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TANZANIA TSETSE CONTROL

PROJECT PAPER

621 - 0144

Submitted: March 1979

Design Team:

Micharl Fuchs-Carsch, ADO
Burton Behrens, Project Manager
Rose Marie Depp, ODPO
Dallas L. Brown, PSC/Tanzania
Dr. D. Leroy Williamson, Tanga
Team Leader
Donald Ferguson, AFR/DR/AID/W

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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

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10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 -)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	370	130	500	4,100	900	5,000
(GRANT) ARDN	(370)	(130)	(500)	(4,100)	(900)	(5,000)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		178	178		600	600
OTHER DONOR(S)						
TOTALS	370	308	678	4,100	1,500	5,600

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 79 F. GRANT	E. 1ST FY 79 G. LOAN	H. 2ND FY 80 I. GRANT	H. 2ND FY 80 J. LOAN	K. 3RD FY 81 L. GRANT	K. 3RD FY 81 M. LOAN
(1) RD	121	080		500		3,200		1,300	
(2)									
(3)									
(4)									
			TOTALS	500		3,200		1,300	

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	Q. 5TH FY ___ R. GRANT	Q. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)					5,000	
(2)						
(3)						
(4)						
TOTALS					5,000	

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SIGNATURE: Horace P. Stevenson

TITLE: Mission Director, USAID/Tanzania

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1. SUMMARY, ISSUES AND RECOMMENDATIONS

A. THE PROBLEM - Trypanosomiasis in Africa:

Tsetse fly infestation (species of the Glossina genus) occurs over roughly 60 percent of mainland Tanzania and over twenty five percent of the Island of Zanzibar. Tsetse flies are the vectors of several forms of human and mamalian Trypanosomiasis (sleeping sickness in humans and N'gana in livestock). Because of the risk of disease, large areas of potentially productive range and croplands are either unused or only partially used. This has the impact of concentrating people and their livestock into dense population pockets. In Tanzania it also reduces the capacity to adequately feed the growing population and to produce an agricultural surplus for export. Continued technical development and the initiation of an operational test program on techniques which may lead to eradication of tsetse is therefore necessary.

Within Africa, tsetse flies inhabit, 11.7 million square kilometers an area more than five times larger than the total agricultural area of the United States. There are areas completely devoid of livestock despite the presence of good quality grazing land and a plentiful supply of water. An assessment of the impact of animal trypanosomiasis was made by Finelle (1974) and summarized as follows:

- area of tsetse infested zone which could be used for livestock raising: 7 million square kilometers;
- total potential population in infested zones: 140 million cattle;
- present population: 20 million cattle;
- possibility of increasing the cattle population: 120 million head;
- average productivity in Africa: 12.5 kilograms per head per year;
- additional meat production: 1.5 million tons per year; and
- value of additional meat production (on the basis of 50 cents per kilogram): US$ 759 million per year.*

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* P. Finelle, "Africa Animal Trypanosomiasis, Part IV: Economic Problems": World Animal Review, FAO, 1974, pp. 15 - 18.

The adverse effects of tsetse borne disease is clearly evident in Tanzania on the mainland. The cattle production has stagnated at a level of about 10 million head and per capita availability of meat and milk is declining, and some 40 million hectares of rangelands (excluding an extensive national park system) are little used for grazing. Even at very modest estimates of optimum stocking rates, the numbers of animal units could be roughly doubled. OnZanzibar the livestock population is declining in part due to an expansion of tsetse fly. The most critical problems encountered in developing these resources and reducing the losses in productivity and output are:

a. a shortage of trained persons to carry out pre-surveys and control programs;

b. the balancing of cost effectiveness of control/eradication methods against considerations related to environmental soundness, and

c. the shortage of finance to undertake control programs and develop the localities where eradication is achieved.

B. PROJECT SUMMARY

Over the past 14 years USAID has sponsored a research program through a Participating Agency Service Agreement (PASA) with the U.S. Department of Agriculture to adapt the technology of the Sterile Insect Release Method (SIRM) — used successfully against the screwworm fly in the southern United States — as a control method for the elimination of tsetse fly in the African Tsetse Fly Belt.

Since 1971 this research program has been carried out at Tanga, Tanzania. The Tanga Project has developed techniques suitable to African conditions for mass colonization of G.m. morsitans. Also, it has built up a colony of 60,000, the largest colony of single species of sterilized tsetse in existence. It has also developed methods of handling, sterilizing, and transporting the tsetse flies to the field site at Mkwaja Ranch.

The Sterile Insect Release Method itself has no adverse environmental effects. Indeed, used together with a traditional spraying technique, it can reduce the amount of insecticides required by as much as 60 percent. Additionally, it can be used together with a non-residual insecticide spray which is relatively non-harmful to the environment to eliminate a tsetse fly population. In essence, it is the most promising complement to traditional control methods for eradicating tsetse with minimum adverse impact on the environment.

The purpose of this project is to eliminate tsetse on Zanzibar by demonstrating the technical and economic viability of SIRM as part of an integral chemical and biological tsetse fly control program, appropriate for Africa.

An isolated test site is prerequisite to conclusive proof of total population suppression on an experimental basis with SIRM. Zanzibar because of its natural water barriers contains this essential characteristic. Also it has only one species of tsetse fly. No other known area with the test site characteristics of isolation and single laboratory colonized species population exists. Zanzibar thus provides an ideal test site, and Tanga provides an ideal base to support field operations.

The project will be divided in two phases of about two/three years each. In the first phase preparation for the Control Program will be made with existing facilities at Tanga and nearby Mkwaja Ranch. The control program will be undertaken in the second phase. Phase I activities include:

a) field surveys in Zanzibar to determine location distribution and densities of G. austeni, the nature of their habitat and the extent of trypanosomiasis on the Island;

b) design adaptation and field testing at Tanga and Mkwaja Ranch of aerial fly release methods, membrane feeding techniques, alternative insecticides, dosage rates and methods of application, and improved field surveying and monitoring techniques. To further reduce costs it is anticipated that new techniques will be developed and tested which will make it more economic to rear and maintain fly colonies in the field;

c) rearing at Tanga of a colony of surplus sterile males of G. austeni for release during Phase II;

d) rearing and maintenance of surplus sterile males of G. morsitans to continue field testing at Mkwaja Ranch near Tanga Center; and

e) further on-site and overseas training of Tanzanians.

These activities will establish the preconditions for a control program on Zanzibar. The actual time required for completion of Phase I is dependent on the number of sterile males needed to control the wild tsetse population on Zanzibar. This number is dependent on the size, density and distribution of the wild G. austeni population, as well as the effectiveness of initial insecticide applications. These sprayings are necessary to achieve a manageable and economic

ratio of sterilized to wild male flies to eradicate tsetse with SIRM over a desired time frame. Consequently, Phase I activities could be completed within 18 months or may extend over a three year period until all the conditions for a successful Phase II are fully in place and until survey results in Zanzibar yield more precise estimates of the important parameters of the control program. For this reason this document seeks approval and authorization of funds for Phase I activities only.

It is proposed that this Project Paper will be amended to seek additional approval and authorization of funds to finance Phase II, the control program, when Phase I preparations have been completed; the conditions for successful field operations are fully in place; the parameters of Phase II are more precisely defined; and Phase II costs can be more precisely determined.

Phase I activities will cost about US$5.0 million over three years or US$2.7 million over 18 months and will be grant funded.

Major AID inputs for Phase I include:

a) approximately 20 person years of long term technical assistance;

b) approximately 25 person months of short term consultant services;

c) 12 years of training for three participants at the B.Sc. level in entomology and parisitology;

d) on-the-job training for veterinarians, laboratory staff, research officers, survey teams, and other Tanga and Zanzibar personnel;

e) construction and equipping of a field laboratory/office on Zanzibar;

f) various commodities including vehicles, trucks and operating costs;

g) total financing (foreign exchange and local cost) of all Phase I activities on Zanzibar Island.

The major TanGov input for Phase I will be about US$ 600,000 to help finance recurrent and capital development expenditures at the Tanga Tsetse Research Center.

The major short-term benefit of this project will be the control of tsetse on Zanzibar. The long-term benefit will be a proven cost-effective environmentally safe and appropriate complement to the total

arsenal of tsetse control techniques in Africa. The successful replication of SIRM in Tanzania and other regions of Africa on a broader scale with other control methods will depend on joint programming with other donors to maintain barriers and to foster optimum patterns of land use in opened regions.

C. ISSUES:

1. Scope of Project:

The scope of project purposes and range of activities have been discussed at considerable length both in AID/W and within the Mission.

The activities proposed for this project have ranged from rearing G. pallidipes and G. morsitans to range management bush control veterinary services, full scale livestock development and land use planning on Zanzibar. The Mission believes that all of these activities are essential in the long-run and that they will indeed be undertaken with or without AID or other donor assistance. In the short-run, however, and bearing in mind the lessons, direction and momentum gained from work at Tanga, it is essential that the purpose and components of this project are brought into proper balance with the practical and immediate requirements of a successful tsetse control program, particularly on Zanzibar. For this reason, it is essential that the secondary project purpose — to prove the operational feasibility and cost effectiveness of SIRM under actual field conditions — not be interrupted so as to preclude development activities of other donors on Zanzibar or with development projects that may be proposed by AID for Zanzibar in the future.

2. Environmental, Social and Economic Analyses:

The analyses contained in this document are preliminary in nature. The proposed activities in Phase I are further technical developments, feasibility assessment and surveying. All these activities will lead to the opportunity for AID/W, USAID/T and TanGov to participate in the decision regarding the most reasonable manner of proceeding with Phase II on the basis of economic, social and environmental considerations. Provision has been made for various services of short-term consultants in Phase I to fully develop and resolve these problems.

3. Level of Technical Assistance:

A major project cost is for expatriate technical assistance, including a mechanic who the Mission considers crucial to project success. After consultation with the PASA team at Tanga and Dr. David Dame of USAID/Ag. Research Station, it is recommended that the level of technical assistance requested herein be approved. Tanzania does not have adequate numbers of adequately trained scientists and it is thus

necessary to provide a relatively high number of technicians.

4. Commodity Support:

A waiver for seven Land Rovers has been requested. Previous waiver requests have been approved for USAID/Tanzania on the basis of special circumstances. The Mission recommends the waiver request justified in Appendix H be approved.

5. Evaluation of Current Research:*

A final project evaluation by the Research Advisory Committee (RAC) was scheduled for February of this year. The purpose of the evaluations was to assess the potential of SIRM as a complement to traditional tsetse control methods. The RAC team has not been fielded due to limitations on travel funds. Without an endorsement from RAC it is difficult to assess the technical feasibility of the proposed project. However the design team reviewed progress at Tanga in mid-1978 and concluded it was reasonable to expect a favorable review from RAC. The Mission has requested AID/W assistance in fielding this team, but to date no action has been taken. The constraints of time, i.e. the necessity of recruiting replacements for the technicians leaving Tanga requires that the PP be submitted at this time.

6. Project Phasing:

Although the project has been divided into two phases this does not mean that the control program will not be undertaken. Approval of the entire project, Phase I add II is requested, however authorization of funds for only Phase I is sought. Phase I activities are designed to prepare for the control program on Zanzibar. It is found that Phase II can be initiated after 18 months, rather than 3 years, the remaining Phase I funds should be sufficient to initiate Phase I whose total annual costs should be about 25% above those of Phase I. This Project Paper will be amended after the first year or at such time that Phase II costs and implementation can be more precisely defined, to seek authorization of funds for Phase II.

D. RECOMMENDATIONS FOR THE ASSISTANT ADMINISTRATOR

1. That you approve Phases I and II of the Tanzania Tsetse Control project and authorize a grant to the United Republic of Tanzania from the Agriculture, Rural Development and Nutrition Appropriation in the amount of $5,000,000 for Phase I activities. (PAF II Contained Appendix L.)

2. That you approve a waiver for the purchase of seven non-U.S. source/origin (Code 935) four-wheel drive vehicles and spare parts. (Justification contained Appendix H.)

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* State cable has advised RAC evaluation will be held the week of March 12, 1979.

3. That you approve the Initial Environmental Examination. (See Part III.C. of the Project Paper.)

II. DETAILED PROJECT DESCRIPTION

A. Background - AID Sponsored Research

In 1964, a USAID research program through a participating Agency Service Agreement (PASA) with the United States Department of Agriculture (USDA) began to pursue research on the Sterile Insect Release Method (SIRM) in Rhodesia. The results of this initial research effort were promising when 98% control of Glossina morsitans was accomplished on a small island in Lake Kariba. Research was discontinued for political reasons, however, the success appeared to warrant further work to perfect techniques for rearing flies and ultimately to conduct a large scale field trial to test both the efficiency and economics of the sterile male technique against flies in Africa (Dame and Schmidt, 1970). In 1971 the locale of the research effort was shifted to Tanzania through a PASA with USDA under the centrally funded DS/AGR project, "Research on Sterility Methods of Tsetse Control (931-0072)". In 1972 work began to develop a tsetse rearing facility at Tanga, Tanzania, in order to demonstrate on a modest scale, the potential for the use of SIRM under non-laboratory conditions against one of the most economically important and prevalent species, G. morsitans morsitans.

The Project at Tanga was designed with three main objectives:

Short-range: to construct a mass rearing facility and develop techniques for mass colonization of G.m. morsitans (completed in 1976).

Intermediate Range: to expand viable fly colonies to produce excess insects for studies on sterilization, packaging, release, and ecological studies as well as to supply a large scale field trial of the SIRM (completed in 1976).

Long-range: to suppress or eradicate G.m.morsitans in a 100 square kilometer test area in accordance with project design to determine the validity of the concept. This objective will be demonstrated by March 1979. The final review of the parent project was planned by DS/AGR for late February 1979. (See Project Issues, Part I.C.)

Schievements include: (1) the completion of laboratory facilities containing a mass reared colony of 60,000 G.m.morsitans, the largest tsetse fly colony in existence (short-range goal), the testing of irradiation, packaging, transport and release techniques for field release trial (intermediate goal), and as part of the long-range objective the field release phase which began in December 1977 was completed achieving 98% control of G.m. morsitans at the test site.

In addition, over 100 Tanzanian nationals have received on-the-job training in the various facets of field and laboratory research under the guidance of five expatriate advisors. One Tanzanian has returned

from the U.S. with a M.Sc. degree in entomology, and a woman will complete an M.Sc. in entomology in 1979. Another man is presently in the States studying toward the B.Sc. degree in entomology.

The object colony of 60,000 G. m. morsitans was reached well in advance of the field release phase. Sufficient host-animals (650 goats and 90 rabbits) are available to supply daily blood meals for the fly colony. The colony output at full strength is approximately 1,000 sterile male flies/day for field release at the test site, Mkwaja Ranch, privately owned by Amboni Limited. Isolation of the test site to inhibit ingress and egress of G. m. morsitans involved construction of a one kilometer-wide, shear-cleared barrier. Barrier construction has been completed and its effectiveness is being tested by monitoring the movement of marked flies released inside and outside the study area. It was necessary to reinforce the barrier by selective application of insecticide in a 300 meter band around the outer barrier perimeter.

Since January 1976, studies on behaviour of sterilized flies in the field and surveys of population dynamics of the field fly population and trypanosomes have been undertaken. The site received two aerial applications of a non-persistent insecticide to reduce the population of G.m. morsitans prior to the release phase of sterile males. Had the SIRM technique not been employed, up to four additional applications of insecticide over a four month period would have been required. Theoretically, an initial ratio of three sterile males to each wild male in the population will result in eradication over a 12-month period. The technique is currently being evaluated in detail. The project is now on schedule with good prospects of success by March 1979.

Because the parent projects have been centrally funded research activities, technical evaluation of the research conducted under these projects with emphasis on the progress toward the applied use of SIRM in tsetse control and trypanosomiasis eradication was undertaken as part of the design teams activities in July 1978. The terms of reference for the evaluation and for the design team are included in Appendix J.

The evaluation team concluded that there is an excellent probability that the Tanga based research will demonstrate that SIRM is technically feasible for use in eradicating G. m. morsitans. It will not result in an eradication of the disease from the ranch herd because only one of two vectors of trypanosomiasis found on the ranch is now subject to the SIRM technique. Further production and release methods remain labor-intensive with the cost per fly released being about 22 cents. While the SIRM technique is expected to be shown technically feasible, (thus justifying further trials using this technique such as those proposed on Zanzibar) additional technical developments are required on less costly methods of feeding flies, fly release systems, and on rearing techniques for other species of tsetse fly before SIRM can become a cost effective complement of tsetse control.

B. Purpose and Goals Statements

The purpose of this project is to eliminate tsetse on Zanzibar by proving the operational feasibility and cost effectiveness of the sterile insect release method (SIRM). As explained earlier, this will involve additional technical developments at the Tsetse Research Center at Tanga and preparations for a control program of single species of tsetse fly. This project purpose supports the USAID Agricultural and Rural Development Program goal as set forth in the Country Development Strategy Statement submitted in January 1979, "USAID Tanzania proposes to undertake those projects which accelerate the transfer and adoption of improved and appropriate technologies, services and systems which will benefit the rural poor". Phase I of this project will provide funding for the Tanga Tsetse Research Center to continue work on lowering rearing costs, testing methods of aerial release of the sterile male pupae, testing insecticides and lowering costs of rearing of tsetse species. Phase I also includes surveying for the distribution of density and habitat of G. austeni and diagnosis of the extent of trypanosomiasis on Zanzibar. During Phase I authorization of funds will be sought for the Phase II control program on Zanzibar. Successful accomplishment of these objectives could lead to a technology which would offer an environmentally sound and cost effective technique which could be used as part of the tsetse control program on mainland Tanzania and other regions in Africa. Control of tsetse fly would provide an additional land base for agricultural and livestock development and control of human sleeping sickness, thereby improving health and facilitating livestock development.

C. Project Outputs: Phase I

To achieve Phase I objectives it will be necessary to provide the following:-

1. Persons trained in tsetse survey/research, and eradication techniques are needed to create an effective tsetse organization. Most training of local staff will be on-the-job with experience being acquired during the survey and ecological studies and insecticide spraying trials. Undergraduate training is planned for three persons in entomology and parasitology. These individuals will form a cadre of Tanzanian nationals with practical experience in scientific and managerial procedures to assume responsibility for continuing trypanosomiasis research and control program.

2. An office/laboratory facility is needed on Zanzibar for the diagnostic surveys and proposed control program.

3. A baseline survey will be completed which will precisely define and map the distribution of G. austeni on Zanzibar. The incidence of trypanosomiasis throughout Zanzibar is not precisely known and must be determined prior to any tsetse control activities.

It is necessary to provide current data on the incidence of omiasis throughout Zanzibar as an aid in determining the ce or absence of G. austeni in various areas and its seasonal ibution and density. As the cattle on the Island are relatively seuentary, the findings would be of value in helping to determine presence or absence of G. austeni in various areas. The seasonal variations in disease incidence could assist in determining the permanent hot-dry season habitats of the fly. Certain information and data already exist including excellent aerial photographs of the Island, taken in October 1977 and vegetation maps based on the aerial photographs which are being prepared by the Department of Overseas Surveys, ODM, London. Such photographs and maps would be essential both for tsetse surveys range management and land use studies. These photographs and maps should provide an accurate method of identifying all probable tsetse habits.

4. An epidemiological survey of trypanosomiasis on Zanzibar will be needed to determine the incidence of trypanosomiasis and other diseases transmitted by biting flies, ticks and other vectors in livestock.

Determination of the infection rate will be done by observations of animals for clinical signs of the disease and by examination of representative blood smears and serological tests from random samples of up to 10% of the livestock in each locality with known tsetse fly infestation. The laboratory/office facility on Zanzibar will serve as the headquarters for this operation.

5. Mkwaja Ranch and Tanga Tsetse Research Center Activities

Activities at these sites will include development of a breeding colony of G. austeni for use in the proposed tsetse/trypanosomiasis control campaigns on Zanzibar Island, more cost effective feeding, pupae and fly dispersal and rearing techniques, and a recommendation for insecticide application. To achieve these objectives it will be necessary to:

(a) Complete G. m. morsitans releases on Mkwaja and continue monitoring;

(b) additional tests on aerial methods of pupae or mature fly release;

(c) establish a breeding colony of G. austeni at Tanga;

(d) conduct membrane feeding trials and test other low cost rearing techniques; and

(e) determine which insecticides including application methods and dosages should be used on Zanzibar; and

(f) conduct an environmental assessment.

These activities are an outgrowth and continuation of activities initiated in the parent projects. The proposed project provides for an overlap in time of the senior research staff to assure that no break in the activities occur.

(a) Release of Sterile Male G.m. morsitans at Mkwaja Ranch

Emphasis must be given to the continuation of the present programme of releasing sterile made G. m. morsitans at the Mkwaja Ranch. It is anticipated that the objective of suppressing the population of this species on the ranch will be achieved by February/March 1979, but it may be necessary to continue releases for a few more months in order to conclusively demonstrate that effective control has been achieved. The decision on when to stop releases and initiate other activities on, say G. austeni must be left with the present project leader or his successor. Even after releases have stopped, fly rounds at the ranch should continue to determine the rate of reinvasion of G. m. morsitans for roughly 18-24 months. In the interim period prior to the build up of the G. austeni colony, surplus sterile males will be used in conducting studies of alternative release methods and the use of SIRM in maintaining the tsetse barrier around Mkwaja Ranch.

(b) Refinement of Aerial Methods for Release of Sterile Pupae or Flies

Before the present rearing operation for G. m. morsitans is discontinued and prior to the need for full production of G. austeni for release on Zanzibar, it would be appropriate to use the disposable surplus of pupae to determine whether alternative and less costly methods of dispersing sterile males can be developed. At present this is affected by four-wheel drive vehicles as far as possible on the ranch then on foot to release stations located throughout Mkwaja Ranch. This procedure would not be feasible if larger areas were to be covered. Aerial release systems have been developed for sterile males of other insect species and there would be many advantages if such a system could be used for Glossina. Technical Developments in packaging and aerial release methods might appropriately be conducted in the period immediately following the termination of the land release of a sterile males at Mkwaja Ranch and prior to the need to concentrate on production of the G. austeni colony. For this activity, the use of a specially equipped light fixed-wing airplane would be required. If successful, the technique could be evaluated for possible use in the Zanzibar control program.

(c) Rearing of G. austeni for Release on Zanzibar

The principal development activity at Tanga over the first 18 months of the proposed project will be the establishment of a productive colony of G. austeni for Zanzibar. The technology for rearing G. austeni is nearly identical to that of G. m. morsitans and G, austeni which are being successfully reared on artificial membranes at the Langford Tsetse Research Station of the ODM/University of Bristol,England. Full production of G. austeni could be required for Zanzibar Island release for a period of about 18 months, following the completion of pre-eradication surveys and investigations on Zanzibar. Following these surveys a decision on the precise way to proceed with the control program on the Island will be made. It is the judgement of the design team that a positive decision as to the technical feasibility of tsetse control in Phase II is highly probable and that the G. austeni colony at the Tanga Laboratory should therefore be programmed to be fully productive roughly 12 months following the initiation of the surveys on Zanzibar. An output of the Project will be demonstration of the feasibility of large scale rearing of a tsetse species for release programs under actual field conditions with simple equipment. However, even if there are no breakthroughs over the first two years of the project in the mass rearing techniques, the present output of Tanga (roughly 1,000 pupae per day) should be adequate for the proposed use of SIRM on Zanzibar.

(d) Membrane Feeding Trial

Presently at Tanga the flies are fed on live host animals (650 goats and 90 rabbits). Maintaining disease-free and healthy animals in enclosed quarters is a burden on scientific personnel and injects an element of risk in the fly-rearing program. Also host-animal feeding is an expensive method, being labor-intensive and requiring air and humidity controlled buildings for their maintenance. A third drawback is that it restricts a significant expansion of fly colonies. Techniques for rearing G. m. morsitans and G. austeni on whole or modified blood on artificial membranes have been developed at two laboratories in Europe, at Langford, England and the FAO/International Atomic Energy Agency (FAO/IAEA) Tsetse Research Laboratory near Vienna, Austria. An objective of this activity will be to determine if such existing systems could be directly transferred to Africa or whether they must be modified for African conditions. The major constraint is expected to be an appropriate source of blood or blood substitute. In Europe adult flies and pupae comparable in size and weight to native wild flies have only been maintained on a modified fresh pig blood diet. Suitable sources of pig's blood are not available in Africa. Experiments are underway to develop a fresh dried product which could be meanufactured for shipment to Africa. The Tanga Research team is also working on a technique to use blood cycled through a membrane and returned to the donor animal. Initially it is proposed to convert a small insectory associated with the rabbitery into an experimental membrane feeding unit. Depending on upon progress made in adopting this technique, a decision may later be taken to convert one or more of the three insectaries to this method of rearing. This will reduce costs considerably by decreasing the live goat herd now maintained to feed flies. If not feasible from a scientific perspective, it will be necessary to continue to maintain the goat herd at present strength.

A second consequence would be that the production of sterile males could not be expanded greatly, and the entire production capability of the Tanga station would be required to produce G. austeni. It should be noted that both G. austeni and G. m. morsitans are being reared in Europe on membranes and it is believed that membranes and irradiated males would be competitive with native wild flies. This fact would need to be confirmed in the initial stage of the project on Zanzibar and at Tanga. Scientists who will be concerned with this work should visit both the Langford and FAO/IAEA laboratories for approximately 2-3 weeks to become familiar with the methods and equipment being used. This is a key component as fewer host animals and considerably less space would be required to rear an equal number of surplus males for release. SIRM is not likely to become economically feasible, especially for the simultaneous control of rearing more than one species until this technology is perfected. Roughly 650 goats are required for daily feeding of the 60,000 fly breeding colony currently in place in Tanga. A reduced number of goats (perhaps 200) would need to be maintained as a back-up feeding system for the breeding colony and for other experimental purposes.

The Tanga laboratory will also examine and test the feasibility of other technologies that could reduce the cost of rearing. For example, it may be possible to construct an insectory which requires no mechanical control of humidity and temperature. Thus one corallary objective of the work at Tanga will be to increase cost effectiveness of SIRM technologies through a variety of test, trials and adaptations.

(e) A recommendations based on Phase I Research regarding an appropriate pesticide, the dosage and method(s) of application will be made.

While it is believed that aerial application of the insecticide is the only practical approach this assumption will require further testing.

It is recommended that a specialist experienced in all spraying applications methods that have been employed against *Glossina* elsewhere should be employed to advise on the most appropriate suppression or eradication techniques to be used in the ecological circumstances on Zanzibar. The person employed should be given access to the PP and other reports and should visit Zanzibar soon after the survey has determined residing locations of the fly at different periods, so that adequate time is available for arranging appropriate air spray trials. The insecticide application specialist should take into account a variety of factors when determining the most appropriate techniques to be used. The type and resting locations on the vegetation occupied by *G. austeni* and meteorological conditions during the hot-dry season would be particularly important.

(f) An Environmental Assessment (EA) will be Conducted near the end of Phase I

The EA will examine the potential ecological impact of the proposed control program on the Island of Zanzibar. One of the objectives of Phase I will be to assess the best methods to be used in conjunction with SIRM to ensure the control of *G. austeni* while at the same time keeping contamination of the environment to a minimum. Consultants who have had experience in monitoring eradication schemes in other African countries will be requested to monitor the effects on a limited number of non-target organizations during the insecticide trials and eradication phases. The University of Wageningen, Holland, and the Centre for Overseas Pest Research, London, both have experience in this field. It is considered that the most critical area is in the western portion of the Island where *G. austeni* occurs in areas of settlement and cultivation.

Phase II

After successful completion of Phase I, USAID will request authorization of funds for Phase II to undertake the control program. It is estimated that this phase will require approximately three years. USAID cannot at this time accurately estimate costs, since Phase I results will determine many factors which will affect funding requirements; however it should be approximately the same as Phase I with additional requirements for insecticides and aircraft rental.

D. Inputs by USAID

1. Technical Assistance - Tanga

Implementation of the activities detailed in the project description will require an expansion of the technical assistance team from that of the parent project at Tanga. The composition of the present technical assistance team for the Tsetse Research Center and the Zanzibar activities are summarised in Table 1.

The technical assistance team at Tanga will consist of an entomologist who will be the Tanga Team Leader, a Field Entomologist; plus an additional Research Entomologist; a Veterinarian and a Tsetse Fly Rearing Expert from the FAO/International Atomic Energy Administration, Laboratory, Vienna, Austria; a Training Officer; and a Mechanic.

The team leader at Tanga will serve as the manager of the Center and would be expected to provide overall technical guidance for the activities on Zanzibar. The Tanga team is required to carry out the following activities:

(a) Monitor G. m. morsitans on Mkwaja Ranch to gather data on rate of return/buildup of the fly population.

(b) Develop an aerial fly/pupae release method, making trials with both pupae and adult flies.

(c) Conduct irradiation and other tests to determine the effects of sterile male vigor and longevity.

(d) Develop less costly feeding methods and rearing techniques for African conditions.

(e) Develop a variable colony of G. austeni to be used in the release program on Zanzibar. The infrastructure used to develop the G. m. morsitans colony will be utilized for this purpose.

(f) Carry out highly controlled testing on Mkwaja Ranch to test and evaluate different types of insecticides, dosage, and application techniques.

(g) Monitor and evaluate all SIRM techniques on the basis of cost effectiveness.

(h) The training officer will be responsible for organizing training activities for junior staff, counterparts, supervise practical training for visiting certificate level students and for other visitors to the Center.

It should be noted that the fly rearing expert in the past has been contracted for from the FAO/IAEA/Tsetse Research Laboratory. Throughout the life of the present research project, the prime contractor, the USDA (PASA) has sub-contracted with the FAO/IAEA laboratory in Vienna, Austria, for supporting technical services. These have included research on membrane feeding and blood preparation and the maintenance of a backup colony of flies for the Tanga laboratory. They have also designed and/or procured special materials and equipment. Their performance was judged to be excellent by the various review panels. The FAO/IAEA Laboratory clearly has pre-eminent capability in specialized tsetse rearing technology. Because of the scarcity of Americans with field experience in SIRM and in tsetse fly survey and control, the design team proposes that USDA continue to sub-contract with FAO/IAEA to provide for a fly rearing specialist (the present incumbent has indicated a desire to remain with the project) and one Entomologist.

2. Technical Assistance - Zanzibar

The technical assistance team on Zanzibar Island will consist of two Entomologists, one of whom will be the Co-team Leader and a Veterinarian. The Co-team Leader would be responsible for the initial surveys and ultimately for the tsetse control and SIRM activities. This team will conduct epidemiological surveys to determine the incidence of trypanosomiasis and other hemoparasitic disease in livestock and conduct entomological studies to determine fly densities and distribution and fly habitat. From the above baseline data for Phase II will be assembled.

3. Technical Assistance - Consultants and Evaluators

Consultants and Evaluators will be required in the following capacities:

	Approximate Person/Month
Environmental Assessment Team (ecologist, economist)	3
Technical Advisory Panel (Tanga and Zanzibar	12
Insecticide Application Specialist	6
Experts in cost accounting, statistics and survey methodology	4

In summary four scientists, a training officer and mechanic will be located at Tanga in addition to three scientists on Zanzibar. One of the Zanzibar scientists would be designated as co-team leader. The co-team leader located on Zanzibar would have authority delegated to operate his program as dictated by the Ministry of Agriculture on Zanzibar and responsibility to undertake surveys and would ultimately be responsible for the control program in Phase II. An exchange of personnel between Tanga facility and Zanzibar for training purposes should be organized and employed. The Tanga team leader would have general responsibility for any transactions involving both the Ministry of Agriculture, Division of Veterinary Services on the mainland (the Tanzanian Government agency responsible for the Tanga Center and its staff) and the Zanzibar Ministry of Agriculture (responsible for Zanzibar).

TABLE 1: EXPATRIATE TECHNICAL ASSISTANCE REQUIREMENTS, PARENT AND PROPOSED PROJECT

LONG TERM	Parent Project*		Proposed				TOTAL
FY	1978	1979	1979	1980	1981	1982	
Tanga Center			(Person Months)				
Team Leader (Entomologist)	(12)	(9)	6	12	12	6	36
Research Entomologist	(12)	(9)	6	12	12	6	36
Veterinarian	(12)	(9)	3	12	12	9	36
Tsetse Rearing Expert (FAO/IAEA)	12	6	6	12	12	6	36
Training Officer	–		3	12	12	9	36
Mechanic	–		6	12	12	6	36
Sub-Total	(60)	(39)	30	72	72	63	216
Zanzibar							
Co-Team Leader (Entomologist)	–	–	3	12	12	9	36
Entomologist)	–	–	3	12	12	9	36
Veterinary/Pathologist	–	–	3	12	12	9	36
Sub-Total	–	–	9	36	36	27	108
TOTAL LONG-TERM	–	–	39	108	108	69	324
CONSULTANTS							
Tanga	–	–	3	5	4	1	13
Zanzibar	–	–	2	6	2	2	12
TOTAL CONSULTANTS	–	–	5	11	6	3	25

* Parent project services are non-add.

4. Local Hire Labor

A variety of personnel will be required for both the Zanzibar and Tanga project sites for all four project years. These requirements are summaized below:

Table 2 : Local Staff - USAID Contribution

Position	Number	Cost per Year (each) (TShs.) 1 US$ = 8.25
A. Tanga		
Sr. Administrative Officer	1	46,800
Secretary	1	34,800
Office Assistants	10	5,400
Laborers and Drivers	30	4,560
B. Zanzibar		
Sr. Administrative Officer	1	30,000
Secretary	1	24,000
Office Assistants	2	5,400
Laborers and Drivers	12	4,560

Table 3 : Local Staff - TanGov Contribution)*

A. Tanga - (Tanzania Ministry of Agriculture)		
Station Manager	1	36,000
Entomologist	1	8,000
Admin.and Support Staff	2	5,400
Laborers	60	4,560
B. Zanzibar - (Ministry of Agriculture)		
Assistant Team Leader	1	36,000
Research Officer	2	18,000
Laboratory Technician	1	21,600
Laborers and Drivers	22	4,560

* See "Inputs by the Host Government", Part II. E.

Table 4 : Summary Technical Assistance and Personnel

TANGA

USAID

a.	Team Leader (Entomologist)	1	(expatriate)
b.	Research Entomologist	1	"
c.	Veterinarian	1	"
d.	Mechanic	1	"
e.	Tsetse Fly Rearing Expert (FAO/IAEA)	1	"
f.	Training Officer	1	"
g.	Administrative officer	1	(local hire)
h.	Secretary	1	"
i.	Office assistant	10	"
j.	Laborers and Drivers	30	"

TANZANIA GOVERNMENT

a.	Entomologist Co-Manager	1
b.	Station Manager	1
c.	Administrative and Support Staff	2
d.	Laborers	60

ZANZIBAR

USAID

a.	Entomologist (Co-Team Leader)	1	(expatriate)
b.	Entomologist (FAO/IAEA)	1	"
c.	Veterinarian/Pathologist	1	"
d.	Junior Office Assistant	1	(local hire)
e.	Secretary	1	"
f.	Office Assistants	2	"
g.	Drivers and Laborers	12	"

ZANZIBAR GOVERNMENT

a.	Assistant Co-Team Leader	1
b.	Research Office Assistants	2
c.	Laboratory/Technician	1
d.	Laborers and Drivers	22

4. Training

Participant training will consist of twelve person years. It is planned to send three Tanzanian nationals who are A-level Certificate holders for university studies abroad leading to two B.Sc. degrees in entomology and one B.Sc. in parasitology. All other Tanzanian personnel will receive on-the-job training to enable them to carry out their duties efficiently and develop the cadre of trained personnel discussed in the outputs section (see Part II. C.). One Technician will be assigned to Tanga to oversee and provide training on Zanzibar and at the Tanga Tsetse Research Center.

5. Equipment and Supplies

Seven four-wheel drive vehicles with spares are to be purchased. Three vehicles will be assigned to Tanga and three to Zanzibar, with the seventh vehicle being purchased in 1981 as a replacement vehicle. Availability of spare parts and servicing are crucial factors in maintaining vehicles for necessary project activities. Landrovers have been selected as the best type of vehicles for the project because of the availability of spare parts and service. (See Waiver Request, Appendix H.).

One $2\frac{1}{2}$ ton truck will be used to haul feed to the goats in the host feeding operation at Tanga and to transport the large number of workers engaged in that operation to and from designated pick-up stations on Tanga. Many workers reside at a distance from the Tanga facility, and absenteeism is commonly as high as 25% when transportation is not provided.

The project will also provide one tractor and covered trailer will be required for Zanzibar to be used for the survey personnel. A tractor is more appropriate than a truck for the conditions on Zanzibar.

Small quantities of various insecticides will be required for the testing of application method and dosages. If procurement waivers are required they will be prepared by USAID and obtained prior to purchase.

Commodities other than transport will be mainly those associated with equipping the laboratory on Zanzibar, plus expendable supplies necessary for normal daily operation of the laboratory and the insectory at Tanga. Much equipment is designed and fabricated to fit the specific needs of the project. The laboratory will be constructed and equipped for the purpose of (a) diagnosing trypanosomiasis and other hemoparasitic diseases in livestock; (b) entomological studies of the tsetse fly and (c) office space to serve as a base of operations for the technicians on Zanzibar.

The following items of equipment will be required at the Zanzibar Laboratory:-

Table 5 : Zanzibar Laboratory Equipment

Item	Number	Price/each	Total
Centrifuges	2	$ 1,000	2,000
Dissecting Microscopes	3	600	1,800
Compound Microscopes	2	1,800	3,600
Incubator	2	1,000	2,000
Microtome	1	2,500	2,500
Deep Freezer	1	1,000	1,000
Air conditioners	6	600	3,600
Sterilizer (steam)	1	1,500	1,500
Drying Oven	2	200	400
Distilled water apparatus	1	400	400
Lab-glassware		2,000	2,000
Standby generator	1	10,000	10,000
Tools - metric (82 pc)	4	250	1,000
Washers, dryers	1	800	800
Refrigerator	2	500	1,000
Hypothermographs	3	700	2,100
Autoclave	1	1,500	1,500
Photostat machine	1	1,400	1,400
Two-way Radio system		20,000	20,000
Typewriter (manual)	3	200	600
Office Furniture and Filing cabinets		5,000	5,000
Calculators (Desk)	3	500	1,500
Hand calculator	3	150	450
Camera attachments	1	1,000	1,000
Animal tatoo machine	2	50	100
Ao Bright hire Hemocytometers	4	50	200
Bunson Burners	3	25	75
Mortar and pestle	2	10	20
Windscope	2	200	400
Raingauge	2	150	300
Hand anemometer	4	200	800
Mettler Balance	2	1,200	2,400
Hydrometer Set	1	100	100
Deluxe 60 min. Bell type timer	4	50	200
Transformer	10	40	400
Automatic Power Sawer	1	250	250
Microchemalocrit Centrifuge	1	500	500
Veterinary Surgical Kits (drips, scapels, hemostats, scissors, needles, syringes etc.)	1	5,000	5,000
Aluminium Screen	20	30	600
			$78,495

In addition approximately $1,000 p/a and $3,000 p/a for expendable office supplies and laboratory equipment are required respectively.

Aircraft services are required in Phase I to test pesticide applications and purge/fly release and $16,000 per annum is budgeted (approximately 60 hrs/p.a. at a rate of $250/hr.). Aerial spraying will be done by a professional operator skilled in the technology of aerial application of pesticides and with specially designed equipment for aerial spray against tsetse. A proprietary procurement waiver will be required if USAID contracts with the same company that provided the services at Mkwaja Ranch. Total Phase I services are estimated to cost about $40,000. This amount is within the waiver authority of the mission director and therefore if necessary will be reviewed by USAID at such time as necessary to procure the services.

7. Facilities and Construction

Housing for five technicians in required. Two houses will be purchased in Tanga at an approximate cost of approximately $30,000 each. USAID intends to rent three houses formerly used by U.S. Consulate on Zanzibar and, therefore, no construction is required for housing on Zanzibar. However laboratory/office facility will be needed on Zanzibar. The Zanzibar Government has agreed to provide a 1/4 acre plot at their Veterinary officer's station on Zanzibar. Preliminary estimates for this facility are approximately $52,000. (See Appendix G, for 611(a) Certification.)

E. INPUTS BY THE HOST GOVERNMENT

The Tanzanian Government will give financial aid on the Mainland (approximately Shs. 800,000 per annum) to support the Tanga facility at approximately the present level of activity.

The Government of Tanzania has, in addition to the Ministry of Agriculture on the Mainland, a Ministry of Agriculture for Zanzibar and Pemba Islands. The Zanzibar portion of the project would be implemented through the Ministry of Agriculture for Zanzibar and Pemba. On Zanzibar a suitable lot will be provided for a headquarters/laboratory. Field and counterparts will be salaried and provided by the Ministry of Agriculture, Zanzibar. Electricity, water and repairs to the laboratory will be the responsibility of the government, except in case of emergencies. Telephone service will also be provided by the government, including official telephone calls within the country of Tanzania.

Personnel to be furnished by the Tanzania Government are illustrated in Table 3 : Local Staff - TanGov Contribution. This includes a variety of laborers and support staff plus counterpart team leaders for both Tanga and Zanzibar.

A Tanzanian shilling contribution to a Trust Fund to be used on USAID projects in Tanzania will be paid at the rate of Shs. 21,600 per annum per expatriate technician.

F. MAJOR ASSUMPTIONS

This project is supported by the following assumptions:-

1. At the World Food Conference in Rome, 1974, major attention was given to the restraints imposed on developing African countries by the presence of tsetse-borne disease. Different methods are now being developed to control tsetse and trypanosomiasis. USAID will make a significant contribution by virtue of its leadership role in applying SIRM technology developed in the United States. International participation in assisting developing countries in achieving control with SIRM could be expected after the technology is fully developed and U.S. input ceases.

2. The Tanzania Government is cognizant of the magnitude of the tsetse fly problem and will continue financial and manpower support for the program. It has plans to initiate certificate level training for tsetse control field officers in January 1979, and to prepare for eventual mainland control programs.

3. The field operational sites will continue to be available. Since 1974, the field site used for the fly release program has been the Mkwaja Ranch, located about 100 km south of Tanga. The Ranch is a subsidiary of Amboni Estates, a privately-owned corporation with an extensive sisal plantation in the Tanga Region. The Ranch site was considered to be marginal for sisal but is potentially excellent rangeland. Over the 18 years the Ranch has been in operation, an excellent herd of about 10,000 head of indigenous cattle has been developed. The herd is grazed on roughly 100 square miles (64,000) acres on that portion of the ranch currently being used for the release program. The Ranch management, which had already initiated the construction of a tsetse fly barrier along one side of the Ranch, agreed to allow the Ranch to be used for the test site. In exchange a one km wide cleared barrier was completed around the Ranch with project funds. This precaution was necessary to prevent reinvasion of wild flies from outside the Ranch during the SIRM release period. The Amboni Estates made caterpillar type tractors, other equipment, equipment operators and laborers available at cost for barrier construction. Also housing for project employees was constructed on the test site with project funds.

From the standpoint of location within the target coastal G. morsitans belt, the facilities made available for use of the team and the excellent cooperation of the ranch manager, the availability of a landing strip on the ranch and the cattle herd, the ranch has proven to be an excellent research site. It is assumed that the ranch will continue to be available for those portions of the

development activities during the present project which require a field release site.

- Further technical developments on aerial release of pupae;
- Complete monitoring of the fly population and disease incidence on the ranch following completion of the SIRM release program;
- Some training activities; and
- At an appropriate date, a G. pallidipes release program.

The project will continue to provide technical advice to the ranch management on trypanosomiasis diagnosis and treatment and on methods of barrier maintenance with and without SIRM, vegetation management, range management, fire control and the like on a TDY basis. This assistance is logically part of investigatory and training objectives of that project related to refining integrated disease control methods in the Tanga Region. However, as the control of G. pallidipes, the second major vector, could not be attempted in the ranch in this project, the ranch management may elect to attempt to control or eradicate G. pallidipes using insecticidal spraying as they have in the past. Second, preliminary investigations of the feasibility of tsetse eradication in portions of Tanga Region are being made by a German technical assistance team. Such donor activity is not likely within the project's lifespan. Should either event occur, another field operation site would be required because of insecticide contamination and possibly costs incurred to develop facilities and a barrier around the release site.

Should the Mkwaja Ranch not be available throughout the entire six year life of project or should an active eradication program be planned for Tanga region, substantial modifications of the Tanga program and facilities (with other donor assistance) might be justified.

Several other alternative field operational sites are available:

(a) Mzeri Hill Ranch initially considered for the SIRM release but rejected because of the high cost of barrier construction and poor herd and range management. Barrier construction and maintenance would be required.

(b) Two National Ranching Corporation Ranches (Morogoro District) used by M.A.T.I./Morogoro for practical training of students in range and ranch management could be used for tsetse officers training course. Barrier construction would be necessary.

(c) Mafia Island - believed to have G. brevipalpis infestation (but not G. pallidipes) and as it is isolated from the Mainland would have similar advantages to Zanzibar Island and would not require barrier construction.

G. Other Donor and USAID Assistance

Related Host Government Projects

The Tanzania Government, using funds from a USAID loan, has purchased equipment, for the clearing of 285 square kilometers of tsetse fly barrier in the West Lake Region of Mainland Tanzania. The barrier construction was initiated in FY 1975 and is scheduled for completion in FY 1979. Tsetse eradication is planned through the use of insecticides. West Lake is expected to become a significant livestock producing area following control of tsetse infestation. As of August 1978, no other tsetse eradication activities are being undertaken in Tanzania, although others are under consideration.

On Zanzibar FAO's contributing significantly to livestock improvement. FAO is already involved in a tick control program. In addition FAO plans to train personnel for seven livestock/veterinary centers. Livestock technicians will be trained in disease identification. This effort will provide complementary assistance to the Livestock Disease Survey planned for Phase I. The Zanzibar Ministry of Agriculture also has other livestock development activities including a DANIDA sponsored tick control efforts, an artificial insemination bull stud farm, and a dairy processing plant.

Other Research

Various other international agencies are involved with research on the SIRM (see Appendix E.). The parent project benefitted from cooperation with these groups. This project will continue the exchange through USAID cooperating agreements with FAO and informal correspondence.

III. PROJECT ANALYSIS

A. Technical Analysis

1. SIRM - The Technology

The sterile insect release method (SIRM) is a genetic or autocidal method which employs a pest species for its own demise - a sex-killing mechanism. Present investigations of this concept against tsetse flies in Africa involves induced sterility in the male sex which must compete with the normal males of a residual population. The desired impact of released sterile males is dependent upon a higher ratio of sterile to normal male flies which causes a population decline and can theoretically produce 100% genetic death in a pest population.

The forebearer and model for SIRM research was the successful and to date unsurpassed, screw-worm, Cochlioniyia hominovorax, eradication program applied in the southern United States. What is generally not known is that this concept was nutured during a period of more than 20 years of research, often with negative results, before its significance and value was finally established. The ultimate verification was finally achieved by screw-worm eradication on the island of Curacao. Parallels can be drawn between the documented screw-worm SIRM research and the evolution of on-going tsetse fly research in Africa based on the concept of male sterilization. For example:

Screw-worm (late 1940's) A technique for sterilizing adult flies by rediation induced dominant lethal genetic mutation was developed using X-rays. A laboratory was established in Texas and a small coastal island was selected as a field test site. Results were nil because of the unfavorable habitat for released flies.

Tsetse fly (1960's) - Tests were conducted on a small island in Lake Kariba, Rhodesia, with Glossina morsitans in which a high level of control was achieved but did not conclusively produce the eradication technology.

Screw-worm (1950's) - A project was implemented in Florida on a portion of the mainland but reinvasion by flies outside the study area negated conclusions or proof of the SIRM technology.

Tsetse (1970's) - A field trial was performed on mainland Tanzania where efforts were made to isolate a target population of tsetse flies. Reinvasion negated absolute proof of eradication.

Screw-worm (1950's) - The technique was tested again on an island two miles off the coast of Florida. Once again reinvasion from

the mainland population thwarted attempts to demonstrate complete population elimination but principles were established. The first successful application of the SIRM was on the isolated island of Curacao in the Carribean.

Tsetse (1979) - Zanzibar Island is available to provide the necessary requirements to fully demonstrate the SIRM against tsetse. No other known area with the test site characteristics of isolation and single, laboratory-colonized species exists, Preference for conventional control techniques could result in the removal of an excellent and perhaps only opportunity to determine the efficacy of the technique.

Screw-Worm (1960's) - The United States was officially declared free of screw-worm damage in 1966.

The success of the SIRM concept occurred during a period when discoveries were mounting on the magnitude of insecticide resistance among major insect pests and when the use of toxic pesticides were being spurned by public opinion. Its effectiveness at such a time virtually guaranteed support for research into methods of genetic control for other pest species. In the late 1960's the list of pest insects involving sexual-sterility research was more than 40 species. Yet, none have yet had the high degree of success the screw-worm program produced. This prompts the question: If the principles for SIRM were established then why has it been so difficult to extrapolate these principles to other pest insects, say, the tsetse fly in Africa? Part of the answer according to a few scientists is that research on genetic control has suffered from an unwillingness to depart significantly from the precise principles of SIRM. One of the outstanding features of genetic control, its specificity, also contributes to weakness. Each program must be tailored to take advantage of the unique weakness each pest species presents. What also must be realized is that some pest species, at the present level of our knowledge do not lend themselves biologically to the rigorous constraints of the SIRM. It is believed, based on research performed in Africa, that the SIRM would be a most efficient complementary tool for the tsetse fly pest management. No other system of insect population control has the feature of greater effectiveness as the natural population declines.

Current methods of tsetse fly control require the application of insecticides either from the ground or air. These techniques are efficient when properly applied and a high population density of tsetse exists, but highly inefficient in terms of number of insects killed with the natural population density is low. In marked contrast, the SIRM is efficient when the natural population density is low and inefficient when the population density is high. Thus the two systems are complementary allowing the introduction of non-persistent insecticides to lower population while permitting a follow-up operation with

sterilized males. The validity of this conclusion can be strikingly shown in theoretical models based on estimated population trends. Assuming a tsetse population was reduced to a low level with insecticide then the theoretical trend of a low-density tsetse fly population averaging 200 flies/mi^2 when subjected to SIRM can be illustrated as follows:

Table 6 : Tsetse Population Pattern with SIRM*

Period of Release (months)	Natural Population without intervention	Natural Population Density at beginning of each period with SIRM	Number of Sterile Males Released each period	Estimated Ratio of Sterile to Fertile Males	Assumed Ratio of Sterile to Fertile Males
0 - 3	200 No males & females equal	200	900 (30 per month)	3:1	75
4 - 5	300 " " "	74	450	4:1	22
7 - 9	450 " " "	22	225	7:1	4
10-12	675 " " "	4	112	16.5:1	1

*IAEA, Technical Report No. 44, 1965.

The brief synopsis identifies the SIRM concept. However, it should be placed in prepare perspective with programs aimed at the control of African animal trypanosomiasis. The 1974 World Food Conference, under the aegis of the United Nations, passed a resolution urging FAO to initiate a program to control animal trypanosomiasis throughout Africa. A five-year preliminary phase is underway to be followed by an operational program estimated to require 40 years to achieve control over some five million km^2 of dry savanna and 2 million km^2 of the wetter savanna areas.

Control methods which are readily and widely employed in the past were aimed at removing the tsetse fly habitat and its food source. This involved clearing the natural vegetation which the tsetse required for shelter and met with different degrees of success depending upon how the land was utilized and whether erosion changes in watershed vegetation were dratically altered. It is understandable that eradication of wild game species, which are the trypanosomiasis reservoir and tsetse fly food source, would nevertheless be disfavored. Almost all present day control methods depend on the use of insecticides. The most widespread technique over the past several years has been primarily the use of DDT and Dieldren, both persistent chlorinated

hydrocarbon insecticides. Extensive eradication campaigns, chiefly in Nigeria, have proven that application of these compounds to the resting sites of tsetse flies to be an effective eradication or control technique. In fact, the use of persistent insecticides remain the only proven technique. As of 1977, resistance to insecticides had not been reported for tsetse fly, but no systematic monitoring program to detect resistance has been carried out in Africa. There is no basis for assuming that pesticide resistance would not occur if populations are pressured by intensified use of pesticides.

As of 1978, tsetse fly control or eradication programs were recorded from 18 African countries, viz - Botswana, Central African Emperi, Ivory Coast, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Republic of Cameroon, Chad, Rhodesia, Rwanda, South Africa, Tanzania, Uganda, Upper Volta, and Zambia. At present large-scale control operations are planned in 33 African countries under the auspices of FAO and WHO programs. Due to the lack of more environmentally and economically sound measures and the urgency for freeing land in Africa usurped by disease transmitting tsetse flies, strong arguments favor campaigns that employ toxic compounds that have been abused and restricted in other parts of the world. The argument is that eradication could be achieved generally with a single application of a persistent pesticide and for economic and operational reasons would be the most desirable. It is argued against control operations which would result in increased pollution over time in the case of pesticides and increase the risk of development of resistance to chemicals employed.

Current interest and active research into alternatives to such schemes involves (1) use of compounds which have no residual effect and are applied as aerosols in very low dosage; (2) genetic control methods; (3) physiological methods (growth inhibitors, attractants). None of the findings so far have demonstrated eradication potential. Trials with non-persistent insecticides have been conducted in Botswana Rhodesia, Rwanda, Tanzania and Zambia which have demonstrated control at dosages ranging from 6 to 20 grams actual ingredient (a.i.) per hectare. In Zambia, 1600 km^2 were treated with five applications of ultra low volume Endosulfan and pest-spray surveys indicated that G. m. morsitans was eradicated except near unsatisfactory isolation barriers although survey results were only reported 1.5 years post spraying. Other lesser successes have been achieved which emphasize the differences in control versus eradication. Research is being continued to develop safe and effective compounds and delivery systems. A distinct advantage exists in utilizing the more desirable features of this technology with other post management technology such as SIRM, as previously outlined. Overwhelming evidence exists that man's unilateral approach to curtailing insect-caused damage has resulted in the biological superiority of its adversaries' technology. Insects can rapidly adapt to such a singular approach, even against highly toxic and diversified poisons. We desperately need the latitude afforded by an arsenal of both biological and technologically united remedial measures. Physiological approaches involves the development

of a new generation of pesticides. These compounds are comprised of molecules which interfer with natural physiological functions. Studies have been initiated in a number of laboratories with organic compounds of high specificity which can kill, sterilize, prevent growth, and lure tsetse to a preselected point. Most promising are certain of the insect growth regulators such as the juvenile hormones. No system to deliver laboratory findings to the field has yet been discovered.

In the context of providing the developing world the benefit of modern technology, methods should be introduced which replace ineffective or destructive traditional approaches to tsetse-borne disease abatement. It is clearly desirable that methods divorced from conventional useage of persistent insecticides be developed. Such compounds persist but unfortunately not where they may have been placed for use. Never has such world-wide attention been given to the vast tsetse problem or control programs planned of such magnitude against Africa's bane. Ecologically and economically safer measures would offset the potential abuses of the environment through the same processes of requiring newer and more toxic compounds to compensate for resistance. Of 108 species of medical and veterinary importance due to their destructiveness, only two species which have not been proven to be pesticide resistant - Glossina and Phlebtomus (sand flies).

Tanzania can be considered the birthplace of tsetse fly research and control since discovery of the trypanosomiasis/tsetsefly vector relationship was discovered there. Control operations were intensively conducted in 1925 and for 35 years following. The Tropical Pesticide Research Institute located in Arusha, Tanzania, contributed significantly to the development of insecticide application techniques including the more modern aerosol dispensing equipment. Yet, after more than half a century, 60 percent of the mainland Tanzania land area remains tsetse fly infested with only some five percent having been reclaimed.

USDA/USAID has pursued a line of research with SIRM which offers a proven technology from our own country. Chief among our reasons is that research with tsetse flies, particularly G. m. morsitans has revealed its high vulnerability to genetic control methods. Although it is unlikely that SIRM could ever be used alone it can supplement more environmentally destructive methods and theoretically be used to eradicate tsetse flies from a selected area. Achievements to date in Tanzania include the (1) demonstration of mass rearing capabilities by producing at Tanga the largest colony of G. m. morsitans in existence; (2) sterilizing and packaging flies for release; and (3) control of the species using an integrated system of population reduction with non-persistent insecticide application followed by sterile male release. Eradication was thwarted by the inability to isolate an experimental population on mainland Tanzania - i.e. to construct an island on the mainland.

What remains is to fully exploit the potential use of SIRM technology to the point of tsetse eradication to prove its efficacy to the international scientific community and to other African nations, viz Upper Volta and Nigeria, where SIRM research is being pursued by the French and German donor agencies. The opportunity exists utilizing Zanzibar Island where one species of tsetse fly G. austeni prevails in isolation from its mainland population. The remote probability of reintroduction through modern transportation could be prevented by quarantine. The unique features of isolation by the Indian Ocean, having a species of tsetse fly that is colonized in Europe from specimens supplied from Zanzibar, the interest of the host government and the Zanzibar Ministry of Agriculture, a support facility on mainland Tanzania minutes away by airline connection, and expertise available through a PASA with the USDA would expedite completion of the test of demonstrating the operational application of SIRM. It is no longer a decision whether to test SIRM technology against tsetse flies but whether we wish to participate in offering our own technology in a valid way. Other options such as abandoning the program and offering the accomplishments so far achieved, soliciting multinational take-over, or contracting the work represents a marked interruption to a phase of research for which a final answer is near at hand. The lack of tsetse fly specialists, the time to organize and implement programs in Africa and the risks involved all suggest a responsibility by USAID and USDA to complete a job undertaken. In various sections of this report a plan is offered to advance the knowledge of SIRM in tsetse fly control and to provide a basis for the expansion of this technology throughout some 33 African nations. The facilities in Tanzania and the presence of the most ideal test site - Zanzibar - represent a positive and totally unique opportunity.

2. The Application of the Technology

(a) Zanzibar - The Physical Environment

Zanzibar covers an area of 1650 km^2. The land is flat, the highest point being 130 m above sea level. The climate is warm and humid throughout the year; the wind is from the north-east from December to March and from the south-west during the rest of the year. The average rainfall over a period of 30 years was 1558 mm; April and May are the wettest months; there is a second wet season in November and December but some rain falls in even the driest months, January (60 mm), February (57mm), and June - August (44-51 mm).

The Island can roughly be divided into two halves by a north to south line. In the west are deep, rich soils where a variety of crops (cloves, coconuts, bananas, cassava, yams etc.) are grown. In the east and south soils are much poorer and coral rag ridges are frequently exposed or just below the surface.

Some virtually undisturbed forests (e.g. jazani forest) and thicket occurs. Some shifting cultivation is practised.

Livestock: According to the livestock census of 1974 there were 19,122 cattle and 11,206 goats on Zanzibar. Most cattle are in the west and north, kept by the arable farmers who each own some 3 acres of land with perhaps 1-4 cattle. A herd of 20 is exceptionally large. During the day the cattle graze on natural pasture under cloves or coconuts, fallow land between cassava and other crops or on waste land. Few animals are kept in the eastern and southern parts of the Island but some government ranches have been established.

(b) The Tsetse and Trypanosomiasis Situation - Zanzibar

Animal trypanosomiasis was first disgnosed on Zanzibar in 1908 but it was not until as late as 1945 that the first tsetse fly was identified. Prior to that time it had been assumed that the disease was mechanically transmitted by other species of biting flies, although latter doubt was expressed that this could be so. The commonest trypanosome is *Trypanosoma congolense*; *G. austeni* is the only species of tsetse fly present. This species does not attack man (hence there is no human sleeping sickness on Zanzibar); is small and inconspicuous and thus had escapted notice for so long.

The present extent of the constraint of trypanosomiasis on the livestock industry is unknown. Formerly "excellent veterinary records of trypanosomiasis cases in livestock throughout the Island (all microscopically confirmed) were kept (undated report - but probably about 1963 - by G.H. Turner, Tsetse Officer), which assisted in the identification of tsetse infested areas.

From 1945 to 1950 at least 7796 cattle with suspected trypanosomiasis were examined and 1365 were confirmed to have the disease. (Report by D. L. Johns, E.A.T.R.O. 1951). No attempt is made at present to conclusively diagnose trypanosomiasis; animals displaying visual symptoms are treated with Berenil. Some prophylaxis of government-owned cattle is undertaken. Livestock are not kept in the vicinity of dense infestations of *G. austeni* and the impact of the disease should thus be measured in terms of areas of suitable grazing incapable of utilization as well as in actual cases of trypanosomiasis.

Following the discovery of *G. austeni* on Zanzibar in 1945 a detailed survey of its distribution was undertaken from 1948 to 1950 (report by D.L. Johns, 1951). Apart from fly rounds in a few areas, which were discontinued in the mid-sixties, and a limited experiment with Dieldren applied to a tsetse infested area by hand sprayers, no further studies have been undertaken. In 1948 - 1950, *G. austeni* was widespread over

Zanzibar with numbers varying according to the suitability of the habitat. Forest and coral rag thicket were considered to be permanent habitats (the Jazani Forest probably contains the densest infestation). Open areas, such as the wanda grasslands in the centre and east of the Island were avoided by the fly, although it occurred in the bush around the perphery. The most complex situation was in the cultivated areas in the north-west of the Island. Tsetse may have only penetrated cultivated areas in the wet season, but some forms of cultivation may have provided shade to be a permanent habitat enabling breeding to take place even in the dry season when the fly is under the most severe climatic stress. Clove and coconut farms, if kept clear of shrub undergrowth, were considered unlikely to harbour tsetse throughout the year. The type of cultivation in the west of the Island, even if not providing a permanent habitat, is such that it provides sufficient cover for the fly to range over relatively large distances, especially in the rains.

Currently, the control of trypanosomiasis is attempted solely by chemotherapy and chemoprophylaxis. This is costly and cannot lead to eradication of the disease. Limited tsetse control to reduce the trypanosomiasis challenge to livestock would be feasible, but as operations would have to be conducted at regular intervals for the foreseeable future the cumulative costs would be high. The fact that Zanzibar is an Island and that the tsetse population there is thus isolated from other fly population on the mainland makes eradicating the disease by vector eradication an attractive possibility. Although the costs involved might be high it would be a one-time cost whereas the economic benefits would accrue over all future years. Techniques are available which, given a well-organised campaign, suggest that eradication would be feasible.

(c) Tsetse Distribution and Incidence of Trypanosomiasis Survey. *G. austeni* is not attracted to man and so studies will have to be conducted using a bait ox. Little fly activity occurs during the middle of the day and most meaningful catches are obtained early in the morning and in the evening. There is probably no fly activity at night. Traps have been little used to catch *G. austeni* and the efficacy of design such as the Langridge trap and the relatively recently developed Challier trap should be tested. If effective, the disadvantages of always having to employ a bait ox would be overcome.

Surveys should include traditional systematic fly rounds carried out over at least a year through representative vegetation types, but should mainly depend on thorough surveying throughout the Island. Whereas it will be necessary to obtain some idea of wet season dispersal it will be most important

to accurately determine the extent of fly distribution during the hot-dry season (January - March). At this time of the year G. austeni will be most restricted in its distribution and insecticide spraying operations of the permanent fly habitats will be conducted at this time. Studies during at least two hot - dry seasons need be required if meaningful results are to be obtained.

Certain ecological studies will be complementary to the detailed distribution surveys. In addition to determining the hot-day season habitats it will also be necessary to determine the resting areas of the flies within the hot-dry season habitats. Evidence suggests (Johns, 1951), that G. austeni rests during the day within one meter of ground; this requires confirmation in the range of permanent habitat occupied by the fly. The night resting sites of G. austeni should also be determined in the hot-dry season habitats (probably primarily forest and thicket) in the eastern half of the Island, to confirm whether, like other Glossina, this species rests on the upper surface of leaves at night.

(d) Epidemiological Surveys of Trypanosomiasis

It is essential that a comprehensive epidemiological survey is carried out throughout Phase I and for at least six months after the fly has been eliminated. (Phase II). Mapping of the diagnosed presence of trypanosomiasis in domestic and wild animals will be necessary as one method of determining the distribution of G. austeni on the Island. Following fly eradication, the rate of disease eradication must be monitored.

The samples should be taken from yearlings, mature animals and old stock. It is noted that weaned calves and yearlings are the most likely markers but older animals under heavy challenge may also show evidence of trypanosomiasis. infection. In addition, not less than two percent of the cattle in the non-tsetse fly infested areas should also be examined to determine whether the carrier state exists. The possibility of transmission by biting flies other than by tsetse also requires verification or rejection. Yearlings are probably the best markers in non-tsetse areas. It will be necessary to mark and identify each animal in the test program. Animals showing positive response in blood smears or sero-diagnosis should be treated and eliminated from subsequent tests and be replaced by an equal number of previously untested animals.

It may also be advisable to investigate, to a limited extent the level of trypanosomiasis present in wild pigs and other wild faunas. This could probably be accomplished using the blood smear technique. If the trypanosomiasis infection

level is high in those species and if the elimination of the principal tsetse vectors turns out not to be feasible, consideration may need to be directed to reducing the population of wildlife reservoirs, particularly wild pigs, as a method of disease control in Phase II.

Because there is only one graduate Tanzanian veterinarian service for both Pemba and Zanzibar, a veterinary pathologist (not envisaged in the PID) has been added to the technical assistance team to conduct these activities. It will be necessary to train local veterinary assistants or protozoologists in the sampling and blood smear preparation techniques and in the routine of clinical observations. It will also be necessary to equip and supply a modest laboratory on Zanzibar for the preparation of blood smears and for the handling, refrigeration and shipping of seriological specimens. The same structure can be used during the project life as the project headquarters.

It is probable that a protozoologist from ILRAD or ISIPE in Nairobi, with follow-up training by project staff, can handle the on-site training of veterinary assistants on a TDY basis. Either of these institutions could handle the seriological investigations of blood sample, until such time as a laboratory equipped to undertake such examinations exists on Zanzibar or in Tanzania.

It is recommended that the protocals for the epidemiological surveys of trypanosomiasis surveys be reviewed by a qualified statistician for validity once they are developed in detail by project staff.

(e) Insecticide Application

Several insecticides and application techniques could be used to reduce the tsetse population on Zanzibar prior to the release of the sterile flies. Phase I therefore includes activities at the Tanga Research Center to evaluate and select the application techniques appropriate for Zanzibar conditions. Current tsetse control projects have used the following techniques.

— Application of Residual Insecticide Sprayed from the Ground
This method is a proven method of tsetse control. It has been most extensively practised in Nigeria where teams of sprayers have covered up to 12,500 km in a year spraying only the daytime resting sites of the flies during the dry season when they have retreated to their permanent habitats. DDT wettable powder had been widely used in dryer areas and Dieldrin in wetter areas. Only 10-15% of the total area is sprayed. Earlier work in Zanzibar

(Johns, 1959) suggested that during daylight G. austeni rests below 1m above the ground. If this can be confirmed, the highly selective application of residual insecticide technique might well be the technique of choice in the cultivated western areas of Zanzibar where aerial application of insecticide could have adverse effects on beneficial insects. In order to obtain the necessary persistence in the humid conditions of Zanzibar it would probably be necessary to use either DDT emulsion concentrate or Dieldrin. The very dense thickets found on Zanzibar in the coral rag areas, would make ground spraying difficult and expensive in these land areas. Finally, hand application requires trained personnel and close supervision. This factor reduces the desirability of this control method.

— Application of a Residual Deposit of Insecticide Sprayed from the Air by Helicopter: In Northern Nigeria G. morsitans, G. palpalis and techinpides have been eradicated from the air to resting sites.

Dieldrin is the most satisfactory insecticide but Endosulfan has also been used. Helicopters have been used because it is more maneuverable than a fixed wing aircraft and can follow the meanderings of riverine vegetation or the periphery of vegetative ecotones. By flying at 4 km/h the rotor downwash assists the penetration of the spray through the canopy. The technique is less discriminative than the ground application method but only some 10-15% of the total area is treated. Helicopter application requires higher dosages (up to 100 ga/hec) of pesticides because the size of the droplets are larger. Problems of wind drift are also associated with this technique. These would be limitations of such a technique in the populated areas of Zanzibar.

— Application of a Non-Residual Insecticide Sprayed from the Ground: This method requires up to six spray cycles at intervals of 10-15 days for tsetse control. Because of labor and materials cost this is an uneconomic method which has been little employed elsewhere. It is not considered appropriate to conditions on Zanzibar due to dense vegetation comprising the tsetse fly habitat.

— Application of Non-Residual Insecticide Sprayed from the Air by Fixed Wing Aircraft: This method also involves up to six spray cycles at intervals of 10-15 days for control. This technique has not yet been proven as an eradication method although highly effective control can be achieved. Whereas application of a residual insecticide by helicopter requires 800 - 1200 g/ha. of an organochlorine insecticide

using relatively large spray drops applied to 10-15% of the area, the fixed wing technique covers the entire area at flight intervals of 200-300 m. five to six times but the dose rate used is very low and the droplet size is in the aerosol range. Endosulfan is being applied in Botswana at a rate between 6-12 g/ha per application. The small droplets are carried by the air currents and the technique can only be used under stable atmospheric conditions. The effectiveness of this technique depends upon each fly coming in contact with the droplets. The method has been tested in Guinea under the vegetation and meteorological conditions similar to those that occur in Zanzibar. It has not been employed in areas of dense settlement and agriculture such as the western areas of Zanzibar. It would appear to be unsuitable for use in such areas as the widespread application of even very low doses of insecticide would well cause significant mortality amongst insects beneficial to the farmers. The method might be applicable in the eastern half of the Island but even here caution would be necessary as the method depends for its success on some insecticidal drift occurring, and thus some contamination of portions of the western half of the relatively narrow Island could well occur.

Phase I will examine these techniques and test them at Mkwaja Ranch in order to make suitable recommendations for Phase II.

(f) Labor

Laboratory officers and field staff currently employed at Tanga will be retained for this project. Since the closing of the American Consulate is imminent, USAID has made arrangements to retain several guards and drivers. Additional laborers will be hired as field work is undertaken. Laborers are readily available at a salary of approximately $50 per month. The two administrative Assistants/Secretaries required at the Zanzibar site will also be retained from the Consul.

There are no issues involved with obtaining the services of either the Tanga or Zanzibar support staff, however it is important not to allow a break in funding between the current and proposed project. If this would occur much time would be lost in seeking replacements.

(g) Construction - Zanzibar Laboratory/Office Facility

A REDSO/EA engineer has provided an initial cost estimate of $52,000. This includes a 30% inflation factor. USAID plans to contract with private engineering firm for construction of this facility. While the Works Ministry of Zanzibar could perform this service, their past record indicates work progresses very slowly. AID will therefore obtain engineering plans from Zanzibar on a competitive basis. Preliminary plans and the 611(a) Certification may be found in Appendix G.

B. Social Soundness Analysis

1. Socio-Economic Characteristics of Target Population

Zanzibar has one of the highest average population density south of the Sahara with an average of 267 people per square mile. In addition, it is among the most urbanised countries in sub-Saharan Africa excluding South Africa. In 1967, 53.8% of the population lived in urban centers on Zanzibar. Most neighbouring countries have an average urban population of 10% or less.

UNFPA established a 2.8% growth rate for Zanzibar's population, however, Moore (1971), quotes a lower figure of 2.0%.* Most authorities consider the UNFPA figures accurate and reliable. The population is youthful with 49% being nineteen years of age or less. Zanzibar can thus be characterized as having a dense population which is young and growing at what is for East Africa an average rate.**

According to ILO figures, Zanzibar has an economically active population of 171,040 in 1964.*** Of these 2,000 are employed in industry and 29,040 are employed by the government or business enterprises. The remaining 140,000 are in the agricultural sector. It was estimated that 48.2% of the active population were employed full time while the remaining 51.8% were either underemployed or unemployed.

Most farmers are small holders who cultivate one to three acres primarily with family labor. Estimates of per capita income range from 660 shillings to 1,500 shillings per annum. The total population of the project areas was estimated at 172,000, with an additional 86,000 people living in Zanzibar town as of 1976. The majority of people living in the project area are poor peasant farmers, (except those working on rice schemes) with traditional technologies which keeps labor productivity at low levels.

2. Social Impact

The project is expected to partially create the conditions under which a series of cultural, economic and social changes can occur as the result of eliminating tsetse on Zanzibar Island. The elimination of tsetse may create an environment in which a larger number of cattle can survive, those that so survive will be larger, produce more milk and meat and in such a clean environment exotic European cattle such as Jerseys could even thrive. This will help to lay a foundation for marked nutritional improvements for rural children and mothers as well as for urban workers.

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* For further details on population, please refer to annex.

** Mainland Tanzania's population is growing at a rate of from 2,5 to 3.0% while in neighbouring Kenya the rate is from 3.2 to 3.8%.

*** Year Book of Labour Statistics. ILO 1976 Geneva, pp.15 (see also pp. 276-299).

Oxen can be used more widely in transportation and possibly as draught animals which may ease the burden of rural women. It is the social impact which tsetse eradication may create which is our present concern.

It should be made clear that tsetse control under this project is only one component in a broader program of disease control and livestock development on Zanzibar. Other agencies have obligated themselves to control other diseases for example, FAO and DANIDA plan to control tick born diseases.

The following social analysis assumes the successful completion of all livestock disease control measures while recognizing that USAID is responsible solely for tsetse control.

3. Social Compatability

(a) Intended Beneficiaries: The targetes beneficiaries fall into two basic categories: farm households currently keeping cattle and farm households who would keep cattle if disease were controlled. Farm households currently keeping cattle number approximately 4,500 or 14% of Zanzibar's rural households. Faced with a trend of declining herds and falling production due to disease, these households would directly benefit through weight gains in their cattle, increased milk production, greater calf survival rates and increased herd sizes. A disease-free environment could encourage greater use of the AI facility and the importation of higher yielding exotic breeds of cattle which are notoriously susceptible to the diseases present on Zanzibar at the moment. The spread of disease in the recent past has forced many small farmers who kept one or two animals out of the livestock picture. Many of these households could re-emerge as livestock keeping households once disease is brought within tolerable limits as well as other households with marginal surpluses for investment who would not dare risk placing their capital in livestock as long as major diseases are so obviously uncontrolled.

Poor households unable to accumulate capital but willing to contribute their labor in caring for cattle will benefit through a system of profit sharing known as wafungai wa nusu nusu. Wives of employed men will also be able to utilize this system to establish their own herds.

Complementary enterprises such as local butchers and milk merchants will gain from more regular, reliable and larger supplies of milk and meat. Children in milk-producing households are normally given a portion of the milk produced, as more milk becomes available their daily intake will rise as well as that of other household members, particularly women.

Surplus milk is sold both within the producing village and to the milk processing plant which supplies urban workers. Zanzibar at present only produces 10% of the milk it consumes.

The importation costs of bringing in sufficient milk and meat to satisfy local demand is borne by the government. This erodes public savings and investment capital which could be used to promote other projects. The creation of conditions which will promote self-sufficiency in milk and meat production will mean greater public savings, less dependency on foreign sources of supply and higher income for local farmers and transporters. It may also encourage local tanning of hides and the development of handicraft industries which utilize the leather, horns, hoofs and bones of the animals. Inasmuch as the Ministry of Agriculture does not plan to determine who will be the recipients of improved breeds nor do they discriminate in their location of disease control programs, potential beneficiaries of the project will be largely self-selecting.

(b) Possible Negative Consequences: Farmers with no interests in keeping cattle may become victimized by livestock owners. The man-to-land ratio is balanced at presence but would become a problem in the near future as population pressures build up on the land.* Following cycles are likely to shorten, and intensified use of land for cropping will most likely lead to declining soil fertility. The land which can be devoted to grazing may, therefore, contract just at the point in time when larger herds will be developing to meet the needs of larger human population. At this point a conflict over land use may emerge between livestock owners, who at present freely graze their cattle on any land which is uncultivated, and farmers cultivating crops exclusively.

Larger herds will require extensive bush clearance programs and/or the development of fodder. In most villages cattle-owning families are a minority. Initially more labor will be required to clear bush than they can raise from their own families. If entire villages are recruited to clear bush with them this would amount to their exploitation of fellow villagers labor. Since most able-bodied men are, due to income differentials, off in town, the youth services, school or the military, a large portion of the labor recruited locally will be composed of women and elderly men. This problem could be mitigated by the issuance of interest-free loans for bush clearance by recruitment of the youth service or military for bush clearance activities or through paid local laborers hired directly by the government.

Wild pigs which are at present the preferred hosts of the tsetse may present another picture. The presence of tsetse

flies is suppressing their population. Once the tsetse is removed their populations may surge giving rise to extensive damage of crops is areas near their breeding grounds and vitimizing farmers in the vicinity.

(c) Adaptability - Most of the potential beneficiaries are mixed agriculturalists, many of whom already keep cattle to supplement income from crops. The implementation of the tsetse eradication project does not require them to make any major social changes. The future development of livestock if the project is successful will, however, call for adoption of upgraded and/or new breeds of cattle. Exposure to past livestock upgrading schemes and the demonstration effect of Saihwals and Jerseys with markedly higher yields on state farms predisposes many farmers to adopt these innovations. The adoption of these innovations is not expected to meet with resistance.

The adoption of the above innovations will be enhanced by making certain that all farmers wanting to adopt higher yielding breeds are able to afford them, by improving extension to small holders with one to five cattle who are often neglected, by mounting a campaign using Swahili written in Arabic script which most people can read, by establishing milk collection centers and rural butcheries which meet minimum health standards and by establishing prices for milk add meat which will encourage producers to raise production.

4. Spread Effects

(a) Diffusion - Tsetse eradication will be islandwide thereby creating immediate opportunities for all present livestock owners. Current calf mortality rates are estimated at 35% due to disease factors. The removal of the tsetse constraint will lead in a short time to a rise in the Island's entire livestock population. Many farmers claim that in the past they kept herds as much as four times larger than their present holdings on the same acreage until their herds were decimated by disease. Rapid increases in herd sizes are not expected to lead to major changes such as large-scale migration in search of new grazing areas. Cultural practices may change as a result of behavior changes associated with tick control but this may not be of great consequence. All present livestock owning households will immediately benefit from tsetse eradication.

The scattered nature of grazing areas in small patches, the custom of tethering cows, the time involved in watering livestock in areas using well water, the custom of spreading one's risks and the desirability of having client households indicates that as cattle populations increase, households with more than five cattle will make greater use of profit-sharing institutions

(wafugai wa nusu nusu) and distribute a good portion of their herd to poorer households not presently engaged in livestock care. The spread effects of the tsetse project will be enhanced in this way without requiring additional inputs.

(b) Durability of Results - Assuming that much stricter quarantine measures are instituted against imported livestock to prevent reinfestation, the results of tsetse eradication should be permanent. Future generations will benefit from the tsetse-free environment created by the project.

The major safeguard required to guarantee the durability of the project's results is the swift and continued application of strict quarantine measures.

5. Equity

Cattle are at present kept by individual smallholders whose herds average five cattle. Some indication of the districution of cattle among the islands 4,500 cattle-owning households can be gained by examining the table below which offers a profile of cattle ownership for Magharibi district and Zanzibar town. This area contains 5,755 or about 25% of the Island's 19,599 cattle. Bearing in mind that fifty percent of the Island's population live there, 36% live in Zanzibar town and an additional 14% are scattered throughout the remainder of Magharibi district.

Table 7 - Cattle Distribution in Magharibi District

Number of Cattle	% of Cows	% of Owners	Absolute Number of Cattle
1 - 5	34.50	67.3	2,210
6 - 10	25.30	19.7	1,522
11 - 20	14.00	5.5	896
21 - 30	5.20	1.2	331
31 - 40	2.60	0.4	164
40L	8.3	0.85	532

As can be seen, 67.3% of all cattle owners have five cows or less and less than 10% of all owners have more than ten cattle. Although the top one percent own 8% of the cattle, the top ten percent own 30% of the district's cattle, cattle ownership is reasonably equitable. Figures for military and institutional herds have been excluded so that the figures shown do not add up to 100%.

Those in the top 1% are wealthy businessmen, many of whom are Arab or Shirazi and whose families control larger than average tracts of land in the clove and coconut areas. Also included in this group are notable Africans, These families initially derived their wealth

from cloves, coconuts, oranges and fish and then diversified their interest and spread their risks by buying urban businesses such as provision stores and bakeries and spreading out into transportation, livestock keeping and other enterprises. Each enterprise is placed under the management of a different family member where possible and the family group collectively operates like a holding company. A Nyamwesi is hired to care for the herd and livestock are kept on a commercial basis.

Those households holding six to twenty cattle are middle income. These households normally do not have sufficient capital to hire herders to care for their herds and make the greatest use of client families as wafugaji wa nusu nusu to acquire the assistance they need to care for their herds. The clients benefit by gaining access to milk for household use, money for sales of surplus milk and by establishing equity through the custom of sharing the offspring of the cattle they care for equally with the owner. Many of the male household heads are deeply involved in local politics as balozi, katibu kataa, and CCM branch chairmen. The creation of a large cadre of clients and retainers who are obligated to them is useful for their career advancement as well as their economic well being. They are eager and enthusiastic to spread their herds as widely as possible.

The largest number of cattle owners are the 67% who own 35% of the Island's cattle. A large number of these families are among the working poor. Many of them acquired their herds by becoming clients for wealthier men and slowly building up their own small holding. Others patiently saved earnings from crop sales, fishing and employment and invested their money in one or two heads of cattle. For many cattle represents a form of savings which can be quickly turned into cash during an emergency or used to meet social obligations during weddings, funerals or religious ceremonies. Most of these families feel that tending for others cattle on a profit sharing basis is a convenient and desirable way of augmenting their incomes and holdings. The sharing of cattle has been a major factor in the control of grazing and has unconsciously guarded against overgrazing and environmental degradation.

It can be seen that while the cattle owners will benefit from tsetse eradication through the reversal of the present trend of livestock decline to one of livestock increase, wealthier cattlemen in the top four percent will benefit disproportionately. This is true not only because they have more cattle but is also due to the greater rapport they tend to establish with officials. Their access to transportation, their ability and willingness to entertain, their awareness of the value of cultivating ministry officials so that they can benefit from their knowledge, advice and active support, the similarity in their background with many officials and the empathy that

results, and their common knowledge of English all give them advantages over most farmers in the lower ten percent. They have struck up friendships with FAO, DANIDA, and USAID officials and have already begun to take advantage of the AI scheme. These initial advantages do not allow them to dominate the livestock industry nor to dictate trends. The scale on which they operate is different enough from the majority of farmers that they have little impact upon them. The greatest empathy exists between those owning one to five cattle and those owning six to twenty cattle. The scale of their farms are close enough as to provide an emulatable model and a target which the majority of small cattlemen feel they can reach. Interaction between these groups is frequent and reinforced by the institution of wafugaji wa nusu nusu. These two groups control over 70% of all the Island's cattle and represent in excess of 80% of the owners. The trend is towards the establishment of greater equity in ownership in the future. Questions of equity and distribution while important and requiring close and constant monitoring should not pose a major threat to the distribution of project benefits.

6. Burdens on Women and the Aged

The declaration of free and compulsory education has increased the number of schools in Zanzibar from 68 before the revolution to 136 by 1978. Attendance is compulsory up through Form III. While the aim of the system is noble and its accomplishments admirable, it has created many new problems. The prolonged absence of youth from farms dependent upon family labor has meant that a greater burden of all farm work has fallen on the shoulders of women and older men. Young mothers cannot count on child care takers to help them care for infants or the homestead and the values of many young men have been so revolutionized by formal education that personal advancement and upward mobility is for them urban centered. They abandon, in many cases, their young families and head to town searching for employment often suffering long periods of unemployment in their quest. One consequence of this is that it is rare to find a cattle owner under the age of 35 years. While cattle keeping is not arduous, bush clearance in areas where burning is not desirable, can be. This is less of a problem in the clove growing areas where farm incomes are higher and approach those of urban workers; there the problem is access to the proceeds from clove sales, i.e. use of the land and trees. Out migration also occurs in the clove areas but it is considerably less than from most other areas.

In many areas the provision of piped water has eased women's burdens and given them more time to devote to other activities. This is especially true in parts of Magharibi district. Due to their proximity to town, many young men work in town and commute home frequently. This has meant that women have had to assume many responsibilities formerly assumed by men. While it true generally that men care for livestock, many employed men have given over the caretaking of

their herds to their wives on a profit-sharing basis modelled on the wafugaji wa nusu nusu system. And as yet small but growing trend is emerging for women to establish equity in their husbands herds and build up their own herds over which they have complete control. Cattle keeping is supplemental to other activities and can be fitted into the daily routine especially in areas with piped water and other burden-easing amenities such as nurseries. In communities with low cash incomes this provides a welcomed income generating activity for women. In the short run, women and older men can be expected to play a greater role in all agricultural activities and every effort should be made to incorporate them in rural development schemes.

7. Social Acceptability : Summary

The generation of demand for disease control and stock upgrading programs has come from the grassroots, i.e. the livestock owners themselves who wanted to be saved from the advance of diseases and falling returns from decreased livestock production. The inclusion of many local officials and party members (who own cattle) in actively identifying tsetse control leads one to conclude that they will wholeheartedly support the project.

C. Initial Environmental Examination

1. Identification and Evaluation of Environment Impacts:

Currently the control of trypanosomiasis is attempted solely by chemotherapy and chemoprophylaxis. This is costly and cannot lead to eradication of the disease. Limited tsetse control, to reduce the trypanosome challenge to livestock, would be feasible but as operations would have to be conducted at regular intervals for the foreseeable future; the cumulative costs and environmental impact would be high. The fact that Zanzibar is an island and that the tsetse population there is thus well isolated from other fly populations on the mainland makes eradicating the disease by vector eradication an attractive possibility. Techniques are available which, given a well-organised campaign, suggest that eradication would be technically feasible.

2. Implications at Tanga and Mkwaja:

In FY 1978-79 a program of release of sterile males produced at Tanga by the PASA Tsetse Fly Research Program are being released on a commercial ranch site of approximately 100 square miles. The release of the sterilized insects for 12 to 15 months eliminated (98% control) one of the vestor species (Glossina morsitans morsitans) inhabiting this grassy woodland area. Other vector species persist in restricted loci after the research is completed. There is now a 1 km band cleared of bush around the ranch. This serves as a partial

barrier to fly movement from the surrounding bush to the ranch. To reinforce this barrier residual applications of DDT have been placed along the outer edge on known resting sites of the flies. Since insecticides are most efficient and economic when insect populations are high and sterile insects most economical when populations are low, two aerial applications of Endosulfan were used to reduce the density of flies prior to the release of sterile males. On the ranch where the testing is being completed, the use of sterile males reduced by 40 to 60 percent the amount of non-persistent insecticide required to control the flies. Current insecticide technology would have required five or more aerial applications of non-persistent compounds such as Dieldrin or DDT on the ranch if SIRM had not been used. The anticipated environmental consequences of the parent research activity are as follows:

— Creation of 1 km Clearing Around the Ranch - This clearing has been undertaken by the ranch management to reduce immigration of tsetse flies from the outlying bush to the ranch. In the area cleared, the barrier reverted to open grassland, improving the productivity of the area. Approximately 25 square miles of grassland habitat have been created and under proper management will remain free of woody vegetation and not be subject to erosion. Limited portions may be available for grazing by ranch habitat. In fact, large game animals appear to prefer the barrier and treated areas as they are fly free.

— Residual Application of DDT Along Perimeter of Barrier Clearing - The barrier clearing reduced the natural migration of flies into the ranch area, but some insects have been carried across the clearing by game animals. To prevent reintroduction of these flies a strip of DDT treatment at periodic intervals has been made along the perimeter of the clearing. The natural resting sites of the flies, i.e. tree trunks six-eight inches or more in diameter are being sprayed with 5% DDT two-six feet above the ground level. Since the flies prefer this site for resting, applications of this nature have been successful for control. The treatment on these selected sites are persistent enough to remain effective for three-six months. Each application requires 250 to 500 lb. of actual insecticide. By treating selected resting sites, the material, although persistent, is situated on only a small percentage of the total habitat and exposure of non-target organisms is minimized.

— Two Aerial Applications of Insecticides - One hundred (100) square miles of the ranch received two aerial applications of Endosulfan. The insecticide was applied in droplets of about 70 microns, a size that floats enough to leave a permanent residue that are toxic to flies or other insects. Endosulfan will persist at low levels in the treated area. The treatments levels were 11 grams

per acre of actual insecticide and approximately 300 lbs of actual insecticide were used. At this level no adverse effects of non-target organisms or on vertebrate or fauna were observed. By using small doplets, it is possible to achieve maximum volume applications. By using sterile males to complete the reduction of the fly population, a net decrease of 40 to 60 percent was achieved in total pesticide usage.

— Release of Sterile Insects - By releasing the sterile insects only after suppression with standard insecticides, it is possible to avoid the creation of a temporary situation in which there is an increase in vectors that are normally present. Thus even at the beginning of the release program, the number of tsetse flies in the natural population plus the released sterile insects will be less than normal. Therefore transmission of trypanosomiasis by the target species will decline immediately and in time be entirely suppressed. The elimination of the target species from the environment is not likely to be accompanied by an increase in closely related species, since the limited evidence available suggests they are not interdependent. Furthermore, there are no known beneficial parasites or predators that depend primarily on a single species of tsetse fly for their survival.

— Summary of Tanga and Mkwaja Activities - The activities conducted during the parent project at the Tanga Tsetse Research Center and the Mkwaja Ranch were the subject of an environmental assessment conducted in 1977 by an expert team of ten persons. It is the judgement of the design team that the proposed activities of the present project are of such similarity to those of the parent project that the negative determination finding of that team remains valid. A description of the parent project drawn from the assessment included as appendix. The conclusions reproduced verbatum were as follows:*

> The environmental assessment team has concluded that the Tsetse Research Project, Tanga, Tanzania will have negligible deterimental effects on the environment of the Project laboratory at Tanga and field test site at the Mkwaja Ranch. As a result, given the successful conclusion of the Sterile Male Insect Release Method, future tsetse fly eradication projects may be undertaken with a 40 to 50% less dependence upon insecticide applications.

Since the activities proposed for Tanga under this project are essentially the same as those evaluated by 1977 EA team, it is recommended that a negative determination be approved.

4. Zanzibar Activities

During the life of the project one specie of tsetse, *Glossina austeni* will be eliminated from Zanzibar Island. In addition, additional technical developments on fly rearing and release methods initiated under an earlier project will be continued at the Tanga Tsetse Tesearch Centre.

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* TA/AGR of the Agency for International Development, U.S. Department of State, the Environmental Assessment Team of Tsetse Research Project, Tanga, Tanzania, April,1, 1977. (See Appendix D for a copy of this report.)

— Land Use - In general a major benefir of tsetse control (other than for control of sleeping sickness) is to alter land use patterns so that unproductive land can be used. This will inevitably have greater environmental impact than any transitory effects of the insecticides used to achieve tsetse eradication. Clearly, such development has to be controlled if land degradation (e.g. by overgrazing) is not to occur. In mainland areas, the removal of the constraint of animal trypanosomiasis can lead to over settlement and overgrazing, where uncontrolled movements of nomadic cattle occur. Nomadic cattle grazing does not occur on Zanzibar and consequently a major difficulty often associated with removal of trypanosomiasis would not occur. Trypanosomiasis control in Western Zanzibar would probably have little or no effect on land use although a few more animals might be kept by individuals farmers, although this would probably necessitate improvements in forage production. In Eastern Zanzibar removal of trypanosomiasis would open up the areas currently little utilized by livestock.

— Water Quality - Application of insecticides will be required. The previous project used aerial application of Endosulfan to reduce the tsetse population, however Endosulfan is potentially highly toxic to aquatic life. Phase I therefore includes testing of different strengths of Endosulfan and application techniques as well as examination of other possible pesticides. The SIRM releases were conducted at Mkwaja after three aerial applications of Endosulfan in order to reduce the population to a level that could be handled with sterile males. The insecticide was applied in droplets (35.45 m in diameter). Endosulfan was found to be persistent at low levels, each treatment utilized 30 grams/ha. of active ingredient (0.0825 lb. per acre total for applications) The potential threat to non-target organisms was minimal, however high dosages are a threat to the invertebrates and fish. Effects were minimized at Mkwaja by spraying in the dry season when rivers were dry. The potential of insecticide use on Zanzibar are not known. Phase I activities include testing and development of application techniques and preparation of a recommendation with respect to insecticides for the control Phase. Results will be available to EA and the Phase I evaluation teams.

— Atmospheric - Mkwaja Ranch applications found air pollution effects from the insecticide application to be transient. A more serious impact to the quality of atmosphere is dust which could eventually be caused by overgrazing. Future livestock development on Zanzibar, therefore, should be complemented by a bush control and range management program.

— Natural Resources - Potential impact on water and land use have been discussed. Experience at Mkwaja Ranch found the ranching operation had not radically altered the fauna or flora so as to

eliminate many, if any, species. The Mkwaja location required barrier clearance and maintenance while the proposed Zanzibar eradication program would not. The potential of destroying natural resources is thus minimized.

— Overall-Social Economic Impact - The project has high potential socio-economic benefits. The research activities give promise of developing a successful methodology additional tool for tsetse control which has 40% - 50% less dependence on insecticide applications than ither control techniques. More immediate benefits could be gained from control program on Zanzibar.

— Health - G. austeni does not cause human sleeping sickness and thus in terms of improving human health the project will have no immediate impact. Eliminating a livestock disease potentially would allow increased dairy and meat production. If increased production could be realised it could result in improved diets. Tsetse control on Zanzibar would prevent further animals from being infected. Already infected animals would require treatment.

— General - A successful eradication program on Zanzibar would offer an environmentally sound pest management technology which possibly could be applied on a wider scale on the African continent.

— Summary - Trypanosomiasis eradication in Western Zanzibar would probably have little or no effect on land use although a few more animals might be kept by individual farmers, although this would probably necessitate improvements in forage production. In Eastern Zanzibar removal of trypanosomiasis would open up the areas currently little utilized by livestock.

The benefit of control programs integrating the efficiency of pesticides, where warranted, with the efficiency of the sterility principles are considerable. It is possible to reduce the total amount of pesticide usage of other control techniques by 40 to 60 percent. Furthermore, it is possible to minimize the impact of control programs that have been used to modify the tsetse habitat (bush clearing) or reduce the abundance of natural hosts of tsetse flies (game elimination).

Other factors that need to be considered when assessing the impact of widespread elimination of tsetse flies include the requirement that fly-free land be maintained fly-free. This is usually accomplished by putting the land into use immediately so that fly re-entry is discouraged. Man's activities in land clearing bush control through range management and settlement usually modify the previous fly habitat sufficiently to prevent fly re-establishment. This type of environmental impact is a requirement if the fly elimination is to be permanent. Zanzibar provides an opportunity to effectively control tsetse and to

test the SIRM without the expense of initial barrier clearance and maintenance since 17 miles of water insulate the Island.

5. Recommendations for Environmental Action:

(a) Based on the design team reviewed of the findings of the April 1977 Environmental Assessment of the Tanga/Mkwaja activities (see Appendix D) it is recommended that a negative determination be approved for the Mkwaja Ranch and Tanga Laboratory research activities.

(b) It is recommended that an Environmental Assessment of the potential impacts of tsetse fly control on Zanzibar be undertaken.

The assessment should be prepared in draft form by members of the implementation team which will include entomologists and veterinarians and TDY experts as required. The draft will be reviewed and recommendations made by the expert project technical advisory panel and approved by procedures in effect at that time.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas 1/	Impact Identification & Evaluation 2/
A. LAND USE	
1. changing the character of the land through:	
a. Increasing the population	M
b. Extracting natural resources	N
c. Land clearing	N
d. Changing soil character	N
2. Altering natural defences	N
3. Foreclosing important uses	N
4. Jeopardizing man or his works	N
5. Other factors	M
Land uses planning	
Squatter and other development	L
B. WATER QUALITY	
1. Physical state of water	M/H
2. Chemical and biological states	M
3. Ecological balance	M
4. Other factors	
_____	-
_____	-

Symbols: N - No environmental impact
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact

IMPACT IDENTIFICATION AND EVALUATION

C. ATMOSPHERIC

1. Air additive	L
2. Air pollution	L
3. Noise pollution	N
4. Other factors	-
_____	-
_____	-

D. NATURAL RESOURCES

1. Diversion, altered use of water	M
2. Irreversible, inefficient commitments	N
3. Other factors	
Fish	N
Wildlife	N

E. CULTURAL

1 Altering physical symbols	N
2. Dilution of cultural traditions	N
3. Other factors	
_____	_____
_____	_____

F. SOCIOECONOMIC

1. Changes in economic/employment patterns	M
2. Changes in population	L
3. Changes in cultural patterns	L
4. Other factors	
_____	-
_____	-

G. HEALTH

1. Changing a natural environment	L
2. Eliminating an ecosystem element	L
3. Other factors	
_____	-
_____	-

H. GENERAL

1. International impacts	N
2. Controversial impacts	N
3. Larger program impacts	M
4. Other factors	
_____	-
_____	-

I. OTHER POSSIBLE IMPACTS (not listed above)

_____	_____
_____	_____
_____	_____

D. Cost Effectiveness

The purpose of this section is to help establish a framework to identify and monitor the most important variables underlying the cost structure of SIRM techniques. It is anticipated that short term consultant services will be used in both phases to collect, collate and analyze relevant data to track whether a desired degree of cost effectiveness is being achieved. It is important to understand that given the nature of the technology, SIRM is subject to a serious trade-off when considerations about cost effectiveness are over-emphasized. This is because a major cost factor in releasing sterilized flies is colony-rearing and maintenance. Yet, the latitude for reducing rearing and maintenance costs is limited by considerations for maintaining the biological viability of the sterilized fly at levels necessary to ensure its competitiveness with the wild fly.

The limited data available to the design team for identifying and analyzing the major cost components of SIRM field applications indicate that additional work is necessary before conditions for optimum cost effectiveness can be determined. This state of affairs is not meant as a criticism of the Tanga center; rather, it is indicative of many research projects whose objectives relate primarily and appropriately to the development and testing of new technologies and techniques. However, as this project moves into its development phase, monitoring of cost effectiveness will be absolutely essential. The following therefore is intended as a brief guideline for the consultants responsible for monitoring cost effectiveness during the life of the project.

Since SIRM is a complementary rather than a substitute technology to, say, aerial release of insecticides, its cost effectiveness need not be established relative to the costs of alternative techniques. For example, to compare the cost of SIRM on a per square mile basis with those of alternatives would unjustly ignore the incremental value of the environmental benefits of using SIRM jointly with conventional techniques. Also the likely reduced marginal costs associated with additional SIRM application relative to those of alternatives would be ignored. Therefore, it may be more appropriate to establish the cost-effectiveness of SIRM on an iterative basis proceeding from an initial cost estimate of SIRM application (total non-development cost of rearing and field release) on a per square mile basis rather than on a per fly released basis alone. Once individual components of the entire SIRM cost structure have been identified and measured, a determination can be made about which components are most feasible candidates for additional work to affect incremental reductions in total costs. For example, leaving aside personal interests of the scientists at large, project management may wish to consider the relative benefit/cost

ratios and timing of additional work on membrane feeding versus additional work on, say, improved methods of field release. Only when an iterative method yields a position where no further cost reductions can be affected, will it become useful to begin to compare SIRM per square mile costs with those of alternative techniques. This will enable overall benefit/cost analyses of SIRM taking into account, on the benefit side, such factors as:

a) the cost savings of fewer insecticide applications;

b) the ecological benefit of fewer insecticide applications;

c) the cost not incurred in barrier construction by using SIRM as a component of barrier maintenance and even of barrier establishment;

d) overall socio-economic benefits stemming from an improved and more effective total arsenal of tsetse control resulting from the use of SIRM as an effective additional complement.

In view of the wide range of potential benefits that can be attributed to SIRM (see Social Soundness Analysis, Part III, B) the design team has little hesitation in recommending approval of this project on the basis of economic considerations, provided that work on cost reductions be given appropriate emphasis in the future.

E. Administrative Feasibility

1. Tanga Center

Managerial responsibility for the Tanga Tsetse Research Center will continue to reside with the Department of Veterinary Services of the Ministry of Agriculture of Mainland Tanzania. At the present time, roughly half of the project-related employees at Tanga receive salaries or are hourly employees paid directly by the Department and roughly half are employed with project funds. The project budget has been prepared continuing this breakdown. The Ministry has agreed to continue to support the Tanga Tsetse Research Center in anticipation of its future more direct impact on mainland control programs.

Although the bilateral agreement between USAID and the Tanzanian Government will detail the financial responsibility of each party related to personnel, procurement of commodities, construction and expatriate housing, due to the severe budgetary constraints of the Ministry in some instances, USAID will assume these obligations to assure timely completion of the project. A renewed commitment of the Government of Tanzania to provide a reasonable share of costs must be assured. Although a strong feature of the parent project has been its counterpart training program, a commitment to assign senior staff

(once trained) to the tsetse research and/or control activities must also be assured.

2. Cooperation with the Government of Zanzibar

The Zanzibar portion of the project would be implemented through the Ministry of Agriculture, Zanzibar. It is essential that the Ministry make available sufficient junior staff to assist with the field programs, in particular the tsetse surveys and ecological studies and for training as handlers of insecticides. Auxilliary staff, such as drivers, will also be required.

Full freedom of movement for project staff must be guaranteed and an assurance should be obtained that flying, possibly including low night spraying operations would be permitted.

The Ministry of Agriculture should provide assurance that an adequate strategy and proposals for land usage and treatment of trypanosomiasis infected animals after tsetse eradication will be worked out during the project. If optimum benefits are to be realised some commitment from Government to ensure such proposals are implemented would be necessary. Such assistance is scheduled as part of FAO/UNDP technical assistance provided to the Ministry of Agriculture.

3. Project Contractor

AID has had a PASA arrangement with USDA's Agriculture Research Station, specifically with the Insects Affecting Man Research Laboratory, since 1964 to provide research on the Sterile Insect Release Method (SIRM) for the control of tsetse flies, the vectors of trypanosomiasis (sleeping sickness in humans and n'gana in animals) USDA/ARS is the only US institution conducting research on this methodology. While several international and other national organizations are conducting research on SIRM none of these organizations are U.S. owned. Based upon USDA's previous work on SIRM and outstanding performance in the parent project, the design team recommends a new PASA be negotiated with USDA to provide the technical services required to implement this project. Additional considerations include: AID's prior investment in developing USDA's expertise in the area of SIRM research; the necessity of fielding a technical assistance team at the Tanga facility prior to the departure of the current PASA team; and USDA's access to the limited personnel with expertise in SIRM.

The USDA team should also have the benefit of the other organizations work in this area and it is therefore recommended that the cooperating agreement with FAO/IAEA be continued (see Appendix E).

F. Financial Plan Budgets and Obligations

Table 8 gives a general breakdown of the total project costs. Detailed Cost Estimates may be found in Appendix B. A three year period is assumed for Phase I. If Phase I were to be completed within 18 months, the minimum time now estimated to fully prepare for the eradication program, Phase II could be initiated immediately with the same level of personnel. Funding would have to be increased by approximately 25% per year to finance additional costs such as aerial contract services, labor and insecticides. The obligation schedule proposed in Table 9 requests $500,000 of funding in 1979. This request includes three months expatriate salaries, six months for locally provided services including local staff, procurement of approximately half of total transport requirements and six months rental of facilities. The FY 80 obligation includes funds for two years of technical services, all training costs, eighteen months of funding for locally procured goods and services; and the funds required for the Zanzibar facility. The final year of obligation for Phase I, FY 1981, fully funds the technical assistance contracts and local procurement costs for one year.

Tanzania Government contributions have been estimated on the basis of previous contributions from both the development and recurrent budgets. Salary contributions were based on current government services salary scales. The recurrent costs implication are not significant since the TanGov have been meeting costs of most local labor and provided some support for vehicle operation and spares. The more important aspect will be the TanGov's ability to undertake, or obtain other donor support, for future mainland eradication programs. The Zanzibar government has a poor record of providing support and therefore no contribution for these costs is expected; however, the Zanzibar Ministry of Agriculture has agreed to make certain staff available and the land for the laboratory/office.

The host country contribution is less than 25% as required by Section 110(a) of the FAA however Tanzania as a relatively least developed country is exempt from this requirement. USAID/Tanzania believes the $600,000 contribution represents a fair share of project costs, Phase I represents primarily feasibility, further technical development and survey activities. A proportionately larger share of annual project costs should be assumed in Phase II central activities. (See Inputs by Host Government, Part II. E.)

Table 8 – Summary Cost Estimates and Financial Plan

(US $ '000)

		AID		Host Country		Total	
		Ex	LC	EX	LC	EX	LC
I.	Technical Assistance	2,641.5	–	–	193.6	2,641.5	193.6
II.	Training	180.6	–	–	–	180.6	–
III.	Off-Shore Procurement	388.2	–	–	–	388.2	–
IV.	Local Procurement	–	676.2	–	240.6	–	916.8
V.	Local Construction	5.2	46.8	–	15.2	5.2	62.0
VI.	Trust Fund	–	–	–	47.2	–	47.2
VII.	Contingency	160.8	36.1	–	–	160.8	36.1
VIII.	Inflation	762.1	160.3	–	101.5	726.1	261.8
		4,102.4	919.4	–	598.1	4,102.4	1,517.5
	TOTAL	5,021.8			598.1		5,619.9
	Rounded Totals	$ 5,000,000		$ 600,000		$ 5,600,000	

Table 9 - Obligation Schedule

(US $ '000)

		FY 1979	FY 1980	FY 1981	Total
I.	Technical Assistance a/	200.0	1,699.0	742.5	2,641.5
II.	Training b/	-	180.6	-	180.6
III.	Off-Shore Procurement	125.0	238.2	25.0	388.2
IV.	Local Procurement c/	130.0	341.3	204.9	676.2
V.	Local Construction	-	52.0	-	52.0
	Sub-total	455.0	2,511.1	972.4	3,938.5
	Contingency 5%	22.8	113.2	60.9	196.9
		477.8	2,624.3	1,033.3	4,135.4
	Inflation	22.5	542.9	321.0	886.4
		5,500.3	3,167.2	1,354.3	5,021.8
	Rounded	5 500.0	$3,200.0	$ 1,300.0	$ 5,000.0

a/ 3 months funding, FY 1979; 2 years funding FY 80; 9 months funding FY 81

b/ Life of training funding in FY 80

c/ 6 months local salaries etc. in 1FY 79

PART IV. ADMINISTRATIVE ARRANGEMENTS OF PHASE I ACTIVITIES

A. Implementation Plan

The first step necessary for the successful and timely implementation of this Project will be the overlap of the ongoing Tanga Research Project and Phase I under this proposed project. Should there be no overlap and the Tanga Project is allowed to lapse, it could cost two years to bring it back to its present state. The opportunity to transfer techniques and procedures, which could keep operations running efficiently, would be lost. Experienced personnel - including Tanzanian technicians trained over a period of years - will be lost. It is extremely important to move ahead as rapidly as possible to get the new project started. August 1, 1979 would be the very latest date allowing for adequate overlap since the present Tanga Project is funded only through September, 1979. However Phase I of the Zanzibar Tsetse Fly Eradication Project can be started at any time before August 1st.

The project will develop in two phases. Phase I calls for the Baseline Survey; the introduction of an initial colony of G. austeni for expansion; testing of the insecticides and their release and application rates; development of new methods for pupae/fly release; and construction and equipping of the laboratory and houses. The Baseline Survey will consist of two components:

The Animal Disease Diagnosis (to be carried out by the Vaterinarian and his assistants, which will ascertain what types of livestock diseases — principally the blood-borne diseases such as trypanosomiasis — are present on Zanzibar; and incidence and the distribution of diseases on the Island, and the relative degree of their economic importance and will make recommendations to the Government of Tanzania for curing or controlling the diseases. Blood sampling will have to be done extensively throughout the Island. This will require good transportation, able field and laboratory assistants and cooperation of the livestock owners.

2. The Tsetse Fly Distribution Survey (to be conducted by the two entomologists, plus their field assistants) which will find:

(a) The geographic locations of fly infestation on Zanzibar;

(b) Fly concentrations;

(c) Fly movement during the different seasons;

(d) Ratio of males to females;

(e) The breeding places (location of the pupae);

(f) Kind of vegetation in the area where the flies are found and what relation the vegetation has to the fly

density. Also, where the fly is found at different times of the 24-hour period.

Methodologies will be determined by the survey technician, one of whom was a member of the Tanga Team, who is competent and experienced. The methods used will probably be patterned after the tsetse fly rounds developed on Mkwaja Ranch. A fly round covers a marked path with a precise area; the round is made according to set times, usually weekly, or bi-weekly, by a pair of field men who catch flies only on these paths. These paths are carefully selected at the beginning of the survey to give the best representative samples of the fly behavior. The exact same fly rounds are sampled throughout the survey and monitoring periods.

New release methods are to be perfected so that sterile males can be introduced at the required regular intervals over specifically measured areas. The ground release system used on Mkwaja Ranch was a system of paths spaced one kilometer apart, hacked out of the bush by hand. This is not practical on Zanzibar, so an aerial drop system (such as one used in the screw-worm eradication in the southern United States) will be perfected for sterile tsetsefly release.

Phase II will include control program, the fly population monitoring; and continued laboratory disease diagnostics on Zanzibar. Tanga will serve as the fly-rearing factory maintaining a colony of 60,000 flies and making surplus available for release on Zanzibar, for as long as needed, while it prepared for larger tsetse control programs on the mainland.

As the natural fly population decreases on Zanzibar, fewer sterile males will be needed and the colony of G. austeni at Tanga can be reduced. The laboratory facilities can then be used to rear different species of flies commonly found on the mainland, Glossina morsitans morsitans and Glossina pallidipes. Initial colonies of these species will come from the FAO/IAEA Laboratory. Up until the present time G. pallidipes, because of characteristics peculiar to the species, has not been successfully colonized, and colonization under laboratory conditions could be perfected at Tanga. A colony of G. m. morsitans, 60,000 strong and the largest colony of tsetse fly in the world, has already been developed at Tanga; and can be easily re-introduced.

PROPOSED SCHEDULE OF EVENTS

PHASE 1

1979

March	-	PP received and reviewed in AID/W
Mid-April	-	Phase I approved and Phase I Authorised
Mid-May	-	Advice of Allotment
End of July	-	Project Agreement signed with GOT
Mid-August	-	Management contract executed (USDA)
"	-	Commodities ordered
"	-	Selection of contractors for local construction
End of August	-	USDA contract with Bristol University for nucleus and back-up colonies of *G. austeni* executed
" "	-	USDA contract with IAEA executed for *G. pallidipes* and *G. m. morsitans*; membrane feeding; and aerial release systems
" "	-	USDA renew tours of duty for the fly-rearing expert and one of the entomologists now at Tanga
" "	-	The two above technicians assume the duties of managing the Tanga fly-rearing station, keeping it in a holding position of 10,000 flies until other technicians arrive at post
November	-	First two technicians provided for by this Project arrive at Tanga (if not earlier)
December	-	Same two technicians assume duties at Tanga (if not earlier)

1980

January	-	All technicians in place at Tanga and on Zanzibar
"	-	Tanga introduction of new technicians
"	-	Survey planning for Zanzibar, training of surveyors
February	-	Survey planning consultant, Dr. James Harley from the Centre for Overseas Pest Research, London, England, arrives for one month's visit.
"	-	Introduce G. austeni nucleus colony from Bristol, England
"	-	Consulting specialist on G. austeni, Dr. Anthony Jordon, from Bristol University, Bristol, England arrives at Tanga for one month's visit
March	-	Begin full-scale Baseline Survey on Zanzibar
"	-	Technical Advisor visit
April	-	Introduce pupae (100+) gathered on Zanzibar to Tanga for rearing for later testing
May	-	Conduct aerial fly release tests using G. morsitans (Mainland)
June	-	Field test the insecticides.
July	-	Using the above results, check on Zanzibar against the natural fly G. austeni to see whether results are the same as in the Mainland tests at the lowest dosage
"	-	Laboratory test of G. austeni from Zanzibar as against G. austeni multiplied at Tanga from Bristol University stock
	-	Technical Review Plan

1980 (continued)

- (1) Perfect aerial release method
  (2) Field test Zanzibar-reared flies against Bristol flies for vigor, strength and competitiveness
  (3) Continue to multiply *G. austeni*
  (4) Continue Zanzibar survey

1981

May	-	Environmental Assessment
June	-	Phase I Evaluation. Results will be considered to determine whether further Phase I work is necessary before decision can be made regarding eradication on Zanzibar or if the project should be terminated (see Evaluation Plan, Part IV.B)
July	-	Phase II PP Amendment Submitted (Latest possible submission)

8. Evaluation Plan

1. Technical Advisory Panel - Purpose

Short term consultant services have been budgeted to finance a technical advisory panel to assist the project manager (USAID) and the project leader (contractor). Periodic evaluation of the present project was undertaken by specialists in entomological research, tsetse fly rearing and veterinary pathology. These sessions had the double value of providing required evaluation of progress toward defined objectives and also provided an opportunity to share experience with fellow scientists and control specialists and to take advantage of new developments in applied research procedures in this rapidly evolving science. It is proposed to continue the use of an advisory panel in this project. The primary purpose of the advisory panel will continue to be to assist the project manager by providing a periodic assessment of progress toward objectives. It will also provide an opportunity to take advantage of the specialist knowledge of members to assist in applying low cost feeding, rearing and release techniques, to assist in evaluating the latest developments affecting cost reductions for use in Zanzibar during Phase II.

The schedule of the panel has been adjusted so that meeting dates coincide with the primary points in the project, such as prior to initiation of ground spraying trials, and prior to evaluation of the proposed methods of eradication.

2. Technical Advisory Panel - Membership

The advisory panel should normally include the following persons and expertise:

Invited Members:

- Entomologist/glossinologist
- Epidimiologist/Pathologist
- Member representing an international institution on agency actively engaged in tsetse/trypanosomiasis control eradication
- Biological scientists
- Immunologist (trypanosomiasis)

Ex-Officio Members

- Tanga and Zanzibar Leaders (contractor) with USDA
- USAID Project Officer
- Project Co-Managers (Tanzania Government) - one Mainland and one Zanzibar
- TanGov Senior officers
- USDA Technical advisor.

The panel will be assisted by other members of the Project team and other consultants as deemed necessary by the project officer or the host governments.

A senior officer in each of the two Ministries of Agriculture (the Mainland and Zanzibar Island) will be invited to sit with the panels in an advisory capacity, the representative from the Mainland Ministry on matters pertaining to the Mainland, and the representative from the Zanzibar Ministry on matters pertaining to Zanzibar.

Evaluation Schedule

Final Review of parent project (March 1979)	1 week
Review Panel examines Phase I progress (July 1980)	2 weeks
Environmental Assessment (August 1981)	2 months
Phase I Evaluation (November 1981)	1 month

The above reviews are scheduled at decision points in project activities.

3. Technical Advisory Panel - Terms of Reference

The Advisory Panel will hold its first review about July of 1980 with the purpose of evaluating the progress of Phase I and the results of the following activities:

Baseline data survey of fly and disease distribution
G. austeni colony progress
Pesticide tests

This initial review will result a recommendation to:

— Proceed with plans and initiation of Phase II eradication activities on Zanzibar.

— Terminate the Zanzibar eradication activities should unexpected technical or risk factors be identified; or

— Undertake additional Phase I trials.

If Phase II is recommended the Advisory Panel will determine that the following conditions have been met:

— Acceptance from an environmental standpoint of the method of spray applications, proposed for Zanzibar.

— Successful development of an aerial release methodology for the pupae/flies. The ground release system used on Mkwaja Ranch would be practicable on Zanzibar, as discussed under (Inputs by AID, Part II, D.)

— The survey has been completed determining fly densities and a determination can be made as to:

(a) Where spraying is necessary;

(b) Where sterile males can be released effectively without prior spraying;

(c) Where sterile mles will be used in conjunction with the spray;

(d) If there are areas restricted from spray because of environment considerations, a determination that natural fly numbers in those areas are small enough to be reduced by release of sterile males;

(e) A colony of G. austeni for Zanzibar sterile male release has been reared and it has been determined that these flies can successfully compete with wild flies on Zanzibar;

(f) The colony of G. austeni is sufficiently large to make available the required number of sterile males for the eradication activity on Zanzibar;

(g) Satisfactory completion of insecticide field tests on Endosulfan which provides a dosage rate effective on G. austeni and non harmful to the aquatic environment.

— All covenants as set out in the Project Agreement have been met.

— Cooperation and support of the Tanzanian Ministries of Agriculture has been sufficient to warrant initiation of Phase II.

If the above conditions have not been met the Advisory Panel will recommend either trmination of the project or continuation of Phase I activities. If Phase I is to continue, the Advisory Panel will outline conditions which would indicate readiness to proceed with eradication activities on Zanzibar and a timetable for meeting the conditions and schedule a special Advisory Panel review at the appropriate time to determine whether the conditions have been met for Phase II control activities.

4. Environmental Assessment (EA)

An EA for the proposed eradication activities, Phase II on Zanzibar will be conducted in 1981. The team should include entomologists and veterinarians and other experts.

The EA will be completed prior to the first meeting of the Advisory Panel. The team should be briefed in AID/W by the Agency Environmental Coordinator, the DS/AGR and the parent project manager and AFR/DR/AGR. The EA teams findings will be considered in the evaluation

of Phase I; the Advisory Panel will include a recommendation for the Assistant Administrator for Africa regarding the acceptability of the EA recommendations and whether possible negative environmental impacts have been identified and mitigated to the extent needed.

C. Negotiating Status and Covenants

1. This project has been developed in consultation with the Ministries of Agriculture of Zanzibar and Mainland Tanzania, the USDA team at Tanga , and AID/W consultants. The project in its final form was discussed with the two TanGov Ministries in January and February 1979. (See Appendix K for letters of request.) Covenants, inputs and implementation issues such as construction and local salaries were discussed. USAID/Tanzania believes this project is ready for implementation and that there are no issues related to timely obligation of funds and implementation.

2. The Project agreement shall contain covenants, providing in substance, as follows:-

(a) The Cooperating country shall ensure that competent personnel are assigned in a timely manner to provide laborers and fill counterpart positions at Tanga and on Zanzibar.

(b) The Cooperating country shall covenant to assign U.S. trained participants to tsetse control activities at Tanga or on Zanzibar.

(c) The Cooperating country shall ensure that charter aircraft have free access to the Zanzibar airport facilities and freedom of overflight of the Island.

(d) The Cooperating country shall provide approximately 1/2 acre of land on Zanzibar for the construction of the veterinary office/laboratory facility.

(e) The Cooperating country shall provide financial support to the Project at a level not less than provided to the current research project activity.

(f) The Cooperating country shall develop a quarantine plan for Zanzibar Island to be initiated in Phase II to protect it from reinfestation of tsetse fly, from the Mainland.

APPENDIX A

LOGICAL FRAMEWORK MATRIX

Life of Project
From FY 79 to FY 81
Total U.S. Funding $5,000,000
Date Prepared February 14, 1979

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number Tanzania Tsetse Fly Control 621-0144

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objectime to which this project contributes: To assist the Tanzanian Government accelerate the transfer and adoption of appropriate and improved technologies, services and systems to the rural poor.	Measures of Goal Achievement: Number of adopters and users of services and systems.	 Field surveys. Information systems. Baseline surveys.	Assumptions for Achieving goal targets: Adopters/users are rational and have equal rights of access to improved technologies.
Project Purpose: To develop and prove the operational feasibility of SIRM as a cost-effective, environmentally safe technology through two phases	Conditions that will indicate purpose has been achieved. End of project status.		Assumptions for achieving purpose:
Phase I To determine the components, scale, time frame and costs of a tsetse control program on Zanzibar.	Phase I. 1. Size and distribution of G. austeni on Zanzibar 2. Effectiveness of initial knock-down sprays. 3. Number of sterilized males required for control. 4. Increased cost effectiveness of colony rearing and release.	Phase I. 1. Field Surveys. 2. Work progress at Tanga in colony rearing. 3. Environmental Assessment Team report and recommendations. 4. Mid-Phase I Technical Review.	Phase I. 1. Laboratory reared flies will be competitive with natural males while lowering costs. 2. Zanzibar livestock development plans include veterinary services, range management and bush control. 3. Phase I evaluation positive. Phase I tasks are on target. 4. AID funding is available. No major technical problems arise.

Life of Project
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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number Tanzania Tsetse Fly Control 621-0144

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose	Conditions that will indicate purpose has been achieved: End of project status.	5. Phase I Evaluation. Recommendation to Assistant Administrator. 6. Insecticide trials 7. Aerial Release Trials. 8 . Cost effectiveness analyses.	Assumptions for achieving purpose:
Phase II Establish SIRM as a viable complement to existing package of tsetse control techniques.	Phase II Control of G. austeni on Zanzibar accomplished.	Phase II Monitoring and Survey.	Phase II Reinfestation does not occur. Zanzibar institutes adequate quarantine measures for imported animals.
Outputs:	Magnitude of Outputs:		
1. Trained personnel at Tanga and Zanzibar.	1. Personnel are able to conduct surveys on Zanzibar and rear flies at Tanga. Three long-term participants receive U.S. training.	1 . Survey results. Supervisors' reports. PIO/P.	1. TanGov will provide competent counterparts.
2. Laboratory facility for livestock and tsetse research completed.	2. Construction and equipping completed.	2. Observation.	2. Contracting and construction occur in timely manner. Materials are available.
3. Colony of G. austeni for Phase II Control program established.	3. To be determined by tsetse surveys.	3. Tanga records.	3. (a) G. austeni breeding colony available on timely basis from Bristol Univ., England. (b) Adequate numbers of G. austeni can be reared for control.

Life of Project
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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number Tanzania Tsetse Fly Control 621-0144

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	Magnitude of Outputs:		(c) No unforseen accident or disaster affects colony.
4. Livestock Disease and Tsetse Distribution Surveys completed.	4. Zanzibar team reports.	4. Reports.	4. Aircraft given access to Zanzibar airport without restriction.
5. Environmental Assessment.	5. Team arrives and completes assessment.	5. Team Report.	5. Competent consultants can be identified and fielded.
6. Recommendations for aerial release and insecticide application.	6. Tsetse Control Work Plan developed.	6. Evaluation and EA team report.	6. Zanzibar and Mainland government continue support. No major environmental or technical issues prevent development of program.
7. Technical developments to lower rearing costs.	7. Membrane feeding. Improvement in rearing facilities.	7. Observation cost records.	
Inputs:	Implementation Target (Type and Quantity)		Assumptions for providing inputs:
USAID			
1. 25 PY of technical assistance.	1. Technicians are fielded.	1. USDA contract and reports.	1. USDA is able to identify persons with SIMM expertise.
2. 12 years of participant training.	2. Technicans returned and working in tsetse research.	2. PIO/P.	2. Appropriate candidates are identified by TanGov.
3. Various commodities for laboratory and laboratory construction.	3. Facility in operation.	3. Observation, inventory.	3. Construction materials and services are available in Tanzania.

Life of Project
From FY 79 to FY 81
Total U.S. Funding $5,000,000
Date Prepared February 14 1979

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number Tanzania Tsetse Fly Control 621-0144

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs:	Implementation Target (Type and Quantity)		
4. Transport and operating costs.	4. Vehicles in place and operating.	4. Observation.	4. Vehicles will arrive in timely manner.
5. Local labor.	5. Staff on board.	5. Payroll	5. Local labor is available.
6. Support for technicians.	6. Housing provided through leases or purchases.	6. Rental leases and purchases executed.	6. U.S. Embassy will make housing and utilities available to AID.
TANGOV			
1. Zanzibar land for lab/office.	1. Land cleared.	1. Observation.	1. TanGov commitment continues.
2. Salaries of laborers and counterparts.	2. Staff on board.	2. Observation, budget.	2. Government funds are sufficient.
3. Zanzibar vehicle operation.	3. Operating expenses made available.	3. Fuel and spares available.	

APPENDIX B

DETAILED PROJECT BUDGETS

- ESTIMATED BUDGET EXPENDITURES

- TANZANIA GOVERNMENT CONTRIBUTION

B-1

ESTIMATED BUDGET EXPENDITURES

	Year 1		Year 2		Year 3		TOTAL		
	FX	LC	FX	LC	FX	LC	FX	LC	TOTAL
I. TECHNICAL ASSISTANCE[a/]									
Tanga									
Team Leader/Entomologist(FC10-11)	71.2		78.3		86.2		235.7		
Research Entomologist (FC9-10)	69.2		76.3		83.9		229.4		
Veterinarian (FC9-10)	60.5		66.5		73.1		200.1		
Tsetse Research Experts*	(35.8)		(39.4)		(43.4)		(118.6)		
Training Officer	60.5		66.5		73.1		200.1		
Mechanic	60.5		66.5		73.1		211.1		
Technical Advisor[b/]	14.9		16.4		25.3		56.6		
Clerk Typist	1.2		1.3		1.4		3.9		
Zanzibar									
Co-team Leader/Entomologist(FC9-10)	60.5		66.5		73.1		200.1		
Entomologist*	(46.2)		(50.8)		(55.9)		(152.9)		
Veterinarian/Pathologist(FC8-9)	52.6		57.9		63.6		174.1		
Miscellaneous									
Consultants	50.0		50.0		100.0		200.0		
University of Bristol[c/]	20.0		13.0		-		33.0		
IAEA Contract*	82.0		90.0		99.3		271.5		
5% O/H	4.1		4.5		5.0		13.0		
Travel	40.0		20.0		35.0		95.0		
Sub total	647.2		673.9		792.1		2113.2		
USDA O/H 25%	161.8		168.5		198.0		528.3		
SUBTOTAL TA	809.0		842.4		990.1		2641.5		2641.5

	Year 1		Year 2		Year 3		TOTAL		
	FX	LC	FX	LC	FX	LC	FX	LC	TOTAL
II. TRAINING[d/]			180.6				180.6		180.6
III. OFF-SHORE PROCUREMENT									
1 2½ ton Truck and Spares	31.5						31.5		
7 Landrovers and Spares[e/]	46.5		46.5		15.0		108.0		
1 Tractor Trailer and Spares	21.5						21.5		
Household Furnishings and Transport (4@$12,800)	-		51.2				51.2		
Equipment Zanzibar Lab	-		85.0		5.0		90.0		
Insecticides (15-40 gallons @ $550/ea.)	-		8.3				8.3		
Sub-total	99.5		191.0		20.0		310.5		
USDA O/H 25%	24.9		47.8		5.0		77.7		
SUBTOTAL OFF-SHORE PROCUREMENT	124.4		238.8		25.0		388.2		388.2
IV. LOCAL PROCUREMENT									
Tanga Personnel[f/]									
1 Sr. Admn. Officer (36,800/= p.a.)		4.5		5.0		5.5		15.0	
1 Secretary (34.800/= p.a.)		4.2		4.6		5.1		13.9	
10 Office Assistants (5,400/= p.a)		6.5		7.2		7.9		21.6	
30 Laborers and Drivers (4,560/=p.a.)		16.6		18.3		20.1		55.0	
B. Zanzibar Personnel[f/]									
1 Jr. Admin. Officer (30,000/= p.a.)		3.6		4.0		4.4		12.0	
1 Secretary (24,000$ p.a.)		2.9		3.2		3.5		9.6	
2 Office Assistants (5,400/= p.a.)		1.3		1.4		1.6		4.3	
12 Laborers and Drivers (4,560/= p.a)		6.6		7.3		8.0		21.9	
C. Aircraft Rental[g/]		16.0		16.0		8.0		40.0	

	Year 1		Year 2		Year 3		TOTAL		
	FX	LC	FX	LC	FX	LC	FX	LC	TOTAL
D. Housing									
Rental 3 Houses Zanzibar		5.0		5.5		6.0		16.5	
Purchase 2 Houses Tanga		60.0		-		-		60.0	
Rental Warehouse Zanzibar		.6		.7		.8		2.1	
Utilities		38.0		42.0		45.0		125.0	
E. Commodities									
Expendable Office Supplies		4.0		4.0		4.0		12.0	
Vehicle Operating Costs h/									
Landrover (6 @ $6.00 p.a.)		36.0		36.0		36.0		108.0	
Truck and Tractor (2 @ $4,000 p.a.)		8.0		8.0		8.0		24.0	
Subtotal		213.8		163.2		163.9		540.9	
USDA O/H 25%		53.5		40.8		41.0		135.3	
SUBTOTAL LOCAL PROCUREMENT		267.3		204.0		204.9		676.2	676.2
V. LOCAL CONSTRUCTION i/			5.2	46.8			5.2	46.8	52.0
SUBTOTAL ALL CATEGORIES	933.4	267.3	1267.0	250.8	1015.1	204.9	3215.5	723.0	3938.5
VI. CONTINGENCY 5%	46.7	13.4	63.4	12.5	50.7	10.2	160.8	36.1	196.9
SUBTOTAL	980.1	280.7	1330.4	263.3	1065.8	215.1	3376.5	759.1	4135.4
VII. INFLATION i/	176.4	50.5	282.6	55.9	267.1	53.9	726.1	160.3	886.4
GRAND TOTAL	1156.5	331.2	1613.0	319.2	1332.9	269.0	4102.4	919.4	5021.8

Rounded to $5,000,000

a/ Technical Assistance estimates prepared by David Dame, USDA/ARS. 10% salary increases in years 2 and 3.

b/ USDA/ARS Project Manager and support.

c/ See Appendix E, Exhibit, 3

d/ Estimates provided by USAID/T/TRG:

Year 1	Year 2	Year 3	Year 4	-	TOTAL
$15,200	14,000	15,000	16,000		60,200 x 3 participants = $180,600

e/ $15,000 per Landrover plus 2 sets of spares.

f/ 8.25 Tanzanian Shillings (TSH) equals $1.00. Estimates provided by Ministry of Agriculture, 10% salary increases in years 2 and 3.

g/ Estimate based on $250 per hour.

h/ Estimates based on:

	Landrovers	Truck/Tractor
Fuel	4,000	3,500
Repairs	1,500	350
Insurance	500	150
TOTAL	$6,000	$4,000

i/ Estimates provided by REDSO Engineer. 250 Tsh. per sq.ft.

j/ 18% Compounded

Tanzania Government Contribution
(Tanzanian Shillings)

	Year 1	Year 2	Year 3	TOTAL
1. PERSONNEL [a/]				T.Shs.
Tanga				
1 Station Manager	36,000	36,000	36,000	108,000
1 Entomologist	18,000	18,000	18,000	54,000
2 Admin + Support Staff	10,800	10,800	10.800	32,400
60 Laborers and 4 Drivers	273,600	273,600	273,600	820,800
	338,400	338,400	338,400	1,015,200
Zanzibar				
1 Asst. Team Leader	36,000	36,000	36,000	108,000
2 Research Officer	36,000	36,000	36,000	108,000
1 Lab. Technician	21,600	21,600	21,600	64,800
22 Laborers and Drivers	100,320	100,320	100,320	300,960
	193,920	193,920	193,920	581,760
Subtotal	532,320	532,320	532,320	1,596,960
II. PROJECT SUPPORT (MAINLAND) [b/]				
Petrol and Spare Parts	150,000	250,000	350,000	750,000
Building Materials + Expendables	50,000	150,000	250,000	450,000
Other Direct Support	260,000	260,000	260,000	780,000
Subtotal	460,000	660,000	860,000	1,980,000
III. Zanzibar Island (Land) [c/]	125,000			125,000
IV. Trust Fund (Mainland) [d/]	129,600	129,600	129,600	388,800
Zanzibar Contribution	318,920	193,920	193,920	706,760
Mainland Contribution	928,000	1,128,000	1,328,000	3,384,000
Total (T.Shs.)	1,246,920	1,321,920	1,521,920	4,090,760
Total (U.S. $)	(151,150)	(160,250)	(184,500)	(495,900)
Inflation [e/]	(27,207)	(34,037)	(46,264)	(101,508)
GRAND TOTAL	(178,357)	(194,287)	(224,764)	(597,408)
			Rounded - $600,000	

a/ Based on Ministry of Agriculture salary scales.

b/ Based on previous payroll and project support.

c/ Land is not sold value completed on basis approximately 15 years rent.

d/ 21,600 T.Shs. paid annually per expatriate, 6 persons.

e/ 18% compounded.

APPENDIX C

JOB DESCRIPTIONS

C

I. RESEARCH ENTOMOLOGISTS

Four entomologists will be recruited. A general job description for this position follows:

A. Assignment

1. Conducts field studies with released flies to determine optimum handling techniques with respect to marking, packaging, transportaing, and releasing of sterile insects.

2. Conducts surveys and experiments needed to establish suitable sites for field release and control areas, determine fly density in various parts of Zanzibar and develop improved survey and detection techniques.

3. Plans working details of tests and experiments. Maintains accurate records of tests or experimental results. Observes, recognizes, and records variants in expected results.

4. Carries out assigned phases of the sterile male release program.

5. Trains and supervises counterpart nationals in all aspects of the research effort.

6. Assists with design and supervision of construction of the research facility.

7. Assists with the development of mass rearing procedures.

8. Prepares reports summarizing results of experiments.

9. Participates in professional meetings and conferences.

10. Keeps abreast of literature and helps maintain a current library for subject matter pertaining to the research.

B. Special Considerations

The incumbent conducts experiments on the application of sterility methods when integrated with other suppression procedures essential to advance work toward the goal of developing control methods for tsetse fly populations on Zanzibar and Tanzania.

C

C. Qualifications

(1) A thorough fundamental knowledge of entomology and a substantial acquintance with current research efforts and insect control practices in the particular areas of concern; (2) a working knowledge of the principles of such related fields as botony, insect and plant ecology, toxicology, and taxonomy; and (3) a working knowledge of the variety of standard statistical methods in resolving the scientific problems presented by the assignment.

The incumbent maintains personal contacts with professional in his own or related scientific fields; management officials of Federal and foreign public agencies; or private organizations; and agriculturists, foresters, manufacturers, shippers, etc.

D. Supervision Received

Work is performed under the general supervision of the Project Leader and Co-Leader who discuss objectives and may assist on matters of policy or substantial change in expenditures. Work plans are developed by the incumbent. Results of biological evaluations and resultant determinants relating to the need, feasibility, and justification of control are reviewed for adequancy of consideration of the biological and ecological variables involved, and of the scientific soundness of the conclusions drawn and recommendations made.

II. VETERINARY MEDICAL OFFICER

A. Assignment

The incumbent is a member of the Tsetse Research Project working with entomologists and other staff officers (Tanzanian and expatriate) in a team effort to conduct a large scale field trial of sterile male release methods against *Glossina austeni*.

Maintenance of large numbers of animals under laboratory conditions for use as hosts in Tsetse fly rearing is an essential requirement of this research. Presently goats and rabbits are kept, but other hosts may include donkeys and sheep. Also, cattle and wild game will be utilized for field surveys of trypanosomiasis incidence on Zanzibar.

The incumbent will:

1. Develop a system for introducing new animals to the fly feeding routine.

2. Design and conduct field surveys of animal trypanosomiasis using serological and pathological techniques.

3. Acquire and maintain healthy goats and rabbits for tsetse fly feeding. Develop a routine, perform and provide staff training in the following important details:

   a. pre-induction quarantine treatments
   b. dehorning
   c. hoof triming
   d. flank shaving
   e. treatments (ex surgery)
   f. washing
   g. feeding and watering regimine
   h. pen cleaning and maintenance (collection of wood shavings, pen repairs, etc.)
   i. inspection and selection of fly-host animals
   j. weighing of goats and rabbits
   k. record maintenance of animal herds
   l. building security checks
   m. expansion of forage crops
   n. rabbit breeding and maintenance

4. Assist with the selection and expansion of forage crops best suited to host animal requirements and local conditions, including silage.

5. Perform host suitability tests and keep informed on fly colony expansion rate to assure constant supply of suitable host animals.

6. Maintain adequate supplies of required drugs, feed, tools, etc. at all times.

7. Participate in local and foreign meetings as agreed to by the Project Manager.

8. Assist with preparation of monthly veterinary report.

B. Supervision Received

The incumbent is responsible to the Project Manager for overall performance of duties, but carries out planned activities with a minimum of supervision.

C. Qualifications

The qualifications for this position include a D.V.M. degree with experience with large animals. A farming or ranching background is desirable. Knowledge about sound animal husbandry and management methods is important. The incumbent must be experienced in planning research activities and reporting on same both orally and in writing. Training in parisitology for one candidate is desirable.

Incumbent must have the capacity to work well with team members of various nationalities. He will bw actively involved in counterpart training of Tanzanian junior veterinary methods and research techniques. Further, he will be in frequent contact with individuals and agencies outside this project and must be able to meet and work well with the general public.

III. MECHANICAL/ELECTRICAL ENGINEER

A. Assignment

The engineer employed by the Tsetse Research Project will be headquarterd at Tanga. He will be responsible to the Project Manager for overall performance of duties. He is expected to work cooperatively with the staff in a team effort to conduct a large scale field trial of sterile male release methods against tsetse flies.

Maintenance of rolling stock and electrical equipment is essential to the continuous operation of the field and laboratory programs. The nature of the work is such that equipment failures can result in a set-back of weeks and in the case of fly rearing, many months. Further, project needs may require specialized equipment to be constructed at the stations, such as insect traps, electric grids, host animal feeding and tethering devices, and other such devices required by researchers. Thus the engineer must possess a degree of creativity and ability to construct specialized equipment.

The incumbent will supervise, train junior staff and conduct the Tsetse Research Project garage work to include the following:

1. Repair, service and maintenance of all government vehicles assigned to this project. Develop a system to have vehicles report regularly for routine service and inspection. Vehicles stationed in the field will necessitate periodic trips to Mkwaja and Zanzibar for maintenance and repair.

2. Maintenance of adequate stocks of most frequently used spares, i.e., points and plugs, fan belts, oil lubricants, etc. for various models of vehicles. Also know local sources of supply and through the Administrative Assistant arrange for purchases if approved.

3. Become familiar with service manuals on file at Tanga for various types of mechanical and electrical equipment.

4. Maintenance of adequate supplies of acetylene and oxygen for welding as well as rods for both acetylene and electric welding equipment.

5. Construction of insect cage frames, and any other construction or repair involving metal cutting, bending, and/or welding.

6. Operation of a neat and orderly garage - accumulation of junk should be periodically disposed of by means of property write-off, transfer or removal. All matters of property disposal require the Project Manager's approval in writing.

7. Maintenance of all farming equipment, i.e., tracotr, harrows, plows, and trailer, and repairs as needed.

8. Accounting for tools and equipment to assure that theft and misuse does not occur. The work to be performed in the station garage is to be limited strictly to equipment. In rare cases, other government vehicles on official business to this station have required repairing - such instances require prior approval from the Project Manager for repairs.

9. Informing the transportation/dispatcher on availability of vehicles.

Assume responsibility for the maintenance of standby electric power plants. Routine operation of the 30KVA unit is performed by expatriate staff on week-end duty. All units, including automatic systems, should be checked routinely to assure that oil, water, batteries, and fuel are at proper levels and all other equipment such as belts, air cleaners, etc. are serviced as needed. Service manuals are available and should be used to set up maintenance scheme.

Assist with wiring and where contract electrical work is performed - supervise and become familiar with all voltage requirements, wiring plans, and load limitations. Perform all minor electrical repairs as needed.

The garage is one department within this project. The engineer will be designated as head of this department and will have full responsibilities. For convenience, electrical maintenance requirements will be placed within this department as well.

Personnel training is an important aspect of the work and should be organized to accommodate new personnel as needed.

Incumbent should become familiar with the entire project operations in terms of goals and objectives, target dates of accomplishments, and operational requirements. This training will be provided by the Project Manager.

C

B. Qualifications

Incumbent must be a mature individual capable of supervising others and working harmoniously with staff at all levels. He must have achieved specific training or possess 15 years (minimum) experience in electrical/mechanical work. He must have a thorough knowledge of petrol and diesel engines for automobiles and trucks. He should be able to use all shop tools including metal working equipment such as acetylene and electric welders.

C

IV. TRAINING OFFICER

A. Assignment

1. Counsels and prepares training programs for TanGov counterparts.

2. Overseas and plans training for all local hire staff including lab technicians, laborers and support staff.

3. Arranges U.S. training for long term participants, advises on curriculum and monitors students' progress.

4. Provides briefings and education tours for visitors to the Tanga Tsetse Research Center

5. Conduct experiments on the application of sterility methods as time allows and assigned by team leader.

6. Arranges logistic support for all trainees.

B. Qualifications

1. A fundamental knowledge of entomology (M.S. in entomology) and a substantial acquaintance with current research efforts and insect control practices.

2. Teaching/tutoring experience.

3. Ability and willingness to undertake a variety of tasks related to training efforts.

C. Supervision

Work is performed under the general supervision of the Project Leader at Tanga.

APPENDIX D

The Environmental Assessment

of the

Tsetse Research Project, Tanga, Tanzania

D

TO	:	TA/AGR of the Agency for International Development U.S. Department of State
FROM	:	The Environmental Assessment Team of the Tsetse Research Project, Tanga
DATE	:	April 1, 1977
SUMMARY STATEMENT	:	The Environmental Assessment Team has concluded that the Tsetse Research Project, Tanga, Tanzania will have negligible detrimental effects on the environment of the Project Laboratory at Tanga and the field test site at the Mkwaja Ranch. As a result, given the successful conclusion of the Sterile Male Insect Release Method, future tsetse fly eradication projects may be undertaken with a 40 to 50% less dependence upon insecticide applications.

THE TSETSE RESEARCH PROJECT -- AN ENVIRONMENT ASSESSMENT

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APPENDICES

I. INTRODUCTION

The U.S. Agency for International Development (AID), Department of State, in accordance with the National Environmental Act of 1969 published "Environmental Procedures," Amendment 216 in the Federal Register, Volume 41, No. 127, 1976. The Amendment insures that environmental factors and values are integrated into the decision-making process of AID program actions. This report describes AID's first step in implementing the new amendment, an environmental assessment of the TA/AGR Tsetse Research Project on the Sterile Insect Release Method (SIRM) that is currently being conducted in Tanga, Tanzania. The Project is jointly sponsored by U.S. AID and the United Republic of Tanzania.

The Rules and Regulations of Amendment 216 provide for exemption from environmental assessment of "controlled experimentations confined to small areas and carefully monitored." Although the Tsetse Research Project may well meet the requirements for exemption, AID has elected not to apply the provision. The Tsetse Research Project was initiated in 1966 and therefore the absence of an initial impact statement (see 216.3 of the Rules and Regulations) has meant that the assessment team did not have the benefit of the evaluations from other Federal Agencies which for future programs may be available.

The environmental assessment team was appointed in the fall of 1976. It conducted a literature search in the U.S., convened a preliminary planning session and soon thereafter, undertook an on-site visit in January of 1977. AID requested the assessment team to provide AID and the Host Country with a comprehensive statement of the reasonable foreseeable environmental effects of the SIRM as a component of an integrated tsetse fly eradication program at Mkwaia Ranch. The assessment team was also asked to consider technically viable alternatives, so that the expected benefits of development objectives could be weighed against any adverse short or long-term impacts upon the total environment or against any irreversible or irretrievable commitment of resources.

The Tanzania-AID Tsetse Research Project is an experiment to test the SIRM under controlled circumstances. Advances in tsetse fly biology and fly sterilization techniques indicate that the tsetse fly may be susceptible to control by the SIRM in appropriate combination with other methods of reducing the fly population. It is also possible that the SIRM may develop into an important maintenance control method. The success of failure of the experiment will provide the necessary guidelines for future large-scale operational programs.

The assessment team undertook to: (1) describe the existing ecosystem; (2) delineate activities that might have beneficial or deleterious effects

on the environment; (3) assess the type and levels of pesticide and herbicide application; (4) anticipate the effect of the treatment upon the ecosystem; (5) assess direct social and economic implications of the SIRM on animal and human populations; and (6) assess how an understanding of the basic science of tsetse fly eradication can contribute to ecosystems management. The information thus derived has been collated in this report for concerned persons in the U.S. and Tanzania.

We wish to thank the staff at the Tsetse Research Project in Tanga, the management of the Mkwaja Ranch, the Department of Zoology at the University of Dar es Salaam, and the Ministry of Agriculture in Tanzania for their cooperation.

A. PROJECT RATIONALE

Tsetse fly infestation in Africa is considered a major constraint to the full utilization of large areas for agricultural livestock production. Infestations of the tsetse fly have precluded human and or livestock occupation of approximately 10 million square km. in Africa. There are several types of trypanosomes, but the major ones cause Nagana in cattle, and sleeping sickness in humans.

With regard to Africa, the World Food Conference in Rome in 1974 declared that "trypanosomiasis and tsetse fly control must be the first phase of an integrated plan of economic development." The declaration was given urgency in the United Nations study on the Future of the World Economy (1976). The Report argued that "the major thrust of food supply in the developing regions will have to come from an increase in their own agricultural output but even after mobilizing available excess arable land resources, the land productivity (including crop yields and cattle productivity) would have to be increased at least three-fold in the developing regions if the 5 percent annual agricultural target is to be realized."

The Tanzanian Ministry of Agriculture ranks animal trypanosomiasis second only to East Coast Fever among the livestock diseases which hinder development. It estimates that 60% of Tanzania is infested by the fly.

In the past, methods for controlling the tsetse fly have included large scale clearing of natural vegetation on which the flies depend for shelter, killing of indigenous wildlife on which the flies depend for food and, more recently, use of insecticides and herbicides. According to (J. Ford, 1976), "in Africa as a whole, one estimates that, since large scale attempts to eliminate tsetse fly were begun in about 1925, total success may have reached about 1.5% of the infested areas, but

that almost certainly this has been more than balanced by reinfestation of formerly fly free land". With an increasing population requiring increased food supplies at the same time that environmentalists are forcefully making the case for the preservation of natural ecosystems research activities in biological control measures have been greatly stimulated. The most promising lead to date is the sterile male release.

In the case of the tsetse fly, the SIRM introduces within the environment active tsetse flies who have been rendered sterile by irradiation. A preponderance of sterile males can virtually halt the reproductive process of a natural fly population in a predictable period of time. Since 1963, U.S. AID has supported research on the development of techniques necessary for suppressing Glossina m. morsitans the species of tsetse which is a principal vector of animal trypanosomiasis in East Africa. The research has been conducted at Tanga, Tanzania.

The objective of the Tanga Project is to determine the efficacy of using sterile males for tsetse fly population control in an area protected from reinfestation. The questions to be resolved are whether a sufficient number of flies can be reared in the laboratory sterilized, transported, and released so that the flies disperse and effectively compete with the males of the natural population.

B. PROJECT FACILITIES AND THE TEST SITE

The fly rearing laboratory for the Tsetse Research Project is located 3 km. west of Tanga, Tanzania. The facilities consist of a rearing station, laboratories, and headquarters for the administrative staff. Construction began in June 1972, and the third insectary was completed early in 1977 In addition to the three insectaries, there are associated animal sheds, animal quarantine buildings, and an irradiation complex. The 8 hectares surrounding the buildings serve as the animal paddocks and the forage crop production area.

In addition to the routine rearing of flies and animal husbandry, the 126 member staff has developed methods for handling, sterilizing, and transporting the tsetse flies and is conducting ecological studies of the field site. The staff plans to assess the density and distribution of the natural fly population, the fertility of the fly population treated on the ranch, and the disease incidence among wild and domestic animals.

Mkwaja Ranch field site for the Tsetse Research Project, is located 100 km south of Tanga, Tanzania (38° 41.5'E, 5° 45'S). The Ranch has operated under the Swiss management of the Amboni Sisal

Estates, Ltd since 1953. Approximately 12,000 head of commercial cattle graze the ranch which consists of a coastal woodland-savannah vegetation mosaic varying from open grassland to dense thicket and high forest. The ranch is divided into northern and southern sections (see Figure I). The northern section covers about 260 sq. km. and is the site of the research program; the southern section is slightly smaller and serves as the untreated control area.

Tsetse files (G. morsitans, G. pallidipes, and G. austeni) inhabit the ranch and transmit animal trypanosomiasis to the livestock. Human trypanosomiasis does not occur on the ranch or in the surrounding area. Four times each year the livestock receive prophylactic treatment (isometamidium) to prevent trypanosomiasis and in addition they are dipped weekly in toxaphene to control tick-borne diseases.

Since the beginning of the ranch operation, several programs have been undertaken to control the tsetse fly. However, today the tsetse flies are present in even larger numbers than they were originally. Importantly, moreover, G. m. morsitans, which was not detected earlier, has become a dominant tsetse species. Past experiments with insecticides and partial barrier clearing have failed; the only new element to be introduced into the environment by the Project is the sterile male fly. These conditions, together with the large number of cattle at risk, make the Mkwaja Ranch an ideal site for the field trials.

C. PROJECT SCHEDULE

The Tanga Tsetse Research Project was conceived in three phases. The first phase, now successfully completed, was to establish a captive colony of G. m. morsitans. The second phase is to expand the colony so as to produce sufficient numbers of flies for sterilization and release. The third phase is to complete the ecological studies and field operations for the suppression or eradication of the tsetse fly in a test area of about 260 square km. The colony of G. m. morsitans at Tanga is the largest colony of a single species of tsetse fly in existence. The colony will reach the level of 45,000 females and 15,000 males sometimes between June and September of 1977, making available between 800 and 1200 males for daily release. These numbers will permit a daily release rate of 3 to 6 flies per square km.

The present conception of the release technique is based upon letting the bulk of the females emerge at the rearing laboratory (females precede males in emergence) and cooling the remaining pupae (mostly males) for transport to the Mkwaja Ranch where they will be irradiated and released prior to emergence as adults. The release of the sterile males will follow two or three aerial applications of endosulfan designed to reduce the tsetse fly population to a manageable level. The releases

will continue for 16 to 20 months. The effectiveness of the treatment will be monitored by routinely assessing the fertility and population density of the target species, G. m. morsitans, and the density of G. pallipides. The adjoining section of the ranch will serve as the control area and will not be treated. The Tanga Tsetse Project is expected to be completed by the end of FY 1979.

II. THE EXISTING ECOSYTEM

A. THE MKWAJA RANCH

Description of an ecosystem requires comprehensive consideration of the interaction between living and nonliving portions of a natural unit. In order for the whole interlocking mechanism to function as a natural community, its various components must be present in sufficient approximation of working harmony to permit normal growth and replacement of the constituent plants and animals. Examples of the nonliving components of an ecosystem are energy, water, essential minerals, and atmospheric gases. Examples of the living components are forage and food producing plants, food producing animals, organisms which aid in recycling, and the dominant species which create the general character of a landscape. It is necessary that all these materials and processes be compatible if an ecosystem is to approach its proper rate of productivity. Removal, stress, or ill health of the important participants can reduce production of materials or cause the natural resources present to diminish.

At the Mkwaja Ranch, the elevation, topography and soils vary and these differences represent distinctive ecosystems. The past and present land use has determined the natural communities as they are described in this report. The general setting for the regional environment has been ably presented in The Natural Resources of East Africa (Russell 1962). Another important reference is the Atlas of Tanganyika (1956). Specific source material will be cited in developing the discussion of separate environmental elements.

Since the establishment of the Mkwaja Ranch in 1953, the management has tried to control the tsetse fly by barrier clearing and use of insecticides. Livestock productivity depends, however, upon chemoprophylaxis and drug treatment as the most effective ways to combat trypanosomiasis. Because of the ranch's professional management and experienced employees, this ranch operation represents, as T. Ford and E. Blaser wrote in 1971, "a large scale field experiment" in commercial livestock production in the semiarid regions of East Africa.

Prior to the ranching operation, the land had been unoccupied because of the low rainfall and the generally poor condition of the soil.

It is representative of many other areas where farming cannot be productively undertaken, but where livestock operations could be maintained. The Mkwaja ranch manager described the major constraints to improve livestock productivity as, first, the tsetse fly, and second, pasture maintencance in the face of the rapid bush regeneration. Forage quality is also a problem and varies from season to season.

The Mkwaja ranch employs 200 workers who, together with their families constitute essentially the total present population of 600. All the settlements on the ranch are related to its operation. Approximately half of the workers and their families have resided on the ranch for over ten years. The other half, primarily herders, come and go frequently. The job of herding has low status and the turnover is so great that it is constant source of frustration to the management.

Almost all settlement services are provided by the ranch. The first ranch school was opened 18 months ago by a teacher provided by the government. Only first and second grades one offered, and children must go to the neighboring village 8 km distant to continue their education. Some 40 children on the ranch reside in small settlements near the corrals or bomas and do not receive any scholling. In compliance with the government campaign that was initiated two years ago, the ranch management embarked upon a massive reading program for adults. Every worker who could read was excused from work two afternoons a week to engage in teaching. This effort lasted for about a year; at its completion, the literacy rate had risen from 30 percent to 90 percent. Other services provided by the ranch are housing, water, and minimal health care.

The ranch organization is atypical. It is the only ranching operation in Tanzania which as remained under private ownership. Although the ranch has invited neighboring farmers with cattle to take advantage of insemination and disease control procedures, there has been little response. The role of the Mkwaja Ranch in training and providing regional leadership is disproportionately small in comparison with its substantial experience in livestock production.

Figure I shows the ranch and the surrounding areas. The ranch area occupies the width of the coastal plain and is divided into two sections, north and south. The Tsetse Project field site is an irregular square between the Indian Ocean on the east and the East African Railway on the west going north from Dar es Salaam to Tanga. Along the north side of the ranch lies a fairly dense mountainous high forest; to the south is the control area of wooded grassland which resembles much of the test site uplands. Between the ocean beach and the ranch is a strip of scattered small plots cultivated by subsistence farmers. The nearby villages are occupied by member of the Zigua tribe. About 5 km to the

northeast of the ranch begin the extensive estates of sisal, cashew and coconuts.

1. Non-Living Components of the Environment

Physiography: The coastal plain at the Mkwaja Ranch release site is a flat, narrow belt of consolidated sands extending inland about 20 km to the toe slope of the escarpment that raises to the Masai plains some 70 km distant. Elevation on the site varies from mean sea level near the mouth of the Msangazi River, containing brackish tide water, to high points of about 100 m on the central east-west ridge that transverses the ranch; approximately half of the ranch area lies below a 65 m contour. The Msangazi River flood plain which courses through the northern part of the ranch does not exceed 40 m in elevation. The lower oceanside portion is a slightly raised, level plain that does not exceed 50 m above the mean sea level. This nor-south strip occupies the eastern 25% of the ranch.

Climate: This tropical region is characterized as having high humidity, an annual rainfall of 800 to 1200 mm, and mean annual temperature ranging between 24° and 32°C. From the requirements of plant growth, the area has a subhumid tropical climate; however, the potential evaporation and moisture deficit is high during the dry seasons, altering the climate of semi-arid conditions at times. Rainfall patterns at the ranch are typically bimodal. The 21-year average annual precipitation is 1,008 mm; however, rainfall is erratic as in many places throughout East Africa. Beginning in 1969, six out of eight years recorded an abnormally low rainfall.

Averages for the 21-year record period as well as for the moist and dry segments are given in Appendix A. When analyzed, these figures show apeak for long rains in April and short rains in November. The corresponding low points in the dry season occur in August and again in February. Humidity remains high except during the mid-day period of direct overhead solar radiation, and the corresponding period of relative humidity sometimes reaches as low as 35 and 40 percent for several hours (see Appendix A).

Parent Material and Soils: The substratum underlying the coastal plain is a combination of coral rag, sandstone, and some limestone (Atlas 1956). The first 5 km inland from the coast contains underlaying of Quarternary alluvium; the next 10 km band contains Quarternary sediments. Deeper marine sandstones and limestones date back to the Jurassic period. The east central uplands of the ranch are suspected to have been caused from a raised Plaistocene reef. Upland soils consist mainly of gray and red orange loamy sands; flood plain alluvium found along the Msangazi

River consists of gray to dark gray "black cotton" soils. Soils of the eastern coastal plain are loosely consolidated and form shallow sandy drainageways coursing south and eastward toward Mkwaja village. The greyish cast is a humic layer to a depth of about 25 cm. This humic layer is also present throughout most of the uplands except on steeper slopes. Below this depth is a red-orange sandy loam. Bleached greyish brown sands, occur in areas of recent erosion and on steeper slopes. Finer, light-colored sandy clay loams of the Msangazi flood plain and along lower portions of the alluvial flats show heavy contraction cracks in rain pond relief. Along the south eastern upland, soils grade from rather well consolidated grey-brown surface sands in the north central portion to poorly consolidated red-orange sands in the southeastern corner. Where the central uplands break toward the Msangazi River to the north and west, grey sands again become higher in color; this reflects more rapid geological erosion from the steeper slopes. Isolated outcropping of coral rag can be found at or near the surface throughout the southern parts of the ranch.

Water: or several months following good rains, the Msangazi River maintains a continuous course across the ranch. Other larger drainages such as the Chogera tributary, which drains the northwestern extension and a few rivulets in the southeast corner also flow following the November-December and March-April rainy periods. Large earthen dams provide year round water for cattle and game. There are 65 dams; 40 are presently functional which is unusual considering the loose sandy soil texture. During the dry season only the largest dams retain water and frequently water is hauled from a distance of up to 32 km. There are 15 good reservoirs, some in excess of five hectares. Attempts at exploiting subsurface water have not been successful. Salt water is all that has been obtained from the several previous borehole attempts. At the present time a borehole is under construction on which an accurate log is being kept. The prospects for this 41 m well appear to be favorable and will provide hydrological information of this little surveyed region south of the Pangani River.

Atmosphere: Atmospheric conditions, apart from the climate, consist of air movement patterns and particulate suspensions, both natural and man-made. As to the latter, except for somewhat excessive daily cattle trailing to and from the corrals (bomas) and the necessary administrative vehicular travel, no man-made agents are produced which escape into the air. Natural agents consist of wildlife induced carbon particles and associated oxides from burning herbaceous and woody materials. The uncontrolled fires are usually caused by man but on a sufficiently routine basis to be considered a normal or "natural" phenomenon. These fires are much reduced and less frequent than earlier years when the ranch was undeveloped land. Formerly, wildlife begun through the coastal plain highgrass and consumed all but the most resistant woody species during both the short and long dry periods each year. Lightening undoubtedly was an agent in the large scale firespread, but under present

range grazing conditions is of less significance. So called wildfires contribute nearly all smoke particulate matter except that from wood fires needed for meals preparation by the ranch household.

Wind patterns follow a prevailing westerly path from the ocean and are stronger during the February - March short dry season than during the July through September long intermonsoonal period. Daily wind (1100-1600 hrs.) movement is highly irregular with strong drying mid-day winds diminishing to near calm between 2200 hours and daybreak. Mid-day extremes might approach 25 to 35 km per hr), while normal movement is between 10 to 20 km hour. Upper level storm patterns can originate from inland convection patterns but the monsoonal begin at sea. Storms produce intensely heavy rain of short duration which, when occurring on dry or super saturated soils, produce large volume run-off with accompanying sheet and gully erosion. These high run-off situations are aggravated by the excessive removal of ground cover caused by cattle, trailing, grazing and fire.

2. Living Components of the Environment

The topical subhumid coastal climate produced by the equatorial latitude and coastal geography has furnished a diverse ecosystem of plants and animals. Most of East Africa is geologically old, with plant and animal evolution and speciation having proceeded uninterrupted relative to the general situation in the temperate zones. In spite of more recent geological changes along this eastern coastal region, plant and animal speciation and distribution show a mixture of interior ecosystems with that of the marine and oceanic environments.

The impact of the ranching operation has not radically altered the fauna or flora so as to exclude many, if any, species. Perhaps the greatest change which has resulted from twenty years of domestic grazing animals has been the rapid encroachment of woody vegetation. In the past, the high volume of grass fuel for repeated burnings prevented bush establishment and maintained only fire tolerant species. The recent efforts to suppress range fires and the effect of livestock grazing have resulted within a short time period in the invasion of bush and the consequent mobilization of much of the nutrient capital of the basic soil productivity.

These vegetational changes have altered the composition of the dependent animal communities. This is not to say that any species of animals or plants have necessarily disappeared; on the contrary, some existing or new species may well have acted as invaders or actually increased their presence. Wart hogs and perhaps waterbuck are examples of species which have been favored by the livestock occupation.

Animal Field Inventory Procedures: During the six day survey period, the range ecologist logged all large animal species observed in order to approximate the biomass. Bass data included date, time of day, route traveled, kilometers traversed and the number of animals by species. Gender was noted when detected. The total of 23.5 hours of daytime observation represented a normal distribution of morning, midday and evening hours. More species were observed during morning and evening activity periods than during the midday periods. This was particularly true in cases of the ruminant ungulates. During the field inventory 373 km of primary and secondary bush track were tranversed. In addition, cross country travel and foot safaris were undertaken to observe plant and animal communities throughout the entire ranch. Animals recorded during the inventory constitute about 40% of the species known to reside for at least part of the year on the ranch.

Animals not seen but known to be present, such as the elephant and buffalo, would add considerably to the biomass. The field inventory and the complete list of larger mammals, birds, and reptiles known to occur on the ranch are given in Appendix B.

Plant Communities: Appropriately, the translation for the Swahili word Mkwaja is the locally conspicuous tamarin tree (Tamarindus indica). Unfortunately, this is where a simple approach to identification and classification of East African coastal vegetation ends. Although a number of classification schemes has been suggested for East African plant communities and ecosystems, none has yet been generally accepted or has stood the test of time. The in-local classification is the physiogomy or plant structure and the surface area coverage by the dominant woody species.

In view of the variation in local methodology and the nature of this in-local tsetse fly habi-at, it was decided to combine the best features of several systems in use and develop a classification method which would meet the specific objectives of this assessment. A review of the literature upon which the assessment method for typing and map preparation was drawn is found in Appendix C.

Limited time precluded a detailed inventory listing of all six types of species components. However, major trees, bush, and grass associations are presented and discussed in Appendix D. The field survey was essential for the analysis of the 1976 aerial photos and the subsequent preparation of the map. Our general interpretation followed the scheme of land units (coastal plain-bush grassland) proposal, Christan (1958). Gillman, who was perhaps most familiar with Tanzanian vegetation, broadly mapped the Mkwaja region as bushed grassland (1949). The assessment team analysis identifies the field site for the Tanga Tsetse Project as four major and three minor land units and associated vegetation cover types.

1. Evergreen grouped tree grasslands found generally throughout the western and southwestern uplands.

2. Mixed (deciduous-evergreen) wooden and/or bushed grassland interspersed between the above forest islands and making up a large part of the northwest extension.

3. The Doum palm-high grass savannah found in the eastern coastal lowlands.

4. Doum and Borassus palm-high grass found in the alluvial flood plains of the Msangazi River.

The minor types which occur in addition to these units may be identified as riverine gallery forests of the Msangazi River and tributaries, the high mixed (evergreen-deciduous) forests of the northern and northwestern mountains, and secondary bushland thickets.

B. THE TANGA REARING LABORATORY

The Tanga Project employs 126 individuals, of whom five are expatriates. The senior staff includes four entomologists, a veterinarian, and a rearing specialist. There are 2 research officers, 3 field officers and 14 assistant field officers with government certificate training. The remaining employees are laboratory and field assistants drivers and support staff.

The construction of the insectaries began in June of 1972; and the third and final insectary was completed in early 1977. All facilities are simply designed and, except for the importation of scientific instruments, have been built with local materials. The complex consists of the three insectaries, associated animal sheds, animal quarantine buildings and the irradiation unit. The 8 hectares surrounding the building serve as the animal paddocks and the forage crop production area.

The insectaries are designed to house 60,000 flies capable of producing 30,000 males per month. Approximately 490 goats and 115 rabbits are maintained as hosts for the flies. The Tanga laboratory uses only blood of living animals. A method for feeding colonies of tsetse flies on blood presented through artifical membranes has recently been developed in Europe, but was not available when the Tanga Project was initiated. In the future, however, the costs of mass-rearing flies will be much reduced by the use of membrane feeding.

A research program such as the Tanga Project does not have a primary responsibility for training. However, the on-the-job training is excellent and must be judged as a significant contribution albeit an indirect benefit. The laboratory is rearing flies successfully with a staff (average age 20), only a few of whose members have had more than seven years of formal education. As the project leader pointed out, if training is neglected at the research stage, when the project becomes operational trained manpower will be scarce. The conclusion reached from observing the management and work disciplines of the Tanga Laboratory is that training, intermediate and advanced, must be a component both of research programs and operational programs.

The Tsetse Research Project has developed good contacts and exchanges with other institutions in Tanzania; however, it would have been desirable if the initial funding of the Project had permitted a more flexible and innovative outreach program. For example, students from national educational institutions would have profit from short-term training fellowships as well as opportunities to conduct research projects under the joint supervision of the Tanga Laboratory scientists and the host country institutions.

The Project is to be commended for the preparation of a brochures in Kiswahili. The Project has developed a working relationship with the International Atomic Energy Agency and the Food and Agriculture Organization and The Tsetse Fly Research Laboratory at Bristol, England. Informal relationships have been maintained with the ICIPE and ILRAD in Nairobi.

III. THE ENVIRONMENTAL ASSESSMENT

A. PROCEDURES

The measures and procedures used by the team to weigh the adverse and beneficial impact of the Tsetse Project were based upon the identification and estimates of the effect of insecticides, and herbicides, bush clearing, and the release of sterile male tsetse flies upon the fauna, flora, soil, water, and atmosphere of the test site. These impacts were evaluated from the perspective of the proposed control of *G. m. morsitans* at the field site and the utilization of the rearing facility in Tanga . The separate impact were not weighed, and, therefore, no comparisons were made of their relative significance.

The team notes that the present environment assessment cannot resolve all the complex socio-economic issues surrounding the mounting of integrated tsetse fly control programs, including the SIRM, over large land areas in Africa. The analysis and prediction of the impact upon human population are considerably more difficult than the technical

analysis of the impact of the control techniques themselves. Information is simply not available as to how the present populations, often already abused and impoverished, will respond to new situations brought about by new technologies. Thus, in its socio-economic evaluation, the team has limited its assessments to those that could be made with a high degree of confidence and has indicated the limitations in the analysis.

The estimated environmental effects of specific projects activities are summarized below. Each aspect of the tsetse fly program at the Mkwaja Ranch and the Tanga Rearing Laboratory has received a separate evaluation.

B. EXPLANATION AND SUMMATION

1. Barrier Clearing: The Mkwaja Ranch management had cleared a one km wide barrier of trees and shrubs around much of the ranch in order to reduce the migration of tsetse flies from the surrounding areas. The Tanga project is presently engaged in completing the barrier. Clearing operations will be limited to the barrier zone. In previously cleared sections, the barrier has become open grassland, and it is anticipated that the entire barrier zone of 65 square km will be covered by grass when the operation is completed. If the grassland barrier is to be maintained and erosion to be prevented, the ranch management must continue to invest in the barrier clearing.

2. Application of Herbicide to Portions of the Cleared Barrier: Following the clearing operation, the herbicide Tordon 155 will be applied to control vegetation regrowth. The herbicide will be hand-applied by brush onto the stumps to avoid general contamination of the soil. The treatments will prevent regeneration and, in turn, the reestablishment of insect and avian population that had inhabi[illegible] the localized environment.

The effect of the clearing operations [illegible] e vegetation is clearly high but at the same time it is very localiz[illegible]. Similar local but rather strong effects will modify certain conditions in the animal community (invertebrate, avian, and mammalisn) in the barrier zone.

3. Application of Residual Deposits of DDT Along the Edges of the Barrier: The 1 km barrier clearing will not be wide enough to prevent all tsetse flies from immigrating into the ranch. Therefore, the barrier will be reinforced by the application of DDT to vegetation outside the perimeter of the barrier. Applications of 5% DDT will be made to the lower 3 meters of tree trunks greater than 25 cm. diameter and on the undersides of lower branches in order to kill resting flies and prevent movement of flies into the ranch area. One application will be bi monthly throughout the duration of the field experiment. The minimum insecticidal barrier will be 300 meters, and each application will probably require about 90 to 100 kilograms of active ingredient equivalent to 2.2 grams per hectare per annum (0.02 lbs) per acre annually) over the ranch as a whole, and 90 grams per hectare (0.08 lbs. per acre annually) in barrier zone. Some short-term contamination of surface water limited to the Msangazi River will occur and limited DDT may accumulate in certain nontarget organisms and in the soil. Since the area to be treated with DDT is relatively small, the effect on nontarget invertebrates, bird and mammals will be minimal.

4. Three Aerial Applications of Endosulfan: Studies of the population density of G. morsitans at the Mkwaja Ranch indicate that two or three aerial applications of endosulfan may be required in order to reduce the population to a level that can be handled with sterile males. Approximately 215 square km will be treated. The insecticide will be applied in droplets (35-45 u in diameters) that float and impinge upon resting and flying tsetse flies, but are not large enough to leave a permanent toxic residue. Endosulfan will persist at low levels in the treated areas. Each treatment will utilize 30 grams./ha. of active ingredient, totalling about 600 kg of insecticide or 90 grams per hectare each (0.0825 lb per acre total for 3 applications). Five or six such applications at two to threeweek intervals are routinely used to eradicate G. m. morsitans. Other studies indicate that even with 5 or 6 applications, residues and the effect on non-target organisms are minimal. Any such effects would normally be limited to invertebrates and fish. When high concentrations of endosulfan are used, it is toxic to fish; however, at the time of the Mkwaja ranch applications, the rivers will be dry and contamination of surface water will be of limited duration. Air polution during the actual spraying operation will be transient.

It must be noted that the normal requirement for tsetse fly eradication over an area of the same size would be five to six applications of insecticides. The use of sterile males following two to three applications will reduce the insecticide application by 40 to 50 percent.

5. Release of Sterile Male Tsetse Flies: As the summary table shows, the release of the sterile males would not affect any of the environmental factors. It should be emphasized that the flies are not radioactive, but they do have the capacity of transmitting disease as vectors of trypanosomiasis. The release of the sterile males at the rate of 3 to 6 per day per square km, following the reduction of the natural population by aerial applications of insecticide, avoids the situation in which there would be more flies than were present in the pretreatment population. The anticipated elimination of the target species from the environment should not be accompanied by an increase in population of other Glossinas species since they are habitat-specific and not interdependent.

6. Rearing of Flies and Host Animal Production: The rearing activities at the Tanga Laboratory are confined to 410 square meters of enclosed space and do not cause any environmental impact. Likewise the maintenance of the host animals takes place only on the enclosed 8 hectares and has no or little impact on the environment with the exception of waste accumulation which is dealt with by the septic tank and recycling of manure.

7. Socio-Economic Consideration: An analysis of the operational and economic feasibility of the rearing laboratory at Tanga will be possible only upon the completion of the field trials in early 1979. Similarly, a useful cost/benefit assessment of tsetse fly control could not be made on the Mkwaja ranching operation, nor could the possible application of the economic feasibility of the SIRM be definitively assessed. Only gross indicators of costs, benefits and returns were available. The Mkwaja Ranch could not operate without a careful and expensive regime of prophylactics and curative drugs or tsetse fly eradication maintained by intensive and continuous insecticide applications. Only four of the past twelve years have been profitable reflecting the substantial capital development costs, including tsetse fly control measures and an average expenditure of $3.00 per head per year for maintenance of minimal disease control. Following the analysis of the SIRM as part of an integrated tsetse fly eradication program, it will be possible to compare the Mkwaja Ranch with other ranching operations in Tanzania and with other successful livestock operations such as Ankole in Uganda and Zululand in South Africa.

The team did not have access to the detailed financial records of the privately managed Mkwaja Ranch and therefore could not directly assign observable benefits to specific operations. Nevertheless, based on observations and discussions with the ranch manager, the following indicators emerged: (1) a profitable livestock operation is not possible when the tsetse fly exists in terms of present state of knowledge of therapeutic and curative treatments; (2) tsetse fly eradication requires a large initial capital investment and continuing high cost maintenance; and (3) ranching operations in the semi-arid regions of eastern Tanzania must be well planned and well managed with respect to the carrying capacity of the land and the available water resources.

IV. APPLICABILITY OF THE ASSESSMENT

A. THE STERILE MALE INSECT METHOD (SIRM)

The elements of the Tsetse Research Project which are relevant to existing or future tsetse fly eradication projects may be summarized as follows: Tsetse fly eradication schemes require extensive planning and careful coordination of each phase of the operation. Of major significance is the fact that fly populations become undetectable well before they are actually eradicated. Due to the low reproductive capacity and the low rate of increase of natural fly populations, many generations may elapse before incipient populations are detected by normal surveillance techniques. The use of sterile males to consolidate and insure eradication in the phase following the use of other techniques may be the most effective approach under certain circumstances.

The Project's research activities involve a wide variety of specific information accrual perhaps more so than other types of control research. This is due to the fact that livestock are used to regulate at the density of natural insect populations of the same species. Thus, original data are required not only on fly production requirements, sterilization effects and handling methods, but also on a wide spectrum of population characteristics of the wild flies, e.g. density, longevity, dispersal, seasonal variation, etc. These data are necessary to make optimum use of the released insects. In addition, integration of the sterile insects with conventional methods will provide new perspectives on population dynamics that can be useful in other programs. Thus, all aspects of the biology, ecology, and insecticide research will provide data and concepts that are directly relevant to other tsetse fly eradication projects.

Population studies being conducted will be particularly important as will studies on the effectiveness of insecticidal barriers used to supplement natural or artificially created barriers. These significant facets of control technology will have a major bearing on most other eradication projects. The advances made on rearing and sterilization research will directly expand the capabilities of African scientists to conduct tsetse fly research and related studies on disease transmission. Field studies with laboratory reared flies will greatly enhance the ecological and biological information currently available.

Conclusive proof that the sterile male technique is effective will make available another tsetse fly eradication technique for futher practical development. Mass rearing of other species of tsetse flies as developed for G. m. moristans at the rearing laboratory, will be applicable to other species, as well as related studies on artifical rearing techniques being supported by Project funding. An increased capability in rearing other species will increase the flexibility of the technique by making its use advantageous in areas with more than one important vector species. The integration of the sterile male releases with control programs that might otherwise be only partially effective may result in effective and efficient eradication of target species that would not have been attempted. The costs of using the sterile male technique in this research program may provide useful information for predicting the costs for integrated eradication schemes in other suitable areas. Thus, any contemplated new eradication scheme should consider incorporation of sterility techniques in the planning stages because of the potential economic savings and/or increases in the total area of land cleared with a fixed amount of capital. For example, in addition to existing tsetse fly control projects, consideration is being given to field operational programs at four locations in Tanzania. 1. The island of Zanzibar; 2. The West Lake area; 3. Mafia Island east of Dar es Salaam; 4. the Handini

area near Masailand. Assuming successful completion of the SIRM trails, it may be anticipated that the insectaries at Tanga might be expanded to provide sterile flies for new programs. Relevant to this point, in 1971, a panel of 32 internationally recognized experts met in Paris to deal with the possible applications of the sterility principle for tsetse fly control. The panel analyzed the possible advantages and disadvantages, and their summary remains the most reliable assessment yet available. The following remarks are based upon the report of the panel, (IAEA Report, 1972).

1. Advantages of the Sterile Male Insect Method: The principal advantage of the SIRM is that the control effort becomes more economical as the natural population declines. This economy results because increasing ratio of sterile to wild males are achieved. As the program proceeds, the total numbers of release flies can be reduced and control becomes increasingly more efficient. In contrast, conventional multiple application of insecticides becomes less efficient in terms of the number of insects killed as the population declines because the cost and percentage kill factor per application remains fixed.

In areas where the SIRM can be utilized alone, this technique avoids contamination of the environment and selectively attacks one Glossina species, resulting in a minimum distriburbance of the environment and other insects. Even if an integrated use of insecticide is indispensable, the contamination of the environment nevertheless is considerably less than that which results from a program based entirely on chemical control. Unlike the majority of other Diptera, Glossina species have an extremely low reproductive potential and low rate of increase per generation. Therefore fewer sterile males are required. The density of the vegetation in the environment, often a serious obstacle for the application of insecticides, does not hinder the dispersion of the sterile insects.

When population density is low the efficiency of eradicating the species is theoretically better with sterile insect release method than with insecticides. The sterility method could be utilized as the final phase of an integrated program. Release of sterile males in low numbers can prevent reestablishment of the species. This technique may be cheaper and more effective than maintaining constant surveillance. In areas, where two Glossina species coexist, the elimination of one species by the SIRM is not expected to result in a sudden increase in numbers of the second species since population sizes are not believed to be interdependent.

Where the control of tsetse is regarded by the authorities as necessary to game reserves or national parks, the use of the SIRM would minimize the detrimental side effects of control. Reduction of the wild tsetse population by other methods may be necessary before sterile males can be effectively used. The use of not more than two or three

applications of a nonpersistent insecticide is not likely to significantly contaminate the environment or damage the fauna except where rare endemic insects are present. Even in areas where the SIRM does not represent an economical gain over other tsetse suppression techniques, it may be the method of choice where disadvantages of chemical or other control methods must be avoided.

2. Disadvantages of the SIRM: The method is not practical nor is it designed to be used alone against high natural populations. Prior reduction with chemicals or other means is a prerequisite. When used alone this method, unlike insecticides, does not immediately reduce the insect population enough to rapidly interrupt disease transmission. Release of large numbers of sterile flies in an area where trypanosomiasis is endemic could temporarily increase the transmission rate. For this reason, the method should not be used alone in areas where human trypanosomiasis is endemic and where immediate interruption of transmission is required.

B. SEPARATE AND INTEGRATED APPROACHES TO TSETSE FLY ERADICATION

Before chemical insecticides were developed, the two most commonly practiced methods for controlling tsetse flies involved clearing woody vegetation on which the flies depend for shelter and eradicating game animals on which they depend for food. These methods are rarely practiced at present; but because of the need to clear a barrier around the Mkwaja Ranch, the method of vegetation clearing is included in the following description of tsetse fly eradication techniques.

1. Clearing of Vegetation. Sheer clearing, involving the destruction of all trees and shrubs, is an effective means of eradicating *Glossina*. It is costly, even when carried out by mechanical methods (Glover et al, 1959; Wooff, 1967) and is now rarely employed except to establish barriers, often in conjunction with insecticides, to prevent the reinvasion of areas freed of tsetse flies. The technique has been employed over wide areas of country against species of the *morsitans* group and linearly against riverine and lacustrine species of the *palpalis* group. In some circumstances soil erosion can result, but there is much evidence that in sanannah regions, removal of all trees and shrubs often causes grass growth to increase and to improve pasture (Ford, Nash and Welch, in Mulligan, 1970). Discriminative or partial clearing involves the removal of only those elements of vegetation essential for the survival of *Glossina*. It has been extensively practiced against riverine *G. palpalis* and *G. tachinoides* in West Africa (Nash 1969) and *G. morsitans*, *G. swynnertoni* and *G. pallidipes* in East Africa.

21. Game Destricution. Slaughter of game animales as a method of tsetse control has been widely practiced in the past in Uganda and Rhodesia. Even when refined by removing only the favored host species (Cockbill et al, 1969), the method is unacceptable today.

3. Insecticides. Treatment of tsetse-infested zones with insecticides is currently the most common method of eradication. Insecticides are applied as persistent deposits of such compounds as DDT, dieldrin, or endosulfan (either from the ground or from helicopters), or as sequential applications of formulation of either dieldrin or endosulfan of ultra low volume from fixed - winged aircraft.

4. Toxicology. The Acute Oral/Dermal (LD^{50} in Rats) and the Acute 24 hour (LC^{50} in Fish) of 4 Pesticide/Herbicides is given below in Mg./Kgm.

	Endosulfan	DDT	Dieldrin	2/4- D
Oral	43	113	46	375
Dermal	130	2000	90	-
Fish*	2.7	7	14	100

*P.P.M. for Blue Gills/Trout fingerlings.

Heavy deposits of persistent pesticides can be applied discriminatively from the ground as a single treatment to the resting sites of the fly. These persistent deposits remain effective for several months, and therefore a single application even kills the flies which emerge from puparia in the soil during the weeks following the application. This method is particularly applicable against species of Glossina with linear distributions and has been widely practiced against G. fuscipes in East Africa (Glover et al, 1960). The method is less practicable against those species, such as G. morsitans, which often occur throughout wide tracts of country. Such species can be attacked, however, when their distribution is restricted during periods of climatic stress (Davies 1971). The most commonly employed insecticides in ground-spray campaigns have been DDT and dieldrin.

Presistent deposits can also be applied by helicopter. Applications can be restricted to certain habitats but are less discriminative within those habitats than are applications from the ground. Extensive successful operations, primarily against G. morsitans, have been performed in Nigeria. Dieldrin emulsion has been the most widely used insecticide, but trials have also been conducted with endosulfan (Spielberger and Abduratim, 1972; Spielberger et al, personal communication).

Observation made on the side effects of insecticides used in various tsetse control schemes indicate that applications of persistent deposits leave heavy local residues (Park et al, 1972, cites initial deposit of 1-10 g active ingredient m^2) that also affect other organisms, especially when applied over large areas. Koeman and his colleagues have studied

these side effects for many years. Koeman and Takken (1976) showed that even a single application of residual dieldrin or endosulfan caused mortality in many nontarget species. Helicopter application affected a wider range of bird species than discriminative groundspray application. Certain species of the fringing forest birds are very vulnerable and disappeared from the treated area. Certain mammal populations also markedly decreased in size (examples are Tantalus monkeys after application of dieldrin, and fruit bats after aerial residual application of endosulfan). Appreciable mortality occurred among fish, amphibians, lizards and snakes.

In general, groundsprays are more discriminative and are therefore less likely to cause irreversible damage than are helicopter applications. Endosulfan was found to cause more damage to cold blooded vertebrates than dieldrin; warm blooded species reacted conversely. In areas treated once, many of the affected species repopulated the treated areas a year or so later by migrating from the nearest untreated populated habitat, provided the areas reclaimed from tsetse had not been altered drastically and the habitat remained suitable. Residues of dieldrin and DDT observed in fish, fish-eating birds, and other organisms collected in areas sprayed one or two years previously have generally been low (unpublished WHO/FAO Report 1976).

When the distribution of the fly is diffuse, restricted application is not feasible and a blanket cover is required. Since residual deposits need to be relatively heavy in order to obtain adequate persistence, it is not feasible to apply insecticide on this scale over the whole habitat available to the fly. The development of methods for the sequential application of nonresidual ultra low volume formulations of dieldrin and endosulfan has been reviewed by Lee (1969) and Burnett (in Mulligan, 1970). Concentrated solutions of insecticide in volatile oil are used, which are dispersed as medium aerosols consisting mostly of 20 - 50u drops. The insecticide must be highly toxic to the fly so that a single drop will contain a lethal dose. Park et al (1972) used 30 gm of active ingrendient (a.i.) per hectare in each of five applications of endosulfan to eradicate G. morsitans in Zambia, and in Botswana as little as 6gm a.i./ha have been used per application (Kendrick and Alsop, 1974). Because puparia in the soil cannot be reached by the insecticide, repeated applications (usually 5 or 6 at about 18 day intervals) are necessary to prevent newly emerged females from reproducing.

A team from the Centre for Overseas Pest Research, London, is currently investigating the effects of sequential aerial application of endosulfan on nontarget organisms in Botswana. In contrast to the effects of residual aerial applications, preliminary results with sequential application suggest that there are unlikely to be any immediate lethal effects on fish or terrestrial or fresh water invertebrates (Russell-Smith, personal communication) because Glossina are highly susceptible and require much less insecticide than other insect species. Most studies followed application rates of 6 gm a.i./ha but there were also little evidence of direct mortality after one application at 12 gm a.i./ha; endosulfan can be highly toxic to fish, but at least these extremely low application rates it clearly had no detrimental effect. No data are yet available for possible sub-lethal effects of endosulfan; samples of fish and water are currently being examined for insecticide residues.

4. Genetic Control. In addition to the SIRM, various other genetic control techniques have been proposed. The most practical at the moment seems to be the exploitation of the hybrid sterility resulting from some combination of crosses between subspecies of G. morsitans. No field trials have been carried out.

5. Biological Control. A number of attempts (especially by Nash, 1933) have been made to exploit parasites of tsetse as a means of control. None have been successful. Tsetse predators and pathogens must be categorized and then effects on tsetse populations must be quantified before they can be used as control agents. Research is proceeding on other chemical control techniques. At a number of laboratories in the United States and Europe, research projects are underway to characterize the effects of juvenile hormones (Denlinger, 1975) ecdysones (Whitehead, 1976) and diuretic hormones (Gee, 1975), but the formulation of a hormonal insecticide for use against Glossina is only a distant prospect. Such insecticides are already in use against other pest species, they have a number of attractive features, including virtually no harmful effects on mammals.

The recent development of highly efficient catching devices that utilize the natural attractiveness of host animals (Vale 1974) is a major advance. In addition, a sex pheromone in G. m. morsitans has recently been isolated and identified (Langley, Pimley, and Carlson 1975), suggesting the possibility of developing a male attractant for use in control activities. It has been suggested that the sounds produced by tsetse flies may act as a means of communication (Kolbe, 1973). Should this be so, it may be possible to devise an auditory attractant.

C. BENEFITS AND IMPLICATIONS FOR DEVELOPMENT STRATEGIES

The tsetse fly belt stretches across the middle of Africa. Generally, it lies between latitude 12 degrees north and 20 degrees south. Little of this vast area is utilized except for periodic livestock grazing, much of which is nomadic. It has been estimated that 240 to 325 million hectares are presently utilized for livestock grazing and that another 200 million hectares could be developed. Recent advances in soil sciences and soil moisture management could expand these estimates. Therefore, this tsetse fly belt looms importantly in the goal of increasing the food production of Africa — and, in fact, of the world. Yet, while the area is potentially productive, its development is complicated by many problems: poor soils, inadequate water, disease, and perhaps in some cases maladaptive social features of the human populations may at times be comparable to the tsetse fly in their negative effects. Moreover, campaigns to control animal trypanosomiasis cannot be isolated from the efforts to prevent other animal diseases. East coast fever, rinderpest, and contagious bovine pleuropneumonia are a few of the many diseases endemic in the tsetse fly belt of Africa.

The mapping of soils by classes and capacity for supporting agriculture or livestock production have been limited in Africa. Techniques are being refined which can help, although progress will depend upon building indigenous capabilities for soil classification and analysis in each nation. Soil classification is necessary since any development strategy for land utilization must reflect the use potential and carrying capacity of the land. The details of land use planning in each country naturally depend on pre-existing institutions and policies. Each form of ranch system must be made economically viable and consistent with national goals on size, employment, and production. Beyond the development of the farmland itself, improvements in roads, markets processing and storage, worker incentives and education and training opportunities are all integral parts of any successful program of economic and social change. The tsetse fly is thus a major constraint, but its eradication is only the first step toward making the tsetse fly belt of Africa productive. Since animal trypanosomiasis is only one of many constraints on optimal livestock productivity, the full benefits of tsetse fly eradication can only be attained within a system in which all other constraints have been eliminated or are at least brought within manageable limits.

Although development planners and tsetse fly experts have stressed that tsetse fly eradication must be integrated with rural development and land use, complete success has seldom been achieved. The Mkwaja Ranch provides an opportunity to experiment with new tsetse fly eradication techniques which appear to be less hazardous to the environment. The ranch also offers the opportunity to observe the integration of tsetse fly control techniques with livestock and resource management. However, the production outputs of the Mkwaja ranch currently are less than satisfactory. Factors other than the tsetse fly which bear on the productivity of the ranch are the relatively low levels of forage production and its seasonal variation in nutritional value: rapid regeneration of bush; other animal diseases; and a calf breeding rate that is limited to about 50 percent per year. The death loss due to trypanosomiasis is low but the effective chemotherapeutic regime requires a substantial investment. Even in this relatively well managed case, the data show that commercial ranching in the semi-arid coastal region of Tanzania is still at best marginally profitable. These observations reinforce the need to precede major tsetse fly eradication eforts with investigations on land carrying capacity, water availability, and training and incentive programs for the populations who will occupy the land claimed from the fly.

If tsetse fly eradication is undertaken on a large operational scale, appreciable environmental modifications will occur and must be weighed against the benefits, short term and long term, of increased food production and employment. It is inevitable that man and his domestic animal will replace wildlife on many areas and that the large game animals will be reduced in number. These anticipated modifications in the environment must be studied well in advance of any large scale tsetse fly eradication programs.

Throughout the twenthieth century, Africa has been exposed to numerous grazing and development schemes, many initiated during the colonial period. Much effort and capital have been spent to superimpose western technologies of animal husbandry and range management on pastoral subsistence economies. Those attempts have often failed because they were not combined with a parallel effort to improve the socio-economic environment of the local people. These past failures dramatize the importance of involving the local communities in the initial stages of development programs. Proposed changes must be carefully evaluated from the perspective of the local populations, and must be supported by thorough analyses of human needs and capabilities. In analyzing the effectiveness of the water development and grazing schemes in Masai areas, Z. Neveh (1966) has found that the failure of the programs could not be explained by the "insatiable desire of the Masai to build up livestock populations for bridal wealth and prestige" as developmental planners have often argued. Rather, the earlier disruption of the Masai nomadic ecosystems by the encroachment of agriculturists upon the better lands formerly available to them caused the Masai to depend for their survival on larger and larger herds. The trauma of the often repeated

experience of disaster and starvation... and the development of water points and disease controls have not improved things but made them worse.

In a similar study of African Pastoralists, Alan H. Jacobs (1965) has described how preconceived views and prejudices about a pastoral society can impair the development planner. For example, "The generalization that pastoralism implies an especially strong and characteristic resistance to social change deserves attention... . The evidence for such a statement is by no means consistent or conclusive. Not only have many African pastoral societies been dependent on external markets and responsible to social change over long periods of time, such as the Fulani and Somali, but others have changed rapidly within a period of a few years, such as Kipsikis and Nandi of Kenya."

Such studies on man and his environment in Africa should be taken into account by every development project, although clearly they were beyond the resources of this environmental assessment.

The Assessment Team did not attempt to identify the options available to national planners in Africa, nor to assess the tsetse fly eradication experiences in Tanzania. The Team wishes to emphasize, however, that international agencies involved in tsetse fly eradication schemes must act in close accord with the host countries. The role of foreign experts should be primarily to determine the probable affect of the various eradication options, and the range of uncertainties regarding the consequences. International and national aid agencies then must leave to the host country in light of its own political and development strategies, the interpretation of this advice and the decision as to what the country should actually do. In particular, the participation of African nations in a continent-wide effort to eradicate the tsetse fly, such as the FAO program, will in the end be weighed against each nation's priorities.

V. CONCLUSIONS

The team concludes that the Tsetse Research Project in Tanzania will have negligible detrimental impact on the environment of the Mkwaja Ranch. In those localized situations where some environmental change has been anticipated, the effects have been evaluated. The objective of the Research Project is to test a new technique for the control G. m. morsitans in an area where it will have no effect on the present use and occupation of the land. To this extent, the 435 sq. km of the Mkwaja Ranch is atypical of the 10 m. square km of tsetse fly infested Africa. The test site was selected to fulfill the conditions and requirements of the experiment.

An assessment was made of the socio-economic impact of the research project upon the ranch environment and the rearing laboratory environment in Tanga. Other than the important component of training and the demonstration of the role of science in helping man shape his environment to his needs, the social impact of this project has been minimal.

The creation by the ranch management of a 1 km wide barrier clearing around the test site to reduce fly immigration is being completed with project funding. The replacement of the natural habitat with grassland in the barrier zone will have a high level of impact on the plant and animal communities, but the disturbance on the ecosystem will be localized and the proper maintenance of grasslands may contribute to a stable ecosystem, providing additional forage.

The herbicide, tordon 155, will be applied to the tree stumps in the barrier zone. Since the applications will be restricted and will be applied manually with brushes, the minimal effects will occur only in the barrier zone.

In order to reinforce the barrier and protect the test area from any fly immigration, DDT will be applied bimonthly to a 300 m strip along the perimeter of the barrier. This selective application will deposit about 545 kilograms of DDT on the test site. This represents an application level of 280 grams/hectare (0.25 lbs/acre) for the treated area. The localized effects of the DDT treatments on the soils and atmosphere will be minimal but the effect on the ecosystem will be high. However, the effects are limited to less than 8 percent of the total test area and within this area only 3 to 10 percent will be actually sprayed.

Two or three aerial applications of endosulfan will be applied to reduce the tsetse fly population prior to the release of sterile males. The total amount of insecticide will be about 1800 kg (92 grams per hectare of 0.0825 lb/acre). These applications will leave minimal residues which will not measurably affect nontarget organisms.

The daily release of 3 to 6 sterile male flies per square kilometer will not affect the environment. The flies are not radioactive and the number released will be lower than the initial population and therefore, the incidence of animal trypanosomiasis will not increase.

V. GUIDELINES FOR FUTURE ASSESSMENTS

The assessment team recommends that when an initial examination of a proposed AID action identifies the need for an environmental assessment, it should be combined with the development of the work plan. This procedure will substantially reduce the costs and enable AID to consult with experts during the preliminary planning stage.

The team recommends that the AID program authorities identify the individuals required for an assessment. A tsetse fly project should include the following specialists:

1. a chairperson, preferably a tsetse fly expert;
2. an entomologist, whose work compliments the chairperson; and
3. an ecologist or wildlife biologist.

Depending upon the design of the project, the environment in which it is to be undertaken, and requirements for integration of land use and development programs, the following specialists should be included as team members or as experts to be consulted by the chairman.

4. animal production specialist; and/or epidemiologist (sleeping sickness); and
5. behavioral scientist.

The ex-officio members of the team will include the mission project officer and the Washington AID program manager. The organizational arrangements and correspondence should be the reponsibility of the Washington office of the AID program manager.

The host country representatives participating in the preliminary planning of the proposed action should be invited to recommend the host country specialist in tsetse fly control and a planning officer from the relevant ministry as members of the assessment team.

Before visiting the site of the proposed action, the members of the assessment team should convene for several days in Washington. At that time, AID should provide all members with relevant past assessments, project evaluations, reports on ongoing projects in related fields, all preliminary data on the proposed action, and any general information on tsetse fly eradication programs.

The chairperson should assign specific responsibilities to each team member. Arrangements must be made in advance for the team to consult with the appropriate experts and officials in the host country during the period of the site visit.

The site visit should be of a duration to allow the necessary data to be collected--one to two weeks. At the conclusion of the site visit, each team member should submit his report to colleagues and as a team prepare the draft report. The team noted that "when AID unilaterally considers that there is a reasonable risk of significant adverse effects on the environment from an activity proposed to it for support, and when efforts to encourage the incorporation of appropriate safeguards are unsuccessful, AID reserves the prerrogative of declining to participate in the activity."

The team has noted that international agencies, FAO and WHO, have undertaken continent-wide assessment of long range programs for tsetse fly eradication in Africa, including a two-year study which will survey selected regions for an assessment of the socio-economic importance of trypanosomiasis and costs of alternative methods of control. The U.S. Government is a participant in the specialized agencies and therefore the team does not see any need for AID to undertake the broad program assessments described in section 216.6 of the Rules and Regulations. Attached to this report are the FAO/WHO studies to date.

APPENDIX E

ORGANIZATIONS INVOLVED IN TSETSE RESEARCH and COOPERATING ARRANGEMENTS

1. Organizations Currently Involved in Tsetse Fly Research
2. Draft Agreement Between IAEA
3. University of Bristol Estimates

E
Ex 1

Organizations Currently Involved in Tsetse Fly Research

AID/USDA (PASA) The PASA provides for research on the Sterile Insect Release Method (SIRM) for the control of Tsetse flies, the vectors of trypanosomiasis (sleeping sickness in humans and Nagana in animals). Research is conducted at Tanga, Tanzania where flies are reared in insectaries for release after sterilization on a 100 sq. mi. tsetse fly infested test area. Target is determination if SIRM is an effective control system.

ICIPE (The International Center for Insect Physiology and Ecology). An internationally supported research institution associated with the University of Nairobi in Kenya. Although not one of the CGIAR supported institutions, it does have substantial support from European, American, African and Asian donors. In terms of prestigious academic support and research guidance, and research discipline, the organization among African Institutions is peerless. The Institution concentrates on research on insect pests and insect disease vectors at basic and applied levels.

IMVET (Institute d'Elevage de Medicine Veterinaire des Pay Tropicaux) Headquartered at Maison Alfort, France. This organization is the operating agency for French Agricultural Research and Development in the Francophone areas of Africa. Its research emphasis has been directed primarily to animal agriculture and related subjects. One of its main project support areas is Tsetse Fly Control Research in Upper Volta, a component of which is SIRM on a riverine species of Tsetse. This research is closely coordinated with the AID activity.

IAEA/FAO (The Joint International Atomic Energy Agency/Food and Agriculture Organization) has been involved in SIRM for several years. It operates a laboratory for SIRM at Seibersdorf in Austria which is closely associated with the AID project at Tanga, Tanzania.

WHO (World Health Organization) WHO has long been interested in the control of insect vectors of human diseases. Although it has no active programs in Tsetse Fly Control it participates in all major meetings or conferences in the subject area. Its role in future programs in the control of river blindness may very well impinge on riverine Tsetse Fly Control.

ILRAD (The International Laboratory for Research on Animal Diseases) This is one of the CGIAR research institutions designated to deal with hemoparasitis diseases (insect vectored diseases affecting the blood systems, i.e. malaria). The primary research focus is on immunology in the target animal-human or other vertebrate - but does not exclude research related to immunology related to vector species.

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Ex 1

ILCA (The International Livestock Center for Africa). ILCA is one of the new CGIAR institutions only now "off the ground". It is designed to conduct research on a broad range of animal science with an emphasis on applied research. One of its major focal objectives is Tsetse Fly Control.

IIBR (The Israel Institute for Biological Research). This institute has a unique capability in entomological investigations in that it can deal with research in areas that cannot be undertaken in the United States, Europe, or other areas of the world. It has an imaginative approach to research in Tsetse Fly Research that cannot be duplicated and a capacity to provide expertise to ICIPE, ILRAD, ILCA, WHO, IAEA, FAO, and AID.

The University of Bristol The Langford laboratories of the University of Bristol have long been associated with Tsetse Fly Research in Africa. The Langford laboratory has maintained a Tsetse Fly colony from which the USAID Tanga colony was derived. It is in constant contact in an advisory and interchange capacity with the Tanga operation.

The University of Antwerp This university has been interested in Tsetse fly control for many years. It has been interested in laboratory rearing of tsetse flies and contributed much to techniques.

EATRO (The East African Trypanosomiasis Research Organization) This organization located at Tororo, Uganda, is one of the premier organizations of Africa dealing with the problem of sleeping sickness and Nagana of cattle. Historically this was the center of research and development in the problems of the disease and the vector.

NITR (The Nigerian Institute for Trypanosomiasis Research) This is the only national non-externally supported institution in West Africa dealing with the problems of Tsetse fly.

TPRI (Arusha, Tanzania) The Tropical Pesticide Research Institute's role in the Tsetse Fly Control program is peripheral . The institute deals mainly with analyses of chemicals in control of insect pests.

APPENDIX E

Exhibit 2

Between

INTERNATIONAL ATOMIC ENERGY AGENCY

And

THE UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ENTOMOLOGY RESEARCH DIVISION

THIS AGREEMENT is made and entered into by and between the International Atomic Energy Agency, hereinafter referred to as the Cooperator, and the United States Department of Agriculture, Agricultural Research Service, Entomology Research Division, hereinafter called the Division.

WHEREAS, there is a current and urgent need for the research hereinafter set forth; and

WHEREAS, the Division and the Cooperator are engaged in research on the biology and control of tsetse flies affecting man and animals; and

WHEREAS, the Division and the Cooperator are both interested in conducting studies on the biology and control of tsetse flies in Africa; and

WHEREAS, the tsetse flies are vectors of trypanosomiasis for both man and animals; and

WHEREAS, the Division desires to conduct certain entomological studies more particularly described herein; and

WHEREAS, it is the intention of the parties to this agreement that such investigational work shall be for their mutual benefit and the benefit of the people of the United States; and

WHEREAS, the cooperative research to be conducted under this agreement will be cooperatively planned and conducted;

NOW, THEREFORE, for and in consideration of the promises and mutual covenants herein contained, the parties hereby mutually agree with each other as follows:

The Cooperator Agrees:

1. To conduct research on methods of blood preservation that would simplify the use of membrane feeding techniques in large scale production of tsetse flies.

2. Continue to develop mass rearing methods using membrane feeding techniques for tsetse fly species of major concern to cattle production, with particular emphasis on Glossina pallidipes.

3. Cooperate with field programmes in developing quality control procedures that are relevant to field activity and competitiveness of tsetse flies.

4. Continue to conduct research on the reproductive and radiation biology of tsetse fly species envisioned for control by the sterile insect technique.

5. Develop shipping methods for intercontinental shipments of tsetse flies.

6. Develop aerial release systems for puparia or adult tsetse flies in cooperation with field projects.

7. Provide training in tsetse fly rearing and biology to trainees as designated and mutually agreed upon by both parties.

8. Provide supplies and equipment in support of field projects.

9. Provide necessary personnel, travel of the Cooperator's employees engaged in the research, materials, services, available equipment, expendable supplies, laboratory and office space, and facilities for the conduct of all research investigations as mutually agreed upon, estimated to be $74,500 annually as set forth in Attachment B to this

B. The Division Agrees:

1. To provide the services of a representative to maintain close liaison with the Cooperator through scheduled visits and other means to review and evaluate research progress and to assist in the planning and coordination of research to be undertaken.

2. To work closely with the Cooperator in planning and conducting the research outlined in A.1. above.

3. To assist in the planning of the experiments and studies, analysis of data, and preparation of reports based on data obtained from these investigations and studies.

4. To make available to the project other personnel and specialized equipment as required and not provided for under A.4. and B.1., above, and as mutually agreed upon for planning and conducting the research covered by this agreement, such equipment to remain the property of the Division subject to its disposition.

5. To assist in defraying the cost of the project by reimbursing the Cooperator for salaries and travel of the Cooperator's employees engaged in the research, expendable supplies, services and materials in the amount not to exceed $100,000 during the period of this agreement.

C. It is Mutually Understood and Agreed:

1. That reimbursement not exceeding $100,000 by the Division to the Cooperator shall be made for specific expenditures for each previous quarter as listed in detail on properly executed invoices or vouchers to be prepared by the Cooperator and submitted to the Division, Beltsville, Md., for approval.

2. The Division and Cooperator shall each pay their respective overhead or indirect costs, and no claim for reimbursement for overhead or indirect costs shall be made by either party.

3. The work will be jointly planned and conducted, and data which are compiled under this agreement shall be compared, analyzed, shared, and mutually interchanged by the parties.

4. The results of the research program outlined may be published jointly by the Cooperator and the Division, or by either of these institutions separately, but manuscripts prepared for publication by either shall be submitted to the other party for suggestions and approval prior to publication. In the event of disagreement, either party may publish results on its own responsibility, giving proper acknowledgement.

5. Checks covering payments under this agreement will be drawn in the name of the Cooperator unless a written request from the Cooperator accompanies the billing requesting, for purposes of check identification, that such checks also include the name of a particular department of the Cooperator's organization. If further check identification is needed, the Cooperator may, (1) number his invoice and request that it be shown on the check, (2) submit invoice in duplicate and request that one copy of the invoice be returned with the check; or (3) request that the agreement number cited on the invoice be shown on the check.

6. The patent provisions applicable to this agreement shall be in accordance with Attachment A attached hereto and made a part hereof.

7. No member of or delegate to Congress or resident commissioner of the United States shall be admitted to any share or part of this agreement or to any benefit to arise therefrom, unless it be made with a corporation for its general benefit.

8. This agreement is contingent upon (a) the passage by the Congress of an appropriation from which expenditures legally may be met and shall not obligate the Division upon failure of the Congress to so appropriate, and (b) budgets and programmes as approved by the governing organs of the Cooperator.

9. All conditions and provisions of this agreement except those contained in paragraphs B.1, B.2, B.3, and B.4, shall become effective upon date of final signature, and shall continue in force until September 30, 1979.

The Government's obligation under paragraphs B.1, B.2, B.3, and B.4, shall become effective upon date of final signature, and shall continue in force until September 30, 1979 but may be renewed for each succeeding fiscal year at the option of the Division until September 30, 1982.

11. This agreement may be amended, modified, or terminated by either of the parties hereto upon 60 days' notice in writing to the other party.

COOPERATIVE AGREEMENT with the International Atomic Energy Agency, Vienna, Austria, for research directed towards determining biology, mass rearing, and control of tsetse flies.

Budget of Estimated Annual Contribution to Project by the International Atomic Energy Agency:

Personnel	Annual Average
Entomologist, Principal Investigator, 10%	$ 5,000
Entomologist	30,000
2 Technicians	14,000
Laboratory space	
Fly Rearing Rooms (240 ft^2)	2,000
Feeding Room (240 ft^2)	2,000
Holding Room (250 ft^2)	2,000
Experimental Laboratory (500 ft^2)	2,500
Instrumentation	
Freeze Dryer	1,000
Constant Temperature Cabinets	1,000
Freezing and storage units	1,500
Misc. Analytical Equipment	4,000
Quality Control Apparatus	3,000
Transportation	
1 Vehicle (25%)	500
	$ 74,500

APPENDIX E
Exhibit 3

MINISTRY OF OVERSEAS DEVELOPMENT AND UNIVERSITY OF BRISTOL

FEB 18 11 08 AM '77

Tel. Churchill 862561
0934-862561
Director:
A. M. Jordan, Ph.D., F.I.Biol.

TSETSE RESEARCH LABORATORY
DEPARTMENT OF VETERINARY MEDICINE
LANGFORD HOUSE
LANGFORD
BRISTOL
BS18 7DU

14 February, 1977.

Dear Dave,

Since I returned I have discussed with Peter and Alastair the possibility of us establishing a 5,000 female back-up colony for the Tanga Project. We have come to the conclusion that this would not be easy as there is not sufficient spare capacity in either our goat or membrane feeding facility. However, should you decide that a second back-up colony is desirable we would be prepared to do our best to assist. This would mean construction of an additional membrane feeding facility and should you decide to go ahead we would need to know as soon as possible, as time is short. The sort of timetable we envisage is:

1 May 1977	- funds available, recruitment of staff, construction of facility.
1 July 1977	- receive first pupae.
1 October 1977	- colony in production? (remember at least parental generation will probably perform badly).
31 December 1978	- Termination.

In our tentative discussions we talked about 2 full-time helpers; in discussion here we feel that 4 half-time helpers would be much more useful and the following estimates are based on this arrangement. Capital Expenditure and Running Costs are the best estimates available; actual expenditure would be supported by receipts.

Estimates

Personal Emoluments (for total of 20 months, BUT no allowance made for anticipated salary scale revisions in October 1977 and October 1978).

	£
25% of remuneration for 1 Professional staff member	3,850
25% " " " 1 Grade IV Technician	1,500
4 half-time Grade 1A Technicians	8,000
Sub-total	13,350 = $ 23229

Capital Expenditure (required at beginning of contract)

To include construction of membrane system, heating plates, feeding plates, etc. Washing-up machine for washing plates, oven for sterilising, refrigerator. Manufacture of cages, trolleys, etc. Staff protective clothing, etc. 3,200 = $ 5568

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	£	
Running Costs (spread over 20 months)		
To include chemicals, heating, laboratory overheads	800	$1392
University Overheads charge		
7½% of total Personal Emoluments and Running Costs	1,060	= $1844
TOTAL	£18,410	= $32,033

At the current rate of exchange (£1 = $1·74) the total cost for the whole 20 months would be about $32,033 plus any adjustment necessary for increases in salary scales.

We await your comments.

Yours sincerely,

A.M. Jordan

1,75446

FY 1977
Staff = 5 months @ 116£ = 580
Running = " " @ 70 = 350
Overhead = " " @ 92 = 460
Capital = 5565
12,183

FY78
8% salary increase est. 12 months @ 125£ = 17076
+ 70
+ 99
1423

FY79
3 months @ 135£ = 4593
71
107
1531

33852

Dr. D.A. Dame,
USDA, ARS, Southern Region,
Insects Affecting Man Research Laboratory,
1600 S.W. 23rd Drive,
P.O. Box 14565,
Gainesville,
Florida 32604,
U.S.A.

APPENDIX F

STATUTORY CHECK LIST

F

II. PROJECT CHECKLIST

A. General Criteria for Project

1. App. Unnumbered; FAA Sec. 653(b); Sec. 671

   (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) Country or International Organization allocation reported to Congress (or not more than $1 million over that figure.

   1.(a) The FY CP contains a request for $500,000. No advice of program change required.
   (b) Assistance is within country allocation reported to Congress in OYB.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   2.(a) Yes.
   (b) Yes. See technical, financial analyses in PP for explanation of satisfaction of Section 611(a)(1).

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

   3. No.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

   4. N/A

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?

   5. Construction costs are less than $1 million. See 611(e) Certification.

6. FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?

6. No future mainland tsetse control efforts would most appropriately be executed as a multilateral project.

7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

7. (a) No.
(b) No.
(c) No.
(d) No.
(e) Yes.
(f) No.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

8. Project technical assistance will be provided by USDA. Commodities for the laboratory will be purchased from U.S. firms.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

9. The host country will provide some local currency for local staff and for vehicle operations.

10. FAA Sec. 21(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?

10. There are no excess U.S. owned local currency.

11. ISA 14. Are any FAA funds for FY 78 being used in this Project to construct, operate, maintain, or supply fuel for any nuclear powerplant under an agreement for cooperation between the United States and any other country?

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local government institutions?

1.(a) Phase I is primarily a data gathering activity.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph -- e.g. a, b, etc. -- which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(b) The project seeks to develop a technology which if successful will offer a more environmentally safe and cost effective technology for tsetse control. In turn this technology could expand the land base available to farmers for agriculture and livestock production.

c. FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

(c) The host country contribution is approximately 10%. Tanzania is a RLDC and the cost-sharing requirement has been waived.

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

(d) For Phase I activities, no Phase I and II will require disbursements over approximately six years. Tanzania is a relatively least developed country.

e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of

(e) Project efforts are focussed on developing an appropriate technology which would increase the opportunity for developmental activities which address these concerns.

B.(e) economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

(f) One output of the project is the development of a cadre of Tanzanians capable of undertaking tsetse control activities.

g. FAA Sec. 201(b) (2) - (4) and -(8); Sec. 201(e); Sec. 211(a) (1) - (3) and -(8). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?

(g) Yes, however, Phase I activities will address these questions more thoroughly.

h. FAA Sec. 201(b)(6); Sec. 211(a)(5),(6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.

(h). Most technical assistance and commodities will be procured in the U.S. A waiver has been requested for non-U.S. source origin vehicles based on special circumstances. See waiver.

2. Development Assistance Project Criteria (Loans only)

a. FAA Sec. 201(b)(1). Information and conclusion on availability of financing from other free-world sources, including private sources within U.S.

B(2)(b)

b. FAA Sec. 201(b)(2); 201(d). Information and conclusion on (1) capacity of the country to repay the loan, including reasonableness of repayment prospects, and (2) reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan. N/A

c. FAA Sec. 201(e) If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds $100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner? N/A

d. FAA Sec. 201(f). Does project paper describe how project will promote the country economic development taking into account the country's human and material resources requirements and relationship between ultimate objectives of the project and overall economic development? N/A

e. FAASec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurement from private sources? N/A

f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan? N/A

3. Project Criteria Solely for Security Supporting Assistance

a. FAA Sec. 531. How will this assistance support promote economic or political stability? N/A

B(3)(b)

b. FAA Sec. 533(c)(1). Will assistance under the Southern African Special Requirements Fund be used for military, guerrilla, or paramilitary activities? — N/A

III. STANDARD ITEM CHECKLIST

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed? — 1. Yes.

2. FAA Sec. 604(a) Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under the delegation from him? — 2. Yes.

3. FAA Sec. 604(d) If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed? — 3. N/A

4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? — 4. N/A

5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items? — 5. Yes. Project plans to purchase commodities and housing from the Consulate on Zanibar which is being closed. Considerable savings will result.

6. MMA Sec. 901(b). (a) Compliance with requirement that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.

III.(A)(7)

7. FAA Sec. 621. If Technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities or other Federal agencies will be utilized, are the particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

7. Facilities of other Federal agencies will be utilized and are uniquely qualified to provide technical services.

8. International Air Transport. Fair Competitive Practices Act, 1974.

If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available?

8. Yes.

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?

1. Local contracting is most suitable since construction activities are limited and therefore probably not of significant magnitude to interest U.S. firms.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?

2. Yes.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million?

3. N/A

C. Other Restrictions

1. FAA Sec. 201(d). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?

1. N/A

III(a)(2)

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?	2. N/A
3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-Bloc countries, contrary to the best interests of the U.S.?	3. No.
4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S. or guaranty of such transaction?	4. Yes. Waiver request is included in PP.
5. Will arrangements preclue use of financing:	
a. FAA Sec. 114. to pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to practice sterilization?	(a) N/A
b. FAA Sec. 620(g). to compensate owners for expropriated nationalized property?	(b) N/A
c. FAA Sec. 660. to finance police training or other law enforcement assistance, except for narcotics programs?	(c) N/A
d. FAA Sec. 662. for CIA activities?	(d) N/A
e. APP. Sec. 103. to pay pensions, etc., for military personnel?	(e) N/A
f. App. Sec. 105. to pay U.N. assessments?	(f) N/A
g. App. Sec. 106. to carry out provisions of FAA Sections 209(d) and 251(h)? (transfer to multilateral organization for lending).	(g) N/A

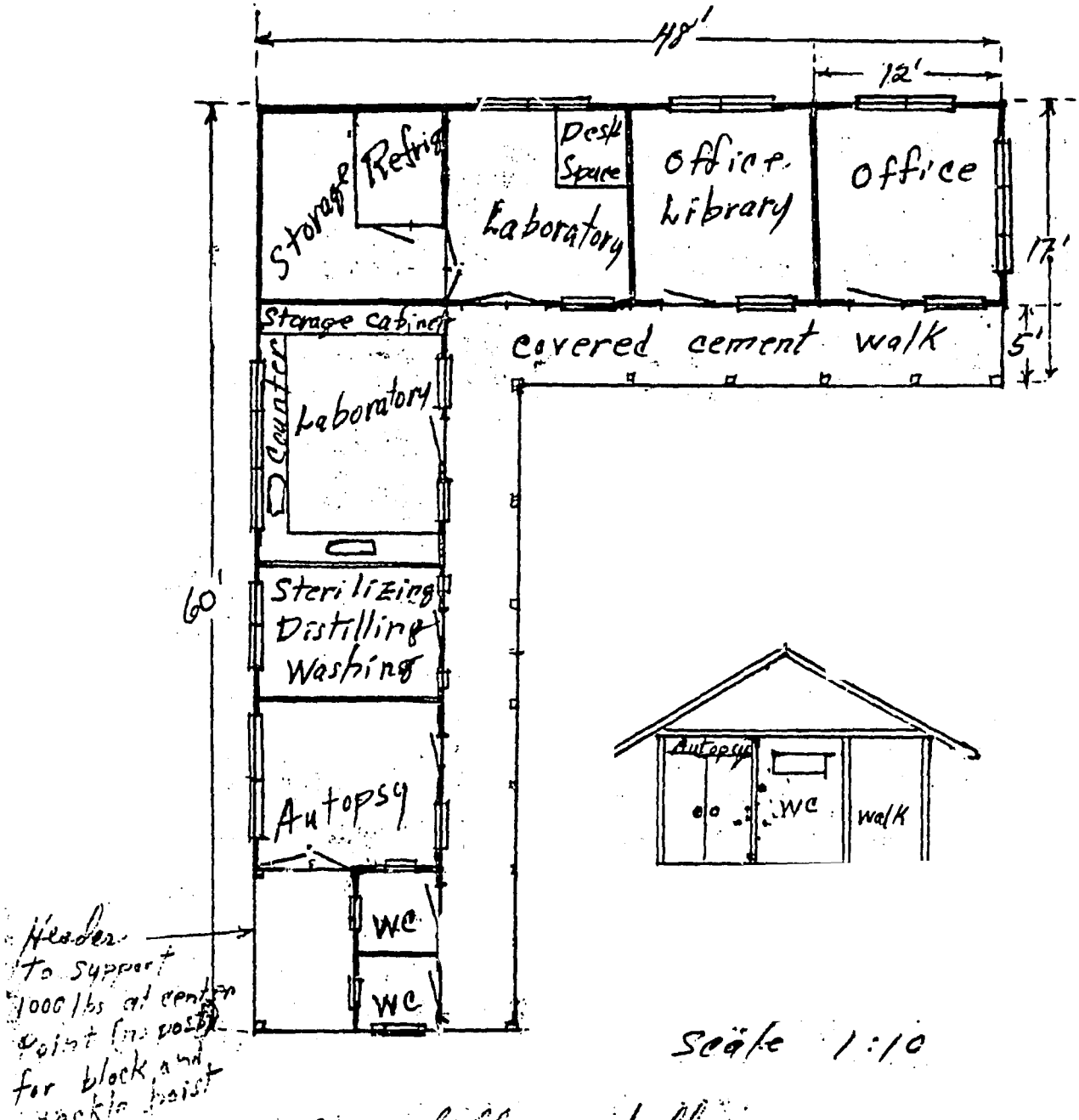
APPENDIX G

611 (a) CERTIFICATION

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
P. O. Box 9130,
Dar es Salaam, Tanzania

file G

Zanzibar lab



1. Concrete floor and footings
2. asbestos tile roof
3. Cement block walls
4. treated wood roof trusses

APPENDIX H

WAIVERS AND JUSTIFICATION

REQUEST FOR PROCUREMENT SOURCE/ORIGIN WAIVER

Problem: Request for Source Waiver from Geographic Code 000 (Selected Free World), to AID Geographic Code 935 (Free World).

(a) Cooperating Country: United Republic of Tanzania
(b) Authorizing Document: PP and PAF II
(c) Project: Zanzibar Tsetse Fly Eradication
(d) Nature of Funding: Grant
(e) Description of Commodities and Approximate Value:

(i)	Five Landrover-type Vehicles and spare parts	- $108,000
(ii)	One 2½ ton truck and spare parts	- $ 31,500

(f) Approximate Total $139,500
(g) Procurement Origin: United Kingdom
(h) Procurement Source: United Kingdom, Australia

Justification for Procurement Source/Origin Waiver Requests

Discussion:

Technicians working on the project must have adequate and reliable transportation at all times. The survey work involves travelling into the remote areas of Zanzibar under all weather conditions, where often bad roads lead into even worse tracks. The tsetse fly survey requires sampling at scheduled times where each date and time of the day must be precisely met. Therefore it is essential that vehicles be procured that are durable, adapted to prevailing conditions, have available spare parts and trained mechanics to repair the vehicles in cases of emergency.

A waiver is requested for seven four-cylinder Land-Rover station wagons with metal tops, a 109 inch wheelbase, four side and one rear door, with a carrying capacity of 10 persons (including the driver) plus 200 lbs and spares of an approximate vlue of $108,000, and one 2½ ton truck fully equipped with cab, truck bed, dual wheels canopy and removable personnel benches, of an approximate value of $31,500.

U.S. manufactured vehicles are not common in East Africa, including Tanzania. Section 636 (i) of the Foreign Assistance Act of 1961, as amended, provides that none of the funds made available to carry out the Act shall be used to purchase motor vehicles unless such motor vehicles are manufactured in the United States, Section 636 (i)

further provides, "that where special circumstances exist, the President is authorized to waive the provisions of this section in order to carry the Foreign Assistance Act of 1967 (which added Section 636 (i) to the Act) it was reported that the committee of conference was in agreement that motor vehicles manufactured in the United States should be procured except where there are emergency or special situations such as a need for right-hand drive or other types of vehicles not produced in the United States (House Report No. 892, dated November 7, 1967).

The Administrator has the authority to waive the provisions of Section 636 (i) by virtue of Executive Order NO. 10073 and State Department Delegation of Authority No. 104.

Primary Justification:

Experience with American-made "Jeep Wagoneers" in Tanzania indicates that frequent breakdowns have been the rule rather than the exception and access to adequate supply of spare parts is impossible because of the wide dispersion of project vehicles. Even minor breakdowns prevent operation of U.S. vehicles for days and perhaps weeks while spare parts are obtained from Dar es Salaam or even the U.S. This situation becomes more serious yearly as U.S. -made vehicles get more complicated. The vehicles to be furnished under this project will be used in Tanga Region and Zanzibar Island, both remote areas of Tanzania. In addition, the TanGov has standardized on LandRover vehicles. In an effort to be responsive to the TanGov requests and to provide effective assistance, it is necessary for the achievement of the project purpose to purchase non-United States manufactured vehicles.

A system of preventive maintenance for "LandRovers" has been developed by the Ministry of Communications and Works and there are sufficient number of trained mechanics able to repair LandRovers. When breakdowns occur an adequate supply of parts is available in all cities and large towns, making it possible to repair vehicles. On the other hand it is often necessary to deadline project vehicles of American manufacture for long periods. The manufacturers of the "Land Rovers" has had long experience in Tanzania and can guarantee services. There is no American firm established in Tanzania, and therefore spare parts and mechanic services are extremely difficult to obtain.

The rugged construction of the "Land Rover" plus its lighter weight than the jeep and other U.S. models, makes it more adaptable to road conditions in Tanzania. An adequate supply of spare parts is available in the country to ensure continual operation and reduction of down time.

By law all driving in Tanzania is on the left hand side of the road. In view of the project need for ruggedly constructed right-hand drive vehicles with an adequate backup of drivers, mechanics, and spare parts and the unavailability of a comparable vehicle with maintenance and parts support from the United States, it is believed that special circumstances exist and therefore appropriate to exercise the waiver authority in those circumstances.

(See attached SER/COM/ALI position regarding waiver requests in Hagan trip Report, 1978 and Dar 1923.)

Recommendation:

For the reasons stated above, that you conclude that sufficient special circumstances exist at this time which warrant the procurement of non-United States manufacured vehicles; that it be determined that procurement of vehicles from the origin requested above is necessary for achievement of the project purpose and attainment of U.S. foreign policy objectives and the objectives of the Foreign Assistance Program, and that you waive Section 636 (i) of the Foreign Assistance Act.

ACTION COPY

UNCLASSIFIED

Department of State

INCOMING TELEGRAM

PAGE 01 DAR ES 01923 041403Z 5793

ACTION AID-30

INFO OCT-01 AF-10 EB-08 OES-07 /057 W

----------018002 041407Z /75

R 041115Z MAY 78

FM AMEMBASSY DAR ES SALAAM

TO SECSTATE WASHDC 8504

INFO AMEMBASSY NAIROBI

ACTION TO: AFR/DR

DATE DUE: 5-2-0

EA | AA | DA | DS | CM

CRM/MO (C&RSC # 2) Ext. 22000

MAY 4 1978

AM 7,8,9,10,11,12,1,2,3,4,5,6 PM

UNCLAS DAR ES SALAAM 1923

AIDAC

NAIROBI FOR REDSO/EA

E.O. 11652: N/A

SUBJ: ARUSHA PLANNING VILLAGE DEVELOPMENT (621-0143)

REF: STATE 102733

1. MISSION STAFF HAVE CLEARED ALL CONDITIONS/COMMENTS WITH REGIONAL OFFICIALS AND NO FURTHER CHANGES SUGGESTED.

2. RE REFTEL HAGAN HAS CONCLUDED THAT HE WILL RECOMMEND NO REPEAT NO FURTHER IMPORTS OF VEHICLES WHICH DO NOT CONFORM TO THE RULE OF THE ROAD IN TANZANIA.

HAGAN FURTHER CONCLUDES NO REPEAT NO US VEHICLE MANUFACTURER NOW HAS OR IS PREPARING TO PROVIDE ANY SUPPORT FACILITIES FOR MAINTENANCE AND THEREFORE WITHOUT SUBSTANTIAL PROJECT PROVIDED MAINTENANCE NO US VEHICLE CAN BE EXPECTED TO LAST LONGER THAN THREE YEARS MAXIMUM. TWO YEARS MORE REALISTIC THIS PROJECT AREA. HAGAN SUPPORTS PARTICULAR WAIVER REQUESTED SUBJECT PROJECT AND WILL SUPPORT MISSION REQUEST TO STANDARDIZE ON LANDROVERS.

SPAIN

Acting Director
USAID/Dar Es Salaam

FROM: Peter J. Hagan
AID/W
SER/COM/ALI

SUBJECT: I. Comments on USAID proposal to request blanket source/origin waiver for procurement of motor vehicles for AID financed projects

II. Project procurement support problems

III. Inspection of seaport and airport facilities

SCOPE:

During the period 4/24/78 through 4/28/78 I inspected a number of commercial automotive establishments in Dar es Salaam and also had discussions with USAID direct hire and contract personnel in an effort to determine vehicle suitability as well as spare parts and maintenance capabilities for AID financed project vehicles operating in Tanzania. Mr. John Lewis, Regional Commodity Management Advisor, REDSO/EA and Mr. Barry Hill, Assistant Agriculture Development Officer, USAID/Dar accompanied me on this survey. Mr. Ron Gollehon of the Ag Credit project conducted the tour

During the period 5/1/78 through 5/2/78 I visited Msimba Seed Farm and Ilonga Agricultural Research Station in Kilosa. From 5/2/78 through 5/5/78 in Arusha region, I visited Masai Range Vehicle Repair Shop, the North Road site of the Arusha Drought Project and the Arusha Seed Farm. I discussed vehicle, heavy construction equipment and farm machinery procurement support and maintenance problems with AID Project Manager Mr. Robert McCandliss, Mr. Pershing Vance, Masai Range Project Chief of Party, Mr. Alex Powers, Arusha Drought Project Chief of Party, Mr. Duane Eriksmoen, Farm Management Advisor, Arusha Seed Farm. Mr. Barry Hill also accompanied me on this survey.

On 4/27/78 and 4/29/78 I visited the Dar Es Salaam airfreight terminal, seaport facilities and National Milling Corporation of Tanzania. Messrs. Paul Russell, USAID/Dar Food for Peace Officer and Barry Hill accompanied me on these inspections.

I. Request for source origin waiver for procurement of motor vehicles for AID financed projects

A. Findings

1. U.S. Manufactured Vehicles

As you know, Section 636i of the foreign assistance act stipulates that motor vehicles purchased to carry out the purposes of the act must be manufactured in the U.S. However, where special circumstances exist this authority may be waived. Since motor vehicles are driven in Tanzania on the left hand side of the road, right hand (r/h)

drive vehicles are certainly the most appropriate configuration for compliance with highway safety standards. There are only two U.S. auto manufacturers which manufacture right hand drive motor vehicles in the U.S. American Motors Corporation (AMC) still manufactures some Jeep utility vehicles in r/h drive but nothing larger (e.g., station wagons, sedans). International Harvester Co. (IH) manufactures the Scout series utility vehicle (comparable to basic Jeep), pick-up trucks and most other larger size trucks in r/h drive configurations in the U.S. for export to foreign markets. No other U.S. auto manufacturer manufactures r/h drive in the U.S. (The fact that multinational corporations with U.S. names (e.g., G.M., Ford, Chrysler manufacture r/h drive vehicles elsewhere in the free world--in some code 941 countries does not qualify such vehicles for compliance with Section 636i requirements. AMC and IH both have distributors in Tanzania.

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AMC

AMC is "represented" by Colt Motors located in Dar Es Salaam. An inspection of this firm's premises revealed the following:

a) The spare parts department carries an extremely meagre AMC parts inventory with a reported spare parts average minimum lead time of 10 months.

b) The maintenance facilities are grossly inadequate by any modern standards. Open shed repair bays are in obvious disarray with very little equipment or tools of any type in evidence. A so-called engine overhaul room was close to a total shambles with engine blocks and parts strewn indiscriminately everywhere. In general, there was little evidence of repair work of any kind underway in the premises generally. I counted 15 AMC wagoneers and two Jeeps deadlined, many nothing more than junk, and I was informed that some of these vehicles had been there for two years or more awaiting parts.

In my estimation, Colt Motors is little more than a poorly run junk yard and I strongly recommend that no U.S. financed vehicle be taken there for service of any kind.

INTERNATIONAL HARVESTER (IH)

We also visited Agriculture and Industrial Supplies Co., Ltd. (AISCO), Dar Es Salaam, the Tanzanian distributor for IH. The General Manager, Mr. A.J. Tairo, informed me that the firm is an IH agricultural and construction equipment dealer and does not stock spare parts or have general maintenance facilities for IH trucks. He said that the Tanzanian National Parks Ministry has 40 or more IH Scout vehicles which are maintained in National Park shops. AISCO does not stock spare parts for these vehicles. Also there are an estimated 15 IH trucks operating commercially in the country. Mr. Tairo stated that to his knowledge only one IH truck had been in his facility during the past year. AISCO has an apparently well run and well stocked facility for maintenance of various types of agriculture and construction equipment of other than U.S. origin. Very few U.S. parts are stocked. It is anticipated the firm will move to larger quarters in near future.

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Ford/GM

We then visited Riddoch Motors, the local Ford dealership. Management officials advised that the firm's operation is basically limited to sales, service and spare parts for U.K. and German Fords but that repairs are made on other make vehicles if and when parts can be obtained. We were informed that there are approximately 20 U.S. Ford Broncos in Tanzania, all of which were brought in by AID. However, Riddoch Motors does not stock spare parts for these vehicles. Spare parts deliveries usually average six months, from time order is placed.

Although there is a General Motors (GM) distributor in Dar Es Salaam, sales and service are limited to other than U.S. models. In fact, the GM dealer referred USAID to Riddoch Motors for dealer preparation services on the 10 Blazers and Chevrolet pickups recently imported by AID for USAID projects. We inspected these vehicles which are apparently ready for delivery to the USAID. These vehicles were purchased without spare parts and no spare parts are available for them in Tanzania. The vehicles are all equipped with electronic ignition systems which are beyond the capability of Riddoch Motors mechanics.

It is also to be noted that Riddoch Motors has been waiting for two months for USAID to provide a head gasket in order to repair USAID's 1½ ton Chevrolet truck. The gasket was ordered by USAID/GSO through normal channels sometime ago but has not yet been received.

Except as outlined above, U.S. auto manufacturers are not represented in Tanzania.

2. Non-U.S. Manufactured Vehicles

USAID project personnel have explained that, with few exceptions, four-wheel drive vehicles are essential for AID project vehicles operated in Tanzania. In this regard, 90% of the 4-wheel drive vehicles currently being operated in Tanzania for any purpose are British Landrovers. The estimated inventory for all 4-wheel drive vehicles in-country today is as follows:

a) Approximately 15,000 r/h drive Landrovers (plus some Range Rovers)

b) Between 500 and 300 r/h drive Toyota Landcruisers

c) Less than 100 AMC vehicles (mostly left hand drive Wagoneers and a few r/h and l/h Jeep utility vehicles)

d) Approximately 30 International Harvester Scouts

British Leyland - Landrover

Cooper Motors, Dar Es Salaam, is the Tanzanian distributor for British Leyland (and also Volkswagen). They have standardized on the importation of two Landrover models only, the 109 in. wheelbase Station wagon and the 109 in. wheelbase pickup. These two models and a few Range Rovers are imported fully assembled. However, the two Landrover models are also imported completely knocked down (CKD) and when available are assembled at the rate of approximately 80 vehicles per month at Cooper Motors local assembly plant. The latter is an excellent facility on a par with assembly plants of similar size located anywhere else in the world. An adjacent spare parts facility stocks 15,000 line items in ample quantities and is currently experiencing no noticeable pipeline delays. The maintenance shops automotive as well as body and fender repairs, are outstanding. E.g., there are 48 indoor automotive repair bays (18 mechanics, 4 welders 4 greasers, 4 electricians), a machine shop, and body repair shop with complete facilities and equipment to perform any level of repairs including engine and transmission overhaul

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and body rebuilding. Cooper Motors has six branch repair shops plus 15 or 16 parts outlets strategically located throughout the country.

Toyota

In view of the high percentage of Landrovers in-country, the reported high performance standards of Landrover, and the logic of standardizing on one non-U.S. made vehicle, I did not consider it necessary or feasible to visit the Toyota distributor.

3. Meeting with U.S. Ambassador

During a meeting with Ambassador James Spain on 4/29/78, he expressed his concern about the advisability of permitting U.S. owned and/or operated L/h drive vehicles in Tanzania. He cited their obvious safety hazards and the ever-present danger of serious accidents and possibly fatalities with L/h drive a contributing factor. (All U.S. Embassy vehicles are r/h drive and two USAID vehicles are r/h drive). We discussed the particularly hazardous situation when a left hand drive vehicle is attempting to pass a large truck on a hill or similar situation where L/h driver vision is seriously impaired.

4. Inspection of Agricultural Research Project Shop at Ilonga

I met with Dr. Paul Duffield, Agriculture Research Project Chief-of-Party and Dr. D.W. Sperling, Agricultural Agronomist at Ilonga Research Station near Kilosa. Dr. Sperling has operated Jeeps and Landrovers in Tanzania for over 5 years. He rated the AMC Jeep basic drive train (engine, transmission, differential) as very reliable and comparable to the Landrover. However, he cited a number of disadvantages and problems experienced with Jeep vehicles:

a) Suspension - Springs and shock absorbers very ineffective and weakest parts of vehicle

b) Fuel tanks - prone to develop leaks and extremely difficult to repair

c) Starter motors - design error results in complete breakage of starter (front u-joint constantly hits bottom of starter)

d) Spare parts - lack of spare parts support from Colt motors. Must depend upon Masai Range Shop for spares.

e) Left Hand Drive - Sperling expressed great concern about safety hazards prevalent with L/h drive vehicle. E.g., headlights of on-coming trucks at night results in blinding of drivers and has resulted in a number of accidents. He was involved in a serious accident of such nature, which fortunately did not result in personal injury but considerable damage to Jeep vehicle.

5. Inspection of Masai Range Shop Facilities at Arusha

On 5/1/78, I visited the Masai Range Project Shop facilities in Arusha. Although somewhat cramped for space, the premises were orderly and apparently well equipped to repair automotive and construction equipment. Spare parts for the AMC Jeep vehicles used on AID projects in the

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6. Cooper Motors - Arusha Branch

I visited Cooper Motors, Arusha on 5/5/78 and spoke to Mr. Manasseh, the Manager. His principal problem is lack of spare parts. This has been caused primarily by inability of Cooper Motors to obtain foreign exchange to import spares. (From my discussions with Cooper Motors Management in Dar this situation has begun to ease considerably). Cooper Motors-Arusha is expanding their facility with the addition of an adjoining new repair garage (22 bays), large parts department, showrooms, etc. With adequate spare parts, they should be able to handle any type repairs. There are also other Landrover spare parts outlets in Arusha and surrounding areas.

7. Arusha Drought Project

On 5/3/78 Mr. Hill and I accompanied Mr. Alex Powers, Chief of Party, Arusha Drought Project on a tour of 60 miles of the North Road site of the project. Recent heavy rains (44 in. in one month - 20 inches more than average monthly rainfall for similar period) have caused very serious damage to the road, washing out completely some segments and causing extreme difficulties in travelling in many sections. Mr. Powers explained that in road construction work heavy duty vehicles are a necessity but the AMC/Jeep vehicles have not proved effective. They do not hold up and are frequently down for repairs, particularly to suspension systems. He is replacing 4 wheel drive Jeeps with Chevrolet pickup trucks equipped with posi-traction. Mr. Powers considers the Landrover vehicle to be too lightly constructed for hauling heavy items (fuel, Caterpillar spares, etc.) on road construction projects.

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was a rise of 30% over the corresponding figure for the previous year. (There are no statistics indicating if L/h drive vehicles were involved in any of these accidents).

2 That USAID/DAR take immediate action to request blanket source/origin waiver for procurement of 4 wheel drive Landrover vehicles (limited to two models cited earlier) for project vehicles to be purchased during next twelve months.

Suggested Justification include following:

a) No acceptable U.S. vehicle representation in Tanzania for any U.S. made vehicle - right or left hand drive. No maintenance or parts support in country except for limited maintenance in a few projects which are maintaining Jeep Wagoneers (L/h drive).

b) Landrover vehicles prove to be the sturdiest and most practical four-wheel drive vehicle for most project use. Adequate spare parts and maintenance availability throughout the country plus the fact that there are 15,000 Landrovers (90% of total 4 wheel drive vehicles) in country attests to logic of standardizing on Landrover.

Note: I have no authority to make any recommendations on administrative vehicles. The latter are monitored by SER/MO. However, I will strongly suggest that SER/MO in future limit vehicles for USAID/Dar to right hand drive and attempt to standardize on one particular brand, preferably a brand recommended by USAID.

3. Designate USAID Project Vehicle Coordinator

The functions of this individual would include:

a) Review each project's vehicle requirements

b) Determine necessity for 4 wheel drive for project uses

c) Limit models to the two currently imported by Cooper Motors.

d) Explore possibility of importing Landrovers from Kenya, Australia, etc.

In this regard, I will attempt to meet with British Leyland executives during a stopover in London during week of May 7 to discuss speed up of deliveries, Australian models, etc.

4. Blanket Waiver

Request AID/W for blanket waiver for one year only with understanding that similar request will be submitted annually accompanied by detailed justification if situation prevalent at that time.

5. Redelegation of Authority

Suggest USAID request redelegation of authority up to $25,000 to waive U.S. manufactured vehicles requirements. (See Handbook 13 para 4d (3) effective date 1 6 73). This should facilitate purchase of a few 4 wheel drive vehicles pending blanket waiver approval.

6. Assess Truck Parts/Maintenance Facilities

Suggest designated Project Vehicle Coordinator thoroughly

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research r/h drive truck parts/maintenance capabilities in Tanzania prior to submission of any waiver requests for foreign made trucks. Suggest checking Isuzu, GM, Bedford, Mercedes, Scania, etc. Also determine if Government of Tanzania has standardized on any particular make or model.

II. Project procurement support problems.

Throughout my stay in Tanzania, project procurment support was a main subject of discussion. Project contract personnel have been experiencing significant difficulty in obtaining equipment, particularly spare parts. There are a number of contributing factors, mainly the following:

a) Delays in processing PIO/C's and other documentation through USAID/GSO - Washington - parts supplier.

b) Extreme congestion and mismanagement at Dar Es Salaam port.

c) Extreme congestion and mismanagement at Dar Es Salaam airfreight terminal.

d) Lack of coordinated system in procurement process.

During the period 4/24 - 4/29/76 I visited equipment dealers in Dar Es Salaam to assess parts and maintenance support capabilities:

a) Agriculture and Industrial Supplies Co., Ltd. (AISCO), Dar Es Salaam.
Mr. Tairo, general manager informed me that most of his sales and service involves German made IH agriculture and construction equipment. He stocks two U.S. models but carries an extremely meager spare parts inventory for them. AISCO has typical problem of obtaining foreign exchange for spares, even though they are a parastatal entity. Although somewhat cramped, the facility was reasonably neat and appeared to be well equipped for repairs to agriculture and construction machinery.

b) Caterpillar - Dar Es Salaam
I met with Mr. E. L. Kamela, parts manager and other staff members. Caterpillar also has chronic problem of obtaining foreign exchange for spare parts. Otherwise, facility is typical Caterpillar operation - fully equipped, excellent facility with capability to do any type of repairs on all types of Caterpillar equipment.

c) John Deere - KJ Motors, Dar Es Salaam
I met with Mr. Mixar Shirpi, Sales Director, and other division managers. This firm represents John Deere (ag equipment), Isuzu (trucks), Honda (motorcycles), and Komatsu (construction machinery). KJ Motors is also having serious difficulties obtaining spare parts. John Deere equipment is of German origin- no U.S. source equipment or spares are stocked.
Isuzu and Honda parts require eight to nine months lead time after orders are placed.

In visits to three agricultural project sites I noted a common problem. Each site has more or less standardized on one particular brand of ag equipment and has accumulated considerable spare parts inventory. E.g., Msimba Foundation Seed Farm has International Harvester (12 tractors, 3 combines, seed drills, disc plows, etc.). Dionga Agricultural

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Seswaron Station has Massey Ferguson equipment (5 tractors and other farm implements). Arusha Foundation Seed Farm has International Harvester Equipment (4 tractors, 2 combines, seed drills, plows, harrows, etc.). In discussions with farm managers and master mechanics, the biggest problem is long delays in receipt of spare parts from U.S. Also, Tanzanian mechanic trainees are familiar with only one brand of equipment. With high sophistication of equipment, particularly combines, adequate maintenance is a continuing problem. An inadequate spare parts pipeline is a significant bottleneck. Spare parts warehousing is excellent at all these locations and maintenance facilities (tools, equipment, etc.) are very adequate.

III. Inspection of seaport and airport facilities

Dar Es Salaam port facilities are modern with heavy-duty overhead cranes operational at some berths. A number of cranes, however, are not operational. On 4/29/73 there were 15 ships working in berths, 7 being lightered to separate area and 10 vessels waiting outside in the anchorage. I was told this is a typical situation with ships constantly moving in and out of berths. The area is extremely congested and storage sheds are always loaded to capacity. Cargo arriving in the port is consigned to Tanzania, Zambia, Burundi, Rwanda and Eastern Zaire. Therefore it is essential that cargo destination is properly marked, e.g., Tanzania - red cross; Zambia - green cross; Burundi - black cross, etc. There are separate warehouses for Zambia cargo. This area is particularly crowded, mainly due to lack of rail cars to move cargo out of the port. (It is myunderstanding that this is mainly because rail cars are being detained in Zambia as storage spaces for cargo and are not being returned to the port).

Also, there are significant quantities of ruined PL-480 commodities in the port which, despite efforts of Mr. Paul Russell, Food for Peace Officer, remain inside warehouses or outside in the weather in condemned condition. This food is not even fit for animal consumption. This situation - pile-up of food commodities - is a major factor in port congestion.

A very serious situation has developed at the airfreight facility at Dar Es Salaam Airport. As airfreight imports increase, Air Tanzania, which handled all incoming airfreight, cannot cope with volume. This has resulted in open storage of considerable quantities of air freight, haphazardly strewn outside the freight terminal. Inside storage facilities are also indisarray and as a consequence much air freight is lost, misplaced or stolen.

Recommendations

1) Immediate consideration should be giv en to the placement of a full-time USAID employee (local hire) at the airfreight terminal to work with Air Tanzania and customs officials to identify and process AID financed cargos.

2) Placement of an AID local-hire employee in the port of Dar to assist the freight forwarder in identification of AID cargos should also ease the situation there and reduce the volume of lost shipments.

3) Consideration should be given to exploring the use of the port of Tanga, particularly for equipment destined for projects in the Northern region of Tanzania.

4) Likewise, use of Kilimanjaro Airport appears feasible for all airfreight destined for Arusha and North country areas.

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5. In light of the fact that Mr. Robert McCandliss, USAID project manager - Arusha will be in the United States during the period late May - June, 1978, I recommend that he accompany me to New York to discuss problems of project commodity procurement currently experienced with the Afro-American Purchasing Center (AAPC) in relation to Tanzanian programs. Problematical bottlenecks in the AAPC procurement process for Tanzanian USAID commodities have led to significant delays in receipt of goods. I will attempt to clear up these problems with the assistance of Mr. McCandliss.

I wish to express my appreciation for the assistance and full cooperation I received from the USAID/Dar staff and USAID contract personnel during the period of my TDY in Tanzania.

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APPENDIX I

PID AND PID APPROVAL

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PID

2. DOCUMENT CODE: 1

3. COUNTRY/ENTITY: Tanzania

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 DIGITS): 1-01[illegible]

6. BUREAU/OFFICE: A. SYMBOL: AFR; B. CODE: [illegible]

7. PROJECT TITLE (MAXIMUM 40 CHARACTERS): TSETSE FLY RESEARCH

8. PROPOSED NEXT DOCUMENT: A. 2 (2 = PRP, 3 = PP); B. DATE: MM 12, YY 77

9. ESTIMATED FY OF AUTHORIZATION/OBLIGATION: a. INITIAL FY 79; b. FINAL FY 83

10. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 = [illegible])

FUNDING SOURCE	
A. AID APPROPRIATED	[illegible]
B. OTHER U.S. 1.	
B. OTHER U.S. 2.	
C. HOST COUNTRY	[illegible]
D. OTHER DONOR(S)	
TOTAL	[illegible]

11. PROPOSED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. FIRST FY ____ F. GRANT	E. FIRST FY ____ G. LOAN	LIFE OF PROJECT H. GRANT	LIFE OF PROJECT I. LOAN
(1) [illegible]	111	961	-	690	-	2,150	-
(2)							
(3)							
(4)							
TOTAL				690	-	2,150	-

12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each): 970

13. SPECIAL CONCERNS CODES (MAXIMUM SIX CODES OF FOUR POSITIONS EACH): [illegible], ENV

14. SECONDARY PURPOSE CODE: -

15. PROGRAM GOAL (MAXIMUM 240 CHARACTERS)

To support the Tanzanian Government goal of self-sufficiency in food production and improved welfare for the country's rural population.

16. PROJECT PURPOSE (MAXIMUM 480 CHARACTERS)

To develop economically and operationally feasible techniques for the control of Tsetse Fly in livestock-producing areas of Tanzania.

17. MISSION RESOURCE REQUIREMENTS (staff/funds)

Specialists from the U.S. Department of Agriculture and the AID Technical Assistance Bureau will be required to assist with preparation of the PRP and PP. FTC funds in the amount of $20,000 are being requested for travel/per diem of team.

18. ORIGINATING OFFICE CLEARANCE

Signature: Vernon C. Johnson

Title: Mission Director

Date Signed: MM 05, DD 20, YY 77

19. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM, DD, YY

AID 1330-2 (3-76)

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PROJECT IDENTIFICATION DOCUMENT

I. SUMMARY OF THE PROBLEM TO BE ADDRESSED AND THE PROPOSED RESPONSE TO THE PROBLEM.

A. Problem to be Addressed:

Tsetse fly infestation over large areas of the country have reduced drastically Tanzania's capability to produce enough meat for domestic consumption. Thus, continued applied research on control and eradication of the tsetse fly is required in order to open new lands for grazing and improve conditions in existing range areas.

Mammalian trypanosomes that are confined to Africa are the tsetse fly-borne species, whose distribution usually coincides with that of their vectors, represented by blood-sucking flies of the purely African genus, Glossina. These trypanosomes are the most important parasites from the medical and veterinary points of view, because they include the causative agents of human sleeping sickness and trypanosomiasis affecting domestic animals (Mulligan, 1970). This PID addresses the severe restraints imposed on agricultural development, particularly the livestock industry, throughout the tropical zone of Africa where tsetse flies and trypanosomes prevail.

Tsetse flies inhabit 11.7 million square kilometers of Africa (Nash, 1969), an area more than five times larger than the total agricultural area of the United States. There are areas completely devoid of livestock despite the presence of good-quality grazing and a plentiful supply of water. An assessment of the impact of animal trypanosomiasis was made by Finelle (1974) and summarized as follows:

- area of tsetse infested zone which could be used for livestock raising: 7 million square kilometers;
- total potential population of infested zone: 140 million cattle;
- present population: 20 million cattle;
- possibility of increasing the cattle population: 120 million head;
- average productivity in Africa: 12.5 kilograms per head per year;
- additional meat production: 1.5 million tons per year;
- value of additional meat production (on the basis of 50 cents per kilogram): US $750 million per year.

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The adverse effect of tsetse-fly borne disease on animal production is most clearly illustrated in Tanzania, where the geographical pattern of cattle distribution is almost exactly opposite that of tsetse distribution. Sixty percent of the land area of Tanzania, 531,670 square kilometers, is tsetse-fly infested. Control efforts spanning nearly three-quarters of a century have opened an estimated 5 percent of this land to productive use (Mwashala and Williamson, 1976). Insecticides currently used for vector control and animal prophylaxis treatments have become expensive to apply and have not produced lasting results in the nation. Several control methods no longer find general acceptance due to salient ecological disadvantages. These methods incorporated such features as mass destruction of indigenous wildlife which serve as reservoirs of trypanosome infection; large-scale clearing of natural vegetation which resulted in loss of soil fertility and land use through erosion; and application of broad-spectrum, persistent pesticides.

Of 108 species of insect-pests of medical and veterinary importance, only two groups of which Glossina spp. is one, have not been shown to possess resistance to insecticides. However, since insecticides will undoubtedly remain the main method of control for years to come (Jordan, 1976), the possibility for resistance development cannot be overlooked. Efforts are underway on an international scale to develop alternatives to the African trypanosome problem that will provide biologically sound approaches to control commensurate with the social and economic needs of the countries concerned.

B. Proposed USAID Response:

The purpose of the USAID response is to test through a continued operational project tsetse fly rearing and field release techniques in Tanga and Zanzibar with the objective of developing and proving methods of tsetse fly control adaptable to infested livestock producing areas of Tanzania.

1. Background:

The very low reproductive potential of Glossina is a weak link in the life cycle which, in theory, is particularly vulnerable to control by methods of genetic manipulation. Following the success of sterile insect release methods (SIRM) against the screw-worm fly, Cochliomyia hominivorax, in the southeastern United States, the potential application of this methodology against tsetse flies was expressed by Knipling (1963). In 1964, USAID sponsored a research program through a Participating Agency Service Agreement (PASA) with the United States Department of Agriculture (USDA) to pursue this field of research in Rhodesia. The results of this initial research effort was to accomplish 98% control of Glossina morsitans morsitans on a small island in Lake Kariba. The success warranted

further work to perfect techniques for producing sterilized flies and ultimately to conduct a large scale field trial to test both the efficacy and economics of the sterile male technique against tsetse flies in Africa (Dame and Schmidt, 1970).

Since 1971, AID/W has supported a Tsetse Research Project headquartered in Tanga, Tanzania, formed through a bilateral agreement between AID and the United Republic of Tanzania. The rationale for such a program is that the level of knowledge about the behavior and ecology, techniques for laboratory colonization, and its rank of economic importance among disease transmitting species of tsetse flies made G. m. morsitans the logical choice for intensive research on SIRM. The project at Tanga was designed with three main objectives divided into short-, intermediate- and long-range goals each of which would mark a successful achievement of a particular phase of the program:

Short-range: To construct a mass rearing facility and develop techniques for mass-colonization of G. m. morsitans.

Intermediate-range: To expand viable fly colonies to produce excess insects for studies on sterilization, packaging, release, and ecological studies as well as to supply a large-scale field trial of the SIRM.

Long-range: To suppress or eradicate G. m. morsitans in a 259 square kilometer test area in accordance with project design to determine the validity of the concept.

Achievements include the completion of laboratory facilities containing the largest tsetse fly colony in existence (short-range goal) and irradiation, packaging, transport and release techniques for a field release trial (intermediate-goal). In addition, 68 Tanzanian government employed nationals have received on-the-job training in the various facets of field and laboratory research under the guidance of five expatriate advisors. One national has returned from the U.S. with a M.Sc. degree in entomology and one man is presently in the States studying toward the B.Sc. degree in entomology. The projected nucleus colony of 60,000 G. m. morsitans has been reached well in advance of the field release phase and the colony, presently at more than 50,000 flies, is the result of restricted population expansion and replacement of less productive strains. Sufficient host-animals (650 goats and 90 rabbits) are available to supply daily blood meals for the fly colony. The colony output at full strength will be approximately 1,000 sterile male flies/day for field release.

Emphasis is focused on development of the field release site at Mkwaja Ranch, privately owned by Amboni Limited. Isolation of the test site to prevent ingress and egress of G. m. morsitans involves construction of a one kilometer-wide, shear-cleared barrier. Barrier

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construction is 90 percent complete and will be tested by monitoring the movements of marked flies released inside and outside the study area. The barrier will be reinforced as needed by selective application of insecticide in a 100-meter band around the outer barrier perimeter. Upon completion of the barrier, studies on behavior of sterilized flies in the field, and surveys of population dynamics of the field fly population and trypanosomes will be undertaken. Then the tsetse population will be reduced by aerial application of non-persistent insecticides. This will initiate the long-range goal and is scheduled to begin September-November, 1977. At least two aerial applications of insecticides will be applied 15 to 18 days apart to reduce the tsetse fly population prior to release of sterile male G. m. morsitans. Theoretically, a ratio of three sterile males to each normal male in the population will result in eradication over a 12-month period. The technique will be evaluated in detail during this period. A schematic work plan (Appendix I) highlights the major project activities. The project is reasonably well on schedule with good prospects of continued success.

Only two projects involving a field trial of the SIRM are in progress on the continent: The subject project in Tanzania (Williamson, 1974) and a program sponsored by the French government in Upper Volta (Itard, 1974). The Tanzanian project has the advantage of having developed a cadre of trained nationals prepared to assist in maintaining continuity of the program during the transition from research to an operational scheme in the country. Although 22 species of tsetse flies are found in Africa, only some five or six species are considered to be of major economic importance (Jordan, 1976). The principles and techniques developed in the laboratories at Tanga can form the base of expanded work against the other species.

2. Proposed Program for Introducing Operational Control of Tsetse Using the SIRM in Tanzania:

A critical aspect of utilizing the findings of the Tsetse Research Project in Tanga is to assure that a lapse in activity does not occur. Such an interruption could have long-term adverse consequences, particularly the existing fly production component which would take, perhaps, years to reactivate.

Also, the current project, which terminates in FY 1979, will only identify release and eradication techniques that will work under controlled and closely supervised conditions. If support to the project is terminated in FY 1979, no data or experience will be available regarding the effectiveness of SIRM under natural field conditions. Continuation of the project to FY 1983 is necessary in order to refine release and eradication methods which are economically viable, and can be replicated using Tanzanian Government resources and management capabilities in the heavily infested areas of the country. Through additional field experience gained by FY 1983, a long-range tsetse fly eradication program for Tanzania can be proposed.

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The scope of USAID sponsorship would include: a. Continue monitoring of the effectiveness of G. m. morsitans control at Mkwaja Ranch by field survey. Corollary to this field investigation, a colony of G. pallidipes would be developed for release at Mkwaja Ranch, within the area surrounded by a tsetse fly barrier, to provide control of another trypanosome transmitting species; b. establishing a colony of G. austeni for tsetse eradication on Zanzibar. Zanzibar, being isolated and having a single species of tsetse, would provide the ideal situation to test eradication techniques. Zanzibar is within easy access to the Tanga facility by air; c. testing artificial rearing techniques developed in Vienna, Austria and Langford, England which would eliminate the necessity for maintaining large herds of host animals in mass-rearing facilities in Africa; d. preparing a long-range plan for utilization of the SIRM in Tanzania.

3. Project Purpose:

The purpose of the project will be to: Develop economically and operationally feasible techniques for the control of tsetse fly in livestock producing areas of Tanzania.

The purpose is linked to the goal of self-sufficiency and improved welfare for Tanzania's population. Approximately 25 percent of the country's rural citizenry depend on livestock as a major portion of their income. The control of tsetse fly will allow utilization of suitable grazing land in many areas for the first time and will permit improved utilization of existing range and brushlands. If the project purpose is achieved, the Tanzanian Government will be provided with tested methods for reducing the debilitating effects of trypanosomiasis.

4. Project Outputs:

The following outputs are expected from the project:

a. The transfer of modern technology to a developing country in which salient disadvantages, both economically and environmentally, of present tsetse control methods would be reduced or eliminated.

b. Development of a cadre of Tanzanian nationals with practical experience in scientific and managerial procedures to assume responsibility for continuation of the work. This aspect will be strengthened through the continuation of advanced training in the U.S. or elsewhere to provide trained entomologists and veterinarians.

c. A developed system for use of the SIRM for control of trypanosomiasis and an assessment of its applicability.

Why not eradication

d. A long-term plan for control of tsetse flies in Tanzania.

To achieve these outputs, 20 person-years of technical assistance

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will be needed in addition to funds for supplies, equipment, and local costs. The period of funding would be FY 1979 through FY 1983.

5. Major Assumptions:

The feasibility of this project is supported by the following assumptions based on current trends.

a. At the World Food Conference in Rome, 1974, major attention was given to the restraints imposed on developing African countries by the presence of tsetse-borne disease. Methods will be developed to control trypansomiasis. USAID will make a significant contribution by virtue of its leadership role in applying SIRM technology developed in the United States. International participation in assisting developing African countries in achieving control could be expected after the program is fully evaluated and U.S. input ceases.

b. The Tanzania Government is cognizant of the magnitude of the tsetse fly problem and will continue financial and manpower support for the program.

c. Tsetse control activities will be integrated into resource development schemes to maximize cost/benefit ratios through judicious application of SIRM.

6. Related Host Government Projects:

The Tanzanian Government, using funds from a USAID loan, has purchased equipment for the clearing of 285 square kilometers of tsetse fly barrier in the West Lake region of the country. The project was initiated in FY 1975 and scheduled for completion in FY 1979. Once the clearing is complete, West Lake could become a significant livestock producing area following control of tsetse infestation.

7. Alternative Projects:

None.

8. Beneficiaries:

The direct beneficiaries of the project would be the livestock holders in Tanzania who could improve the quantity and quality of animal production.

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II. FINANCIAL REQUIREMENTS

A. Estimated Costs ($000) - USAID:

Components	FY79	FY80	FY81	FY82	FY83	Total
Technical Services	400	400	375	300	100	1,575
Training	40	40	40	40	5	165
Commodities	200	30	50	10	10	300
Other Costs	50	30	10	10	10	110
Total	690	500	475	360	125	2,150

B. Estimated Costs ($000) Tanzanian Government:

Components	FY79	FY80	FY81	FY82	FY83	Total
Personnel	70	70	85	100	100	425
Land & Equipment	25	25	25	25	25	125
Local Costs	50	50	55	55	55	265
Total	145	145	165	180	180	815

C. Development of the Project:

Since the Tsetse Research project has been funded under the auspices of the Technical Assistance Bureau in AID/Washington, it is proposed that this office have a major input into the PRP and PP design. The following design schedule would permit approval of the PP for FY 1979 implementation.

-- Submission of PRP -- December 1977

-- Submission of PP -- April 1978

A two-man TAB/USDA team supported by the Mission design officer would be sufficient for PRP preparation.

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D. Issues:

There are two issues which should be considered by AID/W in reviewing the PID. These issues are:

1. Environmental Effects of Tsetse Research

The extensive clearing of barrier strips, possible displacement of watershed and wildlife habitat, and immigration of domestic livestock and their owners will all have an effect on the environment. Also, the environmental implications of the use of insecticides for fly control should be considered. An environmental assessment of Mkwaja ranch release activities was conducted in February, 1977. The work of this environmental team will be reviewed during the PRP design and conclusions reached or further analysis identified regarding environmental implications.

2. Priority of this Activity and the Tanzanian Government Absorptive Capacity

Both the Tanzanian Government's interest in the long-term implications of tsetse fly control and their capacity to finance maintenance and monitoring activities after 1983 when USAID assistance terminates will be fully addressed in the PRP.

SCHEMATIC WORK PLAN

Activity	FY 72	Phase I FY 73	FY 74	FY 75	Phase II FY 76	FY 77	Phase III FY 78	FY 79
Rearing								
Construction of research facility	x	x	x	x	x			
Pupal Collection		x	x	x	x			
Initiation of fly colony		x	x					
Expansion of fly colony				x	x	x		
Increase host animal herd			x	x	x	x		
Construction of insectaries (4)		x	x	x	x			
Expansion of forage production			x	x	x			
Techniques and Methods Development								
Pupal maintenance and sexing				x	x			
Identification of released flies				x	x			
Sterilization					x	x		
Quality Control					x	x		
Packaging and transport of flies					x	x		
Distribution and release of flies; ground and aerial					x	x		
Assessment of sterile male effectiveness and female sterility					x	x		
Trypanosome detection					x	x		
Release of Tanga flies					x	x		

SCHEMATIC WORK PLAN

		Phase I			Phase II		Phase III	
Activity	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79
Field Population								
Identification of test area		x	x					
Population dynamics in test area				x	x	x		
Construction of basic research facility in test area					x			
Isolation of test area (barrier)				x	x			
Insecticide treatment of barrier perimeter						x	x	x
Evaluation of barrier						x	x	x
Trypanosome survey in test area						x	x	x
Release Program								
Tsetse suppression in test area							x	
Release program and evaluation							x	x

REFERENCES

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Finelle, P. 1974. African animal trypanosomiasis Part III. Economic Problems. World Animal Review (FAO) 10:- pp 15-18.

Dame, D. A. and Schmidt, C. H. 1970. The Sterile-Male technique against tsetse flies, Glossina spp. Bull, Entomol. Soc. Am. 16 (1): pp 24-30.

Itard, J. 1974. The present state of colonies of Glossina at Maisons-Alfort (France). Proceedings of the Third International Congress of Parasitology, Munich. p. 940.

Jordan, A. M. 1976. Tsetse Control - present and future. Transactions of the Royal Soc. of Trop. Med. and Hyg. 70 (2): pp 128-129.

Mulligan, H. W. 1970. The African trypanosomiases. Wiley - Interscience, New York. 950 pp.

Mwashala, A. M. and Williamson, D. L. 1976. Research on sterile male release methods against Glossina morsitans morsitans Westw. in Tanzania. In Proceedings of the Inter-state Conference on Animal Health, Dar-es-Salaam. pp 17-19.

Nash, T. A. M. 1969. Africa's Bane: the tsetse fly. Collins, St. James Place, London. 224 pp.

Knipling, E. F. 1963. Practical role of the sterility principle for tsetse fly eradication. Vector Control (WHO) 27: 4pp.

Williamson, D. L. 1974. The biology and mass rearing of

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TELEGRAM

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TAGS:

SUBJECT: TSETSE FLY RESEARCH PROJECT

REF: DAR ES SALAAM 4080

1. BASED ON REVIEW OF PID MISSION IS AUTHORIZED TO PROCEED WITH TSETSE PP DESIGN INCLUDING ADDRESSING ISSUES NOTED BELOW.

2. AID/W NOTES WITH APPROVAL REDUCTION IN USE OF INSECTICIDES PROMISED BY SUCCESS OF THIS PROJECT. ENVIRONMENTAL EFFECT REVIEW PROMISED AT PAGE 8 OF PID EXPECTED TO INCLUDE NAME OF INSECTICIDE TO BE USED FOR INITIAL NONPERSISTENT SPRAY.

3. FIGURES CITED FOR TOTAL AREA AFFECTED BY TSETSE AND POTENTIAL FOR GREATER OVERALL LIVESTOCK PRODUCTION PLAINLY INDICATE POSSIBLE GREAT SIGNIFICANT OF THIS ACTIVITY. CONSIDERATION SHOULD BE GIVEN IN THE PP TO THE ECONOMIC/FINANCIAL COSTS AND BENEFITS OF TSETSE ERADICATION IN THE LIMITED AREA ACTUALLY DEALT WITH BY THIS PROJECT.

4. IN VIEW OF PROBLEMS OF WEST LAKE PROJECT PP SHOULD COMMENT ON MEASURES TAKEN TO INSURE AGAINST REPETITION OF

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DEVELOPMENTS ADVERSELY NOTED BY EARLIER AUDIT REPORT.

5. TSETSE CONTROL IS OF REGIONAL IF NOT CONTINENTAL SIGNIFICANCE AND RESEARCH AND EXPERIMENTATION ON CONTROL OF TSETSE IS UNDER WAY AT INTERNATIONAL CENTER OF INSECT PHYSIOLOGY AND ECOLOGY (ICIPE) IN NAIROBI AND ELSEWHERE. PROJECT PAPER SHOULD CONSIDER ESTABLISHMENT OF SUITABLE REGIONAL LINKAGES FOR INFORMATION EXCHANGE. DESIGN SHOULD INCLUDE CONSULTATION AND IF FEASIBLE PARTICIPATION BY ICIPE AND OTHER CONCERNED. USAID/KENYA, WITH LARGE INVOLVEMENT IN PRODUCTION ASPECTS OF CATTLE-RAISING, MAY WISH TO DESIGNATE AN INDIVIDUAL TO PARTICIPATE OR MAKE LIAISON IN THIS DESIGN ACTIVITY. USAID/DAR ENCOURAGED TO PROVIDE INFO TO OTHER POSTS WHICH MAY WISH TO FOLLOW OR CONTRIBUTE TO THIS PROJECT. ?

6. REGRET DELAY IN AUTHORIZATION. CONSIDERATION OF PID COMPLICATED BY STUDY OF RECOMMENDATION THAT PROJECT BE CHANGED TO REGIONAL FUNDING. VANCE

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REF: Par. 2:

Endosulfan was used in ~~both~~ Two knock down applications at the rate of 20 grams per hectar which was found not to effect non-target organisms.

Par. 3:

Costs and benefits are addressed in ~~III.A~~ PP. Economics Feasibility.

Par. 4:

This proposed project is quite different in nature and implementation from the West Lake Tsetse Project in that:

1. The supervision will be under experienced management supported by experienced technicians.

2. Because of its geographic location and accessibility monitoring evaluation of the project will be ~~[illegible] [illegible] which will be made available to others interested in [illegible] fly [illegible]~~ possible as set out III. G.

3. Aircraft requirements will be met through the charter of suited and well equipped ~~and~~ Planes flown by experienced pilots.

Par. 5:

The phase out period of the present parent project (Tanga)

provides for the compilation and publishing of data, findings and recommendations which will be available to others interested in tsetse fly control.

APPENDIX J

DESIGN TEAM DOCUMENTATION

1. Scope of Work - Evaluation/Design Team, July 1978.
2. Reports of team members.
   a. Ehrenreich and Ward
   b. Scovlin

Scope of Work
for
Tanzania Tsetse Fly Research Review
and
Project Design Teams

A research project utilizing the Sterile Insect Release method (SIRM) to control tsetse fly was initiated in Tanzania in 1971-72 and funded by the then Technical Assistance Bureau (TAB) now Development Support Bureau (DSB) and will expire in early 1979. As such, decisions must be made about future trypanosomiasis/tsetse fly control programs for Tanzania and East Africa.

The objective of this review/design team is to provide the services of technical specialists with knowledge/skills enabling them to assist USAID/Tanzania in ultimately completing a new, expanded, tsetse fly control program in Tanzania. The team will be in the field (Tanzania and Zanzibar Island) o/a July 3, 1978 for a two week period required to complete the review of the current DSB funded research project (Research on the Sterility Method for Tsetse Fly Control) and to provide guidance and counsel to USAID/Tanzania and the TanGov for the design of future programs in trypanosomiasis/tsetse fly control.

Purpose of Proposed New Tanzanian Activities

The purpose of future Tanzanian programs is to develop economically/environmentally feasible techniques for the control of tsetse fly in livestock producing areas of Tanzania. The new program for Tanzania as envisaged by the Africa Bureau consists of three major activity components:

1. Continued technical and operational support for the development and field testing of SIRM technology as part of trypanomiasis/tsetse fly control/eradication programs in Eastern Africa.

2. Assistance to the TanGov in the planning and implementation of the necessary studies/surveys and preplanning activities prior to the implementation of field control programs. The proposed initial location for this activity is the Island of Zanzibar.

3. Technical and financial assistance to the TanGov for the implementation of such plans and programs as a second phase of the proposed project. Phase 2 and 3 may or may not include SIRM, depending upon the successful conclusion of the ongoing research/developmental phases at Tanga and the completion of technical, environmental and economic analysis of the data.

Background - Tanga Research Project

This research project is based on the SIRM technology developed in recent years throughout the world for the control/eradication of a number of insect pest species. Because of its relatively low reproductive potential and corresponding low population densities, tsetse fly appeared to be ideally suited to this system of control. Thus, this project was initiated in Rhodesia in 1963 to investigate the adaptability of the sterile male technique to Glossina morsitans in appropriate combination with other methods of reducing the fly population. The project suffered a series of logistical problems and setbacks until the fly rearing facilities were established at Tanga in 1972. Physical plant facilities including three insectaries, animal sheds and quarantine buildings and the irradiation complex were completed in 1977.

The research at Tanga was conceived in three phases: 1) to establish a captive colony of G. morsitans, 2) to expand the colony so as to produce sufficient numbers of flies for sterilization and release, and 3) to complete the ecological studies and field operations for the suppression and/or eradication of G. morsitans in an area of approximately 260 square km. The project is currently in phase three with releases of sterile flies on the Mkwaja Ranch.

Research since 1972 has focused on routine rearing of flies which included experimentation on the handling, sterilizing and transporting of tsetse flies. In addition, ecological studies were designed to assess the density, dispersion, behavior, fertility and fecendity of natural fly populations and the disease incidence among wild and domestic animals.

The primary field site has been the Mkwaja Ranch where an area of 260 square km. has been utilized for sterile fly release. A one kilometer wide barrier zone has been built around the experimental areas to interrupt dispersal of the flies. The release of sterile males follow two or three aerial applications of Endosulfan designed to reduce the fly populations to a manageable level. The effectiveness of the overall control program is monitored by periodically assessing the fertility and density of the target species G. morsitans and the coinhabiting species which serves as a control, G. pallipides.

Project Issues

The team must address the problems relating to trypanosomiasis/tsetse fly control programs in Tanzania from an immediate and ultimate goal perspective by:

1. Examining the current status of the SIRM technique as a component in an environmentally/economically feasible integrated pest management strategy for the control of tsetse fly.

2. Considering the ultimate land use/natural resource and potential environmental impacts of a massive eradication program and resulting "tsetse free" areas.

SIRM and Tsetse Fly Control

The development of cost effective, environmentally sound technology to control trypanosomiasis is critical to the development of many underpopulated areas of Africa. As such, an integrated pest management approach should be detailed to include the consideration of various physical, chemical, cultural and/or biological control practices for the control/eradication of tsetse fly in Africa and more specifically Tanzania. The SIRM is but a component of such a management scheme and should be considered as such and evaluated with other techniques or procedures in terms of technical feasibility and cost effectiveness. Such consideration must be especially followed if the current project is expanding to Zanzibar and will include two new species of tsetse fly. It is of the upmost importance that specific evaluation criteria be developed to access the forward progress of the overall project including the SIRM procedure wherever it is attempted and with all species included.

Assuming a positive review the team should propose necessary modifications of the present project's activities and the role of the Tanga facility in carrying out economic and operationally feasible techniques for trypanosomiasis/tsetse fly control programs at selected sites in Tanzania including Zanzibar.

Assuming a negative review, the team should examine with USAID/Tanzania and the TanGov possible alternative programs which would best use the facilities and staff which may be suited for bilateral funding in support of agricultural and livestock development in Tanzania. This would be expected to include continued use of the laboratory as a vector and disease research facility and, in general, support for alternative methodologies for trypanosomiasis/tsetse fly control/eradication programs in Tanzania.

More specific issues to be addressed by the team include:

1. Examine data from the field release program at Mkwaja Ranch to determine the overall success or failure of the current control efforts on *G. morsitans*.

2. Whether Zanzibar is a suitable location for futher field testing/application of SIRM technology in Tanzania. If so, what preliminary surveys/studies are needed?

3. Whether the SIRM is likely to become a component of a technically, environmentally, and economically viable trypansomiasis/

tsetse fly control/eradication program in Africa in general and Tanzania in particular.

4. The ecological conditions under which SIRM is likely to become part of field operational programs (i.e. adaptability of methodology to other species, need for barrier zones, etc.).

5. The need/desirability of maintaining the Tanga facility as a research facility, a field operational center and training facility from a regional and national perspective.

6. The capacity/problems of rearing three tsetse fly species (G. morsitans, pallidipes, and austeni) simultaneously at Tanga. Would it not be more efficient to rear G. austeni on Zanzibar?

7. Examine the mass rearing potential of G. pallidipes and G. austeni both on and off membrane feeding. What is state of art on the overall viability/competitiveness/behavior of mass reared sterile males of these species?

8. How much more "research" would be required before operational programs on these three species could begin? Funding required? Time table? Equipment/staff/facilities required?

Potential Environmental Impacts and Land Use Plans

Beyond the specific purpose of the current research project to control/eradicate trypanosomiasis, some higher level considerations must be addressed. As pointed out at the meeting to create a Tsetse Fly/Trypanosomiasis Control Trask Force in November 1977, "new lands" freed from tsetse should be carefully studied in terms of land use inventories and land management priorities, and the potential environmental impact of ignoring these management considerations. Thus, although integrated control will be necessary to control tsetse,integrated land use management plans will be necessary to consider watershed protection, habitat protection (i.e. domestic and wild animal, forest and grazing land, etc.).

A wide ranging debate exists over the importance of opening new lands by tsetse fly control/eradication. It is a debate over the costs and benefits of opening new land to human habitation and exploitation. Increased production, relief from current land pressures and the positive long term regional changes in land use patterns must be weighed against the probability of environmental degradation, erosion, destruction of wild life and the disruption of traditional cultures. Thus, in terms of broader land use issues, the team should:

1. Assess the need for land use inventories or environmental impact determinations prior to field tsetse control programs to review host government plans to assure raticnal management of these sites once cleared.

2. Assess whether AID should provide technical and financial support for such limited land uses as water shed protection, habitat and game protection, forest and grazing reserves as part of an overall integrated land use management plan. Does the technical capacity exist to plan and execute environmentally sound land use schemes in cleared areas?

3. Assess the feasibility of introducing desired modifications among social groups likely to settle in tsetse cleared areas.

4. Assess the relationship of other human and/or livestock diseases in tsetse cleared areas, especially with regard to opening the area for settlement (i.e. East Coast Fever, Onchocerciasis, Schistosomiasis, etc.).

5. What are the potential risks to the environment of tsetse eradication programs? From the eradication method? From human activities? From domestic animals?

6. Does the TanGov have the capacity to manage tsetse fly control/eradication programs? Bureaucratically? Administratively? Does it have the trained personnel? Does it appreciate the ultimate environmental issues?

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A Review of the USAID Tsetse Fly Project and Possible Future Tsetse Fly Projects

By

Dr. John H. Ehrenreich
Dr. Ronald Ward

(conducted in Tanzania, July 3-16, 1978)

C-1

I. Objectives and Statement of Problem - The project seems appropriate and well conceived.

2. Personnel Evaluation - The reviewers were particularly impressed with the capability and dedication of the U.S. project personnel. We were amazed to see the espre de corp of the personnel particularly in view of the problems and hardships of conducting research in Tanzania. Much of the credit for this is due to Dr. Leroy Williamson who has shown himself to be not only a good scientist but also an excellent project leader of both U.S. and Tanzanian personnel.

3. Project Schedule - The project is basically on schedule in spite of problems with facilities, transportation, and weather. This is because of the dedicated personnel and their willingness to work long hours. The project should accomplish its objectives on time.

4. Cooperation of Tanzanian Government - Although many problems were encountered in the early stages of project after being moved to Tanzania, cooperation is improving and is now quite good. For instance the Tanzanian government now puts about $140,000 into support of the Tanga facility and program. This has been of invaluable help beyond the dollar value. The project leader, Dr. Williamson is well

known and respected by officials in the Ministry of Agriculture and other entites such as the University at Dar es Salaam as well as the Agricultural College located at Morogoro, Tanzania.

The Ministry of Agriculture is developing a Training Institute at Morogoro in cooperation with the Agricultural College. This will be a two-year diploma course for Livestock Field Officers, Tsetse. Dr. Williamson is on the committee which is finalizing the curriculum. A copy of the suggested program is attached. This shows the long term commitment of the Tanzanian government to control of the tsetse flies as vectors of trypanosomiasis in cattle.

The review team met with Dr. Maeda, Head of the Livestock Management Division of the Ministry of Agriculture in his office (previously met him socially in the home of Mr. B. B. Behrens). Dr. Maeda is supportive of the USAID tsetse project and appreciative of our assistance. He has a tsetse control officer under him and apparently they are gearing up for more of an effort. For instance, they have a prioritized list of provinces in which they would like to begin control work. They have, in fact, discussed financing such a national program with World Bank.

5. Current Conditions and Estimate of Overall Success - The first and second phases of the project have been completed on schedule and third phase is progressing on schedule and indications are that this last phase will be completed at the predicted time of early to mid 1979.

The first phase of constructing mass rearing facilities and development of techniques for mass-colonization of G. M. morsitans under African conditions, and the second phase of fly colony expansion, studies on sterilization, packaging, release and ecological studies have been completed. This was accomplished in spite of many problems such as transportation, materials inadequate, counterpart personnel etc. It is of great credit to the U.S.A.I.D. staff that these phases were completed in spite of these problems. In spite of similar and additional weather problems the third phase is progressing nicely.

After the second aerial application of endosulfan on the study site at the ranch at the end of 1977, the sterile male release program started. At the beginning of this program, no G. morsitans were evident on the basis of fly-round surveys, but within a few weeks fly counts approximated 10% of those observed prior to control. In the period from early 1978 through July 10, 1978, sterile male tsetses have been released twice weekly in ratios about one to five times the estimated normal male

flies sampled. The results to date indicate that the G. morsitans population has essentially remained at the 10% level for six months. At the present time, there is not an indication of a downward slope in the tsetse population. However, project personnel anticipate that this will occur during the oncoming dry season. The fact that G. morsitans populations have remained fairly high on the portion of the study site where sterile males were not released indicates that some control of G. morsitans has been effected. However, the question still remains whether this degree of suppression is sufficient to reduce the level of transmission of trypanosomiasis by G. morsitans among the cattle on the ranch.

It should be pointed out that to overcome these problems the US staff has had to spend long hours constructing buildings, repairing vehicles etc. which has reduced their time for writing publications (note the RAC concern of lack of publications as mentioned in the July 1977 RAC review).

At the present date, it appears that no scientific papers directly concerning the Tanga project have been published. It is strongly recommended that the U.S. staff be allotted time near the end of the project specifically to write publications. Dr. Williamson provided a list of 25 possible publications which could be written based on this project. These are enumerated in appendix 1.

One problem which looms rather large in succes[illegible] pletion of the third phase is the breakdown of [illegible] This was largely due to an abnormally high [illegible] (the highest rainfall in 23 years) which res[illegible] vegetation growing up in the barrier and neg[illegible] fectiveness of the reinforcing insecticide spray[illegible] Dr. Williamson feels that this can be overcome [illegible] as they go into the dry season.

Future AID Support of Tsetse Fly Program

The May, 1977 PID from the Tanzania program calls for a FY 1979-80 follow-up tsetse fly program supported by the African Bureau. This seems logical and appropriate with some modifications. Basically, the PID recommends continued use of the Tanga facility, continued effort on the Morogoro [illegible] and a tsetse fly control program on Zanzibar.

1. Use of Tanga Facility

Much effort and expense has gone into the development of the Tanga facility and training of the counterpart staff. This coupled with increasing concern of the Tanzanian Government for the tsetse fly problem and their increasing commitment, including the development of the two-year diploma training program makes continued use of the Tanga facility a desirable option. We would thus recommend:

(a) Use of the Tanga facility for developmental research on adopting advancing technology to African conditions

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(e.g.: (1) use of membrane technique in rearing flies, (2) more efficient technique of distributing sterile parpae, (3) more effective fly barrier schemes including possible use of fire, (4) a base for developing a countrywide integrated SIRM strategy, and (5) development of habitat management scrategy and techniques.

(c) Use of Tanga facility to maintain G. M. morsitans maintenence colony.

(d) A counterpart training and development base.

The use of the Tanga facility to develop a colony of G. pallidipes for release at Mkwaja Ranch is a desirable goal but would present greater problems than can reasonably be expected to be overcome and still accomplish the other, higher priority objectives. It could become a component, however, in the future if: (a) G. pollidipes rearing technology develops as expected in Europe, (b) more efficient rearing techniques are adopted to African conditions e.g. membrane techniques, (c) Tanzanian counterparts developed as hoped for, and (d) sufficient funds become available. One factor which may bear on the relavency of this rationale is that the owners of the Mkwaja Ranch are extremely desirous of controlling G. pallidipes and may bring pressure to include as control effort in the total in the total project.

2. Zanzibar Subproject

A possible Zanzibar program would have several factors which

would enhance its chances of success and have other advantages for U.S.A.I.D.: 1) it has only one species of tsetse fly, G. austeni and rearing techniques for an S.I.R.M. approach are already worked out for this species, 2) Zanzibar, being an island has natural barriers to reinvasion, 3) there has been some work on the island in the 50s and 60s and four zanzibarians who worked on these efforts are still there and might be available for work on a new USAID sponsored program, 4) the host government of Zanzibar is very desirious of a control project and would be supportive. The Minister of Agriculture, Mr. Rashid, and the Head of the Livestock Division, Dr. Omari Jabba (DVM from U.K.) would be very helpful in such a project, 5) the British Overseas Agency are currently doing a survey of the island and have a complete 1:10,000 coverage and will have vegetation maps as well.

There would, of course, be some problems such as scattered crop areas intermingled with tsetse infested areas which would make insecticide spray more difficult.

If a program is developed it should include preliminary ecological/survey studies which could determine whether or not the project continued. These studies would include an insect ecology study to determine where and in what densities the flies are located, during the dry season and during the wet season. For instance if the flies only occupy certain vegetation areas during the wet season, control could be timed to be effected during the dry season which would greatly reduce the size of the spray areas. Also included would be parasitiology studies (cattle, blood smears, fly disections etc. to determine

extent of the parasite), spraying studies (to determine type, amount, timing and spray equipment to use in different vegetative types and around agricultural crop areas) and counterpart training. This work could take about two years and would predicate the actual integrated spraying /SIRM efforts.

It is recommended that the parasitological studies be done by Zanzibarians from the Livestock Veterinary Division. These people would have to be furnished microscopes and other lab equipment to do the identification of cattle trypanosomes. They should also have technical assistance provided by a U.S. parasitologist for from six months to one year to train their staff in survey techniques and diagonisis. At that point the Zanzibarians should be capable of carrying out this part of the project.

A sociological analysis is currently being done on Zanzibar by Dalles Browne under contract to USAID Tanzania. This will provide information on social impacts of a tsetse eradication program on local people and social structures as well as preditions of success of subsequent land management efforts.

There should be no adverse environmental effects of a tsetse fly program on Zanzibar. The spray of insecticide would have to be carefully applied to prevent drift into agricultural areas but this can be done. On areas where endosulfan is used the spray is of such low concentration that other insects have not been shown to be effected. Some would argue that there is a chance that once the flies have been controlled, the land could be abused. This, of course, is a possibility but if

that reasoning were followed no progress would ever be made, anywhere.

Once flies were controlled there would be opportunity to implement management of the land, control undesirable brush, reseed to forage plants which once occupied much of these areas and establish an appropriate grazing system. The Minister of Agriculture would be capable of doing this with financial and advisory assistance from FAO and/or World Bank.

Zanzibar is particularly anxious to have this project started. They believe that there is up to 80% infection, however, there is no documentation of this parasitological studies. The Zanzibar government is also anxious to have something (any part of the study) start as soon as possible and if AID decides to proceed it is recommended that at least the surveys begin by October 1, 1978.

The probability of success of the above mentioned possible efforts at Tanga and Zanzibar is high. Preplanning and careful initial surveys will further enhance probability of success. One item of particular importance to success is the overlapping of replacement personnel. Realizing the long time it takes to recruit highly qualified people preliminary efforts should start immediately. It is also strongly suggested that some kind of effort (ecological surveys) be started as soon as possible in order to retain the advantage of enthusiastic support of the Zanzibar government which now exists.

Overall Critique of the Tanga Project:

The early delays encountered during the first two years of the Tanga project appeared to be primarily ones of scientific management. Expatriate personnel who are assigned to a remote area such as Tanga, should have had either prior satisfactory tropical experience or adequate counseling to insure that they and their families can cope with this environment. If such precautions had been taken, the current level of progress might have been achieved two years ago.

The concept of total eradication of a vector species is extremely ambitious, and unless an area is totally isolated, may never be possible to achieve. In the case of the present project, the maintanence of a permanent barrier of 1 km. width has been difficult to achieve, especially due to abnormally high rainfall which acclerated growth of vegetation. Other factors which may produce a residual tsetse population are movement of wild host animals animals through the barrier, passage of motor vehicles bearing tsetse and actual flight through the barrier by flies. Thus, even if the confined tsetse population is reduced to zero (on the basis of fly-round counts) some G. morsitans may show up due to the above factors and others not mentioned.

A more realistic objective to part III of the study would have been the reduction of G. morsitans populations to such a level that this species was no longer a factor in the transmission of

of cattle trypanosomiasis (although of course G. pallidipes would sitll be an important position. Perhaps if A.I.D. had made formal contact with biologists at the University of Dar-es-Salaam early in the project rather than depending upon the Ministry of Agriculture for personnel referrals. In any ration, college-associated individuals are usually a most important resource in the development of counterpart individuals (an example of this was the development of many highly trained counterparts at the SEATO Medical Research Laboratory in Thailand through this mechanism of working with universities, medical schools and a tropical medicine school).

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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Range and Wildlife Habitat Laboratory
Route 2, Box 2315 La Grande, OR 97850

REPLY TO: 1500 External Relations August 9, 1978

SUBJECT: Tanzanian Tsetse Fly Review Team - July 1978

TO: Dr. Donald S. Ferguson
AFR/DR

This memo transmits my contribution to the above review. It is in two parts: first, the background paper for land use planning on Zanzibar which might best be an appendix to the general recommendations; and secondly, the organization and followup for a control program on the island.

Please keep me posted on significant developments. If I can be of further help, let me know.

Sincerely,

JON M. SKOVLIN
Project Leader

Enclosures

ANNEX F-1 #1

Review Draft
Dar es Salaam
July 19, 1978

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APPENDIX

TSETSE FLY REVIEW TEAM REPORT

1.0 Objective - To provide background information on land use and grazing potential for decision making processes concerning an expanded tsetse fly control program in Tanzania.

1.1 Purpose - To develop the planning mechanism for implementing a field control program with special emphasis on Zanzibar Island (component 3, page 3, Erickson's updated draft memorandum on "Scope of work on the tsetse fly review team.").

1.2 Scope - This paper reviews the existing situation on Zanzibar as regards livestock grazing potential in the agricultural setting with particular reference to further testing of the SIRM technique. It addresses some of the specific issues raised in the above document, i.e., page 7, items 2, 3, and 4, and provides additional information requested by the team coordinator Don Ferguson.

3.0 Area Description

3.1 Climate - Monsoonal weather patterns, the small size of Zanzibar Island (640 square miles), and essentially no landform relief (maximum elevation 300 feet) combines to produce a humid tropical climate with little variation. Mean monthly maximum and minimum temperatures for July, the coldest month, are 20 and 30 degrees centigrade (30 year average); for December, the warmest month, they

are 22 and 32 degrees centigrade. Humidity seldom gets below 50% which presents problems in controlled grassland burning and fodder conservation practices. Rainfall averages about 60 inches per year occurring in a bimodal pattern peaking in March (long range season) and November (short range season). Some rains occur each month and droughts are infrequent. Patterns across the island vary somewhat from the drier southeast (perhaps 45 inches) to the wetter northeast (perhaps 80 inches). Frequency of cultivation and cropping are on a bush rotation (shifting cultivation) that follows to some extent these meteorological patterns, i.e., in the southeast 8 to 10 years and in the northwest 2 to 5 years. Soil fertility is also partially responsible for this variation in cropping interval.

3.2 Geology and Soils - Soils are derived from limestone ("Kinongo" of the Wanda variety (low plain) and Maweni variety (stony), from noncalcarious fertile sediments of "Changa" and from marly or clayey Talahe material "Namo" (1)[1/]). The eastern half of the island contains a series of low coral ridge and valley topography. Soils overlaying this coral rag relief are shallow and droughty.

4.0 Vegetation and Land Utilization

4.1 General Land Types - The island might well be separated into north and south, and east and west areas in terms of land types. The

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1/ Numbers in parenthesis indicate references cited at end of the report.

main portion of the island is separated from the southeastern one-third by a narrow isthmus about 5 miles wide between Chwaka Bay and Pete Inlet. This land bridge is partially covered by the small Jazoni Forest. The southeast part of the island is largely bush covered thicket with perhaps 15-20% of the eastern part in cultivation. The main island is the reverse of this composition, being about 80% in intensive cultivation and only about 20-25% on the eastern side being in bushland thicket. Except for areas near the forest, the southeast portion is mostly fly-free and has cattle concentrations about Makunduchi and other small villages. Considerable amounts of charcoal are produced here and this has apparently maintained the tree overstory to such a reduced state as to have nearly eliminated fly habitat. The low heavy thickets could perhaps be partially converted to pastureland with the use of herbicides and a scheme of grazing with fire in the rotation period. Little open natural pastureland presently exists in this southeastern portion.

The main island also contains an eastern strip of bushland thicket from the ocean beach inland for about 4 to 5 miles. This is the second land use division. Geographically, therefore, one can safely assume that all portions east of a straight line from the northern most tip to the southern most tip is covered with bush thicket. Portions of this bushland on the main part of the island have a spotty tree or woodland overstory which probably provides suitable habitat for tsetse flies.

4.11 Land use - In this less productive area, usage is primarily restricted to charcoal production, limited grazing, and occasional cultivation. Probably less than 10% of the land is under cultivation at any one time and the frequency of bush resting between Shamba farming is 8 to 10 years between cropping. As this portion is vacant land at present, more intensive cultivation may follow increasing population pressures. Water resources of this area appear limited. Surface and ground water availability of the entire island have been studied (2).

In the more productive Changa and Wanda soils of the high rainfall western part, cultivation of some form takes place on about every other quarter to one-half acre of land. One exception to this pattern occurs in the southern part of the main island where some natural grasslands exist in a rather depleted and overstocked grazing condition.

4.12 Forage Potential - In general, increased cattle stocking is possible between intensely cultivated Shamba of the western section during the rested periods between cropping if bush control were practiced as part of the rotation. Clean farming through hand-cut clearing would also reduce the fly habitat throughout the Shamba areas. In past times of cheap labor, plantations were kept bush free (3).

4.2 Agriculture - Small plot farmers subsist comfortably on the variety of crops available, the generally dependable rainfall, and the

suitable fertile soils of the main island. Little is imported from the mainland to meet basic needs. Red-meat protein, however, presents a different situation. Although poultry supplements the fruit and vegetable diet, meat is in short supply and must be imported.

4.21 Crops - With the exception of cloves, which is a cash crop, no single fruit or vegetable forms the stable food supply. Most Shamba's contain quantities of cassava, yams, bananas, coconut, paw-paw, and some form of citrus or other fruit which may include oranges, lemons, limes, mangos, or pineapple. In certain more suitable areas, quantities of maze, millet, rice, and sweet potatoes are grown. Less common but often encountered crops are pigeon peas, sugar cane, bread fruit, and tobacco.

4.22 Livestock Production and Management - Cattle of the small east African Zebu variety are tethered daily amongst the Shamba's by a small plot farmer. Cattle owners may have only two or three head. This form of husbandry provides perhaps 90% of beef output of the island but only about 15% of this reaches population centers, namely Zanzibar. Cows are milked and male bullocks are normally consumed in the rural areas at 3 or 4 years of age (550-600 pounds).

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Statistical estimates of cattle grazing on Zanzibar as of 1975 were:

Inventory	19,000
Private	18,000
GOT	1,000
Marketing	
Imports	5,000
Slaughter	7,000
Farm consumption	2,000

Constraints to greater cattle output fall into (a) poor husbandry practices and (b) lack of additional forage areas for expansion.

Mortality of young stock is estimated at about 40% and is mainly attributed to trypanosomiasis. About 25% is attribute trypanosomiasis and the balance (15%) is due primarily to tickborne diseases (4). Drugs for trypanosomiasis, though available, are not administered because of cost and/or lack of diagnostic services or knowledge of this disease by the owners. Dipping, though free, is not practiced due to poor maintenance of facilities and/or lack of interest. Of the fourteen dips, six are Government of Tanzania and in 1973 three of these were inoperable.

Profitability (net income) of the local Zebu is equivalent to about 250 shillings per head per year (5). Better grades of Sihawal and Boran cattle are estimated to return about 450 shillings. Up-grading could eventually, therefore, increase returns measurably.

Present retail prices of beef are about 10 shillings per kilogram in Zanzibar. The availability of government imports, however, sets the demand private butchers are willing to pay farmers for their animals. There seems to be little reluctance on the part of the small farmers to sell cattle as is often the cultural constraint in many African societies.

The availability and price of fish, a preferred protein source, also effects beef marketing on the island. In terms of diet for the 200,000 some inhabitants on the island, each person would receive about 10.5 pounds of red meat from beef at present rates of consumption. This figure should be tempered with the possibility that home consumption estimates--15%--is on the conservative side.

Other livestock on Zanzibar include about 10,000 goats, 100 sheep, and 500 donkeys (6). Goats are kept strictly for meat. Donkeys are for riding and packing and sometimes used for pulling carts; oxen too are draft animals. Neither beast, however, is used for plowing or other cultivation practices.

4.23 Livestock Facility and Range Production - During the Zanzibar safari, the writer visited two of the three beef ranches and two of the three dairy farms. The former were at Tunguu and Wachara; the latter were Mtoni and Bambi.

4.231 Beef Ranches As stated, the cattle had for unknown reasons recently been shipped to the mainland; however, the relatively

poor condition of the rangeland was still evident. Both ranches, except on small parts of Wachara where forage trails were underway, had obviously been stocked far beyond their grazing capacity in recent years. Mr. FilFil, my urstwhile guide and informant, suggested proper stocking to be approximately 10 acres per beast per year which I believe to be quite adequate. Yet, most recently Tunguu ranch was carrying about 700 head on an estimated 18 to 20 thousand acres of bush cleared range. A third beef ranch we drove through, Mchanaa, looked equally impoverished from signs of a recent overstocking. Sheep grazing was planned for this ranch.

4.232 Dairy Farms - Mtoni, the central veterinary station, were stocked with about 30 Jersey cows and some additional young stock. I was told there was perhaps 75 acres of grazing available here. Only with irrigation and fertilizer could one expect to have 3 acres carry a cow even under ideal conditions--Mtoni has had neither water nor fertilizer. The cattle at Mtoni, however, looked fit and apparently were producing well but conception was low. The facilities at Mtoni were adequate to good.

Bambi dairy farm had poor facilities but better forage conditions; still it was overstocked at less than 6 acres per beast per year. Young stock we saw and the cow herd, I am told, are in rather poor condition.

4.24 Grazing Capacities - Five range type grazing situations occur on the Zanzibar: (1) <u>Open plains and valleys</u> along the south coast

of the main island. From the aerial reconnaissance, these were heavily trailed by cattle and were presently grazed to a short stubble of sod-forming grasses. Apparently this is a common-use grazing ground. This area properly stocked should carry at least a beast to 5 or 6 acres under good management. (2) Bushed grasslands of the "Miombo" type west of Jazoni Forest. With proper burning and grazing, this range could be improved without further bush control to carry perhaps one beast per 6 or 8 acres. (3) Cleared ranching areas (beef or dairy). Once restored these should carry about one beast to 8 or 10 acres. (4) The fallow inter-Shamba forage areas of the west side of the island has perhaps the cheapest potential for increased forage production. If these areas were cleared of bush between cultivation patches, there is good evidence to suggest that *Panicum maximum*, guinea grass, would immediately dominate. These areas with high rainfall on good red soils should support a beast for every 2 to 3 acres. Other methods to increase beef output in the Shamba areas incude making greater use of aftermath from harvested crops. (5) Bushland thicket areas of the eastside; the last and maybe most extensive, but perhaps most expensive opportunity to increase forage is from treatment of the eastside thickets. The economic feasibility here, however, is conditioned by the susceptibility of the innumerable bush species to control practices. Resprouting after the first herbicide application of tordon, 24D, 245T, or a similar agent, probably means followup treatments of burning or possibly even respraying.

4.241 Natural Vegetation and Forage Resources - Zanzibar has been exposed to the introduction to exotic plants for hundreds of years. Most crop plant introductions have been agricultural assests. Many ornamentals have added beauty but some trees and bush exotics have been detrimental. For example, Leucaena glaca, a medium-sized bush species has invaded much of the island and produced excellent habitat for the tsetse fly without adding appreciably to the forage resource. Similarly, Lantana, a low bush of no value, has spread throughout the island and occupied space which was probably grassland originally. The indigenous Jazoni Forest at the islands isthmus is a multi-layered stand essentially without any understory grass or herbage. Evergreen trees reach heights of 70 feet; several layers of low-growing trees are also present. Common species are fig trees (Ficus sp.) and cassia (Cassia sp.). Creepers and liana climbers are common. North and south of this forest are extensive swamps of mangrove (Rhizophora mucronata) which also occurs extensively around Chwaka Bay. Screw pine (Pandanus kirkii) is a common inhabitant of the bush thickets along the coastline.

Inland shrub and bush species of the thickets are predominantly of a sclerophyllous evergreen variety producing 100% ground cover. A common invader of the more open Miombo bush type is Mtope Tope (Annonona crysophylla) which is the most widespread bush species on the island (7). However, unless the thicket or bushland is over-topped with a tree canopy layer, it is not suitable habitat for the

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tsetse fly (Glossina austeni). The only acacia to be seen is Acacia zanziabarica and occasionally a spreading Acacia nilotica. The limited grasslands occurring in the south and east are composed of Digitaria scelarum, Hyparrhenia rufa "Fefe", Heteropogon contortus, speargrass, Panticum maximum, guinea grass, Pennisetum purpureum, elephant grass, and Iperata cylindrica, cotton grass, and Cynodon dactylon, bermuda grass. Sedge-like Cyperus species are common in wet areas. Criptograms such as Polypodium scloropendrian or Pteridium aquilinum, brachen fern, are common; the latter is often an indicator of grassland degradation. Herbaceous plants other than grasses and grass-like species are innumerable. Some of the more conspicuous species are Cassia, Aloe species, Indegophers species, Asparagus species, Grewia, Euphorbia, and Ipomea species.

4.3 Wildlife - A rather simple wildlife fauna exists on Zanzibar Island; what birds and mammals might have been present originally presents interesting speculation. The absence of chorny protective features on bush species that is common to plants of the mainland suggests evolution with few large ruminants or herbivores in recent melinia.

Although no special investigation of wildlife was made during the two half-day safari's, species known to be present are the common bush pig (Chosropotamus porkus) and several small antelope, the forest duiker (Cephalophus adersin), the pigmy antelope (Mosotragus moschatus); a red colobus monkey (Colobus angolinsis) is reported to occur in the Jazoni Forest, and bush babies (Galagos zanzibaricus)

are commonly heard in the evenings throughout the island. The elephant shrew (Elephantulus sp.) is know to be common. Bird species do not appear to be diverse or especially abundant. Several types of those observed were rollers and widow birds. Cattle egrets (Bubulcus ibis) were numerous and one large heron was observed. English sparrows are common about the villages and towns. The common black coastal crow is very abundant and is undoubtedly a menace to other birds. No other scavengers were seen nor were birds of prey much in evidence. Reptiles include the rock python (Python sebae), the monitor lizard (Varanus niloticus), and a small skink-like lizard. Several small tree type frogs also occurred on the floor of the Jazoni Forest. Subterranean termites, though present, are not numerous.

Animals formerly reported o[illegible] ly collected from Zanzibar include: buffalo, suni, greater flami[illegible] parrot, cuckoo, and crocodile (8).

Submitted:

Jon M. Skovlin

8.VII.78
Date

J.30

LITERATURE CITED

1. Kent, P. E., and R. E. Linton. 1947. The surface geology of Zanzibar Island. 35 p. with maps.
2. Stockley, G. M. 1928. Report on the geology of the Zanzibar Protectarate. Zanzibar. 126 p. (2 maps).
3. Johns, D. L. 1951. The tsetse fly and trypanosomiasis problem in Zanzibar Island. Report to the Director of Agriculture, Zanzibar. 18 p., typescript.
4. Johns, D. L. 1951. The tsetse fly and trypanosomiasis problem in Zanzibar Island. EATRO Office Report. 18 p.
5. Strong, P. J. H. 1976. Livestock production on Zanzibar. FAO/URT 73/025, Zanzibar. 35 p.
6. Williams, E., and J. Cornellius. Livestock development in Zanzibar. Department of Veterinary Services and Animal Husbandry, Zanzibar. 10 p.
7. William, R. O. 1949. The useful and ornamental plants in Zanzibar and Pemba. Saint Annes Press, Timparlay Altrincham. 497 p., illus.
8. Zanzibar Museum. 1937-1946. Annual reports to members of the Zanzibar Museum.

5, 31

An Expanded Livestock Development Program Associated with Tsetse Fly Control on Zanzibar

Preliminary Land Use Capabilities Survey.

Prior to planning a feasibility study for the forage improvement program that might parallel a tsetse fly eradication project, the potential for bush conversion on the eastside of the island should be investigated. If it is determined to move forward with a Zanzibar fly program, the economic advisability of bush control should proceed immediately. This investigation could be organized simply by negotiating a contract with the foremost expert in the field of African bush control. The contract could specify a report on the efficacy of known herbicides for control of the major bush species in question. It should also relate the expected cost factors for the area and what alternative methods could be recommended.

The expert would need to make a general inventory of composition and density of bush and trees species on the entire area of the eastside. This would entail about 2 weeks of field safari (transport provided) and perhaps two hours of light aircraft flying time at two different periods. A set of the 1977 M. O. D. air photography would also be necessary. The expert would provide his own working tools such as plant keys, collecting equipment, etc. Perhaps expenses equivalent to one trip to the Cornyndum Museum or the University of Nairobi would also be required for species verification, etc.

This expert should also be requested to investigate the hard bush clearing problems in the cultivated section of the west side.

The total travel time and perhaps one weeks time for report preparation will also be needed. In all, probably one scientist man-month and expenses (U.S. $6,500).

o To make the best use of the bush control expert's time it would be advisable to have an agronomist for one to two weeks on the ground to accompany him in bush control investigations. This latter person could be under a PASA arrangement and could advise the agency what prospects existed for followup reseeding or other restoration type range improvement would be most effective. These two persons could provide an estimate of the cost involved for such a followup complimentary range improvement project.

It is quite possible that additional control work would be required after the initial bush control application, especially if controlled burning were possible. Resprouting is a tough problem with this bush

o type. Success of bush control-range restoration assumes absolute control of livestock grazing through management strategies and grazing and burning systems.

One of the foremost bush control experts on Africa is:

Dr. Giles W. Ivens, Professor
Massy University, 57 Collingwood Street
Palmerston North
New Zealand

If the outcome of these pre-investment studies showed promise, then Stage I of the land use capability survey could proceed. This would

involve a small team of experts that would investigate existing land usage and plan an expanded range livestock production program. This project would parallel the tsetse ecology survey prior to control operations.

Stage I of the feasibility study would involve two operations:

Phase A - Predevelopment Study — Time Frame

1. Plant control specialist - herbicides.....1 month.
2. Range ecologist (agronomist).....1/2 month.

Phase B - Implementation (Planning and Survey)

1. Range conservationist (planner) - plant community typing and estimates of forage supplies.....12 months.
2. Range agronomist - forage crops and forage preservation.....6 months.
3. Hydro-geologist (water development specialist)...2 months.
4. Range livestock economist.....4 months.
5. Livestock production husbandry specialist.....12 months.

In Stage II, the Post-Application Development Phase, perhaps a Ranching Development and Education (extension) Officer would be necessary in order to accelerate livestock production opportunities. Their tours would depend on the effectiveness of the followup program.

Submitted by:

Jon M. Skovlin — 8-VIII-73
Date

APPENDIX K

TANZANIAN GOVERNMENT LETTER OF REQUEST

K

REQUEST TO USAID FOR ASSISTING
ZANZIBAR GOVERNMENT IN TSE-TSE
AND STOMOXYS CONTROL AND
ERADICATION PROJECT.

COUNTRY	:	UNITED REPUBLIC OF TANZANIA GOVERNMENT OF ZANZIBAR.
TITLE OF THE PROJECT	:	TSE-TSE AND STOMOXYS CONTROL AND ERADICATION PROJECT.
DATE OF REQUEST	:	JANUARY 1978.
PRESENTED BY	:	MINISTRY OF AGRICULTURE DEPARTMENT OF VETERINARY SERVICES.
USAID CONTRIBUTION	:	US $ 291,500
GOVERNMENT CONTRIBUTION	:	T. SHS 392,240.

1. INTRODUCTION

Zanzibar has tremendous patential for cattle development, had it not been for the presence of trypanasomiasis which is wide spread covering about 360 sq. miles and which interefers with the expansion of livestock industry, and in order to boost the present cattle population of 16,158 to proportions sufficient to drastically reduce the annual import of slaughter stock and eventually to become self supporting as regards to meat and dairy products, the blood sucking flies which carry the disease must be tredicated.

Glossina austeni the only tse-tse fly which transmits the disease is widespread throughout the whole islands of Zanzibar, its numbers varying with the suitable of its habitat. For reasons yet not clear the Pemba island is free from tse-tse infection, and it is because of this that the Pemba Island has more cattle population than Zanzibar, though the latter has a big area, twice as much as the former.

A part from the fact that with the presence of trypanosomiasis in most part of the Zanzibar island cattle population cannot increase on those areas, the government incurres a lot of expenses in taking care of the existing small number of cattle in the areas. About 8260 cattle are being kept in 300 sq. miles infected are. Out of that number, about 1075 cattle are treated annually against trypanosomiasis, and about 2655 cattle receive prophylactic treatment for the same about 2% of the animals are not reported to Veterinary clinics when they are infected. 5% of the treated animals die during the course of treatment (in most cases the infected animal are reported late).

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25% of the cattle, in-calf ones ends with abortion due to this infection and 25% calved ones during lactation produce low milk to the extent that it is not sufficient for their calves.

It is estimated that the loss which trypanosomiasis causes to our country to be as follow:-

1.	Medicine (therapeutical - Berenil etc.)	= $	15,000
2.	Medicine (Prophlactic - Prosalt, samorin)	= $	10,000
3.	Dealth (treated animal 5% of 1075)	= $	9,000
4.	Abortion due to infection	= $	6,000
5.	Less milk produce due to infection	= $	15,000
6.	Infected and not reported	= $	8,000
		$	63,000

However, big economical loss is caused by the fact that no cattle can be reared in heavily tse-tse infected areas, and this make it impossible to establish dairy farms or ranches on such areas.

11. PURPOSE OF THE PROJECT TO THE OBJECTIVES OF USAID AID PROGRAMME.

USAID has already agreed and approved the idea of extending research on tse-tse flies in the island using male-sterile technique now undertaken at Tanga Tse-tse Research Station. However, in view of our planned livestock development programmes the question of making practical approach to eradicate the insects within short period is of paramount importance. Considering that the Island has natural isolation barries and putting into account that the area involved is not big, spraying using applicable insecticides could possibly produce rapid and successful results. Thus why it is suggested to set-up TSE-TSE AND STOMOXYS CONTROL AND ERADICATION PROJECT, in the country, with primary aim of applying both male-sterile technique and Insecticidal Spraying Method using different insecticides and determine which one could be applied to eradicate the disease. The methods could be applied simultaneously at different places of reasonable distances apart.

The objectives of Insecticidal Spraying Method will be:-

1. to survey and maping the infected areas.
2. to determine fly - density and population.
3. to determine effective method of spraying for eradication purpose wheather aeriel or ground spraying.

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111. DESCRIPTION OF THE PROJECT.

The first anti tse-tse and Trypanosomiasis project was started in 1952 until 1954. The area selected for this purpose was a 20 sq. miles at a place called Mwera. This work was carried out by clearing of thickets and by treating of the positive cases. This resulted in a gradual decrease in the incidence of the disease with a corresponding decline. However, after 5 years the thickets regenerated and the incidence of the disease started to increase.

Between 1956 and 1959 further investigations were carried out of Trypanosomiasis in Zanzibar. The gut contents of samples of G. Austeni revelaed that the bush pigs blood formed about 88% of their meal and from this data it was pastulated that bovine Trypanosomiasis could be reduced or even eradicated with the reduction in number or complete eradication of bush pigs. It was suggested that the eradication of wild pigs could be acomplished by the introduction of T. Semiae or swine fever.

However it is not known what extent the pigs played a part in being a resevior for trypanosomiasis. 138 pigs were killed and examined for trypanosomiasis and only one pig showed T. Conglense. This investigation was done to see if the Zanzibar bush pigs were immune to T. Congolense so that they could be got rid of with another species of trypososome, this work, However, did not continue.

The first consideration of using insecticide to eradicate G. Austeni was started in 1962 when Mr. D.B. Turner, Tse-tse officer from Dar-es-Salaam arrived in Zanzibar as an adviser to the project. Mr. Turner, was here from 10th to 16th March in order to study tse-tse problem and he made a demonstration of Insecticide spray at Mangapwani where a pilot scheme for the eradication of tse-tse may be carried out.

DESCRIPTION OF THE AREA.

The pilot scheme was carried out at Mangapwani Northeast of Zanzibar Island between 13 miles north of Zanzibar City. The thickets which were infected by the flies were the Coral reg thickets and the uncleared coconut plantation.

METHOD USED.

Three fly rounds were demarcated within the area. Before spraying, spraying paths were cut at 100 yds intervals.

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The insecticide used was Dieldrex 15 T which contain 18% dieldrin. 2% dieldrin was first used and then a 3% dieldrin was used. The spraying was done by two type of mist blowers. "Motoble" and the "Kinkelder". Each machine was used by a team of three people, 2 sprayers working in turns. The third person carried the insecticide from the mixing point. A land rover was used to carry the equipment.

The insecticide was sprayed on both sides of each trace and to the edges of the thickets. All thickets within the area sprayed starting from a clean area to the actual places where the flies were caught, and the whole thicket within the area where the disease was known to occur.

The insecticide was sprayed from ground level to the high of 3 ft. This is because it was observed that G. Austoni perches on vegetation up to a high of 3 feet above the ground level.

A team of three people usually covers an area of 36 acres per day. On using a 2% dieldrin one gallon of dieldrex covers and areas of 28 acres, while a 3% dieldrin cover an area of 15 acres.

RESULTS.

Before the spraying operation all the area between Uso wa Nembe to the North and Nyale to the South was investigated for the presence of flies and all cattle within the area were examined for trypanocomiasis.

A bait-ox was used to detect the G. Austeni and was used on all fly-founds.

The results showed that 3% Dieldrin to be very effective especially on the fly concentration areas, but no conclusion was reached because the project had to be closed because of shortage of funds and trained personnel to supervise the project.

It is however, hoped that insecticidal spraying method could be very effective against tse-tse flies in the Island, and thus why it is suggested that along with Male-Sterile technique, the method should be tried and find out its effectiveness and for that purpose Tse-tse Eradication Project should be set - up in the country.

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It is for above reasons that USAID is hereby requested to set up Tse-tse and stomoxys Eradication Project in Zanzibar and provide the following:-

1. TECHNICAL ASSISTENCE:

Entomologist	1
Veterinarian	1

2. EQUIPMENTS:

Spraying Equipments	= $	50,000
Camping Equipments	= $	8,000
Laboratory Equipments	= $	12,500
4 Landrovers	= $	48,000
1 7 - ton Lorry	= $	20,000
10 Vespa Scooters	= $	20,000
1 Pegeut - pick up with Canvas	= $	8,000
1 Water - tank Trailer	= $	9,000
Misc. Equipments	= $	6,000

3. INSECTICIDES:

(a)	Dieldrex 15 T to cover 107 Sq. miles at One gallon 15 acres application.	= $	100,000
(b)	Applied drugs	= $	10,000
		$	291,500

4. TRAINING:

USAID is also requested to provide training facilities in the following fields:-

1 Veterinary Surgeon

1 Entomologist

10 Tse-tse field Assistents (on the job training)

3-5 fellowship on Entomology.

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ZANZIBAR GOVERNMENT CONTRIBUTION:

Tse-tse Control Officer	=	T. Shs.	16,560.00
Veterinary Assistents	=	T. Shs.	20,000.00
Labourers (Spraying Services)	=	T. Shs.	84,000.00
Drivers	=	T. Shs.	27,000.00
Trace - Slashes	=	T. Shs.	118,000.00
Fuel and Maintanance of Vehicle.	=	T. Shs.	126,780.00
		T. Shs.	392,240.00

DR. O.A. JUMA, DVM, M.Sc (MOS) DIP. T.V.M (EDIN).

CHIEF VETERINARY OFFICER.

OAJ/SSA:

APPENDIX L

PAF I

DRAFT PAF II

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I

1. TRANSACTION CODE: A (A ADD, C CHANGE, D - DELETE)

PAF

2. DOCUMENT CODE: 5

3. COUNTRY/ENTITY: United Republic of Tanzania

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits):

6. BUREAU/OFFICE: A. SYMBOL: AFR; B. CODE: 06

7. PROJECT TITLE (Maximum 40 characters): Tanzania Tsetse Control

8. PROJECT APPROVAL DECISION — ACTION TAKEN: A APPROVED, D DISAPPROVED, DE DEAUTHORIZED

9. EST. PERIOD OF IMPLEMENTATION: YRS. 06 QTRS

10. APPROVED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 79 F. GRANT	E. 1ST FY 79 G. LOAN	H. 2ND FY 80 I. GRANT	H. 2ND FY 80 J. LOAN	K. 3RD FY 81 L. GRANT	K. 3RD FY 81 M. LOAN
(1) ARDN	121	080		500		3,200		1,300	
(2)									
(3)									
(4)									
			TOTALS	500		3,200		1,300	

A. APPROPRIATION	N. 4TH FY O. GRANT	N. 4TH FY P. LOAN	Q. 5TH FY R. GRANT	Q. 5TH FY S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)					5,000	
(2)						
(3)						
(4)						
TOTALS					5,000	

11. PROJECT FUNDING AUTHORIZED (ENTER APPROPRIATE CODE(S)) 1 - LIFE OF PROJECT, 2 - INCREMENTAL, LIFE OF PROJECT

	A. GRANT	B. LOAN
	2	

C. PROJECT FUNDING AUTHORIZED THRU FY

12. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED ($000)

B. ALLOTMENT REQUEST NO.

A. APPROPRIATION	C. GRANT	D. LOAN
(1)		
(2)		
(3)		
(4)		
TOTALS		

13. FUNDS RESERVED FOR ALLOTMENT

TYPED NAME (Chief, SER/FM/FSD)

SIGNATURE

DATE

14. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [X] 941 [X] LOCAL [ ] OTHER

15. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED

FOR PPC/PIAS USE ONLY	16. AUTHORIZING OFFICE SYMBOL	17. ACTION DATE MM DD YY	18. ACTION REFERENCE (Optional)	ACTION REFERENCE DATE MM DD YY

AID 1330-6 (7-76)

DRAFT

L

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS - PART II

Name of Country: United Republic of Tanzania

Name of Project: Tanzania Tsetse Control

Project Number: 621-0144

Pursuant to Part I, Chapter I, Section 103 of the Foreign Assistance Act of 1961, as amended, (the "Act") I hereby authorize a Grant to the United Republic of Tanzania (the "Cooperating Country") of not to exceed Five Hundred Thousand United States Dollars ($500,000) to assist in financing certain foreign exchange and local currency costs of goods and services required for the project as described in the following paragraph:

The Project shall consist of two phases. Authorization for only Phase I is sought herein. The Project will provide in Phase I, technical assistance, goods training, a laboratory/office facility, and supporting and operating costs for (a) continued research and development efforts at the Tanga Tsetse Research Center, (b) a Livestock Disease Survey and a Tsetse Distribution Survey on Zanzibar, (c) building and equipping of a laboratory/office on Zanzibar, (d) conducting an Environmental Assessment, and (e) determining the feasibility of a tsetse control program on Zanzibar (hereinafter referred to as the "Project).

I approve the total level of AID appropriated funding planned for Phase I of the Project of not to exceed Five Million United States Dollars ($5,000,000) Grant, during the period FY 1980 and FY 1981, including the amount authorized above and additional increments of Grant funding during such period subject to the availability of funds and in accordance with AID allotment procedures.

I hereby authorize the initiation of negotiations and execution of the Project Grant Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority, subject to the following terms, together with such other terms and conditions as A.I.D. may deem appropriate:

A. Source and Origin of Goods and Services

Except for ocean shipping and as provided under paragraph D below, goods and services financed by AID under the project shall have their source and origin in the Cooperating Country or in countries included in AID Geographic Code 941, except as AID may otherwise

agree in writing. Ocean shipping financed under the Grant shall be procured in any eligible source country except the Cooperating Country.

B. Local Currency Costs

The financing of local currency costs related to technical assistance, travel, vehicle operations and housing in the approximate amount of One Million United States Dollars ($1,000,000) is hereby approved.

C. Covenants

The Project Agreement shall contain covenants, providing in substance, as follows:

1. The Cooperating Country shall ensure that competent personnel are assigned in a timely manner to provide laborers and fill the counterpart positions at Tanga and on Zanzibar.

2. The Cooperating Country shall covenant to assign U.S. trained participants to tsetse control activities.

3. The Cooperating Country shall ensure that charter aircraft have free access to the Zanzibar airport facilities and freedom of overflight of the island.

4. The Cooperating Country shall provide approximately ½ acre of land on Zanzibar for the construction of the veterinary office/laboratory facility.

5. The Cooperating Country shall provide financial support to the Project at a level not less than provided to the current project activity.

6. The Cooperating Country shall develop a quarantine plan for Zanzibar Island to be initiated in Phase II to protect it from reinfestation of tsetse fly from the Mainland.

D. Notwithstanding paragraph A above and based on the justification set forth in Appendix H of the Project Paper, I hereby:

1A. approve a procurement source waiver from AID Geographic Code 000 (U.S. only) to AID Geograpic Code 935 (Free World) for seven Land-rover type vehicles, and spare parts at a total approximate cost of $108,000, and one truck of an approximate cost of $31,500.

1B. certify that exclusion of procurment of above described vehicles and spare parts from countries included in Code 935 would seriously impede attainment of U.S. foreign policy objectives and objectives of the foreign assistance program; and

1C. find that special circumstance exist to waive, and do hereby waive, the requirements of Section 636 (i) of the Act.

_____ Date

_____ Assistant Administrator for Africa

Drafted: USAID/T/CDPO:RMDepp:sm:2/14/79