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INTERIM REPORT

of the

STUDY GROUP ON ANIMAL DISEASES IN AFRICA

This report has been reviewed
by the
Subcommittee on Animal Diseases in Africa
and the
Advisory Committee on Africa

National Academy of Sciences
National Research Council
Washington, D.C.
November 30, 1964

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL
2101 CONSTITUTION AVENUE, WASHINGTON 25, D. C.

OFFICE OF THE FOREIGN SECRETARY

November 30, 1964

Gentlemen:

The enclosed interim report has been prepared as the result of a request by the Agency for International Development that the National Academy of Sciences undertake a survey and evaluation of the rinderpest control program sponsored by the Commission for Technical Cooperation in Africa, and to evaluate other major livestock diseases as they relate to the rinderpest program and to livestock production in general, including the impact of disease control on such problems as marketing and processing, range and water resources, and the place of livestock production in the economic development of specific areas of West Africa.

In response to this request, the Advisory Committee on Africa organized a Study Group on Animal Diseases in Africa to conduct the actual survey, and a Subcommittee on Animal Diseases in Africa to review the Study Group report. This report has been reviewed and approved by the Advisory Committee on Africa and its Subcommittee.

Sincerely,

C. W. de Kiewiet
Chairman
Advisory Committee on Africa

Enclosure

INTERIM REPORT

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This report has been reviewed
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This report has been prepared and submitted under Contract AID/afr-211 between the Agency for International Development and the National Academy of Sciences.

CONTENTS

PREFACE

In response to a proposal by the Agency for International Development (AID), the National Academy of Sciences has agreed to conduct a study of livestock diseases and related problems of livestock production in West Africa, with special reference to the rinderpest-control programs sponsored by the Commission for Technical Cooperation in Africa (CCTA).

The Academy has established a study group on animal diseases which will direct its efforts specifically to: (1) evaluation of the CCTA-sponsored rinderpest-control program; (2) evaluation of other major livestock diseases as they relate to the rinderpest program and to livestock production in general; (3) evaluation of the impact of disease control on other problems of livestock production, e.g., marketing and processing, and relation of disease to livestock numbers and available range and water.

In a more general way, and time permitting, the study group will make general observations and recommendations on the broader question of the place of livestock production in the economic development of specific areas in West Africa through: (1) appraisal of the prospects for expansion of production and marketing; (2) identification of problems that interfere with livestock production; (3) appraisal of the need to develop institutions to stimulate and support expansion; and (4) identification of means by which current and planned AID projects could contribute to increasing production and marketing of livestock.

In carrying out its work the study group will: (1) review the available literature and hold discussion meetings with specialists who have had experience with livestock diseases and, specifically, with rinderpest in Africa; (2) visit institutions in the United Kingdom and France to discuss rinderpest and other animal disease problems with specialists who have had broad experience in livestock disease and production in Africa and who will not be available for consultation in Africa; (3) consult in Brussels with the European Economic Community (EEC) to determine not only the immediate proposed support of the CCTA rinderpest-control program, but also the attitude of EEC toward continuing support of this program over an extended period of time and the scientific assumptions upon which the EEC is basing its policies; (4) discuss in Rome with the Food and Agriculture Organization of the United Nations (FAO) officials the FAO proposed regular program, extended technical assistance programs, and possible involvement in U.N. Special Fund projects in livestock disease, production, and marketing; (5) consult in Kenya with the personnel of the East African Veterinary Research Organization (EAVRO) and consider relevance of current research and field programs in operation in East Africa to the problems of the West African region. This will include, specifically, consultation with officials familiar with animal marketing in Africa; (6) visit institutions, laboratories, and administrative units in Central and West Africa

involved with the first phase of the CCTA-sponsored rinderpest-control program to observe the extent of the progress made and to discuss the need and procedures for studies in program effectiveness and vaccination efficacy. The principal contacts will be with the rinderpest program headquarters at Kano, Northern Nigeria. Other contacts will be made at the Vom Laboratory, Northern Nigeria, and Farcha Laboratory, Ft. Lamy, Chad; (7) visit principal laboratories and administrative headquarters for animal-disease-control programs in other West African countries, particularly those to be involved in the second and third phases of the rinderpest-control program. These will include Upper Volta, Mali, Ghana, and Senegal.

The study group received valuable assistance from AID officials in Washington, as well as from those assigned in countries visited by the team. Travel arrangements and appointments with officials of the African governments and staff members of institutions visited were efficiently arranged.

This document is an interim report of the findings and conclusions of the study group to date. By April 1, 1965, a final report containing findings, conclusions, and recommendations will be submitted to AID. Other reports will be prepared as appropriate.

AID's requirement for a preliminary report at an early date, 30 November 1964, made a hurried and concentrated travel schedule essential. The National Academy of Sciences and the study group, in view of the short period allotted to visiting the most significant areas of Africa concerned in the CCTA and AID animal health program, have sought to complement the study by a pre-visit exploration of the available literature and an extensive effort to accumulate additional literature for a more detailed report at a later date.

The study group appointed by the National Academy of Sciences is as follows:

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INTRODUCTION

This preliminary report represents an effort to evaluate the most significant aspects of the animal health, livestock development, range management, livestock marketing, and technical or educational development programs in the West African region as they pertain to AID programs. Several diseases, principally rinderpest, trypanosomiasis, and contagious bovine pleuropneumonia (CBPP) are of immediate concern to these programs. However, a number of other diseases and parasitic conditions existing in this and other regions of Africa also impede the development of a sound livestock industry. Foot and Mouth Disease, for instance, certainly equals rinderpest as the cause for restricted trade in livestock products and this widespread parasitism results in huge, but unmeasured, losses.

Considerable effort has been made to consult the most experienced and knowledgeable individuals available and to visit the most active institutions concerned with tropical animal health, veterinary education and training, and biological production, as well as West African ministries concerned with livestock production and development.

The purpose of this report is to provide an objective evaluation of the animal health programs--particularly CCTA Project 15 (Rinderpest)--in which AID plays an important role. The utilization of a National Academy of Sciences Study Group, unrelated to AID, permits an unbiased appraisal of programs under way and encourages direct and candid replies by individuals questioned. This approach by AID and the National Academy of Sciences to problems relating to technical assistance and program development may provide an effective method for evaluating programs and planning future activities.

A great deal of attention has been directed by the study group toward the education and training activities under way in West Africa, particularly as they relate to providing personnel for the continuation of the disease control programs as many experienced individuals retire from the scene. A very apparent lack of technically qualified nationals exists in every country of the region, and it is obvious that the assistance agencies are faced with a problem of filling personnel gaps to thwart a serious regression in current and planned disease control operations.

Personnel selected by the assistance agencies to stem an anticipated regression must duplicate the capabilities and dedication of the experienced departing specialist as nearly as possible. Even under the most favorably expected circumstances it will be essential for the well-qualified animal disease specialist to understand the problems and attitudes of national administrators and technical specialists assuming new responsibilities in the operation of these programs and projects.

The study group, familiar as its members are with the American scene, well understand the difficulties in recruiting and keeping competent personnel. The mode of recruitment, establishment of salary levels, and AID responsibilities to make best use of specialized talent, are outside the main purview of this report. A solution to these problems of maintaining competent personnel is vital to all of the recommendations and the future success of AID's participation in African assistance programs.

Agencies and Organizations Involved in Livestock Production, Animal Health, and Veterinary Training in Countries in West Africa

West Africa, as well as other areas of the continent, has recently undergone radical political, economic, and social changes. These processes in many instances are extremely fluid, and the livestock development and animal health projects in the entire West African region are directly influenced by emerging organizations, institutions, and local governmental agencies, as well as by international technical and economic assistance bodies, such as the Agency for International Development (AID), the European Economic Community (EEC), the Commission for Technical Cooperation in Africa (CCTA), the Foundation for Mutual Assistance in Africa, the Department of Technical Cooperation (U.K.), and several philanthropic foundations. In addition, the former colonial powers have maintained technical and economic support at varying levels in each of the countries of this region. These assistance activities are rapidly being withdrawn in many instances.

This, of course, presents critical problems of support for maintenance and for personnel capable of effective operational management. Regression in the numbers of animals innoculated, possible periodic shortages of vaccines, and even breakdown in the operation of field units are factors to which the CCTA, AID, and other contributing organizations must now address themselves. Virtually all these potential problems are amenable to solution through prompt provision of technical personnel. If AID proposes continued support for the remaining phases of the rinderpest project or the other CCTA animal disease research efforts, these efforts must be given priority over development of new laboratories, which are difficult at this stage to staff and operate.

Since the EEC and, to a more limited extent, individual European governments are involved in the major financial support of the animal-disease-control program, designated until the end of this year as CCTA projects, a much more critical appraisal on a coordinated basis should be made of the resources available from each source of support to counteract obstacles immediately as they arise.

It is essential that the organizations involved, including AID, take note of trouble spots that actually or potentially impinge on these projects, as well as of opportunities that may arise to enhance progress

of the projects as they are reported by technical staff in the field. With competent veterinary administrative talent at headquarters level, it is possible to avert circumstances that may obstruct progress and to take advantage of possibly unanticipated circumstances that might advance the solution of problems.

Internal Agencies

International: The newly created Organization of African Unity (OAU), which embraces thirty-four African states--essentially all the independent nations of the continent--has a major role in the perpetuation and development of programs related to animal health and livestock development. The recent proposal by the OAU (Cairo, July 1964) for the establishment of a Fifth Commission envisages assumption of responsibility for certain purely technical programs formerly carried out under the CCTA and one of its subsidiary agencies, the Inter-African Bureau of Animal Health. The possibly complicating and limiting factors associated with this re-orientation of cooperative technical assistance are apparent. If these are to be averted, funding systems must be established technical autonomy preserved, and qualified staff recruited.

Regional: Within Africa, a number of alliances and associations have been established between various countries. The most significant of these alliances in West Africa is the Convention of Association between the EEC and the African and Malagasy States, in which thirteen states, formerly in the French colonial area, are involved in programs related to this study.

National: Each of the countries involved in projects related to this study has established or re-organized ministries and institutions. Some have maintained systems similar in structure and operation to those prevailing prior to independence; others have made radical innovations. But all are faced with a serious lack of experienced and qualified staffs. Many of the current veterinary systems in the area are operational only theoretically, and lack financial support for functional activity. Countries such as Sierra Leone, Gambia, Liberia, Guinea, Mali, Niger, Togo, Dahomey, and Mauritania have only a few veterinarians--many have less than five--far too few to carry out organized and supervised programs. A few systems, operationally active, subsist on an interim basis, virtually completely dependent upon funds from external sources which may or may not be forthcoming for future fiscal periods.

External Technical and Financial Cooperating Agencies

Commission for Technical Cooperation in Africa (CCTA): The CCTA is inevitably faced with extinction at the end of the 1964 calendar year. The consensus is that the activities previously undertaken by this organization will be incorporated within the Fifth Commission of the OAU in January 1965. There is hope, but no assurance, that its technical and scientific autonomy will be preserved. Responsible personnel in the West African area are apprehensive that the technical and

scientific principles under which such an organization must operate--that is, the Fifth Commission's functions--may be subject to possible political decisions of the OAU governing structure.

The Inter-African Bureau of Animal Health (IBAH), a unit of the CCTA, has for many years performed a valuable and efficient service in producing the quarterly Bulletin of Epizootic Diseases. This bulletin, which compares favorable with the most respected scientific veterinary publications in the world, has been the sole inter-country veterinary communication medium for the countries of Africa south of the Sahara, and has produced a wealth of scientific and epizootiological information that otherwise might very well have remained dormant.

With the imminent dissolution of CCTA, the continuation of this valuable service is threatened. Failure to maintain publication of the Bulletin, with its high-quality reporting and dissemination of information, would deprive the countries of Africa as well as other countries of the world of an essential tool in the struggle against diseases.

AID and other organizations involved in assistance programs should undertake jointly to ensure the perpetuation of this journal and its reporting services, possibly under the aegis of the Fifth Commission of the OAU.

Consideration needs to be directed toward establishing a working academic relationship between the Scientific Council for Africa (CSA) and the newly organized Scientific, Technical and Research Commission (STRC) of the OAU during the interim period when the new organization will labor without funds and without fully recruited staff. AID support for advisory liaison by an advisory group would surely facilitate the transfer of responsibility for guidance in selecting priorities for funding research and projects to this newly created organization, and aid in its selection of well-qualified membership. Without viable STRC activity, succeeding phases of Project 15 and others are in jeopardy. In the case of Project 15, the authority of the coordinator may be imperiled.

European Economic Community (EEC): The EEC is currently the strongest and most permanently committed agency involved in the support of development programs in the eighteen associated states of Africa. Through its European Development Funds (FED), it is entering a second five-year plan for finance and execution of projects, many of which are directly or indirectly related to animal health and livestock development. Thirteen of the eighteen associated states are involved in various aspects of the five-year plan, but no provision is made within the EEC for support of programs in adjoining states, which are vital to the ultimate success of several regional projects. These regional projects include rinderpest control, contagious bovine pleuropneumonia investigation and control, trypanosomiasis research and control, water and fodder conservation and utilization, livestock marketing, operation of biological production and disease investigation

laboratories and educational development. Several of the thirteen associated states of the region under study derive temporary support from agencies other than EEC. The four former British colonies of the region currently derive some support for projects related to this study from the United Kingdom and external agencies, but they are largely dependent upon national financing, and available funds have in some cases been dissipated. The prospect for adequate future support is remote.

Agency for International Development (AID): Finances for animal health, livestock development, veterinary education, and projects related to livestock in West Africa, involve several millions of dollars in grants or development loans--including funds committed to Phases I and II of the Regional CCTA rinderpest-control projects--and funds committed to the construction and development of an Animal Disease Laboratory for diagnosis, research, and vaccine production in Mali and the proposed support for veterinary education in Nigeria, where that country will, hopefully, provide space for the students of other English-speaking countries of the region. In addition to these major expenditures, a number of bilateral programs exist between AID and several other countries. These also relate to the animal-health and livestock-development programs for the region as a whole. Unfortunately, some of the more costly projects, particularly those relating to education and some unnecessary laboratory construction, have little promise of contributing to the immediate requirements of Phases II and III of the rinderpest project or to the necessary research and development in connection with CBPP and trypanosomiasis control. The problem of maintaining continuity in the development of effective animal-health programs and the ultimate objective of providing an infrastructure through which each country can develop qualified personnel and create adequate laboratory and field services needs to be met, either through direct AID support or through inter-service support by negotiations with other agencies or organizations.

Rockefeller Foundation: The Rockefeller Foundation supports educational development at university level and research in parts of West Africa. Veterinary medicine is one of the disciplines encompassed, and the Foundation has participated in the establishment of a veterinary pre-clinical training program at the University of Ibadan. The Foundations continuing interest in educational development through support for fellowships and research grants is also a major factor in the long-range objective of creating a cadre of competent people to take over responsible positions within government services and institutions.

Others: Several other philanthropic and charitable agencies provide support to schools, institutions, and libraries, and these agencies encourage educational advancement and provide a source of scholastically prepared individuals for more selective advanced training and research.

Biologicals Production, Research and Training Institutions

Biologicals-Production: Three long-established laboratories in West Africa--Dakar-Hann, Senegal; Vom, Nigeria; and Farcha, Fort Lamy, Chad--have been capable of producing and supplying adequate amounts of reliable rinderpest vaccines for many years. Each of these laboratories, to augment production at a level satisfactory for requirements of a plan such as Project 15, have required some additional equipment and limited increases in professional and technical staff. With the advent of tissue culture vaccine (TCV) in 1962-63, total requirements for all West Africa could even more readily be supplied from these three institutions. With respect to vaccine supply, the most critical problems for a program such as Project 15 have been in connection with the development of means for distributing vaccines to non-producing countries and areas. The laboratories are also capable of producing vaccines for other diseases, including contagious bovine pleuropneumonia, anthrax, blackleg, and rabies, in adequate quantities to support programs under way or immediately contemplated in West Africa. Since AID support has already provided adequate facilities, buildings, and equipment for production requirements in Mali, as well as for other countries, the creation of the new, elaborate laboratory presently planned cannot be justified either from an economic or technical point of view. Other unused laboratory space in the vicinity is available for expansion as it may become necessary. It must be concluded that no sound technical or economic justification exists at present for the support of such elaborate facilities as those planned at Bamako. However, if effective controlled vaccine is to be produced at Bamako, the available national personnel (technicians) should undergo several months of intensive training in TCV-production technique at Vom or Muguga. Effective production of tissue-culture rinderpest vaccine requires appropriately trained foreign personnel until technically qualified African personnel are available. A competent virologist and a tissue-culture technician are essential immediately to ensure adequate supplies of reliable vaccines by the second half of Phase II, and there is almost no possibility of adequate TCV production in Mali for the first half of Phase II. Providing expert technicians on short-term assignment under contract is not a solution to this problem of adequately training local personnel for highly specialized responsibilities. A brief period of training and observation for the foreign personnel at Vom or Muguga would contribute much to the elimination of pitfalls inherent in newly established TCV production. If AID cannot contribute to this type of training, it should make every effort to encourage other agencies or the countries involved to support it.

It is, and has been for several years, the almost universal considered judgment of veterinary experts that the three major veterinary laboratories (Vom, Farcha, and Dakar-Hann) in West and Central Africa have the physical facilities and the basic equipment required to meet West Africa's needs for animal-health-control programs operating in the past decade or for those contemplated through 1968. Modest requirements

for supplementary equipment or replacement of out-dated or worn equipment have occurred and will continue.

The critical problem has been recruiting and maintaining competent professional staff, and this problem is becoming more acute as foreign staff personnel continue to leave the region. The creation of new, elaborate institutions serves only to dilute the activity of existing institutions and to over-extend the distribution of essential, qualified personnel.

The most logical and practical allocations of external funding for laboratory support of animal-health programs for West Africa can be made in the maintenance of the major existing laboratories and the recruitment and stabilization of qualified professional personnel to operate these facilities until such time as the governments of the region can provide competent nationals to operate them.

The latest available calculations for the proposed Bamako laboratory, based on 25,500 square feet of building space, place construction costs at approximately $45.00 per square foot. The $222,000 for cost of equipment is not included. Buildings designed for similar functions in East Africa have been erected recently at a cost of approximately $10.00 per square foot. A recently constructed physics and pharmacology laboratory at Colorado State University cost less than $27.00 per square foot. While comparison of costs for similar structures in different locations is not a completely valid basis for judgment, it would appear that the Bamako proposal is inordinately expensive.

If the funds ($1,150,000) for the new laboratory are not firmly committed, it is strongly recommended that they be diverted to other greatly needed animal-health programs within the region.

Research: Basic facilities for adequate research exist at the three main laboratories named earlier, as well as in laboratories in Nigeria at the University of Ibadan, the Ghana Academy of Science in Accra, and in certain laboratories in other areas of West Africa. However, available laboratory facilities in many of these laboratories are not being fully utilized because of lack of certain elements of equipment and personnel. The most critical deficiencies are in personnel, and the situation is rapidly deteriorating. Thus, the logical avenues for laboratory support are through existing institutions where continuation of sound research activity might be maintained through some form of financial subsidization, the effective utilization of existing staff, and recruitment of well-qualified replacement personnel.

The opportunities for basic and applied veterinary research in West Africa are endless, but a few research problems stand out as immediately critical in the solution of disease and parasite conditions seriously curtailing effective livestock production.

There is a need to support the current work on tsetse fly-population sterilization and perhaps to undertake other new fundamental approaches to the vector problem.

In contagious bovine pleuropneumonia, an analytical study of the foci of infection should be made. This study should incorporate basic investigations of the quantitative and possibly the qualitative antigenic differences in the various strains of Mycoplasma mycoides, comparison and further development of diagnostic tests, and practical systems of carcass examination at slaughter points. There is also great need for a continuous comparative study of several types of CBPP vaccine currently in use and the relative effectiveness of several vaccination methods.

The incidence of streptothricosis is apparently increasing, taking a heavy toll in some areas. A practical approach to control of this disease is dependent on expanded research dealing with the mode of transmission and with chemotherapy and other preventive measures.

Numerous other microbial- and parasitic-disease conditions require research attention as soon as financial resources and competent personnel are available.

Training Institutions:* A number of institutions for training animal-health assistants, technicians, and vaccinators exist throughout West Africa, and many more are being established. Nigeria, Ghana, Chad, Senegal, and Dahomey all currently operate such facilities, and Mali and Niger are planning such institutions. These training facilities are generally associated with existing laboratories or colleges, and as a rule do not require elaborate facilities. In most of these institutions, there is a real need for adequate student housing and boarding facilities. There is also a need for modern training devices and library material. The major current problem facing institutions of this type is maintaining competent staff in those already in operation and recruiting new staff for those in the process of development.

Laboratory Animal Facilities: The problems of laboratory-animal management in the tropics are well known. Virtually all the laboratories visited experience difficulties in raising sufficient quantitities of laboratory animals for diagnostic testing and research activities. The problems are often compounded because of the absence of institutions devoted to raising and supplying replacement stock.

Feed is a major problem because few sources of balanced prepared laboratory-animal rations exist. The high cost of imported supplies may periodically strain the financial resources of existing institutions.

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*Professional veterinary education is dealt with on pages 29-31.

In planning new modern laboratories, particularly those of considerable research of biologicals-production scope, full consideration should be given to maintenance of adequate laboratory-animal facilities. In most cases, this involves relatively costly air-conditioning systems and higher operating costs than would be anticipated in a similar establishment in a temperate climate.

Failure to provide laboratory-animal facilities in the design of proposed institutions is a serious oversight--one that might hinder achievement of objectives.

DISEASE CONTROL PROGRAMS

Rinderpest

Rinderpest has been a serious plague of bovine animals in Africa and elsewhere for many years. Beginning in the late nineteenth century, rinderpest epizootics have swept through Africa, at times decimating animal populations. The serious losses among the herds of pastoral peoples probably account in part for their tendency to maintain herds in excess of actual requirement. The survival of a few animals allows the herdsman to rebuild his herd. This keeping of "insurance" animals will not change until the herdsmen of the major livestock-growing areas of Africa are assured their animals will be protected against animal diseases.

Rinderpest control, Project 15 of the CCTA, has made encouraging progress in Phase I of a three-phase program to extend from 1962 to 1968. During Phase I, 1962-63, more than 10 million cattle, or about 80 percent of the bovine animals, were vaccinated in four countries of West Africa (Cameroon, Niger, Nigeria, and Chad)--far more than the six to seven million vaccinates previously anticipated. Phase II, which involves Upper Volta, Mali, Ivory Coast, Ghana, Togo, and Dahomey, as well as the countries participating in Phase I, is scheduled to begin in September 1964, and end September 1967. Several of the new countries scheduled to participate in Phase II are faced with more difficult problems than most of those concerned in Phase I. These problems relate to obtaining vaccine supplies, recruiting and organizing field staff, and supplying field equipment. The problem of vaccine availability is essentially one of funding for purchase and distribution of vaccine. The problem of providing staff is more acute.

Phase III, for which funding commitments are not yet firm, is scheduled to begin in 1966. It will involve extension of the program into Mauretania, Senegal, Guinea, and Sierra Leone, and possibly Gambia, as well as expansion of Phase II programs in Mali and Ivory Coast. It is necessary immediately to begin studies of the required funding for Phase III if resources are to be effectively utilized.

Although no great problem exists in availability of sub-professional field staff, a serious situation exists in the utilization of certain trained nationals from one country within the boundaries of another, since certain non-technical arrangements for inter-country service are apparently difficult to work out.

Furthermore, the 26 qualified veterinary field supervisors from 11 nations, now working under the auspices of CCTA, are insufficient in number to provide adequate supervision of the activities in all the countries involved in Phase II operations. The veterinary personnel

financed through EEC funds cannot be used in countries that are not members of the 18 associated states. Countries such as Ghana, with limited qualified national veterinary personnel, are faced with field operations that will be inadequately supervised unless AID or other external assistance agencies provide personnel. Sierra Leone and Gambia may be faced with similar problems when they come into the Project. To operate field vaccination programs without adequate veterinary supervisory personnel is to court disaster, and AID has too much invested in the Project to ignore this situation or to fail to meet essential requirements. Recent veterinary graduates, capable of working in the "bush" under the direction of CCTA coordinators, would fulfill a part of this requirement. A minimum of two field veterinarians--and possibly four--will be needed to assure successful immunization in these regions. The costs are not excessive, involving only an estimated $15,000 to $20,000 per man per year.*

At least three laboratories--Dakar-Hann, Senegal; Vom, Nigeria; and Farcha, Fort Lamy, Chad--are especially equipped and staffed to produce all the vaccines required in West Africa. With the advent of TCV, the availability is substantially augmented and the cost markedly reduced. The significant problems related to rinderpest vaccines are effective refrigeration for field distribution and, particularly in the case of TCV, adequate serological testing of vaccinates to certify immunity in vaccinated animals.

The first problem can be solved by courier delivery service from laboratories to points of issue and of use in each country. Such a system would require the services of locally employed assistant technicians, and the salaries for such personnel are economically insignificant.

In areas remote from commercial air transport, air charter should be used. In relation to the over-all cost of the Project 15 program, these costs are inconsequential.

In Phase I of Project 15, little critical investigation has been conducted on immune response to TCV in field-vaccinated animals. The primary indication of immunity has been a sharp reduction in the number of rinderpest outbreaks in areas of vaccination. Since TCV produces virtually no clinically apparent vaccination response, it is important

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*As of October 9, 1964, negotiations with Canada may provide this requirement to Ghana.

that representative numbers of vaccinated animals be subjected to immunological testing. Such a system should be established in Phase II of the program, and it is desirable that AID cooperate in organizing and supporting the field services necessary to collect serum samples from representative numbers of animals assembled for vaccination. Responsible individuals recognize the need for conclusive evidence of immunity, and are prepared to support schemes for facilitating the collection and testing of representative serums from vaccinated animals in current and previous phases of the campaign. It is also necessary to organize expeditious transport of such samples to laboratories where arrangements have been formally made for handling suitable tests. To facilitate this essential testing system, AID should supply vacutainers, needles, needle holders, and serum vials to the CCTA coordinator to permit efficient mobilization of samples.

The costs related to vaccine distribution, obtaining samples of serum, and getting them to a laboratory are comparatively small. It is these items of improved logistic support that often mean the difference between success and failure of a project such as this. AID cannot afford to ignore them. It will be desirable also for AID to provide support for conducting tests in at least four laboratories--Dakar-Hann, Vom, Farcha, and Bamako.

A relatively simple hemaglutination-inhibition (HI) test has been developed that may reduce the cost and much of the tedious effort now required for serum-neutralization (SN) tests for determination of antibody response. The developer of this test, Dr. Konrad Bogel, a West German researcher temporarily assigned at Farcha laboratories, should be invited to Vom, and possibly to Bamako and Dakar-Hann, to discuss and demonstrate his test and advise personnel at these laboratories on its use. The directors of these laboratories are interested and agreeable to such a proposal.

The Bamako laboratory has been discussed above. Since it appears unlikely that this laboratory will be in effective production during the first year of Phase II, AID should make every possible effort to expedite recruitment of necessary staff and to organize reliable testing of vaccine output.* It is unlikely that the Project 15 coordinator will approve the use of vaccine from the Bamako laboratory in areas outside Mali until suitable assurances for potency and viability have been established.

Some countries, currently dependent upon vaccines from the three operating laboratories, are experiencing difficulty in obtaining supplies

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*AID has recently signed a contract with a U.S. commercial firm to supply technical advisory services to this laboratory on an "as required" basis. Such type of services do not provide an ideal solution.

as a result of currency valuations. Most of the countries in this position have relatively small livestock populations, and the non-availability of vaccine should not be tolerated, since these foci of susceptible cattle would represent a threat to the success of the program. If an insurmountable problem of payment for vaccine does arise, the program must not be jeopardized, and AID should be prepared to subsidize purchase of vaccine if alternative arrangements cannot be made.

During Phase I of Project 15, some $480,000 was committed for internal costs in Nigeria. In the course of the study, it has been impossible to determine the reason for such a commitment or the exact accounting procedures related to this expenditure.

If the suggestions outlined above in respect to Phase II planning are carried out, the outlook for success comparable to that achieved in Phase I is favorable. It is imperative that planned division of responsibility and estimated funding for Phase III be inaugurated immediately. The estimated requirements of each participating agency and each government must be spelled out as accurately as possible at an early date in Phase II. Failure to carry out Phase III, now scheduled to begin in September 1966, would inevitably lead to a regression of the status of rinderpest control. If Phase II is as successful as Phase I, the coordinator considers that Phase III might very well be inaugurated a year earlier; that is, in September 1965, thus considerably reducing over-all operational costs. Furthermore, immediate attention must be given to establishing a Phase IV, which would involve development of rinderpest control in the Sudan, Ethiopia, and Somalia comparable to that already achieved in other areas of East Africa and that currently under way in West Africa. If effective control in these areas is not accomplished, the threat of re-introduction of the disease into clean areas is very real and the economic consequences to improved livestock production may be fully as serious as they have been in the past.

It is essential to recognize that the rate of progress in the elimination of rinderpest under intensive control conditions is initially rapid, but as the programs progress, the time element necessary for weeding out the isolated and remote foci of infection may be substantially extended.

The possible collapse of the rinderpest project as a result of the disappearance of CCTA would have disastrous repercussions, with governments reacting strongly to short-sighted planning. It is obviously not the sole responsibility of AID to assume the expense and management of this project. Such responsibility quite obviously rests in part with the countries involved, with European countries and agencies participating in the initial phases, and with other organizations, such as the United Nations Food and Agriculture Organization, and certain philanthropic organizations that have in large measure encouraged and supported its initiation. It is not too early for all the participants to begin planning for alternative management of this Project so

that the embryonic Fifth Commission of the OAU can be prepared to assume and carry out those responsibilities previously fulfilled by the CCTA. Delays in such planning will inevitably lead to lost ground in the campaign against rinderpest, and will jeopardize faith in inauguration of proposed multilateral projects for the control of other serious diseases such as trypanosomiasis and contagious bovine pleuropneumonia.

It is impossible to measure accurately the monetary loss that will occur if Phase II of Project 15 is allowed to terminate or stagnate. Almost certainly, a regeneration after a lapse will result in an added operational expenditure as great as that involved in the first year, namely, more than 1.5 million dollars.

Many experts believe that the ultimate eradication of rinderpest from Africa will only be possible when the true nature of the virus survival in nature is understood. The ecology of this virus disease is still not completely understood; many individuals have asserted that there is a great need for long-range research that might elucidate the characteristics of a carrier state and the mechanisms involved in transmission of the virus from a smoldering state in nature to susceptible domestic hosts.

A solution to this problem might ultimately result in effective and efficient control of this disease. It may be advisable for AID to consider supporting such a project in order to protect a considerable investment.

Trypanosomiasis

Trypanosomiasis is one of the greatest factors limiting the development and marketing of cattle in West Africa. Severe clinical manifestations of trypanosomiasis are often intensified by intercurrent disease, parasitism, or other "stress" factors. It occurs enzootically in all areas of tsetse-fly infestation, which amounts to nearly a third of the entire Continent of Africa. Permanent animal husbandry is difficult in heavily tsetse-fly-infested areas; the result is a periodic concentration of cattle in the northern tsetse-free areas, which leads to over-grazing and erosion of land, and, not infrequently, to starvation of animals. In West Africa, nearly half of the available land is uninhabitable to cattle except during the brief periods of tsetse-fly inactivity, and generally these areas are those otherwise most ideally suited to animal raising. Trypanosomiasis is also one of the greatest deterrents to efficient marketing of livestock, since tsetse infestation either periodically precludes movement of animals or causes severe losses in that process.

The West African Institute for Trypanosomiasis Research (WAITR), the Nigerian Ministry of Animal and Forest Resources, Tsetse and Trypanosomiasis Unit, and similar organizations in other countries have accomplished a great deal in tsetse-fly and trypanosomiasis research and in the establishment of pilot tsetse-fly-control programs. Application of currently known trypanosomiasis control methods would contribute much to extension of livestock development.

A great deal of money is involved in the establishment of marketing systems that include mechanical transportation of livestock or livestock products. Yet there is little evidence that any effort has been made to correlate marketing programs with tsetse-fly control despite long-standing recognition by many experts that effective movement of animals to rail heads or to population centers depends on the establishment of tsetse-fly-free corridors through which the animals can move. AID could profitably invest substantial sums in this area of investigation.

Further extensive investigation of the possible resistance or natural immunity of Ndama and other "dwarf" breeds of cattle is of questionable value in the light of past scientifically recorded investigations. Some critical experimental evidence has suggested that dwarf breeds are only partially resistant to trypanosomiasis infection, and that, when subjected to heavy fly exposure, especially under conditions of stress, they too break down with serious clinical manifestation of the disease. Furthermore, there is no consistent evidence that "non-dwarf" animals have been subjected to natural exposure under conditions similar to those to which the dwarf breeds are naturally subjected. Under any circumstances, the dwarf breeds are basically uneconomical; that is, they are low producers and slow-maturing. The average carcass weight of mature dwarf cattle (five years or more) is about 240 pounds, and their utilization as anything other than meat animals is not practical. Research effort and funds currently allocated to further development of this breed could probably be more productively used for other purposes. Some consideration might be devoted, for instance, to improved goat husbandry, since these animals are little plagued by the tsetse fly.

Attention should be directed toward planning efficient trypanosomiasis- or tsetse-fly-control programs in order that the organization can participate effectively in such ventures when the countries of this region are ready to initiate them. Basic systems for effective tsetse-fly control have been established in many areas of Africa, and these systems may well be applicable in areas of West Africa, where increased animal productivity and efficient marketing are integral parts of the AID objectives.

Tsetse-fly-control procedures on the fringes of the fly belt have been very successful, but control in the more ecologically favorable areas for Glossina Spp. require much more rigorous control measures more difficult to implement. Provision of the hoped-for fly-free corridors from the cattle-producing areas of the north to the heavily populated areas of the south where meat is needed may not be possible at the present time.

Intensive exchange of information and coordination of fly-control work is not evident in Northern Nigeria. The programs controlled by the Ministry of Health or the Ministry of Agriculture in the northern

territory of Nigeria are quite different, even though the ecological habitat and species complex is essentially the same. Both programs have been very effective in controlling the flies, but the Ministry of Agriculture program used much less insecticide and required much less time per unit of land area. The Northern Nigeria Ministry of Agriculture program is based on a selective spraying system designed for maximum effect on the particular fly species involved. Greater coordination of policy and systems would seem desirable.

Excellent research personnel have provided much valuable information on the ecology, taxonomy, and control of tsetse flies, but the widespread resignations of these highly trained scientists are leaving serious gaps in the research potential. If progress is to continue in tsetse-fly control, further studies on the ecology and feeding habits of particular species in certain areas are necessary. Retention of experienced personnel is highly important, and increased opportunity for interchange of information between research and control personnel must be facilitated.

Studies involving the sterility principle in tsetse-fly control, financed by AID research funds and implemented by the U.S. Department of Agriculture, have been undertaken recently in East Africa to determine whether they can contribute to effective tsetse-fly control. These studies should be expanded. The extension and coordination of the East African work to West Africa might accelerate the utilization of new techniques in tsetse-fly-control programs. Many areas of trypanosomiasis and tsetse-fly research are worthy of further investigation. Some of those under way at the West African Institute for Trypanosomiasis Research have, for some time, been curtailed as a result of withdrawal of funds and personnel. Consideration should be given to support of the more promising research, particularly in those areas where competent personnel are available. The possibility of including entomological research in U.S. university contracts might be considered. Such research could be accomplished at relatively little cost under the direction of a U.S.-based senior scientist, utilizing doctoral candidates to carry out necessary field investigations.

A great deal of useful, well-equipped research space exists at the West African Institute for Trypanosomiasis Research, and AID should attempt, in future program support, to encourage investigation projects of broader scope than simple trypanosomiasis studies. Such support might also be designed to encourage consolidation of work with that of the nearby Federal Veterinary Research Laboratories.

Contagious Bovine Pleuropneumonia (CBPP)

Contagious bovine pleuropneumonia is less spectacular but probably equally as serious a disease as rinderpest in West Africa, and is far less susceptible to control. It is the subject of CCTA Project 16, now

in a research phase, with the greatest current activity taking place in East Africa, supported as a joint AID-U.S. Department of Agriculture project.

One of the first necessary steps in the approach to this disease in West Africa is the application of newly developed diagnostic techniques. A workable method for large-scale, rapid serological diagnosis, using mobile field equipment, has been devised in East Africa. This system is being used intensively there, but little effort has been made to carry out similar investigations in West Africa.

Close observations of developments in CBPP research in laboratories of Vom, Farcha, and Dakar-Hann, as well as in other parts of Africa, should be maintained by AID, for the results of diagnostic and immunological research will definitely influence the practicability of future control programs. In Nigeria, where the government maintains testing systems, vaccination, controlled movement of stock, and slaughter with compensation, the disease is relatively well controlled, and any AID support for control programs elsewhere should be predicated upon the establishment of similar policies. AID should be aware that highly qualified personnel have been involved in the successful CBPP-control program up to this point. Any future maintenance or expansion of CBPP control will depend on how well the programs are organized and supervised, and upon the availability of funds, both for field services and for compensation for slaughter of infected animals. Potentialities for the economic utilization of carcasses of infected animals should also be investigated.

Research should be supported to develop effective vaccines and more efficient diagnostic tests in the reputable laboratories in West Africa. Such research is essential if future control programs of the magnitude and effectiveness of the current rinderpest campaign are to be realized with respect to contagious bovine pleuropneumonia.

Other Diseases and Parasitisms

Although the three diseases discussed above are generally considered to be of major concern, and to some degree are all subjects of CCTA projects, there are many other diseases which, either singly or collectively, take equal or even greater toll. Some of these also have a deterrent effect on current and future restrictions on international movement of livestock or livestock products. Before any area of West Africa can consider the possibility of efficient livestock production, several of these bacterial, mycotic, viral, and parasitic diseases must be controlled in some measure.

Foot and mouth disease (FMD), for instance, is as great, or perhaps an even greater, impediment than rinderpest to international trade in livestock and livestock products. FMD is not a disease causing spectacular losses in West Africa, and consequently receives little attention.

However, its significance is compounded by the existence of at least two European and two South African types in the region.

A serious disease, and one evidently increasing in incidence, is streptothricosis, a mycotic disease, principally affecting bovines, but also other animals and man. Although biting insects are suspected in its spread, their exact role is uncertain. Periods of high incidence are related to conditions of high rainfall or humidity. A great variety of treatments has been used with little success. This increasingly important disease is worthy of research attention directed toward finding the mode of transmission and devising effective methods of prevention or treatment.

Cysticercosis (larval stage of tapeworm) occurs in as much as 80 percent of the cattle in some areas. It is a definite public health problem and a serious deterrent to export of carcass meat. Its perpetuation is linked to social customs and failure to practice human hygienic principles.

Fascioliasis (liver infestation by flukes) is almost universal among West African cattle, taking a heavy toll in mortality and in weight loss and debility. In some years, the losses from this disease exceed the combined losses from rinderpest, contagious bovine pleuropneumonia, and trypanosomiasis.

External parasites, particularly ticks, generally preclude the introduction of exotic breeds. Only the most efficiently operated livestock schemes can implement measures, such as frequent dipping, to reduce tick infestation to tolerable levels. Since Zebu stock are relatively resistant to many of the diseases transmitted by arthropods, they are more suited to conditions prevailing thoughout West Africa.

Many other diseases and adverse conditions impede efficient livestock development. Some of these can be controlled, and some the indigenous animals are able to tolerate.

HUMAN AND TECHNOLOGICAL FACTORS AFFECTING PRODUCTION AND MARKETING

Systems to control animal diseases and the marketing of cattle are inseparable from the culture of the human groups which handle the animals. The techniques of handling cattle are part of the technology by which some of the human population of West Africa survive in that environment. These are techniques learned by trial and error in centuries of adapting to that habitat. Outsiders introducing new methods of improving livestock would benefit by finding out what has gone on before; for example, the Fulani herdsmen of northern Nigeria and neighboring areas, veterans at trading and breeding cattle since earliest times, have evolved at least five definite strains of cattle. The place of cattle in the lives of both herding and agricultural people has to be understood as just one part of a whole culture. Traditional economic behavior, kinship and political arrangements, religion and folklore, education and technology, notions of beauty, rank and prestige--all must be considered among the human factors affecting the success of modern efforts to control rinderpest and other diseases. Without working through the existing institutions, and attempting to see the world through the eyes of the people affected, outside administrators and technicians may waste time, money, and emotion in attempting to assist Africans to develop a more efficient livestock industry. Proper motivation as well as new forms of human organization are needed to get more protein-producing and cash-producing animals from grazing lands to markets in Africa. AID and CCTA officials working on rinderpest control can provide good case-study material to back up the proposition that one must study why people resist or accept change. If outsiders expect to convince the local inhabitants that they might benefit by such modern control measures as new biologics or quarantine, they need to understand how social change works. Merely recognizing that people are different is not sufficient; imaginative leadership from the outside will most likely come from those who do not let cultural differences provide an excuse for doing nothing or dismissing the situation as hopeless. Human behavior can be understood--and influenced.

While West African cattle may not dominate the social environment as cattle do for such East and South African people as the Akamba, the Bahima, or the Zulu, cattle provide in different degrees--for the Fulani, Mossi, and other people of the area--a point and reason to their way of life. A "cultural manual" or "check-list" for technicians working in the area should include these kinds of information pertinent to controlling disease and marketing cattle: (1) the general pattern of social organization among West African herdsmen, as well as regional variations, such as described in G. P. Murdock's chapter on the Fulani in his Africa: Its Peoples and Culture History (McGraw Hill, New York, 1959); (2) the importance of kinship as the basis for social groupings--especially as it relates to what members of the family manage livestock, how families use

land, what families consume, what they know about animal husbandry, and how they transport animals; (3) the social ties between herding peoples that explain how they work together as a group, thereby affecting the movement of their herds, range management, and marketing; (4) how traditional education systems, based on emulation of kinsmen rather than formal schooling, can provide helpful clues for discovering the channels through which new ideas and techniques flow; and (5) the nature of the relationships between herding people and the sedentary communities (e.g., Hausa, Bambara, Malinke, Mossi, Zerma, and Zoninke) through which the pastoralists move. For example, the planner and technician might take into account the kind of ecological balance between one type of Fulani and settled farmers as evidenced by: their exchanges of agricultural products for milk and butter, the farmer's hiring skilled Fulani herdsmen to tend their livestock, and the fertility brought to the farmer's fields by the transient Fulani livestock whose manure remained after they had been allowed to feed on left-overs from the harvest. Understanding such vestiges of traditional West African pastoralism, and how these vestiges can be adapted to modern times, is critical to the realistic planning of sound improvements in livestock--and ultimately, the economic health of the region. (Planners may be intrigued to deal with the problem of how to coordinate programs for culturally diverse people who exploit the same environment.)

Because of the subtle interplay between science (biological knowledge developed overseas), technology (methods of manufacturing vaccine locally), and human culture (the total way of life of the people involved), the following "technical" questions of modern livestock production will be treated here as an extension of "human factors." This should help to emphasize the importance of educating and training Africans in livestock management as a basis for controlling animal health. Finding water for animals, maintaining a water supply, introducing new grass seed, controlling breeding, and improving the techniques of curing hides and skins ultimately depend on the motives, organizational skills, and knowledge of Africans. The attention given elsewhere in this report to the importance of the quality of overseas veterinary personnel represents a short-term although vital approach to the problem of animal diseases.

Both for short-term and long-term health-control measures, it is the Africans who will decide what kind of cattle they will have, and how they will get them to market. Such decisions will be based on the political situation (how the herdsmen organize themselves vis-a-vis incorporating new techniques and regulating their economic behavior, as well as how they respond to conflict or cooperation with sedentary people--and beyond the farmers, the economic and political goals of people running the newly independent states. Besides the African equivalents of "precinct" and national politics, religious factors may play a strong role in patterning people's responses to modern ways. Chiefs or clansmen who speak with sacred authority, such as Moslem prayer leaders,

may determine the effectiveness of agricultural extension programs coming from a far-away African capital or university or a regional office of UNESCO or the FAO. No technical innovation can be divorced from questions of political, religious, or ideological concern of the herdsmen or the people who buy their products.

Management

The technology of meat production from the initial growing stage to retail or export outlet in West Africa ranks among the lowest levels in the world. The need for improvement to avoid wastage, to stimulate more efficient production, and to provide animal protein products within the economic range of the consumer is obvious. If the advantages to be obtained from disease control are to be realized in terms of an improved livestock economy, certain technological changes related to range management, livestock management, and marketing must keep pace. At this point, there is little evidence that these technological and economic developments are progressing at a satisfactory rate. In each instance, a system for integration between technology and the milieu is critically needed.

Water Conservation

Many attempts have been made to establish wells, dams, and ponds to provide water during the dry season, particularly in the Sahel, in order to reduce the necessity for ceaseless transhumance with attendant losses. But these water developments or conservation schemes are currently seldom concerned with forage development or fodder conservation, with the result that the areas adjacent are often completely denuded. The future development of the livestock industry is dependent on further expansion of water resources, but AID support for such projects should be predicated on concomitant projects defining forage development and conservation as well as stocking rates in areas affected. It is absolutely essential that overgrazing stimulated by water-development schemes be eliminated in future programs. AID has recognized the problem of balance between water development and controlled grazing, but its solution is very difficult.

Pasture Control and Fodder Conservation

The problems related to feed utilization around watering places in arid areas has been mentioned. The whole of the livestock-raising pattern is affected by feed availability. Efforts attempting to overcome feed shortages at various stages of livestock growing and marketing have so far made only a barely discernible impression. The application of demonstrated effective methods of hay making, pasture rotation, bush control, controlled stocking rates, seasonal destocking, provision of feed-holding areas on market routes, and controlled marketing have made little headway. Such programs should be an integral part of any

livestock-development program, and AID support for livestock-development schemes should require agreement by the participaing government to provide adequate legal support for effective implementation.

Breeding Programs

The development of breeding programs in West Africa is characterized by inconsistency and repetition of proven past mistakes. Insufficient attention has been devoted to selection within indigenous breeds. Breeding experiments over the past thirty years, which have shown that introduction of European breeding stock has been a failure, and have further emphasized that such stock is susceptible to enzootic diseases and other adverse environmental factors, have been largely ignored. Research has indicated emphatically that a sure practical method of improvement involves selection within indigenous breeds, combined with rational introduction of zebu bloodlines. Projects involving the introduction of dairy stock are glaringly inappropriate. Recently, a trend toward introducing frozen semen, rather than male stock, has developed. This has some obvious advantages, but the financial support for such schemes should come from local entrepreneurs, and AID support should be limited to advisory services in the initial stages of organization and training.

In other parts of Africa, breeding programs related to commercial enterprise have produced dramatic results. Some of these involve selection of indigenous breeds over a 25-30-year period; others involve maintenance of pure-bred foundation herds and cross-breeding to produce market animals. Several demonstrations of out-crossing, using Bos indicus (Sahiwal) or Bos africanus (Borano) strains, have been carried out in Africa. Some breeds of West Africa show considerable potential for improvement through selection, and appear to be useful in cross-breeding projects. AID breeding programs should be designed to take advantage of the wealth of positive information already accumulated, and expectations for effective results should be anticipated as taking not two to four years, but twenty to thirty.

The support for breeding programs dealing with dwarf-type cattle should be abandoned. These animals mature slowly and are obviously inefficient. Their reputed trypanosomiasis tolerance is of questionable value in the long-range cattle-development scheme.

Introduction of European or American dairy and beef breeds should be discouraged, for they offer little potential for hybrid vigor under African conditions, and they are notoriously susceptible to many diseases and parasitisms of Africa.

Nutrition

The problem of animal nutrition in West Africa is intimately associated with the effective development and utilization of natural

pastures. In a few areas, desirable grass species may be introduced. In addition to pasture development, adequate animal nutrition depends on controlled grazing, which implies rotational utilization of demarked areas, controlled stocking rates, and conservation of fodder. To supplement available pasturage, more effective utilization of supplemental feed, such as oil seed cakes, slaughterhouse by-products, and possibly fish residue meal, can contribute much to the delivery of higher-quality animals to slaughter points.

Overcoming the effect of dry periods and the consequent feed shortages is no more insurmountable than overcoming consequences of long winter dormancy in other parts of the world. Development of an efficient livestock industry in West Africa is dependent on successful demonstrations of fodder conservation along with other programs already cited.

In certain areas, a great deal of attention should be directed to providing mineral and trace elements for animals in order to increase fertility and reduce the consequences of mineral and trace-element starvation.

Marketing

Hides and Skins

One of the greatest wastages in livestock products in West Africa is in hides and skins. A great need exists to expand the training programs related to flaying and curing hides and skins. AID is supporting some training programs in these areas, but the resulting information and the additional programs of this kind introduced into new areas seems to wither and die. The practical application of rural demonstration areas away from major metropolitan centers, such as those commonly under way in East Africa, has apparently never been attempted. Consequently, there does not appear to be a sufficient reservoir of reasonably good-quality hides or skins to make practical the setting up of a grading system.

Meat

The production and marketing of meat in West Africa are very inefficient processes. The marketing of average meat animals takes approximately twice as long as it takes in Europe, and the animals are approximately twice the age and half the carcass weight of those in Australia or the United States. With a meat-hungry Africa, and a potential resource that can easily satisfy the regional requirement and additionally can contribute to foreign-exchange earning, such inefficiency cannot be tolerated; there are areas of Africa no more suitable for livestock production that have altered the situation and have succeeded in approaching the productivity achieved in other parts of the world.

Another fact worthy of note in the comparative production of meat is that West Africa's average annual take-off of cattle in relation to total cattle population is 7-10 percent. The comparable figure in Europe and the United States is 28 percent and over.

With these basic comparative productivity estimates established, it is clear that the livestock assistance programs for West Africa must be designed to eliminate cuases of loss, contribute to the alleviation of periodic starvation, and increase the efficiency of livestock movement to market areas. The first two problems have been dealt with in previous sections of this report. The third is more complex. It involves the regulated movement of animals either on foot or through commercial transport, and the freeing of control over market systems to develop maximum incentive for livestock production and to eliminate current losses due to shrinkage, disease, and stress factors. ~~AID pro~~grams in support of marketing must be designed to eliminate these difficulties and must not be authorized without agreement of participating governments to provide adequate legal controls and physical facilities for handling animals.

Evidence exists that entrepreneurs are willing and able to participate in marketing meat nationally and internationally if protective devices favorable to profiteers are eliminated. AID programs must be directed to assistance favorable to marketing systems with the desirable characteristics of those in Europe, the United States, Australia, and some parts of Africa. After a thorough examination of the available literature on livestock marketing, AID should initiate a study of elements where information is lacking, contradictory, or obscure. Many of the studies already completed on this subject define specific areas in which conclusive information is lacking.

The area of West Africa interposed between the tsetse-free northern cattle-growing region and the great meat-consumption areas of the coast is infested by the fly. The movement of animals through this area is a costly and hazardous undertaking. The only logical solution of this problem is the establishment of systems that will eliminate or reduce the hazard. One involves the slaughter and shipment of meat from the north to the south or, in the case of Senegal, from the east to the west, or the establishment of tsetse-fly-free belts for the trail movement of animals to market areas. Both systems are practical; one involves the development of slaughterhouses in cattle-grow'ng areas, creation of refrigerated transport, and provision of warehouse facilities at points of consumption; the other involves feasible reclamation of tsetse-fly-infested territory at costs varying from 5 to 28 cents an acre. Either of these systems is a long-range project to which AID or any other assisting agency should be addressing itself. Both systems have been demonstrated effective in other parts of Africa, no less plagued by similar conditions.

The obvious conclusion to solutions of meat marketing problems of West Africa is that programs require much more detailed long-range planning, a greater scope in country participation, and a much greater recognition of the need for regional and international correlated activity.

MANPOWER AND EDUCATION

Although the United States Government Agencies and veterinary medical educational institutions have participated in educational planning abroad for many years, and a great deal of money has been committed to support of various veterinary educational schemes, no apparent, consistent policy guidance has been established. In fact, the activities in support of veterinary educational programs appear to be conducted without regard to well-established principles and without realistic attention to encouraging the ultimate establishment of competent professional veterinary services.

It is the consensus of experts who have studied the problem that an immediate need exists for the establishment of two veterinary schools of creditable professional status, one in the English-speaking area of West Africa and one in the French-speaking area of the same region.

Apparently, AID has little or no cognizance of the principles for veterinary education in underdeveloped countries established by an international panel, formed in 1960. The panel prepared two reports, one in 1962 and another in 1963. It is not suggested here that a fixed and arbitrary pattern for veterinary education be prescribed, but that there be certain minimum requirements for faculty staffing, curricula, and student entry. It is recognized that curricula may require areas of altered emphasis from one region to another.

The need for a close association between veterinary education and allied sciences, including agricultural, biological, and medical disciplines, has been repeatedly stressed by experts. It is essential that veterinary faculties be established in association with existing universities engaged in teaching and research. AID-supported veterinary education projects have neglected consideration of this principle or considered it to be of minor importance.

In the development of regional veterinary educational systems in West Africa, plans should specifically include the initial utilization of the most competent African veterinary graduates already in the area--at least at the instructor level. An effort should be made to induce research participation by these individuals in order to ensure a flow of teachers with increased professional competence and status into the faculty. Research should be directed toward major problems of the region.

Support for post-graduate fellowships must be provided primarily for students willing to undertake studies within institutions in the region. Post-graduate work abroad should be limited to a few very carefully selected students who have demonstrated interest and competence in some phase of veterinary work within their own countries. Such a system provides a method of overcoming the prevalent desire

among students for perpetual education with no intention of becoming active in national animal-health organizations.

Considerable thought should be given to encouraging and supporting upper-class veterinary students to participate in national animal-health programs during inter-term vacations. Programs such as this would augment student experience, channel interests in future professional activity, and provide funds for school expenses.

If educational progress internationally is expected, AID must, at the earliest possible moment, convene a meeting of qualified experts to define the requisites and terms for over-all assistance to veterinary education in West Africa. Failure to establish such terms will inevitably prolong uncoordinated and inefficient educational policies--an expensive exercise for participating organizations, and frustrating to the recipients.

The suggested composition of this group of experts is shown in the appendices on page 51.

Current Status and Future Needs

Veterinary and sub-professional veterinary staff strength varies considerably from country to country in West Africa. No country of this region has anywhere near the required numbers of qualified nationals in veterinary services. Several countries do, however, have considerable foreign veterinary support and reasonably adequate staffing in the sub-professional services (i.e., laboratory technicians, animal-health assistants and vaccinators). In assessing immediate professional veterinary requirements, it must be recognized that the governments of West Africa cannot immediately absorb significantly more veterinary personnel than were utilized under the optimum colonial systems. Veterinary activities in these countries are almost wholly preventive in nature. The economics of livestock production in these areas will not support extensive clinical treatment systems in the immediate future.

Up to now, veterinarians have been educated abroad. Some countries of West Africa have, or will soon have, substantial numbers of veterinarians trained in Europe and North America, but others have few or none.

Veterinary colleges, adequately staffed, equipped, and housed--one in English-speaking and one in French-speaking West Africa--could supply the professional veterinary requirements for the foreseeable future. In the English-speaking area, the only university capable of participating in a veterinary educational program until recently has been the University of Ibadan in Nigeria. A nucleus for developing veterinary education has been established at this institution for some ten years, but there has been virtually no unified attempt to consolidate available resources for veterinary education in a central institution. Local or regional internal political pressures have diluted already limited resources. Thus, in English-speaking West Africa, there are

numerous plans for veterinary education, but none has adequate support to utilize the available human resources effectively. Adequate university-level veterinary education cannot be established without adequate staff, proper balance of research and teaching, and sufficient clinical facilities. None of the existing programs, including the veterinary portion of the Kansas State University Contract, provides these essential requirements.

The situation in veterinary education in French-speaking West Africa will depend primarily on France or French-speaking countries for support. The only adequate site for professional veterinary education in French-speaking West Africa is at the University of Dakar. The countries of French-speaking West Africa and France also have not yet solved the problem of professional veterinary education, but have relied on a system of veterinary education in European schools. This system has not produced satisfactory results; thus, careful consideration must be given to support for veterinary education at the University of Dakar, the only institution in the region capable of undertaking a professional veterinary education program.

Training and education at the sub-professional level is less critical. Countries of both French-speaking and English-speaking West Africa have established schools or training centers for animal-health assistants, laboratory technicians, and vaccinators. Unfortunately, many of these centers have given the impression, through their use of terminology, that graduates have professional veterinary capability. AID should avoid participation in any sub-professional training programs that do not specifically designate trainees as animal-health assistants, laboratory technicians, or other appropriate titles.

Training Abroad

Although it is currently necessary to educate veterinarians abroad, the policy should be abandoned as soon as professional veterinary educational institutions have been established in Africa. It has repeatedly been observed that African graduates of European or American schools are not adequately trained in veterinary disciplines suitable for direct application in Africa. Moreover, exposure of African students to cultural conditions and animal-health-protection systems of some more advanced countries often leaves them ill-prepared to cope with conditions in rural Africa. Thus, many students seek perpetual advanced education abroad or, alternatively, posts in only the major metropolitan areas of Africa. Many others seek professional or administrative employment in fields not related to veterinary medicine.

As veterinary services develop in this region, the requirement for veterinary post-graduates and specialized training will increase. To assure continuous progressive development of trained personnel, facilities for advanced training must be planned for and developed within African universities and research institutions. Only a few especially well-qualified individuals should be selected to undertake such training abroad.

UTILIZATION AND SELECTION OF PERSONNEL IN AID PROGRAMS

U.S.-Based Personnel

AID's widespread involvement in veterinary programs, and the complexities involved in staffing, funding, and servicing such programs, is well recognized. The dimensions of AID veterinary activity in some years involves direct hire of more than thirty veterinarians, continuing participation of many U.S. veterinary colleges, the development of a large number of veterinary training scholarships and fellowships, and, in an area such as West Africa, the expenditure of several millions of dollars on veterinary programs.

It is the consensus of professional organizations and individual specialists, experienced in these problems, that no organization can operate effectively in this field without the full-time services of qualified veterinarians at over-all planning and directional levels. AID attempts to operate without such personnel have not proven economic or efficient. Advice of itinerant consultants, basically preoccupied with their own specialties in the United States is inadequate.

In view of the generally accepted principle that some forms of assistance in veterinary science, education, and animal-health-control programs will be required for an indefinite period in the future, it is essential that qualified veterinarians be recruited immediately for permanent duty at headquarters-level in Washington. Proper selection of such personnel will provide a basis for realistic planning of future veterinary activities, and for establishing a corps of adequately trained senior and junior field staff dedicated to continuing career service.

Other Personnel

The numbers of personnel required for AID assignments in fields related to veterinary and animal-health projects have varied greatly from year to year. There is no apparent evidence of a trend toward decreasing requirements. Future manpower requirements must be anticipated, including AID personnel, trained nationals, and individuals from other sources. With the advent of independence and new situations, it is apparent that responsibilities for the control of disease and the efficient production of animal protein will devolve on agencies and organizations not associated with the old colonial regimes. The success of the effort is largely dependent on the quality of the technical people involved. Qualified people cannot perform successfully without adequate support.

One immediate need in Phase II of the rinderpest project is for two to four veterinarians to supervise field teams operating in

Ghana, Sierra Leone, and Gambia. Such supervisory assistance may be required also in Phase III, and the possibility of providing them should be considered immediately. These veterinarians cannot be obtained by means of CCTA funds or funds from other sources. If AID investment in the rinderpest project is to be protected, recruitment of these veterinarians--preferably young men, capable of withstanding arduous field conditions--should begin at once. They should be assigned to the CCTA project with the understanding that they are candidates for AID career appointments. AID requires a nucleus of trained, experienced people for field assignment in tropical veterinary medicine for many years to come.

With respect to personnel requirements for university veterinary educational programs, which are developed primarily under contract arrangements with U.S. universities, contracting institutions will be required to provide staff strength to meet recognized educational standards. In view of the availability of well-qualified foreign nationals, institutions must be allowed and encouraged to employ such persons.

A final point should be made concerning the recruitment and training of AID personnel. Difficulties in the implementation of the animal-disease-control program repeatedly arise from cultural factors, such as: the difficulty of inculcating new standards of sanitation among African laboratory personnel; the difficulty of communicating to the African personnel the logic behind the scientific procedures they were required to perform; the difficulty of anticipating or understanding the resistance of herdsmen and agriculturalists in cooperating with the program and the imponderability of bureaucracies in many of the newly developing countries.

Serious attention must be given to the resolution of these problems. For this purpose, the participation of an anthropologist as a consultant during the planning of future phases of the program would be advisable. It should be his task to anticipate sources of difficulty in the implementation of the program and to make available to AID personnel the information necessary to deal with such problems more effectively.

This is not to suggest that the anthropologist has ready answers for all the dilemmas posed by the implementation of such programs, but rather to emphasize that the hidden costs--in time, money, and good will--that result from failure to assess scientifically the cultural aspects of the problem, make such an addition desirable.

SUMMARY AND CONCLUSIONS

Summary

The animal-health programs in West Africa are primarily supported by: 1) the governments of the region, 2) the former colonial governments, and 3) the European Economic Community through its Fund for Economic Development. Project 15, Rinderpest Control, derives about two-thirds of its external financial support from the European Economic Community through contributions to the Commission for Technical Cooperation in Africa, and the remaining third from the Agency for International Development.

Animal health, technical training, veterinary education, research, and biologicals-production programs are supported by various organizations and agencies.

The Commission for Technical Cooperation in Africa has been the organizational structure through which many of the programs have operated. Its dissolution at the end of 1964, four years before the anticipated completion of the final (Phase III) phase of the rinderpest program, leaves continuation of the program the responsibility of the Fifth Commission of the Organization of African Unity. Decision as to whether or not the OAU, through its Fifth Commission, will carry on with the terms of reference similar to those of the Commission for Technical Cooperation in Africa will apparently be made in February, 1965. This action will also influence the future conduct of other regional programs, including those related to study and control of contagious bovine pleuropneumonia and trypanosomiasis.

AID and other organizations are involved in a number of projects, many of which are bilateral and directly or indirectly influence the rinderpest and other regional programs. These include biologicals production, range management, water development, animal husbandry, marketing, technical training, and veterinary education. Virtually all these programs impinge on the rinderpest project in some degree, and all are interrelated in the over-all objective of disease control and efficient production and utilization of livestock products. Continuing long-range planning is essential to train professionally qualified African personnel within the region, and to maintain adequate technical and scientific assistance until this manpower objective is reached. Completion of these tasks depends on cooperative support from many sources. AID is already committed to a significant share of the total burden. Fulfillment of these commitments in a creditable manner requires that AID assess the scientific requirements for current and proposed programs. Such assessment and implementation require administrative reorganization to include competent professional direction.

Conclusions

Control of animal diseases is an essential part of the livestock-development programs in West Africa, and the need for expanding animal protein food supplies will continue to be critical for the foreseeable future.

The CCTA-sponsored rinderpest program (largely supported by European countries associated with the newly independent West African states and the EEC) has been highly successful in its first phase of operation. The two succeeding phases are confronted with certain obstacles, not the least of which may be transfer of CCTA activities to the Fifth Commission of the OAU. Other problems include continuing participation of qualified personnel, provision of essential equipment, and organization of a system for determining immune status of vaccinates. These are problems which AID might have anticipated and should now undertake to meet at once.

The Study Group takes particular note of the influence of disease control on the already critical problems of overgrazing, lack of fodder conservation, imbalance in water development, and restrictive marketing. It is emphatically suggested that assistance relating to these problems is now lagging, and if the benefits to be derived from rinderpest control are to be realized, additional coordinated effort must be directed toward solving the many problems described and discussed in this report.

AID activity in supplying a further elaborate biologicals-production laboratory in Mali was unnecessary, and the current program does not assure production of reliable vaccine. Further justification, based on research and diagnostic need, is premature since adequate personnel are not available to staff such facilities. The expenditure involved in this program could have been far more effectively utilized in support to existing biologicals-production centers in the region, and to establish modest diagnostic centers.

Educational and training programs are essential if the gains in animal-disease control are to be maintained and extended; the ultimate responsibility for this lies with the new nations themselves. It is quite apparent that educational development programs of the past failed to provide a nucleus for such development, and in many respects those currently under way are seriously deficient.

Manpower to provide effective disease control until the new nations of the area are capable of providing their own human resources is seriously deficient. If AID activities are to relieve this situation, it must establish a veterinary position at headquarters-level to guide and support programs under way and those anticipated. Field personnel must be carefully selected for competence in the tasks to which they are assigned, and receive adequate professional support and direction.

It is the consensus of the Study Group that the African Bureau must have competent veterinary direction at headquarters-level, and a substantial increase of veterinary personnel in field and laboratory positions to improve progress toward objectives of programs to which it is already committed in West Africa.

This opinion is emphatically supported by the Subcommittee on Animal Diseases in Africa which reviewed and commented upon the Study Group's report.

RECOMMENDATIONS

I. It is recommended that the Agency for International Development continue its support of the CCTA-sponsored rinderpest control program (J.P. 15). The following steps are recommended:

A. That AID provide financial support for the employment of veterinary field supervisory personnel as required in the current Phase II and future Phase III operations if other agencies participating in Project 15 are unable to provide such support. (See pages 13,14)

B. That AID take immediate steps to support efficient and reliable delivery of vaccine supplies to field units through the use of courier service on commercial aircraft, and utilization of charter aircraft where necessary. (See page 14)

C. That AID, in planning future support for Project 15, anticipate interruption of vaccination schedules resulting from the inability of certain countries to purchase vaccine. Contingency funds should be established to such purposes to assure continuity of the campaigns. (See pages 15, 16)

D. That AID recognize that the determination of immune response in rinderpest vaccinates is essential. This necessitates the establishment of an effective system for testing antibody response to the vaccine in appropriate numbers of animals as an indication of immunity. Provision of improved practical serum collecting equipment, and a method of transporting samples to testing laboratories without spoilage, are essential to such a program. (See pages 14, 15)

E. That AID support those technically sound programs being formulated by other participants in Project 15 for extending a Phase IV of this Project to include immunization campaigns in Sudan, Ethiopia, and Somalia, similar to those under way in West Africa and other regions. (See page 16)

II. The Agency for International Development-sponsored programs for control of diseases other than rinderpest, and for improving livestock maintenance and marketing may be facilitated by observing the following recommendations:

A. That AID consider collaboration with other agencies or institutions to continue and expand the publications and communication systems of the Inter-African Bureau of Animal Health. (See page 7)

B. That AID support the establishment of regional diagnostic facilities as an adjunct to vaccination and other veterinary programs. (See pages 20, 21)

C. That AID review tsetse-fly-control programs now under way in northern Nigeria with the objective of selecting the most practical and economic systems for current and future projects. (See pages 18, 19)

D. That AID consider future veterinary research and investigations in northern Nigeria that might expand the scope of West African Institute for Trypanosomiasis Research, Vom, and possibly lead to a consolidation of its activities with those of the nearby Federal Veterinary Research facilities. (See page 19)

E. That AID veterinarians closely observe the contagious bovine pleuropneumonia (CBPP) diagnostic and immunologic research under way at several laboratories in East and West Africa in order that practical application of useful developments might be applied to future field control programs. (See pages 11, 20)

F. That AID recognize the necessity for long-range assistance planning involving a multiplicity of technical disciplines in livestock management in order to derive maximum benefit from a variety of projects now under way. (See pages 27, 28)

G. That AID establish a system for imparting a basic knowledge of the cultural factors governing livestock-raising practices to its technical personnel involved in assistance projects. (See pages 22, 23)

III. The proposed laboratory to be constructed in Bamako, Mali, and to be financed largely by the Agency for International Development, is not justified from a technological viewpoint. It is, therefore, recommended that consideration be given to diverting the funds assigned for construction of additional laboratory space at Bamako to more worthwhile and necessary projects, such as:

A. The establishment of regional units for the diagnosis of animal diseases (see Recommendation IIB).

B. Support for efficient vaccine distribution (see Recommendation IB).

C. Establishment of testing systems for determining antibody levels in vaccinated animals (see Recommendation ID).

IV. Implementation of all programs of disease control and livestock management and marketing will require effectively trained African personnel. It is therefore recommended:

A. That AID convene a meeting of veterinary educators to establish basic requirements and coordinate plans for future support of veterinary education programs in the region. (See page 30)

B. That AID participate only in those sub-professional training programs in which the status of graduates is clearly defined; i.e., animal-health assistants, technicians, etc. (See page 31)

C. That AID support development of specialized advanced veterinary training programs within Africa and consider only a few well-qualified individuals for advanced training abroad. (See page 31)

V. It is the opinion of the Study Group on Animal Diseases in Africa and the Subcommittee on Animal Diseases in Africa of the Advisory Committee on Africa that successful accomplishment of animal disease control, management, and livestock marketing programs supported by the Agency for International Development, hinges on the employment of veterinarians at policy-making levels for guidance and direction. It is therefore recommended:

A. That AID acquire a senior veterinary staff officer as a prerequisite to effective and economically sound implementation of the Agency's animal diseases programs in Africa. (See pages 5, 32)

B. That said veterinary staff officer have continuing access to the appropriate specialists in U.S. institutions whose combined advisory services are vital to the development and operation of sound programs in veterinary medicine.

APPENDIX A

Itinerary - Personnel Consulted and Institutions Visited

The Study Group left Washington, D.C., on July 26, 1964. The following persons were consulted on the dates and at the locations indicated:

July 27-28

Pirbright, Surrey, England

Animal Virus Re .rch Institute

J. B. Brooksby, Director

P. B. Capstick, Institute Staff

Walter Plowright, Institute Staff

R. F. Sellers, Institute Staff

G. R. Scott, University of Edinburgh, Edinburgh

Ian M. MacFarlane, Assistant Coordinator, CCTA, Fort Lamy, Chad

July 29-30

Brussels, Belgium

European Economic Community (EEC) Office

Harry H. Bell, Liaison Officer to the EEC, U.S. Embassy

Clinton L. Brooks, Assistant Agricultural Attaché, U.S. Embassy

Ralph C. Fish, Chief, European Mission for Research on Animal Diseases, ARS, USDA, Amsterdam

M. Mohrmann, Chief, Central African Agricultural Services, EEC

M. Weimar, Central African Agricultural Services, EEC

Henri Lepissier, Director, CCTA Project 15, Ouagadougou, Upper Volta (Headquarters Phase II)

Walter Plowright, Consultant to NAS Study Group, Animal Virus Research Institute, Pirbright

July 31-August 5 — Rome, Italy

Food and Agriculture Organization of the U.N. (FAO)

E. A. Eichhorn, Chief, Animal Health Branch, Animal Production & Health Division, FAO

W. Ross Cockerill, Assistant to the Director, Animal Production & Health Division, FAO

J. G. Rumeau, Chief, Veterinary Education and Research Section, Animal Health Branch, FAO

Mark H. French, Chief, Animal Production and Health Division, FAO

A. W. Chalmers, Veterinary Officer, United Nations Special Fund, Study Group on Agricultural Development and Marketing in East Africa

Hans Hofod, Dairy Branch, FAO

Robert Tetro, Agricultural Attaché, U.S. Embassy

August 6-15 — Nairobi, Kenya

Hon. William Attwood, U.S. Ambassador to Kenya

William C. Wild, Director, United States Agency for International Development, Kenya

John L. Cooper, Food and Agriculture Officer, USAI

Frank E. Moore, Livestock Advisor, USAID

Stanley Stone, Chief, East African Mission, Animal Diseases and Parasite Research Division, Agriculture Research Service, United States Department of Agriculture

Leroy Coggins, East African Mission, Animal Diseases and Parasite Research Division, Agriculture Research Service, United States Department of Agriculture

W. G. Beaton, Director, Inter-African Bureau for Animal Health (IBAH), Commission for Technical Cooperation in Africa (CCTA)

M.A.S. Lobry, Assistant to the Director, IBAH, CCTA

R. L. Wooldridge, Acting Director, Department of Veterinary Services, Kabete

R. W. Lewis, Assistant Director, Department of Veterinary Services

I. Mann, Veterinary Officer, Department of Veterinary Services, Kabete

Don Destro, District Veterinary Officer, Department of Veterinary Services, Kitale

P. E. Glover, Chief Zoologist, Department of Veterinary Services

Peter Hughes, Senior Veterinary Officer, Animal Industries

Derek North-Lewis, Artificial Insemination Service

Peter Long, Veterinary Officer, Department of Veterinary Services Experiment Station, Naivasha

Michael Blasdale, Supervisor, Dept. of Veterinary Services Experiment Station

William Bruce, Acting Chief, Veterinary Research Officer, Department of Veterinary Research, Kabete

H. Ohder, Department of Veterinary Research

D. W. Brocklesby, Acting Director, East African Veterinary Research Organization (EAVRO), Muguga

R. N. Gourley, Assistant Director, EAVRO

Jane Walker, EAVRO

W. P. Taylor, EAVRO

C. Rampton, EAVRO

Ian McIntyre, Acting Dean, Faculty of Veterinary Science, Kabete, Kenya

Peter C. Nderito, Assistant Dean, Faculty of Veterinary Science, Kabete, Kenya

Duncan Brown, Acting Director, Wellcome Foundation Laboratory, Kabete

John Burger, Wellcome Foundation Laboratory

James Smith, Veterinary Officer, Resettlement Scheme, Nyeri

Harry Carroll, FAO, Kabete

Douglas Hinde, Livestock Rancher, Nanuyki

Sir Donald McGillivary, Project Leader, UNSF Study Group to East Africa

D. Pean, Deputy Secretary, Ministry of Agriculture, Nairobi

August 15-19

Lagos, Nigeria

H. E. A. O. Odelola, Acting Secretary General, CCTA

John Williamson, AID Coordinator, CCTA Projects, USAID

Walton M. Nixon, Acting Food and Agriculture Officer, USAID

Ephriam Hixon, Agricultural Education Advisor, USAID

W. H. North, Assistant Director, Program Office, USAID

James Ford, Chief, Livestock Branch, USAID

Charles Coleman, Veterinary Advisor - Eastern Region, USAID, Ibadan

L.A. Fahlund, Veterinary Advisor, - Western Region, USAID

August 20

Fort Lamy, Chad

Hon. Brewster Morris, U.S. Ambassador to Chad, Fort Lamy

Joseph Guardiano, Program Director, USAID

Konrad Bogel, EEC Grant to Farcha Laboratory, Fort Lamy

Georges Tacher, Chief, Livestock Sector #1, Farcha

August 21-24

Kaduna, Nigeria

H. E. M. Bukar Shaib, Permanent Secretary, Ministry of Agricultural & Forest Resources, Northern Region, Kaduna

W. A. Rex, Assistant Director, USAID, Kaduna

Everett L. Headrick, Agricultural Program Assistant, USAID

John Schnautz, Veterinary Advisor, USAID

L. Larson, Livestock Advisor, USAID

Edward Kiefer, Agricultural Marketing and Processing Advisor, USAID

D. W. MacGregor, Veterinary Officer, Department of Agriculture & Forest Resources, Northern Region

R. Davis, Veterinary Officer, Veterinary Field Station, Tsetse Center, Mando Road, Kaduna

August 25

Vom, Nigeria

A. L. C. Thorne, Acting Director, Federal Veterinary Research Service, Vom Northern Nigeria

K. Nixon, Assistant Director, Federal Veterinary Research Service

Victor Smith, Federal Veterinary Research Service

Robert Harris, West African Institute for Trypanosomiasis Research (WAITR)

H. T. B. Hall, Acting Director, Livestock Assistant's School, Vom

August 26-27 — Kano, Nigeria

H. E. M. Hamzuio, Assistant Secretary, Ministry of Agricultural & Forest Resources, Northern Region

Harold J. Brooks, Livestock Advisor, USAID

Channing J. Frederickson, Entomology Advisor, USAID

Daniel Stewart, Tsetse Fly Control Officer, USAID

August 28-29 — Ibadan, Nigeria

Charles Coleman, Veterinary Advisor, USAID, Eastern Region

Charles Fry, FAO

August 31 — Accra, Ghana

H. E. Krobo Edusei, Minister of Agriculture, Accra

William Sponsler, Program Officer, USAID

Jack Walker, Livestock Advisor, USAID

Achew Frempong, Chief, Animal Health Officer

K. O. Gyening, Chief Veterinary Officer

Cecil Jackson, Director, Ghana Academy of Sciences

M. Irfan, Principal Research Officer, Ghana Academy of Sciences

K. M. Sappe, Assistant Secretary, Ghana Academy of Sciences

E. N. W. Oppong, Veterinary Officer, Ghana Academy of Sciences

September 2-5	Bamako, Mali
	Hon. William J. Handley, U.S. Ambassador to Mali, Bamako
	M. Kouyate, Deputy Minister Development, Bamako
	I. Konate, Director Livestock Development, Bamako
	Marvin Goff, Veterinary Advisor, USAID
	Felix Lapinski, Program Officer, USAID
	Thomas Bond, Veterinary Advisor, USAID
	M. Leipsig, Chief Engineer, Abattoir Construction Project (EEC)
September 7-9	Dakar, Senegal
	H. E. Karim Gaye, Minister of Rural Economy, Dakar
	H. E. Iboa N'Gom, Deputy Director of Livestock Services, Ministry of Rural Economy, Dakar
	Charles Adams, Second Secretary, U.S. Embassy, Dakar
	P. C. Morel, Chief of Entomology Service, Hann Laboratory
	B. Guilloceau, Hann Laboratory
	M. Chambeau, Chief, Microbiology Section, Hann Laboratory
September 10	Paris, France
	Henri Lepissier, Director, JP 15, Ouagadougou
	Denis Baron, AID Coordination Officer, American University

APPENDIX B-1

ADVISORY COMMITTEE ON AFRI[illegible]

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Stanford University
Stanford, California

Dr. Frederick C. Lindvall
Chairman, Division of Engineering
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NAS-NRC Staff

Dr. Wilton S. Dillon, Head
African Affairs Section

Member, Ex-Officio

Dr. Harrison Brown
Foreign Secretary, NAS-NRC

APPENDIX B-2

SUBCOMMITTEE ON ANIMAL DISEASES IN AFRICA

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Ex Officio Members:

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Dr. C. W. de Kiewiet, Chairman, Advisory Committee on Africa, NAS-NRC

Staff:

Dr. Wilton S. Dillon, Head, African Affairs Section, Office of the Foreign Secretary, NAS

APPENDIX B-3

SUGGESTED PARTICIPANTS
ADVISORY MEETING ON VETERINARY EDUCATION IN WEST AFRICA

W. R. Pritchard, Dean
School of Veterinary Medicine
University of California, Davis

D. K. Detweiler, Member FAO/WHO
Expert Panel on Veterinary Education
School of Veterinary Medicine
University of Pennsylvania

L. C. Ferguson, Member FAO/WHO
Expert Panel on Veterinary Education
Dean, College of Arts and Sciences
Michigan State University, East Lansing

G. K. Underbjerg, Department of Physiology
College of Veterinary Medicine
Kansas State University, Manhattan

Rue Jensen, Dean
College of Veterinary Medicine
Colorado State University, Fort Collins

Sir John Ritchie, Member FAO/WHO
Chief Veterinary Officer
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W. G. Beaton, Director
Internal African Bureau of Animal Health
Muguga, Kenya

Desmond Hill, Director
College of Agriculture and Veterinary Science
University of Ibadan, Ibadan, Nigeria

C. Bressou, Member FAO/WHO
Expert Panel
National Veterinary College of Alfort, Paris

John J. McKelvey, Jr., Associate Director
Agricultural Sciences
The Rockefeller Foundation, New York

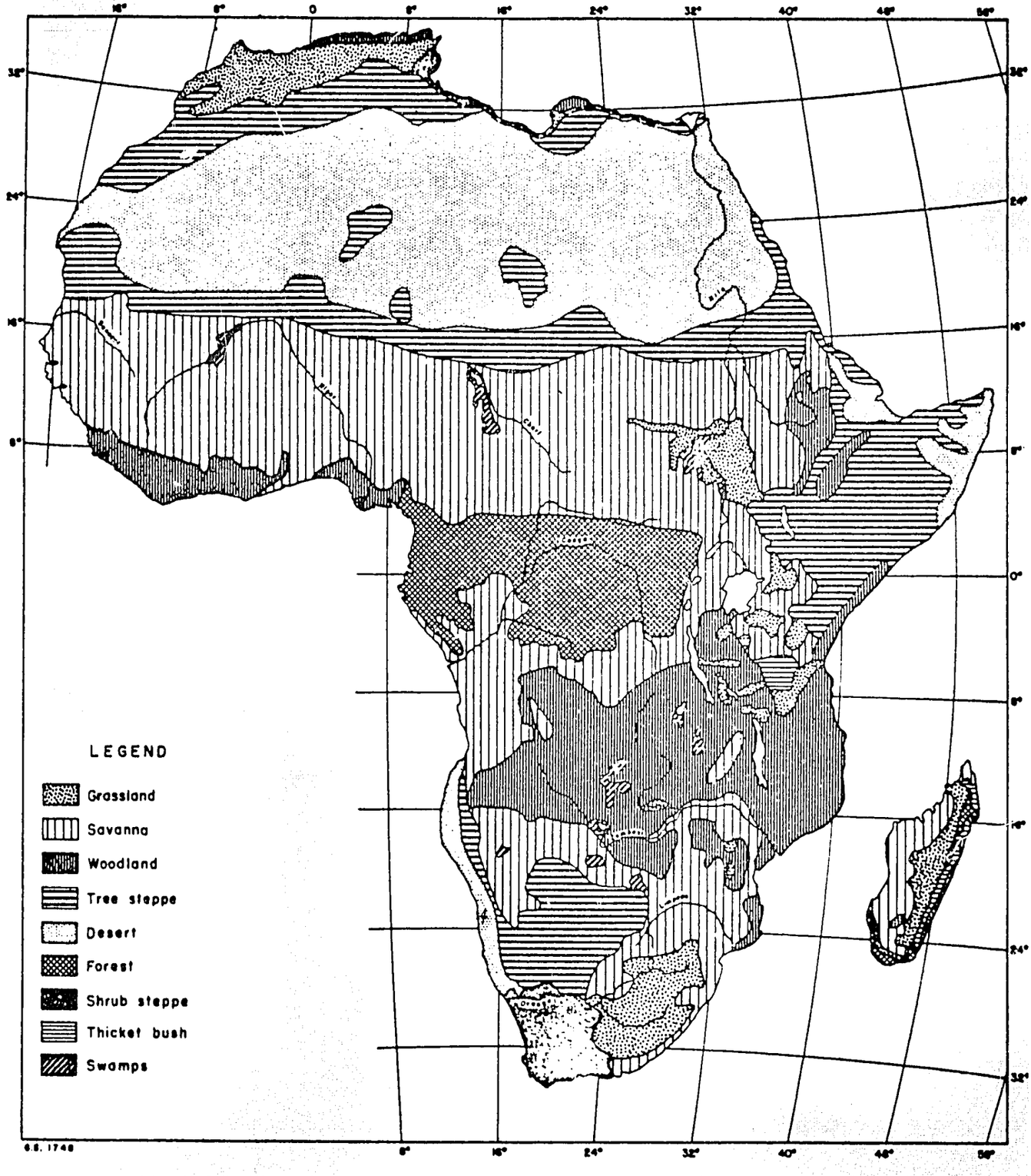
J. G. Rumeau, Section of Veterinary Research
and Education
Animal Production and Health Division
Food and Agriculture Organization, Rome

A. O. Odelola, Acting Secretary-General
Commission for Technical Cooperation in Africa
Lagos, Nigeria

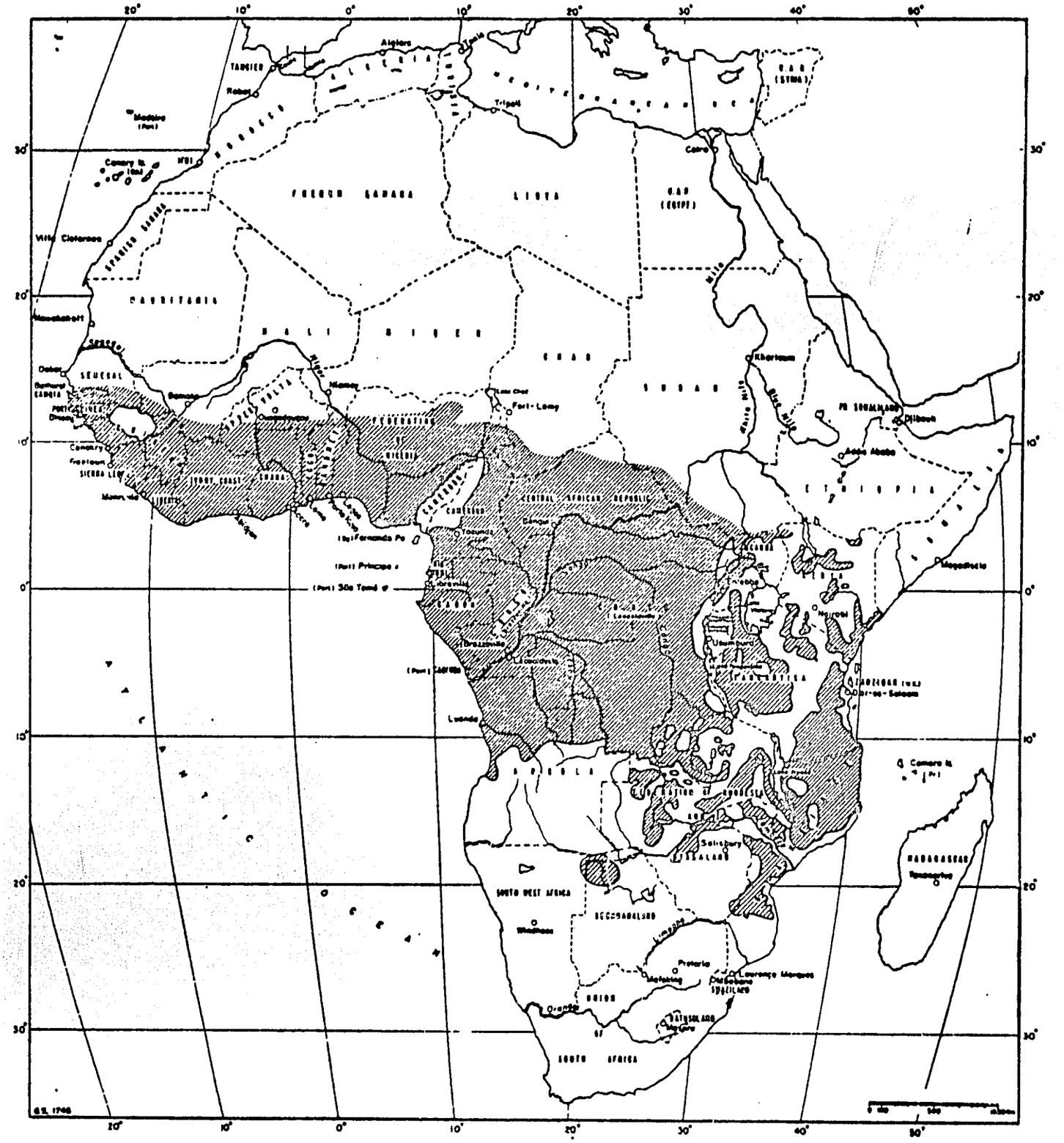
Bukar Shaib, Permanent Secretary
Ministry of Animal and Forestry Resources
P.M.B. 2012, Kaduna, Northern Nigeria

T. S. Williams, Dean
School of Veterinary Medicine
Tuskegee Institute

Map I — MAIN VEGETATION BELTS: AFRICA

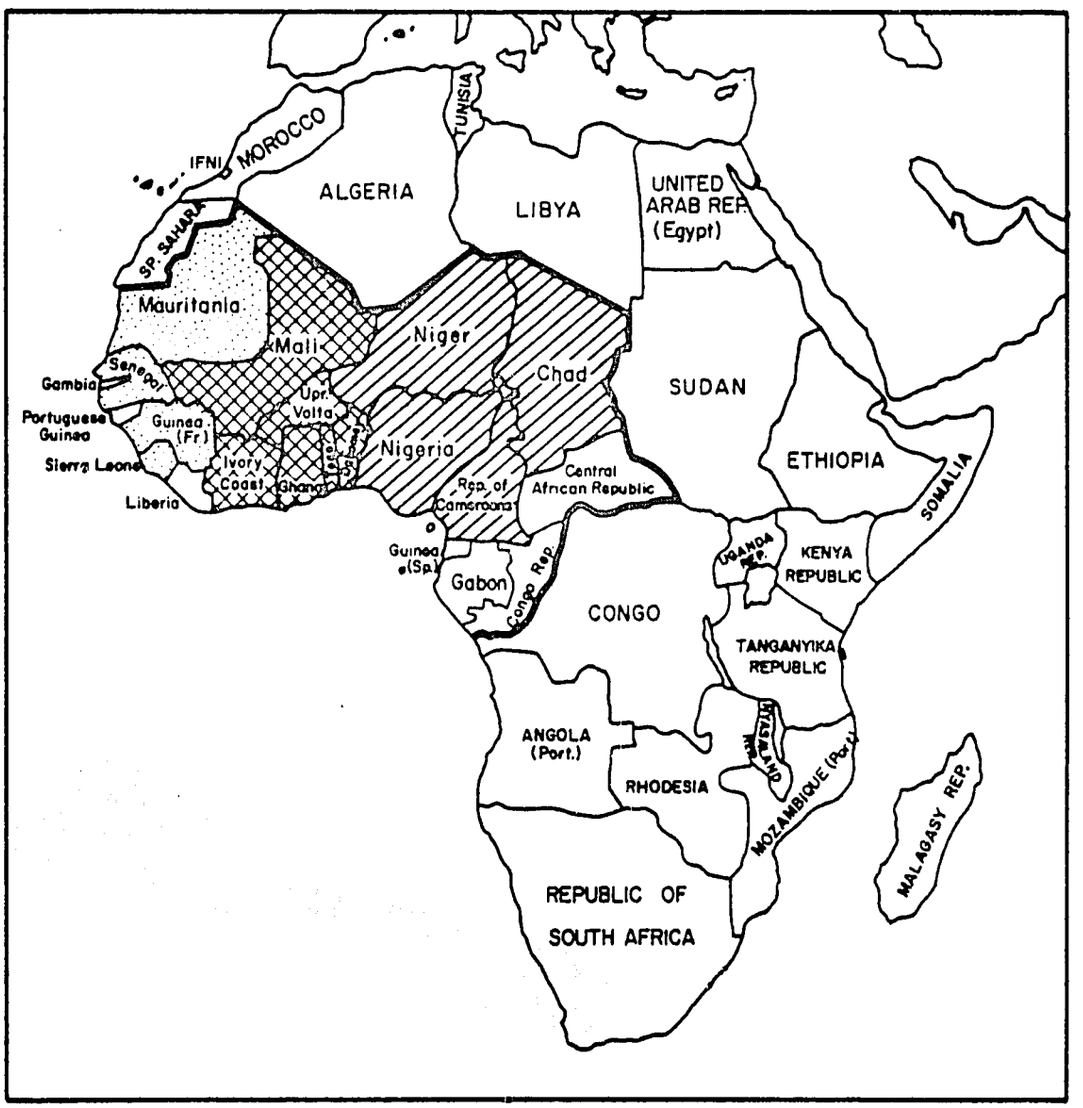


Map 2 - DISTRIBUTION OF TSE-TSE FLY: AFRICA



LIVESTOCK AND MEAT MARKETING IN AFRICA
Report of a survey by H. J. Mittendorf and S. G. Wilson, special FAO consultants and the Centre at Fort Lamy, Chad, 5-22 December 1960 -- Rome - March 1961

Map 3 - Project 15 - Rinderpest Control - Initiation of Phases

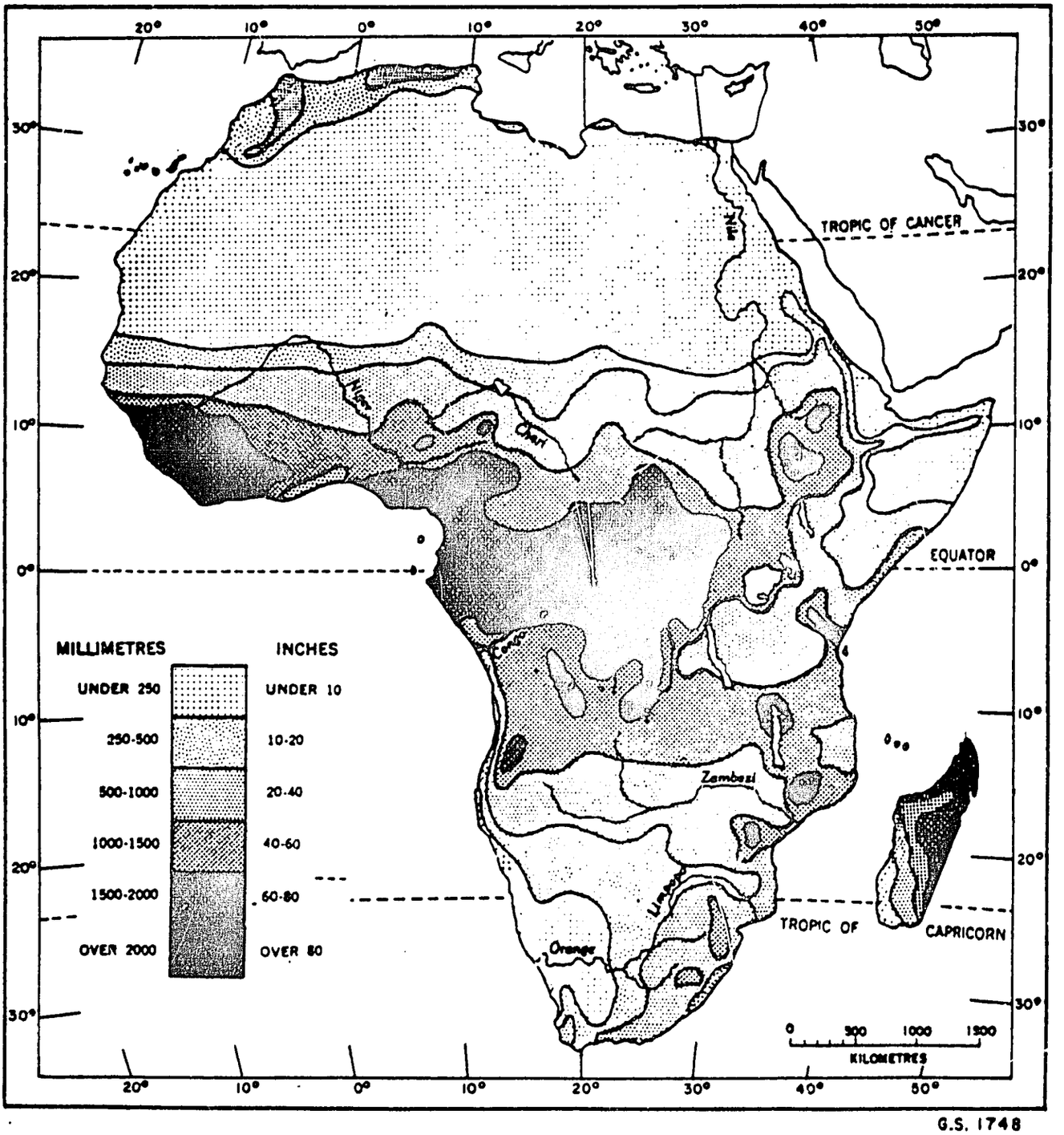


Phase I October 1962

Phase II October 1964

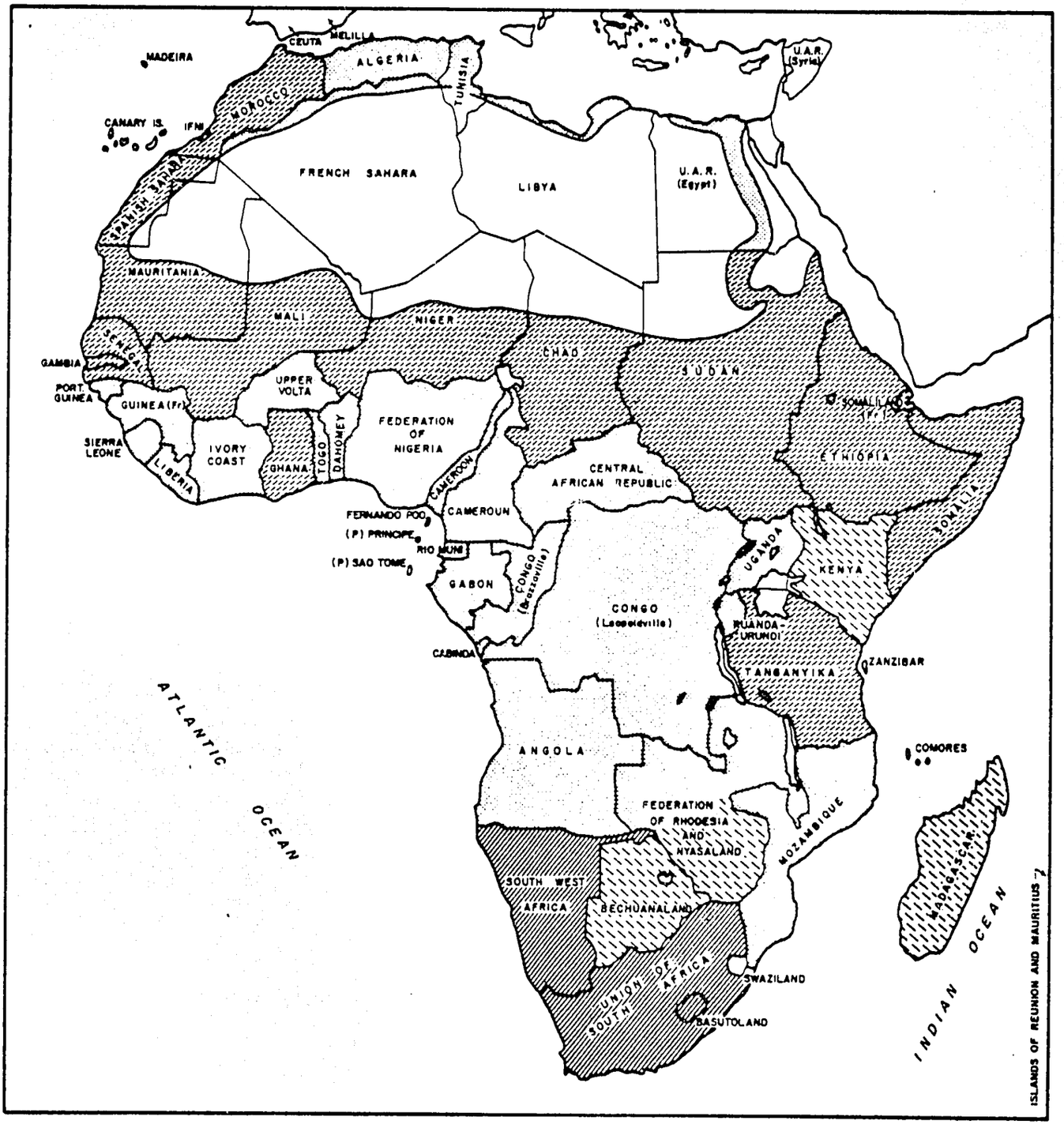
Phase III October 1965

Map 4 - AVERAGE ANNUAL RAINFALL: AFRICA



LIVESTOCK AND MEAT MARKETING IN AFRICA
Report of a survey by H. J. Mittendorf
and S. G. Wilson, special FAO consultants
and the Centre at Fort Lamy, Chad, 5-22
December 1960 -- Rome - March 1961

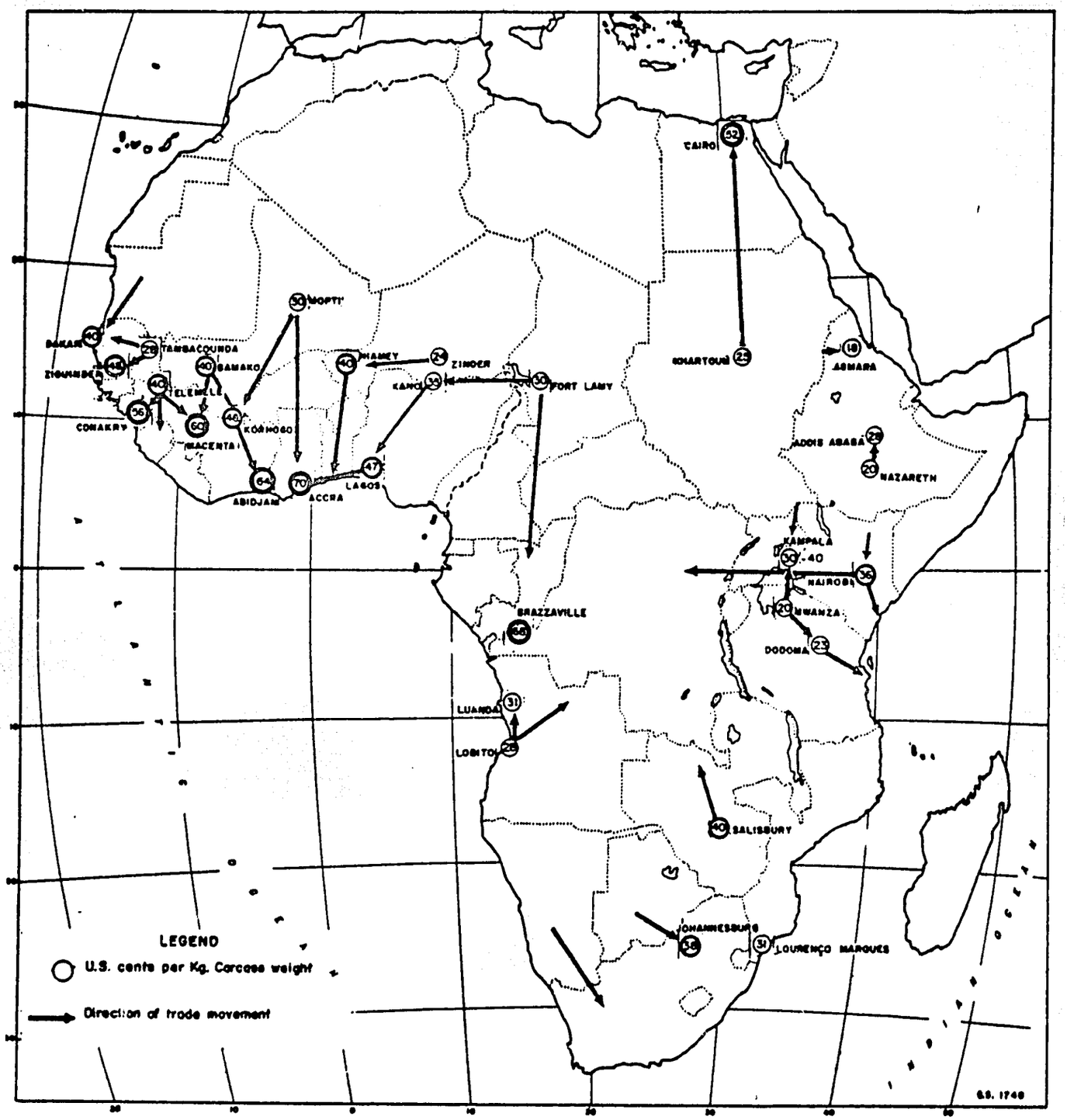
Map 5- ESTIMATED MEAT CONSUMPTION LEVELS
IN AFRICAN COUNTRIES
1957-59



< 8 | 9 - 16 | 16 - 30 | Average per capita in Kg | 31 - 40

LIVESTOCK AND MEAT MARKETING IN AFRICA
Report of a survey by H. J. Mittendorf and S.G. Wilson, special FAO consultants and the Centre at Fort Lamy, Chad, 5-22 December 1960 -- Rome - March 1961.

Map 6 - WHOLESALE BEEF PRICES & TRADE MOVEMENT: AFRICA
July - September 1960



LIVESTOCK AND MEAT MARKETING IN AFRICA
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and S. G. Wilson, special FAO consultants
and the Centre at Fort Lamy, Chad, 5-22
December 1960 -- Rome - March 1961