turning to the social and common services, most research at present is concerned with health and medicine, but sociology is a growing science in Africa, and some forms of psychology, especially what is called personnel research, have already become important, though not yet used much in East Africa. Sociology and anthropology are highly important also in relation to administration and law. Communications,* especially roads, need a lot of investigation and scientific control, and the same is true of the building industry. Economic research, including demography, and the statistics on which it is so largely based, has to pervade the whole.

Those who are not intimately connected with development in Africa, and some of those who are, have difficulty in comprehending the delay between the provision of facilities and staff for scientific work and the production of results in a form ready to be applied for the benefit of economic or social progress. In many forms of science this delay is apt to be from five to ten years. This implies that development planning for science ought to be five or ten years ahead of that for economic and social progress. But the history of Africa, as of other parts of the world with the possible exception of the U.S.A. and U.S.S.R., shows that research planning has generally been five or ten years behind rather than ahead of practical needs.

Nevertheless, a great deal of knowledge already exists about Africa; but it is not used to full advantage. Sometimes this is because the knowledge is not available to those who take administrative or political decisions; examples will spring to the mind of anyone familiar with the past five years in East Africa. More often it is on account of the immense practical difficulties of causing new systems, which have been proved by science, to be introduced to the human, biological and physical environment of Africa.

It cannot be assumed by those who administer research or provide the funds that research will regularly produce the results hoped and worked for. Lord Kelvin wrote in a despondent moment: "One word characterises the most strenuous of the efforts for advancement of science that I have made perseveringly during fifty-five years; that word is failure."

Often it is far from certain that a particular problem is capable of solution, but it may well be that the course of the work will reveal different and unexpected facts of much practical importance. In East Africa more than in older countries which have established their research organisations long ago, there is apt to be a clamour for these practical results. Examples are seized on from youngest and

* This account is not concerned with the scientific aspects of rail, air and telecommunications, which are looked after by the two large self-contained services, the East African Railways and Harbours Administration, and the East African Posts and Telegraphs Department.

most immature research organisation to justify its expense, and scientists are urged to bring their results to public attention. While this is a healthy means of helping to keep research and development in close touch with each other, it has its dangers, for no director or research worker should be expected to make interpretations, far less public pronouncements other than those of a tentative kind and closely safeguarded, until he is completely satisfied that the evidence warrants firm conclusions. Particular danger comes when publicity is taken out of the hands of the scientists. Again there are familiar examples from East Africa such as the premature and erroneous publicity given to antricide, which, for a short time, until corrected by the scientists, jeopardized policy concerning the relation between trypanosomiasis and the animal industry. That episode concerning an investigation which was inspired, sound, but incomplete, emphasizes the need for allowing the scientist to establish his facts and announce them in his own good time.

Many authoritative statements emanating from East Africa in recent years—I would instance His Excellency Sir Philip Mitchell's despatch of April, 1946, on the agrarian problem, His Excellency Sir John Hall's foreword to the Development Plan for Uganda, and the Development Plans themselves for the four territories—have emphasized the seriousness of the problems to be faced. Not least of these is that of achieving a satisfactory relation between the rates of population increase and production increase, in order to provide an economic basis on which the standard of living in the region as a whole can rise rather than fall. Few if any of such statements have indicated the means by which the problems could be solved or the part which science could and should play. Certainly the Development Plans by themselves will not provide the solution even if they are carried out fully and according to schedule. These ten-year plans must in fact be regarded as temporary ameliorative measures. The solutions to the basic problems could hardly be found in less than fifty years, say two African generations. Longer term plans will have to be prepared later when there is more information upon which to base them, and one of the objects of research is to provide that information. But this cannot be done without the long-term planning of science itself.

By this it is not intended to imply that research is susceptible of detailed planning many years in advance. Indeed, the opposite obtains: it has been aptly said that "the healthiness of a research organisation can be gauged by the degree in which its work departs from agreed programmes." But it is possible and necessary to plan well ahead for the provision of facilities and staff, to indicate broad problems to which solutions are required, and above all to produce the kind of scientific and administrative climate in which good research work flourishes.

The provision of the right climate for science can be summed up in one word—faith—faith on the part of those who administer and provide the funds for science that the directors and staff of research organisations will spend their available effort to the best advantage and

will not fritter it away unnecessarily on unproductive lines; faith on the part of the scientific workers that the men and committees which supervise their activities have adequate sympathy with their point of view; and faith on the part of territorial governments in the East Africa High Commission at all its levels, and vice versa.

Given this mutual faith, which of itself implies the necessary support and freedom in thought and action, and particularly given the requisite time, a healthy research organization will undoubtedly benefit quickly the communities it serves by producing results which will often turn out to be of surprising practical value.

With the above questions in mind, one basic factor must be mentioned early in this study. For a number of good reasons, which are elaborated later, a large part of research in East Africa is now organised or planned on a regional basis with the various branches adjusted to provide a framework which is soundly balanced as a whole. Underlying this unitarian concept is the fundamental consideration that every project which forms part of the planned whole has to be such as to meet the essential needs of the territories constituting the region. In other words the schemes are such as would be carried out by the territorial governments themselves were it not for the fact that it is more economic and efficient, financially and in manpower, to carry them out in a system of inter-territorial collaboration, particularly having regard to the need for retaining links with developments outside the region.

Some parts of the plan have limited objects and are of short duration. Other parts are less limited and the objects will change from time to time as the work develops in accordance with the needs of the territories. In nearly all cases, but particularly in those schemes of long duration, continuance depends on financial contributions from the territories, not only directly to defined schemes but indirectly to the organisation of the East Africa High Commission, of which they from a part.

At the present stage when a number of organisations have been set up and the Colonial Research Service is coming into being, there is a supreme need for future financial security in order that sound programmes can be devised and pursued. Research which is subject to the hazard of interruption on financial grounds cannot be fully productive. Unfortunately this particular time is also one of financial stringency in relation to the Colonial Development and Welfare Research Fund, from which a large part of inter-territorial research in East Africa is financed. At present the sources of finance for many sections of East African research cannot be foreseen beyond March 1956, when the provisions under the Colonial Development and Welfare Acts of 1940 and 1945 will cease. Since, as already explained, many forms of research need to be planned some ten years ahead, we must rest in the hope and expectation that a new Act of the U.K. Parliament continuing provisions for colonial research will be made appreciably before the expiry of the existing Acts.

Whatever may be the extent of outside assistance in the future, in men, money and equipment, it is necessary to ensure that the territorial governments recognise that the continuation of these schemes and the rate and manner of their development are essential to the future success of the regional programme regarded as a whole. The review of the various schemes and projects which follows, considered in general in Chapters II to VIII, and in particular in Chapter IX, is therefore an attempt to produce a considered judgement on the requirements of research in East Africa, of a kind which will enable those concerned, either in the territories or in London, to assess them as a whole.

II. HISTORY

The Ormsby-Gore Commission of 1924 and the Hilton-Young Commission of 1928, in considering the possibilities of closer union in East Africa, laid special emphasis on the need for co-operation in research and science between the several territories comprising the region. On a broader scale the Hailey Survey of 1934-37 pointed to the same principle, but also, by drawing comparisons between one region or territory and another, showed the need for closer co-operation between the several European powers responsible for the regions of Africa. These general questions have been pursued by a number of more recent commissions and reports.

Meanwhile, in East Africa, up to the outbreak of Hitler's war, touch was maintained in the fields of medicine, veterinary work, various branches of agriculture and the like, by periodic discussions between directors of technical departments and meetings of specialists. The only scientific departments with truly inter-territorial functions were the East African Meteorological Department, which was developed as an inter-territorial service in 1929, stimulated to a great extent by the need to connect under one control a series of stations along the imperial airways route, and the East African Agricultural Research Institute at Amani, which had been established a year or two earlier on the foundations laid by the Germans before the 1914-18 war. In addition, however, the Tsetse Department of Tanganyika, based on the laboratories at Old Shinyanga, was conducting research designed to serve the needs of Kenya and Uganda as well as of Tanganyika, and the Veterinary Department of Kenya, based at Kabete, was performing similar functions in veterinary research and was producing sera and vaccines for use in all the territories.

Difficulties occasioned by the war increased the isolation of research workers and of technical departments, but meanwhile the opportunities for expansion and the establishment of inter-territorial scientific activity were much enhanced by the Colonial Development and Welfare Acts of 1940 and 1945. With a larger expenditure on scientific work in view, the organisation of research in East Africa was much discussed towards the end of the war, so much so that attention in scientific matters tended to become focused more on organisation than on the very few workers who

were engaged in actual research and investigation. Schemes were worked out in detail, notably one which proposed the creation of an authority to spend money, which, it was suggested, should be voted en bloc from the Colonial Development Fund, and from the East African governments. This proposal, which would have given East Africa powers to decide on its own scientific policy without much reference to London, would have been appropriate to a Dominion rather than to a Colonial system of government. It did not meet with a favourable reception, even when modified by reducing the executive functions of the proposed Council: it was before its time.

From 1944 till 1947 a number of visits by scientists from the United Kingdom to East Africa began to clear the air and prepare the way for establishing truly inter-territorial research in a number of subjects. The procedure was generally as follows: the visitors studied the position in East Africa and made proposals. In a number of cases a conference of territorial representatives and specialists met to consider the proposals before the departure of the visitors. This led to applications from the East African Governors' Conference for money to be voted as research grants from the Colonial Developmnet and Welfare Fund.

The first new research service to be established by this means, and the only one to be properly financed before 1947, was for inland fishery research, and in this case the whole cost for a period of five years was provided as a Colonial Development and Welfare grant. Later the Secretary of State insisted that, for all major schemes, a proportion of the recurrent funds should be provided by the East African governments. For a period the proportion often applied was one-third from East Africa and two-thirds from C.D. and W. grants, but later the proportion provided by East Africa was generally increased to one-half. There are still certain research schemes operating in East Africa wholly financed from C.D. and W. funds, but in such cases the research is intended to serve the needs of the whole Colonial Empire, and is based in East Africa as the area in which the work can be done most efficiently.

Notable among visits from outside specialists, most of which led later to the establishment or expansion of inter-territorial research, were those by Sir Frank Engledow, Sir Harold Tempany, and Professor Munro in 1946 on agricultural subjects, by Professor P. A. Buxton in 1945 on the reorganisation of tsetse fly and trypanosomiasis research, by the late Professor McSwiney in 1946 on medical research, and by Sir Ian Heilborn and Sir John Simonsen in 1946 on industrial and related research. In addition visits by the Advisers to the Secretary of State on agriculture, forestry, fisheries and medicine contributed in no small measure.

Thus the position in 1946-47 can be summarised as follows. Research and investigation of many kinds were being undertaken independently in the technical departments of territorial governments. In addition, inter-territorial research was proceeding or planned in agriculture, veterinary work, tsetse flies and trypanosomiasis, inland fisheries and industrial research, although several of the institutes involved were being

reorganised. There were Standing Research Committees, composed mainly of directors of territorial departments, in agriculture, veterinary work, medicine and tsetse and trypanosomiasis, and an Industrial Research Board, while the proposals for an all-embracing East African Research Council were in the pigeon hole.

There was, however, another less tangible factor, which in best described as "scientific malaise." Everywhere in East Africa, except perhaps in the Groundnut Scheme, which was at that time just beginning its operations, there seemed to be a feeling of frustration among scientists in more or less degree. Some of the dissatisfaction was concerned with terms of service—and in this connection the White Paper on the Scientific Civil Service in the United Kingdom (Command 6679 of 1949) had been widely read,—but more important was the recognition by many scientists of the magnitude of the problems facing East Africa and the apparent inability to solve them. There was a prevalent feeling that science and the scientific viewpoint were not edequately represented in deliberations. Many thinking scientists compared the state of affairs in East Africa with that in the United Kingdom and some of the Dominions where, partly through the influence of the war, the voice of science had come to take a prominent place in government decisions.

This was the background against which a provisional plan for the development of regional research in East Africa was prepared. Meanwhile, all the territories had prepared their Development Plans and these enabled a plan for research services to be integrated in some measure with the needs of rapidly developing communities.

The years 1947-51 have been devoted to putting parts of the plan into action as opportunity offered. In general the procedure has been to sketch out a scheme for a research organisation or service and its progressive development over a period of ten years ahead, but to apply for funds only for the capital and recurrent expenditure required during the first five years. When the finance for this initial five-year period was assured, a director was appointed and subsequently the arrangements for that particular organisation were left largely to him in consultation with territorial departments concerned on the technical side, and the offices of the Administrator and Finance Member of the East Africa High Commission on the administrative and financial sides.

It is not claimed that the difficulties have come to an end. Indeed, once a research organisation or service has come into being the limitation of finance and the need for consultation in a multiplicity of directions have often magnified them. For example, concerning terms of service for research scientists, whereas the Colonial Research Service was established by the Secretary of State to operate from January, 1949, and a superannuation scheme to go with it has commenced in January, 1951, most of the work of fitting people in has yet to be done. But looking at the picture as a whole, there is now at least a scheme of things.

III. REGIONAL ORGANISATION OF SCIENCE

The organisation of science on a regional rather than a territorial basis has several advantages. Firstly, a regional organisation can view the technical problems of the several participating territories as a whole. Secondly, it can generally afford to have a larger staff of specialists than could a single territorial department, and this brings several lines of thought to bear on a single problem and in consequence quicker results. Thirdly, the regional organisation, because of its larger size and the scientific "climate" which it engenders, is likely to attract first class young men and women to its staff and also scientific visitors from institutes in other countries who come to the tropics to undertake particular studies. Fourthly, by pooling resources, a regional organisation can achieve greater financial efficiency, and, compared with three or four seperate organisations, can save on both capital and recurrent expense.

Looking into the distant future, the time may come for an all-embracing scientific and technical service for East Africa as a whole, implying regional instead of territorial departments of surveys, geology, agriculture, veterinary services, forestry, fisheries, health and the like. But so long as the territorial governments themselves are separate, it is essential for most of the executive side of scientific work to be arranged territorially. Therefore the regional scientific services which are responsible to the East Africa High Commission are limited for the most part to advisory functions and the research and investigation which are necessary for good advice.

There are a few exceptions to this, for example, the Lake Victoria Fisheries Service, which is responsible for the administration and development of the fisheries in a vast lake shared by the three East African territories. As such, this small service may be regarded as an important pilot scheme, because it provides a pattern for what may one day become desirable in other technical spheres. Other exceptions are the Desert Locust Control, a large but it is hoped temporary department closely attached to the Desert Locust Survey; also the practical work of tsetse reclamation, particularly in pilot schemes, which is included in the functions of E.A.T.T.R.R.O.

The East African Malaria Unit and Leprosy Specialist, though primarily advisory, deal with the application of what is already known as well as acquiring new knowledge. The East African Meteorogical Department and Statistical Department collect, analyse and present data as a service to governments and the community. Both are scientific departments in their separate spheres, in that their work involves the scientific method, and for that reason their senior staff is composed of qualified specialists; but research in the ordinary sense does not at present come closely within their purview.

A number of the services under the East Africa High Commission are called "research organisations" rather than "institutes." This is intended to emphasise that the work pervades the whole region and is

not necessarily located at particular places. The organisation necessarily requires a headquarters, which sometimes includes extensive laboratories, libary, etc., but the object of each research organisation is to conduct research on behalf of East Africa wherever it can be pursued most efficiently. This may be at headquarters, at a territorial laboratory or outstation, in the bush, or, in certain cases, at a centre of research outside East Africa.

Each research organisation or department operating under the East Africa High Commission is responsible through its director to the Administrator. The ownership of the headquarters is vested in the High Commission and in certain cases outstations are established under High Commission control. But in general it is hoped that facilities for inter-territorial staff to work at outstations in the main ecological and economic zones in East Africa will be provided by the territorial government in which such stations are situated.

In order to facilitate contacts between staff, to reduce overheads, and avoid the duplications of services such as library and workshops, the headquarters of more than one organisation may be situated in close proximity. An example is the headquarters of the agriculture and forestry research organisation and the veterinary research organisation which are being established on one large area of land some 15 miles from Nairobi, giving good communications to all parts of the region to be served.

There is one further important matter of principle applying to these East African scientific services, namely, that, by appropriate arrangement, a research organisation can undertake or assist in work for some territory in Africa outside East Africa. The Zanzibar Protectorate, though technically not a part of the East Africa High Commission, is a participator in a number of the scientific services and in one case, that of marine fisheries research, provides the headquarters. A looser connection exists with British Somaliland and the Seychelles, two colonial territories which are more nearly related to the East African than to any other colonial region. In the veterinary field it has been the pratice over many years for biological products, vaccines and sera manufactured in East Africa to be supplied to other parts of the continent on appropriate payment. It has been recently agreed that the East African Veterinary Research Organisation may conduct research on major animal diseases which affect West Africa as well as East Africa, the reason in this case being that the establishment of a veterinary research organisation for the West African territories has had to be deferred. A similar arrangement may be made concerning agricultural research, affecting more particularly the Central African colonies. Likewise a close integration is being arranged between the inland fisheries research now firmly established in East Africa and that in Northern Rhodesia and Nyasaland, particularly in the training and secondment of staff. Advisory visits from East African staff in other subjects are fairly frequent.

Such arrangements are not limited to British colonies. They have already been made from time to time with the Anglo-Egyptian Sudan, and there is no reason against them being made with respect to non-British territories in Africa. The advantage of such mutual assistance, which is of course reciprocal, is obvious: it results in broadening the experience of the East African scientists as well as in taking advantage of experience in other parts of the continent.

The present position concerning the inter-territorial research and scientific services is summarised in the table at the end of this chapter, which is based on 1952 estimates. The scientific potential is shown against each subject on the basis of (a) the number of posts in professional scales, equivalent to the grades of the Scientific Civil Service, and (b) the total recurrent expenditure.

Some points of explanation concerning this table are required lest it should convey a wrong impression. In order to give a comprehensive picture it includes certain branches of inter-territorial scientific work being conducted in East Africa but not responsible to the East Africa High Commission, namely, the Colonial Insecticides Unit, the East African Institute for Social Research and certain smaller sections financed by Colonial Development and Welfare funds which are included under the appropriate headings. The table does not, however, include scientific work undertaken by several departments of Makerere College in Uganda, which is beginning to contribute in no small measure to the scientific potential of East Africa.

It is interesting to note that the average cost of supporting a professional officer, including his assistants, facilities and all overheads, has an all-in average of about £5,000. The range is very wide, from under £2,000 per professional officer in the case of Sociology to over £10,000 in the case of Meteorology and the Desert Locust Survey. For Agriculture, Forestry and Fisheries the figure is £3,700. Such comparisons have small value, however, except as indicating marked differences in the type and conditions of work. Those organisations which appear cheaper in the table require a high proportion of qualified scientists with little in the way of assistants and apparatus. Those which appear expensive require the opposite. In the Desert Locust Survey, for example, a scientist working in the centre of Arabia has no local facilities except sand, and perhaps water at a distance. He is in charge of a team consisting of 3 or more European field officers and a considerable body of Arabs and Africans. He requires a fleet of vehicles, wireless and perhaps a light aircraft as well as scientific equipment. On the other hand a sociological research worker say in Uganda may need little more than one or two African field assistants, a vehicle and secretarial facilities at headquarters. This comparison will suffice to indicate that any attempt to judge the efficiency of a research organisation by its cost per scientist would be entirely misleading.

Summary of E.A. Regional Scientific Services in 1952

	No. of officers in professional scales (1)	Recurrent Expenditure (1952 estimates)	% of whole: Officers in professional scales	% of whole: Recurrent Expenditure
		£		
Meteorology (E.A. Meteorological Department)	10	109,254	7	14
Agriculture and Forestry (E.A.A.F.R.O.) (2)	27½	102,759	18	14
Animal Health (E.A.V.R.O.)	10½	44,122	7	6
Tsetse Flies and Trypanosomiasis (E.A.T.T.R.R.O.) (3)	23	119,172	15	16
Locusts (Desert Locust Survey) (4)	7	85,646	4	11
Insecticides (Colonial Insecticides Unit) (5)	8	35,500	5	5
Fisheries (Inland Water Research, Marine Research, and Lake Victoria Fisheries Service) (6)	14	52,246	9	7
Industrial Research (E.A.I.R.B.)	7	23,263	4	3
Health and Medicine (E.A. Bureau, Medical Survey, Filariasis Research, Virus Research Institute, Malaria Unit, Leprosy)	24	101,726	16	13
Sociology (E.A. Sociological Research Institute) (5) ...	10	18,500	7	2
Statistics (E.A. Statistical Department)	10	60,672	7	9
		752,860		
Less Revenue (6)		10,000		
	151	742,860	100	100

Footnotes

(1) The figures show established posts, excluding those "in obeyance", but there are vacancies in some departments.

(2) Figures include Termite Research, Ecological training scheme and half head of Animal Husbandry Division, which is shared with E.A.V.R.O. They do not include Clove Research in Zanzibar.

(3) Entries exclude Antricide Research which is due to end early in 1952.

(4) The Desert Locust Survey is financed from other countries besides East Africa. Entries exclude the Desert Locust Control.

(5) The Colonial Insecticide Unit and E.A. Sociological Research Institute are not responsible to the East Africa High Commission.

(6) Against the expenditure of the Lake Victoria Fisheries Service, which is £17,991, can be set revenue of about £10,000 from administering the Lake Victoria Fisheries Act.

IV. RELATION BETWEEN REGIONAL AND TERRITORIAL SCIENCE

The reasons in favour of organising science on a regional basis and of creating inter-territorial rather than territorial posts for specialist officers are often very strong, as explained in the previous chapter. As part of the campaign against amateurism in the colonies there is need for more real knowledge of the less common specialities, and often it is possible for such provision to be made inter-territorially when it would be impossible territorially. Nevertheless most territorial departments of agriculture, veterinary services, medical services, etc., find it necessary to maintain groups of specialist officers for routine work and for investigations of a short-term kind on problems with which the department is directly concerned.

From time to time the possibility has been discussed of such territorial specialists being transferred *en bloc* to regional organisations to form a pool from which individuals could be seconded to territorial departments according to requirements. There are reasons in favour of such a procedure but they are overweighted at the present time by reasons against it, so that, for the next five years at least it can be assumed that territorial departments will continue to employ direct such specialists as they require. As the demands for scientific work increase, so too may some of the specialist groups responsible to territorial governments.

It is, however, possible to make a broad definition of the functional relationship between the regional organisation and the territorial department working in the same general subject. There are three main stages in science: firstly, there is fundamental or long-range research which is designed to discover new principles; secondly, there is the technological stage in which a new principle is tested in a variety of local conditions in order to determine how far it is applicable and to adapt the technique to local circumstances; thirdly comes the application of the new principle in farming, medicine, industry, or whatever the subject may be. The regional research organisation is concerned with the first two, the fundamental and technological stages; it is not usually concerned with the application to practice. The territorial department on the other hand is primarily concerned with the application of the new knowledge and all the executive work which is thereby entailed, but it has also to take a large share in the technological stage of trial in local conditions. It is thus in the second or technological stage that the functions overlap and there is need for the closest collaboration.

This distinction of functions has of course many variants. For example, territorial scientists have often in the past, and no doubt will in the future, reveal important new principles in the course of their work, whereas a research team of regional organisation may on occasion pursue a particular technique to the point of application.

V. COUNCILS, COMMITTEES AND CONFERENCES

Until the formation of the East Africa High Commission and the Central Assembly at the beginning of 1948, the former Governors' Conference called meetings in particular subjects as the need arose. When possible such meetings included men who were actually engaged on research, in addition to the directors of territorial departments, and sessions were arranged for the discussion of technical subjects as well as questions of organisation.

After the formation of the Central Legislative Assembly, which assumed responsibility for the scientific and research services administered by the High Commission, a more formalised system of councils and committees became necessary in some subjects. In setting up the structure two principles have been adopted: firstly, not to establish any inter-territorial councils or committees until the need for them became overriding, and secondly, to keep them as small as possible.

These bodies have in general conformed to a similar pattern. They are convened by the High Commission, and usually the Administrator or his representative is chairman. Their members are representative of the territorial departments as well as of High Commission services concerned with the subjects at issue. They have advisory functions which extend not only to the High Commission, but also to the territorial governments. Whereas research is often their main subject for discussion, questions of policy and development are by no means always excluded.

In certain subjects, such as tsetse flies and trypanosomiasis, it has not been necessary to establish an inter-territorial consultative body because collaboration between the four territories and the inter-territorial organisation has proceeded satisfactorily without it. There are territorial committees on tsetse flies and trypanosomiasis which seek information and advice from E.A.T.T.R.R.O. In meteorology likewise, there is no inter-territorial body, though some aspects of the subject come within the purview of the East African Air Transport Authority and other aspects are considered by the East African Agricultural Council.

In the agricultural group of subjects, it was found that a forum for inter-territorial discussion was necessary and the East African **Advisory Council on Agriculture, Animal Industry and Forestry** was formed and held its first meeting in January, 1949. With four territories to be represented, three of them with separate departments of agriculture, veterinary services and forestry, and also the need to introduce unofficial representation, this body could not be kept small and in fact numbers 26. At its first meeting this Council set up a Standing Research Committee with a much smaller membership, capable of acting for the Council at relatively short notice, but it was found that this system did not give the best form of supervision to the two inter-territorial research organisations concerned, the East African Agriculture and Forestry

Research Organisation and the East African Veterinary Research Organisation, in addition to dealing with agricultural policy and research in the territories. Accordingly, at its second meeting in January, 1951, proposals were agreed by the Council and have subsequently been acted on for establishing a separate **Research Organisations Committee** to deal with the inter-territorial research. The Research Organisations Committee has Technical Co-ordinating Committees composed of the territorial directors of Agriculture, Veterinary Services, or Forestry together with the inter-territorial director concerned. In addition the Council sets up Specialist Committees for technical discussion on specialised subjects such as grassland, fertilisers, insecticides, and the like.

In the case of fisheries, the smaller size of the inter-territorial organisations and the fewer territorial authorities simplified the problem, and accordingly the **East African Inland Fisheries Research Advisory Committee** which first met in 1949 could be kept small, with one technical representative from each of the three territories together with the inter-territorial director. The **East African Marine Fisheries Research Advisory Committee,** formed in 1951, is of similar size and function. The **Lake Victoria Fisheries Board,** however, which advises on the control and development of the fisheries of that lake and on the activities of the Lake Victoria Fisheries Service has to deal with administrative as well as technical questions and therefore is a larger body with a membership of eleven.

The Desert Locust Survey Advisory Committee is of a somewhat different character since the Desert Locust Survey and Desert Locust Control with which it is concerned have to be integrated with activities in a number of other countries to the north of East Africa. Like the other committees it is composed of men who by their qualifications and experience can contribute to the work, but it is not limited to East African members. It includes members from the Anti-Locust Research Centre in London; an Italian, Egyptian and an officer from the Anglo-Egyptian Sudan have been asked to join the committee and Ethiopia, Saudi Arabia and the Yemen have been asked to send observers to some meetings.

The East African Industrial Research Board, which was formed during the war, continued in its original form until 1951, when it was reconstituted as a board of representatives of the governments with the Administrator as Chairman. Most of the former members are retained as a technical panel chaired by the Director of East African Industrial Research, thereby bringing special knowledge and experience to bear on the work.

Towards the end of 1951 an **East African Standing Advisory Committee for Medical Research** was set up with the Administrator as Chairman and as members the three Directors of Medical Services and the Senior Medical Officer, Zanzibar, two academic representatives from Makerere College and two persons nominated by the Colonial Medical

Research Committee. Provision is also made for the appointment of two other members associated with medical research. The terms of reference of the Committee are to advise on the needs for medical research in Kenya, Uganda, Tanganyika and Zanzibar and on the means for ensuring that the results of research are applied in practice, and to keep under review the facilities for inter-territorial collaboration in medical research. Prior to the formation of this Committee co-ordination of research in the medical field was provided by **Annual Meetings of the Directors of Medical Services** in which Directors of Medical Services of Northern Rhodesia and Nyasaland participated in addition to the Directors of Medical Services of the East African territories. In order to bring in outside experience, and in some degree to co-ordinate medical activities with other neighbours, it became the custom to invite observers from other territories, such as Portuguese East Africa and the Belgian Congo (this happens also from time to time in other subjects).

In the case of geology, it was decided in 1947 not to pursue for the time being proposals which had been advanced for the amalgamation of the three Geological Surveys in Kenya, Tanganyika and Uganda. Consequently, there is no inter-territorial service. Nevertheless, **Annual Geological Conferences** have been held in the three territories in rotation since 1948 and, with a system for the exchange of information between meetings, these have helped materially to co-ordinate the various activities. Like the medical meetings, the scope of these annual geological conferences has been expanded from time to time by inviting geologists from territories bordering on East Africa, namely the Sudan, Southern Rhodesia and the Belgian Congo.

Another series of meetings was instituted in order to co-ordinate questions relating to wild animals, including conservation, control and research. These gatherings have included the territories of Central as well as of East Africa. The first was convened by the East African Governor's Conference in May, 1947, at Nairobi. This was followed by a smaller informal meeting in 1948 held in Northern Rhodesia. The second full conference on this subject was convened by the Central African Council in September, 1950, at Victoria Falls and included representatives of the Union of South Africa and the Belgian Congo. This was followed in turn by another informal meeting during May 1952 in Tanganyika where British West Africa as well as East and Central Africa was represented. The proceedings of all these Fauna Conferences have been published, a precedent which has been followed by the East African Geological Conference of 1952 and, it is hoped, will be followed by other inter-territorial meetings in due course.

A number of subjects are not covered by formalised systems of meetings such as those outlined above, and for these special confereneces have been convened from time to time. Although the East Africa High Commission has generally been the instigator, the value of such meetings has been enhanced by pooling information and experience from a wider

area than East Africa. A prominent example has been a conference on Hydrology and Water Resources of British East and Central Africa with observers from elsewhere, convened by the High Commission in November, 1950, at Nairobi. Conferences such as this have been to some extent international in character, and they have relation to the full inter-African technical conferences convened by the Commission for Technical Co-operation in Africa South of the Sahara. These are mentioned in Chapter VII.

A list of the principal meetings held during the years 1947 to 1952, inclusive of Councils, Committees and Conferences, is in the Appendix.

VI. RELATIONS TO THE COLONIAL OFFICE AND TO SCIENCE IN THE UNITED KINGDOM

The system of councils, committees and meetings in East Africa while, as explained above, being kept to a minimum, is designed to operate on behalf of East Africa in a similar way to the larger system set up by the Secretary of State in London to advise on research and scientific matters for the whole Colonial Empire. On the research side the central body which brings all subjects together is the Colonial Research Council, of which most members are the chairmen of the councils and committees on special subjects. These other bodies are the Colonial Products Research Council, the Colonial Medical Research Committee, the Committee for Colonial Agricultural, Animal Health and Forestry Research, the Colonial Insecticides, Fungicides and Herbicides Committee, the Colonial Social Science Research Council, and the Colonial Economic Research Committee.

In addition to the above, other bodies which sit at the Colonial Office and include research within their purview are the Colonial Tsetse Fly and Trypanosomiasis Committee, the Colonial Agricultural Advisory Council, the Colonial Fisheries Advisory Committee, and the Inter-Departmental Committee on Locust Control. Joint committees may be set up by two or more of these bodies, such as the Game Sub-Committee, which has been set up jointly by the Colonial Agricultural Advisory Council and the Colonial Tsetse Fly and Trypanosomiasis Committee.

Some of these bodies have their own secretariats, but the Research Department of the Colonial Office is the main executive machine for taking action on their many recommendations. A number of full-time scientists sit at the centre of things, including a Secretary for Colonial Agricultural Research, a Director of Colonial Medical Research, a Director of Colonial Geodetic and Topographic Surveys, a Director of Colonial Geological Surveys, a Director of Colonial Products Research, a Director of the Anti-Locust Research Centre, in addition to the advisers to the Secretary of State on agriculture, veterinary work, forestry, fisheries, and medical subjects. Several of these officers, notably the directors of Colonial Geodetic and Topographic Surveys, Colonial

Geological Surveys, Colonial Products Research and Anti-Locust Research, have teams of scientists and laboratories in England in order to conduct work of a kind which can be done more efficiently in England than in the colonies.

It is obviously important for the scientific and research services operating in East Africa to maintain close touch with the advisory and executive machine at the Colonial Office. Therefore, while the Administrator, operating on behalf of the East Africa High Commission, is the sole executive authority responsible for these services in East Africa, each organisation or department maintains, through its director, frequent contact on scientific subjects with the relative committee or council at the Colonial Office. Furthermore, in order to keep the authorities at the Colonial Office fully informed, copies of records of all important meetings in East Africa are sent for information to the Secretary of State.

Apart from this formalised system there are however a large number of direct and informal contacts between scientists working in East Africa and those in the United Kingdom and other countries overseas. For the healthiness of colonial science it is of high importance that such contacts should be encouraged and expanded. Sometimes they are with government scientists in the United Kingdom, notably those operating under the Department of Scientific and Industrial Research, the Agricultural Research Council and the Medical Research Council. Three of the laboratories of D.S.I.R., those of building research, road research and pest infestation now have Colonial Liaison Officers who visit the colonies and conduct extensive correspondence with men at work in them. There are also close relations maintained with particular institutes or University departments in Britain by reason of scientists now in East Africa maintaining touch with their former colleagues in Britain.

Another method of maintaining touch and bringing new developments of science in the old countries to bear on Africa and vice versa is by encouraging scientific visitors. The value of such visits not only to East Africa but to the visitors themselves and the institutes and laboraories in Britain from which they are drawn can hardly be overestimated. The value is greatest not in the week or so snatched perhaps during a University vacation to see what Africa looks like, but in the working visit of a sabatical term or year during which it is possible to go below the surface and make a serious contribution to African science. So far it has been mainly in the biological fields, where the opportunities and facilities offered by the organisations and institutes in East Africa are greatest, that such working visits have been most fruitful. Important work has thereby been done by highly qualified scientists at a cost to East Africa of little more than the return passages, and new ideas have been introduced both to East Africa and to Britain. At present only one or two of the East African research organisations have special funds available to meet the expenses of visiting scientists, but it is a principle which warrants wider application.

VII. RELATIONS TO OTHER REGIONS OF AFRICA

In future science in East Africa must be integrated more closely with that in other parts of the continent. Many problems on which scientists are at work elsewhere are very similar to, and sometimes identical with, those in East Africa, and they all involve the same basic principles and methods. A full exchange of knowledge is the corner stone of scientific progress.

Immediately to the west lies the Belgian Congo and Ruanda Urundi, where science is already well advanced. There are two large research organisations, I.N.E.A.C. (Institut National pour l'Etude Agronomique du Congo Belge) based at Yangambi near Stanleyville, and I.R.S.A.C. (Institut pour la Recherche Scientifique en Afrique Centrale) based near Costermansville, each with a number of substations. These are comparable with the inter-territorial research organisations in East Africa. I.N.E.A.C., which has a staff of over 100 qualified scientists, deals with research in the broad agricultural sphere, including animal industry and forestry, while I.R.S.A.C., which is a younger body and in process of rapid growth, is concerned with research in many subjects other than agriculture. There is also much scientific work in direct relation to development activities undertaken by the technical government departments in the Congo, which have a number of well established laboratories.

To the north lies the Anglo-Egyptian Sudan which likewise has a good deal to teach East Africa, particularly perhaps in the subjects of settlement schemes and rehabilitation of agriculture as typified by the million or so acres of the Gezira Scheme. This is probably the most successful of any settlement scheme in Africa as gauged by economic results, and is unique as having been from its inception under close scientific control, with a large research institute devoted to its problems, although concerned also with other parts of the country. The broad areas of the Southern Sudan, including the Sudd area, are closely linked to East Africa by problems of Nile control, and the development of native peoples in a vast area which will one day be of high economic importance.

To the south, in British Central Africa, attempts at the regional organisation of science in relation to the Central African Council have not yet achieved very much, although the Council had for a period a Scientific Secretary who wrote a comprehensive report covering all the main fields. There is, however, important work proceeding in some of the departments of Southern Rhodesia—a good example is the Department of Irrigation, which includes all water development and hydrology in its functions—as well as in the two colonies of Northern Rhodesia and Nyasaland, which have a close community of outlook with East Africa. Likewise, East Africa would benefit from closer contact with the Portuguese territories in science and technology.

Further south, the Union of South Africa is by far the most advanced part of the continent in its scientific development. Politics apart, many of the problems which today face East Africa have already been, at least partly, solved in the somewhat different environment of the Union, but at the same time various recent scientific meetings have shown that East Africa has something to give as well as much to receive from closer co-operation. The organisation of much of the research work in the Union under C.S.I.R. (Council for Scientific and Industrial Research), an independent department directly responsible to the Prime Minister, is an example which may ultimately be followed in other parts of the continent.

During the past few years the Scientific Secretary to the High Commission and a number of other East African scientists have visited these other regions of the continent in order to further scientific liaison, and East Africa has received many scientific visitors from them with much advantage.

There are now two international agencies specifically designed for scientific and technical collaboration in Africa south of the Sahara, both established during 1950. One is C.C.T.A. (Commission for Technical Co-operation in Africa south of the Sahara) operating from Europe, and the other, C.S.A. (Scientific Council for Africa south of the Sahara) operating from Africa. These two have complementary but different functions.

C.C.T.A. is composed of official delegates of the participating governments, namely the United Kingdom, France, Belgium, Portugal, the Union of South Africa, and Southern Rhodesia. Its principal function is to reach inter-governmental agreement in any problems affecting technical co-operation in Africa, without having to resort to lengthy correspondence and diplomatic channels. It operates at the level of metropolitan Governments, and has, since 1950, met twice each year in one or other of the European capitals, with one meeting held in Cape Town.

The first meeting of C.C.T.A. early in 1950 formalised a system of international co-operation in Africa which had come into being a few years earlier and had led to a number of important inter-African conferences on scientific and technical subjects. Those which have been held up to the end of 1952 have been concerned with the following subjects: Tsetse flies and Trypanosomiasis, Rinderpest, Soils and Soil Erosion, Nutrition, Indigenous Rural Economy, Statistics, including Demography, Malaria, Medical Education, Forestry, Housing and Building. They are listed in the Appendix. Other similar Inter-African Conferences to be held under the auspices of C.C.T.A. are in prospect for 1953, notably one on Fauna and Flora to be held in October at Costermansville in the Belgian Congo.

Several of these C.C.T.A. conferences led *inter alia* to the formation of Inter-African bureaux of information. Thus there is now a Bureau of Tsetse and Trypanosomiasis (B.P.I.T.T.) at Leopoldville under joint French-Belgian direction; a Bureau of African Soils and Land (B.I.S.) in Paris; a Bureau for Epizootic Diseases (I.B.E.D.) at Muguga near Nairobi; and an Inter-African Labour Institute at Bamako in the French Sudan. There is also an Inter-African Pedological Service based on Yangambi in the Belgian Congo. C.C.T.A. supervises the activities of these inter-African bureaux and the Pedological Service.

The Scientific Council for Africa South of the Sahara (C.S.A.) originated separately from C.C.T.A. and in a different way. In October 1949 the Union of South Africa took the initiative in convening a large African Regional Scientific Conference at Johannesburg. It was attended by a contingent of scientists from East Africa and from nearly all other countries south of the Sahara and it proposed the establishment of C.S.A. This was subsequently agreed by the Metropolitan Governments, so that C.S.A. came into being formally at its first meeting in November, 1950, held at Nairobi.

Although a new organisation, it may be said to be already deep-rooted, because its origin extends back more than twenty years. In 1929, General Smuts put forth a plea for international collaboration within Africa, including especially scientific subjects. This was followed in 1934-1937 by Lord Hailey's "African Survey". The subject was taken up with vigour at the Empire Scientific Conference held in 1946 in London, and it was following one of that Conference's recommendations that the Union of South Africa convened the African Regional Scientific Conference of 1949.

The same powers participate in and provide the finance for C.S.A. as for C.C.T.A., namely, the United Kingdom, France, Belgium, Portugal, Union of South Africa, and Southern Rhodesia. C.S.A. is composed of thirteen scientists, most of them actually working in Africa. They are appointed primarily as representative of their scientific subjects, but with regard also to equitable representation of the geographical sub-divisions of Africa and of the countries and territories concerned.

The functions of C.S.A. can be summarised as to help in the co-ordination and development of science in all parts of Africa south of the Sahara by keeping scientific activity in the several regions under continuous review. C.S.A. is the scientific adviser of C.C.T.A.; it studies what research problems of common interest could usefully be suggested to governments or other agencies for research; it encourages and establishes contact between research workers and facilitates their exchange or movement; it collects and distributes reports and information of general value; it suggests to governments, or itself arranges, the convening of meetings between scientists. In the last-mentioned activity, C.S.A. concentrates on meetings of small groups of specialists rather than on large formal conferences which will continue to be arranged by

C.C.T.A. Thus, during 1952 C.S.A. has held specialist meetings on the co-ordination of Geological Research and on Fauna Research, and also, at the invitation of the East African High Commission, was responsible for a Symposium on African Hydrobiology and Fisheries which was held during October at Entebbe. In 1953 C.S.A. expects to hold specialist meetings on Social Studies, on Library Services and on Maps.

In order to pursue these functions C.S.A. has a whole-time Secretary-General and small secretariat, which for the time being is based temporarily in East Africa at the Muguga research institute. Two years experience of C.C.T.A. and C.S.A. working as separate but mutually dependent organisations, the former being executive, the latter scientific, has shown the need for them to draw ever closer together. In consequence some reorganisation may be expected during 1953.

In this sketch of international aspects of African science, the specialist agencies of the United Nations Organisation, namely, the World Health Organisation, the Food and Agriculture Organisation, the Educational, Scientific and Cultural Organisation and the World Meteorological Organisation also take a place. Indeed, they are already active in a number of directions in Africa. W.H.O. has established an African Regional Commission with an office at Brazzaville, and has organised a number of activities. F.A.O., amongst other matters, is organising a Land Use Survey of the World, in which Africa is to be covered by a special commission; it has also established a committee for surveying indigenous livestock, in which East Africa is playing a part, and it expects to establish a Fisheries Council for the Western Indian Ocean. The newly created World Meteorological Organisation established a Regional Association for Africa at its First Congress in Paris in March 1951. The British East African Territories (including Mauritius) constitute in their own right a Member of this Specialised Agency and belong to the Regional Association for Africa.

In all this international African scientific activity, British East Africa, which is already better equipped and better organised than some other sub-regions of the continent, has an important part to play, and in some subjects may be expected to give the lead.

VIII. ASSISTANCE FROM THE UNITED STATES

Scientific and technical assistance from the United States of America to the so-called under-developed territories means "the provision, dissemination, and application of scientific knowledge and professional skills which can contribute to the more efficient use of natural resources both human and material, and in promoting the prosperity and welfare of the inhabitants". The method by which this technical assistance is provided is generally in the form of American scientists or technicians proceeding to the territories which are to receive the assistance for periods of work on the spot. Since consultations have to be made between a large number of authorities, and suitable American personnel,

willing to proceed to under-developed territories, are not always easy to find, the delay between the initial proposal of a project and the arrival of an American scientist to undertake the work is apt to be considerable. In consequence American assistance has not yet had a large effect in East Africa, but it is likely to play an increasing part during the next five years.

The system whereby this assistance is given is somewhat complicated. In East Africa, however, we are mainly concerned with only two of the various bodies, namely, E.C.A. (Economic Co-operation Assistance Administration) which came to an end in 1952 and has as its successor M.S.A. (Mutual Security Agency) which is expected to continue till June, 1954. E.C.A. concentrated on technical assistance projects with a potential economic impact on production before 1952, whereas M.S.A. will concentrate on projects indirectly contributing to economic development. In other words E.C.A. was essentially short-term, while M.S.A. is longer term.

In East Africa the main effect of E.C.A. and M.S.A. to date has been in the provision of geologists from America to work with the territorial geological surveys. In other subjects, particularly in the entomological and agricultural spheres, a large number of projects for E.C.A. assistance were advanced by two American missions which visited the African territories and consulted authorities on the spot. The first of these was by Mr. H. H. Stage, who visited East Africa in May-July, 1949, and submitted proposals for work in relation to tsetse flies, malaria, fruit flies, ticks affecting livestock, insects affecting stored products, forest problems and game management. The second was by three prominent American agriculturalists, Drs. Lambert, McCall and Cline who visited East Africa later in 1949 and proposed a number of other projects considered to be of high priority. Some of these were primarily territorial in character, but those of wide implication which have since been considered in detail are an investigation of the control of groundnut aphids which are responsible for spreading rosette disease, soil survey, soil fertility studies and breeding work on maize and sorghum.

In the earlier negotiations on these projects, leading to the selection of a few which were considered to be appropriate for formal application to the E.C.A. authorities, one condition had been that the work by an American specialist would involve provision by the British authorities of staff who would learn from the American and subsequently continue the work after his departure. With expanding programmes of science in East Africa, it was difficult to guarantee such staff or the accommodation and facilities which the Americans and their assistants would require. Now, however, this condition is likely to be interpreted more liberally, so the opportunities for taking advantage of American scientific aid are becoming wider.

IX. THE SUBJECTS

In this Chapter the principal scientific subjects are considered separately. The order in which they are given and the space allotted to each have no bearing on their relative importance. The order is, however, a logical one. First the physical background of the land and atmosphere is considered, and proceeding by the way of water resources and the study of plants and animals we are led to the primary industries of agriculture, forestry, animal industry and fisheries, together with two major factors which retard development, tsetse flies and locusts, and to studies of insecticides. The last of the subjects concerned directly with production is industrial science. So are reached the sciences concerned with man himself, such as medicine, sociology, and economic science.

Under each heading a very brief summary is given of how things are at the present time, but more attention is devoted to the shape which the various projects may take during the next few years, that is up to March, 1956, when financial assistance under the present Colonial Development and Welfare Acts comes to an end. Certain large and important subjects, such as the agricultural groups, tsetse flies and locusts, are mentioned in but a few paragraphs, because in such cases the departments concerned publish regular full reports which are available to everyone. In certain lesser subjects more is included because less is available in published form elsewhere.

In order to provide a clear summary of the various services concerned with research and science in the region, and to show at a glance who is responsible for them and from what sources their finance is drawn, the following table has been prepared. The subject headings are the same as in the subsequent sections of this Chapter. The table is comprehensive, but the subsequent descriptive sections are concerned almost wholly with inter-territorial services, particularly those responsible to the East Africa High Commission.

Subjects	Services	Administering Authority	Sources of finance
1. Surveys and Maps	Central Directorate of Colonial Geodetic and Topographical Surveys	Colonial Office	C.D. & W. (D)
	Territorial Survey Departments	Territorial Governments	Territorial funds
	Proposed co-ordinating work on East African Atlas	Proposed Makerere	?
2. Geology and Archaeology	Directorate of Colonial Geological Surveys	Colonial Office	C.D. & W. (D)
	Territorial Geological Surveys	Territorial Governments	Mostly territorial funds
	Coryndon Museum	Museum Trustees	Grants from Kenya Government, municipality, etc., and door receipts
3. Meteorology	E.A. Meteorological Department	E.A.H.C.	Govts. of United Kingdom, Kenya, Tanganyika, Uganda, Zanzibar, Egypt, Mauritius and India.
4. Hydrology	Territorial departments or sections of departments	Territorial governments	Territorial funds
	Proposed Bureau	Proposed E.A.H.C.	?

Subjects	Services	Authority Administering	Sources of finance
5. Background Biology	Coryndon Museum	As above	As above
	E.A. Herbarium (E.A.A.F.R.O.)	E.A.H.C.	C.D. & W. (R)
	Proposed Insect Collections	Proposed E.A.H.C.	?
6. Agriculture and Forestry	E.A.A.F.R.O.	E.A.H.C.	C.D. & W. (R) and Territorial funds
	Territorial Depts. of Agriculture	Territorial governments	Mostly Territorial funds but some C.D. & W. (D) & (R)
	Territorial Depts. of Forestry	Territorial governments	ditto
	Overseas Food Corporation	O.F.C.	United Kingdom funds
	Colonial Development	C.D.C.	United Kingdom

2. Geology and Archaeology	Directorate of Colonial Geological Surveys	Colonial Office	C.D. & W. (D)
	Territorial Geological Surveys	Territorial Governments	Mostly territorial funds
	Coryndon Museum	Museum Trustees	Grants from Kenya Government, municipality, etc., and door receipts
3. Meteorology	E.A. Meteorological Department	E.A.H.C.	Govts. of United Kingdom, Kenya, Tanganyika, Uganda, Zanzibar, Egypt, Mauritius and India.
4. Hydrology	Territorial departments or sections of departments	Territorial governments	Territorial funds
	Proposed Bureau	Proposed E.A.H.C.	?

Subjects	Services	Authority Administering	Sources of finance
5. Background Biology	Coryndon Museum	As above	As above
	E.A. Herbarium (E.A.A.F.R.O.)	E.A.H.C.	C.D. & W. (R)
	Proposed Insect Collections	Proposed E.A.H.C.	?
6. Agriculture and Forestry	E.A.A.F.R.O.	E.A.H.C.	C.D. & W. (R) and Territorial funds
	Territorial Depts. of Agriculture	Territorial governments	Mostly Territorial funds but some C.D. & W. (D) & (R)
	Territorial Depts. of Forestry	Territorial governments	ditto
	Overseas Food Corporation	O.F.C.	United Kingdom funds
	Colonial Development Corporation	C.D.C.	United Kingdom funds
	Empire Cotton Growing Corporation	E.C.G.C.	Cotton Industry
	Coffee Research	Kenya government	Territorial funds and Coffee Industry
	Sisal Research	Tanganyika Sisal Growers Association, Kenya Sisal Growers Association	Sisal Industry and Territorial funds
	Tea Research Institute	Board of Management	Tea Industry
	Pyrethrum Research	Kenya Government	Pyrethrum Industry Territorial funds and

Subjects	Services	Authority Administering	Sources of finance
7. Animal Health	E.A.V.R.O.	E.A.H.C.	C.D. & W. (R) and territorial funds
	Territorial Depts. of Veterinary Services	Territorial governments	Mostly Territorial funds with some C.D. & W. (D) & (R)
8. Tsetse and Trypanosomiasis	E.A.T.T.R.R.O.	E.A.H.C.	C.D. & W. (R) and territorial funds
	Territorial Depts. or sections of Tsetse contro	Territorial governments	Territorial funds with some C.D. & W. (D)
9. Locusts	Desert Locust Survey	E.A.H.C.	C.D. & W. (R), and direct grant from U.K. government and Territorial funds
10. Insecticides	Colonial Insecticides Unit (E.A.)	Colonial Office and Tanganyika government	C.D. & W. (R)
11. Wild Fauna	Territorial Game Depts. Proposed Research Unit	Territorial Governments ?	Territorial funds ?
12. Fisheries	E.A.F.R.O. (Freshwater)	E.A.H.C.	C.D. & W. (R) and territorial funds
	Inter-territorial Marine Fisheries Research	E.A.H.C.	C.D. & W. (R) and territorial funds
	Lake Victoria Fisheries Service	E.A.H.C.	Territorial funds
	Territorial Depts. of Game and Fisheries (Kenya and Uganda)	Territorial governments	Territorial funds
	Territorial Depts. of Agriculture (Tanganyika and Zanzibar)	Territorial governments	Territorial funds

Subjects	Services	Administering Authority	Sources of Finance
13. Secondary Industries	E.A.I.R.B. (E.A.I.R.O.)	E.A.H.C.	Territorial funds and proposed C.D. & W. (R)
	Territorial Depts. of Public Works, etc.	Territorial governments	Territorial funds
14. Health and Medicine	E.A. Bureau of Research in Medicine and Hygiene	E.A.H.C.	C.D. & W. (R) and territorial funds
	E.A. Medical Survey	E.A.H.C.	C.D. & W. (R)
	Filariasis Research Unit	E.A.H.C.	C.D. & W. (R)
	E.A. Virus Research Institute	E.A.H.C.	C.D. & W. (R) and territorial funds
	E.A. Malaria Unit	E.A.H.C.	C.D. & W. (R) and territorial funds
	E.A. Leprosy Specialist	E.A.H.C.	

			torial funds
10. Insecticides	Colonial Insecticides Unit (E.A.)	Colonial Office and Tanganyika government	C.D. & W. (R)
11. Wild Fauna	Territorial Game Depts. Proposed Research Unit	Territorial Governments ?	Territorial funds ?
12. Fisheries	E.A.F.R.O. (Freshwater)	E.A.H.C.	C.D. & W. (R) and territorial funds
	Inter-territorial Marine Fisheries Research	E.A.H.C.	C.D. & W. (R) and territorial funds
	Lake Victoria Fisheries Service	E.A.H.C.	Territorial funds
	Territorial Depts. of Game and Fisheries (Kenya and Uganda)	Territorial governments	Territorial funds
	Territorial Depts. of Agriculture (Tanganyika and Zanzibar)	Territorial governments	Territorial funds

Subjects	Services	Administering Authority	Sources of Finance
13. Secondary Industries	E.A.I.R.B. (E.A.I.R.O.)	E.A.H.C.	Territorial funds and proposed C.D. & W. (R)
	Territorial Depts. of Public Works, etc.	Territorial governments	Territorial funds
14. Health and Medicine	E.A. Bureau of Research in Medicine and Hygiene	E.A.H.C.	C.D. & W. (R) and territorial funds
	E.A. Medical Survey	E.A.H.C.	C.D. & W. (R)
	Filariasis Research Unit	E.A.H.C.	C.D. & W. (R)
	E.A. Virus Research Institute	E.A.H.C.	C.D. & W. (R) and territorial funds
	E.A. Malaria Unit	E.A.H.C.	C.D. & W. (R) and territorial funds
	E.A. Leprosy Specialist	E.A.H.C.	Territorial Funds and BELRA
	Other schemes proposed	Proposed E.A.H.C.	Proposed C.D. & W. (R) and Territorial funds
	Territorial Depts. of Medical Services	Territorial governments	Territorial funds
15. Sociology	E.A. Institute of Social Research	Colonial Office and Makerere Council	C.D. & W. (R)
	Territorial Unit in Tanganyika	Tanganyika government	Tanganyika territorial funds
16. Economics and Statistics	E.A. Statistical Offices	E.A.H.C.	Territorial funds
	Proposed research units	Proposed E.A.H.C.	Proposed C.D. & W. (R) and territorial funds

. Abbreviation used in above table

C.D. & W. (D)	=	Colonial Development & Welfare (Development Funds).
C.D. & W. (R)	=	Colonial Development & Welfare (Research Funds).
E.A.H.C.	=	East Africa High Commission.
E.A.A.F.R.O.	=	East African Agriculture & Forestry Research Organisation.
E.A.V.R.O.	=	East African Veterinary Research Organisation.
E.A.T.T.R.R.O.	=	East African Tsetse and Trypanosomiasis Research and Reclamation Organisation.
E.A.F.R.O.	=	East African Fishery Research Organisation.
E.A.I.R.B.	=	East African Industrial Research Board.
E.A.I.R.O.	=	East African Industrial Research Organisation.
BELRA	=	British Empire Leprosy Relief Association.

1. Surveys and Maps:

Since early 1947, when the Central Directorate of Colonial Geodetic and Topographic Surveys started operations, much progress has been made in the topographic survey of East African territories by air methods. The annual programme of air photography is arranged in priority areas for each territory after consultation with the territorial and regional authorities concerned. After the photography, which is controlled by radar, is completed for a particular area, two or three sets of the actual photographs are lodged with the territorial Director of Surveys for reference by all departments concerned. Meanwhile, at the headquarters of the Central Directorate in the United Kingdom, preliminary plots are made from the photographs and are printed usually on the scale of 1: 50,000 (1 mile=1.267 inches). These preliminary plots may be with or without contours, and are issued for use in the territory. After correction and addition of detail from ground observation, insertion of place names, etc., they are ultimately replaced by the final published contoured maps.

The preliminary plots and the photographs themselves have proved of high value for geological, hydrological, forestry, agricultural, and many other purposes. They are so useful in fact that from time to time there have been requests from technical meetings and conferences that the production of preliminary plots should be speeded up, if necessary at the expense of delaying the issue of the final corrected maps.

Meanwhile the territorial departments of survey continue their full responsibilities for cadastral work and in some cases have expanded on topographical and geodetic work in close relation with the Central

Directorate. The recommendations made in 1945 by the Colonial Survey and Geophysical Committee that regional survey directorates should be established and take over some of the functions of territorial departments were dropped, and therefore the High Commission does not come into this subject except in a consultative capacity. The "East African Regional Topographic Survey" still figures however on the Order in Council establishing the High Commission, so the door is still open if some degree of regionalisation were desirable in future.

Another aspect of mapping is concerned with the preparation from available material of maps showing special subjects. Such maps are of high value, indeed are indispensable for many purposes, especially in planning developments. To be of maximum use they should be of small scale in order to show large areas on one sheet, and the maps showing the distribution of different subjects should be on identical scale for direct comparison one with another.

Of the East African territories, Tanganyika is the only one which has a series of such maps, published by the Survey Department on the scale of 1: 4,000,000 in the form of the "Tanganyika Atlas". The lack of a similar atlas for Kenya, Uganda and Zanzibar puts them at a serious disadvantage.

For this reason suggestions were put forward during 1948 that the territories should consider the preparation and publication of an East African atlas to cover the whole of Tanganyika, Kenya, Uganda and Zanzibar, that is, the areas between longitude 29° and 42° E. and latitudes 5° N. and 12° S. It was suggested that the following subjects should be covered on a standard scale: physical features, rainfall, hydrology, temperature, geology, mineral resources, soil types, vegetation, forest areas, fauna and fisheries, tsetse flies, animal industry, plant industry, populations, tribal areas and alienated land, political divisions, medical and educational facilities, communications, and scientfic and research centres. Consultation with territorial authorities produced varying degrees of support for such a project, and consultation with the Colonial Office elicited an offer from the Central Directorate of Colonial Geodetic and Topographic Surveys to undertake the fair drawing and printing of such maps if the basic data were compiled in East Africa. It was thought that the geographical department of Makerere College might be a suitable centre for the collation of much of the data required.

Since then, progress has been made by certain other agencies in preparing maps of some of the subjects mentioned above. For example, the authorities in Paris responsible for preparing the international geological map of Africa have published the sheet covering British East Africa on their standard scale of 1: 5,000,000; in addition, an inter-territorial geological map of East Africa on scale 1: 2,000,000 is in active preparation by the three territorial Geological Surveys, as arranged at successive East African Geological Conferences. An international map of the distribution of tsetse flies in Africa, arranged by the Inter-African

Conference on Tsetse and Trypanosomiasis of 1948, has been prepared and is being published on the 1: 5,000,000 scale. Other special subject maps have appeared such as a simplified version of a map of vegetation types of Tanganyika prepared by Gillman, which is published by the American Geographical Society on a scale 1: 2,000,000. Gillman's map on a scale of 1: 500,000, from which the simplified version was prepared, exists only in manuscript and photographic negatives.

Some subjects may be covered also by a projected British Colonial Atlas in a series of volumes for West Africa, East Africa, and Central Africa on which work has been proceeding at the London School of Economics.

The conclusion to be reached is that the full needs of East Africa are unlikely to be met by the publication of atlases and maps which are already in preparation and that, following the international geological and tsetse fly maps of Africa, a standard scale of 1: 5,000,000 is probably the best for initial purposes to illustrate other subjects, although larger scales would no doubt be required later. This matter should be pursued during the next few years with the object of publishing adequate special subject maps, either for East Africa as a whole or, following the example of Tanganyika Territory, for each territory separately. In the latter case larger scales might be adopted with advantage for Uganda and Zanzibar.

The collection, analysis and presentation of the data required for these maps will involve consultation in many directions. Most of it could, however, be done from a centre such as the Geographical Department of Makerere if requisite financial assistance were provided for secretarial and drafting work. If this could be arranged close co-operation should of course be maintained with the authorities mentioned above, particularly the Central Directorate of Colonial Surveys and the Territorial Survey Departments.

2. Geology and Archaeology:

The three Geological Surveys in Kenya, Tanganyika and Uganda have been in existence and have done fine work over a considerable number of years, but some of them have not been able to proceed very rapidly with steady geological survey work except in areas of known mineral importance. Partly for this reason and partly because none of the three was large enough to provide requisite specialist services which are required in geological work, the Colonial Geological Committee set up by the Secretary of State recommended in 1945 that the Colonial Geological Surveys should be centralised, with a directorate in London and regional headquarters in the principal Colonial areas. The regional organisation in East Africa would absorb and expand the three territorial departments and would re-establish geological work on a more rational basis.

These recommendations led to the establishment of a directorate in London, and later to the absorption of the Mineral Resources Division of the Imperial Institute as a reference laboratory to serve geological work in the colonies; but the proposal for establishing a regional headquarters in East Africa met with a mixed reception and has been deferred. However, in order to secure more integrated work by the three territorial surveys a system was instituted in 1948 by the High Commission for holding annual geological conferences for inter-territorial discussion of questions of organisation and technical geology. The first was held in 1948 at Entebbe, the second in 1949 at Dodoma, the third in 1950 at Nairobi. The rotation then started again; the fourth conference in 1951 was at Entebbe and the fifth in 1952 at Dodoma. These discussions have shown that there is a strong case for pooling effort in some branches of the subject so that the whole region can take advantage, for example, of the wrok of a particular specialist, or of equipment which may exist in one territory but not in the others. As a result of the conferences and regular correspondence between the three heads of the geological surveys, a number of collaborative arrangements have been made.

Geology is one of the subjects in which American assistance under the E.C.A. programme has already had some affect in East Africa. Several American geologists are now working with the territorial departments thereby increasing their effective effort. Nevertheless, each territory individually is unlikely ever to be able to afford a geological survey large enough to become truly efficient, so that on scientific grounds the case for the amalgamation of the three surveys under a regional directorate remains a strong one.

One branch of geology for which adequate provision does not yet exist but which has been pressed at each of the inter-territorial geological conferences is archeology. The unique contributions to science made by Dr. L. S. B. Leakey and his collaborators have shown East Africa to be so rich in the origins and early history of man and the related apes, that in revealing this fund of hidden knowledge, East Africa has an obligation which may be compared in some ways with its obligation to conserve the African fauna. Apart from the importance of the subject to culture in general, there is a strong case for research in this subject on account of the importance of tertiary and quaternary geology in connection with water supplies and certain mineral resources, coupled with the value of the archaeological wealth to the tourist industry.

For these reason projects were advanced between 1944 and 1948 for establishing an Archaeological Survey, if possible on an inter-territorial basis. It was suggested that this should be a government department similar to the Archaeological Surveys which have been established by a number of other governments, including some British colonies. However, in spite of strong support from the first Pan-African Archaeological Conference held in February, 1947, at Nairobi, and further reference to

the proposals at the second Conference in this series held in October, 1952 at Algiers, these projects have not reached fruition on acount of lack of financial support.

Meanwhile the work developed along lines rather different from establishing an independent survey. Members of the staff of the Coryndon Museum have continued to make new and important discoveries whenever they could be spared from museum duties to prosecute field work. Notable has been the revealing of a unique assemblage of myocene apes, including **Proconsul**, which is close to the line of man's origin, on Rusinga Island, in Lake Victoria. This work has been undertaken with the aid of research grants from the Royal Society, from private sources, and from the Government of Kenya. The new buildings of the Coryndon Museum, to be opened early in 1953, will provide much better facilities for housing and displaying at least some of the unique archaeological and palaeontological collections. In addition the Royal National Parks have developed in Kenya and have been followed by similar organisations in Tanganyika and Uganda. Though primarily concerned with wild life, the organisation in Kenya has recognised the importance of archaeological and historical sites, a number of which are now under its control. This authority has also appointed an orientalist to develop and preserve some of the important relics and ruins in the coastal area, notably the ancient city of Gedi. In Uganda, where the linkage of archaeology is perhaps closer with geology than with National Parks, an archaeologist has been appointed to the Geological Survey Department, but it may be possible to arrange for part of his laboratory studies to be conducted at the Coryndon Museum in order to take advantage of the special facilities of comparative collections, library and scientific guidance. In Tanganyika much interest has been taken in another branch of the subject on account of the fine rock paintings in the Kondoa district, on which work has been done by enthusiasts in the administrative and geological services, as well as by staff from the Coryndon Museum on visits.

Whereas the project for a full-scale inter-territorial archaeological survey must be regarded as dropped for the time being, it is certainly desirable to provide for an acceleration of the work during the next five years. It is particularly important that several young archaeologists should be set to work in East Africa under the guidance of specialists of international reputation whom we happen to have but can hardly be expected to remain for ever. As mentioned above, Uganda has already taken a step in this direction. It must be hoped that Kenya and Tanganyika will do so also before long, and later it may be found desirable to bind the territorial archaeological work with that of the Coryndon Museum into a regional unit.

3. Meteorology:

The East African Meteorological Department, now under Mr. D. A. Davies, came into being primarily in response to the demands of

aviation for an adequate system of short-term forecasting, and this branch of the subject still absorbs much of the department's activity and available funds. But the study of meteorology and climatology has a far wider importance in development than its relation to one section of the transport system. Indeed, meteorology impinges on almost every form of activity, particularly in agriculture, water supply and health. A substantial part of the departmen's activity is now devoted to meeting the requirements of the various authorities in East Africa dealing with these and related subjects. Information supplied in this way is mainly in the form of climatological statistics and special reports on particular problems, as well as weather forecasts.

Soon after Hitler's war there was a move to create an Empire-wide meteorological service of which the East African department would have become one part, but the proposals were not endorsed at the Civil Aviation Conference of 1947 held in London. The East African Meteorological Department continues therefore as a self-contained regional unit, though closely linked with its neighbours such as the corresponding departments in Central Africa and in the Sudan. Contact is maintained mainly through the African Regional Association of the World Meteorological Organisation. Funds for the financing of the department's activities are provided mainly by contributions from the Governments of Kenya, Tanganyika, Uganda and Zanzibar and from the United Kingdom. Small contributions are also made by other Governments in recognition of the benefits they derive directly or indirectly from the department's activities.

Although the department deals with a wide variety of scientific subjects, mainly in the physical field, there has been little opportunity as yet to introduce much research in the ordinary sense into its activities, owing to the heavy routine duties. The need for a wide variety of meteorological research is however becoming ever more apparent, particularly on those aspects where meteorology impinges on subjects such as water supply, agriculture and health. To take an example, in the problem of the Desert Locust (see Section 9), recent work has shown that migration and breeding of the locusts are closely related to the movements of air masses leading to zones of convergence. Thus the fundamental study of air masses is likely to be of the utmost importance in connection with the locust problem.

Recently, the water supply and agricultural interests have strongly supported proposals for adding a small climatological research section. This would concentrate on rainfall statistics, their collection, analysis, and presentation in such form as to be of maximum use to the many interests involved. In spite of other needs for research, such as the study of the fundamental physical and dynamical atmospheric processes in tropical air masses and their effects on climate, and technological problems such as the artificial stimulation of rainfall and studies of

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eco-climates, etc., it is generally agreed that research on rainfall must take priority.

The importance to East Africa of adding a rainfall research unit to the Meteorological Department can hardly be overstressed. A mass of rainfall statistics has been collected over many years at considerable expense, but the department has never yet been in a position to allocate staff away from routine duties in order to get the best out of the accumulated data and to present them in a form of maximum use. When this work is done it may emerge that improvements could be effected in the systems of collection and routine presentation, and certainly the development of the region as a whole would be aided. The hydrological work which is now increasing in East Africa (see Section 4) is another potent reason for this climatological investigation, because there is a growing need for relating hydrology to climatic conditions. The project was advanced in strong terms by the Conference on Hydrology and Water Resources of East and Central Africa of November, 1950, and was endoresed by the East African Advisory Council on Agriculture, Animal Health and Forestry in January, 1951. The record rainfalls recorded in East Africa during 1951 following two drought years emphasise the big deviations from the mean which are characteristic of tropical climates, and hence the need for more thorough study.

4. Hydrology:

The tremendous importance of water supply in Africa has taken many years to become fully recognised. There has been a tendency to take water for granted, and if the rains failed, and a river or a bore-hole dried up, to pass it with a shrug and a tightening of the belt. But to-day, the problems which are resulting in many parts of the region from ever increasing population coupled with ever decreasing water supplies, are causing much concern. New water ordinances are being enacted, and hydrological data are being collected actively by territorial departments as a background to the best use of available resources. Added to this the big international schemes of water control, typified in East Africa by the Lake Victoria Project, of which the hydro-electric installation at the Owen Falls Dam is a part, have greatly increased the need for proper hydrological study.

There are abundant examples where engineering-works, ranging from small dams for storing run-off as rural water supplies to large hydro-electric installations or irrigation schemes, cannot be designed or constructed efficiently because of insufficient hydrological data. In temperate latitudes it is generally agreed that records of stream flows should be continued for thirty years in order to cover adequately the maximum and minimum discharges and to estimate means. In the tropics, where the deviations from the mean are apt to be much greater than in temperate latitudes, still longer periods of observation are needed;

but in very few cases are there even ten-year records of East African rivers.

Stimulated by the need for much fuller data of the upper tributaries of the Nile system, related to the Lake Victoria and Lake Albert projects, a fairly full hydrological survey of Uganda rivers has been undertaken and this includes those parts of Kenya and Tanganyika which lies within the Nile system. In Tanganyika a separate Water Development Department, which includes hydrology, has been operating for some years, while in Kenya hydrology is looked after by a section of the Public Works Department, but water resources also come closely within the purview of the Member for Agriculture and Natural Resources.

It is not an object of this Survey to criticise the provisions made by territorial governments for scientific and technical work, but it must be mentioned that some other territories in Africa have found it necesary to devote much more attention to water than have the East Africa Governments. For example, Southern Rhodesia with an annual budget of about £20 million, has in recent years voted about £2 million annually to its Department of Irrigation under Mr. Havilland. In spite of its name this is in fact a department for all forms of water development, and of its large engineering and technical staff approximately one-fifth are occupied in the hydrographic section, which is primarily devoted to investigations on which to base development work. The greater part of the development, incidentally, is devoted to dam building and surface storage.

In view of the growing importance of hydrology and the need for some form of inter-territorial collaboration, an informal meeting of East African hydrologists was held early in 1950, and this was followed in November of that year by a full Conference on Hydrology and Water Resources convened by the High Commission and held in Nairobi. The report of this conference, including the technical papers submitted to it, was published in order to provide a guide to some branches of future activity. Only one of the proposals, that relating to an inter-territorial hydrological bureau, calls for comment here.

In hydrological work there is much need for uniformity of method, especially in the case of drainage systems which traverse territorial or national boundaries. Unless the records and analyses undertaken by one authority are accepted without question by another authority in the same drainage area, difficulties are apt to arise. Apart from this a close integration of records obtained from the different areas and territories could lead to more rapid progress. Accordingly, the conference recommended that ". . . an inter-territorial bureau of hydrological information be set up, if possible covering all the East and Central African territories. Its main functions would be to collect and disseminate information on investigational methods, equipment, progress in research, and hydrological data. At a later stage the question of

expanding the bureau to undertake functions in research and training of staff should be considered". Realising that there may be practical difficulties in establishing one such bureau to cover both the East and Central African regions, it was suggested that a small working party might be appointed to make more detailed proposals.

This was not the first time that the suggestion had been made for establishing some kind of permanent inter-territorial liaison for hydrological studies. The subject was raised, for example, at the first inter-territorial Conference of East African Geologists held in 1948. The project has been pursued both in East Africa and Central Africa at meetings held during 1952.

5. Background Biology:

The potential for economic reasearch in biological subjects bearing on agriculture, forestry, fisheries and health is being increased considerably in East Africa. This increase in economic and applied work, if it is to be efficient, needs a corresponding expansion in systematic and other background zoology and botany, including arrangements for the critical identification of plants and animals. It is often forgotten that in the old established countries of Europe and North America more than a century of study was devoted to plants and animals since the days of Linnaeus before what is sometimes called "modern biology" came into existence. The fascination of natural history and the devotion of many biologists to the structural aspects of their science had provided an extensive background of systematic knowledge. Tropical biology on the other hand, though dealing with more diverse environments and a greater variety of from in both plant and animal life, never passed through that stage.

Recognising the need for expanded studies in background biology, proposals were submitted in London early in 1946 for establishing a Colonial Biological Survey designed to start on a small scale but to expand over a period of ten years, organised regionally but in close association with the British Museum of Natural History and the Royal Botanical Gardens, Kew, as the two oldest and largest centres in the Commonwealth dealing with these subjects. It was to be expected that a comprehensive scheme of that kind could not be adopted in toto, but for East Africa there has been some progress towards it.

The Coryndon Museum in Nairobi is the main centre in East Africa for systematic zoology. It is an independent institution operating under a Board of Trustees, financed partly from independent sources but mainly by the Kenya Government. A good part of the museum's work is concerned with display and education, but the Trustees, realising from an early date that a healthy museum must have a backing of research work, decided that the best service which the Coryndon Museum could give to East Africa was in zoology, botany and archaeology, leaving ethnology, history, etc., largely to other museums in the region, such as

the Uganda Museum and the King George Museum at Dar-es-Salaam. Thus the Coryndon Museum now has a staff of five competent scientists engaged mainly on insects, birds, mammals, plants and fossils. Voluntary work by others adds considerably to its scientific potential.

Inevitably the work of the Coryndon Museum in systematic biology will have to grow, and before long it may be expected to fulfil this function on behalf of all East Africa. Indeed, it already does this to so considerable an extent that it is rather surprising that requests for financial assistance from the Governments of Tanganyika and Uganda have so far met with no response. Expansion is now possible both in display and research on account of new extensions to the buildings, which are financed from public subscription together with Kenya Government contributions.

Since there are obvious advantages in keeping the main centres concerned with systematic biology in close association with one another, the High Commission has adopted a policy of placing certain of its biological services in close proximity to the Coryndon Museum by arrangement with the Trustees. The museum's own building programme includes in its master plan not only more display halls and workrooms, some of which are now constructed, but a series of separate research blocks in the grounds. There is space ultimately for six of these blocks, and of these two have already been built to house High Commission services, namely, the East African Herbarium and the headquarters of the Desert Locust Sruvey. The new East African Herbarium operates as part of E.A.A.F.R.O. and into it has been moved the large herbarium of Amani, together with the systematic botanists of E.A.A.F.R.O. working on it. In addition, the Coryndon Museum herbarium and botanist together with certain smaller herbaria are housed in the same building, and the various collections are being amalgamated into one comprehensive reference herbarium for all East Africa.

Integrated with this project is a research scheme administered by the Colonial Office for the preparation of a "Flora of East Africa" to be prepared on the same lines as the well known "Flora of West Tropical Africa" and published by Kew. This scheme has come about in response to many requests from both East Africa and Kew, commencing with correspondence during 1933, followed by various requests from interested government departments, until 1947, when the East African Agriculture and Forestry Research Conference went into some detail on the subject. The scheme forms a part of the general project for a colonial biological survey referred to above; it provides for six additional botanists to be attached to Kew, but to work from time to time in East Africa on their special groups. The full publication of the "Flora of East Africa" may take ten or even twenty years, but already the first part, on the Ranunculaceae, is complete and was published in 1951 as a sample of the rest.

Thus there has been marked progress on the botanical side of biological survey, but this has not yet been paralleled on the zoological

side, which is more complicated on account of the greater diversity of animal than of plant life.

The most difficult zoological problems are in systematic entomology on account of the prodigious number of closely related species, and it is suggested that this subject should be started seriously during the next five years by an arrangement similar to that already made for systematic botany. Steps should be taken along the following lines:—

(a) A building for systematic entomology should be erected in the Coryndon Museum grounds similar in design to the East African Herbarium and in conformity with the master plan for the development of the site. In it should be pooled all major reference collections of insects and related groups such as ticks, spiders and centipedes, which exist in East Africa, except of course those collections required for constant reference by workers in agricultural or medical departments, or for display in appropriate museums.

(b) The staff to work on these collections would consist of the Coryndon Museum's entomologist and any other entomologists working mainly on systematics who may be recruited to the inter-territorial research organisations. In addition to the staff who would be actually based in the insect building, there would be space for work by other officers who require to consult large reference collections.

(c) In addition, the need for enhancing the systematic study of tropical African insects is such that the Colonial Office might consider a scheme for entomology similar to that which they have made for flora. Such a scheme might provide for the appointment of three or four additional scientific officers to the British Museum (Natural History) or the Imperial Institute of Entomology, parallel with the botanists appointed to Kew referred to above. They would have to spend periods of work in East Africa, and during those times would be based on the proposed insect building.

This scheme, like those for the East African Herbarium and the Flora, involves a partial decentralisation of work from the United Kingdom centres. When established the East African Herbarium and Insect collection would serve as filters for the material submitted to the United Kingdom institutes. At present these United Kingdom institutes have great difficulty in discharging work on the mass of biological material sent to them from all over the Commonwealth. Under the proposed scheme only material which cannot be properly determined with the reference collections and knowledge available in East Africa would be passed on from this region.

Is it possible that a full project for systematic entomology such as that suggested above cannot come within the financial resources available up to 1956. Even if no more can be provided than a capital grant of say £10,000 for the building and fittings, the establishment of

proper facilities for a central reference collection would by itself enable a much better basis to be laid in this subject. We should not forget the voluntary work on insects which, in some groups such as the Coleoptera and Lepidoptera, has already contributed greatly in East Africa; but voluntary workers require decent facilities.

Entomology is by no means the only branch of systematic zoology on which work is required. Some of the other important groups of animals could be left safely for the time being in the hands of the Coryndon Museum's own staff, who are in frequent touch with specialists in particular groups in other parts of the world. But in the case of one highly important group, the mammals, there is a definite need for improved facilities in East Africa. Work in recent years has shown that we are far from having a proper knowledge of the taxonomy of East African mammals, especially in some groups, such as rodents, which have high economic importance as carriers of human disease and as destroyers of forest nurseries and crops. The systematic study and classification of the smaller carnivores, insectivores and bats is also incomplete. Many government departments, especially Medical, Veterinary and Forestry, continually demand information of this sort which the Coryndon Museum can sometimes supply, but often not, even with the backing of the British Museum and other large institutions. The proposed fauna research unit (see Section II) which it is hoped, will be studying mammals in the field, must also be linked with an institute where skulls, skins and skeletal material can be studied and housed. For these reasons the appointment of a mammalian zoologist to the Coryndon Museum must be regarded as of high priority and should be considered as soon as funds for such a purpose are foreseeable.

In the special fields of marine and freshwater zoology there is almost unlimited scope for studies in background biology and systematics. On the whole, however, the fishery research units at Jinja and Zanzibar, together with the British Museum and the Coryndon Museum provide an adequate system to cover at least the fish and those other aquatic animals and plants of primary economic importance.

6. Agriculture and Forestry:

Agriculture is by far the largest industry in East Africa, and is at the root of most of the problems of development. Forestry, in both its productive and protective aspects, is closely linked to agriculture in questions of land use. Therefore the research organisation for these two subjects combined, which is directed by Sir Bernard Keen, F.R.S., with Dr. H. H. Storey, F.R.S., as his deputy, should be the largest of those in East Africa.

The broad lines of the Organisation's growth were laid down in 1947, at which time it consisted of the former East African Agricultural Institute at Amani with nine scientists and eight other European staff. The organisation was planned to grow to thirty-five scientists, and other

European staff in proportion during the course of five years, 1948 to 1952 inclusive, within the finance voted at that time. The development to date is fully recorded in E.A.A.F.R.O's annual reports for 1948, 1949, 1950 and 1951.

The first five year period was called phase 1, and finance was provided from Colonial Development and Welfare research funds for the whole capital requirement of £285,000, subsequently increased to £296,000 and one-half the recurrent cost, the other half being authorised by the East African Governments. Subsequently it was intended that the organisation should embark on phase 2 of its growth in order to increase its staff to a full complement of forty-five scientists in 1954 and 1955. It was recognised that additional capital expenditure on laboratories and housing would be needed, but a number of the buildings provided for in phase 1, such as administrative offices, library, stores, gas installation, etc. were designed to be adequate for phase 2 as well as phase 1.

After discussions about the best site for the headquarters of this organisation, the Kenya Government generously made available about 1,600 acres at the south end of the Muguga Forest Reserve, fifteen miles from Nairobi. The offices, library, and three laboratory blocks, together with ancillary buildings, and housing, have been established according to phase 1 of the building programme, and were formally opened by the Secretary of State for the Colonies on 26th May, 1951. On their occupation most of the station at Amani has been vacated and has become available for the East African Malaria Unit.

It is important to note that these buildings and facilities now established at Muguga South provide not only for E.A.A.F.R.O. but also for part of the requirements of the sister organisation E.A.V.R.O. This is in accordance with the decision taken at the East African Agricultural Conference of 1947 that the headquarters of the two organisations should be contiguous, that they should share certain facilities of a kind which could be more economically provided as common services, and that research in animal husbandry should be their joint concern. Thus the buildings at Muguga South provide offices for the directorate of E.A.V.R.O. and an inter-African epizootic diseases bureau as well as of E.A.A.F.R.O., headquarters for the joint Animal Husbandry Division, library, workshop and stores which are also shared, and a quarter of the laboratory space is earmarked for E.A.V.R.O. These working buildings account for less than one half of the capital grant of £296,000 for Muguga South, because the greater part had to be spent on the preparation of the site and layout for farmland, access roads, boreholes and water supply, electricity, gas installation, and housing and hostel accommodation for European, Asian and African staff.

From 1947 to 1952 the staff has increased to 23½ scientists on the established list, including the director, deputy director and ½ of the head of the Animal Industry division, the other ½ being provided by E.A.

V.R.O. There are also four scientists in the separate schemes for Termite research and Ecology training. Even including these 4 officials, the total 27½ is a long way short of 35 which were intended to be recruited by 1952. The reason for this smaller staff is mainly the rise in recurrent costs consequent on salary revisions, etc.

The present indications are that, within the foreseeable funds, it will be possible to increase the staff of scientists by about 5 to a total of 32 or 33 by 1955, instead of 45 by that date as originally envisaged. An arrangement has been made however with the re-constituted Board of the Overseas Food Corporation whereby 4 scientists on the O.F.C. staff are attached to E.A.A.F.R.O. as regards the direction of their scientific programme up to March 1953 when the arrangement will be reviewed. Adding these we reach the total of 36½ scientific officers under the direction of E.A.A.F.R.O., which compares with the number of 35 which has been regarded throughout as the minimum required to frame a balanced research programme. The scientific officers will be accompanied in their work by Scientific Assistants, and in this connection negotiations with the Pyrethrum Board and the Sisal Growers Associations, though not adding to E.A.A.F.R.O.'s scientific officer staff, may increase the scientific assistant staff in appropriate directions.

A basic aim of E.A.A.F.R.O. is to study and elucidate the fertility status of tropical and sub-tropical soils, and this covers a wide variety of subjects. Technological as well as fundamental studies figure prominently in part of this work, as illustrated by the Fertiliser Research Scheme, which has ben an important part of the organisation's activities up to 1952. It has been conducted in close association with territorial agricultural departments of Kenya, Tanganyika, and Uganda. especially in the Lake Victoria Basin, where the populations are heavily concentrated. Arrangements have been made recently for the technological side of this work to be taken over in future by the territorial departments, leaving E.A.A.F.R.O. free to take on new duties.

Side by side with the work on the fertility of soils is a division of E.A.A.F.R.O. dealing with plant diseases and pests. Some of this work, concerned with groundnuts, is conducted in close association with the Overseas Food Corporation; another part, concerned with the breeding of resistant varieties of cassava, is being continued at Amani after most of the staff have moved to Muguga. Research on the sudden death of cloves at Zanzibar has operated as a separate scheme but under the aegis of the organisation. This was due to close down during 1952 thereby releasing scientists for other important work, but in view of recent results which, if pursued further may have high practical importance, the period has been extended. This research has already shown that the disease is caused by a fungus and not a virus as had been suspected. One line of the work, moreover, branched off on to a disease of coconuts and revealed the cause and insect vector together with the effect of a predatory ant in controlling the vector. This

ancillary investigation promises to have a profound effect on the copra industry of the coastal areas of Kenya and Tanganyika as well as of Zanzibar.

In connection with forestry problems, a study by E.A.A.F.R.O. of the fungus diseases of cypress trees in Kenya has already led to some change in the policy of wide-scale planting of soft-woods. Silviculture also takes an important place in the organisation's work, and an experienced forest entomologist co-ordinates work in the territories on this subject, which is growing in importance as indigenous forests are being replaced in many areas by exotic soft-woods. Another branch of entomological research, in this case dealing with agricultural crops, is being pursued in co-operation with the Empire Cotton Growing Corporation.

Another important division of E.A.A.F.R.O. deals with animal husbandry ; it is conducted jointly with E.A.V.R.O. and is described under that head (see Section 7).

The above examples indicate the broad lines of some of E.A.A.F.R.O.'s work and how the organisation is being used for major problems wherever the research can be conducted most efficiently.

In addition to its functions in direct relation to East Africa, E.A.A.F.R.O. supervises and administers certain Colonial Research schemes which, though sited in East Africa, are intended to serve the Colonial Empire as a whole. One of these schemes deals with research on termites, and another with ecological survey, in particular the training of plant ecologists for subsequent work in other regions. While both these schemes are financed in whole from C.D. and W. funds, their siting in East Africa implies that they will conduct a substantial amount of work which will be of direct interest and value to our region.

Side by side with the growth of E.A.A.F.R.O., several of the territorial departments of agriculture have recently enhanced their potential for research work. For example, the Kenya Agricultural Department is at present increasing its former provision for research and investigation by capital expenditure of £218,000 on headquarters and outstations from the Kenya allocation of the Colonial Development and Welfare vote, and recurrent expenditure of about £28,000 per annum from the colony's revenues.

Phase 1 of E.A.A.F.R.O. is now complete, but as mentioned above, financial limitations particularly of recurrent funds, will leave the organisation inadequate in size to tackle many of the most important of the inter-territorial problems in agriculture and forestry. These limitations imply that, during the remainder of the period of C.D. and W. finance, up to March 1956, the organisation will have to concentrate its activity on soil science (including the microbiology of soils), on plant pathology and on animal husbandry, with a few officers on forestry problems. The original plans provided for several other divisions, such as plant breeding and entomology, but these will have to be deferred until more funds become available than are foreseeable at present.

7. Animal Health:

The animal industry is second only to the plant industry in its importance to East Africa, and since the two are so intimately connected in farming systems every effort is being made to bring them into the closest touch with each other insofar as inter-territorial research is concerned. For that reason the new headquarters of E.A.V.R.O. (East African Veterinary Research Organisation) are in close proximity to those of E.A.A.F.R.O. and indeed the two share the same buildings for certain purposes such as administration, library, and some services.

Inter-territorial veterinary research has during the past five years had its set-backs as well as its advances. Early in the period E.A.V.R.O. was formed and, for reasons of economy in capital expenditure, it was thought that it could share to some extent buildings, experimental farm land, and other facilities with the Kenya Veterinary Department at Kabete. The inter-territorial staff was very small to begin with, and in order that E.A.V.R.O. should take over the extensive work of manufacturing biological products a number of the staff of the Kenya Veterinary Department were transferred for this purpose to E.A.V.R.O., which assumed this responsibility in 1948. Subsequently events proved that the sharing of headquarters was unwise economy and that the assumption of responsibility for the manufacture of biological products was premature. Coupled with rather extensive outbreaks of rinderpest in various parts of East Africa there was an unfortunate breakdown in the preparation of Kabete attenuated goat virus. It was decided to place the laboratory and field work at Kabete under single rather than dual control, and to reinvest temporarily the Kenya Veterinary Department with the responsibility for biological products. In consequence E.A.V.R.O. reverted for the time being to a small unit of workers engaged on research in various fields of the animal industry.

Meanwhile, the principle has been adhered to of creating an inter-territorial research organisation of appreciable size and that the biological products which are so necessary for the whole region should ultimately be prepared on an inter-territorial basis. The directorate of E.A.V.R.O. and some parts of the laboratory work will by September, 1953, be located at the new headquarters shared with E.A.A.F.R.O. at Muguga South. The main laboratory and field work will, at about the same time, be transferred to a new area comprising nearly 1,000 acres named Muguga North, made available by Kenya Government, nearly adjacent to the farm land at Muguga South which will be used by E.A.A.F.R.O. and by the joint E.A.A.F.R.O./E.A.V.R.O. Division of Animal Industry. Research grants have been made by the Secretary of State for the provision of facilities and construction of laboratories, animal houses, etc., at Muguga North, and these, together with a balance from a previous grant for capital expenditure by E.A.V.R.O., amount to £300,000. The Director, Mr. H .R. Binns, O.B.E., has had extensive consultations with the specialists at Onderstepoort in South Africa as well as with Colonial

Office authorities concerning the design and layout of Muguga North, and the buildings are now will advanced.

In 1952 there are only 10½ scientific officers in E.A.V.R.O., including the director, deputy director and ½ the salary of the head of the joint animal industry division, and thirteen European assistants; but the authorised establishment is expected to increase to twenty scientific officers and twenty-five European technical and administrative staff when facilities at Muguga North are available. The present staff are engaged in a variety of directions. Research on antrycide has been carried out under a joint scheme shared with E.A.T.T.R.R.O.—the experimental work being situated at Mariakani on cattle exposed to light tsetse infection. Research on East Coast fever was resumed at the beginning of 1950 and in connection with this studies on ticks have comprised the establishment of breeding strains of a number of species. Research on lapinised rinderpest virus has been carried on and the new vaccine which has resulted from these investigations is being used on an increasing scale with success on the more susceptible types of cattle in East Africa. Helminthology has included two main lines, the systematics and life cycle of ruminant paramphistomes and schistosomes, including liver fluke, and the determination of their freshwater snail hosts, and the development and bionomics of the common wire worm on pasture under a variety of conditions.

A tuberculosis survey has been undertaken in Tanganyika with the aid of a mobile laboratory and caravan unit. In the Iringa district for example, where some 13,000 cattle were tuberculin tested, about 14% of adult and young stock reacted to mammalian tuberculin and the rate was sometime as high as 40%. Animal nutrition research has included comparison of the digestibility of several different grasses at different stages of maturity, the variation of digestibility and nutritive value of pastures throughout the year, and the value of fodder legumes, in addition to a survey of blood phosphorous in various areas of Kenya.

Research on animal husbandry was envisaged in the original schemes for E.A.A.F.R.O. and E.A.V.R.O. as a part of both organisations, and plans are now well advanced for establishing an animal industry division to look after the many branches of this subject. It will be concerned with animal products such as hides and skins, which take a very high place in the exports from East Africa, as well as with the nutrition, physiology, genetics and management of domestic animals. To begin with it will be staffed by a head of the division, who will rank as a deputy director, five scientific officers, a farm manager, and two scientific assistants. All these will be provided by E.A.A.F.R.O. and E.A.V.R.O. from their approved establishment. In addition a leather chemist, whose salary is provided by the East African Hides, Tanning and Allied Industries Bureau, will work with the division.

When fully established, the headquarters of E.A.A.F.R.O. and E.A.V.R.O. together at Muguga North and South will be one of the largest

scientific centres in Africa, and it may be expected that the library and diversity of specialists available for consultation will attract to it a considerable number of visiting workers and certain other permanent organisations. Indeed, this process has already started in that Muguga has been chosen as the best centre for the Inter-African Bureau of Epizootic Diseases (see Chapter VII), and as a temporary measure the offices of the Scientific Council for Africa South of the Sahara have been situated there since October 1951.

8. Tsetse Flies and Trypanosomiasis:

The large organisation now known as E.A.T.T.R.R.O. has its roots many years back in the Tsetse Department of Tanganyika, as explained in Chapter II. For a good many years up to 1947 there were two establishments, one for research on tsetse flies at Shinyanga in Tanganyika — the former headquarters of the Tanganyika department — and a small supplementary laboratory for trypanosomiasis research at Tinde, also in Sukumuland some thirty miles south of Shinyanga. The work done in these laboratories, much of it of a fundamental kind, helped greatly to lay the foundation for the practical reclamation work against tsetse flies, and the control of human trypanosomiasis throughout the region.

Following on a report by Prof. Buxton after visiting East Africa in 1945, two separate directorates were set up under the Governors' Conference and subsequently became High Commission Departments, one for tsetse and trypanosomiasis research to include the work at Shinyanga and Tinde, and the other for tsetse reclamation, including advisory services to all three territories. In 1948, however, it was decided to combine the two under one organisation, E.A.T.T.R.R.O., and Dr. H. M. O. Lester, O.B.E., was appointed Director with headquarters in Nairobi. In 1952, on Dr. Lester's transfer to Malaya, Dr. E. A. Lewis was appointed director of E.A.T.T.R.R.O. The work of the research scientists at Shinyanga and that of the inter-territorial pool of scientists on reclamation services, some of which were based in Uganda and Tanganyika as well as Kenya, was reorientated in order to provide a combined service of maximum use to the territories. With the retirement of senior officers the laboratory at Tinde was for a time placed on a care and maintenance basis. Some of the large field experiments in practical reclamation were continued under the combined E.A.T.T.R.R.O. while others were closed down. The emphasis on the work was changed somewhat following the wide recognition that tsetse flies, while they had prevented large tracts of East Africa from being used in the past, have at the same time saved these areas from disorderly systems of development. As new areas are reclaimed in future, the opportunity exists for introducing sound systems of settlement, ranching, and other forms of land use.

The bulk of practical reclamation is undertaken by the separate territorial departments which have been set up for this purpose in Tanganyika and Uganda, and by a tsetse branch of the Veterinary

Department of Kenya. E.A.T.T.R.R.O. is, however, enabling a co-ordinated plan for reclamation to be adopted throughout East Africa, and schemes advanced in the territories are now referred to E.A.T.T.R.R.O. for detailed comment and advice before they are put into effect. Officers of E.A.T.T.R.R.O. often assist in the investigations which are necessary before a reclamation project is agreed, and they may take part in the field work when it is under way.

During the early part of this century, following the fearful epidemics of sleeping sickness, the human problem was dominant to the problem of nagana or cattle trypanosomiasis. However, the measures taken in evacuating populations from danger areas such as parts of the north shore of Lake Victoria, and in concentrating populations into sleeping sickness settlements as in parts of Tanganyika, brought human trypanosomiasis under control. In recent years, therefore, trypanosomiasis in domestic animals has become dominant as a problem to that in humans.

In addition to the inter-territorial research undertaken at Shinyanga and Tinde, much work on trypanosomiasis has been and still is done by territorial veterinary and medical departments. Nevertheless, such is the importance of these diseases that proposals for establishing an additional research centre, a Central Trypanosomiasis Institute for East Africa, have been under discussion for some time. The need for this was first emphasised in 1938 by Dr. O'Brien, then Medical Adviser to the Secretary of State. It was endorsed in Prof. Buxton's report of 1945, and after prolonged discussion it has been decided to create such an institute in Uganda at Sukulu, a few miles south of Tororo. During the early discussions on this subject it was thought that the new institute when created would absorb the work which had been conducted formerly at the Tinde Laboratory and also a good part of that done at Shinyanga, thereby reducing very considerably the size of the research units of E.A.T.T.R.R.O. operating in Tanganyika. However, in the event, the new central trypanosomiasis institute at Sukulu, with a staff of eight scientific officers and their assistants, will be an addition to, rather than a replacement of, the research based on Shinyanga and Tinde.

Supplementary to the work based on the Nairobi headquarters and the institutes at Shinyanga, Sukulu and Tinde E.A.T.T.R.R.O. has projects for three pilot schemes of tsetse reclamation, one in each of the three territories. The scheme in Kenya known as the "Masai Scheme" is to be located in the Cis-Mara area of the Narok District, concerned primarily with *Glossina pallidipes*, and is complementary to a major scheme in Trans-Mara to be undertaken by Kenya Government in connection with the encroachment of this fly onto the dairy farming areas of Sotik. The Kenya Government would be responsible for the beneficial use both of the land cleared by themselves and the land cleared by E.A.T.T.R.R.O. The scheme proposed in Tanganyika is on the Makata plains and has the special object of reclaiming a wet season grazing area of some 25,000 acres so that the potential dry season grazing areas of the Makata

plains could be used for ranching. In Uganda the proposed scheme is in Ankole where, during the past twenty years, *G. morsitans* has steadily encroached from the south and has now linked with *G. pallidipes* in the north, thus cutting the grazing areas of Ankole in half. The aims of this scheme would be first to check the mortality in cattle which is very high, and secondly, to make possible the enlargement of the livestock industry. It is proposed that in this large project, E.A.T.T.R.R.O. should tackle the central *morsitans* belt while the Uganda Government would deal with the *pallidipes* problem in the north.

These three schemes are concerned primarily with the use of the land by ranching, and therefore cut straight at the main problem of cattle trypanosomiasis. They will provide opportunity for applying the many recent results of research in field conditions under thorough scientific control.

9. Locusts:

The development and activities of the Desert Locust Survey since October, 1948, are fully covered by the published reports of the Director, Mr. P. R. Stephenson. It is sufficient here to mention that the Survey was formed as a department of the High Commission in order to keep the desert locusts under observation in their permanent breeding areas, to conduct research on the locust and its environment, and to give adequate warning of any future invasions, so that proper control organisations could be developed in advance.

The organisation is based in Nairobi in a special building provided in the grounds of the Coryndon Museum, but most of the field operations are conducted outside East Africa in the suspected areas of permanent breeding, in Somalia, British Somaliland, Ethiopia, Eritrea, the Aden Protectorate, Yemen, Saudi Arabia, and Oman, in close collaboration with other countries interested in the problem. In order to do this the Survey has to have a number of mobile teams with mechanical transport at a long distance from headquarters. In addition to investigations in the suspected areas, there is special provision for the Survey to carry out research on the factors affecting swarming of the desert locust in order to try to devise new methods of prevention. Three of the series of field teams now operating in Saudi Arabia, Eritrea and British Somaliland, were provided for from the inception of the Survey. In 1950 a team was provided for Oman, and in 1951 another team started operations in the Aden Protectorate. To make the survey of suspected areas reasonably complete, a further team to operate in the Yemen started in 1952. These field teams are not only reporting and observing agencies, but have facilities at their disposal for preliminary measures to control insipient swarms, and already during 1949-1952, while new wide-scale invasions are threatened, these facilities have been used to very good advantage.

The survey has been able to foresee the new invasions of Africa by migratory swarms, and on its advice the large supplementary organisation

for desert locust control has been established. This control organisation, which is closely integrated with the Survey, is necessarily extremely costly, with votes of over £1 million per annum for several years, but may well save many times its cost by avoiding serious depredation to crops. Meanwhile, it is of high importance that the work of the Survey itself should not be impeded by concentration on control measures, and also that the research work should go on.

10. Insecticides:

The Colonial Insecticides Unit which is based in East Africa, conducts research on behalf of the whole Colonial Empire. It receives all its funds from Colonial Development and Welfare sources and is not responsible to the East Africa High Commission. The Tanganyika Government is the administrative authority while the unit is operating in this region. For some years the unit was based at Entebbe, Uganda, but early in 1951, on the completion of new laboratories some ten miles from Arusha in Tanganyika and the construction of housing for the staff in Arusha township, the base was moved there, although one or two of the staff remain in Uganda to complete investigations which had been initiated.

The scientific direction of the work is undertaken by the Colonial Insecticides, Fungicides and Herbicides Committee through the officer in charge in East Africa, Mr. K. S. Hocking, who is on long-term secondment from E.A.T.T.R.R.O.

The main object of study has been and continues to be the effects on mosquitoes and tsetse flies of the new insecticides such as D.D.T. and B.H.C. in different formulations and under different methods of application. Many notable results have been obtained in relation to the control of malaria, particularly in testing the effects of residual spraying in houses, native huts and buildings, and in relation to trypanosomiasis by the application of insecticides in areas both small and large, sometimes by ground methods, but also from aircraft. These results are fully described in the many reports from the unit and in published papers.

The stage has now been reached in some branches of the work when field experiments on a relatively large scale are required to test out the economics of applying the results which have been obtained. Two such experiments are in mind, both proposed in association with High Commission scientific services and the territorial governments. They are likely to take a prominent part in the work of the unit during the next few years, and therefore are briefly described.

The first is a proposed experiment in the use of residual insecticides against hyperendemic malaria, which will be conducted in association with the East African Malaria Unit. It has become clear that the failure to stop malaria transmission completely in hyperendemic areas in previous house-spraying experiments was at least partly due to the smallness of the areas treated, so a search has been made for an area

of several hundred square miles with a reasonably large population affected by hyperendemic malaria, and as isolated as possible from other malarial places. No ideal area has been or could be found, but it has been agreed that the best places are in the low-lying parts of Same district of Tanganyika, and the Taveta area of Kenya, that is, the country around the north and south Pare Mountains. This large area of over 1,000 sq. miles contains two intensive malarial regions each of roughly 150 sq. miles, one east of the South Pare Mountains with about 7,000 inhabitants, and the other in Taveta district with about 8,000 inhabitants. The people are of the Pare and Taveta tribes and population movements to and from other malarious areas should be small. At present, as a preliminary to the proposed large experiment, field officers are collecting data on mosquitoes and the distribution of dwellings, and small-scale experiments with different insecticides formulations are being carried out in order to determine details for the large-scale work (see also Section 14).

The second experiment is concerned with tsetse flies. Air spraying trials against various species carried out during the last three years in Uganda and Tanganyika have led to big improvements in the technique of application and have shown that under favourable conditions something approaching 100% kill of adult flies can be achieved in one coverage of areas of practically leafless thorn bush or Miombo woodland. The big experiment now proposed is designed to try out what is already known over a wide area, possibly combining air spraying with other methods of eradication, with the principal object of finding out whether air spraying is an economic method of dealing with tsetse flies. The area proposed is about 600 sq. miles of country in Tanganyika which would be valuable for Masai development if it was freed of tsetse flies. It consists partly of thorn bush carrying *G. swynnertoni*, partly of open plains and mbugas, and it is hoped that by a small amount of light clearing the open areas can be so linked that the tsetse bush can be divided into several isolated patches of 100-130 sq. miles each. In such case a year's spraying programme with two aircraft could cover all the infected bush and certainly reduce the fly to a very low level. It should then be possible by ground application of insecticides, or by other methods, to demolish any remaining pockets of fly.

11. Wild Fauna:

The remarks under this head apply largely to future needs, although they derive from a number of discussions on problems of the control and conservation of wild animals which have been held during the past few years. Prominent among these have been the four Fauna Conferences we have had in East and Central Africa, at Nairobi in 1947, at Chilanga, Northern Rhodesia, in 1948, at Victoria Falls in September, 1950 and at Tengeru, Tanganyika, in April, 1952; also the Inter-African Rinderpest Conference of 1948 at which the highly important question of the relation between wild fauna and disease of stock was a prominent item. Meetings

elsewhere have also contributed much towards the common problem, notably the United Nations Conference on the Conservation and Utilisation of Resources held at Lake Success in August, 1949, the International Technical Conference on the Protection of Nature held there also, and the African Regional Scientific Conference held at Johannesburg in October, 1949.

Discussions at these meetings, which have included men who are specially concerned with fauna problems in the field, have revealed that, in spite of the great interest in and extensive literature on the African fauna, we are still working in the dark. Very little scientific knowledge yet exists about the wild animals. Now that the unique African fauna is beginning to take its rightful place in the development of the continent, as an important economic, cultural and scientific asset in National Parks and Reserves, and also in relation to the agricultural and animal industry, the need for greater knowledge about the many species of animals has become acute.

The kind of things we require to know with precision are: What species of wild animals suffer from or are carriers of the main diseases of domestic animals? What areas of land do the different species require for their health and happiness? What are their feeding habits, breeding rates, and other relations to the environment? What are the movements and migrations of wild animals in the different areas and how can they be determined accurately, e.g., by the application of marking techniques, and how prevented? What are the best ways of ensuring that the populations of wild animals in a prescribed area do not increase beyond the safety mark; is it possible to arrange this by a correct balance between herbivores and predators, without the intervention of periodic heavy mortality and disease or of drastic measures of control? How can land, left mainly to nature, be managed in order to provide its maximum carrying capacity for wild life?

The Inter-African Rinderpest Conference made detailed proposals for establishing a research unit on wild fauna, and for experimental work in the construction of barriers at strategic points designed to control or prevent the undesirable mass movement of wild animals; it concluded that East Africa would be the best area for such an enterprise. These proposals, having been generally endorsed and in some ways modified by subsequent meetings, were formalised during 1950 as far as the East African territories are concerned by the Game Sub-Committee set up at the Colonial Office jointly by the Tsetse and Trypanosomiasis Committee and the Agricultural Advisory Council. The Game Sub-Committee concluded that three things were necessary in order to place the wild fauna of East Africa in their proper scientific perspective, namely:—

(1) A qualified biologist should be appointed to the staff of the Game Department in each territory to secure scientific information, and to assist in the application of scientific principles to the work of control and conservation.

(2) A research team of four men should be recruited to investigate and collect information on game problems in one area—Tanganyika was suggested—to supervise the practical work involved in setting up experimental game fences, and to undertake research into game management. This team should consist of a biologist, a veterinary research officer, a botanical ecologist, and a game ranger.

(3) There should be a survey to collect, correlate and assess information available in all quarters on scientific questions relating to the mammalian fauna of Africa.

The first of these proposals is primarily the concern of territorial governments, but the second and third are clearly of inter-territorial, if not international, significance.

Details for the second project were worked out for a research unit to be centred near the eastern border of the Serengeti National Park in Tanganyika where the problems of conservation, control, disease (especially rinderpest) and of appropriate wild animal management are in juxtaposition. Estimates were prepared and half the necessary funds for 5 years' work were earmarked from the United Kingdom provided the other half were contributed by the East African governments. However, towards the end of 1951 the East African governments, while expressing much interest, were unable to vote their share of the cost.

The third project mentioned above, namely, a survey of what is already known about the wild fauna, has been established by appointing a worker to make an intensive study of the literature under supervision of Dr. Harrison Matthews, the Scientific Director of the London Zoological Society.

12. Fisheries:

The natural productivity of waters in East Africa, both inland and marine, is such that the output of fish could be much increased by encouraging and in some cases controlling the development of the industry. In addition there are possibilities for a fish farming industry, especially in those areas remote from the sea or the lakes. The ultimate object is to achieve a condition of maximum sustained yield in all fisheries, but before much progress can be achieved towards that end there is need for research.

The organisations for fishery research and development, both territorial and inter-territorial, have come into existence largely during the past three or four years. Before then, in the case of Kenya, there was a Fish Warden in the Game Department although most of his attention had to be devoted to trout fisheries, and there was a Fishing Inspector for the Kenya waters of Lake Victoria; in Uganda, the Game Department paid a good deal of attention to fisheries although it had no fishery officers as such.

There is now in Kenya a group of officers under the Fish Warden of whom two are devoted to marine fisheries, three to rivers and lakes and fish farming, and one is a qualified biologist in charge of a river research centre. In Tanganyika, there is a similar group responsible to the Agricultural Department consisting of a Fisheries Officer for inland lakes, another for fish farming, and a third for marine fisheries. In Uganda there are four fisheries officers responsible to the Game Warden dealing with the main centres of the industry other than Lake Victoria and, in addition, a fisheries officer has recently been appointed to organise and develop a fish farm. There is also a Fish Marketing Corporation (T.U.F.M.A.C.) which is opening up new fisheries, and organising marketing and distribution. Zanzibar also has a Fisheries Officer responsible to the Director of Agriculture.

Lake Victoria provides by far the largest inland fishery, and is shared by the three territories. It is now looked after by the Lake Victoria Fisheries Service with a Chief Fisheries Officer, Cdr. G. F. Cole, three Fisheries Officers, and a Field Officer. The work of this Service, which was established in 1948, has been envisaged in three phases: the first phase, now nearly complete, was to gather knowledge about the fishery, and to assess its size and its main problems; the second phase, now under way, is to introduce and administer inter-territorial fishery legislation which is designed to assist the fishermen to develop the industry and to conserve stocks for the future; the third or technological phase will be to introduce new or improved methods of fishing, to tap new resources, and to organise better methods of preserving fish and marketing and distribution. The headquarters of the Service for the first phase were at Mwanza, but for the second administrative phase they have been moved temporarily to Kisumu.

For fishery research, which involves studies in hydrology, chemistry, algology, invertebrate zoology, as well as of fish, there are units for both inland and marine studies as part of the High Commission research services, and also a river research station in Kenya, and experimental fish farms in Kenya and Tanganyika. The regional organisation for inland fishery research based at Jinja, directed by Mr. R. S. A. Beauchamp, has an establishment of five research officers, including the director, and two field officers. Its work up to date has been concentrated mainly on Lake Victoria, but other waters in Uganda, Kenya and Tanganyika, have come within its purview.

Although pressure has been brought to bear for more research work on Lake Victoria as well as in Uganda and Kenya, the expansion to Tanganyika Territory is first priority to enable the organisation to serve all East Africa. It is also necessary for the organisation to be in close contact with the fishery research in the Central African region which is based on Fort Roseberry and on Lake Bangweulu in Northern Rhodesia.

In order to achieve these objects a detailed scheme was worked out for a modest expansion of the organisation by establishing a small sub-

station at Kigoma on Lake Tanganyika which is the base of the fishery officer of the Tanganyika Government responsible for inland fisheries. This development, however, has not yet taken place.

Inter-territorial marine fishery research started early in 1951 with a unit based on Zanzibar in the charge of Dr. J. F. G. Wheeler and equipped with the M.F.V. "Research". The European staff is intended to be 5 scientific officers, including the director, together with a master and chief engineer for the vessel, but it may be a year or so before all the posts are filled, particularly as the laboratory which will provide their working facilities cannot be completed for some time.

The unit's initial function is to conduct a survey, lasting about two years, of the fishery resources in the area bounded on the west side by the coast and on the east by a line drawn from a point 30 miles off-shore from the northern border of Kenya to a point 30 miles off-shore from the southern border of Tanganyika. In the course of this survey a number of scientific and technical problems will reveal themselves for more detailed study at a later stage. Since some of these problems will require laboratory facilities ashore it is convenient that a large amount of the initial survey must be conducted at sea while the laboratory is under construction. The survey will be of a practical kind to reveal the possibilities of developing economic fisheries outside the range of native fishing craft. This will include study of the pelagic fish which are believed to migrate down the East African coast, but also of all other important species of fish, including those living off-shore and in-shore. The survey will cover also by-products of fish such as liver oil and isingglass, and studies of plankton and of hydrology.

The chief need of this research unit, not yet provided for, but likely to become acute during the next few years, is for a larger research vessel. The M.F.V. "Research", which has already seen much service on a fishery survey of the Seychelles/Mauritius area of the Indian Ocean, is too small for the work even in its initial stages. She would be quite impracticable for the oceanographic studies which will almost inevitably succeed the primary survey of fish resources, and, having but a single engine, she involves risks in operating off an all-too-frequent lee-shore. In the original plans for the unit it was intended to provide a larger vessel properly equipped for marine research and it must be hoped that this intention will be turned into action as soon as financial conditions allow.

13. Secondary Industries:

The East African Industrial Research Laboratory, which is under the direction of Mr. H. B. Stent, was established in 1942 with the principal object of encouraging new light industries to produce goods for local consumption in replacement of those which were not available at that time on account of the war. In this task it achieved considerable success and a parallel organisation for manufacturing goods, the East African

Industrial Management Board, soon separated off, making pottery, vegetable cooking fats, various chemicals, etc.

After the war the Industrial Research Board continued and has done valuable work over a period of years with meagre facilities and at remarkably low cost. With a staff of never more than seven scientists it has run a ceramics section which has given much assistance to local industries for bricks, roofing tiles, domestic pottery, and drain pipes, and has concentrated recently on refractories made with locally produced kyanite. It has done important work also on the complex problems of processing the phosphate deposits at Tororo, Uganda, together with soda ash, to manufacture silicophosphate as a fertiliser, an industry which is now producing a considerable proportion of the phosphatic fertilisers used in East Africa. Another branch of the work has been concerned with a new process for extracting pyrethrin from undried pyrethrum flowers, and the Industrial Research Board aids a number of other industries with advice and assistance in chemical analysis, etc.

Since 1945 many discussions have taken place and memoranda prepared on the expansion of the I.R.B. in order to provide a more adequate background of science for the further development of industries, and in 1947 a scheme was proposed by the Board for establishing E.A.I.R.O. (East African Industrial Research Organisation) which would absorb the Industrial Research Board and provide an organisation adequately staffed and equipped to meet the current needs of chemical and other industries, investigations on building methods, road construction, etc.

After some delay these proposals led to a research scheme for the appointment of a Director of E.A.I.R.O., whose first task would be to examine the needs of East African industrial research in consultation with territorial authorities, and to make recommendations for establishing an organisation which would meet those needs. In the event no appointment to this post has been made, but in April, 1951, Mr. Stent was appointed Director of East African Industrial Research with terms of reference which, in addition to continuing the present work, include surveying the industrial research needs of East Africa and making recommendations to provide a basis for enlarging the organisation.

Up to now the Industrial Research Board has been financed by the East African Governments without grant aid from Colonial Development and Welfare funds. To begin with all three Governments participated, but in 1947 Tanganyika withdrew its contribution because it had enlarged its own Government chemical laboratory to meet its particular needs, pending the establishment of E.A.I.R.O., which was then not expected to be long delayed. When proposals for E.A.I.R.O. are agreed both in East Africa and by the Secretary of State, it is hoped that it will receive funds from a Colonial Development and Welfare research scheme and also from the three territorial Governments.

Details of the new organisation and the method of financing it have yet to be finally settled, but the proposal which has received approval in principle in East Africa is that it should consist of 4 sections of which one would be based in Tanganyika, another in Uganda and the other two in Kenya.

There would be a unit for chemistry and chemical engineering which, together with the organisation's directorate, would be in Nairobi in proximity to the largest centre of secondary industries as they exist today. Officers from this unit would, however, visit the other East African territories and if need arose would work in them from time to time. A second unit would deal with building investigation, particularly the increased use of local materials which at present account for about one-third of the cost of building, but the proportion of which in relation to the larger costs of imported material and labour might be considerably increased if better techniques for the use of local materials could be developed. Indeed, as long ago as 1946 the Directors of Public Works in the three territories proposed that building research should be established on a regional basis as an addition to the Industrial Research Board. The building research unit would also be based initially in Nairobi where facilities for this kind of investigation are perhaps better than elsewhere.

The third unit, devoted to road investigation, would be based in Tanganyika where the problems of roads appropriate to low traffic densities are more acute than in the other territories. High standard and bitumen surfaced roads built to specifications which have been proved in other parts of the world are generally provided with adequate scientific control by the Public Works Departments or big contracting firms, but the kind of road which depends to a large extent on the local soil presents problems which can only be solved in Africa. It is a striking fact, for example, that the causes are not yet known of such a well-known phenomenon as "corrugations" of gravel- and earth-surfaced roads.

The fourth unit would concentrate on metallurgical work and this would be in Uganda where important problems in this sphere need intensive study, particularly those connected with the complex of metal deposits in the neighbourhood of Tororo. The initial separation and the subsequent processing of these minerals into pig iron and iron pipes, fertilisers and perhaps phosphorus, niobium, etc., is known to involve a number of technological and scientific problems. Since large sums would be involved in the capital investment for these proposed mineral industries, and the annual turnover would be substantial, a considerable research unit might be justified, particularly in the early stages.

An Industrial Research Organisation established on the lines outlined above would of course, be quite modest in its scope. Each of the four units would consist of only some 5 or 6 scientists and therefore the programmes of research would have to be strictly limited. While certain lines of investigation might be advanced by the organisation from the laboratory stage to the pilot plant stage, it is unlikely that the staff

would have the extensive facilities which they might expect at big centres of industrial research say in the United Kingdom or South Africa. Indeed one of the principles applying to all East African research organisation—that the work should be done wherever it can be conducted most efficiently—would have to apply rigorously to E.A.I.R.O. In pursuing this principle there may be occasions when a member of the staff would have to work for a period with the better facilities in other countries, and by a similar arrangement it would be hoped that specialist staff from say the Department of Scientific and Industrial Research in the United Kingdom would come for periods of work in East Africa. This has already occurred from time to time, for example when a specialist from the Water Pollution Research Board of D.S.I.R. worked for a tour in East Africa to solve certain problems of the disposal of coffee and sisal wastes. This particular subject of the treatment of industrial effluents to avoid water pollution has a growing importance in East Africa, particularly in areas such as near Jinja in Uganda, which are scheduled for industrial development. E.A.I.R.O. may in future have to add additional units to study this or other problems as they become urgent.

14. Health and Medicine:

Inter-territorial research in health and medicine is arranged somewhat differently from other subjects. It is not one organisation but is made up of several independent units or institutes each separately responsible to the Administrator of the High Commission, with the East African Bureau of Research in Medicine and Hygiene as a co-ordinating agency.

One of the foundations of the present system was the report by the late Professor McSwiney made after visiting East Africa in 1946. Prior to his visit there had been much discussion on establishing a central inter-territorial medical research institute, but he recommended against this and emphasised that so little was known about health in Africa that the first need was for surveys of health and medical conditions, conducted mainly in the field, in order to distinguish between the many contributory factors, such as living conditions, nutrition and diseases. McSwiney recognised that basic research on many diseases was still required and that a greater preventive bias should be introduced into medical work. While much had been done on certain medical problems, for example trypanosomiasis, circumstances had prevented equally full study of others. In consequence there was no complete knowledge or unanimity of view on what were the most important diseases affecting different communities. Furthermore, in any scheme of medical development, attention should be directed especially to those diseases which hinder economic progress, and it is there that research designed to improve techniques of control and prevention is most important. Accordingly an East African Medical Survey should have high priority in the general scheme of research. It would have to be conducted in

several areas characterised by different modes of life, and its findings would on the one hand indicate to territorial medical departments the main problems on which to concentrate effort, especially in preventive medicine, and on the other would indicate the subjects in which research was most needed.

Professor McSwiney's second proposal was that a regional bureau should be set up to keep in touch with all forms of medical research and health conditions, to serve as a projection, so to speak, of the Colonial Medical Research Committee in London, and also as an information centre on hygiene, preventive and curative medicine, to serve the whole area.

Effect was given to both these recommendations in due course. The bureau was established with Dr. K. A. T. Martin as its Director in a separate building in the grounds of the Kenya Medical Department laboratories in Nairobi, where it has access to one of the biggest medical libraries in East Africa and therefore does not need to accumulate a large amount of literature of its own. The East African Medical Survey suffered vicissitudes in its early stages, in changes of staff and through other causes, but is now established under Lt. Col. W. Laurie based at Mwanza, Tanganyika, where laboratory and houses are built. The workers in addition to the director are 6 medical research officers, 2 health visitors, a statistician and 5 other Europeans as well as Asian and African assistants. The work is concentrated on the Wasukumu south of Mwanza and on related tribes isolated on islands in Lake Victoria; but later it may extend activities to other populations which are concentrated around the Lake Victoria basin in all three territories.

Meanwhile, the Colonial Medical Research Committee took the initiative in establishing several other medical research projects of considerable size in East Africa. One for filariasis research for which the team is, like the medical survey, based on Mwanza and under the direction of Lt. Col. Laurie. It consists of 4 research officers, 3 European laboratory technicians and ancillary staff.

Another major unit is the East African Virus Research Institute situated at Entebbe, Uganda. It was previously known as the Yellow Fever Research Institute and was founded in 1936 as a result of decisions reached between the International Health Division of the Rockefeller Foundation and the Colonial Office. Thanks to the generosity of the Government of Uganda, excellent laboratory facilities were made available in the former Human Trypanosomiasis Institute erected in 1931. The Yellow Fever Research Institute was under the direction of the Rockefeller Foundation until the end of 1949 when the connection was officially terminated. During these years important researches on yellow fever were carried out under the direction of Drs. A. F. Mahaffy and K. C. Smithburn. On 1st January, 1950, it was renamed the Virus Research Institute to denote the wider scope of its programme, and Dr. E. S. Horgan was appointed director. The staff includes two medical research

workers in virus diseases, one epidemiologist, two medical entomologists and one zoologist. The researches, in addition to investigation of human virus diseases such as yellow fever, embrace studies of the insect vectors and of wild animals, especially monkeys, which are reservoirs of virus diseases affecting man.

Yet another project arranged by the Colonial Medical Research Committee has been a study of relapsing fever by Dr. Walton conducted mainly in Kenya; this has produced remarkable results, particularly on the relationship of human beings to the ticks which are vectors of this disease.

The High Commission also has initiated projects acting on the advice of annual meetings of Directors of Medical Services in East Africa. One of these is the East African Malaria Unit under Dr. Bagster-Wilson which became based at Amani in Tanganyika early in 1951, when the laboratories and houses there were mostly vacated by E.A.A.F.R.O. This unit has three objectives: firstly to train staff for territorial departments in the techniques for controlling malaria, secondly to advise the Governments on schemes for malarial control, and thirdly, research. In addition to the director the unit has a staff of a medical research officer, two malaria field officers, a malaria engineer and also an office staff and a number of African assistants. One substantial project is for a large practical experiment in controlling malaria in hyperendemic areas. This was discussed at the World Health Organisation Malaria Conference held in Kampala in 1950, and is to be conducted in close association with the Colonial Insecticides Unit (see Section 10). The Insecticides Unit will be concerned with the more technological aspects of the use and effect of insecticides, while the Malaria Unit will concentrate on the human side of the combined investigation. There is no economic justification for expending large sums on the control of malaria in rural areas, or even on investigating methods of control, until it is known how much it is worth spending on prevention, in other words what the result would be in terms of increased activity by the population. Therefore it is fundamental to any programme of public health in rural areas to assess what effect hyperendemic malaria has in relation to other diseases, on the output and wealth of the people, and on mortality. It is true that similar investigations are required in the case of other diseases as well, and are indeed being made in certain areas by the East African Medical Survey, but there is no higher priority than malaria. Supplementary to this major experiment the Malaria Unit has work progressing on the bionomics of malaria vectors, such as the resting places of adult mosquitoes, the reasons for the successions of anopheline species in waters common to several, and the relation between mosquito breeding and fish culture.

The other unit which was established chiefly at the instigation of the Directors of Medical Services is for leprosy, and deals with practical applications as well as investigations. The leprosy specialist, Dr. J. Ross Innes, has in the course of a year or two conducted extensive surveys

in East Africa and also Northern Rhodesia and Nyasaland which participate in this scheme, and has laid clear foundations for the better prevention and cure of this disease. It may be said in fact that the basic field work has now been done. There is however need for further research of the kind which could best be conducted in a small research institute attached to a Leprosarium. Among the subjects for investigation would be the therapeutics and biochemistry of the new drug compounds now being used in leprosy, and fundamental research on the pathology, bacteriology and biochemistry of the disease. The establishment of such a research unit should be visualised when the necessary preventive and curative Leprosaria are being established in the territories.

In the case of several of these inter-territorial units, notably the Virus Research Institute, the Filariasis Research Unit and the Medical Survey, scientific oversight of the work has been provided by the Colonial Medical Research Committee in London, although administrative responsibility is vested in the High Commission. The Malaria Unit and Leprosy work are also High Commission services. Much progress is now being made in all these subjects as is well illustrated in the annual reports for 1950 and 1951 of the Bureau and of the separate directorates.

Another research scheme of inter-territorial significance, though it is administered by Tanganyika and not by the High Commission, is for research on precipitin sera. The reason for this is that Mr. B. Weitz, working at the Lister Institute in London, has perfected a test by which it is possible to identify the blood found in the stomachs of biting insects such as tsetse flies and mosquitoes as having come from particular species of animals. In basic research on tsetse flies and trypanosomiasis as well as on other insect-borne diseases of man and animals, there is still an important gap in our knowledge about this subject. The question has bearings also on policy concerning the wild fauna; whether, for example, the eradication of game from a particular area will have the effect of eradicating particular species of tsetse flies. This research is conducted in Tanganyika, in close co-operation with E.A.T.T.R.R.O.

The territorial medical departments have not been idle while these regional activities have been in process of establishment, and have themselves conducted important research work, particularly perhaps on the insect-borne diseases. One noteworthy example was investigation leading to the control of onchocerciasis in Kenya, a disease which is transmitted by the small "black flies", particularly *Simulium neavei*. For a long time the larval stage of this fly could not be found in spite of several investigations by specialists. The discovery was finally made in 1950, following a joint effort by a hydrobiologist on fishery research and a medical entomologist — a good example of inter-departmental collaboration. The larvae were found to be symbiotic with freshwater crabs living in rapid flowing streams.

Another good example of collaborative enterprise, also concerned with onchocerciasis, has been in the neighbourhood of Jinja in Uganda where there is danger from another species of "black fly", *Simulium damnosum*, which abounds in the rapid reaches of the Victoria Nile. In this case a Belgian specialist who has been concerned with enradicating the flies and onchocerciasis in the somewhat similar conditions of Leopoldville, visited Jinja, and recommended an experimental spraying of insecticides by aircraft. This was done through the agency of the Colonial Insecticides Unit with satisfactory, although perhaps temporary, results in reducing the fly and the danger of the disease. It has been followed up by adding D.D.T. to the waters of the Nile in order to kill the larvae of this troublesome fly.

Important branches of medical research which are a little outside the main subject of this account are conducted at Makerere College and the Mulago Medical School in Uganda. Some of these are supported financially by a Colonial Development and Welfare Research grant, and they deal specially with physiology and aspects of nutrition in relation to pathological conditions; also with anatomy and other branches of research related to medicine.

Looking to the future, the East African Medical Survey may, after a while, change its main object from the present phase, which is concerned primarily with investigation, to a second phase concerned with application of the results. On the other hand it might perhaps hand the application of the work on to the territorial departments and extend its investigations to other African areas for comparison with the work now being conducted in Sukumaland. The Filariasis Research Unit may end at the conclusion of the present scheme in 1954, in which case its facilities would presumably be absorbed into those of the Medical Survey. The Malaria Unit must certainly continue and perhaps expand, there being facilities for doing so already in existence at Amani and Muheza, the former providing good living and working conditions, the latter providing plenty of malaria a few miles away at a lower altitude. The Virus Research Institute at Entebbe likewise has a great field of research open to it which must continue over a number of years.

Planning the future of health and medical research must, for reasons explained above, depend to some extent on the results of the Medical Survey, and should be designed particularly towards the development of techniques for preventive application. Meanwhile, however, there are some other outstanding problems which, judged by any criteria, demand fuller investigation on an inter-territorial basis but are not covered by the existing units and projects. Among these are nutritional studies which are already being pursued in certain directions. Shistosomiasis is a disease of ever growing importance and one requiring research in East Africa in its biological as well as medical aspects. On the biological side studies of the snail vectors are already being pursued by the Fisheries Research Organisation at Jinja, and on the medical side by territorial departments. Silicosis and tuberculosis present problems

which likewise require investigation, perhaps on the lines of the present inter-territorial leprologist's work. Yet another problem is that of plague, which continues to be endemic in certain areas and requires study of the small rodents and their parasites as well as of human beings. It is hoped that during the next five years it may be possible to initiate investigations on one or more of these problems.

There is a final and very important question which enters into most forms of medical research and medical practice, namely the effct upon the numbers, activity and output of a population of large scale disease control measures. This is a matter closely related to studies in demography considered in Section 16, as well as to the East African Medical Survey. So far in East Africa there have been no specific control measures in any disease put into operation on a large enough scale for such an investigation to be undertaken, but it raises questions of fundamental importance to the social and economic development of these territories and to the tropics in general.

15. Sociology:

The East African Institute of Social Research, which had been the subject of reports and discussions for several years, started work in May, 1950, when its Director, Dr. Audrey Richards, and initial staff arrived in East Africa. By the end of the year, in addition to the director and administrative secertary, the workers comprised an urban sociologist, an anthopologist, a linguist who is an African Research Officer and another African research worker studying land tenure. During 1951 the staff was increased by the addition of a psychologist, an economist, four additional anthropologists, and an Indian sociologist. During the following two or three years, three other posts are scheduled, bringing the full establishment to thirteen officers including the director. Several of these will however be holders of research fellowships or bursarships rather than of established posts, so that the number of research workers in the Institute is to some extend fluid.

As an indication of the extent of social research work proceding in East Africa the staff figures of the Institute are somewhat misleading, because one of its important functions is to give advice and help to workers who are not necessarily part of the Institute itself. Whereas Tanganyika is the only East African Government to establish its own anthopological unit, there are a number of Colonial Research Scholars or Fellows on sociology attached to territorial Governments, and there are Fulbright scholars from America working on sociology in East Africa. At the end of 1950, although the Institute's own staff was nominally four, there were in fact at least fifteen workers engaged on social research in East Africa and in some cases under the supervision of the Institute.

It is clearly of importance for all these social research workers to be in close touch with each other and also with territorial officers concerned with administration, agriculture, health, social welfare and the like, and

with this in mind the director has established a system of joint discussion of problems once or twice each year. The first such discussion took place in December, 1950 at Kampala with twenty-two workers concerned in political, economic and linguistic problems. The second was held in July, 1951 at Astrida in Ruanda Urundi at the invitation of I.R.S.A.C. This occasion provided a full exchange of view between British and Belgian sociologists on questions of mutual interest such as the labour migration between Ruanda Urundi and Uganda. A similar meeting is to be held at the Institute's headquarters at Kampala in February, 1953. It may be possible later to arrange such discussions at other places away from the Institutes headquarters, for example in Kenya, Tanganyika or Zanzibar. Thereby problems in other territories can be brought to bear on the Institute's work and *vice versa.*

To begin with the Institute had no buildings of its own, but in June 1951 it moved into modest quarters at Makerere consisting of a small office and 6 flats. The character of the work involves most of the staff being away in the field for a large part of their time, so it is not intended to build a large headquarters.

The work is in accordance with programmes approved by the Colonial Social Science Research Council, and submitted to the East African Governments. It covers the following functions, (a) information centre and publications, (b) conduct of field studies, (c) conduct of studies of administrative importance to Governments, (d) linguistic research, (e) organisation of experiments in methods of social research adapted to East African conditions, (f) training and supervision of research workers. Up till now the Institute has been specially concerned with studies in Uganda, such as that of the Baganda villages, and the settlement of immigrant labour from Ruanda Urundi which is causing change to the social system in some areas. An important social survey has been undertaken also on the rapidly growing town of Jinja. During 1951 the Institute also commenced three studies in Tanganyika, at Biharamulu, Bukoba and Buha and has been concerned with the planning of an urban study in Dar-es-Salaam.

Following the modern trends in social research, the director suggests that in the past there have been too many isolated studies of particular peoples and too few on the changing conditions to which all peoples are having to adapt themselves. On this account the Institute and research workers connected with it are at present devoting special attention to the study of the development of local government in African societies.

16. Economics and Statistics:

The study of economics and statistics, especially such aspects as demography, although it falls mainly within the economic rather than the scientific sphere, has to provide the piecing together of the jig-saw of development. By studying the past and the present forecasts can be made of trends in the future. On account of the inevitable delay between

the initiation of research work and the production and application of its results, the forecasting of trends in development is of high importance in planning research and in fact forms an integral part of the scientific picture.

The East African Statistical Department under Mr. C. J. Martin has an establishment of ten qualified statisticians, including the director, and a considerable ancillary staff of clerks, statistical assistants and machine operators. The majority are based on the headquarters in Nairobi, but units are posted to sub-offices in Entebbe and Dar-es-Salaam. The department is now capable of keeping fairly well up to date with the collection and analyses of the main economic statistics and publishes some of the more important series regularly in the E.A. Economic Bulletin. There are a good many series requested by Governments, however, which the department is not yet able to prepare; some of these present unusual difficulties and there are others for which clerical assistance is not yet availble. Pressure on the staff is such that the trained economists have little time to deal with the research aspects. Nevertheless the department has been a forerunner in the development of methods of census taking and calculation of national incomes in under-developed areas. Other smaller economic surveys and studies have been undertaken from time to time.

There is need therefore for adding to the department, or to the economic side of the High Commission activities, one or two small units of a research character which can work unimpeded by routine operations. One project has been advanced, designed to produce information on which the future trend of national income can be based. In the case of Kenya and Uganda the Governments already produce adequate funds for the Statistical Department to analyse current national income from year to year; but, although the data is known to exist, there has been no serious attempt to produce figures for national income for past years, so that it is well nigh impossible to forecast future trends. A project has been prepared therefore for the addition to the department of a small unit to collect and analyse the data on this subject back to 1930.

Tanganyika has advanced another related project, namely, an analysis of the existing structure of industry. This project, which may include Nyasaland and Zanzibar as well as Tagnanyika, will, it is hoped, be the subject of a short-term investigation during the next few years.

One of the most important subjects is the study of demography, and trends of population change which have to provide the background for all future developments. The census of East Africa of 1948-49, which was planned and analysed by the Statistical Department, provides a most important datum line. The next census when it takes place will, like the last, involve a large amount of additional work for a short time, and will produce another datum line for comparison with earlier censuses. But there is also great need for some continuing work between censuses, following up their results, collecting supplementary figures in sample

areas which make the census results more significant, and generally putting the subject of demography on a more reliable footing.

The intensive work on demography conducted in East Africa during the past few years has been paralleled by studies on a somewhat different basis in other parts of the continent, in South Africa, Southern Rhodesia, and in the Belgian, French and Portuguese territories. Demography, perhaps more than many other subjects, needs co-ordinating on a pan-African basis and it is significant that the inter-African Statistical Conference held in July, 1951 at Salisbury devoted special attention to this subject and recommended that some form of continuing organisation should be established with the co-ordination of demographic data as one of its main functions.

Apart from special needs mentioned above, there is the more general one of piecing together the many parts of the economic puzzle as information comes to light or forecasts are made for the future. Within the existing structure in East Africa it does not appear that there should be any further high powered economic advisers, but rather one or two statisticians of wide interests without heavy routine duties, who could from time to time sit back and think on the basis of available material. They would be termed an "operational research unit" in the United Kingdom, or an "economic analyst unit" in the United States. They would be engaged on the study and interpretation of statistical information, including the possible or probable effect of each subject on the living standards of the population. They would keep under review not only the movements of the various economic statistical series but would forecast future changes also. In short, the task of this section would be to assess the interaction of all these factors on the general economy of East Africa. The suggestion that such a unit should be created in East Africa is put forward for consideration at a future date when some expansion of inter-territorial services may be possible.

17. Libraries and Information:

Good libraries are indispensable for scientific workers. They need to be properly classified and referenced, and staffed with qualified librarians to deal not only with the backlog of classification and incorporation of new material, but also to assist the research worker in preparing reference lists on particular subjects, and if necessary summaries or translations of papers. East African science is not yet well equiped in these ways.

There are a good many scientific and technical libraries belonging to the High Commission services, departments of territorial Governments, and non-Government bodies such as the East African Natural History Society and Uganda Society. Some of these have valuable books collected over a long period, but few have even a small proportion of the reference works and periodicals which research men require, and even more important, few have qualified librarians. In organising the libraries of

the High Commission Services, and preferably including also those of territorial Governments, the concept should be that all are parts of one general reference library, though housed separately in sections according to the special interest of each institute or department. A common system of referencing, preferably the "Universal Decimal Classification," should be adopted throughout, and all libraries should be open for reference and lending to all scientific workers whatever the service they may belong to.

Such an ideal will be impossible to achieve until there are more qualified librarians and the backlog of classification and referencing is completed. But the first step towards it was when the High Commission published its paper No. 2 in 1949 entitled "Scientific and Technical Periodicals held in the Principal Libraries of British East Africa". This includes the holdings of 53 libraries; its preparation was initiated by the Nairobi Scientific and Philosophical Society, and much work was done on it by the Librarian of the East African Literature Bureau. It has been of considerable service, but is already out of date in parts and a revised version is required.

Modern scientific library and reference work should take advantage of special methods and techniques, including copying of rare papers by microfilm, photostat or other methods, and the use of miscrocards on which a considerable amount of important scientific literature is becoming available. Such aids are particularly important in Africa, where it is often difficult for the individual worker to gain access to all the literature he needs. The only library in East Africa reasonably equipped in this way is that of Makerere College in Uganda which has miscrofilm and microcard readers but no equipment for providing miscrofilm or photostat copies of literature for workers elsewhere. It is a matter for consideration whether at least one of the High Commission scientific libraries should not be equipped in such ways in order to provide an inter-territorial service. If it were decided so to do, the choice would probably fall on the library at Muguga, which is the largest library of the High Commission services and has the advantage of holding many long series of holding many long series of periodicals.

Apart from the need for distributing information in published or report form through the agency of libraries, there is also continuing need for individual contact and exchange of information and views at all levels from departmental directors to the most newly arrived scientist. The most fruitful results of widest economic significance often come from those points in the system where several scientifis disciplines or the work of several departments impinge. Some of this kind of contact is attained at meetings of councils and committees when reviewing past work and formulating programmes, but this by itself is by no means sufficient. For example developments in basic and technological research throughout East Africa may be of importance to the Statistical Department because new processes or findings may have considerable influence on economic forecasts, and that department should not have

to await the publication of annual reports before becoming aware of such developments. Even within the regional research and scientific services there is danger of our scientists, few as they are, working in water tight compartments, a danger which must be fought at all costs.

18. Publicity:

Just as science as a whole can be divided into three stages of fundamental research, technology, and application to practice, so its publications tend to fall into the same three categories.

The publication of original contributions to science usually takes place over the signature of the individual or group who actually did the work and it appears in some well-recognised scientific journal published in Europe, the United States or perhaps a Dominion. It is right that this system should continue because original contributions to knowledge, particularly on the more fundamental aspects, take a permanent place in scientific literature even though they may be of direct interest to quite a small circle of specialists around the world. The distribution of the new knowledge to specialists of all nations is best achieved through well known journals which find a place in the shelves of all libraries dealing with that subject, while the system of obtaining offprints of the original paper for the use of the author or the institute which originated the work provides for additional distribution.

Many results of science, particularly those coming from the technological stage, present a different problem in publication because they are of main interest to the region in which the work was done. For these it is important to have journals of good standard published from East Africa itself. There are already several : the East African Agricultural Journal, the East African Medical Journal, the East African Engineer, and the Journal of the East African Natural History Society, which may be ranked as inter-territorial journals ; also two important ones published from the territories, namely, Tanganyika Notes and Records, and the Uganda Journal. The last two are not restricted to science, and, like the inter-territorial journals, they have an appreciable circulation outside as well as inside East Africa.

The distinction drawn between the widely known European, American or International Journals on the one hand and the East African Journals on the other is by no means hard and fast. Quite a number of new scientific principles from basic research have been published first in East African journals, whereas from time to time papers which are primarily technological in character are more appropriately placed in European than African journals.

It must be expected that the journals published in East Africa will, during the next five years, become progressively larger, more important, and have a wider circulation both in the region and elsewhere. Moreover, their number may be increased. There has been a move, for

example, to start an East African Journal of Veterinary Science, but the launching of a new technical journal is a step which cannot be undertaken lightly, and there is much to be said for the view that it would be better in East Africa to concentrate on enlarging and improving the existing journals, which are already widely recognised, than to establish new ones.

Of the existing journals the East African Agricultural Journal, which caters for the animal industry and forestry as well as for plant industry, and from time to time publishes articles on fisheries as well, has probably the widest circulation. It is designed to be of interest to farmers as well as to those who are engaged in some aspect of scientific work. None of the East African technical journals, however, is designed primarily to cater for the third stage of scientific publication which may be defined as projecting the scientific outlook and scientific results on to the lay public. This function is best performed through the agency of the daily and weekly press, including the semi-scientific press such as "Field, Farm and Garden", published from Nairobi. This is an important function of science, though it is often neglected.

In publicity, as in the conduct of scientific work, it is desirable to have some definition of the responsibilities of the regional services as compared with the territorial departments. The East African Advisory Council on Agriculture, Animal Industry and Forestry considered this matter and reached a conclusion which, though designed specifically for agriculture, is a useful guide for other subjects also. It reads as follows :—

(1) Publicity on all maters of research and investigation of direct concern in the practice of farming should normally be the responsibility of territorial departments, which would be kept fully informed of any such matters emerging from the work of the inter-territorial research organisations.

(2) The research organisations themselves should prepare reports on their research and investigation, and should also draw the attention of the public in non-technical language to matters which are likely in the future to have practical value.

In addition to the forms of publication discussed above, there are the Annual Reports of each department or service which provide authoritative statements of activities and are the main source of published information about work which is in progress. Moreover, during the formative stage of the services operating under the High Commission, a series of six Progress Reports on Research and Scientific Services was isued by the Scientific Secretary in multigraph form during 1948-50. These have been primarily for the information of the Central Assembly but have had a considerable circulation elsewhere. They cover some inter-territorial scientific work not directly responsible to the High Commission. The Annual Reports of the East Africa High Commission itself and of Territorial Government, and also reports issued by the

Colonial Office on the colonial territories and colonial research, contain summarised statements on a number of scientific activities in East Africa.

X. CONCLUSION AND FORECAST

It is widely recognised today that a sound background of science and research is a necessary part of any modern state, so there is no need for further justification of the activities described in the last chapter. It is, however, necessary to emphasise that science and research cannot flourish and fulfil their essential service to the community without adequate finance. In this connection it should not be forgotten that a large part of the money for the inter-territorial scientific and research services, in many cases about one half of recurrent funds, and often the whole of initial capital funds, and also for some of the territorial services, is provided under the Colonial Development and Welfare Acts of 1940, 1945 and 1950. The total provision for the 10 years April, 1946 to March, 1956 under these Acts is £140,000,000, of which £13,000,000 is earmarked for research. Up to 30th September, 1950, that is less than half the 10 years period, £8,300,000 of the total research funds had been actually committed, including many schemes which were provided for some years ahead, thus leaving an uncommitted balance of £4,700,000 to provide for the rest of the period to 1956. This uncommitted balance was thus about half of the funds already committed, and it had to provide for the continuation of schemes whose currency would expire before 1956 in addition to any new schemes.

These figures apply to the whole Colonial Empire, of which the East African region may perhaps be considered to be about one-fifth ; but the Colonial Development and Welfare research funds already committed to expenditure in East Africa represents a much higher proportion, approximately one-third. This large proportion has come about partly because the organisation of science was more advanced in East Africa than in other colonial regions, and partly because a good deal of research undertaken on behalf of the whole Colonial Empire and financed *in toto* from Colonial Development and Welfare research funds could be pursued more efficiently in East Africa than elsewhere. East Africa has thus been a guinea pig (so to speak) in colonial science, and if the scientific services provided here prove their value, they will point the way to future developments in other regions.

Whether Colonial Development and Welfare assistance will in fact end in April, 1956, is, of course, unknown, but it may be remembered that in the terms of the Act of 1945 there is a distinction between monies voted for research purposes and those voted for development purposes, and that the door is at least not closed to the possibility of research funds continuing. Whether they do so or not, it is well to have a forecast, however approximate, of the shape of things to come.

The existing state of inter-territorial science and research has been summarised in the table in Chapter III. The table in this Chapter has been prepared in similar form suggesting what the state of affairs will be in 1956, by which time the various services, some of which are still in process of formation, should be fully established. Entries in the columns showing recurrent expenditure have been made on the assumption that costs will not rise above the 1952 level. In a number of cases it is already known how much money may be expected from C.D. and W. funds on condition that the East African Governments also make contributions in agreed proportion, so that the entries are by no means entirely guessed. Entries in the column showing the number of officers in professional scales allow for a modest expansion in some services in accordance with details set out in the relative section of Chapter IX.

A comparison of the two tables shows an increase from 1952 to 1956 in total recurrent cost from £752,860 to £868,000 (less revenue in both cases) which provide for a total staff of 151 scientists in professional grades rising to 182, together with their assistants, equipment and ancillary services. The cost rises at a lower rate than the number of scientists because overheads do not increase in proportion to scientific staff.

The relatively small increase in cost, 17% in 4 years (only 11% if revenue is taken into account) in this forecast confirms the principle that the period we are now embarking on is one of consolidation rather than of renewed expansion. But the process of consolidation, including the putting into effect of schemes already agreed in principle, and reaching a balance between the subjects in accordance with the needs of the territories, invitably involves a certain amount of expansion in some directions and reduction in others.

A comparison of the percentage columns for 1952 and 1956 shows that the chief effect of the plan would be to increase slightly the proportion of the total effort devoted to research on the productive services, particularly animal health and secondary industries. Some might wish that the emphasis on the productive services should go further but that could hardly be achieved without pushing up the total cost.

Summary Forecast of East African Regional Scientific Services in 1956

	No. of officers in professional scales	Recurrent Expenditure to nearest £1,000	% of whole Officers in professional scales	% of whole Recurrent Expenditure
Meteorology (E.A. Meteorological Department) (1) ...	12	120,000	7	14
Hydrology (E.A. Bureau of Hydrology)	1	6,000	1	1
Agriculture and Forestry (E.A.A.F.R.O.) (2) (3) ...	28½	110,000	16	13
Animal Health (E.A.V.R.O.) (3) (4)	20½	103,000	11	12
Tsetse Flies and Trypanosomiasis (E.A.T.T.R.R.O.) (5)	30	118,000	16	14
Locusts (Desert Locust Survey) (6)	10	100,000	5	11
Fisheries (Inland Water Research, Marine Research, Lake Victoria Fisheries Service) (7)	16	62,000	9	7
Industrial Research (E.A.I.R.O.)	14	55,000	8	6
Health and Medicine (E.A. Bureau, Medical Survey, Virus Research Institute, Malaria Unit, Leprosy Unit)	25	96,000	14	11
Sociology (E.A. Sociological Research Institute) (8) ...	13	28,000	7	7
Statistics (E.A. Statistical Department) (9)	12	70,000	6	8
	182	868,000	100	100
Less Revenue (4) and (7)		47,000		
	182	821,000		

Footnotes to table

(1) The increase of qualified officers from the 10 in 1952 assumes the addition of a small climatological research unit.

(2) Excluding Termite Research, Ecology Training Scheme, etc., which may be completed by 1956.

(3) The ½ relates in both cases to the head of the Animal Industry Division, responsible jointly to both organisations.

(4) Against the expenditure of E.A.V.R.O. can be set revenue expected from the sale of biological products which is estimated to amount to about £35,000 per annum.

(5) The estimates on which finance under C.D. and W. schemes has been assured provided for 32 offcers in professional scales, but owing to the rise of costs since the estimates were framed 30 is a more likely total by 1956.

(6) Insecticides research, which figures after Locusts in the table for 1952 on page 11 is assumed for the purposes of this table to cease as in independent unit in East Africa by 1956, because it is financed wholly from C.D. and W. funds.

(7) Against the expenditure of the Lake Victoria Fisheries Service, which is expected to be about £20,000 p.a. can be set revenue of about £12,000 from administering the Lake Victoria Fisheries Act.

(8) The E.A. Sociological Research Institute is not responsible to the E.A. High Commission.

(9) The increase of 2 qualified statiscians from the 10 in 1952 is intended to provide a small research unit.

In thinking of the balance of subjects and the relative proportions of the strictly limited research effort we must bear in mind the purposes which they are intended to serve. Some services or organisations which are concerned with revealing natural resources and devising techniques for using them or for preventing diseases, can see no end. Among these are those concerned with Geology, Meteorology, Agriculture and Forestry, Animal Health, Fisheries, Secondary Industries, Health and Medicine, Sociology. Others have more defined objectives such as the Central Directorate of Colonial Goedetic and Topographic Surveys, which aims to provide a background of geodetic fact and detailed topographic maps sufficient for a good many years to come. In the case of the Tsetse and Trypanosomiasis Organisation and the Desert Locust Survey, the object is to bring knowledge concerning these major scourges to a point at which sound techniques can be applied on a large scale to eliminate them or at least to contain them within bounds.

Thus, taking the long view, some of these organisations must be regarded as being with us for ever, while others may in course of time cease to be necessary, thereby allowing the effort and expenditure which they involve to be saved or to be devoted to other directions. By these remarks it is by no means intended to suggest that East Africa will be in a position to dispense with or even reduce any of these scientific services in the foreseeable future with the exception of a few smaller ones which are mentioned in the relevant sections of Chapter IX. But, to take the examples of the two biggest organisations, E.A.A.F.R.O. and E.A.T.T.R.R.O., while comparisons can be misleading, and it has to be remembered that E. A. T. T. R. R. O. is not dealing merely with trypanosomiasis and tsetse flies but also with the vast problem of rendering great tracts of Africa available for settlement and production as they are required, the following must be borne in mind. After the build up and consolidation during the next few years, East Africa will have an organisation for tsetse and trypanosomiasis research and reclamation which will be larger than the maximum which can be foreseen for the sister organisation of E.A.A.F.R.O. dealing with research on the whole agricultural and forestry industries. When that time comes it may be thought that the comparison between these two is somewhat, out of balance, and, if further expansion becomes possible, as it will certainly be desirable, the emphasis should be placed on agriculture and forestry research rather than on tsetse and trypanosomiasis. With the heavy concentration now foreseen on tsetse and trypanosomiasis it may be that some of the main problems will see their solutions during the next five years or so, and it may then be possible to reduce the size of E.A.T.T.R.R.O. in favour of one or more of the sister organisations.

This of course is not the only example where a re-orientation of the balance of effort or some degree of reorganisation might prove necessary before many years are past. It is given merely as an indication of the need for keeping the whole system under continuing review in relation to the needs of the countries which it serves.

The fact that what some regard as an unduly high proportion of Colonial Development and Welfare research funds is being spent in East Africa does not imply that this region is overweighted with research. Far from it. One way of demonstrating this is by broad comparisons of the proportion of total public funds spent on research activities. The total recurrent expenditure on interterritorial science, including the Meteorological and Statistical Departments which are not primarily concerned with research, in 1952 amounts to £752,860 (Table page 11). If we add to this a round figure of half as much again for research undertaken by territorial governments, we reach a figure of about £1,125,000, which is less than 3% of the 1952 budgets of the four territories added together.* In practice the governments are spending considerably less than 3% on research on account of grant aid from Colonial Development and Welfare funds.

The territorial budgets are expanding rapidly, and it must be assumed that their totals will rise during the next five years at least as rapidly as the research expenditure. Therefore the percentage of the total spent on research is unlikely to increase, although the East African governments may be expected to bear a larger share in due course.

Now, if we compare this percentage of less than 3% with a neighbouring region such as the Belgian Congo, we find that considerably larger sums, amounting to a higher proportion of public expenditure, are spent there on research. The largest research organisation in the Congo is I.N.E.A.C., corresponding roughly with E.A.A.F.R.O. and E.A.V.R.O. combined, and the annual expenditure is approximately 3% of all public expenditure in the Congo. With I.R.S.A.C. and research undertaken by the central government and provincial departments, the whole proportion on research must be at least 5% of total public expenditure. The Belgian authorities find that this pays dividends. There is little doubt that the East African authorities will find that research in East Africa pays dividends also when our organisations, most of which are younger than those in the Congo, have got into their full stride.

In selecting priorities for financing scientific work, especially at a time like the present when the funds available may be inadequate to meet all needs, there is a tendency to cut out the small schemes and concentrate on the big ones. But this is not necessarily the best way of obtaining good results. There are many cases, not only in large organisations but also in small units, where the shoe pinches, so to speak, and a relatively small grant relieves the pressure and enables work to be done which may produce results of wide importance. For this reason various small projects as well as the continuation of major organisations

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* Kenya £ million 14.8; Tanganyika £ million 12.8; Uganda £ million 12.1; Zanzibar £ million 1.4 (excluding separate DARA budgets of Kenya £ m. 6.3; Tanganyika £ m. 6.6; Zanzibar £ m. 0.3).

are mentioned in Chapter IX. Examples are the special maps or atlas of East Africa in Section 1, the hydrological bureau in Section 4, a building for reference collection of insects in Section 5, fauna research in Section 11, and proposals for economic research in Section 16. These and other projects mentioned have been subject to consideration for some time.

Finally I would make a plea that in the future organising and financing of research in East Africa, some measure of what may be described as the academic system should be introduced, as it has already been introduced in branches of the United Kingdom Civil Service and in certain government research organisations in other parts of Africa such as I.R.S.A.C. in the Belgian Congo and C.S.I.R. in the Union of South Africa. Under the strictly Governmental system, after appropriate committees have decided that a particular investigation is needed, and other committees have made available the requisite funds, search is made for a man to do that particular job within an agreed programme. If he succeeds he is apt to line up for promotion to other jobs involving more responsibility but less research; if he fails, he is apt to go on failing. The academic method on the other hand consists of picking a really good man and unleashing him. If he succeeds in his research he probably goes from strength to strength in a research career. If he fails he is well advised to give up research. Thus in a university containing a number of scientific departments, funds accumulate around the best men. If a department goes into a scientific decline, it may be forgotten for a while and receive little money until new inspiration, occasioned perhaps by a change of senior staff, is followed by a fresh flow of funds. The government research department, however much it may stagnate, tends to go on consuming funds at the former rate.

At present inter-territorial research in East Africa appears healthy, with abundant inspiration coming not only from on top but from the workers themselves, and most departments are striving for increased funds. We have many committees which propose new schemes, but maybe the time will come when we shall need other committees to close down or reduce those schemes which in due course show signs of stagnation.

APPENDIX

SCIENTIFIC CONFERENCES AND MEETINGS, 1947-52

I. East or East and Central African meetings, mostly arranged by East Africa High Commission

East African Annual Geological Conferences

1st Meeting, 11th-12th May, 1948, Entebbe, Uganda.
2nd Meeting, 2nd-4th June, 1949, Dodoma, Tanganyika.
3rd Meeting, 16th-18th May, 1950, Nairobi, Kenya.
4th Meeting, 15th-18th May, 1951, Entebbe, Uganda.
5th Meeting, 13th-16th May, 1952, Dodoma, Tanganyika. (Report published).

East and Central Africa Conference on Hydrology and water Resources

1st Meeting, 15th-17th November, 1950, Nairobi. (Report published). Smaller group of specialists met in May, 1950, at Nairobi, in September, 1951, at Entebbe, and in 1952 at Salisbury.

Lake Victoria Project

1st East African Conference, 25th November, 1947, Nairobi.
2nd East African Conference, 3rd-4th August, 1949, Nairobi.

East African Agricultural Research Conference

29th-31st July, 1947, Nairobi.
(Proceedings of technical sessions published in E.A. Agric. J., 13, p. 67).

East African Veterinary Research Conference

1947, Kabete.

East African Forestry Meeting

1948, Nairobi.

East African Advisory Council on Agriculture, Animal Industry and Forestry

1st Meeting, 25th-27th January, 1949, Kabete, Kenya.
2nd Meeting, 20th January, 1951, Muguga, Kenya.
3rd Meeting, 25th-26th January, 1952, Muguga, Kenya.

Grassland Research Committee

1st Meeting, 7th-8th December, 1949, Nairobi.

Committee on Water Utilisation by Vegetation

1st Meeting, 25th November, 1949, Nairobi.

Fertiliser Research Committee

1st Meeting, 13th-14th July, 1949, Nairobi.

Committee on Insecticides

1st Meeting, 29th November, 1950, Namulonge.

Sub-Committee on Animal Industry Research

To be formed on establishment of Animal Industry Division of E.A.A.F.R.O. and E.A.V.R.O.

Committee on Plant Breeding

1st Meeting, 29th November, 1950, Namulonge.

East African Agriculture, Forestry and Veterinary Research Organisations Committee (R.O.C.)

Reconstituted from

Standing Research Committee, which met three times:

1st Meeting, 2nd November, 1949, Nairobi.
2nd Meeting, 31st May, 1950, Nairobi.
3rd Meeting, 25th September, 1950, Nairobi.

The reconstituted R.O.C. has met as follows:

1st Meeting, 16th August, 1951, Nairobi.
2nd Meeting, 27th September, 1951, Nairobi.
3rd Meeting, 25th January, 1952, Muguga.
4th Meeting, 18th April, 1952, Nairobi.
5th Meeting, 19th September, 1952, Nairobi.

Technical Co-ordinating Committees

Committees, composed of Directors of Territorial Departments (Agriculture, Veterinary and Forestry) and the Directors of the appropriate Research Organisations, are formed under R.O.C.

Desert Locust Survey Advisory Committee

1st Meeting, 24th February, 1949, Nairobi.
2nd Meeting, 21st June, 1949, Nairobi.
3rd Meeting, 16th August, 1949, Nairobi.
4th Meeting, 3rd October, 1949, Nairobi.
5th Meeting, 25th November, 1949, Nairobi.
6th Meeting, 30th January, 1950, Nairobi.
7th Meeting, 5th May, 1950, Nairobi.
8th Meeting, 17th-18th July, 1950, Nairobi.
9th Meeting, 16th August, 1950, Nairobi.
10th Meeting, 10th April, 1951, Nairobi.
11th Meeting, 19th-21st July, 1951, Nairobi.
12th Meeting, 23rd-26th June, 1952, Nairobi.

East and Central Africa Conferences on Fauna (Reports published)

1st Meeting, 8th-9th May, 1947, Nairobi.
2nd Meeting, 11th-12th June, 1948, Chilanga, N. Rhodesia.
3rd Meeting, 18th-19th September, 1950, Victoria Falls, N. Rhodesia.
4th Meeting, 15th-17th April, 1952, Tengeru, Tanganyika.

Lake Victoria Fisheries Board

1st Meeting, 12th December, 1947, Jinja, Uganda.
2nd Meeting, 4th-6th December, 1948, Mwanza, Tanganyika.
3rd Meeting, 22nd-23rd July, 1949, Kisumu, Kenya.
4th Meeting, 17th-18th August, 1950, Entebbe, Uganda.
5th Meeting, 28th-29th March, 1951, Mwanza, Tanganyika.
6th Meeting, 5th-6th November, 1951, Kisumu, Kenya.
7th Meeting, 26-27th May, 1952, Entebbe, Uganda.

East African Inland Fisheries Research Advisory Committee

1st Meeting, 26th-26th July, 1949, Jinja, Uganda.
2nd Meeting, 7th-8th November, 1950, Jinja, Uganda.
3rd Meeting, 30th March, 1951, Mwanza, Tanganyika.
4th Meeting, 7th-8th November, 1951, Jinja, Uganda.
5th Meeting, 28th-29th May, 1952, Jinja, Uganda.

Inter-territorial Marine Fisheries Research Advisory Committee

1st Meeting, 27th-28th August, 1951, Zanzibar.
2nd Meeting, 2nd-3rd June, 1952, Zanzibar.

East African Industrial Research Board

12th Meeting, 18th February, 1947, Nairobi.
13th Meeting, 15th May, 1947, Nairobi.
14th Meeting, 21st August, 1947, Nairobi.
15th Meeting, 19th February, 1948, Nairobi.
16th Meeting, 24th June, 1948, Nairobi.
17th Meeting, 3rd March, 1949, Nairobi.
18th Meeting, 16th June, 1949, Nairobi.
19th Meeting, 3rd November, 1949, Nairobi.
20th Meeting, 2nd February, 1950, Nairobi.
21st Meeting, 15th June, 1950, Nairobi.
22nd Meeting, 14th November, 1950, Nairobi.
23rd Meeting, 6th March, 1951, Entebbe.
24th Meeting, 19th June, 1951, Nairobi.

Annual Meetings of Directors of Medical Services

19th, 20th August, 1947, Nairobi.
5th, 6th August, 1948, Nairobi.
24th, 25th August, 1949, Nairobi.
26th, 28th July, 1950, Nairobi.
19th-21st July, 1951, Nairobi.
10th-11th July, 1952, Nairobi.

II. **International Meetings attended by representatives of East Africa**
(In most cases reports have been or will be published)

Conference on Tsetse flies and Trypanosomiasis
February, 1948, Brazzaville.

Conference on Rinderpest
October, 1948, Nairobi.

Conference on Soils
November, 1948, Goma.

1st Conference on Nutrition
October, 1949, Dchang.

2nd Conference on Nutrition
November, 1952, Gambia.

Conference on Indigenous Rural Economy
November, 1949, Jos.

Conference on Statistics
July/August, 1950, Salisbury.

Conference on Malaria
November, 1950, Kampala.

Conference on Medical Education
May, 1951, Dakar.

Conference on Forestry

December, 1951, Abidjan.

Conference on Housing and Building

November, 1952, Pretoria.

African Regional Scientific Conference

October, 1949, Johannesburg.
Arranged by Government of Union of South Africa.

Anglo-Belgian Inland Fisheries Conference

June, 1949, Elizabethville.
Convened by Government of Belgian Congo.

C.S.A. (Scientific Council for Africa South of the Sahara)

1st Meeting of Council, November, 1951, Nairobi.
2nd Meeting of Council, November, 1951, Dakar.
3rd Meeting of Council, August, 1952, Costermansville.

Specialist Committee on Geology, June, 1952, Muguga.
Specialist Committee on Fauna, October, 1952, Nairobi.
Symposium on African Hydrobiology and Inland Fisheries, October, 1952, Entebbe.