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in West Africa With
Special Reference
to Upper Volta



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**ONCHOCERCIASIS CLEARANCE IN WEST AFRICA
WITH SPECIAL REFERENCE TO UPPER VOLTA**

Eileen Berry

Charles Hays

and

Earl Scott

**Case Study
Paper #2**

**Training Course for Preparing
Initial Environmental Examinations**

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1

ONCHOCERCIASIS CLEARANCE IN WEST AFRICA
WITH SPECIAL REFERENCE TO UPPER VOLTA

1. Onchocerciasis: The Disease and Its Effects on Man.

Onchocerciasis is caused by the parasite Onchocerca Volvulus. This disease is found in tropical Africa (from Senegal to Ethiopia and Tanzania), Yemen, Mexico, and Central and South America and infects 20 million people world-wide. The parasite is transmitted by a blackfly called Simulium damnosum which has the following life cycle. The adult worms live in the skin of the affected person and they form visible and palpable nodules there. The female worm produces millions of embryos (microfilariae) which then migrate throughout the body and penetrate tissues and cause inflammatory changes. (These changes will be described in more detail below). The microfilariae then remain in the skin until they die or are ingested by a biting blackfly. Within the blackfly, they develop into infective larvae in a 6 or 7 day period. When the blackfly bites another person, the larvae are liberated onto the skin of the new host. They enter the body through the bite wound and over a two month period become adult worms which mate and give rise to more microfilariae.

The presence of the parasite in man causes a myriad of different clinical manifestations from chronic skin conditions, including atrophy, depigmentation and severe rashes, to eye problems which may culminate in blindness. Other conditions

caused by the parasite include inflammation of the lymph system with hernias and elephantiasis occurring as a result. The eye conditions are the most important and destructive consequences of the disease and in severely affected areas over 10% of the population may be blind. In these same areas, 30-50% of the adult male population may be incapacitated by loss of vision. These visual defects are caused by the invasion of the eye by microfilariae. When the worms die, they cause a cellular reaction which over time produces a progressive clouding of the cornea and eventually blindness.

The disease can be diagnosed by three different methods. The first is an examination of the skin for the nodules caused by the adult worms. The second, and most reliable way involves taking a small skin snip and looking for the microfilariae in this sample. A final method uses an anti-onchocercal drug that kills the larval worms and sets up an itching skin reaction which provides a tentative diagnosis of the disease. In cases where no disease is present, no reaction occurs.

The disease can be cured with two available drugs, suramin and diethyl carbamazine. But these drugs produce sufficient toxic and allergic reactions to prevent their utilization in major treatment campaigns.

1.1 The Transmission of Disease: The Simulium Damnosum Blackfly.

As indicated above, the blackfly is the carrier of the disease from man to man. This species requires fast-flowing rivers and streams for the development of the larvae from the eggs. The females lay their eggs on partially submerged supports and the larvae extract food from the swiftly flowing river. After several stages of development, which takes about two weeks from eggs to adult, the adults emerge and the females soon begin to seek out animals (preferably man) to feed upon (the males require plant juices only for their nutrition) (see Figure 1). The female fly bites man mainly below the knee. If there are large numbers of flies, they become a nuisance and make work difficult or impossible without some kind of protection.

The life span of the flies depends upon environmental conditions such as temperature and rainfall. Due to the need to have fast-flowing water for larval development, there is a great deal of seasonal variation in *S. Damnosum* populations. The numbers of flies correlate directly with the intensity of stream flow. Thus, hydrological information is essential for accurate planning of control activities. The females often travel up to 40 km from the larval sites. This wide flight range allows for widespread dispersion of the vector. It should

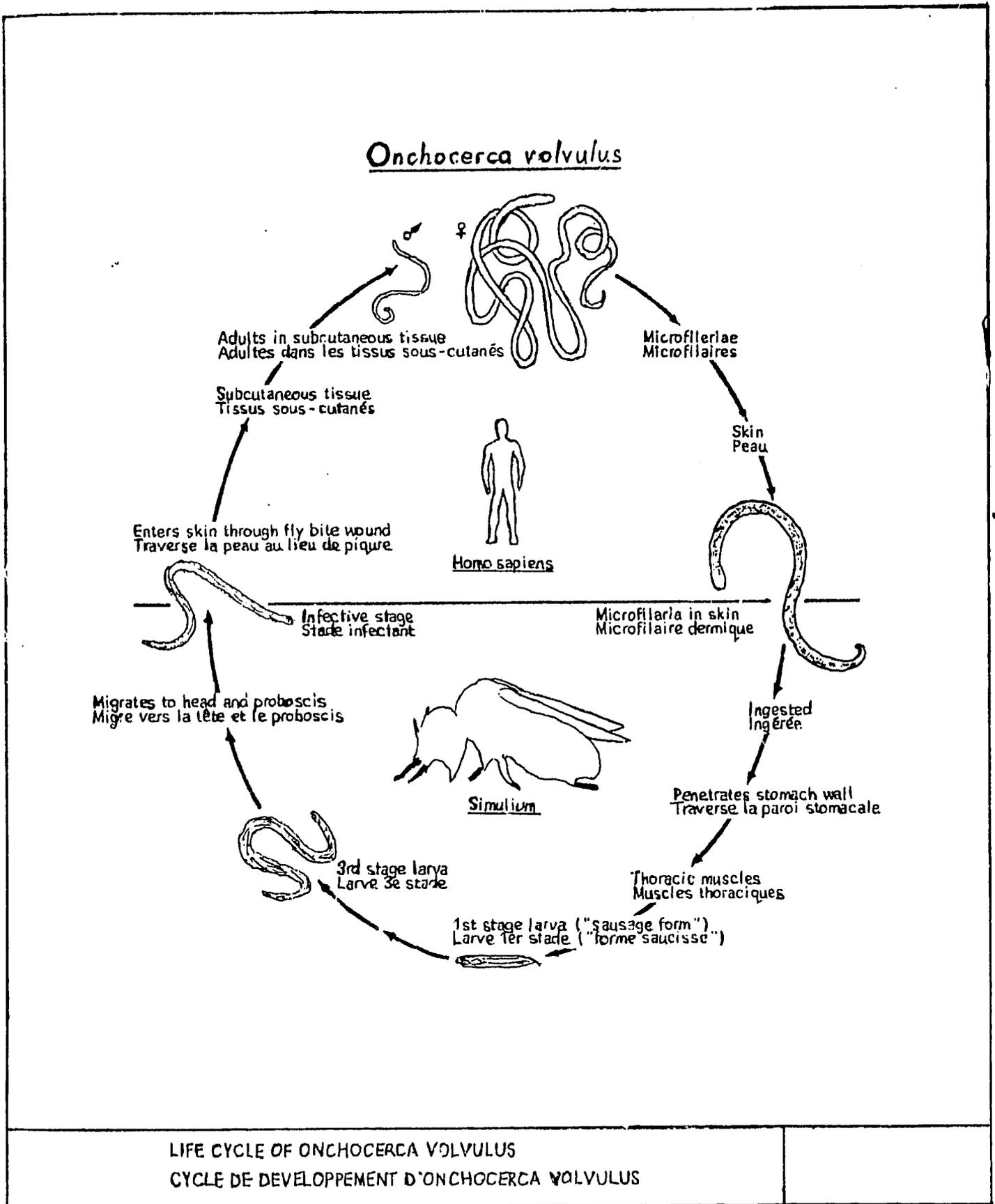


Figure 1

be made clear, however, that the right conditions for larval production occur in a limited number of places due to the very specific conditions that are needed for larval development.

S. Damnosum is an effective carrier of onchocerciasis and as many as several thousand infective bites per man per year have been recorded in some West Africa surveys.

Because of the very great efficiency in transmission, the fly must be entirely eliminated before the disease can be controlled. One way in which blackfly control could be accomplished would be by building enough dams to convert any fast-flowing areas of streams into small reservoirs. This approach would be quite costly and without careful design, the dam spillways could become an excellent breeding site for the blackfly. In fact, the distribution of the fly has been expanded by some small dams which have already been built in the region. Thus, water control is neither a cheap nor effective approach.

The only practical means for controlling the blackfly at present is the use of insecticides to kill the larvae as they develop in the rivers. When insecticides are put into the river upstream from the breeding sites, the larvae ingest the insecticide and die. The use of such insecticides in streams which provide water for many other uses raises many

environmental questions which must be examined in greater detail.

1.2 Special Epidemiological Features

Onchocerciasis is a cumulative parasitic infection. This feature of the disease is best seen in endemic areas. Some people in the population have signs of accelerated aging of the skin, others may show little effect in spite of long exposure to infective bites by the blackflies, and the remainder show the natural course taken by the disease once a person is infected. In hyperendemic areas, those which have prevalence rates of 70% or more and a 4.0 percent rate of blindness, infections begin to be detectable in the second year of life. Thereafter, the prevalence increases rapidly, reaching a ceiling of nearly 100% by age 20. At this age, the intensity of infection as indicated by microfilaria counts of skin biopsies continues to rise until a saturation level is reached. Considerable variations exist in these saturation levels between individuals and between communities with similar endemicity, but little explanation can be offered for these differences.

Differences also exist between the sexes. Infections are more intense among males than among females of the same age group. Similarly, the prevalence of eye lesions and blindness

are higher among males than females. In most cases, serious eye lesions can be detected in those persons who have had the disease for 10 or more years.

Large differences in endemicity levels, in infection intensity, and in frequency of blindness are found between villages located in proximity to each other. These micro-epidemiological gradients are directly related to the proximity of villages to fast flowing rivers and streams where the blackfly vector breeds and where suitable conditions for larval development exist. Female flies seek the nearest source of human blood and they are not inclined to venture further until their blood source moves. Consequently, these frontline villages nearest the breeding ground are repeatedly attacked. At the same time, they serve as an effective "barrier" for communities located greater distances from the breeding grounds. Based on these observations, villages were classified as either "1st," "2nd" or "3rd" line villages (Figure 2). The most striking differences between the three types of villages are in the age patterns of the prevalence of infection in children and teenagers, and in the frequency of eye lesions and blindness in adults.

The villagers' response to onchocerciasis is to emigrate, abandoning their villages, their land and their livelihood. Presumably, there are many previously inhabited and fertile areas along rivers and streams that have been abandoned for

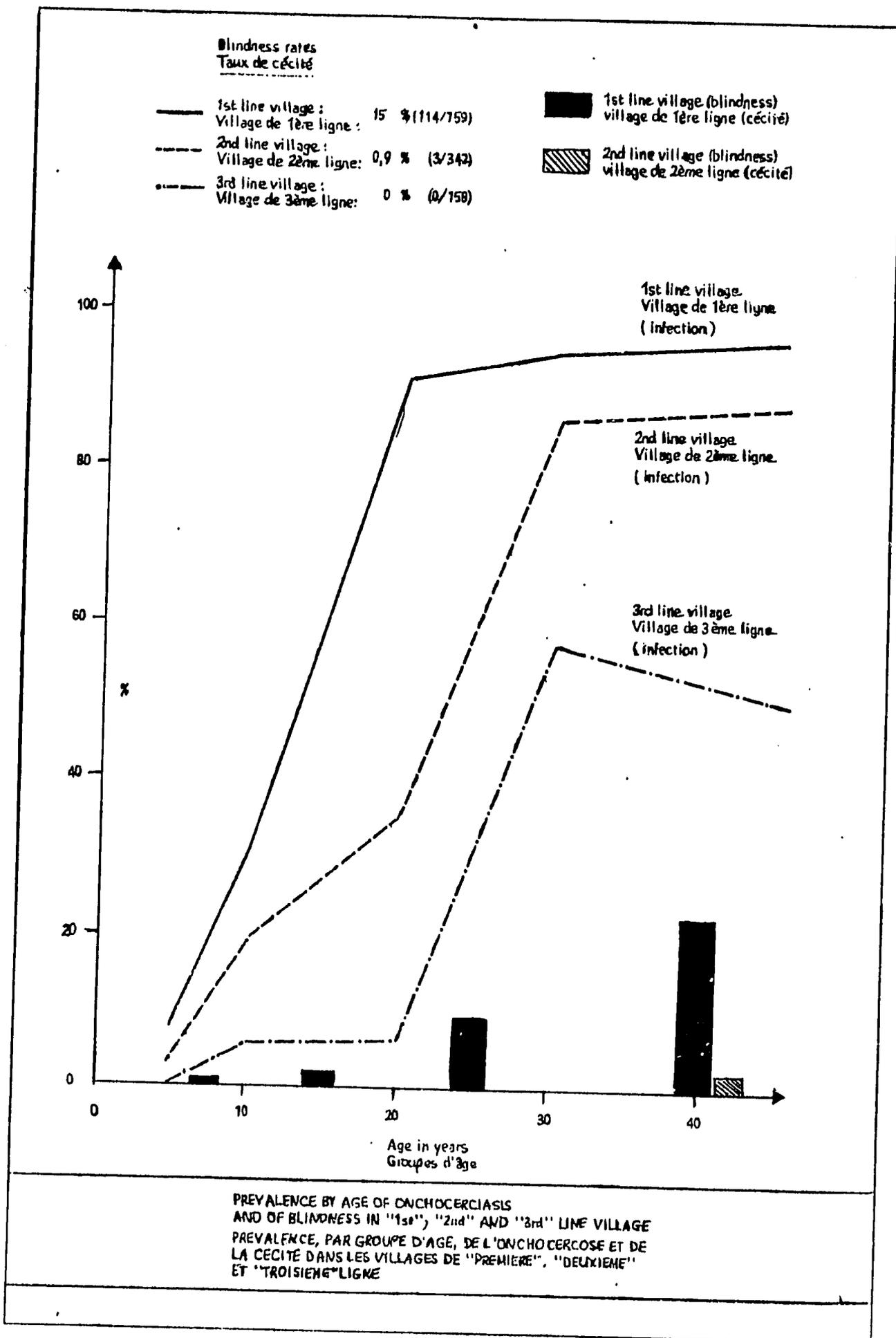


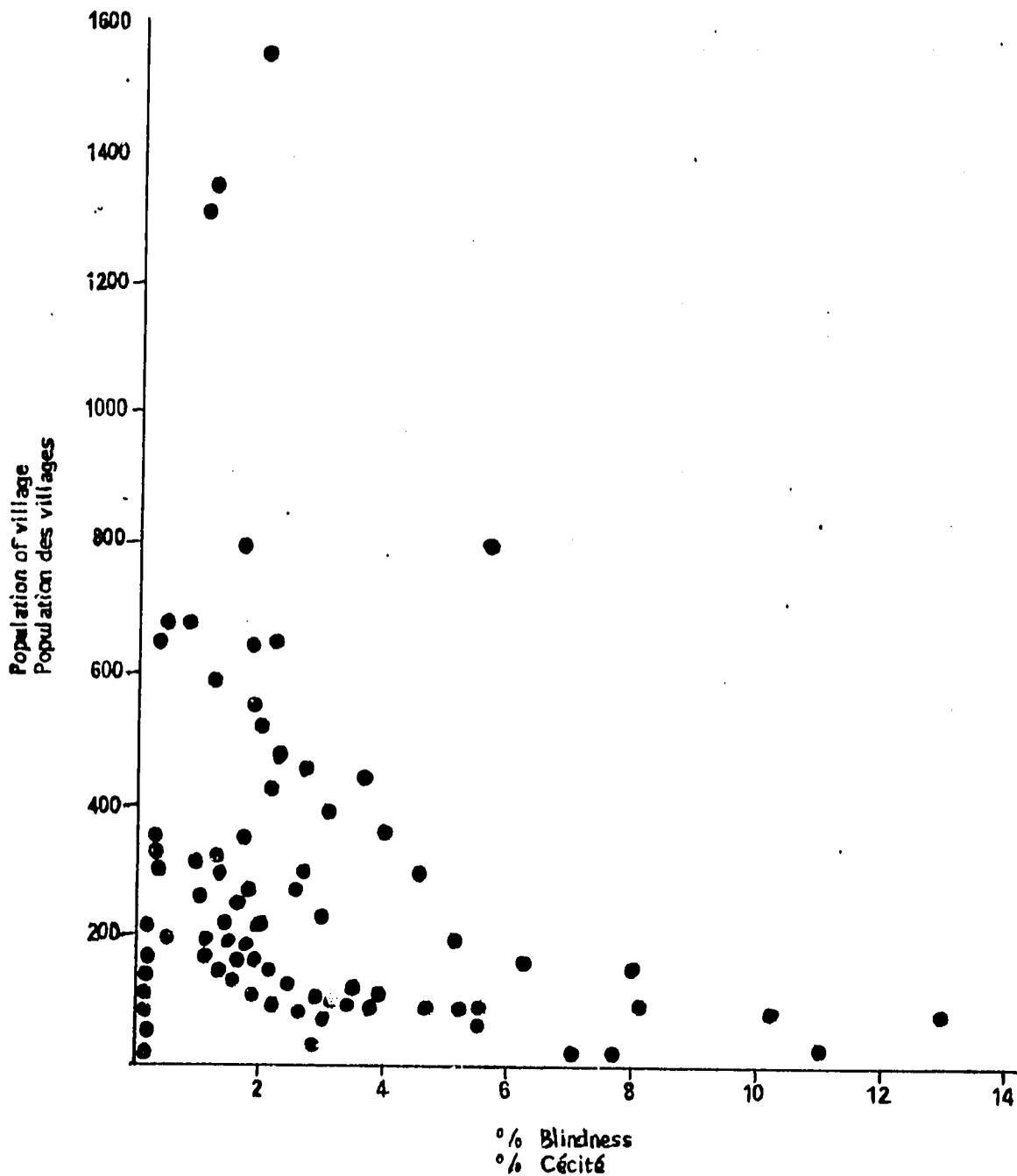
Figure 2

fear of "river blindness." The available data support this notion (Figures 3 and 4). In essence, the front-line villages are smaller in population than other villages and this small size is due to emigration from disease-infected areas.

Population studies in local areas also show strong out-migration from heavily infested river basins. For example, calculations of trends in the onchocerciasis hyperendemic areas of northeast Ghana in the last decade show an overall net migration loss per district up to 2.9% per annum -- highest in the Sissili area -- but with the pattern of heaviest decline quite clearly in riverine locations with movements of people to upland, watershed areas (Figure 5).

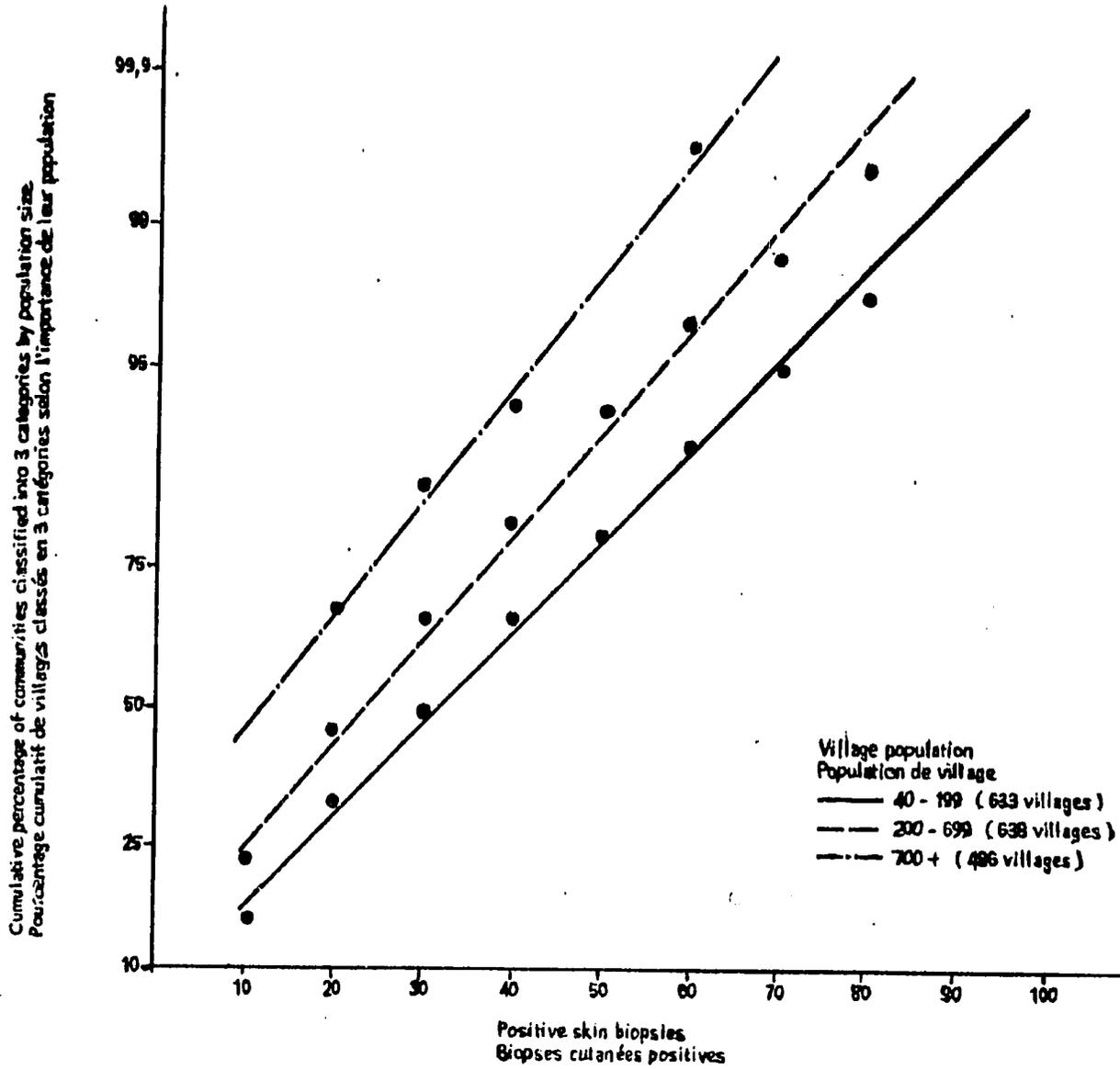
Outmigration and the progressive abandonment of villages are also documented for the Zebila area of northeast Ghana. In this region, there has been a continuous retreat of population from lowland areas to upland areas (Figure 6). This pattern of retreat is documented for other parts of the study area.

Infectivity gradients of onchocerciasis, prevalence of nodules in the skin, and the geographical associations between onchocerciasis and blindness and the pattern of village abandonment, all suggest that the disease is probably the prime cause of population retreat. As a result, the majority of these



ONCHOCERCIASIS-TUMU DISTRICT, NORTHERN GHANA. ASSOCIATION BETWEEN BLINDNESS RATE AND VILLAGE SIZE (77 VILLAGES; TOTAL POPULATION 22,706)
L'ONCHOCERCOSE DANS LE DISTRICT DE TUMU, GHANA SEPTENTRIONAL, ASSOCIATION ENTRE LE TAUX DE CECITE ET LA TAILLE DU VILLAGES (77 VILLAGES; POPULATION TOTALE DE 22,706 HABITANTS)

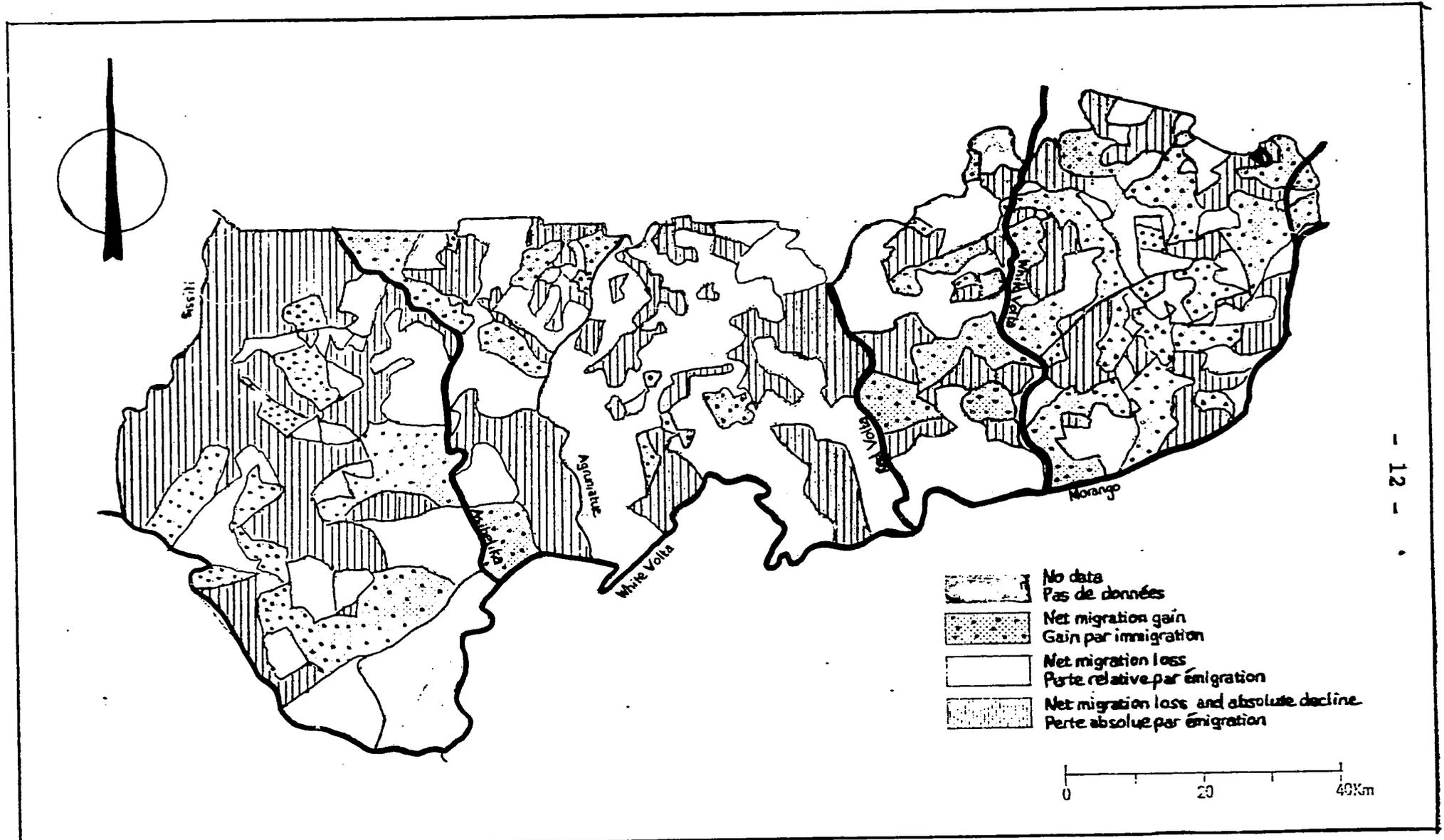
Figure 3



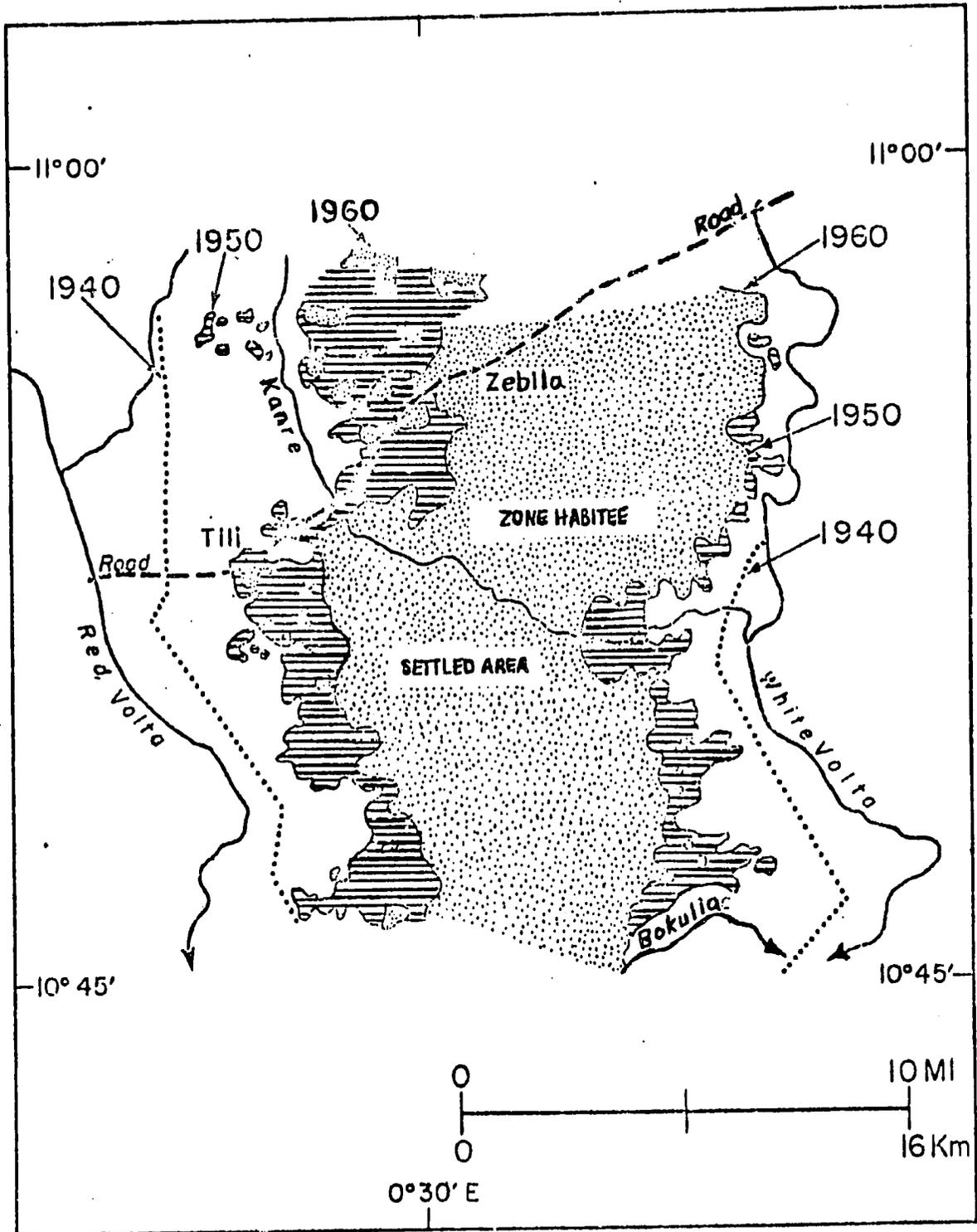
RELATIONSHIP BETWEEN POPULATION SIZE AND PREVALENCE OF ONCHOCERCIASIS. CUMULATIVE % CLASSIFICATION OF VILLAGES BY PREVALENCE OF ONCHOCERCIASIS (GAUSSO-LOGARITHMIC SCALES)
RELATION ENTRE LA TAILLE DE LA POPULATION ET LA PREVALENCE DE L'ONCHOCERCIOSE. FREQUENCE CUMULEE DES VILLAGES DE CHAQUE CATEGORIE EN FONCTION DE LA PREVALENCE DE L'ONCHOCERCIOSE

Figure 4

Figure 5



NET MIGRATION TRENDS IN THE DISTRICTS OF BAWKU, BOLGATANGA AND NAVRONGO, IN NORTH-EASTERN GHANA, BETWEEN 1940 AND 1960.
TENDANCES MIGRATOIRES NETTES DANS LES DISTRICTS DE BAWKU, BOLGATANGA, ET NAVRONGO, DANS LE NORD-EST DU GHANA, ENTRE 1940 ET 1960.



PATTERN OF POPULATION RETREAT IN THE ZEBILA AREA OF NORTH-EASTERN GHANA, BETWEEN 1940 AND 1960
ASPECTS DU RETRAIT DE LA POPULATION DANS LA REGION DE ZEBILA, NORD-EST DU GHANA, ENTRE 1940 ET 1960

Figure 6

out-migrants are concentrating on the upland areas and at the same time the younger, predominantly male population is migrating to the cities or plantations in search of job opportunities.

Forced outmigration of the young, male population has a negative effect on society: a) the ratio of males to females drops significantly; b) the proportion of the population in the labor force (working age) drops appreciably; c) the average age of the population increases somewhat; d) the proportion of work done by men over 60 increases; and e) the productive capacity of the family is seriously reduced. In essence, forced outmigration from river valleys to watershed areas places a burden on society and on the land that neither can support.

The upland areas are especially vulnerable to overpopulation (100 persons per km²) and intensive cultivation. In the Dissin areas of western Upper Volta, for example, the ecologically stable traditional agricultural system, a quasi-shifting principle of land rotation, has been changed to continuous cultivation, which rapidly depletes the soil. Villagers are locked into a "vicious cycle of agrarian poverty" that can only be broken by the addition of new land and increased productive capacity.

One first step which could help to reverse this downward

spiral into poverty is the eradication of onchocerciasis and S. damnosum in the study area.

2. Description of the Program

The West African Onchocerciasis Vector Control Program is a three-stage multidonor program designed to combat the disease and remove a formidable obstacle to socio-economic development in seven countries of West Africa, namely Upper Volta, Niger, Mali, Benin, Togo, Ghana, and Ivory Coast (Table I). It is a major international development effort, covering a huge land area, and with a time span of twenty years which is the length of time needed to ensure eradication of the vector. Apart from its humanitarian aspects, the program has the potential to bring into productive use large areas of relatively fertile valley land in the Volta River Basin which are presently underutilized or abandoned, primarily because of the prevalence there of the disease onchocerciasis, commonly known as "river blindness."

Onchocerciasis is a disease which is awful in its effect upon human life through its impact of misery and its impairment of capability. The objectives of the program are therefore both humanitarian and economic, and it represents a singularly important opportunity for positive intervention in development and, at the same time, a singular risk of environmental mismanagement because of the exceptionally large scale of its operation.

TABLE 1

Area and Population Covered By The Programme

Country	Total Area (km ²)	Area Covered By the Programme (km ²)	Estimated Total Population	Approximate Population in Programme Area
Dahomey	112 620	56 000	2 770 000 (1)	547 000
Ghana	238 377	98 000	8 546 000 (3)	1 600 000
Ivory Coast	333 270	110 000	5 100 000 (2)	1 000 000
Mali	1 204 000	125 000	5 300 000 (1)	1 400 000
Niger	1 187 000	17 000	4 000 000 (2)	90 000
Togo	56 600	18 000	1 956 000 (2)	555 000
Upper Volta	274 000	230 000	5 421 000 (1)	4 900 000
TOTAL	3 405 867	654 000	33 093 000	10 092 000

(1) 1971.

(2) 1970.

(3) 1970-71 census.

The total land area said to be heavily infested and covered by the program is about 700,000 km² and of this, some 65,000 km² can eventually be brought into productive use. This figure represents the total amount of valley land within the program area which is thought to be unexploited because of the disease. While in the past there seems to have been cyclical movements between the valleys and the uplands as people made difficult choices to bear either with the disease or the impoverished land, there is now ample evidence of retreat from the valleys in Ghana and in Upper Volta since the beginning of this century. Generally, residents on the Plateaux have experienced a reduction in farm area per family because of increasing population, a lowering of yields due to overcropping, and a reduction in work capacity and aging of the family due to outmigration of young people. Permanent and temporary migration from the whole region is also a feature of many of these countries.

The map (Figure 7) shows the extent of the program area in each of the seven countries. It lies within the savanna zone of West Africa (Figure 8), which is one of the worst infested regions of the world in terms of this disease and was therefore given priority when the Onchocerciasis Control Program began after the technological feasibility of large scale control had been affirmed in 1968.

The savanna zone is the part of West Africa which lies between the forest zone of the south and the desert zone of the north (latitude 8⁰N - 15⁰N). It is a region of low and erratic rainfall decreasing from south to north (1000 mms to 600 mms per year on

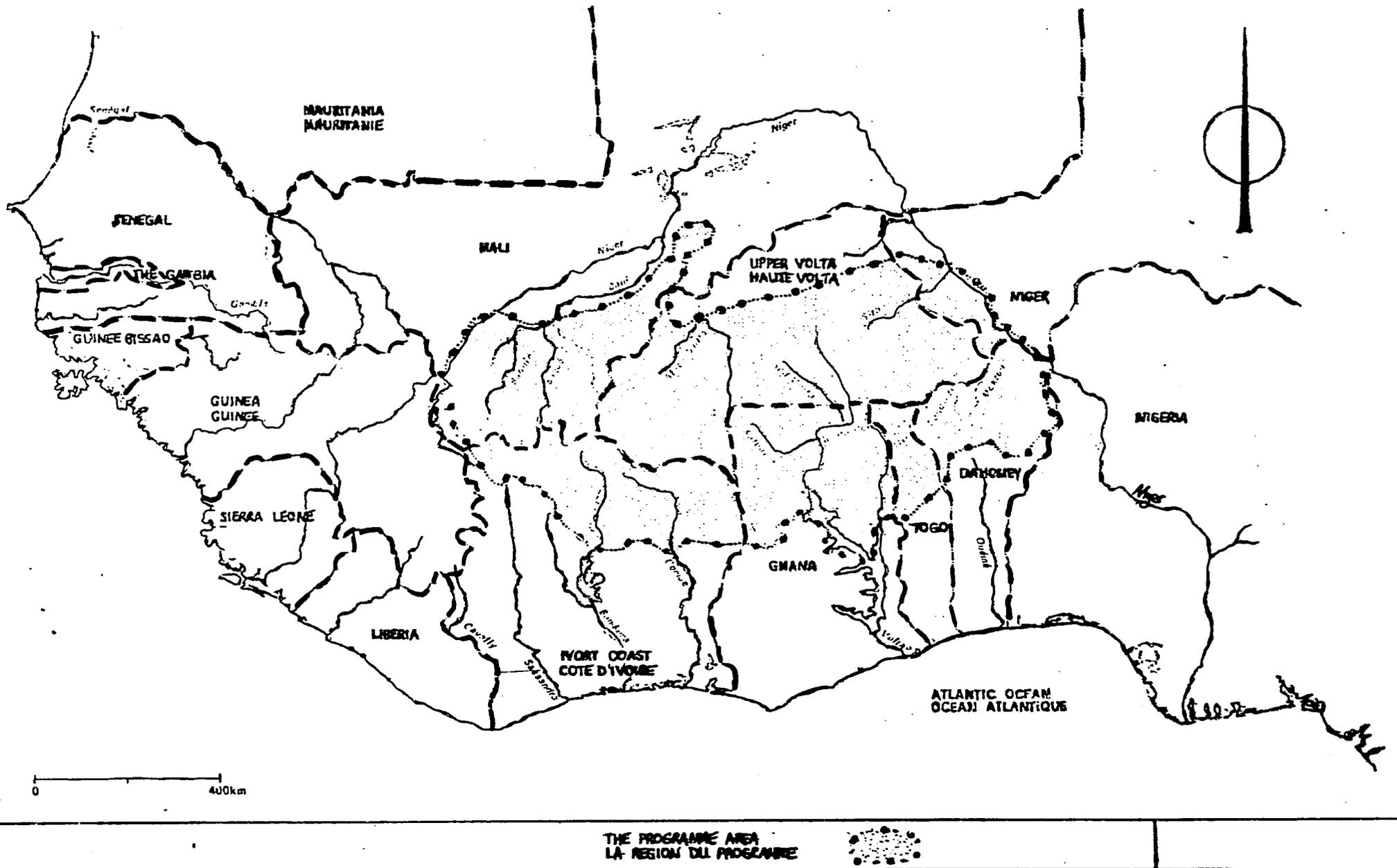
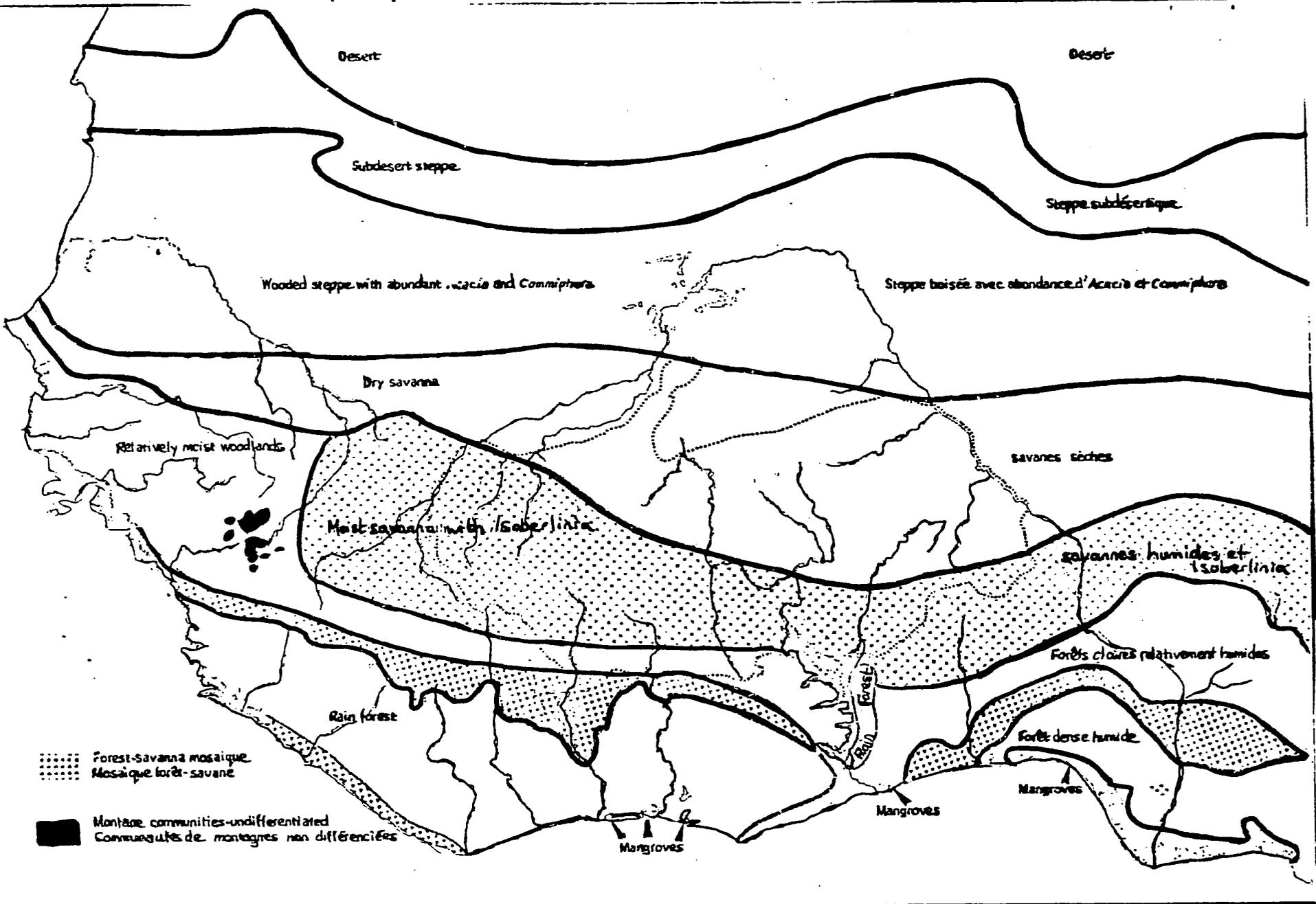


Figure 7



MAJOR ECOLOGICAL ZONES OF WEST AFRICA
 PRINCIPALES ZONES ÉCOLOGIQUES D'AFRIQUE OCCIDENTALE

Figure 8

average) which means that the vegetation cover likewise tends to decrease in that direction with local exceptions due to edaphic or site conditions. Trees become increasingly confined to the watercourses as one moves northwards and grasses become less luxuriant and less continuous in covering the ground. The rainfall is concentrated in the summer months, likely to occur sometime between April and October, but the length of the rainy season also varies a good deal from year to year and from place to place so that immense variation exists at any one time. It is difficult to predict and plan for, so that rainfed agriculture is a hazardous undertaking, while agriculture based upon the surface waters of rivers and lakes is also uncertain because of the large variations in volume and rate of flow of the rivers, few of which are perennial. Hundreds of small dams have been built during the last twenty-five years for agro-pastoral purposes and many more are planned.

Groups have developed sophisticated and intricate adaptations which have enabled them to manage in this uncertain environment over the centuries, based upon seasonal movements, integration of different local resources, and complementary exchanges of goods between different communities to ensure basic food supplies. The economies are agro-pastoral with animals and arable cultivation varying in importance among different ethnic groups.

The main food crops are cereals, mostly sorghum, millets and maize, with rice becoming a crop of increasing importance. Groundnuts and bambarra nuts are also important items in the local diets. Most basic food crops are grown on family farms or bought

or exchanged in local markets. Opportunities for the sale of cash crops are more limited than in the coastal regions. The chief export crops are cotton and groundnuts. Animals and animal products are traded within the region, particularly from the interior to the coast, and there are possibilities for expansion of this trade and for the improvement of stockrearing methods.

The savanna region of West Africa is one of the poorest regions in the world. The recent drought and the prevalence of major diseases in the better watered and more fertile valley lands has inhibited their use and contributed in large measure to the general poverty. Reclaiming these valley lands can therefore bring a major development opportunity to the seven countries concerned. In total, these disease ridden valleys are said to constitute one of the few last "frontier zones" for new settlement left in West Africa. Although population distribution is related to ethnic groupings in this area as well as to environmental factors, there is no doubt that the geographic pattern of retreat is strongly correlated with the pattern of incidence of onchocerciasis and blindness, suggesting that this is the prime cause of movement away from the valleys. An analysis of the epidemiological data shows also a strong negative association between village size and the prevalence of the disease, with the smallest villages having the highest percentage of infected people. Studies made in northeastern Ghana at localized sites show heavy migration away from the riverine settlements.

The method of disease control proposed for the project is destruction of the larvae of the black fly vector: Aircraft spray a chemical compound on the breeding places. The chemical apparently has no residual effects although periodic monitoring by hydro-biological studies is planned. The long life of the adult worm in the infected person means that a long control campaign is necessary. Spraying began in 1974 and reclamation of the cleared land is considered feasible some eighteen months after the spraying is done. This ideal, envisaged by the program planners, of planned, government controlled settlement to take place after an area has been declared medically safe, has become unrealistic in most areas because of the difficulty of stopping spontaneous movements which often start as soon as spraying begins. Such movements are a measure of the need for new land and the distress in the more crowded upland regions. Indeed some governments have moved ahead of the medical campaign and established settlements in anticipation of the elimination of the disease, treating people with chemotherapy as an interim measure, a strategy which is not feasible for the whole of the campaign area because of the difficulty of monitoring drug use.

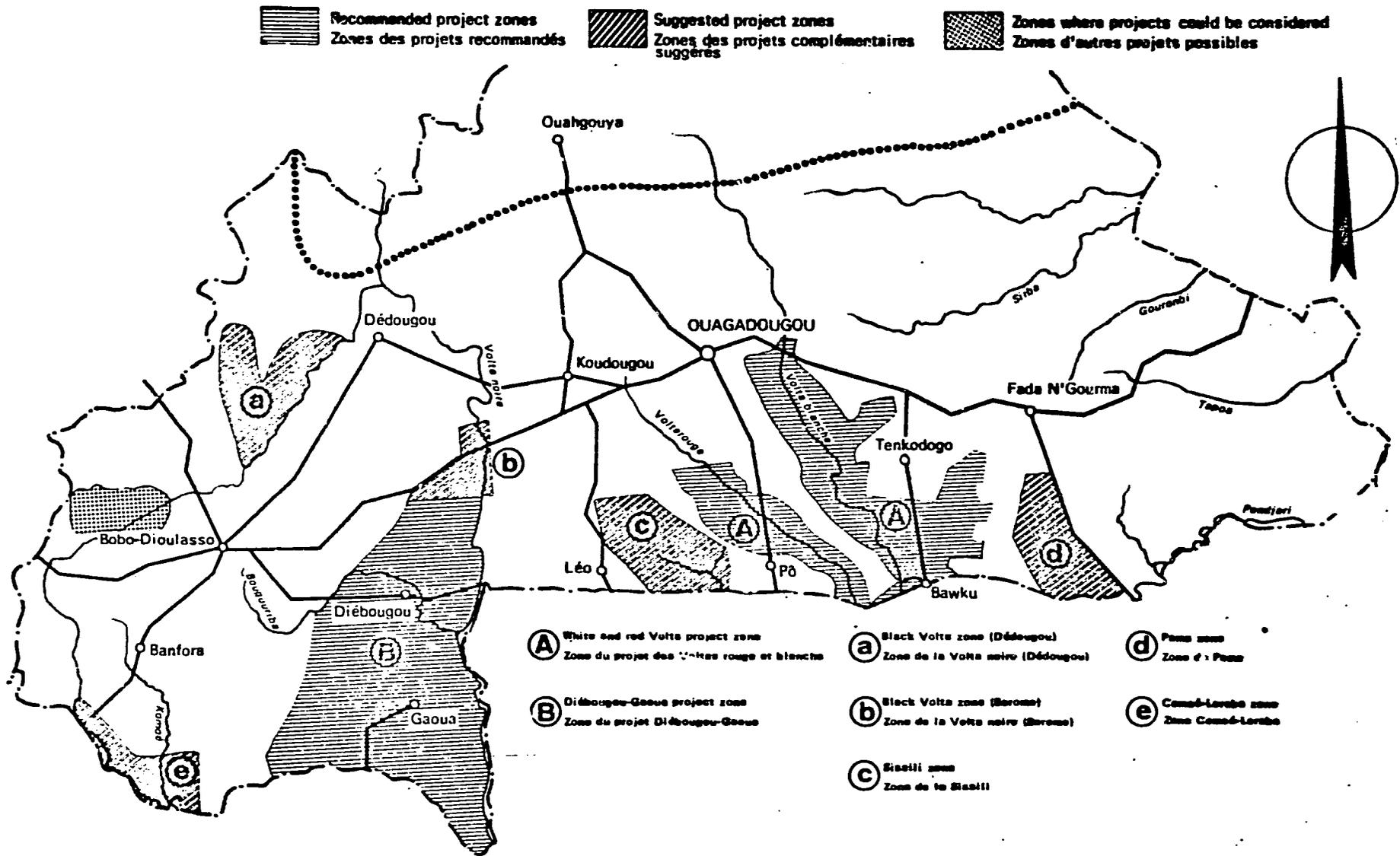
Resettlement of the land will bring many difficulties. Organization and structure for the production of food and cash crops differ from region to region and between ethnic groups. Aspects of rural infrastructure such as credit facilities, storage, and roads need to be developed to encourage production and facilitate distribution. Successful development may depend upon integration with other regional development activities and the provision of services by the regional administration.

To this end, sponsoring agencies have tried to establish a long term regional, coordinated approach to the economic development of the cleared areas. Accordingly, an Economic Development Unit was set up to coordinate policies and projects, with an emphasis on integrated rural development, the provision of infrastructure such as roads and wells, and the establishment of agricultural extension programs.

Five major zones were identified as the initial focus, two in Upper Volta and three others in Ghana, Togo, and Ivory Coast. In addition, five supplementary projects were identified. The whole area covered by these ten units amounts to about 12,000 km² which is a small part of the total valley land covered by the control campaign, but a large area to deal with on a planning basis. The five major zones were chosen because they were heavily infested valleys with good soils adjacent to areas of dense population. They are:

1. Red and White Volta area in Upper Volta
2. Black Volta area (Diébougou and Gaou districts) in Upper Volta
3. Bawku, Navrongo, and Bolgatanga, in N.E. Ghana
4. Korhogo and Niakaramandougou in Ivory Coast
5. Sansann and Mango area in Togo (See map- Figure 9)

The response of the individual governments to the international agency initiative in this respect has been slow. The biological control campaign has been accepted on a regional basis of necessity but economic development tends to be viewed more cautiously, and from a national stand. For this reason, and because of the spontaneous movements of people both into areas where some planning has begun but also into areas where no action has yet been taken



LOCATION OF THE PROPOSED ECONOMIC DEVELOPMENT PROJECTS
LOCALISATION DES PROJETS DE MISE EN VALEUR ECONOMIQUE SUGGERES

Figure 9

to deal with reoccupation, there has been a good deal of piecemeal development and events are moving ahead of any planned schedule. Consequently, opportunities to guide and influence the settlement and resettlement of people are being missed and there is a grave danger that environmental mismanagement may lead to wastage or poor utilization of this major new land resource. There is therefore an urgent need to devise operational strategies to deal with this colonization, preferably by taking advantage of the dynamic initiative shown by the new settlers and by devising rational inputs to assist them and to help them become more productive in the new environment. It is essential that a population distribution be attained which will preclude overuse of the land and prevent soil erosion problems. The present opposition shown to spontaneous settlers by the national governments is counter-productive and also creates problems with the international agencies.

The headquarters of the control campaign and of the economic mission is Ouagadougou, the capital of Upper Volta, in the center of the program area. There are four sponsoring agencies: UNDP, IBRD, FAO, and WHO, the latter being the executive agency. The management structure of the program is shown in the diagram (Figure 10). As can be seen, it is a complicated and wide ranging program involving many donors, many governments, many agencies, and many contractors and support services. While individual projects and operations are carefully costed and while attempts have been made to assess the benefits under various hypotheses, economic evaluation in any precise way is almost impossible on this scale. The justification for the program rests mainly on the case that incalculable

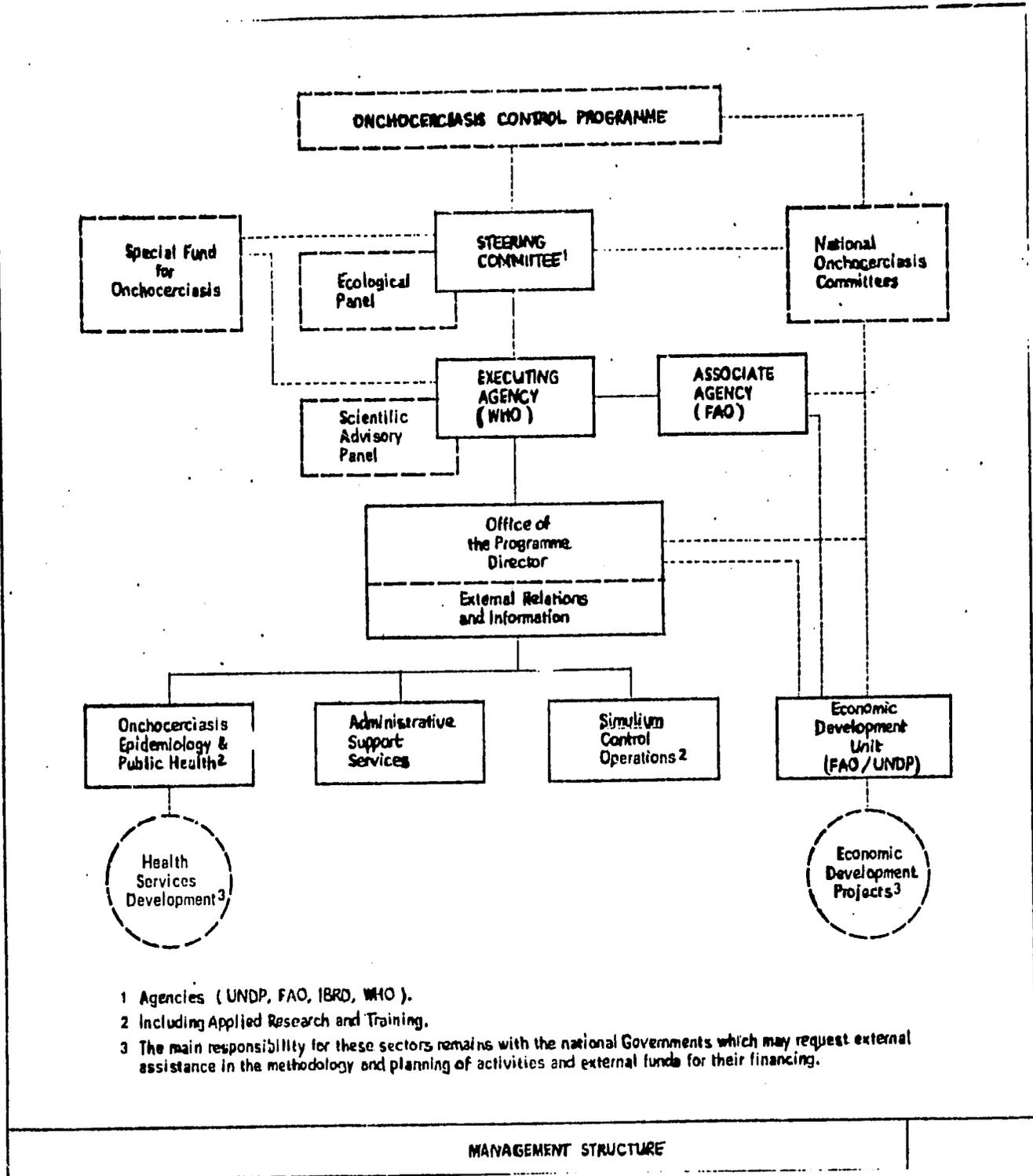


Figure 10

long term benefits will accrue that are both humanitarian and economic, which could not be funded by the host governments concerned. Many of these countries are among the poorest in the world and need donor assistance to finance their normal operating budgets and are in no position to fund even modest investment projects. The importance of the program may, however, be judged by the willingness of the international donor agencies to raise funds for it. It is estimated that the cost of the biological campaign is of the order of US \$120 million and the plans for the cost of development of 10 design zones in cleared areas, is of the order of US \$240 to \$300 million. A special fund has been created for the purpose, to be assisted by IBRD.

3. The Case Study: Upper Volta

Upper Volta is the country most seriously affected by onchocerciasis and by its economic effects. Of the seven governments, Upper Volta is most committed to systematic settlement and resettlement of the cleared areas. For this purpose, a special authority was set up, known as the AVV or Authority for Management of the Volta Valleys (Autorité des Aménagements des Vallées des Voltas). Although this was established by presidential decree in 1974, it had in fact been operating before this time in association with FAC (Fonds d'Aide et de Cooperation) and was staffed mainly by French experts. The general approach to recolonization of the onchocerciasis free zones is basically that of the FAC, central planning and tight supervision and control, with rigid criteria for the selection of settlers (based on age and number of active family members etc.) and with the authority retaining ownership of the land so that unproductive families may be expelled.

A multi-ethnic policy means that planners are faced with the problems of creating new social structures and new communities, described realistically in one report as "a formidable challenge to planners." They have to consider whether settlers are of the same religion and culture. In some cases these may be language barriers leading to distrust. If houses are being provided, dissatisfaction may arise due to different preferences in house styles. Even place names for new settlements have to be chosen carefully if farmers are to be made to feel comfortable.

All these problems can be intensified if there are some indigenous people already living in the resettlement area. New settlements become enclaves apart from the indigenous population. They can dispute ownership of the land; can be jealous if social services are provided solely for new settlers. In the long term, they may even be forced to leave. This is another reason why governments are so hostile toward spontaneous settlers, being concerned about possible poor interactions with existing peoples. Thus governments are trying either to expel the spontaneous settlers or absorb them into the planned schemes.

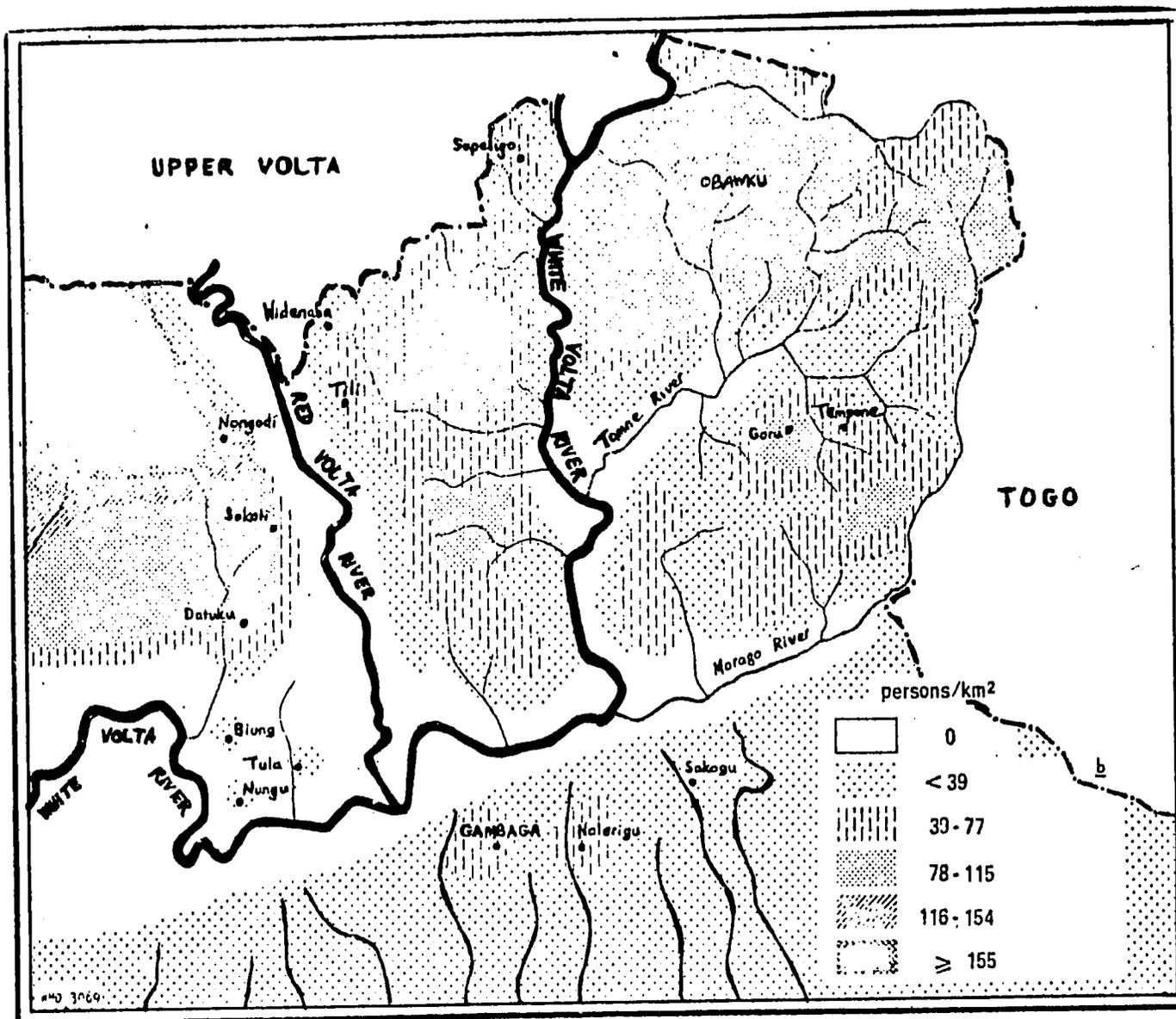
The policies and methods of the AVV are then completely contrary to the approach suggested by the Economic Development Unit of the PAG Mission (Preparatory Assistance Mission to the Governments of Dahomey, Ghana, Ivory Coast, Mali, Niger, Togo, and Upper Volta. WHO, Geneva 1973) which advocated for Upper Volta, government facilitated spontaneous migration, with an agricultural extension service installed to improve farming. This was recommended because these areas had been previously occupied and so spontaneous migration could be expected and predicted with some accuracy.

Once the disease factor is controlled, the Valley lands of the Volta basin represent the best natural resource base in the country with the possibility of increasing food production, cash crop production, and livestock rearing. It is estimated that the additional output of cereals, which could be expected, amounts to 250,000 tons and that this increase, added to present production, could satisfy 90% of the country's needs (PAG Report, 1973 - At present the uplands of Upper Volta face a food grain deficit of 50,000 tons per annum).

Completely uncontrolled and unaided colonization could lead to low level exploitation for lack of necessary inputs, lack of expertise in farming unfamiliar valley lands, and lack of access to markets. Low level exploitation could in turn lead to poor environmental management with possibly deleterious effects upon soil structures and water resources, particularly in the long term if demographic increase is taken into account. These are the basic problems facing any government concerned with the development of its cleared zones.

4. The Red and White Volta Settlement Zones

This is the region accorded the highest priority in Upper Volta by the PAG Mission and is the site of the first AVV settlements. (See Figure 11 for population density in this area). It is a large area of some 970,000 hectares of which at least one quarter is good arable land. Settlement began in four pilot areas: Linoghen, Kaibo, Mogtedo, and Bane. Families were chosen strictly on the basis of specific criteria. They had to have three active family members and to conform to required standards in respect of



POPULATION DENSITY AROUND THE RED AND WHITE VOLTA RIVERS (Taken from a map by Dr. K.R.S. Morris)

Figure 11

age, educational level or training level, and agricultural competence. The complementary inputs from the government are one hectare of land for the family house and vegetable plots, plus six or seven hectares of field land for crops, situated a short distance from the home in the planned village area. Seed, supplementary food for the first year, and medium and short term credit for the purchase of traction bulls and agricultural inputs such as fertilizer and insecticide, are given to each family. An "encadreur," or extension worker, is to be assigned to twenty families and the intention is that he will replace the traditional authorities for all social matters in the newly created village. The plan is to attempt to use relocation to break with the traditional practices.

The new villages are deliberately new social creations. Each will have 600 inhabitants and will be provided with one well, one school, and a structure for storage of food, crops, and machinery. Other government facilities will include roads and a dispensary per 14,000 people and a maternity unit per 40,000 people. Field trial stations for crop research and a seed multiplication center are also planned. Settlers are to be encouraged to raise a small number of animal for sale. Although tsetse is a hazard to the development of livestock in the Black Volta zone, it is less of a problem among the Red and White Volta lands.

There are also long-range plans to establish agro-industrial farms and ranches with the intention of, providing employment for young men aged 18-25, and limiting emigrations. These plans also aim to provide: a) a stable and sufficient production of certain industrial crops such as sugar cane, fibres for textiles and oil seeds; b) an improvement in the production of meat; and c) the training of young workers in agriculture and stock raising. Small

processing industries will also be established which will help the development of the community.

The planned external investments are thus of a high order per settler, and on top of those mentioned, there are also the pre-feasibility studies and mapping projects planned to take place before settlement actually begins. The intention is to locate the villages in accordance with a map of constraints based on soil, water, and topographical measurements. Two hundred and seventy five villages are planned for the next fifteen years. By 1975 there were fourteen villages in existence, equal to 463 families or about 3,500 people of which thirteen were in the White Volta area and one in the Red Volta (The Black Volta region is to be opened to settlement officially this year).

4.1 Present Situation and Emerging Problems

The biggest source for potential settlers is the Mossi plateau where population is estimated at a high (in terms of poor soils) 40 per km². Families are mostly composed of illiterate farmers who grow cereals, keep a few goats and sheep, and get meagre earnings from fishing or handicrafts. They also depend on remittances from family members who are absent migrant workers in the Ivory Coast or in Ghana.

A recent study of three villages (ORSTROM 1975) showed that per capita incomes were abysmally low, of the order of US \$14 per year for the estimated total income with cash income amounting to a negligible US \$2. Other settlers are recruited from Ouagadougou, Koupela, Kaya, Yatenga, Kondougou, and Sahel ORDS (Regional administrative units). In addition to the rigid criteria for selection, settlers are accepted on the promise that they will follow the AVV directions for

Although the terms of recruitment are clearly set out in the AVV and other documents, it has become clear to workers in the field that many settlers do not understand the terms of their agreement and that no contracts are signed. This is of special importance in view of the fact that they can be expelled from the schemes for non-compliance. It is reported that there are few problems in recruiting workers as recruiting agents are paid a bonus. However, all this may be nullified by dissatisfaction and disrupted by people leaving the scheme if some of the emerging problems are not tackled.

Present complaints center around the fact that the infrastructure in the new villages is as yet no better than in the old. Roads are reported to be poor, wells dry up before the rainy season begins, and there is an absence of some things which had been introduced earlier in the traditional villages, such as the grain milling machines, which the women had come to find very useful. Women were the ones to complain about lack of health care which they had been led to expect. They also complained that they were not allotted their own personal fields as had been customary in their home villages. Although these problems are being rectified other complaints arise over the heavy work involved in clearing the heavy valley soils. A very understandable source of worry to the settlers is the amount of debt they incur as scheme participants and the lack of alternative income sources with which to pay it should the crops fail. Plans are in hand to develop other employment opportunities, but there are few available at the present time.

All these complaints are basically reasonable and the settlers' anxiety understandable when considering what is being asked of them. Here we have a group of people with very low income, and a low expectation of future increases, suddenly being required to live in a new and very different environment, and one which they had in the past known to be unsafe because of disease. They are required to adopt new farming methods, new crops, and to use animal traction. They are asked to become involved in new credit and marketing arrangements, all of which are unfamiliar to them, and to assume debt burdens of about US \$500 which must seem like a fortune if we think of the total income of US \$14 per year given in the ORSTROM report in 1975. On top of all this, they are asked to live in close contact with other ethnic groups to form new social structures, and to accept a high degree of supervision and direction in their lives.

5. Environmental Impacts of Reoccupation

The agencies involved in the Onchocerciasis Vector Control Program envisaged a planned approach to reoccupation of the valley lands, on a long term, regional, basis, in order to maximize potential. Reoccupation was planned to begin some eighteen months after spraying. The policy was declared to be "integrated rural development" with basic infra-structure of roads and wells, credit facilities, and an agricultural extension service.

In many cases, however, notably in the Black Volta region but also in parts of the Red and White Volta Valleys,

settlement has taken place ahead of schedule. There has been spontaneous movement into:

- a) areas where no planning has yet been initiated
- b) areas where planning has started
- c) areas where spraying is not yet completed.

The major question is whether this spontaneous colonization has a different impact on the environment than that of planned reoccupation and planned settlement? What operational strategies are needed to deal with this colonization process and what inputs can help to protect the environment? In considering the environmental consequences of reoccupation of the valley lands, all kinds of planned and unplanned colonization would need to be taken into account.

5.1 Modes of Colonization

The first distinction is between planned and unplanned occupation, but within the planned category, the PAG Mission representing the agencies made a distinction between the re-occupation of abandoned areas where property rights were pre-determined, and settlement was of previously empty areas. It was recommended that repopulation of abandoned villages in the riverine areas should receive first priority. It was found that there was a "very positive attitude of local people of all types with entire compound families eager to reoccupy their ancient land" while attitudes to planned settlement in new areas was positive only in densely populated areas such as the Tiebele district, land scarce areas such as Manga and Zabre, and among the younger members of some families. In the Red and White Volta zones, however, the emphasis has been on settlement with a high degree of control and organization.

Three important modes of colonization exist:

- a) government planned and controlled settlement,
- b) government controlled re-occupation,
- c) Spontaneous, uncontrolled, movement.

An environmental assessment could usefully examine the implications of these three modes of colonization, and also the consequences in the home "source" areas of movements away. (Indicators of environmental distress there, such as the substitution of the less demanding millets for sorghum, falling yields, poorer grasses replacing more edible ones, etc. could be monitored.)

5.2 Common Environmental Problems

Although the emphasis here is on considering the impacts of different kinds of re-occupation, there are fundamental problems of settlement and re-settlement in a new environment which will be common to all newcomers and these are set out below:

- a) different soils, mostly heavier clay soils which are more difficult to clear and to work,
- b) different types of vegetation to clear,
- c) different animal populations which could mean new pests to threaten crops as well as health. Tsetse fly, for example, is common,
- d) new problems of water management and flooding,
- e) new micro-climates affecting health as well as farming,

- f) new accessibility or possibly less accessibility to markets affecting crops grown, standard of living, etc.,
- g) new potential for different crops. However, where new crops are introduced, traditional crops may continue to be grown regardless of the suitability of soil or slope, because traditional crops are essential to local diets.

5.3 The major differences between planned and unplanned colonization are listed below, and it is clear, a priori, that these will have different impacts on the environment, so that the questions relate to how? and where? and in what combination? and what policy implications arise?

A. Planned

1. Controlled numbers and controlled family size, predictable effects,
2. Planned tenure system,
3. Decision making controlled externally to family,
4. New farming systems (imposed and regulated).
5. New crops with new soil and water requirements also leading to changes in soil composition,
6. New techniques of cultivation including irrigation and use of animal traction. Problems with tsetse. Need for fodder crops,
7. New social organization and arrangements, some institutionalized as part of the scheme but others

resulting from necessary changes where previous arrangements broken by movement away, e.g. where family cattle are entrusted to care of another adjacent group,

8. New outlets for production leading to new resources of cash and these in turn can affect inputs into the farm, e.g. fertilizer,
9. Use of fertilizer and insecticides in farming operations,
10. Different work patterns for labor, different seasonal demands, and the effects of these on land use.

In the planned settlement areas there is a deliberate policy of working towards the establishment of communal village with mixed ethnic composition, aimed at encouraging open attitudes to other innovations. The issue of conflict and/or cooperation therefore arises.

B. Unplanned

1. Uncontrolled numbers and a variety of family size, with estimates for different groups ranging from 7/8 to 30 on one family farm. More social surveys are required as present data are insufficient,
2. Tenure system varying according to group, variety of farm sizes,
3. Decision making largely unknown, presumed variety of goals and practices,
4. Farming systems likely to adhere to known ways and correspond to habit and need, but research needed here,

5. New crop potential but is it used?
6. New techniques possible, are they used?
7. What breaks in traditional social arrangements accompanied move?
8. New outlets for production may arise in regions where infrastructure improved in connection with planned schemes but the questions relate to how this can be used,
9. Effect of contact with schemes on fertilizer use,
10. Changes in work plans and labor needs related to new soils and difficulties in working them.

Presumably there is more variety of systems in the un-planned areas of colonization, though in all cases social variables will have an impact on the planned schemes and through this on the environmental factors. Much more research is needed and some of the exploratory social surveys produced conflicting evidence for lack of a real comprehensive survey. The number of migrant workers per family unit for instance is important in terms of number of "present" active members and also in terms of cash availability to household and for farming inputs. The degree of integration between local communities and the regional and national system is also a relevant factor in considering both food and cash crops, i.e. how isolated or how self-sufficient is the local community? And what is the relevant entity then for the study of environmental impacts? Whose environment?

Turning more particularly to the environmental impacts, these may be categorized as:

- a) Positive or negative,
- b) Primary, secondary, or sequential,
- c) Intended or unintended,
- d) Reversible or irreversible,
- e) Affecting the vulnerability of systems,
- f) Short term or long term efforts.

The essence of the methodology suggested here is to look for environmental impacts in terms of process and change. The way communities interact with and affect their physical environment is a matter of choice as well as constraint, and these effects are complex and dynamic. They can only be properly understood in terms of social and physical systems. Therefore the headings set out above are no more than guidelines for considering what aspects of the social systems, represented in this case by the different ethnic groups and the mode of re-colonization, are important in affecting the physical environment. They are not categories into which the various factor variables can be separated.

6. Availability of Data for Case Study Area

Red and White Volta Valleys

Settlement has begun in:

Linoghen

Kaibo

Mogtedo

Bane

Existing data

1950's Air photos 1:50,000 (evidence of past land use)

1960's Air photos done by IGN for road construction
and soil surveys. 1:10,000 and 1:30,000

1970's Air photos, panchromatic and infra red. 1:20,000
to 1:50,000 and 1:100,000 IGN and Kenting of Canada

Landsat study proposed to begin 1976-77

Land use and land suitability surveys proposed with
data mapped on scale 1:200,000

ORSTROM Climatic data since 1920 (4 stations in the
West African oncho area)

Monographie Hydrologique gives hydrologic data
for the Volta basin

Soil maps

1:500,000 whole country

1:50,000, 1:100,000, 1:200,000 some areas

1:5,000, 1:10,000 and 1:20,000 for a few areas (AVV)

Ground water surveys by consulting firms:

BURGEAP, SOGETHA, SCET, BRGM (well description,
population served, village surveys). Areas not
covered, Oradara, Bobo-Dioulasso, Banfora, and Gaoua

ORSTROM Milieux Ruraux Mossi Aspects Economiques, 1975

Information Sources

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USAID Project Paper 625-11-190-912 Regional Onchocerciasis-Free Area Planning, 1976.

USAID Project Review Paper 686-0203 Oncho-area Village Development Fund. Upper Volta 1975.

USAID Project Paper 686-0212 Oncho-Areas Village Development Fund 1975.

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Horowitz M. Disease Control and Human Settlements.

LOGICAL FRAMEWORK

Project Title: Resettlement of Onchocerciasis Controlled Valley Areas in Upper Volta

<p><u>NARRATIVE SUMMARY</u></p> <p>Program or Sector Goal. The broader objective to which this project contributes (A-1)</p> <p>Eradication of onchocerciasis</p> <p>The establishment of new settlements in seven countries of West Africa in areas cleared of onchocerciasis.</p>	<p><u>OBJECTIVELY VERIFIABLE INDICATORS</u></p> <p>Measures of Goal Achievement (A-2)</p> <p>Disease being eradicated. Newly established settlements becoming access-fully integrated communities socially and economically</p>	<p><u>MEANS OF VERIFICATION</u></p> <p>(A-3)</p> <p>Detailed studies of the villages and health surveys to be undertaken regularly to determine progress.</p>	<p><u>IMPORTANT ASSUMPTIONS</u></p> <p>Assumptions for achieving goal targets (A-4)</p> <p>Infrastructure - e.g. roads, markets, health services and schools will be provided.</p> <p>Stable political and economic conditions will prevail during the life of the project. Settled areas will have been cleared completely of onchocerciasis.</p>
<p>Project Purposes (B-1)</p> <p>To Reduce Outmigration.</p> <p>To halt soil degradation and increase production on the plateau by relieving population pressure through establishment of controlled settlements in cleared valleys.</p> <p>To increase output of food and cash crops and raise individual farm incomes</p> <p>To provide agricultural extension services through encadreurs who will also make social decisions for the community then serve.</p>	<p>Conditions that will indicate purposes have been achieved (B-2)</p> <p>THRIVING COMMUNITIES WHERE</p> <p>(1) Production and marketing run smoothly</p> <p>(2) Social integration has taken place</p> <p>(3) Social welfare needs are catered for.</p> <p>Additional output of cereals of 250,000 tons per annum (estimate).</p> <p>Individual farm income to rise from \$124 p.a to \$416 p.a.</p>	<p>(B-3)</p> <p>Periodic evaluation of both newly settled areas and plateau regions through</p> <p>(1) Sample soil surveys and sample water/water quality surveys</p> <p>(2) Case studies of villages looking at agricultural production and marketing, use of social services, employment, traffic flows.</p> <p>(3) Questionnaires - to gain villagers view of their environment.</p>	<p>Assumptions for achieving purposes (B-4)</p> <p>(1) Sufficient people will be willing to move back to the valleys</p> <p>(2) Prices for farm produce will remain the same despite changes in volume of production</p> <p>(3) There will be no re-occurrence of onchocerciasis</p> <p>(4) Social integration of different groups in new settlements will take place without conflict</p> <p>(5) Density of population and desired size of holdings will be adhered to - to avoid degradation of newly settled areas</p> <p>(6) Sufficient investment will be available to provide employment for all settlers</p> <p>(7) Population movement will be controlled - not spontaneous</p> <p>(8) Regional administrations will be able to cope with additional services needed</p> <p>(9) There will be no resistance to transferring social leadership to encadreurs.</p>
<p>Project Outputs (C-1)</p> <p><u>Institutional Infrastructure</u></p> <p>Establishment of Marketing systems, organization of health services and schools</p> <p>Training of farmers by encadreurs</p> <p><u>Physical Infrastructure</u></p> <p>Building or rebuilding of villages. Installing roads, water supplies and social service buildings. Establishment of farm support systems.</p>	<p>Magnitude of Outputs (C-2)</p> <p>250 wells</p> <p>250 schools</p> <p>10 dispensaries</p> <p>4 maternity units</p> <p>100 encadreurs trained</p> <p>1 seed multiplication center</p> <p>field trial stations</p>	<p>(C-3)</p> <p><u>Institutional Infrastructure</u></p> <p>Progress reports from institutional officers</p> <p><u>Physical Infrastructure</u></p> <p>Technical reports of UNDP/IBRD/FAO/WHO.</p>	<p>Assumptions for achieving outputs (C-4)</p> <p><u>Institutional Infrastructure</u></p> <p>(1) Marketing systems can be imposed and organized from above</p> <p>(2) Farmers will accept help and advice from encadreurs</p> <p>(3) Social services will be used at predicted level.</p> <p><u>Physical Infrastructure</u></p> <p>Roads, wells, schools, dispensaries, farm support systems will be provided before settlement begins.</p>
<p>Project Inputs (D-1)</p> <p>Technical assistance</p> <p>Farmers training</p> <p>Physical infrastructure</p> <p>Institutional infrastructure</p> <p>Program administration</p>	<p>Implementation Target (Type and Quantity) (D-2)</p> <p>\$48.8 million</p> <p>(Figures not available on breakdown).</p>	<p>(D-3)</p> <p>UNDP/IBRD/FAO records and reports</p> <p>But particularly W.H.O. Records and reports.</p>	<p>Assumptions for providing (D-4) inputs</p> <p>Funds and personnel available in a timely manner</p> <p>Participants available and able to move as requested</p> <p>Onchocerciasis teams have completed clearance of valley areas.</p>

2. Logical Framework

Program Goal

The program goal is the settlement and socio-economic development of a 655,000 km² area in the Volta River Basin of which approximately 65,000 km² are abandoned valleys with relatively fertile soils. This region stretches from the banks of the Niger River near Bamako, Mali on the west to the Nigeria-N. Dahomey border on the east and from approximately 8° latitude in the south to a line from Bamako to Niamey (approximately 13° latitude) in the north. A number of major valleys are uninhabited in this region due, research indicates, to the heavy infestation of river blindness (onchocerciasis) which causes severe debilitation and, in many cases, blindness. After years of study which culminated in the 1973 WHO/FAO report - Control of Onchocerciasis in the Volta Basin Region, and years of research, which led to the development and successful testing of an ecologically-safe larvicide to control black fly larvae - Abate - the Onchocerciasis Vector Control program was initiated in 1974. The goal of the multi-donor program is the same as the AID program goal - the settlement and socio-economic development of the abandoned valleys in the Volta River Basin. WHO progress reports to date indicate that the vector control program has been enormously successful in decreasing the number of onchocerciasis-carrying black flies in the area where spraying has been initiated.

Indication of Goal Achievement

1. Settlement/repopulation of 600,000 - 1,000,000 people in the deserted valleys of the major economic development project areas. Most immigration will flow from densely populated plateau areas nearby, such as the Mossi Plateau in Upper Volta, the Bolgatanga-Bawku-Navarro area of N. Ghana, and the Korhogo area of the Ivory Coast. As a result there will be decreased population/land pressure in these areas and subsequently an opportunity for increased agricultural production in the out-migration areas.

2. Annual agricultural production of 355,000 tons of sorghum, millet, maize, rice, cotton, groundnuts and sesame in the Volta valleys. Studies indicate that soils in the uninhabited valleys of the Volta Basin are generally of high quality and under careful exploitation could significantly increase the total food production of this region, which has been severely affected by the Sahelian drought.

3. Government services provided to support the social and economic development of the population of the valleys. Basic government services must be extended into the Volta valley areas in order to attract migrants and to ensure balanced development of the area. This will involve, in most cases, a major extension of already weak government social and economic services and a further

dispensation of the scarce financial and human resources of government service organizations. Provision of basic services will certainly require major donor assistance.

4. Minimal social/cultural conflict among migrants moving into the onchocerciasis-free zones. Social/cultural harmony between ethnic groups migrating into the resettlement zones is essential to sound exploitation of their economic potential. In zones which have not been inhabited in recent memory, conflicts may arise between ethnic groups competing for dominance in a new region. In zones which have been abandoned over the past 30-40 years, tribal land-use rights often still exist and the government must negotiate compensation for land expropriated to accommodate settlers from other ethnic groups. Minimal social/cultural conflict in the onchocerciasis-free zones will be a basic indicator of goal achievement.

Goal Assumptions

1. Onchocerciasis is the relevant factor in the abandonment of fertile river valleys in the Volta Basin. Private and public (WHO, FED, FAO) research over the past ten years strongly suggests that river blindness is indeed the cause of the progressive abandonment of the Volta valleys. Using techniques as varied as oral history and regression analysis, researchers have presented evidence which seems to conclusively indicate that out-migration has increased in direct proportion to the density of black flies and the incidence of onchocerciasis in the valleys studied.

2. Families can be induced to occupy the fertile valleys. Heavy migration into the Volta valleys, once they are freed of onchocerciasis, appears likely; but migration patterns will probably vary, based on ethnic attitudes towards migration and resettlement. In several affected areas, such as the White Volta in Upper Volta and the Bandama valley in the Ivory Coast, migrants have already begun to move into the environs of the valleys awaiting termination of the well-publicized spraying campaigns. Where high population density in nearby areas is coupled with positive attitudes towards resettlement, especially among the young, rapid migration into the Volta valleys seems assured. Where areas surrounding the valleys are sparsely populated, such as Southwest Niger, and northern Benin, major resettlement schemes may be less feasible and certainly will require detailed study.

3. Sufficient donor and participating government monies will be available to fund development projects. As noted above, preliminary estimates (1973) placed the capital cost of developing seventeen resettlement schemes in the Volta valleys at between \$240-300 M.

Most of the participating governments have never been able to fund an Investment Budget (which is usually funded by donor project investments) and many require donor assistance to balance their Operating Budgets. The Sahelian drought has further reduced the capability of governments such as Mali, Upper Volta, Niger and Dahomey (all are also MSAs) to meet the investment requirements for developing

the onchocerciasis program area. Development of these Volta valleys will, therefore, depend largely on the largess of the donor community which, given the ease with which funds have been raised for the Vector Control program (\$53 M. from 18 donors), apparently has been convinced of the opportunity which development of the Volta valleys affords.

Project Purpose

The purpose of this project is to assist in the timely preparation of realistic, innovative plans and projects for the development of the onchocerciasis-free zones - plans and projects which emphasize the improvement of productivity and the standard of living of the poor majority. The key words in the purpose statement are "timely" and "innovative". AID assistance must be sufficiently "timely" and flexible to ensure a rapid response to the planning needs of participating governments as they become apparent during the planning process. AID funding of the Landsat study will ensure a comprehensive data bank essential to high quality macro-planning of the economic development of the oncho areas. AID assistance should also encourage innovation in planning the development of the onchocerciasis-free zones. AID funds will provide the financial margin for fuller, more detached studies of opportunities for innovative solutions to basic problems affecting the onchocerciasis zones collectively and individually. AID assistance will also encourage the development of projects which select the rural poor as a target group and are designed to improve their productivity and standard of living. AID will undertake feasibility and design studies only in zones where it is apparent that the primary beneficiaries will be the rural poor rather than large land holders or government parastatal organizations.

End-of- Project Status

1. A comprehensive basic data bank will be available for use in Upper Volta, Ghana, Benin and Mali (the latter via the bilateral Mali Land Use Inventory project).
2. Areas where major U.S. capital assistance will be channeled will have development projects which reflect AID priority concerns. AID capital assistance will probably be concentrated in 2-3 major resettlement zones where AID is the primary donor (e.g. Eastern Ord, Upper Volta region of Upper Volta, Northern Togo) and in 2-3 additional zones where AID is one of several donors.
3. Options for dealing with major issues in design of onchocerciasis-free development projects carefully researched and results communicated to government planners. The large-scale development program in the onchocerciasis-areas provide an extremely valuable opportunity for developing and testing new approaches to integrated rural development projects and for testing innovative solutions to major problems common to the area. It is anticipated that 4-6 major problems - such as the provision of basic low cost health or education services to resettlement

areas - will be addressed during the course of the project and that study recommendations will be incorporated into investment programs for the onchocerciasis zones.

Purpose Assumptions

1. IBRD, UNDP and other donor funds are sufficient to complete the elements of the IBRD/FAO methodology which will not be funded by AID, but which will complement AID assistance. UNDP has provided \$500,000 per country for oncho-area planning. The IBRD plans to provide funds to Ghana, Mali, Upper Volta and Benin for social and economic studies and long-term tech assistance (to prepare 10-year development plan) in the near future. The Ivory Coast, Togo and Niger have not requested additional assistance for oncho planning.

2. Participating African Governments will place priority on equitable distribution of onchocerciasis program benefits. Evidence to date indicates that this assumption is valid with two possible exceptions. Contrary to the basic (but non-binding) scenario for developing the onchocerciasis zones suggested in the FAO/WHO PAG report (major project benefits to small farmers moving into onchocerciasis-free zones) the Ivory Coast and possibly Togo seem to favor exploitation of the onchocerciasis-free zones by large-scale private or parastatal organizations. Other participating governments have clearly given priority to a more equitable distribution of program benefits.

3. AID willing to commit substantial capital resources for implementation of some aspects of onchocerciasis-free development projects in several countries. The ROAP assumes AID willingness to commit major capital resources for development of the onchocerciasis-free zones and is designed to facilitate AID capital investment through intermentions in the planning of onchocerciasis-area development. The approved CWR DAP recommended \$24-30 M. AID investment in the onchocerciasis free zones over the next 15 years. Therefore, this assumption, barring a major reversal in AID planning or in the fortunes of the Onchocerciasis Vector Control Program, must be considered valid.

Outputs

1. LANDSAT study-information for data bank

a. present land use land use maps at 1:200,000 with overlays for each main land use category

- b. land suitability land suitability maps at 1:200,000, soil resources classified in accordance with their use and productive capacity and ranked in order of the combined economic and social benefits that would accrue as a result of their exploitation
- c. climate description of the climatological characteristics, relationship between weather and yield potential
- d. ground water info on potential ground water sources, water exploration guides
- e. surface water info on existing bodies of surface water, their variation by season. location of existing wells

2. Completed studies which deal with innovative alternatives to basic problems of integrated rural development projects in onchocerciasis free areas. It is anticipated that 4-5 major studies of this nature will be carried out. The studies in some cases (e.g. the control of bilharzia in onchocerciasis settlement zones) will be region-wide in scope and in other cases (e.g. attitudes towards migration to resettlement zones in Ghana) may be national in scope.

3. Completed feasibility and design studies for potential long-range AID capital investment.

Output Assumptions

1. Participating African Governments will request U.S. assistance in planning development of onchocerciasis-free zones. To date, several participating African Governments including Togo, Ivory Coast, Niger and Upper Volta have requested initial U.S. assistance for planning development of onchocerciasis-free zones. Ghana has expressed interest in U.S. assistance but has only recently organized its onchocerciasis-planning unit. Dahomey and Mali have not yet requested AID planning assistance except for the Landsat study.

Inputs

	FY 76	Interim Quarter	FY 77	FY 78	TOTAL
1. LANDSAT study	1,000,000				1,000,000
2. Problem-related studies 4 @ \$100,000		215,000	335,000		550,000
3. Feasibility & Design Studies 4 @ \$100,000			400,000		400,000