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MINISTRY OF PLANNING, STATISTICS AND ECONOMIC ANALYSIS

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VOLUME 1

BACKGROUND - METHODOLOGY

**SOCIO-ECONOMIC PROJECT FOR THE
DEVELOPMENT
OF
ONCHO-FREE AREAS**

**CENTRAL BUREAU FOR PROJECTS
B.P. 2022 - COTONGU
PEOPLE'S REPUBLIC OF BENIN**

**MULTINATIONAL AGRIBUSINESS SYSTEMS, INC.
1401 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22209**

1980 - 1983

PROJECT PERSONNEL

BUREAU CENTRAL DES PROJETS

MULTINATIONAL AGRIBUSINESS SYSTEMS INC.

QUESTIONNAIRES DESIGN

MIDINGOYI Soulé, Agro-economist
Project Co-director
HOUSSOU Grégoire
Statistician-Demographer
AKLAMAVO Michel
Agro-economist
AHOUANSON Théophile
Agro-economist
AVIMADGE Maxin
Epidemiologist
EHOINSON Marcelin
Zoo-technician

Dr Bernard L. DELAINE, Sociologist
Chief of Party
Dr Gerald P. OWENS, Agro-economist
Director

FIELD WORK

MIDINGOYI Soulé
HOUSSOU Grégoire
AKLAMAVO Michel (Part-time)
AHOUANSON Théophile (Part-time)
AKPODJI Cosme (Part-time)
MONGBO Cosme (Part-time)

Dr Bernard L. DELAINE
Charles K. DANA
(Short-term consultant)

REPORT PREPARATION

MIDINGOYI Soulé
HOUSSOU Grégoire

Dr Bernard L. DELAINE
Gaylord L. WALKER
(General supervision)

We would like to thank all those who participated in this project in particular the Beninese professionals who contributed efficiently to its success. Also our thanks extend to the 120 field enumerators, the 22 controllers and the 60 base line data analysts in Cotonou.

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GENERAL OUTLINE OF THE SOCIO-ECONOMIC STUDY FOR THE DEVELOPMENT
OF ONCHOCERCIASIS FREE AREAS

VOLUME 1:	General information - Methodology	
VOLUME 2:	Socio-demographic data.	ATACORA
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VOLUME 1

GENERAL INFORMATION - METHODOLOGY

I. PRESENTATION OF THE PROJECT

A. General Framework

The Socio-economic Study Project of Onchocerciasis-free areas, directed by the Central Projects Office, is part of a broader regional planning project for the elimination of onchocerciasis involving seven countries of West Africa (Benin, Ivory Coast, Upper Volta, Mali, Ghana, Niger and Togo). The technical assistance for this project has been entrusted to Multinational Agribusiness Systems Inc. (AID Project no. 698-0416). This is only the second phase of the participation of AID in a regional program covering three phases and centered around multilateral aid aimed at eradicating onchocerciasis and promoting the planning and economic and social development of those regions.

The first phase, which is expected to cover a period of 20 years, was started in January 1974. It consists of a systematic struggle against the insect which is the vector of onchocerciasis in the seven countries affected. Onchocerciasis prevails, indeed, endemically throughout Benin, but the regions that are most afflicted are the two northern Provinces of ATACORA and of BORGOU. Those Provinces are inhabited by only one fourth of the population of the country, although they cover two thirds of its area and include some of the regions that are the most suitable for agriculture and animal production.

The region initially targeted for the elimination of the vector of the disease, the "similium damnosum" fly, extended to the north of the 10th parallel, that is to say only the northern part of the Provinces of BORGOU and ATACORA.

This region includes:

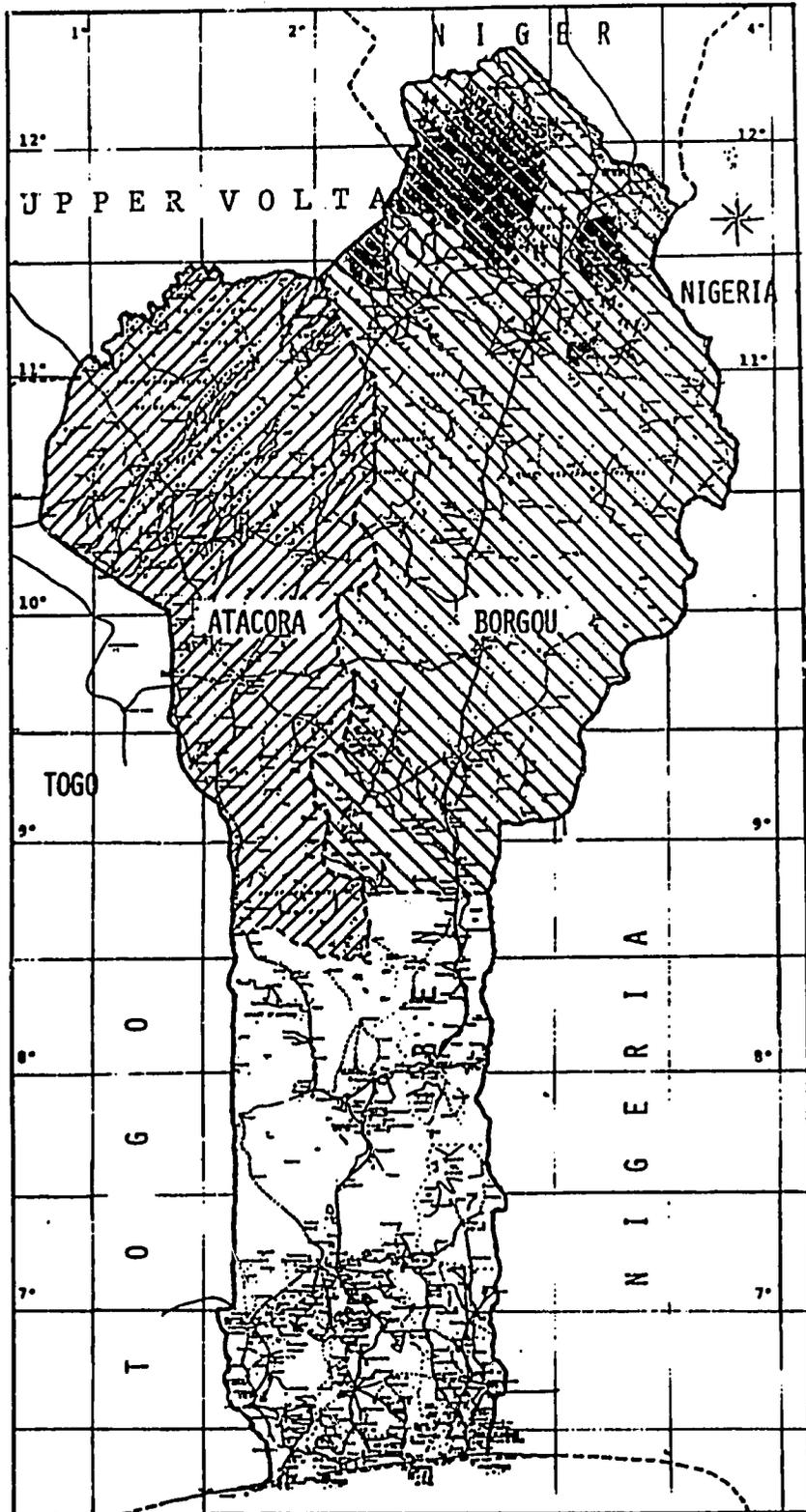
- the basin of the Pendjari composed of the river of the Pendjari and its affluents, the Mékrou and its affluents,
- the vast plains of the Niger basin, including its three major rivers, the Mékrou, the Alibori and the Sota and their affluents.

Studies showed, however, that 50% at least of the persons infected by the fly were living in the Districts of NIKKI, PARAKOU, DJOUGOU and BASSILA. Therefore, the Government of Benin requested that the onchocerciasis control program be extended to 8° 30 North, which touches the southern borders of the Provinces of BORGOU and ATACORA.

This study is part of the second phase. The second phase consists in aid to the participating African countries aimed at the development of their regions that are free from onchocerciasis. This is to be done over three stages:

- a) the establishment of an information base or data bank,
- b) the use of this information to prepare ten-year development plans for the regions that are free from onchocerciasis,

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The Two Northern Provinces of Benin



- c) the identification and the preparation of a certain number of specific investment projects in the onchocerciasis-free region within the framework of the development plans.

The third phase projected calls for financial investments with appropriate technical assistance needed to exploit the development plans in the selected onchocerciasis-free regions.

The first stage of the second phase, that is to say the establishment of a data bank, is subdivided itself into three substages.

- 1) Study of the soils and rainfall, based on aerial photography. The mosaics are 1/50 000 for the two Northern Provinces. This project is financed by the United Nations Development Program (UNDP).
- 2) A Landsat-based study, financed by USAID and administered by the African Development Bank.

This study combines satellite images and on-the-land verification. It made it possible to obtain data on rational utilization of the land, climatology, surface and groundwater resources, geological and mineral resources, the infrastructure and potential of agriculture and animal husbandry. However, these data obtained within the framework of the LANDSAT study have to do in particular with the physical resources of the regions free from onchocerciasis and have to be complemented with information on the socio-economic characteristics of those regions. The specific objective of this study is to encourage the exploitation of all of the natural resources of the region, such as minerals, animal husbandry, water and forests and fishing. This study should therefore

serve as a basis for the implementation of a number of measures aimed at the development of the two Provinces of the North.

- 3) A socio-economic study of the two Provinces of the North of Benin and is financed by USAID. Its specific objective is to collect, analyze and evaluate the economic and social data that could help the authorities of Benin to establish a data bank upon which would be based in the future the planning and the development of the Northern Provinces of ATACORA and BORGOU.

These studies as a whole, which are financed by the UNDP and USAID, should therefore comprise a data bank that can be used as a basis for preparing a development strategy as well as investment studies for onchocerciasis-free regions.

B. Terms of Reference

1. Objectives of the Project

The contract between the Government of the People's Republic of Benin and Multinational Agribusiness Systems Inc. concerning the technical assistance to be provided to the Central Projects Bureau for a socio-economic study defines the purpose of the project in the following terms:

"This project is aimed specifically at gathering, analyzing and evaluating socio-economic data in the onchocerciasis-free regions of Benin (the two Provinces of the North, ATACORA and BORGOU) with a view towards assisting the Government of the People's Republic of Benin in the establishment of a base of information according to which the future planning and exploiting of

these regions that are free of onchocerciasis can be carried out. This information should be sufficiently detailed to show the effects of the various socio-economic variables on the development possibilities in those regions in which onchocerciasis is under control". (Article 2 of the contract).

2. Methodology

This same contract defines the methodology to be followed, in Article 3 thereof, which provides the following:

After a general study of the data currently available, the main method for collecting data for this project will include a certain number of sample socio-economic surveys to be conducted in 120 representative villages in all the former districts of the two provinces, covering different climatic, ethnic, agricultural and economic variations in the North. Over a period of about fifteen months, covering a complete agricultural cycle, about five enumerators in each district will gather detailed information on production and consumption at the family level. Furthermore, teams of special and more mobile enumerators will carry out special studies on identifiable problems exceeding the village level, such as the systems of transhumance (movement of livestock and herders to different grazing grounds with the changing of the seasons), regional marketing, land ownership and the preparation of new lands, rural communications, localized overpopulation and other problems or constraints as they are identified and in accordance with their order of priority. The investigations to be carried out at the site will be completed by the study and a bibliographic summary of the non-published government data and others, whenever this is possible.

More precisely, the contracting party, under the direction of the Central Projects Bureau (BCP - Bureau Central des Projets) within the Planning Ministry and in cooperation with the Benin experts attached to this project, will proceed with a general review of the sources of existing data, followed by the preparation of methods and techniques for the execution of a number of surveys and special studies such as are described above. The details of this general review, of the various surveys and special studies can be changed during the course of the operations carried out by the research team.

- a. Inventory and examination of the socio-economic resources covering subjects such as the infrastructure and administration at the village level, markets and marketing cycles, development models, ethnic and linguistic distributions, governmental and private services, access to river basins, low-lying grounds, and other areas of interest, etc.
- b. Agricultural survey, including information on rural production and population, cultivation systems, use of manpower, and animal husbandry activities at the village level.
- c. Social surveys at the village level on the social structures and the major decision-making units, production and consumption units, emigration, decision making on production, household budgets, economic differences among the villages, their sources and consequences, and the practices and results of the methods that the villages innovated.
- d. Surveys on the marketing of the major commercial centers and those of lesser importance, attributes in regard to goods and trade, commercial circles, price, credit, control of transportation and commerce.

- e. Information on public health, including inventories on the personnel and the infrastructure in the field of health, as well as a review of the information available on morbidity, mortality, and other selected special studies.
- f. Studies of the livestock-breeding system of trans-humance or seasonal migration.
- g. Special studies of localized problems or constraints to development (excluding preliminary project studies and/or feasibility studies on specific projects) such as the historical background on the establishment of the villages and the personal adaptations in regions that are severely afflicted by onchocerciasis, the land tenure system in the low lying areas, overpopulation and the damage to the soil in the district of BOUKOUMBE, as well as multilingual and literacy programs in the rural areas.

II. EXECUTION OF THE PROJECT

A. General Information

The contract was signed on June 3, 1980 between the Government of the People's Republic of Benin and MASI. The project entered its execution phase with the arrival of the team leader who arrived in Cotonou on June 23, 1980.

Some of the most urgent tasks undertaken by the persons entrusted with the project during the first few months were the following:

- examination and review of existing data, visit to the project area and initial contact with the provincial and local authorities
- description of the objectives of the program sufficiently detailed to serve as a guide in the planning and scheduling of the activities concerning the obtaining of information, taking into account the staff made available to the project, i.e.

by MASI

<u>Staff</u>	<u>Man/months</u>
- an expert in development research, experienced in rural socio-economics (team leader)	24
- An expert in development research (agricultural economist)	5
- Project Manager at the main office	<u>5</u>
TOTAL	34

by Benin

<u>Staff</u>	<u>Man/months</u>
- Assistant Project Manager (agricultural economist)	Part-time
- One statistician-demography expert	Part-time
- Two Regional Supervisors	Part-time

- One Zoo-technician Part-time
- One doctor of epidemiology Part-time

The drawing up of a description, as brief as possible, of the information that is needed to meet the objectives, and, using this as a base, the drawing up of a work plan stipulating the means and the schedule to be followed to obtain this information. This is a particularly important stage, since most of the activities of this type tend to collect more data than can possibly be obtained within the limited time constraints, the financing agreed upon, and the available staff. There is practically no limit to the amount of useful and interesting information that could be obtained on the subject of ATACORA and BORGOU. It was necessary, however, to limit the activities strictly to meeting the objectives defined in order to remain within the scale of financial and human resources available.

B. Objectives of the Socio-Economic Study

As defined at the working session between the team leader of MASI and his Benin counterparts, the objectives of the socio-economic study are the following:

"to collect, analyze and evaluate the basic socio-economic data in the two northern provinces in order to assist the Government in establishing an information base for the future planning and exploitation of these areas that are free from onchocerciasis."

In other words, the essential objective is to establish a base of information that could be used for the preparation and implementation of the program for the development of those areas. Since the essential activity of these areas is agriculture, it would therefore be appropriate to conduct an

in-depth analysis of the available resources and of the potential of the region at the human resources level as well as at the level of the physical, administrative and social infrastructure. To accomplish this, besides the inventory and the examination of the existing economic and social resources, a complete study should be undertaken on agricultural activities, marketing circles, as well as in-depth surveys of the two provinces of a sociological nature. The individual objectives characterizing each of the specific studies comprising the socio-economic survey can therefore be defined as follows:

1. The socio-demographic study should provide detailed information on the population of the two northern provinces, that is to say the ethnic groups, their importance, the distribution of each of these groups in terms of age, sex, marital status and level of education. It should also permit envisaging the population movements arising from births, deaths, migrations, and establishing the rate of growth of the population and the size of the labor force available.

A second section, more directly sociological, will reveal the social organization of the various ethnic groups, the social production relations prevailing in each of these groups, the decision-making centers and eventual conflicts between the various decision-making centers.

Lastly, a final section would reveal the dynamism of the population by examining the people's expectations, their expectations for their children, the extent of fatalism and satisfaction with life.

2. The socio-cultural study, a necessary supplement to the socio-demographic study, has the purpose of enabling us to penetrate the social and cultural life of the ethnic groups, of the village, the community and the district.

It will also enable us to establish the type and intensity of the relations existing between the various ethnic groups, the predominant systems of social structure, the source of prestige and the basic values of each of these groups, as well as their expectations. This study will also reveal the role and importance of women in each of the ethnic groups.

Other points covering the inequalities among the villages, migratory flows, attitude of the population with regard to change and innovations, the needs that are felt and the specific problems facing the people during the year will provide a more complete picture of the development potential of these regions.

3. The purpose of the study on public health is to carry out an inventory of the sanitary infrastructure and of the personnel in place. The study should also enable us to evaluate the extent of onchocerciasis and other diseases of the region, which weaken the human potential, and to establish the conditions of health of the population in general and its life expectancy. To this end, the study will include aspects covering environmental hygiene, nutrition and pollution of water used for consumption, of the various ethnic groups regarding the doctor in general and modern medicine in particular as well as how they use modern and traditional medicine.
4. The budget-consumption study will make it possible to establish the standards of living of the population through a systematic analysis of the household budget. This includes aspects concerning the decision-making centers involved with the expenditures on production and the expenditures on consumption of the population involved, as well as their savings level.

5. The purpose of the marketing study is to establish the role and the importance of markets at the economic and social level. It will also permit identifying the commercial circles for the main products, the role and the number of intermediaries. Lastly, it will allow for identifying the problems relative to transportation, the pricing system, credit, the system for storage of the products, and, to a certain extent, to quantify the losses occurring in the marketing system in effect.

6. The purpose of agricultural study is to establish the main components of the exploitation structures and the production systems in effect. Besides the establishment of a schedule of agricultural activities and a description of the cycles of production, it will permit obtaining data on the areas cultivated, the yields obtained, the technical assistance received and desired for each product. An analysis of the available labor force will make it possible to quantify the rate of employment of the farm population according to the regions and the seasons. Lastly, the study of the land tenure system in effect and new agricultural structures being implemented will supplement the information available.

7. The study on the animal husbandry system and transhumance will provide a description of the animal husbandry system being used and the importance of raising animals according to ethnic groups. It will also have the purpose of analyzing the phenomenon of transhumance (migration of herds to pastures according to the seasons), with the ensuing consequences at the economic as well as the social level. This will be carried out in two stages: first of all a brief questionnaire presented to the herd owners (one cow or more) and another questionnaire intended for the herdsmen.

C. Work planning

After the objectives have been fully determined, a planning of the activities was established according to the following schedule:

This planning, presented at a general meeting held at the Central Projects Bureau in November 1980 in the presence of the Director of the Central Projects Bureau, the persons in charge of the National Planning Cell of the onchocerciasis-free regions, the representative of USAID in Lome and the person in charge of USAID in Cotonou, could not be followed in its entirety. This was due to several reasons, the main one being the absence of regional supervisors during several months of the survey. During this absence, the work of the enumerators left much to be desired and, during the analysis of the surveys in Cotonou by a specially-trained team, numerous errors were detected in the calculation of the areas of the fields and parcels of land and the production. The data on the source and use of the factors of production were irreparably lost. However, thanks to the parcel and yield index cards it was possible to re-calculate all of the areas and production data. Since this work takes a considerable amount of time, a new strategy was defined in May 1981 for the review and analysis of the data. Instead of working on the two provinces at the same time, it was decided to completely terminate the base-line data processing and verification of one province before starting with the second province. This made it possible to start keypunching in Washington the data of one province, while the other was being subjected to base-line data processing in Cotonou. When the surveys in the field were finished, the activities of the project were then carried out in accordance with the following schedule:

D. Methodology

To cover all the aspects of this socio-economic study of the two provinces of the north, several methods were employed:

- Examination and analysis of all the existing data.
- Surveys of key indicators such as the CRL at the village level, the CCR at the community level and the CRAD at the district level.
- Surveys at 15 households selected per village in a total of 120 villages which themselves were selected according to reliable statistical methods. These surveys were to be carried out over a period of at least 12 months.
- Direct observation in the field. Every enumerator was to spend an entire year in a village. He would be requested to observe life in the village, the problems facing it, the activities carried out there, the working times and the intensity of work, trading in goods and services, cultural and religious and medical practices that are characteristic, and any special event that occurs during the year. At the end of those 12 months spent in the village, each enumerator is to present a report covering each of these aspects. This report will be supplemented by a systematic interview with each of the supervisors. This means that the work by the enumerators is not limited to merely carrying out the surveys, but also involves total participation in the very life of the village, thus acquiring an in-depth knowledge of the potential for development of each village and the constraints limiting such development.

1. Preparation of the Questionnaires. The months of August, September and October were devoted to the preparation of the questionnaires. Since the surveys were of a multiple type, several questionnaires were prepared to meet the objectives mentioned for each of these surveys.

The general survey was the first survey to be carried out at the selected households. It combines several questionnaires that are to be filled out at the same time and includes data of a socio-demographic, socio-cultural, health and transhumance type. All of the data of the socio-demographic survey were pre-coded. Since the socio-cultural data only included primarily qualitative and open questions, they could not be coded until after the questionnaires had been received filled out based on the responses obtained. The data on health, nutrition and hygiene included open questions and closed questions. The open questions were coded after the questionnaires were received. Finally, the data on transhumance only included open questions which were also coded after the questionnaires were received.

The agricultural economic survey was completely pre-coded. It included some general information on the size of the farm, the make-up of the household, the water supply, the harvesting activities, the duration of the time the land is allowed to remain fallow, etc., before delving more deeply into certain aspects such as how the land is acquired and used, the areas cultivated and the production, the source and use of the factors of production, the inventory of live animals, tools and equipment for farming, a depreciation schedule, monthly table on family labor, mutual aid and the wage-earning labor force, and, lastly, a cultivation schedule and the working time per operation, crop and hectare. A special daily index card was developed to enable the enumerators to fill out these tables.

The budget-consumption survey was also completely pre-coded. After some information of a general nature on the systems of savings used, the survey is composed of monthly tables of receipts and expenditures by product and by category of products. Lastly, it includes a table on monthly consumption by products. In order to be able to fill out these tables, daily index cards were prepared so that the enumerators could note all the information needed from day to day.

The socio-cultural survey, to be carried out at the key indicators, involves practically nothing else than open questions. These questions are divided into two main categories: on the one hand, questions concerning specific problems and the needs of the district, the Communes and the villages, the need felt by the population, the positive and negative factors for development, the types of relations existing between the ethnic groups, the popular celebrations, the social function of marketplaces and relations with the exterior, and, on the other hand, questions on the ethnic groups themselves, i.e. the influence of tradition, the customary ceremonies, the inequalities in the group and the attitudes towards change.

The health survey to be conducted with the directors of the medical districts, will make it possible to draw up the inventory of existing infrastructure, the number of patients who came for care and the major diseases treated during the course of the year. This survey only requires manual analysis.

The transhumance survey, to be carried out with the herdsmen, includes essentially nothing else than open questions and concerns the size of the herd, the number of owners, the relations between the herdsmen and the

owners, the care given to the animals, and the reasons why the herdsmen accompany the herds during the transhumance or change of pasture grounds.

The questionnaires relative to each of these surveys were completed in their preliminary form at the end of October, 1980. A complete copy of each of them was then sent to:

- the Ministry of Rural Development and Cooperative Action,
- the Ministry of Public Health,
- the Ministry of Higher Education and Scientific Research,
- the Ministry of State Farms, Animal Husbandry and Fisheries,
- the Director General of the National Institute of Statistics and Economic Analysis,
- the Director of State Planning, and
- the Director of the Central Projects Bureau,

Invitation was made to them to examine the questionnaires and take part in a working session where they would be given an explanation of the details and the objectives of these surveys and where their suggestions would be received for any eventual changes before the questionnaires were put into their final form.

Taking into account the suggestions made in particular by the technicians of the INSAE (National Institute of Statistics and Economic Analysis), these questionnaires were revised and put into their final form in December, 1980, and were printed in January. The questionnaire on Marketing was drawn up in January and February, 1981 to be given to the households at the end of the farm session. The questionnaire included questions on the

various marketing systems used for each of the crops cultivated, the various proportions sold to the different types of buyers, the extent of satisfaction with the prices offered by each of these buyers, and the problems encountered in selling these products. A brief one-shot demographic survey was also carried out in the last month of the surveys to study the changes that took place in the population during the year of study.

2. Preparation of the Instruction Manual for Enumerators

Commensurate with the preparation of the questionnaires, the project team prepared an instruction manual for the enumerators for continuous reference during and after their training period. In the introduction the manual describes the context of the project, the objectives to be achieved and the general methodology defined for fulfilling those objectives. Then, some practical and ethical conditions are developed which the enumerators have to take into account to do their work efficiently, maintaining good relations with the households surveyed. Also, an operational definition of each of the concepts used is presented. The following sections describe manner of filling out the general questionnaire. Following this, the agricultural economics questionnaire and the budget consumption questionnaire, based on the daily index cards are made available to them. The codes of the provinces, of the districts, villages, nationalities and cultural practices are given in an annex.

3. Selection of the Villages and Households

The selection of the method for drawing the household survey sample is determined by a certain number of factors: 1) the scientific requirements from the point of view of representativeness; 2) the degree of accuracy desired at the time of generalizing the conclusions;

and 3) the geographical, human and budgetary constraints which prevent carrying out the operations. From the statistical point of view, each of the two provinces, considered separately, forms an infinite population. Hence, to the extent that it is desired to generalize at the province level, a minimum sample of 664 households per province is necessary to obtain a confidence level of 99% and a tolerable error of = .05, as shown by the following formula:

$$n = \frac{NZ^2}{4E^2N + Z^2}$$

where n is the size of the sample, N is the total population, E is the sampling error, and Z is the statistical value resulting from the confidence level selected. (For a confidence level of 99%, the Z value is 2.50). With 60 enumerators per province, it is therefore possible to select 60 villages, but not more, in view of the distances between the villages. In each village an enumerator surveys 15 households weekly, which raises the total number of households surveyed by province to 900. This figure is more than the minimum required within the limits expressed above. Hence, a selection method becomes necessary: the method of sampling by probability proportionate to the size of the villages. In effect, to assure the selection of a sample of representative households, each household has to be given the same probability of selection. The simplest, if not the best, method would be to give each village the same probability of selection and to select the same percentage of households in each village. Although this method offers the advantages of clarity and simplicity, it is not, however, the most effective from the statistical point of view. In effect, in the two provinces of northern Benin the villages differ greatly from the point of view of the number of households

comprising them. The selection of the villages based on the same probability of selection for each village with a fixed percentage of households in these villages would yield the following result as a limiting case: a small number of large villages selected in a first sampling stage, with a corollary that the villages selected to represent all of the villages would come from a very small number of those villages, which would unavoidably introduce a bias in our sample. From the point of view of representativeness, it is preferable to select a large number of villages with a small number of households in each village. This is the principle that was adopted for this study in selecting the method of choosing the sample by probability proportionate to the size of the villages. Thus, the largest villages have a greater chance of appearing in the sample. However, when selecting the same number of households per village it turns out that in the last analysis each household has the same probability of selection, as shown by the following formula:

$$\text{Probability of a household} = \frac{\text{number of villages selected}}{\text{size of the village}} \times \frac{\text{households selected by size of the village}}{\text{total population}}$$

This formula reveals, in effect, that in the last analysis each household has the same probability of being selected, independently of the number of households per village. This is shown by the fact that the size of the village which appears in the numerator and the denominator cancels itself out: the probability of selection of a household is therefore equal to the number of villages selected, multiplied by the number of households selected in each of the villages, divided by the total number of households.

To do this it is necessary to obtain the list of all the villages of the two northern provinces with their respective population. This information was supplied to us by the Institut National de la Statistique et de l'Analyse Economique (INSAE - National Institute of Statistics and Economics Analysis). It then became possible to draw up the list of these villages with the cumulative population and then obtain a sampling fraction in order to determine the first village selected. The sampling fraction was added systematically to this number to obtain the 60 villages for each of the provinces.

The following villages were selected:

LIST OF THE VILLAGES SELECTED

PROVINCE: ATACORA (01)

<u>DISTRICTS</u>	<u>CODE</u>	<u>VILLAGES</u>	<u>CODE</u>
BASSILA.....	01.....	Aoro.....	001
		Kikele	002
		Manigri-Oke	003
		Nioro	004
BOUKOUMBE.....	02.....	Koukouangou (C.U.).....	005
		Kounadogou	006
		Kounkotchougou	007
		Koutagou	008
		Koukongou	009
		Dimantima	010
		Koukouangou (C.R. Tabota)	011
		Dipokofontri	012
COBLY.....	03.....	COBLY.....	013
		Sienou	014
		Datori	015

COPARGO.....04.....	Pargoute.....	016
	Galora	017
	Pabegou	018
	Tahu	019
DJOUGOU URBAIN.....05.....	Petoni-Poho.....	020
	Angaradebou	021
	Leman-Mande	022
DJOUGOU RURAL.....06.....	Barei.....	023
	Barienou	024
	Bellefoungou	025
	Yoroussonga	026
	Dabogou	027
	Vahoui	028
	Dewa	029
KEROU.....07.....	Kossou.....	030
	Koabagou	031
	Pikire	032
KOUANDE.....08.....	Gorgoba.....	033
	Damouti	034
	Danri-Peulh	035
	Maro	036
	Sekogourou	037
MATERI.....09.....	Pauri.....	038
	Tihoun	039
	Koussega	040
	Boutouhou-Pingou	041
	MATERI	042
	Pingou	043
NATITINGOU.....10.....	Pouya.....	044
	Kounitchangou	045
	Yetapo	046
	Winke Nord	047
	Perma	048
OUAKE.....11.....	Bohondo.....	049
	Konte	050
	Kagnifele	051
	Kawado	052

PEHUNCO.....	12.....	Beket.....	053
		Pehunco-Gah	054
		Guimbererou	055
TANGUIETA.....	13.....	Nanebou.....	056
		Tanongou	057
TOUCOUNTOUNA.....	14.....	Bouyagnindi.....	058
		TOUCOUNTOUNA	059
		Tantoukou	060

PROVINCE: BORGOU (02)

<u>DISTRICTS</u>	<u>CODE</u>	<u>VILLAGES</u>	<u>CODE</u>
BANIKOARA.....	15.....	Arbonga.....	061
		Soroko-Peulh	062
		Founougo	063
		Kokey	064
		Gomparou	065
		Domboure	066
		Sirikou	067
		Tintemou	068
BEMBEREKE.....	16.....	Gando.....	069
		Beroubouye	070
		Teme	071
		Pedarou	072
GOGOUNOU.....	17.....	Bagou.....	073
		KEROU	074
		Lougou	075
		Gamarou	076
KALALE.....	18.....	Neganzi.....	077
		Kourele	078
		Mareguinta	079
		Bessassi	080
		Nassiconzi	081
KANDI.....	19.....	Alfakoara.....	082
		Gogbede	083
		Keferi	084
		Kossarou	085
		Pade	086
		Sam	087
		Sonsoro-Peulh	088

KARIMAMA.....	20.....	Kargui.....	089
		Kompatin	090
MALANVILLE.....	21.....	Monkassa.....	091
		Tolozougou	092
		Galiel	093
		Tassi-Tedji	094
N°DALI.....	22.....	Maregourou.....	095
		Wari	096
		Tamarou	097
		Sirarou	098
NIKKI.....	23.....	Soubo.....	099
		Gah-Marou	100
		Ouroumon	101
		Daroukpara	102
PARAKOU.....	24.....	Camp-Dagbe.....	103
		Pebie	104
		Ouansirou	105
		Tourou	106
		Tranza	107
		Zongo-Zenon	108
		Bakperou	109
PERERE.....	25.....	Guinagourou.....	110
		Pane	111
		Sontou	112
SEGBANA.....	26.....	Liboussou.....	113
		Piami	114
SINENDE.....	27.....	Benke.....	115
		Sekere	116
		Niaro	117
TCHAOUROU.....	28.....	Wari-Marou.....	118
		Kpassatona	119
		Worogui	120

Since the extrapolation rate is the inverse of the probability of selection, to estimate the parameters of the population within a given confidence interval it suffices to apply the following formula:

$$\bar{x} - z_{\alpha/2} \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

Once this operation had been carried out, INSAE provided us with access to the census data on each of the villages selected. Each of the households were classified into two categories: farming households and non-farming. Based on this list, twelve farming households and three non-farming households were selected at random. Three additional farming households and two non-farming households were added to the selection, to be used as a replacement in the event that some households refused to take part in the survey. Thus, a total of 720 farming households were chosen for the agricultural economics survey and 900 households for the general and budget-consumption survey.

4. Selection of the Key Indicators

To complete the information gathered from the households, three types of questionnaires were prepared especially for the key indicators. These are socio-cultural surveys, health surveys and surveys on transhumance. Since the provinces are organized into districts, communes and villages, the district, commune and village authorities (the CRAD, CCR and CRL) were the most appropriately placed for completing the socio-cultural information obtained from the households, at the various levels of the village, the commune and the district. These authorities were thus selected as the key indicators for filling out the questionnaires concerned with the infrastructure, requirements of the population and

their socio-cultural characteristics, as well as the distribution of the ethnic groups and the relations they maintain among themselves.

The chiefs of each of the medical districts (one per district) were in the best position to furnish information on existing health infrastructure, the number of patients in care centers and the types of diseases treated. Consequently, they were selected as the key indicators and a special questionnaire was prepared for them.

The herdsmen were the obvious persons who could provide all the information needed on transhumance. Since it was impossible to take a census of them, as they were essentially nomads, the solution chosen was to conduct the survey with two or three herdsmen per district, according to the possibilities of the controllers who had the direct responsibility for this survey.

5. Selection and Training of the Controllers and Enumerators

Two training programs had been planned: one for the controllers and the other for the enumerators. Since it had been decided to conduct the same training program for the controllers and enumerators in the two provinces, the project teams were split up into two groups. One group was in charge of the training in BORGOU and the other in ATACORA. In each of these two provinces the Provincial Labor Office was asked to provide a list of potential candidates who had a baccalaureate degree (for the controller) position and at least the CEFEB level for the numerator position. On February 12 in NATITINGOU and PARAKOU about twenty candidates took a two week training course, at the end of which 11 candidates were kept per province. The training course started with the showing

of a film on onchocerciasis, in order to make the future controllers aware of the medical problem of onchocerciasis as well as the economic and social consequences for the regions infected. After several sessions of explaining what their roles, functions and responsibilities were, the various questionnaires were distributed to them and carefully explained. They then received practical training, learning to fill out the questionnaires and to conduct interviews without influencing the replies regarding the questions of a qualitative nature. For several days they practiced in the field, contacting households that had not been selected for our sample. During daily work sessions their performance was analyzed and solutions were proposed to remedy difficulties encountered. They were also taught, under the direction of technicians from the Studies and Planning Office of the Ministry of Rural Development and Cooperative Action (D.E.P.) and the Department of Agricultural Research and the DRAPES of the CARDER of Zou and ATACORA, to read compasses to measure fields and to place density squares to evaluate yields. They learned, at the households, to fill out the daily index cards on the time spent working, expenses and income earned, consumption of food and, after several days of practical exercises, how to report this information in the pertinent tables of the questionnaires. These practical exercises with the households also made it possible to pretest the questionnaires, which had not been done because of the lack of time and means. During these "tests" the questionnaires proved to be functional and only a few changes were made later. After two weeks of intensive training at the theoretical and practical level, 11 trainees were selected and recruited as controller agents for each of the provinces for the duration of the surveys.

The training program of the enumerators took place according to the same scheme with the 150 candidates at NATITINGOU and PARAKOU. Eighty were pre-selected to follow the three week training program. These trainees were recruited by the controllers who tested their knowledge and their abilities. There were numerous practical exercises for the controllers in the field on how to conduct an interview; how to fill out questionnaires, how to read a compass, how to measure the fields, place the density squares and evaluate yields; how to make a sketch of the farm and the diagrams of fields and parcels at a certain scale. At the end of the program, 60 trainees were selected in each of the provinces. Control areas were established for each controller, who thus assumed the responsibility for a defined area which could include from four to eight villages selected according to their geographical distribution and the distances involved. The selection of the villages entrusted to each numerator was made based on their knowledge of the languages, since it was of the utmost importance for the enumerator to speak the language of the village to conduct the surveys in the language of the households selected.

6. Strategy and Logistics

a. Making the Population Aware

Before sending the enumerators into the villages selected, the Prefect of each of the provinces sent a radio message to all of the district Chiefs, advising them of the project and requesting that they prepare the people to participate in the survey. Support by the administrative authorities greatly facilitated the work of the enumerators who generally were well received by the village people. The controller and

the enumerator, accompanied by the village delegate, could thus explain to the people why they were there and why they stayed so long in the village. They also explained the importance of the cooperation of the people to the future development of the region. Only one village in ATACORA refused to receive the enumerator and this village was immediately replaced with the help of the district Chief. In some areas certain villages not selected even asked to be included in the sample. The awareness work had been effective.

b. Execution of the Survey

As each agent had been introduced to the people by the Delegate from the village, the enumerator could start identifying the households selected, which was not always an easy matter in view of the movement of the population since the last census, in particular in the PEULH villages. The most difficult to find were the non-farming households, most of whom are civil servants or teachers. Some had been replaced, others had not been replaced, so that in some villages it was not possible to find three non-farming households. After households were identified and their agreement obtained to participate in the study, the surveys began. The general surveys were completed first, then the daily index cards were prepared. This made it possible to complete the corresponding tables of the agricultural economics and budget-consumption survey at the end of the month. In the first month they also had to distribute the socio-cultural surveys to the local authorities. In BORGOU, they were not distributed until much later. The general surveys themselves were not completed the first month because the population

table required more time in the case of a large family. Furthermore, comprehensive supervision led to finding many errors in the manner in which the tables had been filled out and it became necessary to leave these questionnaires with the enumerators so that they could redo some of them. Also, the first controls revealed numerous errors in filling out the index cards: everyone did not have a good understanding of the work to be done and did not apply properly the instructions received during the training course.

c. Logistical Support

The enumerators were put in their respective villages in three days with the help of the district Chiefs and the persons in charge of the CARDERS. The enumerators were equipped with all the necessary materials: bicycles, instruction manuals, index cards, questionnaires, and a list of the households selected. As there was an insufficient quantity of compasses, decameters and scales, they were distributed to the controllers who had to circulate this material among the villages for which they were responsible. Each controller was directly responsible for four to eight enumerators, the number being determined by the distance among the villages. In effect, each controller had to visit these enumerators at least once a week to check the work and see to it that daily index cards had been properly filled out. In some villages, it was determined very early that some enumerators are not performing their work conscientiously, that they remained quietly in their cabins and invented the replies instead of going into the households. In such cases the enumerators involved were immediately fired and replaced by

others who had finished the training program but had not been kept initially. Furthermore, an award system was established to encourage those who were working satisfactorily. Finally, the regional supervisors, who were also part of the CARDER teams, had to go regularly to each of the areas and supervise the work of the controllers as well as the enumerators. The controllers had been given mopeds (motor bikes), since some villages were more than 100 kilometers from their connection point. They received compensation for the fuel they had to buy. This system was supposed to assure, at least theoretically, excellent development of the operations. It did not function as well as anticipated. In effect, the regional supervisors, working in the CARDER at the same time, could not have enough time for the trips that they had to make. What was worse, both abandoned the project several months later because they received a scholarship to study in France.

Since they were not replaced until four months later in the case of ATACORA and five months later in the case of BORGOU, the controllers, left to themselves, no longer concerned themselves with the surveys and no longer went to the villages. During these months, the enumerators themselves lowered their efforts and got behind in their work, such as measurement of fields which had not been finished six months after the surveys had been started. The same held true for the placement of the density squares. At the time of harvests, few made an effort to record the yields or proceed with the weightings, since the controllers had not distributed the scales as they should have done. When the new supervisors came on the job, it was already too late to recover certain information

or resume certain operations. In those places where the harvests had already been sold, it was out of the question of course to proceed with the weighting. This indicate the adverse effect of the departure of the regional supervisors, and failure to replace them for five months. Added to this, were the payroll difficulties which made it impossible to pay the enumerators within a reasonable period of time, to such extent that some of them lost interest in their work. However, few abandoned their post before the end of the agricultural cycle. Six villages in ATACORA and two in BORGOU were deleted as a result of these problems.

d. Recovery of the Surveys and Preliminary Analysis

The recovery of the general surveys, of the daily index cards and the socio-cultural surveys was not easy to do. The general surveys, the first to be done, were not received back until October, as well as the daily index files of the first months of the agricultural economics and budget-consumption survey. The reason for this delay was to give time to the controllers to review the questionnaires involved and to have them corrected on the site by the enumerators. In effect, during inspection tours the Chief of the Project and the Deputy Director found many errors which had to be corrected before the final coding. Once these surveys had been returned to the Cotonou office, a team of specially trained agents systematically checked out the replies obtained to the various question, to eliminate the errors that the controllers had overlooked, and then to code all of the open questions on the basis of the replies obtained. The general survey was thus delivered to the Benin Data Processing Office on February 1, 1982

for keypunching the data and eventual computer analysis. As the daily index cards were returned to the Central Office of Cotonou, they were subjected to preliminary analysis and the information was transferred to the tables recapitulating the questionnaires. As this work was finished for a province in the month of June (the team of agents doing the preliminary analysis was increased to 60), it was necessary to proceed with the systematic verification of the data on areas of fields, parcels production. The large number of errors detected made it necessary to redo all the calculations of the areas, parcels and production based on the index cards on parcels and yields. The data whose margin of error was too high has been corrected. The same work was then done for the province of BORGOU.

The socio-cultural questionnaires sent to the district Chiefs, commune Mayors and village Delegates, were unequally distributed in BORGOU. The Prefect was contacted too late requesting them to fill out the questionnaires. As a result less than half of the questionnaires were completed and returned in April 1982. The health surveys sent to the medical districts, twice in one year, were not recovered, with a few rare exceptions. This was despite our insistence that the Regional Supervisors go to each medical district to get them. The tables ahead show that in ATACORA only the questionnaires of the district of COPARGO were completely filled out and returned, whereas for the districts of TANGUIETA and TOUCOUNTOUNA no information was returned to us at the district, Commune or Village level. In BORGOU, the maximum rate of responses reached 80% for the district of BANIKOARA and KARIMAMA, but no information was sent to us from the district of Tchaourou.

In view of the small percentage of responses obtained, a new questionnaire, which were simpler and smaller in size, was prepared in August 1982 to be sent as soon as possible to each district Chief. This made it possible to complete the information that was missing for four districts in BORGOU and three districts in ATACORA.

SOCIO-CULTURAL SURVEYS SENT AND RECEIVED

ATACORA

DISTRICTS	DISTRICTS		COMMUNES		VILLAGES		TOTAL		RESPONSE RATE
	SENT	RECEIVED	SENT	RECEIVED	SENT	RECEIVED	SENT	RECEIVED	
BASSILA	1	1	2	0	4	3	7	4	57%
BOUKOUMBE	1	0	7	4	8	8	16	12	75%
COELY	1	0	2	1	3	1	6	2	33%
COPARGO	1	1	4	4	4	4	9	9	100%
DJOUYOU URBAIN	1	0	2	0	3	2	6	2	33%
DJOUYOU RURAL	1	0	6	4	7	3	14	7	50%
KEROU	1	0	3	2	3	2	7	4	57%
KOUANDE	1	0	4	0	5	4	10	4	40%
MATERI	1	1	3	1	6	5	10	7	70%
NATITINGOU	1	0	3	2	5	5	9	7	77%
OUAKE	1	0	4	1	4	4	9	5	55%
PEHUNCO	1	0	2	2	3	3	6	5	83%
TANGUETA	1	0	2	0	2	0	5	0	0%
TOMCOUNTOUNA	1	0	3	0	3	0	7	0	0%
TOTAL	14	3	47	21	60	44	121	68	56%

**SOCIO-CULTURAL SURVEYS SENT AND RECEIVED
BORGOU**

DISTRICTS	DISTRICTS		COMMUNES		VILLAGES		TOTAL		RESPONSE RATE
	SENT	RECEIVED	SENT	RECEIVED	SENT	RECEIVED	SENT	RECEIVED	
BANIKOARA	1	1	6	5	8	6	15	12	80%
BEMPEREKE	1	0	4	0	4	4	9	4	44%
BODJOUNOU	1	1	4	1	4	3	9	5	55%
KALALE	1	1	4	2	5	3	10	6	60%
KANDI	1	0	6	1	7	2	14	3	21%
KARTAMA	1	1	2	1	2	2	5	4	80%
MALANVILLE	1	1	4	1	4	4	9	6	66%
N'DALI	1	0	4	0	4	1	9	1	11%
NIKKI	1	0	3	2	4	1	8	3	37%
PARAKOU	1	0	5	0	7	1	13	1	7%
PERERE	1	1	3	3	3	1	7	5	71%
SEGBANA	1	1	2	1	2	1	5	3	60%
SINENDE	1	1	3	0	3	0	7	1	14%
TCHAOUROU	1	0	3	0	3	0	7	0	0%
TOTAL	14	8	53	17	60	29	127	53	42%

HEALTH SURVEYS SENT AND RECEIVED
AT MEDICAL DISTRICTS

<u>ATACORA</u>	<u>SENT</u>	<u>RETURNED</u>	
		1981	1982
BASSILA-----	+		+
BOUKOUMBE-----	+	+	-- +
COBLY-----	+		
COPARGO-----	+		
DJOUGOU URBAIN----	+		+
DJOUGOU RURAL----	+		
KEROU-----	+	+	+
KOUANDE-----	+	+	+
MATERI-----	+		
NATITINGOU-----	+		+
OUAKE-----	+	+	+
PEHUNCO-----	+		
TANGUIETA-----	+		+
TOUCOUNTOUNA-----	+		+
TOTAL-----	14	4	-- 9

BORGOU

		1981 1982	
BANIKOARA-----	+	+	
BEMBEREKE-----	+		
GOGOUNOU-----	+		
KALALE-----	+	+	
KANDI-----	+	+	
KARIMAMA-----	+	+	
MALANVILLE-----	+		
N'DALI-----	+		+
NIKKI-----	+	+	+
PARAKOU-----	+		+
PERERE-----	+		+
SEGBANA-----	+	+	
SINENDE-----	+		+
TCHAOUROU-----	+		+
TOTAL-----	14	6	6

The surveys on transhumance with the herdsmen and which were entrusted to the care of the controllers were recovered as they were carried out, during the months of January and February 1982. Lastly, the surveys on marketing distributed in March 1982 were recovered without difficulty at the end of April.

e. Validity of the Data Collected

The validity of data collected depends upon the seriousness with which the enumerator did his work, how representative the sample is and the good will of the persons surveyed. The sample was selected according to methods that permitted a tolerable error of .05 within a confidence interval of 99%, thus assuring excellent representativeness at the province level. This error is considerably increased, however, owing to the deficiency in the system for collecting data. We have already mentioned the slovenliness of most enumerators during the six month of absence of the Regional Superiors. Some information of an agricultural economics nature was irredeemably lost. Others are the result of a posteriori estimates rather than accurate measurements at the proper time (yield and production) and some were just simply invented. A manual, systematic review of all of the questionnaires of ATACORA and BORGOU made it possible in part to eliminate or to correct the data which were not the result of empirical research.

Concerning the validity of the information supplied by the farmers themselves, a brief survey done in March 1982 with the controllers revealed the following: 34% only gave information of fair quality,

and 7% gave unreliable information. The distribution of the quality of the information obtained by district and by village is as follows:

QUALITY OF INFORMATION
SUPPLIED BY SURVEYED HOUSEHOLDS

DISTRIBUTION OF HOUSEHOLDS HAVING SUPPLIED INFORMATION							
1. ATACORA	GOOD		AVERAGE		POOR		TOTAL
	F.A.	%	F.A.	%	F.A.	%	F.A.
BASSILA	25	49%	24	47%	2	4%	51
-Aoro	-		13		-		
-Kikele	7		5		2		
-Manigri Oke	8		3		-		
-Nioro	10		3		-		
BOUKOUMBE	68	64%	29	27%	19	9%	106
-Koukouangou	7		5		1		
-Kounadogou	12		2		-		
-Kountochougou	13		2		-		
-Koutagou	6		4		4		
-Koukangou	-		12		1		
-Dimantima	9		2		1		
-Koukouangou	12		-		1		
-Dipokofontri	9		2		1		
COBLY	22	55%	13	33%	5	12%	40
-COBLY	8		6		1		
-Sienou	3		7		2		
-Datori	11		-		2		
COPARGO	32	59%	14	26%	8	15%	54
-Pargoute	7		5		3		
-Galora	8		2		2		
-Pabegou	8		5		2		
-Tahu	9		2		1		
DJOUGOU URBAIN	10	37%	10	37%	7	26%	27
-Petoni-Poho	-	cancelled					
-Angaradebou	8		6		1		
-Leman-Mande	2		4		6		

DJOUGOU RURAL	40	57%	29	42%	1	1%	70
-Barei	10		5		-		
-Barienou	11		1		-		
-Bellefoungou	10		5		-		
-Yoroussonga	9		4		-		
-Dabogou	cancelled						
-Vanhoui	cancelled						
-Dewa			14		1		
KEROU	16	66%	5	21%	3	13%	24
-Kossou	6		4		2		
-Koabagou	10		1		1		
-Pikire	cancelled						
KOUANDE	16	40%	21	53%	3	7%	40
-Gorgoba	cancelled						
-Damouti	cancelled						
-Danri-Peulh	6		6		-		
-Maro	7		6		-		
-Sekogourou	3		9		3		
MATERI	49	63%	26	34%	3	4%	78
-Pauri	5		9		-		
-Tihoun	9		4		-		
-Boutouhou-							
Pingou	8		2		2		
-MATERI	10		3		1		
-Pingou	10		3		-		
-Koussega	7		5		-		
NATITINGOU	42	64%	21	32%	3	4%	66
-Pouya	7		3		2		
-Kounitchangou	9		3		-		
-Yetapo	7		8		-		
-Winke Nord	9		5		1		
-Perma	10		2		-		
OUAKE	42	74%	14	24%	1	2%	57
-Bohondo	7		8		-		
-Konte	12		3		-		
-Kagnifele	11		1		-		
-Kawado	12		2		1		
PEHUNCO	25	67%	12	33%	1		38
-Beket	10		4		-		
-Pehunco-Gah	12		-		-		
-Guimbererou	3		8		1		

TANGUIETA	16	61%	10	39%	1		27
-Nanebou	7		5		-		
-Tanongou	9		5		1		
TOUCOUNTOUNA	20	49%	15	36%	6	15%	41
-Bouyagnindi	7		5		1		
-Tantoukou	7		4		2		
-TOUCOUNTOUNA	6		6		3		
TOTAL	423	59%	243	34%	53	7%	719

2. BORGOU	GOOD		AVERAGE		POOR		TOTAL
	F.A.	%	F.A.	%	F.A.	%	F.A.
BANIKOARA	82	71%	31	27%	3	2%	116
-Arbonga	11		4		0		
-Soroko-Peulh	13		2		0		
-Founougo	1		11		3		
-Kokey	13		0		0		
-Gomparou	11		4		0		
-Domboure	13		2		0		
-Sirikou	10		3		0		
-Tintemou	10		5		0		
BEMBEREKE	33	55%	22	37%	5	8%	60
-Gando	9		4		2		
-Beroubouye	11		3		1		
-Teme	8		5		2		
-Pedarou	5		10		0		
GOGOUNOU	29	64%	12	27%	4	9%	45
-Bagou	11		4		0		
-KEROU	cancelled						
-Lougou	12		3		0		
-Gamagou	6		5		4		

KALALE	37	49%	30	40%	8	11%	75
-Neganzi	10		5		0		
-Kourele	13		1		1		
-Mareguinta	5		8		2		
-Bessassi	5		7		3		
-Nassiconzi	4		9		2		
KANDI	52	54%	38	39%	7	7%	97
-Alfakoara	9		5		1		
-Gogbede	2		7		3		
-Keferi	5		9		1		
-Kossarou	11		4		0		
-Pade	11		1		2		
-Sam	6		8		0		
-Sonsorou-Peulh	8		4		0		
KARIMAMA	2	7%	28	93%	0		0%
-Kargui	2		13		0		
-Kompatin	0		15		0		
MALANVILLE	32	53%	25	42%	3	5%	60
-Monkassa	15		0		0		
-Tolozougou	6		9		0		
-Galiel	4		9		2		
-Tassi-Tedji	7		7		1		
N'DALI	33	56%	14	24%	12	20%	59
-Maregourou	6		4		4		
-Wari	13		2		0		
-Tamarou	7		5		3		
-Sirarou	7		3		5		
NIKKI	30	50%	26	43%	4	7%	60
-Soubo	9		5		1		
-Gah-Marou	8		6		1		
-Ouroumon	8		6		1		
-Daroukpara	5		9		1		
PARAKOU	37	41%	39	43%	14	16%	90
-Camp-Dagbe	5		9		1		
-Pebie	2		12		1		
-Ouansirou	cancelled						
-Tourou	8		4		3		
-Tranza	6		2		7		
-Zongo-Zenon	5		8		2		
-Bakperou	11		4		0		

PERERE	22	49%	23	51%	0	0%	45
-Guinagourou	11		4		0		
-Pane	0		15		0		
-Sontou	11		4		0		
SEGBANA	24		4		2		30
-Liboussou	12		2		1		
-Piami	12		2		1		
SINENDE	33	77%	10	23%	0	0%	43
-Bouko	13		1		0		
-Sekere	8		6		0		
-Niaro	12		3		0		
TCHAOUROU	28	68%	11	27%	2	5%	41
-Wari-Maró	9		5		0		
-Kpassatona	10		3		0		
-Worogui	9		3		2		
TOTAL	474	56%	313	37%	64	7%	851

f. Analysis of the Surveys

During the month of November 1981, contacts were made with the National Institute of Statistics and the Benin Office of Data Processing to advise them of the various surveys to be analyzed. Since the National Institute of Statistics did not have the capacity to do the work requested, there was no alternative left other than the Benin Office of Data Processing (Office Béninois d'Informatique-OBI). After examining the questionnaires and the statistical tables required, the officials of the OBI confirmed that they had the capacity in manpower and hardware to do the work requested, thanks to the Statis program recently developed. All of the general surveys were then forwarded to them on February 1, 1982, with the assurance that the statistical analysis desired would be completed by June, 1982. In the month of June we were informed that the OBI was not able to furnish us with the tables requested since their Statis program was actually not appropriate for our needs. However, they would be able to give us some simple descriptive tables by October 1982, which was done. This, however, was not even one third of what was needed. The analysis on marketing was also entrusted to the OBI. The analysis of the agricultural economics and the budget-consumption surveys was performed in Washington by Onyx Inc., on a Perkin Elmer computer, model 3320 which has a memory of 1 million bytes. The program used was the IMSL (International Maths and Statistical Library). The general survey was handled by ONYX, but limitations of budget and time did not make it possible to obtain all of the tables requested. For these same reasons, it was not possible to undertake in the United States the analysis of the marketing survey which, in its present form, is not usable.

The analysis of the socio-cultural and transhumance surveys which were returned to us was performed manually by the Project Chief. The brief survey on population movements was entrusted to the statistician of the project.

The data from the surveys were analyzed by using two types of statistics; descriptive and inferential. The descriptive statistics enable us to write the data of the survey in an understandable manner. The inferential statistics, in turn, enable us to draw conclusions from the sample in such a way that they are valid for the general population for each province.

With regard to the descriptive statistics, we present two types of analysis. The first has to do with a single and the second has to do with two or more cross variables. The analysis of a single variable is generally presented in the form of a table giving the distribution of the absolute and relative frequencies and sometimes even the cumulative frequencies when they have a particular significance. The tables are followed by certain statistics describing the distribution characteristics of these variables: the arithmetic mean, which is the most common measure of central tendency for variables of ordinal level; the mode, which is the value of the observation which appears most frequently; and the median which is the value above which half of the values are found and below which the other half of the values lies; the standard deviation which gives the measure of dispersion of the data around the mean for variables of ordinal level; and the range, which gives the two extreme values. The analysis having to do with two or more cross variables goes beyond the simple description of the data, since it has a power

of explanation and prediction. This is why cross tables are followed by a certain number of measures of association concerning the various types of data. Thus, the X^2 (Chi-square) makes it possible to determine if there is a systematic relationship between two variables, regardless of their nature: qualitative or quantitative. However, although the Chi-square indicates whether the variables considered are independent or related, it does not indicate the extent of the association that exists. Among the measures of association based on Chi-square we used the coefficient of contingency C the maximum value of which depends upon the size of the statistical table. Thus, for a 2 x 2 table, the maximum value of the C coefficient is .707. In general, it is only used for tables with the same number of columns and rows. Cramer's V is a measure of association for rectangular tables and ranges from 0 to +1. It is used for nominal variables. When it assumes a value approaching 1, this means that there is a strong relationship between the variables that have been selected. But it does not indicate the manner in which these variables are related. When the categories are of the same interval, the most appropriate measure of association is Pearson's correlation coefficient which varies from 0 to ± 1 , according to the direction of the association. For variables of ordinal level, Spearman's coefficient (r), not parametric, is the most appropriate. It also varies from 0 to ± 1 , according to the direction of the association.

The t-test and the One-Way ANOVA are used to compare two or more groups, and to determine whether the differences between the means of each of these groups

are sufficient to conclude that the means of the respective populations are different. If the means of the various groups are quite dissimilar, the t-test will have a significant value, leading to the conclusion that the two groups in the population do not have the same mean.

The Chi-square, Pearson's and Spearman's coefficients correlation, besides having a descriptive value, are also significance tests just as the t-test and the One-Way ANOVA and therefore they have an inferential value. It is important to point out here, however, that inferential statistics only concern the sampling error (set in advance at .05) and do not take into account the other errors, such as for example those resulting from shortcomings on the part of the enumerators or replies that are not very reliable that are furnished by the surveys. For a certain number of variables of this study, the errors resulting from the way in which the data are collected are certainly of greater importance than the sampling error and therefore a large number of generalizations to be made at the statistical level are subject to caution. Considering the degree of association that exists between two variables, the significance tests yield the probability that such an association can be due to the sampling error, in the case that such an association does not exist in the population considered. In other words, we assume a priori that there is no association at the level of the district, the nationality or the province, then we determine whether the association found in the sampling could be only due to the sampling error. If this association cannot be reasonably attributed to the sampling error, we then consider that such an association exists in the population. The significance level gives the probability that the

measure of association calculated is the result of the sampling error. Three significance levels are customarily used: .5, .01 or .001. This means that the chances of obtaining the association calculated as being the result of sampling error are, respectively 5%, 1% and .1%. In the following statistical tables we indicate therefore the significance level for each measure of association calculated. This concerns all the statistical tests calculated.

III. PRESENTATION OF THE AREAS OF THE STUDY

The geographical scope with which this study is concerned is not limited to only the areas where onchocerciasis is under control, but covers the entire territory of the two provinces of the North: ATACORA and BORGOU.

A. Geographical Aspects

1. The Province of ATACORA

The province of ATACORA occupies the northwest part of the People's Republic of Benin and has an area of 31,200 km² (which is the equivalent to 28% of the national territory). It extends between 8°30' and 11°20' North latitude. It is bounded on the west by the Republic of Togo, by the north by the Republic of Upper Volta, by the east by the province of BORGOU, and to the south and the southwest by the province of Zou.

As a whole, the province of ATACORA has a climate of the Sudanese-Guinean type with some variations from south to north. In its northern part the climate approaches the Sudanese type. The entire region has a rainy season from mid-April to October and a dry season from November to March.

In terms of hydrography, the province of ATACORA has the following bodies of water: the Mékrou, Alibori, Upper Ouémé and Pendjari. Because of its broken and relatively high terrain, the province of ATACORA is the so-called water tower of Benin.

Its population is estimated at 481,509 inhabitants, yielding a population density of 15 inhabitants per square kilometer (1979 census).

2. The Province of BORGOU

The province of BORGOU occupies the northeastern part of the People's Republic of Benin. It extends between 8°5' and 12°5' latitude North and covers an area of 51,000 km², which is equivalent to 45% of the national territory. It is bounded on the north by the Niger River and the Republic of Niger, on the south by the province of Zou, on the east by the Federal Republic of Nigeria and on the west by the province of ATACORA and the Republic of Upper Volta.

The province of BORGOU is characterized by a climate of the Sudanese-Guinean type broken down into two seasons: a rainy season from April to October and a dry season from November to March. The average annual rainfall is 1,200 mm in South BORGOU and 900 mm in North BORGOU.

Two river basins comprise the hydrographic network of the province of BORGOU:

- the Basin of the Niger into which the affluents of the Niger River flow: the Mékrou, the Alibori and the Sota
- the basin of the Ouémé, where the Ouémé River gives birth to the Okpara river.

The population of the province of BORGOU is estimated at 489,301 inhabitants. With an area of 51,000 km², it has one of the lowest population densities per km² of the country, i.e. 9 persons per km² against 33 for the national territory as a whole.

B. Political and Administrative Organization

According to the provisions governing the territorial administration in the People's Republic of Benin, a Prefect is at the head of each province. The province is administered by a State Committee for Administration of the province (CEAP - Comité d'Etat d'Administration de province) headed by the Prefect and the members of which are elected from among the political, technical and administrative authorities of the province.

- The province is subdivided into districts. The provinces of ATACORA and BORGOU each have 14 districts. A district Chief heads each district and he is the chairman of the Revolutionary district Administration Committee (CRAD - Comité Révolutionnaire d'Administration du district) composed of members who are elected from among the political and administrative authorities of the district.

- Each district is broken down into communes which are administered by a Mayor who heads the Communal Revolutionary Council (Conseil Communal de la Révolution - CCR) the members of which are elected by the general population.

- The commune, in turn, is divided into villages and town quarters. At the head of a village or town quarter is a Delegate, assisted by members of the Local Revolutionary Council (CRL - Conseil Révolutionnaire Local) appointed by election.

C. Organization of the Agricultural Staffing

In each province the agricultural staffing is provided by the Regional Action Center for Rural Development (CARDER - Centre d'Action Régionale pour le Développement Rural). This is a government agency under the direction of the Ministry of Rural Development of the rural areas through technical staffing in the following fields:

- plant production
- forest production and protection
- animal protection
- cooperative action
- processing and primary marketing of agricultural products
- preparatory, construction and improvement works on land in the rural areas
- agricultural mechanization, etc.

To cover all of these fields of activity, the CARDER is organized in the following manner:

- a department including a certain number of technical divisions;
- a sector per district directed by an authority responsible for rural development (Responsable du Développement Rural - RDR);
- a subsector per commune headed by a subsector chief; and
- a center per village or group of villages.

D. The Forms of Organization of Agricultural Production

At the level of each of the two provinces it is possible to distinguish three major types of organization of agricultural production:

- the family operations;
- the revolutionary groups for cooperative action (Groupements Révolutionnaires à Vocation Coopérative - GRVC); and
- the experimental agricultural cooperatives of the socialist type (Coopératives Agricoles Expérimentales de Type Socialiste - CAETS).

The family operations continues to be the most predominant controlling more than 90% of the agricultural production in each of the two provinces.

This form of organization is characterized by:

- private appropriation of the factors of production;
- the small size of the operation; and
- the prevalence of human energy over the other factors of production.

The Revolutionary Groups for Cooperative Action (GRVC) are a form of pre-cooperative association of farmers. The fields or the parcels of land are always individual, but they have to be placed side by side in order to facilitate the utilization in common of certain means of production and to make the staffing operations more efficient. Thus, the private appropriation of lands is not involved. Under its present conception, the GRVC is a transitional stage between the individual operation and the collective operation.

The experimental agricultural cooperatives of the socialist type (CAETS) are actual production cooperatives, because of the collective nature of the appropriation of the means of production and the

production processes. A certain number of these CAETS are currently being tried within the provinces of BORGOU and ATACORA (see Volumes 6 and 12).

E. Organization of Health

1. Medical Districts

Similar to the political and administrative level, the province is divided into medical districts at the health level, each of which is headed by a doctor. The medical districts located in the seat of the district generally include a central dispensary, a maternity ward, and occasionally a hospitalization room. The number of staff depends upon the size of the district. The various medical districts include the dispensaries, or medical posts, the maternity wards and the Mother and Child Protection Centers (P.M.I.), the Village Health Units (U.V.S.) the operation of which is assured by a midwife or an assistant, and the communal health complexes (Complexes Communaux de Santé - C.C.S.), to which are added the sales outlets of the National Pharmaceutical Office (Office National de Pharmacie - O.N.P.). Lastly, there are some hospitals and private clinics in each province.

2. The Program for Controlling Onchocerciasis

The purpose of the onchocerciasis control program is "to reduce the impact of the onchocerciasis disease to such a level that it no longer represents a problem to public health, an obstacle to socio-economic development or an impediment to the recovery of good tillable lands that are currently lying "fallow".

The organization of the program includes:

- a) The Joint Program Committee (Comité Conjoint du Programme - CCP), composed of :

The National Onchocerciasis Control Committees of the seven member countries,
The Consultative Committee of Experts,
The Committee of Sponsoring Agencies.

- b) The Program is administered by a Director and includes four units:

The Vector Control Unit,
The Epidemiological Development Unit,
The Socio-economic Development Unit, and
The Administration and Management Unit.

The technical execution of the program is the responsibility of the Vector Control Unit, which is best known by its English abbreviation V.C.U. This unit is composed of divisions, including the division of aerial operations which is in charge of the weekly applications of larvicide(s) and the division of entomological evaluation which is in charge of spreading these applications against the simuliid populations that are the vectors of the disease.

In Benin, the center of the entomological evaluation network is PARAKOU. Prior to July, 1982 this sector was based in NATITINGOU, but as the result of the extension of activities towards the south, the town of PARAKOU, which had a more central position, was more suitable for supervising the entire region.

The entomological surveillance sector of PARAKOU is divided into four subsectors, i.e.:

- NATITINGOU and KANDI for the treated area,
- PARAKOU and Bohicon for the area envisaged for the extensions.

These subsectors are managed by medical entomology technicians, all of whom are Benin nationals.

In the field, the means employed to control the vectors of onchocerciasis depend upon the strategy of the treatment operations and the entomological evaluation. The treatments are applied using aircraft. The program has eight helicopters and two airplanes distributed among two bases: Bobo in the Upper Volta and Kara in Togo. The subsector represents the operational base unit of the entomological evaluation. The program area is divided into 24 subsectors and each of them is provided with three to four teams for catching the flies. These teams are responsible for the weekly gathering of the data related to the residual population of the vectors of onchocerciasis. The subsector also has four-wheel-drive vehicles when required, a radio for transmitting the data, a laboratory and all of the administrative support necessary for proper operation of such a service.

The program is currently employing 84 persons in Benin, all of whom are Beninese nationals the exception of the Sector Chief.

All of the waterways that are currently under insecticide treatment in Benin are part of the hydrological systems of the Pendjari, the Oti and the Niger rivers. This has to do more precisely with the rivers descending from the

western and eastern slopes of the ATACORA, as well as from the Sota, the Alibori and the Mékrou. The Ouémé and its affluents are not being treated.

In 1977, the World Health Organization (W.H.O.) defined two entomological criteria for removal of onchocerciasis from the valleys. There are the Annual Transmission Potential (A.T.P.) and the Annual Bite Rate (A.B.R.). The thresholds for these values were established, respectively, at 100 infesting larvae of the parasite for the ATP and 1,000 bites from the vector for the ABR.

The entomological results obtained in Benin in the area treated indicate that these thresholds are rarely reached since the start of the control operations, except in the valley of the re-infested waterways. The areas where, from the entomological point of view, the transmission of onchocerciasis no longer constitutes a danger to human populations are: the basins of the Pendjari, the Upper Mékrou, and the upper Kéran, except for the region of Tipaoti and Tapounde, where the ATPs still remain high owing to the re-infestation.

The situation is not as good in the middle valleys of the Mékrou and of the Alibori, as well as in the valley of the Sota. Every rainy season, these areas suffer the re-infestation phenomenon. It has been shown, however, that the impact of the re-infestation in the transmission of onchocerciasis in the controlled region was confined to a strip of about three kilometers on both sides of the banks of the channels of affected water. (1)

(1) This information was supplied in February 1983 by the Onchocerciasis Control Program in the Basin of the Volta, the headquarters which is located in Ouagadougou in Upper Volta.