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Final Report of Upper Volta Village Livestock

November 1980

Contract AID/afr-C-1338

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FINAL REPORT OF

UPPER VOLTA

VILLAGE LIVESTOCK PROJECT

Contract AID/afr-C-1338

Project no. 686-11-130-203

November 1980

Consortium for International Development

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EXECUTIVE SUMMARY

Introduction

The Upper Volta Village Livestock Project (VLP) was a multi-phased project initiated by the Agency for International Development (AID) in 1975. After necessary Agency approvals and agreements with the Government of Upper Volta (GOUV), the Consortium for International Development (CID) was given a contract (AID/afr-C-1338) to implement Phase-I project activities during the period from June 1977 to November 1980. The University of Arizona was selected as lead university for the Consortium and was given overall management responsibility for the project.

In addition to on-campus administrators and field administrators, the long-term CID team consisted of an animal scientist, a range manager, and a social scientist. Short-term assignments were carried out in the areas of animal health, range management, women's role in livestock production, and marketing. The GOUV provided a co-director and professional counterparts.

The VLP was terminated by AID at the end of Phase I.

Project Goals

The overall goal of the VLP was to improve livestock production in Upper Volta and, thereby, the quality of life of village livestock producers and to contribute to the Voltaic economy.

The goal of Phase I of the project was to lay groundwork for village-level livestock programs in Upper Volta by:

1. Organizing local groups of livestock producers to initiate changes in animal health, livestock production, and range management.
2. Establishing a quantitative baseline for range- and livestock-management practices from which appropriate programs can be planned and against which developmental change can be measured.
3. Testing a number of animal health, livestock production, and range management innovations in local situations and

evaluating their success and potential for application in succeeding project phases.

4. Training Voltaics for roles in future livestock projects.

Strategy

The VLP attempted to build lasting change into the livestock production system by first acquiring the cooperation of livestock producers. Only then did the CID team proceed with the administrative and logistic activities necessary to implement the proposed activities. Proposals to the village producers were based on what were perceived to be the constraints to the long-term viability of the traditional livestock production system as it becomes tied increasingly to the world economy. The balance of technical and social science inputs has proven particularly fruitful in this regard. We believe that one change in the livestock producers' lives effects many other, often unforeseen changes. Every effort was made to respect livestock producers' existing beliefs and values and to implement changes where the producers themselves saw problems. At times this involved demonstrating the existence of a problem and the potential for its solution. It is very unlikely that imposing "solutions" where no problem is perceived has lasting value.

Results of Phase I

A basis has been established for successfully implementing livestock programs at village sites in Upper Volta. Specific accomplishments include the following:

1. Local committees of livestock producers were organized at six sites. They acted as advisors to CID team members, who were devising programs to be tested. Committees or subcommittees were involved in providing information and testing innovations. At the end of Phase I, all committees were still active and ready to participate in Phase II.
2. A quantitative baseline was established to assess the current status of animal health, productive capacity of range lands (including establishment of trend plots for

monitoring changes in productivity), animal production practices, women's roles in livestock production, and wood exploitation from rangelands.

3. A number of innovations were tested and evaluated at the project sites. Inclosure/exclosure plots were installed to test rest-rotation and other controlled grazing systems. Concrete vaccination corrals were constructed. Color-coded vaccination receipts were provided for vaccination of cattle, sheep, goats, and chickens. "Modern" and "traditional" chicken projects were tested. A chicken project for women was initiated. Traditional wells were improved or reconstructed, and new wells were dug. Tree and bush species for supplemental feeding of livestock were planted.

4. A number of Voltaics were trained and/or were provided opportunities to study. Extension agents, field assistants, and livestock nurses were trained in field activities and in working with village people. Bachelor of science degrees in animal science and range management were awarded to two counterparts by New Mexico State University. A study tour of range management practices in the arid/semiarid parts of the southwestern United States was provided for the Voltaic project director. Counterpart personnel assigned to the VLP by the Livestock Service were given on-the-job training in project operation and management. Students from the University of Ouagadougou were given opportunities to work with CID team members.

VLP Phase II

One task of Phase I was to gather information and test ideas that would be useful in determining which kinds of development activities would be feasible and appropriate during Phase II of the project. Background came from the Baseline Report we prepared and from our myriad experiences with livestock production systems at the VLP sites in Upper Volta and at other locations.

The program for Phase II was collaboratively designed by the CID team, GOUV counterparts, USAID representatives, and interested Voltaics. The design procedure for Phase II of the VLP had five major steps: problem-statements review, idea generation, project organization, preliminary project design, and final project design.

The proposed Phase II project is broad in scope, but the number of areas where activities will be carried out is limited. Our view is that it is better to carry out a wide variety of development activities for a smaller number of livestock producers in a few locations than to try to implement one or two changes in the livestock production system for everybody, everywhere in Upper Volta. A third phase of the project can then be devoted to expanding the most successful activities to more livestock producers in more areas.

Phase II heralds an increasing emphasis on concrete action based on the pilot programs and baseline-data collection undertaken in Phase I. Continually assessing the needs of livestock producers before implementing programs serves as the most effective means of improving the capacity of the Livestock Service to extend services to the village level. Training professionals is aimed specifically at alleviating the shortage of expertise required to implement livestock development programs. Voltaic administrators and professionals will play a greater role in implementing Phase II than they were able to do in Phase I. By the end of Phase II, the need for U.S. expatriates should be greatly reduced and the capability of the Livestock Service greatly expanded from its former emphasis on animal health. The essential nature of the VLP--that is, working from "bottom to top"--will not be foregone even though the second phase of the project puts heavy emphasis on capital and infrastructure investments. The overall project consists of a set of subprojects:

VLP Phase II--Subprojects

Administration and Core Support

Natural Resources
- Range Management
- Water Resources Development
- Village Wood Lots

Human Resources and Social Service

Animal Health

Animal Production
- Cattle
- Small Ruminants
- Poultry

The subprojects are not independent, but provide us a way of detailing activities and of insuring complete, integrated coverage of problems (as many as possible) needing attention.

The VLP Phase II is a decentralized, integrated rural development project that focuses on small-scale livestock producers and strong local participation. One goal is to increase production of meat, milk, and eggs for the benefit of producers. The VLP also attempts to sustain the natural-resources base, including range vegetation, wood (for energy and construction), water, and soil.

For rural livestock producers and families, it provides education in areas of animal production and health, resource management, sanitation for humans and animals, and nutrition. It also provides education for Livestock Service personnel.

It addresses health aspects of the problems of livestock producers by providing sanitary water, reducing disease transmission, and improving nutrition. This is accomplished primarily by enlisting support of existing health services for project sites.

Many of the activities of VLP Phase II can be carried out in cooperation with existing GOUV programs in other sectors of the economy or with complementary donor-funded programs.

Project Evaluation

The VLP was evaluated during and at the end of Phase I by internal and external reviewers. Generally favorable comments were received.

Formation and interaction with local-level livestock producers' committees (men's and women's) were very effective. They provide the necessary interaction and feedback so frequently missing from development projects.

Provisions of baseline data will allow Phase-II implementers to actually measure changes (in range, animal health, and livestock production practices) within the selected sites, to judge the effectiveness of projects, and to assess changes--or lack of change--in areas with no active intervention.

The successful installation of inclosure/exclosure plots, accomplishment of vaccination programs, initiation of color-coded vaccination receipts, establishment of the various poultry projects, and construction of vaccination corrals and traditional wells provide models of innovations that assist decision-makers in determining which actions to continue at the same sites or in which actions to initiate at other sites in Upper Volta.

The people trained by the VLP in livestock production and range management will continue to live and work in Upper Volta at all levels of livestock production from local producers to national-level administrators.

The Phase-II project, designed by the CID team on the basis of information gained during Phase I and on input received from GOUV counterparts, can begin immediately.

1 INTRODUCTION

1.1 PURPOSE

This final report is presented as the ultimate step in fulfilling the contract between the Consortium for International Development (CID) and the U.S. Agency for International Development (USAID) (Contract No. AID/afr-C-1338), Upper Volta Village Livestock Project (VLP). It will also serve as a vehicle to convey the results and findings of Phase I of the project, a three-year period of action and studies, to USAID, the various relevant agencies of the Republic of Upper Volta, and to other individuals and organizations interested in the livestock production system in West Africa.

1.1.1 Description of Structure of Final Report

For the various readers materials are presented at several levels of detail. The Executive Summary will provide those with interest but limited time a quick overview of the project. Chapter 1 is a review of the project goals and results in a form which is both succinct and still provides enough detail for project evaluation. A perusal of Chapters 1 and 3, the Phase II project design, is recommended to readers who are planning additional livestock activities in Upper Volta or similar regions of West Africa. Chapter 2 constitutes a more detailed presentation of the project results, and other technical details are appended in Chapter 5. Chapter 4 contains a list of references. The latter three chapters will be of particular interest to specialists in specific disciplines. Additional details are found in the project files and may be had by contacting Dr. W.G. Matlock, Office of International Agriculture Programs, The University of Arizona, Tucson, Arizona.

1.1.2 Brief Project History

The history of the VLP began with the preparation of the Project Identification Document (PID) and Project Paper (PP) in 1975. (The design team was fielded by CID in October-November 1975 on a separate contract.) Subsequently the Project Agreement (ProAg)

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was signed by USAID/Upper Volta and the Government of Upper Volta (GOUV) on 31 May 1976.

A Request for Proposal (RFP) was then issued by AID/ Washington. CID received the request and after determining the interests of its member universities prepared a proposal which was submitted early in 1977. The University of Arizona was named lead university for CID in the project proposal because of its strong interest in the Sahel region and expertise in arid lands livestock production. Dr. John L. Fischer, Coordinator of African Projects for CID, was instrumental in organizing the CID efforts to this point.

After review of proposals received in AID/W, CID was selected as the contractor, and a contract was issued for Phase I of the VLP. The original contract period was from 22 June 1977 to 30 September 1980. It was later extended through 30 November 1980.

Dr. W. Gerald Matlock was selected as CID Project Director, and recruitment for the field team began in June 1977. Initial team members were Grant Scott, animal scientist and Chief of Party; Scotty Deffendol, range manager; and Richard Vengroff, social scientist. Dr. Vengroff was replaced by Fred Sowers at the end of his two-year assignment in 1979.

From July to October 1977 the first team members were given French language instruction as necessary at the Foreign Service Institute (FSI) in Washington, D.C., and received standard AID and Upper Volta orientation by the FSI Orientation Office. Specific VLP and CID orientation also was provided by Drs. Fischer and Matlock.

After testing by FSI the team was approved and sent to Upper Volta. They arrived in Ouagadougou on 31 October 1977 and began project activities immediately.

The USAID project representative at that time was Archie Hogan. Mr. Hogan had prepared for the CID team's arrival by arranging for housing and personal needs, purchasing vehicles and other commodities, and selecting field sites. He was replaced by Rebecca Niec in 1978. In 1979 E.G. VanVoorthuizen was named USAID project representative.

Peace Corps volunteers Greg Garbinsky, Alan Johnston, and Roger Hedge were assigned to the project in 1977 to provide assistance to team members. When their tours of duty ended in 1979, James Flint was assigned to the project.

Mr. Dooda Koops, a volunteer in the Dutch technical assistance program, also was assigned to the project during 1977 and 1978.

The original Voltaic project director was Dr. Guigma. In addition 12 field assistants were hired (two at each active site). In 1978 M. Lebende Sionne assumed the project director's role. Other counterparts added later were Dula Koulibaly and Emmanuel Traore.

Evolution of the detailed Work Plan began soon after the team's arrival in Upper Volta. It subsequently went through three revisions.

Field activities of the CID team began with visits to the six project sites and definition of their logical physical and social boundaries. Local livestock producer committees were organized at each site and made part of the project planning process. No later activities were undertaken without the agreement of the local committee.

Certain actions were implemented at the outset to obtain increased local support for the project and to test their feasibility. Several vaccination corrals were constructed, and an infrastructure was set up to improve the effectiveness of local vaccination programs. Pilot poultry projects were completed at three sites. Later a well improvement program was initiated with assistance from the Peace Corps volunteers.

Since a primary purpose of Phase I was to develop an understanding of the livestock production system, considerable effort was devoted to gathering data about the natural resources of each site and livestock husbandry practices. Several surveys were made to determine the perceptions, knowledge, and interests of the livestock producers.

Inclosure/exclosure plots were established in two locations to serve as a means of controlling land use and as demonstrations of problems associated with overgrazing. They would also become the laboratories for testing range management (grazing) schemes.

Because wood use is a major factor in environmental impact on range resources, a reconnaissance-level survey of wood cutting and wood cutters was made at one site. Later assistance was provided in planting forage tree species.

Short term assignments were used to supplement the expertise of the field team. John Mare, veterinarian, provided information on animal diseases and treatment programs in the field areas. Helen Henderson, anthropologist, lived in Koukoundi for three months and described the role of women in livestock production. James McCullough, marketing specialist, studied the livestock marketing process and how marketing decisions are made. Shawn Kelly, range manager, assisted Mr. Deffendol in carrying out range survey work.

A reporting system was established for the project. Two-month activity reports and six-month comprehensive reports were prepared. Reports were submitted by each specialist at the end of their short term assignments. During the second project year a Baseline Report containing all available information about the sites, the livestock producers, and their animals was written. Problems which has been identified and/or demonstrated were defined in the Baseline Report.

Using the Baseline Report and team experience as a guide, personnel initiated Phase II of the VLP in 1979. Two workshops were held involving CID and Voltaic project personnel, Livestock Service officials, representatives of other Voltaic and international agencies and USAID personnel. At the first of these, held in February 1980, agreement was reached on the identification of problems and the desired general characteristics of Phase II. A draft of the Phase II project was then prepared by the CID team. At the second workshop in May 1980 the draft was revised and polished. It appears in this report as Chapter 3.

Abdoulaye Kone and Ahmadou Guiao were sent to New Mexico State University for academic programs in range management and animal science. They returned to Upper Volta for field work with the VLP during summer vacations. Training also was provided for field assistants and other Livestock Service personnel. Special instruction and field experience were given to Michael Kcuda, a student from the University of Ouagadougou.

1.2 GOALS AND RESULTS

1.2.1 Evolution of Project Goals

The general goals for the VLP were established in the Project Paper and subsequent Project Agreement by the design team and later by AID analysts. Despite the relatively short in-country time three concepts extremely important to the success of the VLP were elaborated: (1) the project would focus on livestock production activities at the village level; (2) Phase I would be a time for learning and data collection in advance of attempting major interventions in the livestock production system; and (3) the implementaton team would include a full time social scientist. In responding to the RFP issued by AID/W, CID added information concerning how priorities would be set and goals would be achieved.

The initial project Work Plan was developed by the CID team shortly after their arrival in Upper Volta. USAID and Government of Upper Volta (GOUV) personnel were consulted in the process. As team experience increased, goals were revised and priorities shifted slightly as evidenced in subsequent revisions of the Work Plan.

Table 1.1 is a comparison of the objectives as stated in the contract and the objectives in the final revision of the Work Plan. The major difference is in the area of animal feeding. The original objectives mentioned assisting in "improved feeding practices" and "assisting livestock owners in exploring methods of farm finishing and fattening." These objectives were modified and listed last in the Work Plan because the CID team learned from the livestock producers' committees that livestock owners had little interest in feeding schemes.

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TABLE 1.1

STATEMENT OF OBJECTIVES

The major objective of the service to be performed under this contract is to assist the Upper Volta National Livestock Service and three selected, semiautonomous regional development organizations (ORD's of Kaya, Koupela, and Fada N'Gourma) in planning, designing, and implementing livestock projects and/or programs for small rural livestock producers at the village level. Specific objectives as provided in the Project Agreement included:

Contract No. AID/afr-C-1338	Work Plan (Revision 4)
1. Assisting selected villagers to improve animal health through a concentrated program of vaccination and internal and external parasite control, improved feeding practices, and animal selection.	a. Assisting selected villagers to improve animal health through a concentrated program of vaccination and internal and external parasite control and animal selection.
2. Assisting livestock owners in exploring methods of farm finishing and fattening.	b. Exploring with indigenous power structures the possibility of developing grazing schemes through the organization of livestock producers' associations.
3. Exploring with indigenous power structures the possibility of developing grazing reserves through the organization of grazing associations.	c. Explore the feasibility of initiating a controlled grazing program in one or more selected sites, and the possibility of creating a major range management reserve in at least one ORD.
4. Initiating a controlled grazing program in one or more selected villages.	d. Assisting selected village leaders with determining the validity of present burning practices and developing methods for controlling excess burning of grasses, shrubs, and forbs.

TABLE 1.1 (Continued)

Contract No. AID/afr-C-1338	Work Plan (Revision 4)
5. Assisting selected village leaders with determining the validity of present burning practices and developing methods for controlling excess burning of grasses, shrubs, and forbs.	e. Providing training opportunities in livestock production management for extension agents, future leaders of livestock projects, and village livestock producers.
6. Providing training opportunities in livestock production management for extenstion agents, future leaders of livestock projects, and village livestock personnel.	f. Examine the possibilities for animal selection and farm feeding for special markets.

1.2.2 Resume of Project Goals and Results

The following six sections provide a resume of the work carried out by the CID team for the Village Livestock Project. All activities are related to the project goal as defined in the AID/CID Contract and/or the 4th revision of the Work Plan. A series of tables is included wherein goals/activities are cross referenced to the Final Report section where results are discussed.

1.2.2.1 Defining Sites (see Figure 1.1)

1.2.2.1.1 Goals

Site definition was a mutual responsibility of the social scientist and the other team members: "Rural Sociologist . . . duties: . . . assist team members and GOUV in selecting villages and village complexes where livestock programs will have high degree of success." (AID/CID Contract)

Table 1.2 gives the specific activities planned by the team to define project sites and notes the sections of this report where detailed results of the activities are presented.

1.2.2.1.2 Results

General designation of the project sites was made before the arrival of the CID team. Specific boundaries and rationale for the choice of the sites were not made clear.

On arrival the social scientist and range manager set about jointly to clarify and precisely define the boundaries of the project sites based on both natural geographic features and upon the existing network of human and community interactions.

One site near the Ghana border was dropped because of the institutional barriers to working in an area where unrestrained international movement was an element of the villagers' and their livestock's daily lives. To increase the chance of success the Fodigué site was replaced by the Gourgou-Moaga site where GOUV and specifically Livestock Service influence was felt to be greater.

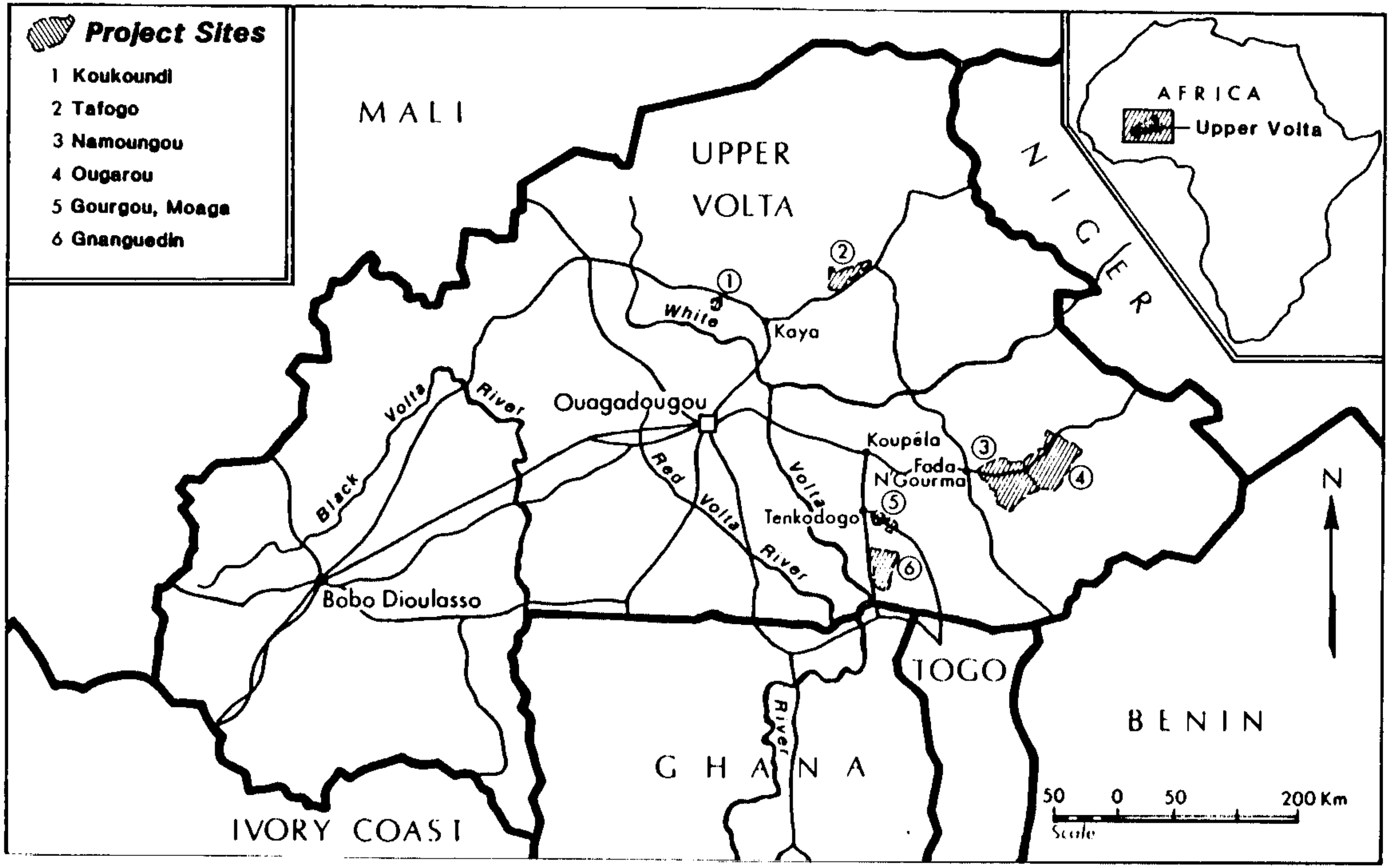


Figure 1.1 VILLAGE LIVESTOCK PROJECT SITES

TABLE 1.2

ACTIVITIES AND RESULTS OF THE SITE DEFINITION GOAL

Goals/Activities*	Location of Results in Final Report (Section No.)
A. Initial contacts with local leaders--village chiefs, chiefs of quartier, canton chiefs, are being or will be made.	2.1 Site Descriptions 2.3 Human and Institutional Resources
B. Initial contacts with ORD level personnel--directors, Livestock Service, agriculture, extension personnel, are being or will be made.	Bi-monthly Report
C. Sites, and tasks to be undertaken in each, are defined.	2.1 Site Descriptions
D. Site priorities have been proposed as follows:	
(1) Extension work in initial phases of project in Gnanguedin and Tafogo sites (15-30 villages per site).	2.2.1 Range Resource Inventory--Tafogo Site 2.2.3 Range Resource Inventory--Gnanguedin Site
(2) Limited preliminary efforts to be followed by extensive work in later stages of the project in Namoungou, Ougarou, Koukoundi, and Gourgou-Moaga sites.	2. Resources (Baseline Report)

*Annex I, Work Plan for CID Team, Upper Volta Village Livestock Project, January 1979, 4th Revision

Refinement of site choice was also made in the case of Gnanguedin. This site was nearly dropped because of the conflict between VLP plans and those of the Volta Valley Authority (AVV). Chances for fruitful cooperation between the two agencies appeared to be limited by the AVV's semiautonomous status. In the end agreement was reached to amend the boundaries of the Gnanguedin site to include an area not within the short- to medium-range development goals of the AVV. Success in Gnanguedin was based on working toward satisfying the needs of the existing population rather than on establishing an entirely new population. Hence, a reconciliation of conflicting objectives within GOUV was achieved.

Koukoundi was chosen to be a single village site where interventions would be confined to a smaller and contained population. In Tafogo, it was decided to make the principal interest of the VLP effort focus upon the population living in a series of villages along the site's dominant low-lying area, with secondary activities diffusing to neighboring areas. Tafogo was chosen as the base village because of the existence of a rather powerful and well-regarded traditional chief.

1.2.2.2 Collection of Baseline Data

1.2.2.2.1 Goals

The range management specialist and animal scientist had major roles in the collection of baseline data, and the social scientist and short term staff had supporting roles. The duties as given in the contract were as follows: Range Management Specialist and livestock specialist . . . duties: "conduct a baseline survey of range conditions and utilization and a baseline survey of soils." "Rural Sociologist . . . duties: . . . conduct studies in selected villages and village complexes that will further clarify the complexity of land tenure, livestock ownership and grazing patterns." Table 1.3 gives the specific activities planned by the team to collect baseline data and notes the sections of the report where detailed results are presented.

TABLE 1.3

ACTIVITIES AND RESULTS RELEVANT TO BASELINE
DATA COLLECTION GOAL

Goals/Activities	Location of Results in Report (Section No.)
A. Physical resouces (Tafogo and Gnanguedin sites)	
(1) Water resources and estimates of volume, including seasonal surface water, year round surface waters, man-made dams, traditional wells, and permanent lined wells.	2.2.1.11 Water Resources (Tafogo site) 2.2.3.11 Water Resources (Gnanguedin site)
(2) Vegetation will be described by scientific nomenclature in each resource area. Percentage, composition, and density of particular species will be determined. Range trend and carrying capacity studies will be initiated.	2.2.1.6 Description of Vegetation (Tafogo site) 2.2.3.6 Description of Vegetation (Gnanguedin site) 5.5.1 Rangeland Inventory Analysis 2.2.2 Carrying Capacity and Stocking Rates (Tafogo site) 2.2.4 Carrying Capacity and Stocking Rates (Gnanguedin site) 5.5.3 Trend Study Method
(3) Burned areas will be defined in each resource area and effects on vegetation will be examined.	2.2.1.9 Burning (Tafogo Site) 2.2.3.9 Burning (Gnanguedin Site)
B. Human resources and interactions	
(1) Delineation of demographic characteristics (all sites)	2.1 Site Descriptions 2.3.1.1 Economic Orientation 2.3.2 Women's Role in Livestock Production
(a) Population (b) Ethnic composition	

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
B. (1) (c) Compound composition	
(d) Neighborhoods	
(e) Economic orientation and specialization	
(2) Propensity for innovation (all sites): identification of characteristics associated with and possibilities for adoption of new techniques of production by village populations: elite and mass surveys	2.3.1.4 Attitudinal Dispositions 2.3.1.5 Contact with Government
(a) questionnaire design	
(b) preliminary testing and modification of questionnaire	2.3.1.6 Attitudinal Predispositions--Modernity and Efficacy
(c) translations (oral and written) into Moré, Gourmantche, and Fulani	
(d) training of interviewers in use of questionnaire (on site)	
(e) test in a village site (Koukoundi)	
(f) sample design and selection	5.3 Methodology for Social Science Research Used
(g) survey implementation in select villages in all sites and remaining secondary site	
(h) data coding, processing, and analysis	
(3) Land tenure (Ougarou, Tafogo, and Gnanguedin sites)	2.1.1 Site Descriptions 2.2.1.1 Physical Boundaries (Tafogo)
(a) delineate political boundaries between all villages in principal sites	2.2.3.1 Physical Boundaries (Gnanguedin)
(b) determine land tenure rights--especially with reference to grazing land	
(c) examine dynamics of decision-making and change in village land tenure systems	

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
B. (4) Social and economic relations between crop production and animal husbandry (Ougarou, Tafogo, Gnanguedin, Namoungou, Koukoundi)	
(a) expansion of the bush, fields, and gardens into grazing lands (b) wells and water supply usage (livestock, human, garden) (c) water rights	2.2.3.5 Priority Uses (Gnanguedin) 5.5 Range Management Procedures
(5) Socioeconomic basis for burning (Gnanguedin, Koukoundi, and Namoungou)	
(a) burning by farmers (b) burning by herders (c) other causes of burning	2.4.2.4.3 Burning See also 2.2.1.9 Burning (Tafogo) 2.2.3.9 Burning (Gnanguedin)
(6) Socioeconomic interactions between ethnic groups (Gnanguedin, Koukoundi, and Namoungou)	
(a) contractual herding relationships	2.4.2.2.2 Contractual Herding Arrangements
(b) inter-ethnic perceptions	2.3.1.3 Inter-ethnic Conflict
(c) contemporary interactions--positive and negative (e.g., fertilization of fields, destruction of fields by livestock)	3.2.2.2 Contractual Herding Arrangements
(d) transhumance patterns	2.4.2.2.3 Transhumance
(7) Livestock management and decision-making (village level) (Ougarou, Tafogo, Koukoundi, Gnanguedin, Namoungou)	2.4 Livestock Production System 2.4.2.2 Herding and Transhumance (cattle) 2.4.2.4.1 Range Management (cattle)

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
B. (7) (a) livestock management survey--animal health, traditional pasture management, transhumance patterns, local marketing rationality (b) delineation of leadership patterns (c) identification of traditional basis of influence (d) administrative basis of influence (e) decision making in the area of livestock raising (f) identification of potential leadership cadres for organization of livestock producers and grazing associations	2.4.2.5 Protection, Diseases and Pests (cattle) 2.4.2.6 Marketing and Transportation (cattle) 2.4.3.2 Herding and Transhumance (sheep and goats) 2.4.3.5 Protection, Diseases and Pests (sheep and goats) 2.4.3.6 Marketing and Transportation (sheep and goats)
(g) women's role in livestock production	2.3.2 Women's Role in Livestock Production
C. Animal and poultry resources	
(1) Characteristics	2.4.3 Sheep and Goats
(a) functions or utility (milk, meat, work, other)	2.4.3.1 Genetics, Physiology, and Utility
(b) general herd or flock composition (sex, age, and seasonal conditions)	2.4.4 Poultry 2.4.4.1 Genetics, Physiology, and Utility 2.4.5 Swine 2.4.5.1 Genetics, Physiology, and Utility
(2) Ownership	
(a) transhumant characteristics: corridors of transhumance as related to grazing lands and village cropping	2.4.2.2 Herding and Transhumance (cattle) 2.4.2.2.1 Herders (cattle) 2.4.2.2.2 Contractual Herding Arrangements (cattle)

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
C. (2) (b) sedentary characteristics: village herds or flocks and animal traction as related to village cropping system	2.4.2.2.3 Transhumance (cattle) 2.4.3.2 Herding and Transhumance (sheep and goats) 2.4.3.2.1 Herders (sheep and goats) 2.4.3.2.2 Transhumance (sheep and goats)
(3) Diseases, disorders, and their characteristics (a) communicable and non-communicable diseases (b) external and internal parasites (c) degree of debilitation and/or economic factors of prevalent disorders (d) existing control or treatment (e) other	2.4.2.5 Protection, Diseases, and Pests (cattle) 2.4.2.5.1 Cattle Losses 2.4.2.5.2 Animal Health Measures 2.4.3.5 Protection, Diseases, and Pests (sheep and goats)
(4) Economic factors and marketing (a) market locations and live-stock exports (b) sale trends and prices by month and reason in each location (c) abattoirs 1) those located in larger cities and their functional characteristics 2) those located in small towns and small villages and their characteristics 3) quality control and animal health inspections (d) marketing as related to pro-duction market demands	2.4.2.6 Marketing and Transportation (cattle) 2.4.2.6.1 Marketing Motivation 2.4.2.6.2 Where Cattle Are Sold 2.4.2.6.3 Cattle Sold 2.4.2.6.4 Cattle Sales per Livestock Producer 2.4.2.6.5 Income from Cattle Sales 2.4.2.6.6 Seasonal Varia-tions in Cattle Sales 2.4.2.6.7 Factors In-fluencing the Sale Price of Cattle 2.4.2.7 Cattle Slaughter, Processing and By-Products 2.4.3.6 Marketing and Transportation (sheep and goats)

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
C. (4)	2.4.3.6.1 Marketing Motivation 2.4.3.6.2 Sheep and Goat Sales by Age and Sex 2.4.3.6.3 Where Sheep and Goats Are Sold 2.4.3.6.4 Sheep and Goat Sales by Individual and Ethnic Group 2.4.3.6.5 Amounts Received from Sheep and Goat Sales 2.4.3.7 Small Ruminant Slaughter, Processing and By-Products 2.4.4.4 Marketing (poultry) 2.4.4.5 Marketing (swine)
D. Livestock production and range management	
(1) Livestock production technology (all sites)	2.4.2.1 Genetics, Physiology, and Utility (cattle)
(a) production data collection: genetics, physiology, nutrition and feeding, water supply, protection (diseases, pests, and predators), environmental control, herding treatment and medication, off-take or sales, slaughter, processing by-products, storage, transportation and marketing	2.4.2.4 Nutrition and Supplementary Feeding (cattle) 2.2.1.11 Water Resources (Tafogo) 2.2.3.11 Water Resources (Gnanguedin) 2.4.2.5 Protection, Diseases, and Pests (cattle) 2.4.2.6 Marketing and Transportation (cattle) 2.4.2.7 Cattle Slaugher, Processing, and By-Products 2.4.3.6 Marketing and Transportation (sheep and goats)

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
D. (1) (a)	2.4.3.1 Genetics, Physiology, and Utility (sheep and goats) 2.4.3.4 Nutrition and Feeding (sheep and goats) 2.4.3.5 Protection, Diseases and Pests (sheep and goats) 2.4.3.7 Small Ruminant Slaughter, Processing and By-Products 2.4.4.4 Marketing (poultry) 2.4.4.5 Marketing (swine)
(b) examination of current management practices: record keeping, integration of all production activities, group action or co-operative membership, use of non-family labor, planning and timeliness of herd combinations and conservation of resources	2.4.2.2 Herding and Transhumance (cattle) 2.4.2.2.2 Contractual Herding Arrangements (cattle) 2.4.2.4 Nutrition and Supplemental Feeding (cattle) 2.4.3.2 Herding and Transhumance (sheep and goats) 2.4.3.4 Nutrition and Feeding (sheep and goats)
(c) examine existing infrastructures: transportation, storage, markets and marketing outlets, financial services, inputs, processing, transfer of knowledge and policy	2.4.2.6 Marketing and Transportation (cattle) 2.4.2.7 Cattle Slaughter Processing and By-Products 2.4.3.6 Marketing and Transportation (sheep and goats) 2.4.3.7 Small Ruminant Slaughter, Processing and By-Products

TABLE 1.3 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
D. (2) Range management technology (Tafogo and Gnanguedin sites)	
(a) examine existing physical grazing/herding infra structure: herding hierarchy/ daily/long term herding; grazing land rights; water rights; allocation of agricultural land; grazing patterns and seasonal use; influence of burning; water management; forest and game reserves; grazing reserves; sale of animals and direction of sales; cattle routes; crop and livestock integration; coping with drought	2.2.1.11 Water Resources 2.2.2.1.2 Natural Forage 2.2.2.1.3 Crop Residues 2.2.3 Range Resource Inventory--Gnanguedin Site 2.2.3.1.1 Traditional Boundaries 2.2.3.5 Priority Uses 2.2.3.7 Crop Production 2.2.3.8 Forestry 2.2.3.9 Burning 2.2.3.11 Water Resources 2.2.4.2.1 Season of Use
(b) examine vegetative change by comparing aerial photos of 1955 and 1974: tree canopy; forage species; vegetation classes	(This could not be done)
(c) land-use classification into resource areas (management areas): immediate high density area (villages); cultivated or agricultural area; grassland area; forest-wooded area.	2.2.1.6 Description of Vegetation Types (Tafogo) 2.2.3.6 Description of Vegetation Types (Gnanguedin)

1.2.2.2.2 <u>Results</u>

There were little reliable data on the livestock production system for the project sites. The CID team collected, analyzed, and assembled relevant data in a baseline survey which is presented in Chapter 2 of this report. The baseline data serve as a standard against which changes resulting from later project interventions may be measured.

The CID team did not view data collection as an end in itself. The goal was to achieve a balance between the continuing demands for additional data and the need to initiate implementation activities.

1.2.2.3 <u>Organization of Local Groups</u>

1.2.2.3.1 <u>Goals</u>

The organization of local groups was a cornerstone of the VLP, specifically: "Exploring with indigenous village social and power structure the possibility of developing grazing reserves through the organization of grazing associations." The Range Management Specialist, the Animal Scientist, and the Social Scientist were designated key roles: "Range management specialist and the Livestock Specialist duties . . . design, conduct and implement resource development demonstration. The Range Management Specialist and the Livestock Specialist must be acutely aware of the sociological, religious and economic constraints of the developing country," and the "Rural Sociologist duties: . . . assist team members in working with the indigenous social power structure in redefining the problem areas based on local traditions, values and conditions." (AID/CID Contract)

Table 1.4 gives the specific activities planned by the team to organize groups of local livestock raisers. These groups were basic to the team's understanding of the social, religious, and economic context in which they were working. Table 1.4 also notes the sections of this report that deal with local group organization and interactions.

TABLE 1.4

ACTIVITIES AND RESULTS RELATED TO THE ORGANIZATION OF LOCAL GROUPS GOAL

Goals/Activities	Location of Results in Report (Section No.)
A. Community organization work in Tafogo, Ougarou, Namoungou, Gnanguedin, Gourgou-Moaga sites to establish functioning committees of livestock producers.	5.3 Methodology for Social Science Research Used 5.4 Formation of Livestock Producers' Committees
(1) Make contact in all villages in each site to explain the project and its general goals.	2.3.2 Women's Role in Livestock Production
(2) Design and explain the functions of a site-wide committee of livestock producers.	
(3) Select villages and neighborhoods that will choose representatives.	
(4) Insure adequate (equitable) representation of all ethnic groups, types of livestock producers, local traditional leaders, and local opinion leaders.	
(5) Instruct villagers in work of representatives and the mechanism for selection.	
(6) Coordinate timing of meetings of site village livestock committees with project team members.	
(7) Observe interactions of/and assist each committee in coordinating its goals with project goals.	
(8) Develop a regularized system for local inputs and feedback to project activities, ideas, and proposals.	

TABLE 1.4 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
A. (9) Develop village level livestock committee and increase contacts between extension agents and individual livestock producers.	
B. Develop and implement a vaccine delivery system in all sites in coordination with the National Livestock Service, and local livestock producers' association.	

1.2.2.3.2 Results

One of the principal accomplishments of the VLP was the organization, establishment, and maintenance of the village livestock producers' committees. These are village and site-wide groups through which CID team technical proposals are refined, accepted, and then transferred into concrete programs. These groups made an immeasurable contribution in helping the social scientist "in redefining problem areas based on local traditions, values, and conditions."

The groups were originally established through working with the indigenous social power structure. In October 1980 there were active and functioning site-wide committees in each of the six major sites (Koukoundi, Tafogo, Ougarou, Namoungou, Gnanguedin, and Gourgou). Table 1.5 provides a sample of the types of meetings which were held during a single six-month period of the project. The variety of locations, the different levels of interaction from government officials to village groups, and the variety of topics discussed are indicative of the kinds of relations the CID team developed and maintained during the project.

There were also management subcommittees in the two major sites of Gnanguedin and Tafogo. There were poultry subcommittees in the VLP sites with active poultry projects. At Koukoundi, there was a highly motivated and effective women's livestock producer subcommittee. With CID personnel, they helped identify problem areas and helped to set priorities in their solutions. The basis for further formation of local level subcommittees was laid; however, their actual organization was suspended because of the anticipated gap in funding between the first and second phases of the project. Ad hoc groups, such as one for the water development program, were organized as needed to accomplish specific tasks and then disbanded.

All groups and official committees met frequently with different personnel from the CID team and GOUV. This supplied an institutional link through which innovation at the national level could and did diffuse to the remote village level. The multi-village or site-wide committees were particularly effective in

TABLE 1.5

TYPICAL SITE AND ORD COMMITTEE MEETINGS*

Location	Date	CID Team With	Topic
Kaya	6 July	Prefet-sous Prefets-ORD	Presentation of work program
Koudoundi	14 July	Chef de Canton, villagers	Benediction for vaccination park
Tafogo	20 July	Site Livestock committee	Project interventions
Koupela	8 Sept	ORD director and staff	Work program
Tenkodogo	18 Sept	Prefet-sous Prefet, secretary gen., ORD dir., and staff	Presentation of work program
Tafogo	30 Oct	Site livestockmens' committee	Project interventions
Tafogo	1 Dec.	Site livestockmens' committee	Project interventions
Gourgou	6 Dec	Village group	Project interventions
Ougarou	8 Dec	Site livestockmens' committee	Project interventions
Namoungou	8 Dec	Site livestockmens' committee	Project interventions
Moaga	15 Dec	Village chiefs and representatives	Formation of site livestockmens' committee

*Examples from July-December, 1978

bringing together members of different villages to discuss problem areas and potential solutions to dilemmas that are common to all of them. This foundation of cooperation was not only valuable in accomplishing project goals but was also perceived as an interesting and desirable development by the villagers themselves. Through it, they should continue to provide an invaluable source of feedback as more and more of the proposed solutions are implemented during Phase II.

1.2.2.4 Identification and Demonstration of Problems

The identification and demonstration of problems is inextricably mixed with the identification and demonstration of alternative solutions (section 1.2.2.5). Problems must be perceived and demonstrated before alternative solutions can be formulated and tested.

1.2.2.4.1 Goals

The contract document designates only a single task toward problem identification: "Rural sociologist . . . duties . . . assist team members and village legitimizers in identifying alternative solutions to the identified problems and set priority for solutions."

In addition, two items in the contract (nos. 1 and 5) provide solutions to generally known problems of the region:

Assisting selected villages to improve animal health through a concentrated program of vaccination and internal and external parasite control, improved feeding practices, and animal selection.

Assisting selected village leaders with determining the validity of present burning practices and developing methods for controlling excess burning of grasses, shrubs and forbs.

Table 1.6 presents the specific activities planned by the CID team to identify and demonstrate problems and notes the sections of this report relevant to problems. Section 1.3 of this chapter discusses

TABLE 1.6

ACTIVITIES AND RESULTS RELEVANT TO THE IDENTIFICATION AND DEMONSTRATION OF PROBLEMS GOAL

Goals/Activities	Location of Results in Report (Section No.)
A. Livestock and health	
(1) Measurement of livestock nutrition and livestock health problems and needs.	1.2.2.4.2.1 Vaccination and Antiparasite Programs
(2) Design of demonstration of needs for improved nutrition and improved animal health.	1.2.2.4.2.2 Color Coded Vaccination Receipts
(3) Design of demonstration of needs for projects in livestock fattening and finishing.	1.2.2.4.2.3 Supplementary Feeding of Livestock
B. Resource depletion and quality	
(1) Vegetation: nutrition value, vigor, quantity, regeneration, and distribution	5.5.3 Trend Study Method 2.2.1.6 Description of Vegetation Types (Tafogo)
(a) start measuring long- and short-term vegetative trends by establishing permanent measuring points in Tafogo and Gnanguedin sites	2.2.3.6 Description of Vegetation Types (Gnanguedin)
(b) establish vegetative canopy inventory in Tafogo and Gnanguedin sites (tree inventory)	5.1 Tafogo Site Wood Study 2.2.1.8 Forestry (Tafogo) 2.2.3.8 Forestry (Gnanguedin)
(2) Water: distribution, accessibility, and brief notation of quality	1.2.2.4.2.4 Traditional Well Improvement Program 2.2.1.11 Water Resources (Tafogo) 2.2.3.11 Water Resources (Gnanguedin)

TABLE 1.6 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
C. Burning (Gnanguedin and Tafogo sites).	
(1) Quantitative surface area burned	2.2.1.9 Burning (Tafogo) 2.2.3 9 Burning (Gnanguedin)
(2) Frequency of burn	
(3) Observed ecological effects of burning	
D. Demonstration of Range Management.	
(1) Establish in Tafogo and Gnanguedin sites fenced study plots of .5 ha and 50 ha, and an exclosure plot of .5 ha at Koukoundi village site (pending availability of material and labor)	1.2.2.4.2.5 Demonstration Plots
E. Preparation of problems involving livestock: Tafogo, Koukoundi, Ougarou, Namoungou, and Gnanguedin sites.	
(1) Preliminary identification of problems by:	2.3.1 Existing Cultural Milieu
(a) region (technical and administrative)	2.3.4 Institutional Resources
(b) local level dealers	
(c) organizations (livestock producers' association)	2.3.3 Livestock Producers' Committees
F. Individual level identification of problems--livestock management survey	
(1) Methods of implementation	2.3.1 Existing Cultural Milieu
(a) survey questionnaire design	2.3.2 Women's Role in Livestock Production
(b) preliminary testing and modification	2.4 Livestock Production System

TABLE 1.6 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
F. (1) Continued	
(c) translation into More, Gourmantche, and Peulh	
(d) training interviewers	
(e) field testing: Koukoundi site	
(f) sample design and selection	
(g) data coding and processing	
(h) data analysis and final support	

the findings of the project in the context of the problems identified by the CID team.

1.2.2.4.2 Results

Problems were identified in the course of making the baseline survey. A preliminary set of priorities was established for dealing with these issues. Local perceptions of problems were not always in accord with their technical identification. Where differences occurred it was necessary to design and implement demonstrations of the "need for change." These demonstrations were carefully designed on a sound social and technical basis to achieve the desired effect in the given locale (environment).

Specific programs to demonstrate problems include the vaccination and anti-parasite program, color-coded vaccination receipts, supplementary feeding of livestock, traditional well improvement program, and range demonstration plots.

1.2.2.4.2.1 Vaccination and Anti-Parasite Programs

The VLP set up a model infrastructure in each of the sites within each ORD. Two extension agents were trained as vaccinators for each of the six sites. The extension agents worked under the supervision of a livestock nurse assigned by the National Livestock Service or in some instances worked without direct supervision.

Vaccines from the National Livestock Service pharmacy were distributed to the livestock producers through the extension agents. They move from community to community within each site vaccinating livestock as requested by the livestock producers.

Early in the VLP's tenure the CID team assumed complete responsibility for the vaccination program at the project sites. When Dr. Sionné became Voltaic Project Co-Director on May 1, 1978, he was placed in direct charge of the entire vaccination program as well as the supervision of the extension agents and their activities. The CID team continued in a vital cooperative role, working directly with the extension agents and the livestock health programs, but the overall management remained in the hands of Dr. Sionné.

Dr. John Maré, D.V.M., University of Arizona, Department of Veterinary Science, recognized the need for a strengthened diagnostic service to assist in the proper identification of animal diseases. Since Maré's assignment the German Assistance Program, under the direction of Drs. Fink and Schrecke, D.V.M.'s, designed and equipped a central veterinary diagnostic and training laboratory for Voltaic technicians who operate the facility. Unfortunately, this laboratory became operative too late in Phase I to contribute substantially to the VLP.

1.2.2.4.2.2 Color-Coded Vaccination Receipts

Based in interviews with a large number of Voltaic livestock producers of diverse ethnic groups, the CID team social scientist concluded that the vaccination programs of the National Livestock Service were not well understood. His specific observations were as follows:

1. Many livestock producers bring cattle in for vaccinations only after the animals are already sick.
2. Many livestock producers vaccinate their animals against only one or two of the diseases which periodically ravage their herds.
3. Many livestock producers who had had their cattle vaccinated did not know which diseases they had vaccinated against. In numerous cases they said they had vaccinated against a particular disease, but project extension agents' records and recollections indicated that a completely different vaccine had been administered.
4. Often livestock producers who had lost animals to a disease they erroneously thought they had vaccinated against blamed the vaccinators or the Livestock Service as a whole for their losses.

In order to cope with these problems, project extension agents carried out a thorough educational campaign in project sites. To assist in these efforts extension agents were issued color-coded vaccination receipt books. Each set of receipts was color-coded for a different cattle disease:

pasteurellosis--green
trypanosomiasis--pink
rinderpest--blue
black leg--yellow
anthrax--orange
pleuropneumonia--white

At village meetings, livestock producers were informed of the relationship between the color-coded receipt and the disease it represents. It was shown that this simple device makes it easier for livestock producers to realize that a variety of vaccinations are available; that vaccines are disease specific, i.e., one vaccine does not protect an animal against all diseases; and that owners need to vaccinate their cattle several times during the year to insure maximal protection.

This receipt system was initiated in all VLP sites. Initial reactions by livestock producers were highly favorable. It is suggested that this or a similar system be implemented by the Livestock Service on a national basis.

1.2.2.4.2.3 Supplementary Feeding of Livestock

In most of the six sites of the VLP the following by-products are available and are used extensively, but are improperly stored or handled.

Peanut hay--This is a valuable feed that is rich in nitrogen, thus high in protein. Peanut hay from four hectares of peanuts and dried under the best conditions will feed a pair of working oxen for about 200 days if they are fed four to five kilos two times a day with some concentrates.

Rice straw--It has limited feeding value, but it can be used to assure survival during the dry season. It will not suffice as the only feed ration for working animals.

Millet and rice bran--Mostly this has been given to chickens, but it constitutes a food rich in phosphorus for work oxen and horses.

Peanut and cottonseed cake--One kilo per day in the ration of a working or fattening animal provides an important energy balance to the ration.

Root crops--yams and manioc.

Some suggested rations for traction animals--from materials generally available in each of the six sites:

1.	Peanut straw	12 kg		
	Wild grass hay	4 kg		
	Wild grass silage	4 kg		
	Ground sorghum	2 kg		
2.	Grass hay	8-10 k		
	1 kg of mixture		Phosphate tricalcique	3 kg
			Sea salt	5 kg
			Sorghum grain	100 kg
	1 kg cottonseed or peanut cake			
3.	Grass hay	7 to 10 k		
	Sorghum or peanut cake	1 to 2.5 kg		
4.	Sorghum	1 k		
	Rice straw	5 k		
	Peanut hay	8 k		
	Peanut cake	0.5 k		
	Rice flour	0.5 k		

In each of the six sites the practice of feeding traction animals, as well as sheep and goats and cattle not used for traction, was studied. The feeds that are most commonly stored are peanut hay, bean hay, and late planted millet stalks. Farmers have also been observed to feed some grass hay, sorghum, and bean pods. They commonly buy white rock salt for salt licks.

The farmers' feeding methods can be faulted in the manner in which they store peanut and bean hays on top of platforms, exposing them to hot sun and dry winds. There is an inordinate amount of leaf loss and, thereby, a nutritive loss.

Silage pit trials have been held in the Fada ORD but with unsatisfactory results. Farmers say that in the rainy season when low-land grasses are at their best stage of growth for making silage, they are too busy with their own crop cultivation to have time for gathering green grasses, chopping them up, and packing them into earth pits. The more transhumant livestock growers were not convinced that silage or hay making would fit into their scheme of livestock movements from place to place.

The more sedentary farmers who have livestock do store crop residues, such as described above, but there is never enough. Even those who use traction animals cannot salvage sufficient crop residues from their fields to maintain their traction animals through the entire dry season. As a result they are often forced to assign the animals to a herder until the following cropping season.

Concerted attempts were made in the Tafogo and Koukoundi sites to interest farmers in growing some forage and hay crops on a trial-demonstration basis. Several farmers were approached and a proposal was made to them for a cooperative program. Farmers were asked to add to their farming operation just a few rows of a legume seeding (amounting to 1/5 ha). The seed and P_2O_5 fertilizer were to be provided by the VLP. Farmers would be expected to plant, cultivate, and harvest the crop.

No farmers accepted the offer. The reasons may include any of the following:

1. The feasibility of growing forage crops had not been demonstrated locally.
2. The farmer is extremely busy during the rainy season.
3. To date open-range pastures have supplied livestock with feed.
4. Most farmers have only enough land to grow food for their families.

1.2.2.4.2.4 Traditional Well Improvement Program

One of the initial requests made by the livestock producers was for the Project to improve their water supplies. The objective of this work is to assist villagers in developing their potable water sources, first for human needs and second for watering limited numbers of village cattle and small ruminants. It was not meant to furnish all the potable water needs of any one village area or project site. Needs were discussed with the livestock producers' committee and priorities established.

The following well sites were selected and approved by the Tafogo livestock producers' committee: Tampelga, Damkarko Daga, Longouzou, Djamkoka, Inclosure Site, Kamboinciberi, Seno, Tafogo Site (open site), and Bougou. The sites were selected in areas of densely placed traditional wells where there was not already a cement-lined well. In addition, one well site was selected at the Koukoundi project site.

The plan was that the Project would cement line the walls to the water table, after which the National Hydrology and Rural Equipment Service (HER) would take the wells below the water table and complete cement lining to the new depth. The Project would furnish the cement, steel rods, and hand tools necessary to complete the wells to the water table and would supervise the villagers in hand digging the wells to this depth. Payment of masons was also by the Project. The villagers would furnish manpower, sand, and gravel. Table 1.7 summarizes the activities of the well improvement project.

1.2.2.4.2.5 Range Demonstration Plots

Two types of demonstration plots were established by the VLP with the consent of the local livestock producers' committees: exclosure plots and inclosure plots. The purposes of the demonstration plots are several:

1. To demonstrate useful, as well as harmful effects of burning; seasonal differences in burning; effect on vegetative composition and vigor of plants, as well as plant reproduction.
2. To establish carrying capacities for a known vegetative type.
3. To demonstrate to all livestock and management groups actual vegetative and animal condition differences between control plots (inclosure and grazing land adjacent to it).

TABLE 1.7

ACTIONS OF THE WELL IMPROVEMENT PROGRAM

Locations	Actions
Tampelga	Dug 7 m to granite but collapsed before cement lining placed.
Damkarko Daga	New well started by HER.
Loungouzou	New well dug 15 m, diameter 1.8 m, aprons and stands constructed.
Djamkoka	New well dug 10.6 m, diameter 1.8 m; aprons and stands constructed.
Inclosure Site (Tafogo site)	Not necessary; near enough to Tougouri reservoir.
Kamboinciberi	Not enough labor available to dig well.
Seno	Not enough labor available to dig well.
Tafogo site	Existing well deepened 10.5 m, diameter 1.4 m.
Koukoundi	Dug 24 m and still dry; lined 8.5 m up from bottom.
Bougou	Existing well deepened 3.5 m, diameter 1.2 m.
Gourgou	Three new wells completed.
Gnanguedin	One new well completed.
Exclo-Inclo Plot (Gnanguedin)	Not necessary, near enough to water.
Kilaoce	One new well completed.

4. To demonstrate advantages of having control over animal movement within a certain grazing land condition

Exclosure plots are control plots where all domestic livestock are fenced out. These plots are .5 hectares. Exclosure plots allow for long-term monitoring of site degradation (change) including effects of grazing, agricultural expansion, wood cutting and woodlot development, and soil movement.

Inclosure plots are grazed plots whereby a known number of a given type of domestic animal are contained within a known surface area for a known period of time. These plots are used in establishing carrying capacities of certain vegetative types. Plots are to be a minimum fenced area of 50 hectares. Inclosure plots allow for adjustments to recommended grazing capacities by offering comparative analyses between controlled use inside inclosure plots, non-use exclosure plots, and traditionally grazed areas adjacent to the inclosure and exclosure plots.

The plot proposals were designed and presented to livestock producers' groups. Discussions followed for several months, after which approval was given, and sites were selected. The actual implementation proceeded with participation of range management subcommittees.

Plots at Gnanguedin. Three fenced plots were established within the proposed community grazing area at Gnanguedin:

1. A temporary four-strand barbed wire exclosure area of approximately 0.5 hectare was established early in 1980 for university students to carry out comparative vegetative research (see Figure 1.2).
2. A .84 hectare five-strand barbed wire permanent exclosure plot was completed 30 April 1980 in the northeast corner of the larger inclosure plot. No entry of grazing animals is allowed. This plot will be used to compare a control, non-use, area with a regulated-use area, and a traditionally grazed pasture. All three conditions exist side by side (see Figure 1.3).

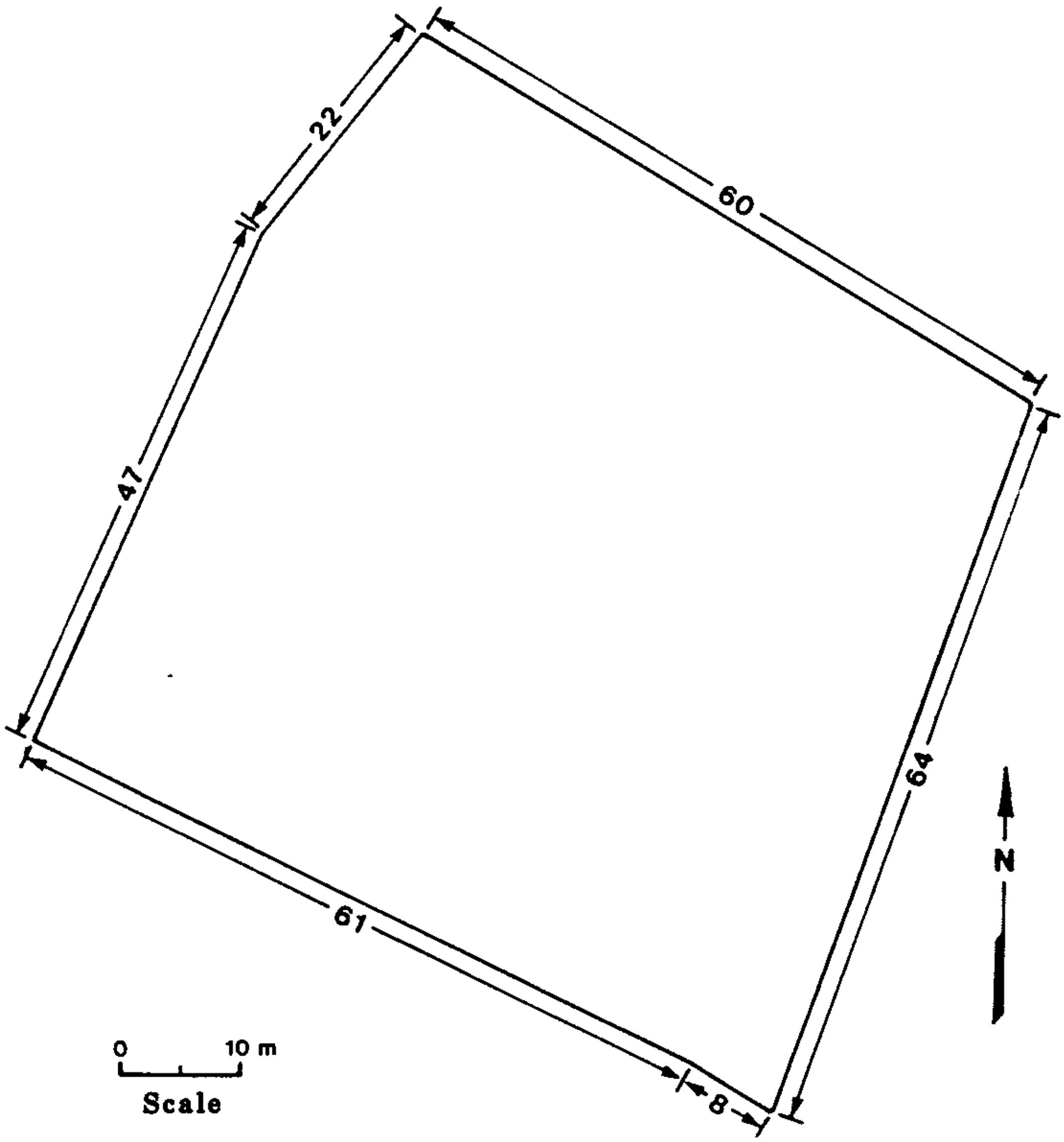


Figure 1.2 STUDY PLOT, GNANGUEDIN

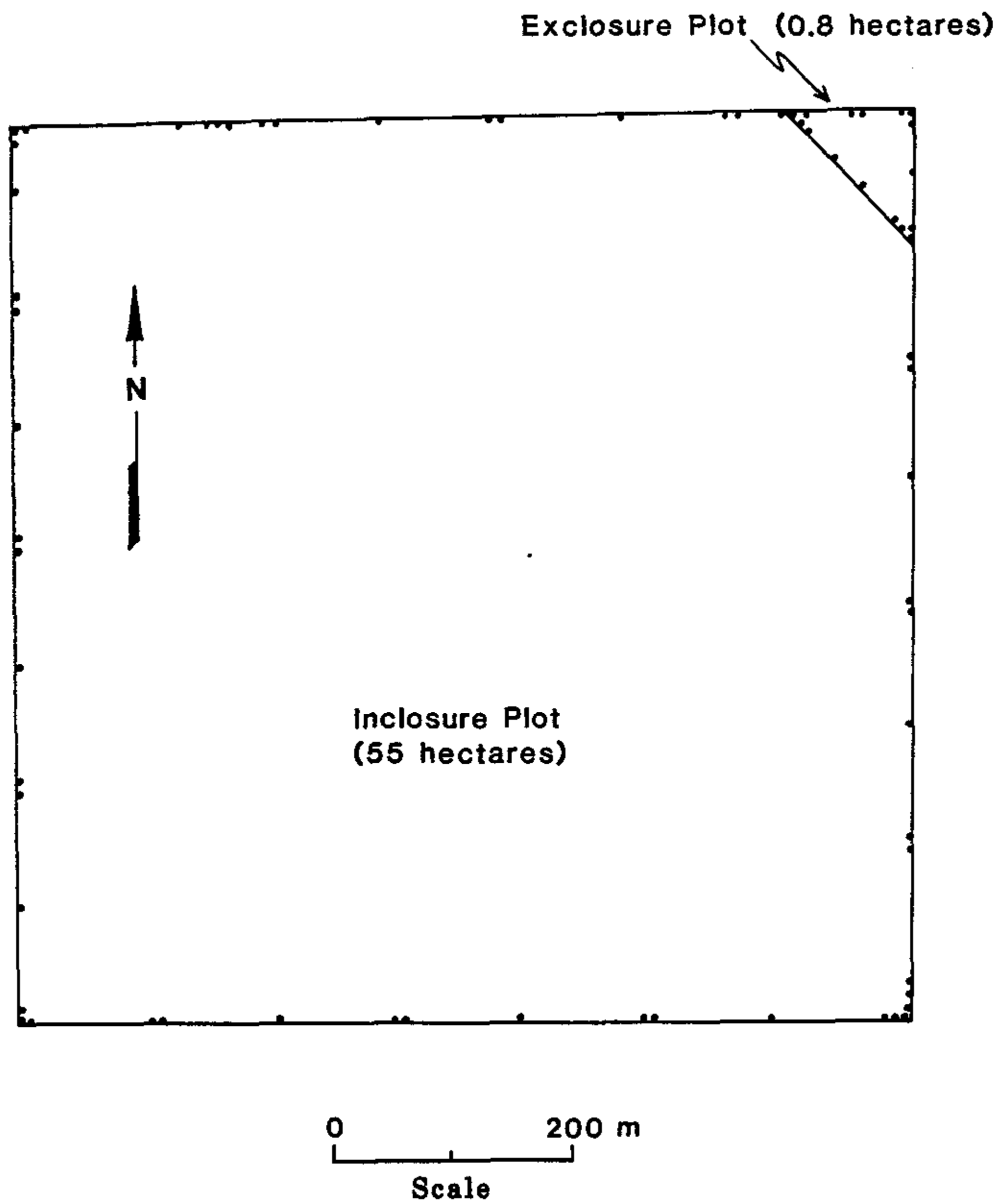


Figure 1.3 INCLOSURE-EXCLOSURE FENCED RANGE MANAGEMENT DEMONSTRATION PLOT, GNANGUEDIN

3. The third plot is the 55.37 hectare inclosure plot constructed of five-strand permanent type barbed wire fencing (see Figure 1.3). One gate entrance is provided on the southeast corner, near the old highway (regulated-use area).

All plots are along the old Bittou-Bané highway (old Nat'l Route N^0 12), one kilometer north of Bittou. The temporary exclosure plot is 4 kilometers north of the junction, and 7 meters to the east of the road; and the larger permanent plot is 11 kilometers north and just off the old road to the west. This plot is approximately 5 kilometers due east of Gnanguedin, and the south fence line can be viewed as a white spot from the microwave tower at Gnanguedin. The south fence is lined up on the microwave tower (see Figure 1.4).

There is a natural potable water source in a major drainageway one kilometer west of the fencing.

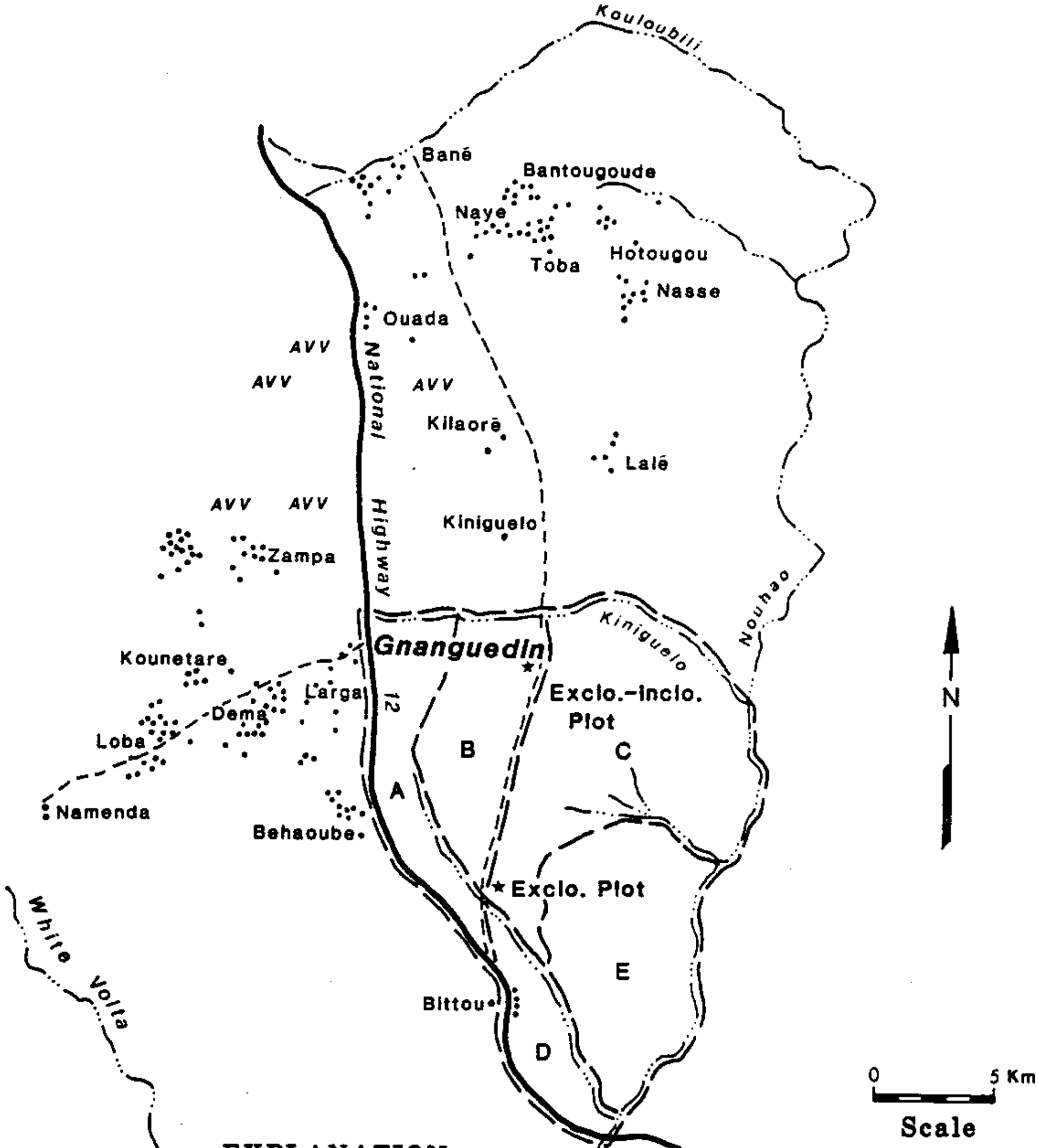
Inclosure Plot Carrying Capacity (post-burn). Total vegetative production per hectare is 3000 kilograms dry matter (biomass), adjusted to 1300 kilograms of grazeable dry matter before burn. Prescribed burning should be early in October-November, as soon as the vegetation can carry a fire. Roughly 78% of grazeable dry matter, by weight, should be destroyed by fire, leaving an estimated carrying capacity for a month grazing season of 21 Animal Units (A.U.). December and January are non-use recovery months following burn. Soils are still adequately charged with moisture to encourage regrowth.

$$\frac{\text{1300 kg dry grazeable biomass/ha x}}{\text{22\% biomass post-burn}} = \text{286 kg/ha}$$

$$\frac{\text{286 kg biomass/ha x 55.37 ha (inclo. plot)}}{\text{190 kg dry matter/A.U. mo. x 4 mo. grazing season}} = \text{21 A.U.}$$

(Feb. thru May)

The wisdom of repeatedly duplicating the burning treatment is questionable. Fire resistant plants become dominant and more



EXPLANATION

- Project Boundaries
- Compounds
- All Season Road
- 4-Wheel Trail
- Drainages
- ★ Range Management Demonstration Plots
- AVV Volta Valley Authority Lands

Figure 1.4 GNANGUEDIN SITE

desirable grazing species less dominant. Loudetiopsis scaettae represents 35% of the grass in the plot and is very fire resistant, and it has a usability rating of only .3 out of a possible 1.0.

Plots at Tafogo. The inclosure demonstration plot is an attempt at controlling livestock and human use on a range site. The 50-hectare fenced surface is located just northwest of the reservoir at Tougouri in a Gramminea-Tree vegetative type (see Figure 1.5 for location and Figure 1.6 for plot design).

The plot was installed in February 1979, with its first period of use in December 1979. Stock will be trailed one kilometer to water along an established bike trail to the Tougouri Reservoir. Fencing is six-strand barbed wire, 124 cm high. Wooden corner posts and fiberglass pickets, three meters spacing, were used. The fence is goat and sheep proof. Actual livestock use of this plot was to begin in late 1980 or early 1981 under the supervision of the local livestock producers' committee.

The exclosure demonstration plot is a non-use control plot and is situated on the northeast corner of the inclosure plot (see Figure 1.6). The fencing is wire mesh on the bottom topped with one strand of barbed wire.

Additional Plots. An exclosure demonstration plot was installed in the Koukoundi site, two kilometers northwest of the chief's compound in a Tree-Graminea vegetation type. When it was evaluated in April 1980, it was in good repair and showed striking differences between forage inside and outside. Grass and erosion trend plots were established at Tafogo and Tougouri.

1.2.2.5 Identification and Demonstration of Alternative Solutions

As noted in section 1.2.2.4 there are close relations between the identification and demonstration of problems and the identification and demonstration of alternative solutions. There is considerable similarlity between the goals and results of both sections. However, the discussion of specific activities has been allocated to one section or the other and not repeated.

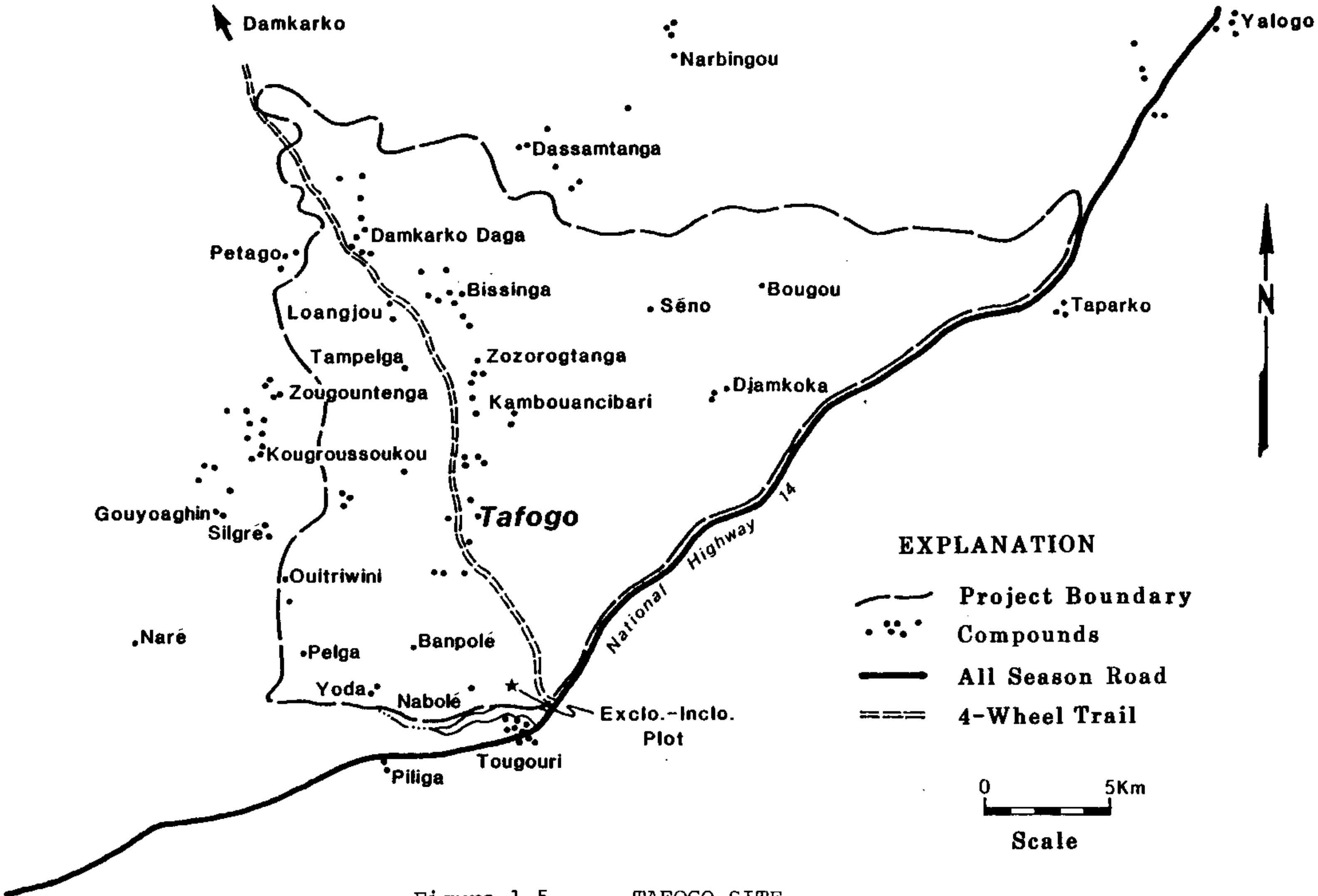


Figure 1.5 TAFOGO SITE

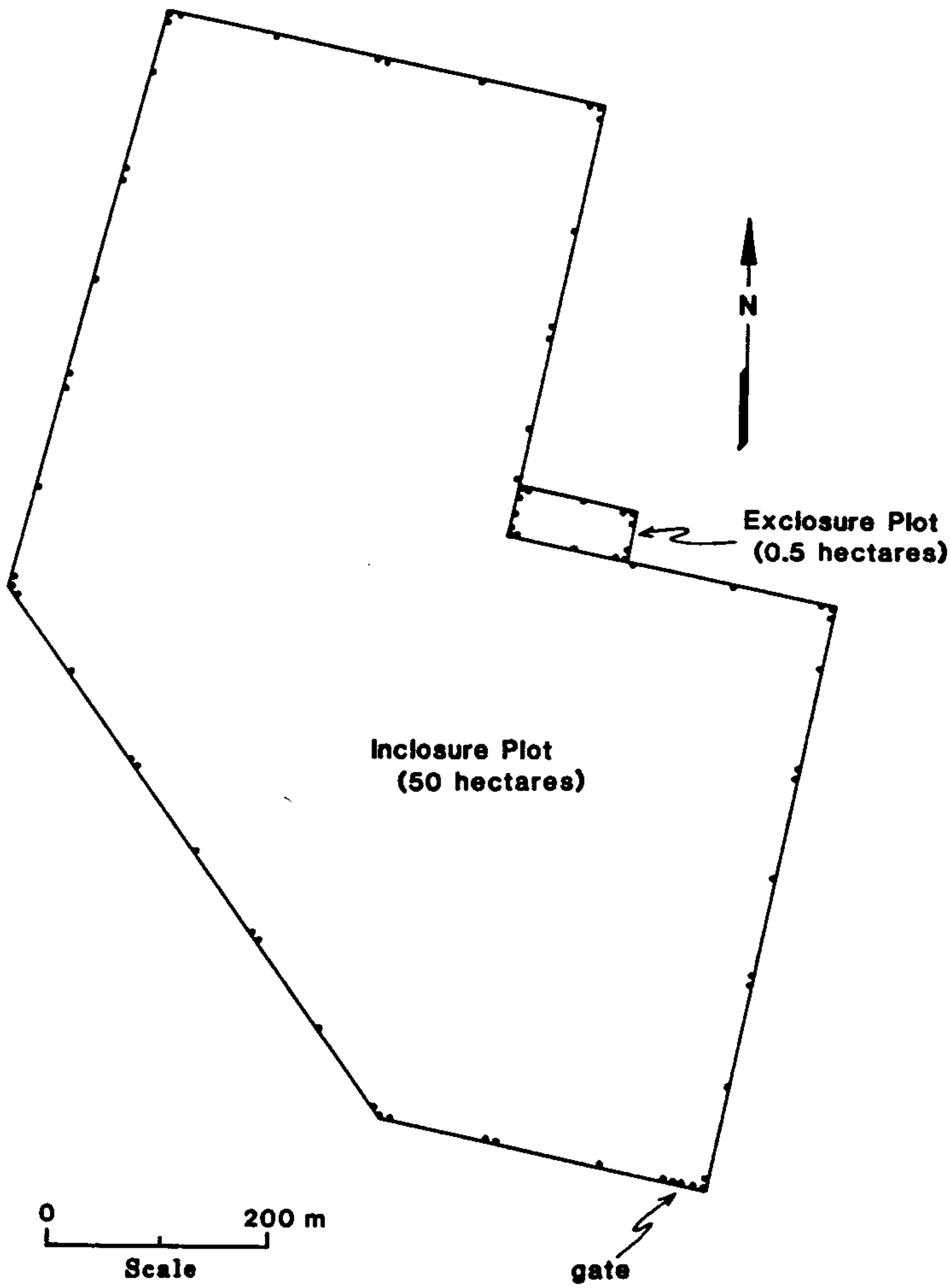


Figure 1.6 INCLOSURE-EXCLOSURE FENCED RANGE MANAGEMENT DEMONSTRATION PLOT, TAFOGO SITE

1.2.2.5.1 Goals

The contract specifies, "The major objective of the services to be performed under this contract is to assist the Upper Volta National Livestock Service and three selected semi-autonomous Governmental Area Development Organizations (ORD's of Kaya, Koupela, and Fada N'Gourma) in planning, designing, and implementing livestock projects and/or programs for small rural livestock producers at the village level." The contract also mentions "initiating a controlled grazing program in one or more selected villages." The duties of the range managemtnt specialist and the animal scientist require them to ". . . b) design and implement sound management practice schemes including reseeding, water development, grazing patterns, stocking rates, controlled burning (as determined by the data), in support of the overall project; c) design and set up range nutrition analytical laboratory (to include facilities for energy, nitrogen, phosphorus, and in vitro analysis); and d) conduct nutritional analysis of the forage in order to establish a research basis and to support experimental research."

The social scientist's role is to "assist team members and village hierarchy in devising practical methods for program implementation." A veterinarian on short term assignment would "assist the animal scientist in instituting a continuing program directed at treating and controlling livestock disease and disorders," and "work with government level individuals in the Department of Veterinary Services in designing and implementing the livestock health program."

Table 1.8 gives the specific activities planned for identifying and demonstrating alternative solutions. The detailed results of these activities are referenced by sections of this report.

1.2.2.5.2 Results

Concrete activities, such as the implementation of the vaccination program, continued throughout the project life. Other activities, justified by analysis of the baseline data, were tested

TABLE 1.8

ACTIVITIES AND RESULTS RELEVANT TO THE IDENTIFICATION AND DEMONSTRATION OF ALTERNATIVE SOLUTIONS GOAL

Goals/Activities	Location of Results in Report (Section No.)
A. Controlled and coordinated grazing: It must be determined if it is possible on any level, local, regional, or national, to establish nationalized land-use policies which will allow for the establishment of voluntary controlled and coordinated grazing schemes. Feasibility studies and an examination of implementation methods pertaining to these schemes are the tasks to be undertaken in the first few years of the project.	
(1) Administrative and social infra structure (team) Tafogo and Gnanguedin sites:	
(a) organize and involve an ORD level planning committee (regional committee) in the feasibility of efforts and in the determination of implementation methods	Table 1.4 is an example
(b) coordinate efforts with other technical services and national projects; elevage service, AVV, and agri- cultural services	Examples throughout, especially 1.2.2.4.2.4 Wells 1.2.2.1 Defining Sites
(c) develop understanding of land- use planning practices within the site of livestockmen's committees	1.2.2.3.2 Results-- Organization of Local Groups
(2) Develop a site grazing scheme in the Tafogo site in which:	
(a) a known land surface will support a known number of cattle, sheep, and goats for a known period of time without adverse effect on the natural environment	1.2.2.5.2.1 Grazing Practices

TABLE 1.8 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
A. (2) (Cont)	
(b) grazing relief will be given certain vegetative areas during a growing, producing, and germination cycle (one year)	1.2.2.4.2.5 Range Demonstration Plots
(c) a livestockmen's group within each site will control and administer terms-of-use within each site, and safeguard the integrity of the site grazing scheme vis-a-vis agriculture production within an overall land-use plan	
(d) agricultural interest will not infringe upon grazing zones for agricultural purposes	
(e) adequate stock water will be provided so as to have no adverse effect on the natural environment. Human water resources will also be an important consideration in high density (e.g., village) areas so as to have no adverse effect on the natural environment	
(3) Develop a site grazine reserve (Gnanguedin, ORD Koupela).	
(a) The purpose is to create a large pasture reserve area whereby pressures from expanding agriculture would be eliminated and where long-term practical grazing studies and more scientific environmental studies would be undertaken.	1.2.2.4.2.5 Range Demonstration Plots 1.2.2.5.2.1 Grazing Practices
(b) Management of the long-term practical grazing studies would be undertaken by National Livestock Service personnel in close collaboration with the ORD and	

TABLE 1.8 (Continued

Goals/Activities	Location of Results in Report (Section No.)
A. (3) (b) the livestockmen's committee of Gnanguedin. The ORD would be the planners and their constituents would be the users of the pasture reserve.	
(c) Livestock permitted on the reserve pasture scheme (see a above) would be herds with prior tenure (perhaps three years) in either the reserve area or the Gnanguedin site villages or pasture.	
(d) A small parcel within the reserve would be used for scientific range management studies: a) grass reseeding plots b) long-range trend studies c) adjusted grazing capacities	
(e) The reserve would not be fenced but would depend on natural well-defined boundaries and regional and local administrative authority to guarantee its integrity.	
B. Develop a livestock production scheme demonstrating what can or cannot be done about the following (Scott):	
(1) Animal and poultry health	1.2.2.4.2.1 Vaccination and Anti-Parasite Programs 1.2.2.4.2.2 Color-Coded Vaccination Receipts 1.2.2.5.2.2 Koukoundi Women's Poultry Project 1.2.2.5.2.3 Modern Poultry Breeding Program 1.2.2.5.2.4 Alternative Poultry Program
(a) continued and strengthened vaccination programs for large and small ruminants	
(b) an expanded health program to include:	
1) farm poultry and swine vaccination activities (if feasible or profitable)	

TABLE 1.8 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
B. (1) (b) 2) antiparasitic practices, both external and internal for all animals	
3) the installation, as required, of properly constructed and adequate vaccination parks in all sites (depending upon availability of material and labor)	1.2.2.5.2.5 Vaccination Corrals
(2) Nutrition, including feeding facilities.	
(a) Introduction, demonstration, and establishment, with selected cooperating farmers, of additional farm forage and hay crops to be grown in a program designed to alleviate low-level nutrition of animals during dry seaons and to maintain working and breeding animals in good condition until seasonal forage and grasses are available.	1.2.2.4.2.3 Supplementary Feeding of Livestock
(b) Establishment and production of high energy forages for preservation and use in a farm feeding program with selected cooperating farmers. This effort will be designed to increase farm income by providing fattened or better finished animals for local markets.	
(c) Mineral and salt feeding supplement for all sedentary ruminant livestock and for range livestock.	1.2.2.5.2.6 Supplemental Mineral Feeding of Livestock
(d) Country-wide investigations of the availability of high energy waste by-products, at economical prices, that can be utilized as supplemental feed for fattening or finishing farm animals.	

TABLE 1.8 (Continued)

Goals/Activities	Location of Results in Report (Section No.)
B. (3) Management of livestock	
(a) An innovative livestock management program designed to synchronize breeding and seasons with seasons of higher natural grass and forage production.	2.4.3.3 Breeding Management (sheep and goats)
(b) A program for the adoption of scientifically accepted livestock practices which will help to alleviate the high mortality rate of young animals.	
(4) Poultry production project	
(a) Extension training encadreurs	1.2.2.5.2.3 Modern Poultry Breeding Program
(b) Vaccination training encadreurs	1.2.2.5.2.4 Alternative Poultry Program
(c) Cost-benefit analysis to determine feasibility and/or profitability of poultry production for average farmer.	1.2.2.5.2.2 Koukoundi Women's Poultry Project

or demonstrated before final implementation. Lines of communication were established with other organizations working in livestock and related sectors to maximize the possibilities for coordination of efforts.

Specific programs to demonstrate alternative solutions included innovative grazing practices, the Koukoundi women's poultry project, modern poultry breeding programs, alternative poultry project, vaccination corrals, and supplemental mineral feeding.

1.2.2.5.2.1 Innovative Grazing Practices

Two proposals for management of grazing resources in the Tafogo site were made to the local livestock producers' committee and were still under consideration at the writing of the final report: (1) a rest rotation grazing system and (2) reforestation plots.

The rest rotation grazing would involved an area of 600 hectares divided into three 200-hectare parcels. Table 1.9 presents the proposed scheme. The acceptance of the responsibility for such a rest rotation system would signal the development of the livestock producers' committee into a range users group with goals to improve plant vigor and quality and to reduce soil erosion. In discussions with the committee they were concerned with their ability to physically protect unfenced plots.

The reforestation plots would protect soil from wind and water erosion, provide firewood and construction materials, and supply additional forage for animals. At the writing of the final report research into sources of tree seedlings still continued (see Appendix 5.1).

1.2.2.5.2.2 The Koukoundi Women's Poultry Project

This project was an outgrowth of the work on women's role in livestock production (section 2.3.2).

The Koukoundi women have organized themselves into a livestock committee. With the aid of their husbands and with the

TABLE 1.9

REST-ROTATION GRAZING SCHEME AND USE PERIODS

-3- 200 Ha	-2- 200 Ha	-1- 200 Ha
1st year grazed	1st year grazed	1st year rest
2nd year grazed	2nd year rest	2nd year grazed
*3rd year rest	3rd year grazed	3rd year grazed
4th year rest	4th year grazed	4th year grazed
5th year grazed	*5th year rest	5th year grazed
6th year grazed	6th year rest	6th year grazed
7th year grazed	7th year grazed	*7th year rest
8th year grazed	8th year grazed	8th year rest
9th year rest	9th year grazed	9th year grazed
10th year grazed	10th year rest	10th year grazed

*Reseeding program begins

sanction of the Koukoundi site livestock producers' committee, the women have been able to start a modest but very practical poultry project. With the assistance of the VLP , the women are now involved in a hen-laying project (60 hens).

The husbands of the women constructed the poultry house and yard upon advice of experts of the Livestock Service. The VLP provided the fencing, feeding, and watering devices, and six Rhode-Island Red cockerels purchased from the Poultry Center in Ouagadougou at 1000 CFA each. The women themselves provided the hens.

The purpose of this project is to increase the poultry numbers of the village by obtaining good quality cockerels to place with the native hens to produce a more hardy but more productive crossbred chicken. Unfortunately the VLP (Phase I) drew to a close at a time when these women needed advice and support the most. At that time no continuing support was anticipated from the Livestock Service or from any donor agency.

1.2.2.5.2.3 Modern Poultry-Breeding Programs

The overall purpose of the poultry breeding project was to test the feasibility of a modern* poultry raising project under village conditions.

The objectives of the VLP venture into modern poultry breeding at the village level were as follows:

1. To raise the quality of poultry in the villages by providing upgraded cockerels and hens for acquisition by villagers.
2. To create an interest in poultry raising as a farm enterprise.
3. To test the commercial feasibility of poultry raising for villagers as a profit-making enterprise.
4. To teach and provide awareness among the villagers as to the necessity for using vaccines, medicines, and good sanitation for the control of disease and the promotion of good health in village poultry flocks.

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*Modern poultry breeding project, for our purpose, is defined as artificially brooding and rearing chickens in confinement using balanced feed rations and relying on accepted prophylactics for disease control.

The VLP established completely financed and logistially supported poultry raising demonstrations.

A rustic poultry housing complex (see Figure 1.7) was established in Namoungou, Fada ORD; Tafogo, Kaya ORD; and Gourgou, Koupela ORD. Poultry buildings at Ougarou were repaired and whitewashed. Each complex became the property of, or was under the control of, the local village chief.

The VLP demonstrated that raising poultry in a modern method was not financially feasible in the two sites, Gourgou and Tafogo. Calculations show that, even if the permanent fixtures and buildings are amortized over a period of about five years, it requires a 100% survival of all the chickens to "break even" at the market sales price of 500-700 CFA per head.

The village poultry projects could not have existed without the very expensive backstopping provided by the CID team and Voltaic technicians. Salaries, the transportation of supplies, and vehicle maintenance are unaccounted for in the economic analysis. Therefore, it would be impossible for villagers to operate alone without benefit of donors.

Both project sites, Gourgou and Tafogo, experienced extreme losses due to disease and poor husbandry. In spite of close supervision by trained extension agents, the mortality of the chickens at the Tafogo site was 58%. Much of this was due to inaccessibility to the source of supplies and medicines at the Central Pharmacy in Ouagadougou. Numerous times a disease breakout had made serious inroads into the flock's health before medications could be obtained. Sometimes a disease was rampant within the flock at the time of vaccination, which resulted only in compounding the disease intensity. Much of this can be attributed to the great distance of the poultry site from the Central Pharmacy, to the lack of communication, and to unreliable transportation.

Some of these health problems were alleviated by the placement of refrigerators at the village site where vaccines can be kept on hand, but this is an expensive proposition for the villagers without donor assistance.

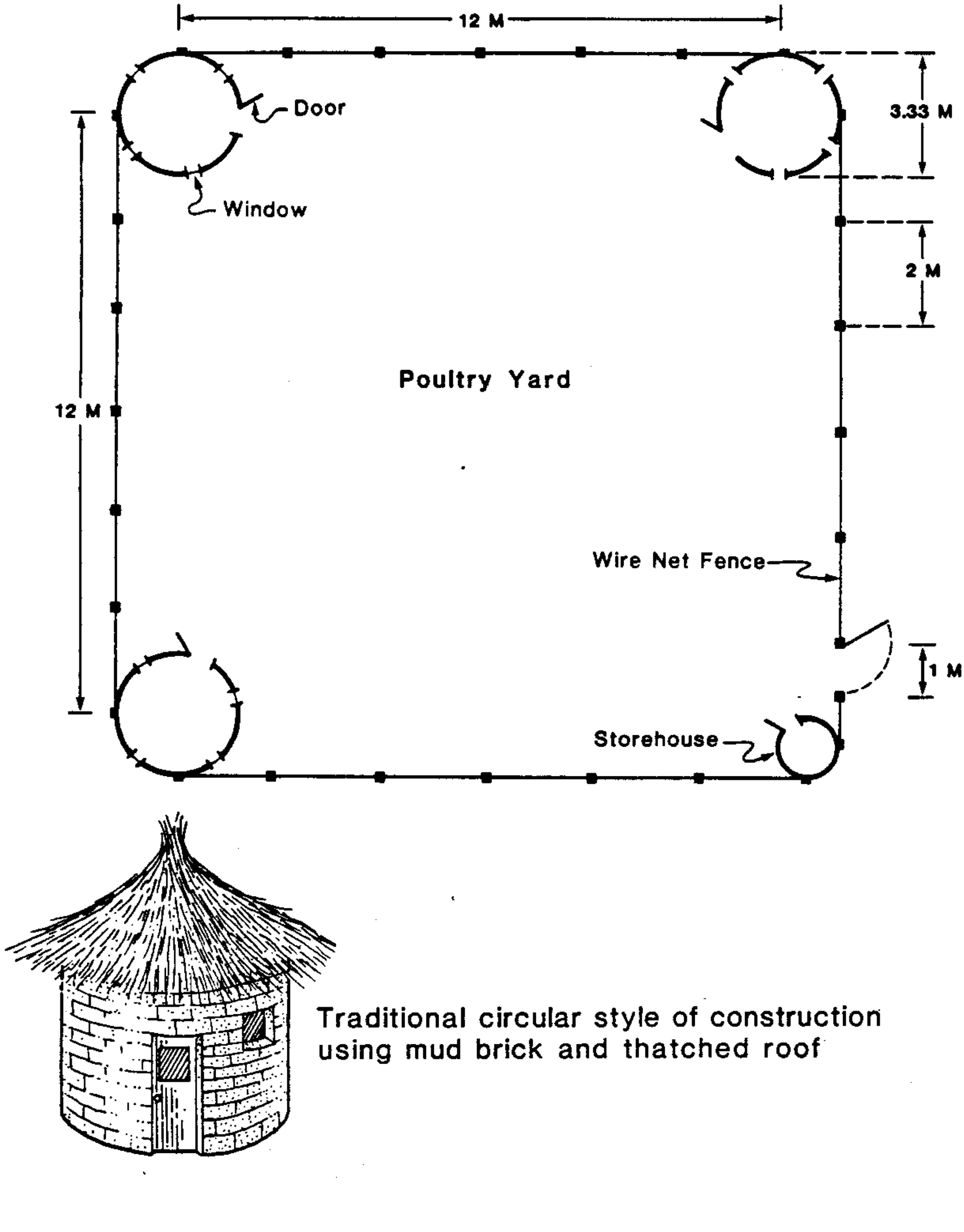

Figure 1.7 LAYOUT OF A POULTRY BREEDING PROJECT

1.2.2.5.2.4 An Alternative Poultry Project

Poultry raised in the traditional manner have an inherent tendency to balance their own rations. Their ranging about the village during the daytime allows them access to insects and some other protein sources from kitchen scraps, animal droppings, and other wastes. The gleaning and screenings from grain crops are available. These sources of foods are limited, but may be supplemented with milk used for family nourishment, especially for baby chicks. Various vegetable sources such as manioc and other root crops can furnish the basics for a good poultry feed.

Native chickens or those chickens raised traditionally have a tendency to decrease in size through the succeeding generations. This can easily be overcome by the introduction of European breed cockerels periodically. The hardiness developed in the native hen makes this a desirable cross. This method of upgrading village flocks is recognized and encouraged by the technical experts of the Livestock Service.

Mr. Oula Koulibaly, assistant to the Voltaic Director of the VLP, prepared a paper concerning the difficulties of poultry production at the village level. He outlined a breeding program to show the accumulated benefits of crossing European cockerels with local hens, as well as the sanitation and feeding and care of the poultry flock (see Appendix 5.2).

1.2.2.5.2.5 Vaccination Corrals

Wherever livestock are raised there is always a need for safe and efficient means of handling animals. In Upper Volta, as in most parts of Africa, livestock producers construct corrals with thorn bushes and tree limbs. These temporary structures hold a few animals at a time in a relatively small area. The younger men of the village wrestle the animals to the ground and hold them immobile while the vaccinations and castrations are performed. The incidences of gorings and broken bones both for man and animal are quite high.

The village chiefs and livestock producers were well aware of the dangers. They agreed to the construction of modern livestock corrals and at each site designated certain parcels of land for such a purpose. The livestock producers' committees recognized that the location and placement of the structures should be to accommodate both the sedentary and the transhumant livestock producers.

Using the basic measurements of the standard corrals, constructed of iron tubing by French technicians several years ago, the CID animal scientist with the advice and assistance of Mr. Tiendrebeogo Boniface, livestock assistant, Kongoussi, drew up a design that was accepted by livestock producers' committees in all six sites (see Figure 1.8).

Vaccination corrals were completed at Ougarou, Namoungou, Koukoundi, and Gnanguedin. Two corrals already in existence were repaired.

The new corrals were constructed of reinforced concrete, concrete blocks, and mortar. The basic design allows for innovative alterations and adaptations as needs arise. Spray races for large ruminants and dipping vats for small ruminants are possible future additions. The corrals also can be useful for internal parasite control treatments, weighings, and other measurements.

In siting the vaccination corrals, the CID team gave attention to the need for a source of water so that programs of spraying or dipping for external parasites could be adopted. This need led the CID team to plan a program of well improvement (see section 1.2.2.4.2.4).

The vaccination corral installations have increased by 50% (over the old brush corrals) the number of cattle which can be vaccinated in a given period of time without increasing the number of veterinary nurses or other vaccinators. Also, the new corrals have facilitated the retention and control of cattle, thus making the prophylactic treatments much less dangerous for both man and animals.

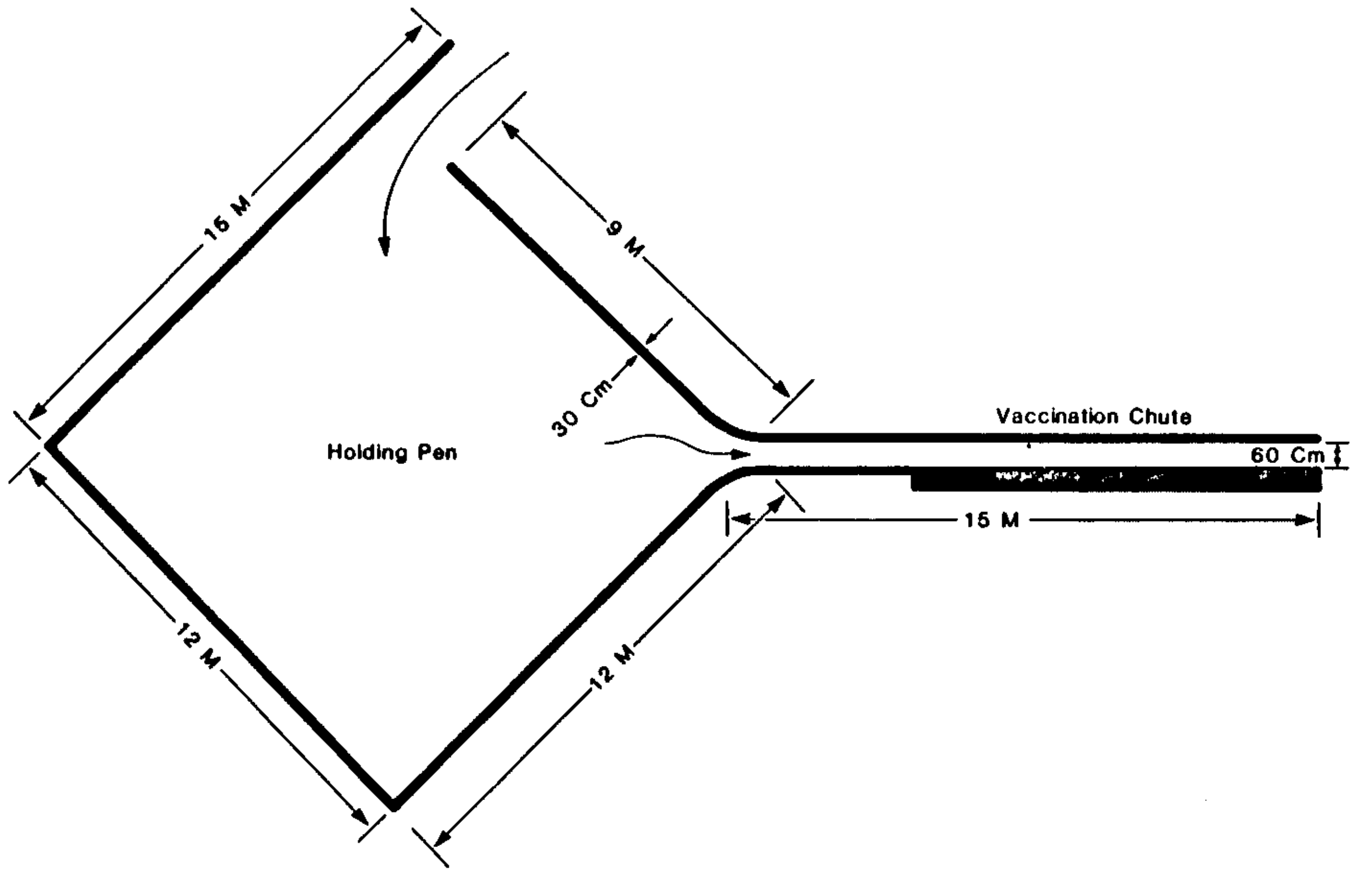

Figure 1.8 VACCINATION CORRAL

1.2.2.5.2.6 Supplemental Mineral Feeding of Livestock

A few livestock producers are beginning to provide a mineral supplement in their livestock feeding. Each year the sales of mineral-salt blocks are increasing. In the last three years the Kaya factory, the fabricator of mineral-salt blocks, has increased its output by 75%. A mineral block containing cottonseed, which will add protein to an animal's diet, is now being introduced at a price of 130 CFA per kilogram.

The blocks are sold in cylinders of two and five kilograms to livestock producers and are becoming increasingly popular. Distribution problems are limiting more extensive use of the blocks.

The VLP has taken a leading role in promoting interest in these mineral blocks throughout the three ORD's. A rotating fund was established at the Livestock Service to assure a constant supply of mineral blocks to livestock producers.

1.2.2.6 Training

1.2.2.6.1 Goals

In the contract training was a major element of team activities: "providing training opportunities in livestock production management for extension agents, future leaders of livestock projects, and village livestock personnel." The contract also mentions the following specific duties for team members: "Range management specialist and animal scientist . . . train and advise a local counterpart in all pertinent aspects of range management and improved livestock management; and work with village, local government, and expatriate individuals in demonstrating the need for, and the gain from improved range practices and improved livestock management . . . Rural sociologist . . . assist in training ORD staff (directors, veterinary nurses, and extension agents) in community development procedures . . . Veterinarian . . . train local veterinary assistants in identification and treatment of livestock's diseases and disorders, ... returning periodically to conduct seminars or supporting work in the veterinary discipline."

Table 1.10 gives the specific activities planned to meet the training goals and notes the sections of this report where training activities are detailed.

1.2.2.6.2 Results

Expansion of knowledge concerning project activities and technical inputs such as range management principles, livestock production, community organization, identification and treatment of livestock diseases was essential. Recycling and additional in-service training occurred regularly.

Training activities commenced early in 1978 and were conducted at intervals throughout the project life. Training for personnel of the Livestock Service was arranged and coordinated with the schedules for programs and personnel established by the Livestock Service. Training for extension agents and local livestock producers was an ongoing process throughout the life of the project. Training for local livestock producers began after the team achieved an understanding of local conditions and problems.

1.2.2.6.2.1 Training of Livestock Service Personnel

Training sessions were held quarterly in Ouagadougou. Each session was three days in length. Dates of the sessions during Phase I of the VLP were April 3-4-5, 1978; July 5-6-7, 1978; October 2-3-4, 1978; January 8-9-10, 1979; April 2-3-4, 1979; and July 9-10-11, 1979. In addition to team representatives the training sessions were held for three livestock assistants and six veterinary nurses. Topics covered included project orientation and discussion, improved livestock production, veterinary medicine, and principles of range management.

After some time two Voltaic counterparts were assigned to the VLP: Mr. Traore and Mr. Koulibaly. Mr. Traore worked closely with Mr. Deffendol as is reflected in the latter's bi-monthly reports where the two frequently visited project sites together to attend local committee meetings and to carry out range management field work. Mr. Koulibaly worked closely with Mr. Scott on the poultry projects as is mentioned in section 1.2.2.5.2.4 (Alternative Poultry

TABLE 1.10

ACTIVITIES AND RESULTS RELEVANT TO TRAINING GOAL

Goals/Activities	Location of Results in Report (Section No.)
A. Livestock Service Personnel: time frame: 3 days each quarter.	1.2.2.6.2.1 Training of Livestock Service Personnel
B. Extension Agents (all sites) time frame: quarterly training and refresher course, 1978-1984, Ouagadougou	1.2.2.6.2.2 Training of Extension Agents
C. USAID participant trainees-- July 1, 1978-July 28, 1979	
(a) Range management trainees	1.2.2.6.2.3 Participant Trainees
(b) Animal production trainees	

Project). His report on the poultry situation is included in this report as section 5.2.

1.2.2.6.2.2 Training of Extension Agents

Quarterly training and refresher courses were held in Ouagadougou for the 12 project extension agents (two from each project site). Topics treated included extension methods, improved livestock production, identification and treatment of diseases and disorders, community organization, data gathering and recording, and principles of range management.

The extension agents received both formal training and on-the-ground practical guidance. In the field their training included, but was not confined to, the following areas: interviewing techniques, principles and techniques of social animation and community development, translation and interpretation between project technicians and local village livestock producers, basic range ecology and the importance of the conservation of natural resources, elementary vegetation measurement techniques, modern poultry raising concepts and methods, basic animal disease diagnosis, vaccination and other animal health treatments, maintenance of veterinary equipment, and record keeping. This training was accomplished by short courses, with examinations, within applied field situations, and by normal working routine.

1.2.2.6.2.3 Participant Trainees

Two Voltaic students were enrolled at New Mexico State University in undergraduate programs in animal science and range management. Mr. Abdoulaye Koné completed a B.S. degree in Range Management including two months of practical field work in Upper Volta. The work in Upper Volta was entitled "Introduction to Applied Range Management Techniques and Problems in the Soudano-Sahel Zones of Upper Volta," and was supervised by Mr. Deffendol, the CID team range management specialist. Topics covered in the stay in Upper Volta included an introduction to and awareness of the National Livestock Service and its projects; other useful technical and information sources; introduction to traditional village social structures of Fulani, Mossi, Bissa, and Gourmantche ethnic groups, and discussions concerning technology and development within; introduction and review of plants and plant communities within the Soudanian and Sahelian vegetation zones, including variations and transition areas; observations of range management improvement practices and simple livestock management tools attempted and used at the Markory Ranch; techniques available to a range manager in developing range management programs in societies where the science is unknown; interpretation and use of aerial photography in natural resource identification and management; computation of water resource inventory data for well volumes in project sites and location of wells on aerial photos as a basis for the traditional well improvement project and first-hand knowledge of the difficulties of applying range management within the existing system of shifting agriculture.

Mr. Amadou Guiao completed a B.S. in animal science and also returned periodically to Upper Volta for practical training. During the summer of 1978, Mr. Guiao worked alongside the CID team in planning vaccination corrals; he was exposed to the numerous problems that exist between the Livestock Service and the livestock producers including weak infrastructure and centralization of authority, lack of training, and lack of financing. Mr. Guiao's main emphasis during the summer was with the poultry project. His report details the objectives of the project, project costs, a calendar for vaccinations, construction of pens, and discussion of the projects in particular villages. Mr. Guiao had hoped to be able to complete a Master's degree in poultry management before returning to Upper Volta but unfortunately had to return to Ouagadougou because of uncertainty about the future of Phase II of VLP.

1.2.2.6.2.4 Training of University of Ouagadougou Students

During late 1979 and mid-1980 a Voltaic student, Mr. Marcel Somba, carried out research on the ecological responses of Sudanian Zone tall grass savanna to various fire and grazing treatments. The experimental plot he used was one of the three established at the

Gnanguedin site (see Figure 1.2). Mr. Somba assisted regularly in collecting information for the resource inventory at Gnanguedin and assistent in compiling that information. He participated in site range management committee meetings and helped install the fencing for both his experimental plot and the larger 50-hectare demonstration plot at Gnanguedin. Every three weeks he visited the small fenced plot near Bittou where burned, clipped, and control plots were weighed and measured for regrowth. Mr. Somba's thesis defense was scheduled for October 1980.

1.2.2.6.2.5 Community Development Programs and Training of Local Livestock Producers

While specific community development programs are discussed under another heading it should be emphasized that because every action taken by the VLP in the project sites has been discussed and approved by the site livestock producers' committees, it has necessarily involved a community development/rural extension component. The inclusion of local livestock producers in the decision-making process has resulted in the creation of a solid base for future development activities. This foundation is one of the tangible but less visible accomplishments of Phase I VLP efforts.

Community development activities were essential to many of the Phase I programs. They include developing the color-coded vaccination receipt system to educate herders to the existence of different vaccines and to corresponding animal health problems, organizing and mobilizing voluntary labor in the well development program, and bringing together different ethnic groups in the organization of the women's committee and cooperative poultry project in Koukoundi.

The training of local livestock producers was an active part of the entire operation and fundamental to the philosophy of the VLP. It was reflected in the community development activities, the technical activities, the committee meetings, and the definition of the roles of the various staff of the project. To a large degree, the CID team attempted to learn from the producers themselves, the rationale for their behavior within the system in which they perceive themselves as operating. Then using this information the technical team tried to introduce both social and material changes into the existing system. Direct concept familiarization was used to educate producers concerning animal health treatments and products, ecological principles, reforestation, and other subjects.

1.2.2.7 Report Preparation

1.2.2.7.1. Goals

The contract specifies the following reports as being contractual obligations:

(a) Bi-Monthly Status Reports covering project endeavors, problems and required actions. This is a personal report to be submitted by each technician.

(b) Bi-Annual Project and Team Report covering all project activities including progress, adherence to implementation plan, areas of concern, future plans and required actions. This report will be submitted to the CDO/ Upper Volta in 20 copies of which ten (10) will be in French.

(c) Other reports as may be required.

(d) TDY Personnel will submit one report covering each month of their TDY status.

Table 1.11 names the reports anticipated by the project and lists the sections of this final report where reports or references to reports are presented.

1.2.2.7.2 Results

Reporting of project progress was an ongoing activity throughout the life of the project. All reports produced by the VLP are on file at The University of Arizona. The Baseline Survey Report (see section 5.6) presented information obtained about livestock production systems in the project area. Together with end-of-tour reports of individual scientists, they provide a basis for the final report. In addition, all short term staff members prepared narrative reports before leaving Upper Volta.

TABLE 1.11

ACTIVITIES AND RESULTS RELEVANT TO REPORT PREPARATION GOAL

Goals/Activities	Location of Results in Report (Section No.)
A. Bi-monthly written progress report to GOUV and AID (November and December 1977 and every 2 months thereafter).	5.6 List of Reports Produced
B. Semiannual written progress report to GOUV, AID, and CID (December and June each year).	
C. Planning, coordination, and evaluation report to ORD staffs at Kaya, Koupela, and Fada.	
D. Baseline written progress report to GOUV, AID, and CID (June 1979).	
E. Final written progress report to GOUV, AID, and CID (September 1980).	

1.3 FINDINGS OF VLP PHASE I

The purposes of this section are to (1) summarize the major problems of the livestock production system and their underlying causes at the village level in the six VLP sites. We do not suggest that these problems have just been "discovered" by the VLP team. What we have done is to sharpen perceptions of the problems and quantify relationships where possible; (2) list topics which the VLP Phase I was unable to cover, covered inadequately, or for which there is continuing need for information; and (3) provide a basis for design of proposed solutions to problems in Phase II using the information and experience gathered in Phase I.

The problems are treated separately in the following discussion only to facilitate the analysis. In fact, they are not so easily, if at all, separable, and some duplication in the descriptions is unavoidable. One important finding of Phase I of the VLP is the need to address the problems as part of an overall livestock production system and the livestock production system as part of a larger socioeconomic system.

1.3.1 Problem Identified

The baseline survey and preliminary action-oriented programs have resulted in the identification and clarification of many problems. They have been grouped for discussion into five major problem sets in the material which follows.

1.3.1.1 Problem 1--Low "Quality of Life"

Livestock producers and their families, particularly women, have a low "quality of life."

1.3.1.1.1 Major Causes

They live and work in an environment with poor soil quality, limited water and vegetative resources, and many human and animal diseases.

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Rainfall, which is the most important climatic factor, is sparse (500-900 mm per annum) and quite variable in time and space. Soil is particularly lacking in organic matter, which compounds the water scarcity problem. Like soil, vegetation shows extensive degradation from human and animal use and abuse.

The high prevalence of parasitic and infectious diseases, coupled with often sub-optimal diet and a harsh physical environment, has led to high mortality rates for animals and humans. One hundred fifty-seven livestock owners reported losses in 1978 of 456 head of cattle, 671 sheep, and 555 goats.

The resource/population ratio is becoming continually smaller due not only to degradation of the environment but also to increase in human and animal numbers. This limits economic opportunity and income levels. The population growth rate in Upper Volta is about 2.3% per annum, resulting in doubling about every 30 years. The average annual rate of growth for the Upper Volta Gross National Product has fallen from 1.7% during the period 1965-71 to 0.4% for 1970-76 (World Bank 1978).

The Physical Quality of Life Index (PQLI) for Upper Volta in the early 1970's was 16, an extremely low value.* There is no evidence of any substantive change since then.

1.3.1.1.1.1 Contributing Factors

GOUV and other agricultural development programs have not usually been directed at women, although their traditional roles include many agricultural and livestock activities. The culture has tended to limit even further the livestock raising opportunities for women. There have been insufficient numbers of female extension workers or women's committees to discuss problems and solutions with women. We found in Koukoundi that 67% of the women owned stock and that income from them is important in family economics.

Livestock production is a critical part of the subsistence strategy of many Voltaics, but lack of community-based agricultural

*The PQLI is a composite, weighted number derived from three indicators: infant mortality, life expectancy at age one, and basic literacy (Morris 1979).

and livestock projects have precluded good management of resources so that each household makes decisions in its own immediate interests which may be, in the long run, to the detriment of the community.

We have found that livestock owners, both men and women, respond to organizational efforts that they see as advantageous to them. Examples are poultry projects, vaccination corrals, and color-coded vaccination receipts. Local involvement may be lacking, however, usually when programs for improving the community or region are not perceived as having results beneficial to the individual household. In setting up the inclosure/exclosure plots at Tafogo, for instance, there has been resistance because it is difficult for livestock owners to see benefits from such a long range project.

High morbidity and mortality rates among livestock mean inefficient use of labor and resources, and lead to a shortage of animals for milk production, sacrifices, and sales. The quality of the diet could be improved if more milk, meat, and eggs were available. We found milk sales in Koukoundi to be a major source of income for Fulani women. Mossi and Rimalbe women spend significant proportions of their money purchasing milk for young children.

Our surveys in the project sites show that of 150 livestock producers, the average income from livestock was 65,000 CFAF. Buying grain was the most frequent and important reason for selling stock.

Infected animals transmit or serve as the reservoir for a large number of human diseases, including anthrax (cattle, goats, sheep, swine), histoplasmosis (chickens), leptospirosis (cattle, swine), beef tapeworm (cattle), trichinosis (swine), trypanosomiasis (cattle), brucellosis (cattle, goats, sheep), and tuberculosis (cattle). High infection rates in livestock contribute to high prevalence of human morbidity and mortality.

Both animal and human diseases are maintained at high levels partly by the unsanitary and ephemeral water supplies, and the joint use of them by humans and livestock. Inadequate nutrition is common, and there is a lack of medical facilities.

Poor economy of Upper Volta limits the activities it can carry out to improve the human standard of living. Consumer goods are expensive relative to agricultural products. Improvement of the livestock production system could help to provide additional resources for GOUV. However, since present production does not meet local needs, improvement of the livestock production system may not lead to increased commercial off-take rates for some time. Initial productivity increases will lead to improved quality of life for local producers and their families, however, and thus increase their ability to implement other improvements.

Lack of economic opportunity leads to a high rate of out-migration of young males from Upper Volta, thus draining the economy of its most productive labor. Women are left with the heavy responsibility for subsistence farming. This limits the improvement of the livestock system.

Conversely an improved livestock production system would provide more economic opportunity, thus encouraging young men to stay at home.

1.3.1.2 Problem 2--Animal and Human Health

The high incidence and prevalence of disease and internal and external parasites in domestic animals causes high morbidity and mortality (particularly of young animals), leading to decreased productivity and economic loss to producers and the GOUV. Some diseases of animals are transmitted to humans.

1.3.1.2.1 Major Cause

Large populations of many animal parasites and infectious disease agents are not controlled effectively by the current National Livestock Service program. Milk and other products from diseased animals are consumed by humans with high likelihood of disease transmission.

1.3.1.2.2 Contributing Factors

The haphazard nature of the current disease and parasite control program may actually help to build up immunity to control agents in populations of disease causing organisms. The current program of vaccinations is spread very thinly so that there is no regular schedule of vaccinations for regions of the country or for an individual's herd. No vaccinations are mandated. The understanding of the consequences of problems and preventive measures by livestock producers is inadequate.

There is little detailed knowledge of extent and seasonality of incidence of specific diseases and parasites since there are few field veterinarians and consequently few field studies of disease. Tabulation of stockowners' own diagnosis of disease shows trypanosomiasis, black leg, and pasteurellosis to be the most common diseases of cattle. For small ruminants the most common are trypanosomiasis, rinderpest of small ruminants, and pasteurellosis. Their perceptions are the starting point for education about programs of disease control based on veterinary field surveys and laboratory work.

There is inadequate training of Livestock Service personnel in diagnostic procedures and control measures. Veterinary nurses and extension agents in our project sites are infrequently given opportunities for upgrading their training. There are no women extension agents to work with women livestock owners.

There is a high rate of injury to animals and humans during vaccination without corrals; therefo e, corrals are necessary.

Present methods and drugs used by the Livestock Service may in many cases be inappropriate. For example, the widespread use of "Exhelm" without improved diagnosis may be much more expensive than necessary to achieve control. Drugs are not always selected for low cost.

Livestock owners do not clearly understand the purpose of the National Livestock Service program in the project sites. Our surveys showed that one vaccination was thought to be as good as another, and that pills and injections were thought to be for the same purpose.

There has been little education in preventive measures the livestock owners can take on their own; e.g., water supply points and calf-rearing pens are unsanitary and contribute to reinfection of animals, but there is no program to increase understanding of water borne diseases and parasites. No water quality analyses are made routinely.

The present program does not have enough logistical support. Transportation, vaccines and drugs, refrigerators and other storage facilities at sites, and syringes and other equipment are lacking. The GOUV resources are extremely limited.

Economic loss of livestock means less surplus is available for the GOUV to sell to other countries to obtain foreign exchange, and consequently less ability of GOUV to provide services needed by livestock producers. Operating funds for the Livestock Service have decreased from 1.52% to 0.88% of the total national budget between 1961 and 1976.

The VLP helped to fill some of this lack of logistic support in the project sites, where previously very few veterinary nurses or field assistants were actually working in the field.

Traditional transhumance makes it difficult to provide veterinary service to animals on a preconceived schedule. Our surveys show that transhumance routes and schedules differ greatly between sites, but are regular so that it would be possible to plan health programs around transhumance, although this requires more mobility on the part of the Livestock Service. Unrestricted transnational movement of animals to and from Mali, Niger, and Ghana allows reinfection of animals and means that carriers of diseases and parasites are nearly always present.

Unhealthy and therefore less efficient animals put more pressure on the grazing resources. More animals are needed to produce the same amount of products as would result from smaller numbers of more healthy animals. Also, overgrazed rangeland means more energy expenditure on the part of the animals to obtain required nutritional intake.

Improving animal health and feeding efficiency without improving management of grazing resources and controlling animal numbers is counterproductive because of increased pressure of resources.

It is difficult to reach remote villages particularly in the rainy season. Small ruminants are an important component of the livestock sector, but have been neglected in many animal health programs. An increase in herd size resulting from improved health programs will have a minimum immediate impact on increasing the commercial off-take.

1.3.1.3 Problem 3--Degradation of Vegetation, Soil, and Water Resources

There is a long-term trend of depletion and degradation of vegetation, soil, and water resources.

1.3.1.3.1 Major Causes

The animal stocking rate exceeds the carrying capacity of the grazing resources during the latter part of the dry season and early rainy season. Our resource inventory at Tafogo shows that in 1978, a "normal" rainfall year, the stock rate exceeded carrying capacity by more than 4000 Animal Unit Months (A.U.M.).

Tree cutting exceeds the regrowth rate. Our estimates of consumption rates of wood for fuel and construction and of regrowth rates show that wood is being cut at about twice the regrowth rate.

Population pressure has led to cultivation of land that should be used only for grazing since its inherent soil characteristics lead to erosion and degradation when cultivated under existing climatic conditions. Decreasing fallow periods without adequate compensatory input of organic matter and nutrients also leads to increased degradation and erosion. Results of our Tafogo survey show sizeable areas affected in this way.

1.3.1.3.2 Underlying Factors

Loss of vegetation leads to increased erosion and deteriorating soil quality, which in turn results in decreased infiltration of rain water, less recharge to groundwater, and decreased time of surface water flow. These factors then contribute further to vegetation loss and continue the vicious circle. Increased erosion also leads to more rapid sedimentation of reservoirs and consequently loss of reservoir capacity. Sizeable parts of the Tafogo site have been depleted of all vegetation. There is a lack of understanding by livestock producers of the importance of grazing management.

Decisions about grazing are made individually to maximize the short-term economic interests of livestock producers but lack collective responsibility. There is a lack of community control over grazing land and lack of effective range management procedures and enforcement mechanisms. The concept of individual ownership of animals is deeply ingrained and not likely to change.

Forage production on gravel-lateritic soils is not feasible. Random trekking of animals through areas where trails are not well defined tramples vegetation. Inefficient livestock production systems require more animals to supply needed income and off-take animals. Wood cutting and selling are important income-generating activities for livestock producers. Existing water resources and development of water sources for animals may exceed locally available animal plant food. A high demand for permanent or improved wells still exists, although provision of water for livestock is not the limiting factor at many sites. The rate of water use may exceed recharge and accelerate depletion.

1.3.1.4 Problem 4--System Inefficient

The present livestock production system is inefficient, with large standing biomass and low off-take rates, and a large proportion of feed being used for maintenance. Seasonal food shortages (meat, milk, eggs) for livestock producers and other Voltaic consumers are common.

1.3.1.4.1 Major Cause

Unavailability of feed during later dry season and early rainy season leads to substantial weight loss and drop in milk production.

1.3.1.4.2 Underlying Factors

There is no quantitative information on seriousness of the weight loss or effects of "solutions," because animals are not weighed. Large numbers of grazing animals are required to meet income and subsistence needs resulting in depletion and/or degradation of vegetative resources.

Sheep and goats may be more efficient producers of meat, milk, and other products, but they have been neglected in most livestock programs. They eat a wider variety of forage, produce more protein per unit of forage consumed, and are more drought tolerant.

The milk production system is important to present producers and consumers, and has a real economic benefit for Fulani women. A larger number of low efficiency animals must be held to insure the supply of milk.

The concept of individual ownership of animals is deeply ingrained and not likely to change. There is not available land or labor to produce forage. The agricultural system is labor intensive and there is little time for forage production during the rainy season. Human food resources are now barely adequate, and so it would be unwise to use good crop land for forage instead of human food crops.

Forage production on gravel-lateritic soils is not feasible. Crop residues are not large and are also used for fuel and construction. Some fodder storage practices are inefficient; e.g., groundnut plants are allowed to dry in the sun, thereby losing much of their nutrient value.

Animals are presently used as bank accounts, insurance against times of poor crop production. Thus it is more important for livestock producers to keep a larger number of inefficient animals than to sell off when they are at their peak. No adequate alternative credit or savings mechanisms now exist that would permit increased off-take and bank accounts in cash instead of stock. Livestock producers in our survey indicated a preference for having greater numbers of animals and selling only for grain purchases and ceremonies or gifts. The seasonal and annual changes in market conditions are large and rapid.

1.3.1.5 Problem 5--Previous Projects Ineffective

Current and previous development projects have not been as effective as they could be in bringing about permanent improvements in the livestock production system and in bringing it to its full potential as a contributor to the Voltaic economy.

1.3.1.5.1 Major Causes

Inadequate time is allowed to understand the system; implement workable, acceptable changes; and monitor results. Most donor-funded livestock projects last 2-5 years, but qualified scientists generally agree that longer periods are needed to bring about lasting change in arid lands livestock production systems. Gaps in continuity and changes in implementation strategy further reduce project effectiveness.

Livestock production often is considered in separate parts and in isolation, when, as discussion of previous problems has shown, it is an integrated subsystem of a much larger system. For example, VLP poultry projects had limited success because of failure to deal with infrastructure (supply of feed, vaccines) and marketing aspects.

Development projects are not well coordinated by either GOUV or donors, leading to duplication of effort and competition for scarce resources and local and national support. For example, the VLP was not well informed about other donor-funded projects in livestock and related areas. No attempt is made to get personnel from various projects together. When AID/W sponsored a seminar in the United States on problems of West African livestock projects, VLP personnel were not invited.

The size of development projects exceeds the absorptive capacity of the "system" in both infrastructure and personnel. Most projects have been too large and designed for "splash" effect rather than "spread" effect or carefully phased activities.

Carrying out multi-faceted activities at too many remote sites contributes to the difficulties.

1.3.1.5.2 Contributing Factors

Sufficient Voltaic counterparts are lacking because GOUV resources are limited. Extension service has not been effective; personnel are inadequately trained and compensated. Women extension agents have been difficult to get. They are unable or unwilling to live alone in remote locations.

There is a lack of involvement of groups of people who see their interests as vitally connected with project goals. (VLP has made a major effort to reduce this problem.) Local involvement is not always easy to get; people remember the ineffective and sometimes counterproductive projects of the past. Full advantage has not been taken of local women's groups.

There is a shallow relationship of projects with ORD's. Action is at the ORD level, but ORD support is not always forthcoming. Frequently there is no involvement of ORD's in planning stages. There is not always good cooperation between the ORD and the central government; some ORD's are more difficult to work in than others.

Past failures make implementation of "new" livestock-related projects more difficult. There is less interest in them and less money available for them.

1.3.2 Additional Research Needed

Although specific research projects are not described, major topics and approaches for additional research are suggested in this section. Research to monitor the effects of intervention is required as an integral part of the VLP Phase II action-oriented program.

Research needs are divided for purposes of discussion into three categories: social-cultural, economic, and technical.

1.3.2.1 Research on Social-Cultural Factors

Baseline data on quality of life factors are needed for future evaluation of development projects. This should include family income, nutrition, health, education, clothing, and housing. Procedures should be identified and developed and tested to effectively communicate project information (goals and operating procedures) to livestock producers. These could be developed and tested through existing livestock committees and extension agents. This activity should include a study of the barriers to participation facing potential participants so that these can be reduced or overcome. Techniques for increasing acceptance of VLP activities should be identified. Little is known about programs designed to induce behavioral changes such as increased off-take from herds. There is a need to study effective extension systems elsewhere in developing countries. How is information best communicated? How can extension agents be motivated?

A more comparative study of the nature of effective community involvement in Sahel areas is needed. (Much information is already available.)

Other factors requiring research include extent of transnational animal movement, sex ratio of human population as an indicator of migration, and barriers to the acceptance of goat milk.

1.3.2.2 Economic Research

Cost and revenue (benefit) figures should be obtained for demonstration projects (interventions in animal production and health) conducted by VLP to permit calculation of the feasibilities of implementation of similar programs on a larger scale. For example, an experiment could be done comparing one site (paying for vaccine) with a distant site (not paying for vaccine). Detailed records from project operations should provide the data necessary for this analysis without the need for extensive additional data gathering.

A market survey is needed to establish the costs of most purchased consumer goods. A "market basket" composed of commonly purchased items might be used as a standard of comparison. The potential economic role of small ruminants is not well understood. Although there have been studies of small ruminant commercialization, ruminants are generally viewed by producers as presenting essentially the same problems as cattle. This is not true since the small animals play a much more important role in domestic consumption, and since they represent a potentially valuable export to the countries of North Africa.

Since there tends to be a specialization in either cattle or small ruminants on the part of herders, little is known about how the two might function together in a balanced herding economy.

Poultry represent a largely unexploited resource: essentially nothing is known about potential markets for poultry, and systems for their commercialization outside local markets are not extensively developed. Market data on poultry are generally lacking and should be gathered in markets and from VLP experience with poultry sales activities. Since poultry represent a potential increase in economic activity for women as well as men and can provide high quality, inexpensive protein on the local level, the lack of information in this area is particularly harmful.

Little is known concerning the integration of VLP activities to improve the livestock production system with the Voltaic market system. Gathered data only become useful when they can be used to develop programs that are effective in the field. Implementation activities on a small scale can provide this type of information relative to commercialization.

Additional studies of market structures are not needed; however, it would be helpful to outline the relationships existing between the larger marketing system and the particular VLP activities. Specifically, it would be useful to find out where animals and goods bought and sold by farmers and herders served by VLP activities come from and where they go.

Data should be gathered on herder decision-making processes. This can be done through observation and discussion with herders at the time of animal sales either in the field or at markets in which they participate. It is not sufficient to interview individuals once; their behavior must be observed and discussed throughout the year. It is not clear how the individual decides how many animals to sell during the optimum period, nor whether he is able to make an informed decision based on grain needs.

Whether the VLP activities in the area of animal health would have significant impact on these sales is impossible to determine from existing data. Similarly, there is insufficient information to identify factors that might be utilized to increase off-take (sale of animals) from increased herds.

1.3.2.3 Technical Research

A natural resources survey should be made at other VLP sites to include resources listed below:

1. Vegetation: grasses, shrubs, trees, extent of burning.
2. Land use.
3. Soil: erosion status, erosion hazard.
4. Water resources: surface; depressions, reservoirs, swamps; streamflow.
5. Groundwater resources: traditional wells, improved wells.
6. Carrying capacity.
7. Stocking rate, including study of source of animals (local or from outside sites).

A disease and parasite survey needs to be done. Disease (incidence) records should be examined, and then a concerted effort should be made to establish improved field diagnostic capability at the project sites. Preliminary disease evaluation can be made during a short-term visit by a veterinarian, but ultimately a full time veterinarian should be assigned to this task.

The prevalence of various nematodes, cestodes, and trematodes likely to be present in cattle and small ruminants (e.g., *Haemonchus*, *Cooperia*, *Ostertagia*, *Oesophagostomum*, *Trichostrongylus*) must be determined so that an appropriate anthelminthic program can be developed. The possible use of parenterally administered (injected) anthelminthics should be investigated.

The prevalence of other diseases, possibly present but currently not recognized or being misidentified, should be determined by a VLP veterinarian with adequate laboratory backup. The incidence of various tsetse flies in this area needs further investigation.

Data are needed on seasonal fluctuations in animal weights. Storage methods for animal products using appropriate technology need to be identified and field tested. Alternate sources of energy for village residents must be identified and made available. Energy requirements of new technologies in action programs must be compared with energy benefits (returns). Effect of goat milking (for humans) on goat kids must be determined.

1.4 EVALUATION AND FUNDAMENTAL PROBLEMS

There were many of the usual problems associated with implementation of Phase I of the VLP. The project was evaluated twice. The first evaluation was conducted jointly by CID and AID in March 1979. A number of administrative and logistic problems were identified at that time, and some corrective actions were taken. Evaluation reports were prepared, and since the problems were discussed adequately therein, they will not be elaborated further here.

A second evaluation was made in August and September 1980 by a team organized by USDA, at AID request. As of the writing of this report, the results of their evaluation are not available.

However, two fundamental or systemic problems of great concern remain. They had a significant impact on decision-making for the VLP.

1. Methods are needed urgently to improve the collaboration between AID and the U.S. universities in delivering technical assistance. The right words have been spoken and written in the "collaborative mode," but a strong spirit of collaboration does not exist yet. Specific procedures are needed to deal effectively with differences of opinion regarding what is to be done and how it should be done.
2. Improving the subsistence level and quality of life of small-scale livestock producers in the Sahel will require many years of dedicated effort. There is no quick fix. A commitment to long term involvement therefore is necessary. Unfortunately, several aspects of the U.S. technical assistance system including congressional restrictions, and greater rewards for moving money than for using it wisely and well, make such commitment difficult.

1.5 ACKNOWLEDGMENTS

Successful completion of Phase I of the VLP has depended on the contributions of many people in the United States and Upper Volta. In addition to the CID, USAID, and Voltaic personnel directly associated with the project, whose contribution has already been noted, we call attention to, and thank, the following individuals:

Upper Volta National Livestock Service

Dr. André Beré, Director; Dr. Hama, Assistant Director; Dr. Dioula, ONERA; Mr. Boly, Mr. Gandia, Mr. Kifondo, Mr. Kinda, Mr. Dieudonna Ouedraogo, Mr. Mogmenga Boukary, Mr. Gougoare, Mr. Samandougou Adama, Mr. Fabe, Mr. Zeba, Mr. Bongsare Lazare, Mr. Alfred, and Mr. Barre, Extension Agents; and Mr. Diolompo Frederick, Mr. Boniface Ouedraogo, Ms. Germaine Ouedraogo, Mr. Hubert Ouedraogo, Dr. Badilo, Mrs. Beatrice Balma-Zormgrana, Mr. Francoise Tiga Zormgrana, and Mr. Sambo, Field Assistants. In addition there were many veterinary nurses, chauffeurs, secretaries, translators, and others who were always helpful.

AID/Washington and USAID/Upper Volta

John Hoskins and Richard Meyer, USAID Mission Directors; Samir Zoghby, Projects Administrator; Dr. Carolyn Barnes, Mary Ann Reigleman, Dr. Richard Swanson, Ms. Chris Brown, Ms. Josephine Guisson, Mrs. Marilyn Hoskins, Dr. Jay Smith, Vince Barrett, USAID Contract Personnel; and Douglas Butchart and Lew Ortega, Development Services/AID/W.

CID/University of Arizona

Bernie Henrie, CID Deputy Director for the VLP; Drs. R. N. Henderson, R. Netting, P. Ogden, R. Reeves, Richard Rice, and E. L. Smith, University of Arizona campus backstopping; D. A. Cleveland, Assistant to the Project Director; and N. Ferguson and T. Wycott, final report preparation and translation.

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2 RESOURCES

2.1 SITE DESCRIPTIONS

The project agreements between the GOUV and USAID called for the selection of six project sites in the territories of three Regional Development Organizations (ORD's--Organisms Regionaux de Developpement). The three ORD's designated are Central North, Central East and East with administrations located in Kaya, Koupela, and Fada N'Gourma respectively. The physical boundaries of each of these three ORDs correspond with the boundaries of the central administrative regions, the prefectures. In the case of the Central East the headquarters for the prefecture and the ORD are found in different towns, Tenkodogo and Koupela respectively. For the other two ORDs, prefecture and ORD offices are located in the same town.

Two sites were chosen in each ORD in coordination with the staff of the National Livestock Service and the ORDs. The sites then were delineated by the CID team on the basis of physical and social characteristics. It is still very difficult to place precise confidence intervals around the representativeness of these sites.

The distribution of ethnic groups within the sites is typical of the regions in which they are found. Physical characteristics are likewise not atypical of these regions. There is little reason to believe that livestock practices within the research sites differ markedly from such practices in other Sudanian zone areas of Upper Volta. Furthermore, the research sites are distributed from the edge of the Sahel in the north through the Sudanian zone in the south. (See Figure 2.1). Since the largest portion of Upper Volta falls in a similar environmental regime the reader may wish to extrapolate to the country as a whole. This should be done with caution.

2.1.1 ORD of Kaya (Central North Prefecture)

The two sites in the Central North ORD, Tafogo and Koukoundi, lie in the transitional area between the Sudanian and

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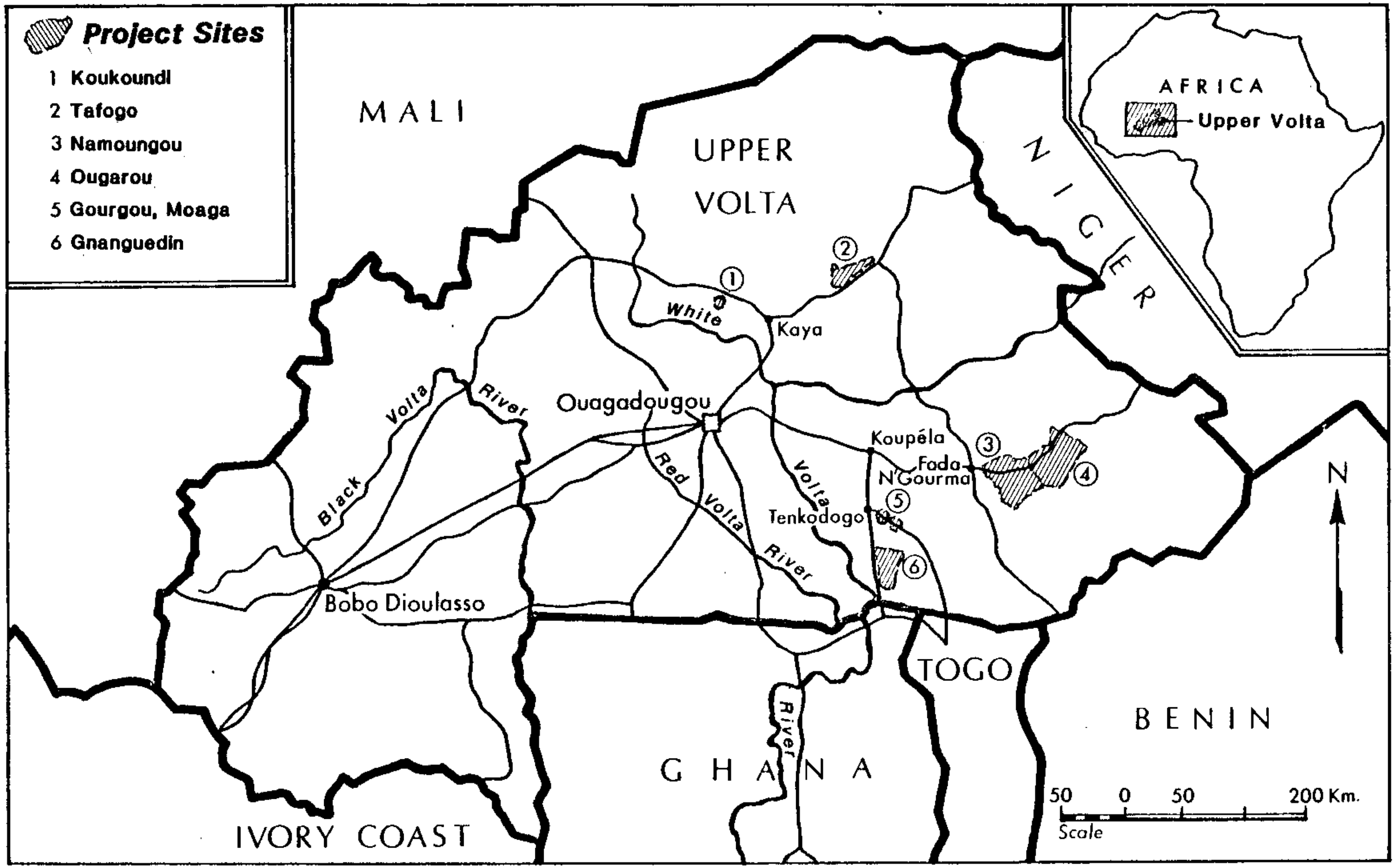

Figure 2.1 VILLAGE LIVESTOCK PROJECT SITES

Sahelian climatic and vegetative zones. Rainfall averages 650-700 mm per year (Pallier, 1978).

The Tafogo site, located approximately 70 km northeast of Kaya, comprises an area of about 50,000 hectares. (See Figure 2.1 for location and Figure 2.2 for detailed view.) Physically the area is well defined by several drainage basins. The ethnic composition of the site is predominantly Mossi, although there is a significant Fulani minority. Scattered groups of Maranse, Gourmantche, Bella, Rimalbe, and others also live in this area.

Administratively, Tafogo is in the arrondissement of Tougouri which falls under the sub-prefecture of Boulsa. There are three ritual chiefs over the land. The largest section of the site, beginning in Tafogo and including the area to the north and east (Tafogo, Dassamtanga, Bougou, Seno, Djamkoka) is under the chief of Narbingou. The second largest section of the site, the area to the north and west of Tafogo (Bissinga, Damkarko Daga, Loangjou, Zougountenga) is the ritual domain of the chief of Damkarko. The remainder of the area to the southwest of Tafogo falls under the chief of Pelga. Although both Damkarko and Narbingou are formally outside the site these important chiefs are fully aware of project efforts, and send representatives to all site committee meetings.

The ethnic composition of almost all the villages in the Tafogo site consists of a combination of a Mossi majority and a Fulani minority, often with a smattering of other ethnic groups. The two exceptions are Seno and Dassamtanga which have Black Fulani (Rimalbe--former slaves of the Fulani) majorities. Unfortunately, the 1975 national census is aggregated into large villages only. The village clusters, found in the census for this site include areas both within and outside the territory of the site.

As can be seen in Table 2.1 the 1975 census shows between 13,000 and 14,000 inhabitants in the larger region. A complete census of the adult population of the village of Tafogo conducted by project extension agents counted more than 2,000 persons for the village (all neighborhoods). This compares with a national

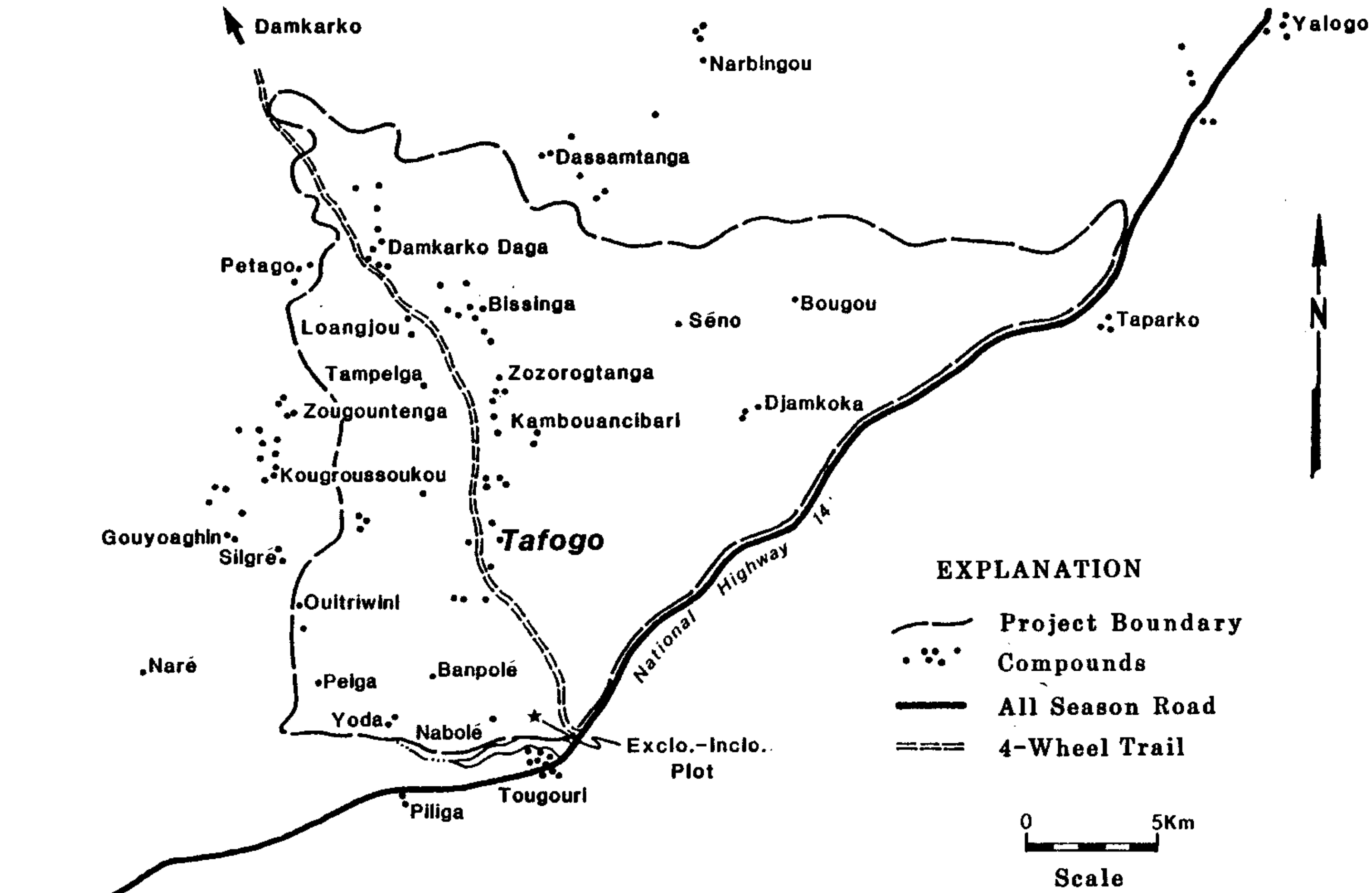

Figure 2.2 TAFOGO SITE

Table 2.1

TAFOGO SITE POPULATION

National Census (1975)

Village	De Jure Population	De Facto Population
Damkarko	5,184	4,903
Narbingou	4,535	4,395
Pelga	1,697	1,633
Tafogo	2,623	2,515
Total	14,039	13,446

TAFOGO VILLAGE - ALL NEIGHBORHOODS (1977-1978)

Village Livestock Project Census

Tafogo	Adults:		% of Adults	# of Compounds	% of Compounds	Estimated Total Population
	Mossi	944	85.0	195	83.7	1,717
	Fulani	145	13.1	32	13.7	264
	Maranse	21	1.9	6	2.6	38
Total		1,110	100.0	233	100.0	2,019

census figure of approximately 2500. The national census estimate, however, includes several small surrounding villages in the Tafogo total. Based on the project census figures, it is estimated that the population within the area of the site is somewhere between 5000 and 6000 (Table 2.2). The village population density is thus about 12 or 13 per km^2. Since the population tends to be clustered in the more productive agricultural areas along the three lowlands, this figure does not give a true picture of actual population density.

In the village of Tafogo, extension agents counted 233 compounds, 83.7% of which are Mossi, 13.7% Fulani and 2.6% Maranse. Mossi constitute about 85% of the total population while the Fulani account for 13.1% and the Maranse 1.9%. In general the compounds in the village are widely dispersed, with the Fulani occupying outlying areas, away from the main agricultural zones.

The main crops produced in the area are millet and white sorghum, supplemented by cowpeas, peanuts, cotton and various garden crops. It is a zone of intensive livestock production.

The second site in the Kaya ORD, Koukoundi (see Figure 2.1 for regional location and Figure 2.3 for details of site), is located about 100 km due north of Ougadougou, and about 20 km southeast of Kongoussi. This site has an area of about 6400 hectares. The site consists of the villages of Koukoundi and Sorgho, with some activities extending to surrounding villages such as Bissa and Sabşé. The population of Koukoundi is 36.8 percent Fulani Rimalbe and 63.2 percent Mossi. Sorgho is entirely Fulani, Bissa is almost entirely Mossi and Sabşé is predominantly Mossi, with a Fulani minority.

The area is in the sub-prefecture of Kongoussi and under the ORD sector chief of Kongoussi. Traditionally, the Mossi canton chief* in Sabşé presides over the area. His younger brother serves as the chief of Bissa. The chief of Koukoundi is also under the orders of the chief of Sabşé. The village of Koukoundi, settled over 80 years ago by the ancestors of the current Fulani residents, has a Fulani chief. Given differences in the degree of hierarchy in

*Officially the position of canton chief no longer exists but its unofficial importance is maintained.

TABLE 2.2

POPULATION ESTIMATIONS FOR THE TAFOGO SITE AND ADJACENT AREAS, 1978/'79

Human Occupancy Zones (in ha)	Number of Samples in Each Zone		Average Number of Compounds per Sample	Total Compounds Tafogo Site	Total Compounds Adjacent Areas
	Tafogo	Adjacent Areas			
1/2- 2	88	116	1	88.0	116.0
2- 4	51	37	1.8	91.8	66.6
5- 10	46	84	3.4	156.4	285.6
11- 20	37	66	5	185.0	330.0
24- 45	36	25	7	252.0	175.0
50- 95	13	20	11.6	150.8	232.0
100-180	6	6	24	24.0	144.0
Total	272	354		948.0	1,349.2

Tafogo Site	948 compounds x 5.3 persons per compound
(39,872 ha)	= 5,024 persons
Population density	= 12.6 persons/km^2
Adjacent Areas	1,349.2 compounds x 5.3 persons per compound
(25,756 ha)	= 7,151 persons
Population density	= 27.8 persons/km^2

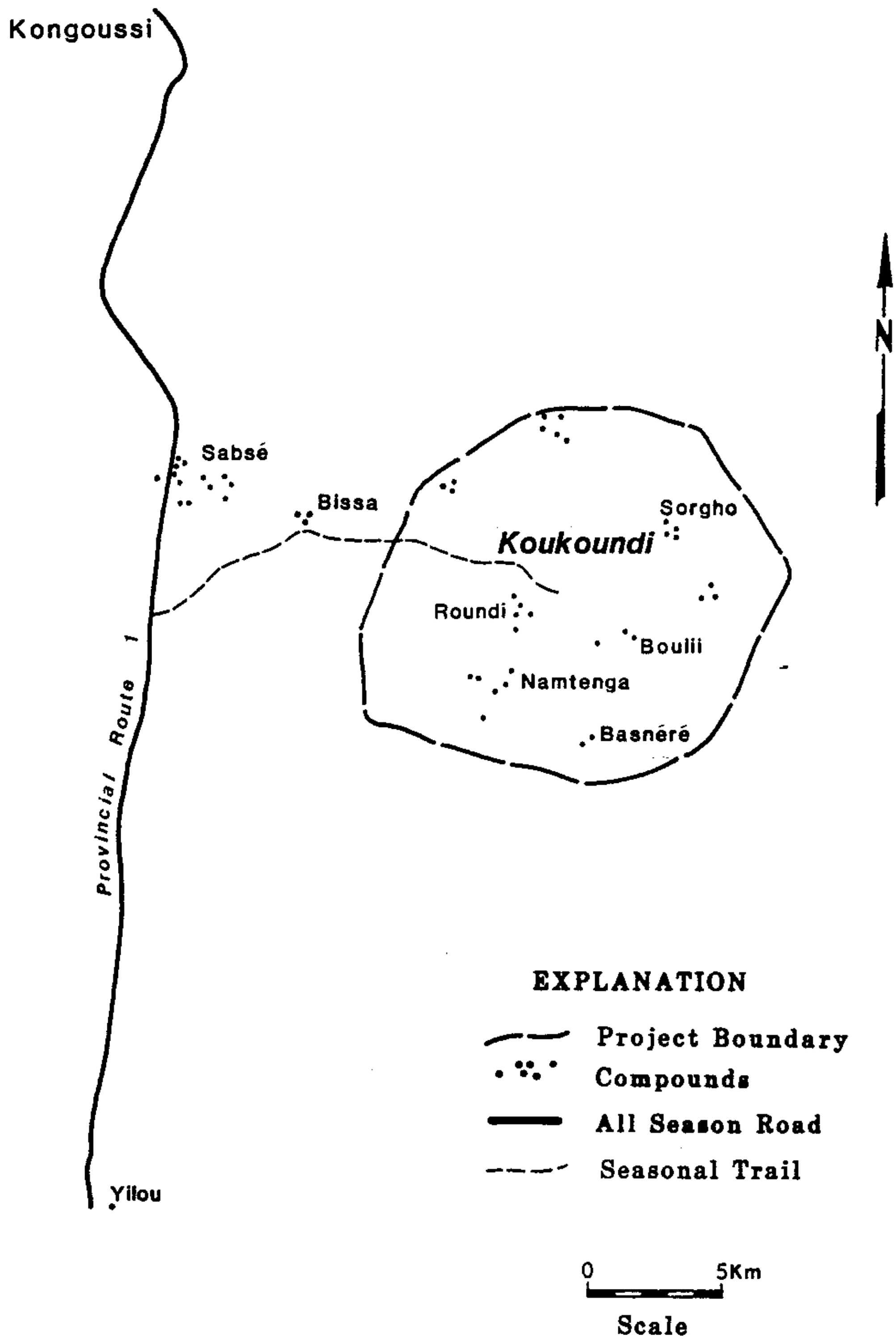

Figure 2.3 KOUKOUNDI SITE

the social structure of the Mossi and Fulani, decision-making in the village is a rather nebulous affair. The Fulani village of Sorgho is under the jurisdiction of the chief of Koukoundi.

The population of Koukoundi is estimated by the project census to be about 456 (Table 2.3). The settlement pattern is generally dispersed, although clusters of compounds are often found in the Mossi neighborhoods. Principal crops are millet and white sorghum, supplemented by maize, cowpeas, cotton, peanuts and some garden crops.

There are large numbers of livestock owned by villagers, both Fulani and Mossi. The majority of the Fulani-owned herds spend a good part of the year outside the area, either in transhumance or in some cases, permanently in the areas to the south (e.g., Leo). Any estimate of livestock density is therefore not very meaningful.

Of the two sites in the Kaya ORD, priority has been given to the Tafogo site. Smaller, more localized efforts are underway in the Koukoundi area.

2.1.2 ORD of Fada N'Gourma (East Prefecture)

The two sites in the eastern ORD are centered on the villages of Namoungou and Ougarou, 30 and 70 km respectively east of Fada N'Gourma. (See Figure 2.1 for location within the region and Figures 2.4 and 2.5 for site details.) Rainfall in this region varies between 800 and 900 mm per year. The area is in the Sudanian vegetation zone.

Both sites fall under the sub-prefecture of Fada N'Gourma. Namoungou is under the ORD sector of Fada. Ougarou is under the sector chief in Matiakoali, some 25 km to the northeast. Ougarou is also the base for the ORD subsector. Both sites fall under the chief of Fada, but Ougarou is by tradition also subject to the canton chief in Matiakoali.

The two sites are physically drainage basins, with very low population densities. Namoungou comprises an area of approximately 101,000 hectares and Ougarou is only slightly smaller with 97,000 ha.

TABLE 2.3

KOUKOUNDI SITE POPULATION

National Census (1975)

Village	De Jure Population	De Facto Population
Koukoundi	697	671
Sorgho (Fulani)	48	49
Total	745	720

Village Livestock Project Census

Koukoundi		Adults	% of Adults	# of Compounds	% of Compounds	Total Pop.	% of Total
	Fulani	92	36.8	20	40.8	168	36.8
	Mossi	158	63.2	29	59.2	288	63.2
Total		250	100.0	49	100.0	456	100.0
Sorgho (Fulani)		45	100.0	14	100.0	127	100.0
Total for Site						583	

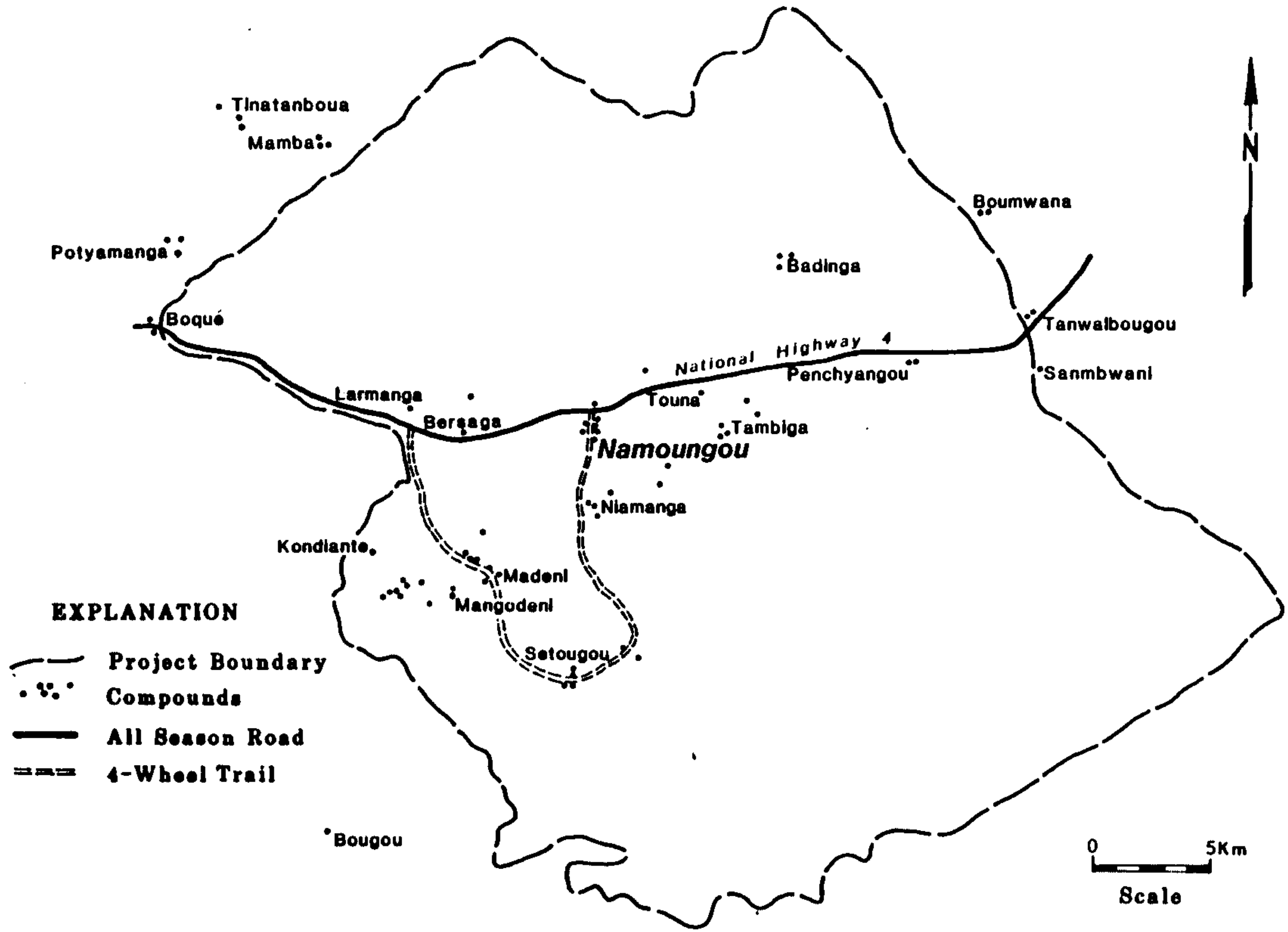

Figure 2.4 NAMOUNGOU SITE

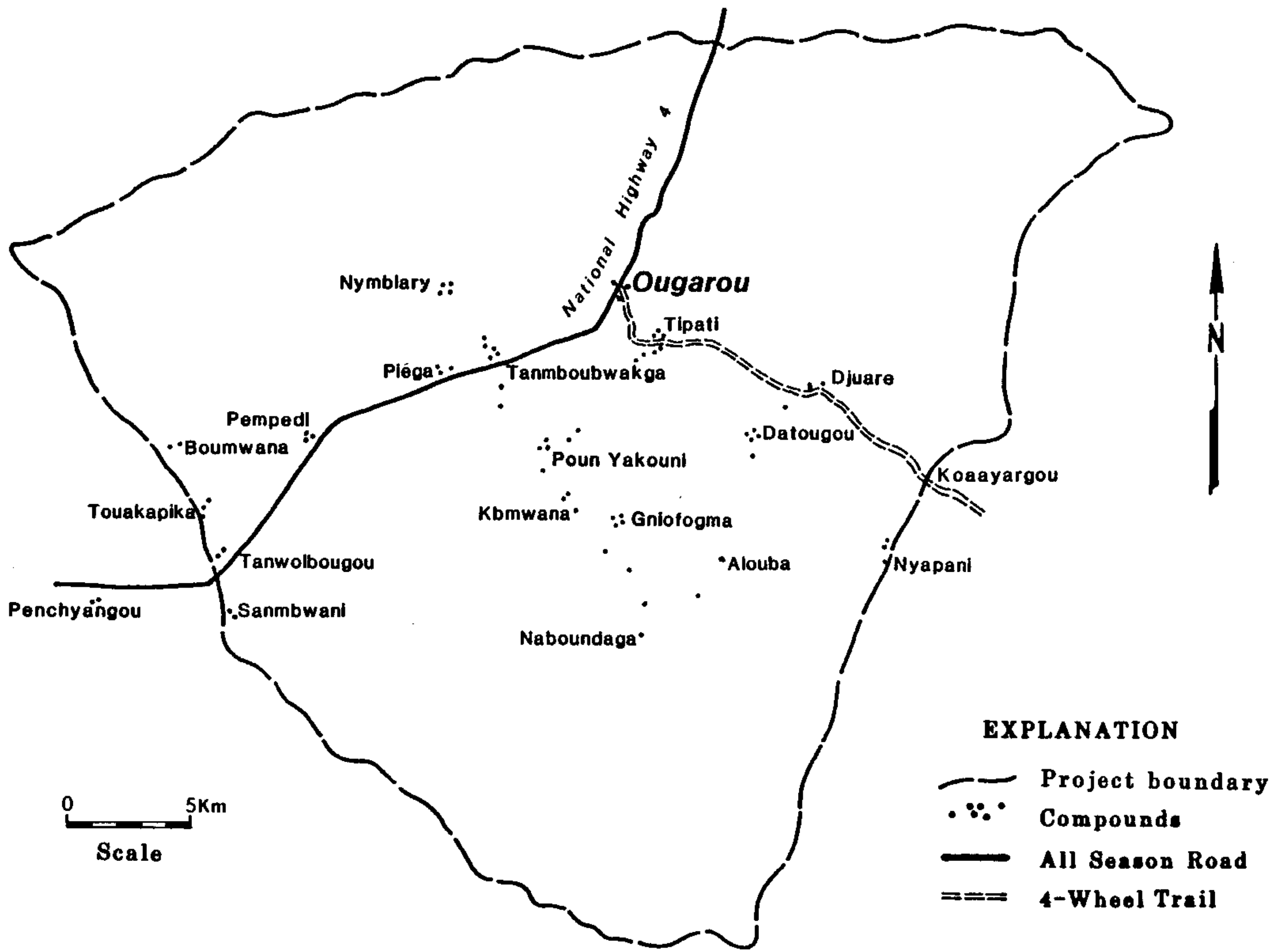

Figure 2.5 OUGAROU SITE

The national census (1975) counted 2958 residents of the Ougarou site. Our census (1977-78) counted 1639 residents excluding the village of Gniofogma which is included in the national census (Tables 2.4 and 2.5). These discrepancies are quite large, but it is felt that project figures are more accurate than those obtained in the national census. For the entire Namoungou site the national census lists a population of 3110 (Table 2.6). The figure for Namoungou village is 840 while our census of the same village lists 655. Whichever figure one accepts it is clear that the village population density of both sites is very low (between 2 and 3 per km^2).

Both sites are predominantly Gourmantche, with a significant Fulani minority. Small concentrations of Hausa and Mossi are also found throughout the region. The villages are not as widely dispersed as those in the Kaya ORD. During the rainy season many Gourmantche move out from the villages to houses located near their bush (remote) fields. The Fulani tend to settle on the perimeters of the Gourmantche villages.

The principal crops are sorghum, millet, cow peas, peanuts, maize, rice and a variety of garden crops. The same low density figures that pertain to humans also apply to livestock. It is estimated that there are 5-8 cattle per km^2 in the region. However, this is probably a low estimate for large utilization since many herds use this area during transhumance. To the east of the site, given the ratio of cattle to people and the vast area potentially available for livestock use, one can see the importance of the zone for the future of livestock production.

Ougarou was selected as the primary site in the eastern ORD. In Namoungou a number of small-scale interventions are being tested.

2.1.3 ORD of Koupela (Central-East *Prefecture*--Tenkodogo)

The principal site in the Koupela ORD is centered on the village of Gnanguedin, located some 45 km south of the *prefecture* administrative capital of Tenkodogo (see Figure 2.1 for location in the region and Figure 2.6 for details of the site). This site encompasses an area of about 46,200 hectares. The second site,

TABLE 2.4

OUGAROU SITE POPULATION

National Census (1975)

Village	De Jure Population	De Facto Population
Datougou	279	277
Gnifogma	694	673
Ougarou	547	539
Piéga	1,132	1,158
Ponio Koni	306	294
Total	2,958	2,941

Village Livestock Project Census 1977-1978
of Ougarou (not including Gnifogma)

Village	Adults	Total Population
Datougou	78	142
Djuare I	122	222
Djuare II	45	82
Nymbiary	112	204
Ougarou	179	327
Piéga	161	294
Ponio Koni	159	289
Tipati	43	79
Total	899	1,639

TABLE 2.5

SITE OF OUGAROU POPULATION DATA

Village	Ethnic Group	Adults	% of Adults	# of Compounds	% of Compounds	Total Population	% of Population
Ougarou	Gourmantche	112	62.50	27	58.60	204	62.30
	Fulani	50	27.90	10	21.70	91	27.80
	Hausa	9	5.00	6	13.00	17	5.10
	Mossi	8	4.40	3	6.50	15	4.50
	TOTAL	179	99.80	46	99.80	327	98.70
Piega	Gourmantche	135	83.90	31	75.60	246	83.70
	Hausa	12	7.50	6	14.60	22	7.50
	Mossi	14	8.70	4	9.80	26	8.80
	TOTAL	161	99.10	41	100.00	294	100.00
Datougo	Gourmantche	78	100.00	12	100.00	142	100.00
Nymbiary	Gourmantche	71	63.40	16	64.00	129	63.20
	Fulani	41	36.60	9	36.00	75	36.80
	TOTAL	112	100.00	25	100.00	204	100.00
Tipati	Gourmantche	30	69.80	5	62.50	55	69.60
	Fulani	13	30.20	3	37.50	24	30.40
	TOTAL	43	100.00	8	100.00	79	100.00
Djuare I	Gourmantche	122	100.00	18	100.00	222	100.00
Djuare II	Gourmantche	45	100.00	9	100.00	82	100.00
Poun Yakouni	Gourmantche	115	72.30	19	73.10	209	72.30
	Fulani	44	27.70	7	26.90	80	27.70
	Total	159	100.00	26	100.00	289	100.00

TABLE 2.6

NAMOUNGOU SITE POPULATION

National Census (1975)

Village	De Jure Population	De Facto Population
Boadini	257	254
Bandingui	269	264
Kodjounti	582	583
Mabangani	118	116
Madeni	221	226
Mangoudeni	139	134
Namoungou	837	806
Sanipienga	291	280
Sietougou	397	381
Total	3,110	3,044

Village Livestock Project Census

1977-1978*

Namoungou	Adults	% Adults	Total Population	% of Population
Fulani	54	15.0	99	15.1
Gourmantche	295	82.2	537	82.0
Mossi	10	2.8	19	2.9
Total			655	100.0

*Several Hausal compounds were not included.

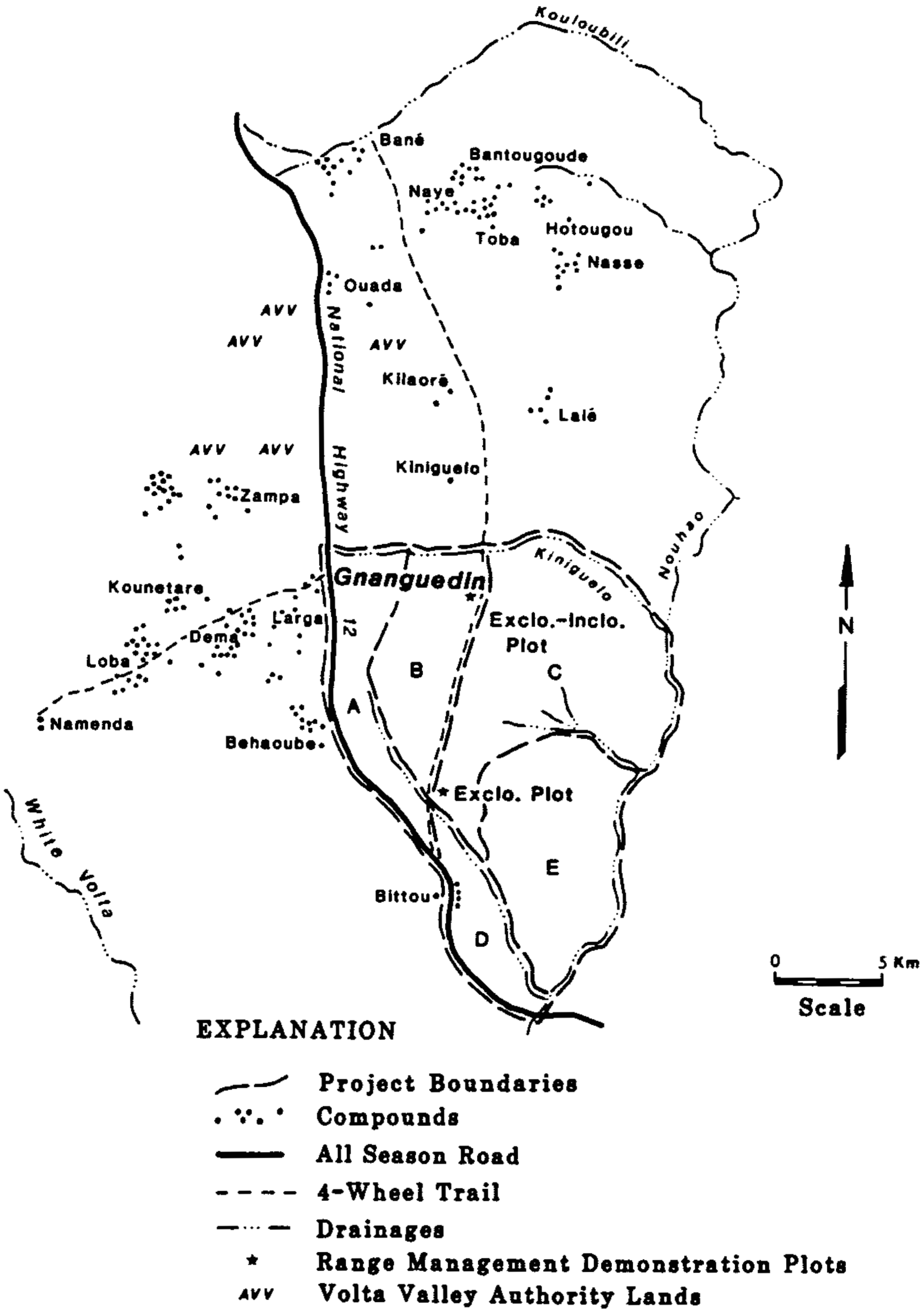

Figure 2.6 GNANGUEDIN SITE

Gourgou-Moaga, is located in the area just east of Tenkodogo on the road to Ouargaye. (See Figure 2.1 for location within the region and Figure 2.7 for site details.) Both sites are in the southern part of the Sudanian zone, with rainfall averaging about 950 mm per year. Both sites are densely populated and generally the remaining tree cover is minimal.

Census figures for the area are too grossly aggregated to be of much use. The figures for Gnanguedin gathered by the project census are instructive (Table 2.7). Although this is traditionally a Bissa village there has been considerable movement south into the area by Mossi from Tenkodogo. The Mossi have been attracted by the greater abundance of fertile land and grazing for their cattle. There has apparently been a similar southward movement by the Fulani. Our population estimate for the village itself is 1218, of whom 73.2 percent are Mossi, 23.2 percent Bissa and 2.8 percent Fulani. The Fulani estimate is too low as it does not include several camps 3-4 kilometers outside the area of the village. Most of the other villages in the site such as Dema and Loba are predominantly Bissa with a Fulani minority and a few Mossi.

At a later date, it was possible to estimate the human population of the Gnanguedin site by counting the numbers of compounds visible on aerial photographs. The Gnanguedin site was subdivided into the Gnaguedin Area and the Bittou east area.

The Gnanguedin Area. The human population is estimated to be 2,321 occupying 329 hectares, with 99% of the population located within a strip 2.5 kilometers wide east of the paved National Highway 12. This area is only 2% of the total 17,992 hectares of the area (see Table 2.8). Bittou east area, including the village of Bittou, has an estimated population of 2,059 occupying 312 hectares, of 98% is within two kilometers of National Highway 12, to the east. The population only occupies 4% of the total 7,104 hectares (see Table 2.9).

The overall human density for the site is .17 persons/hectare, or 17.5 persons/kilometer^2. This compares favorably to the

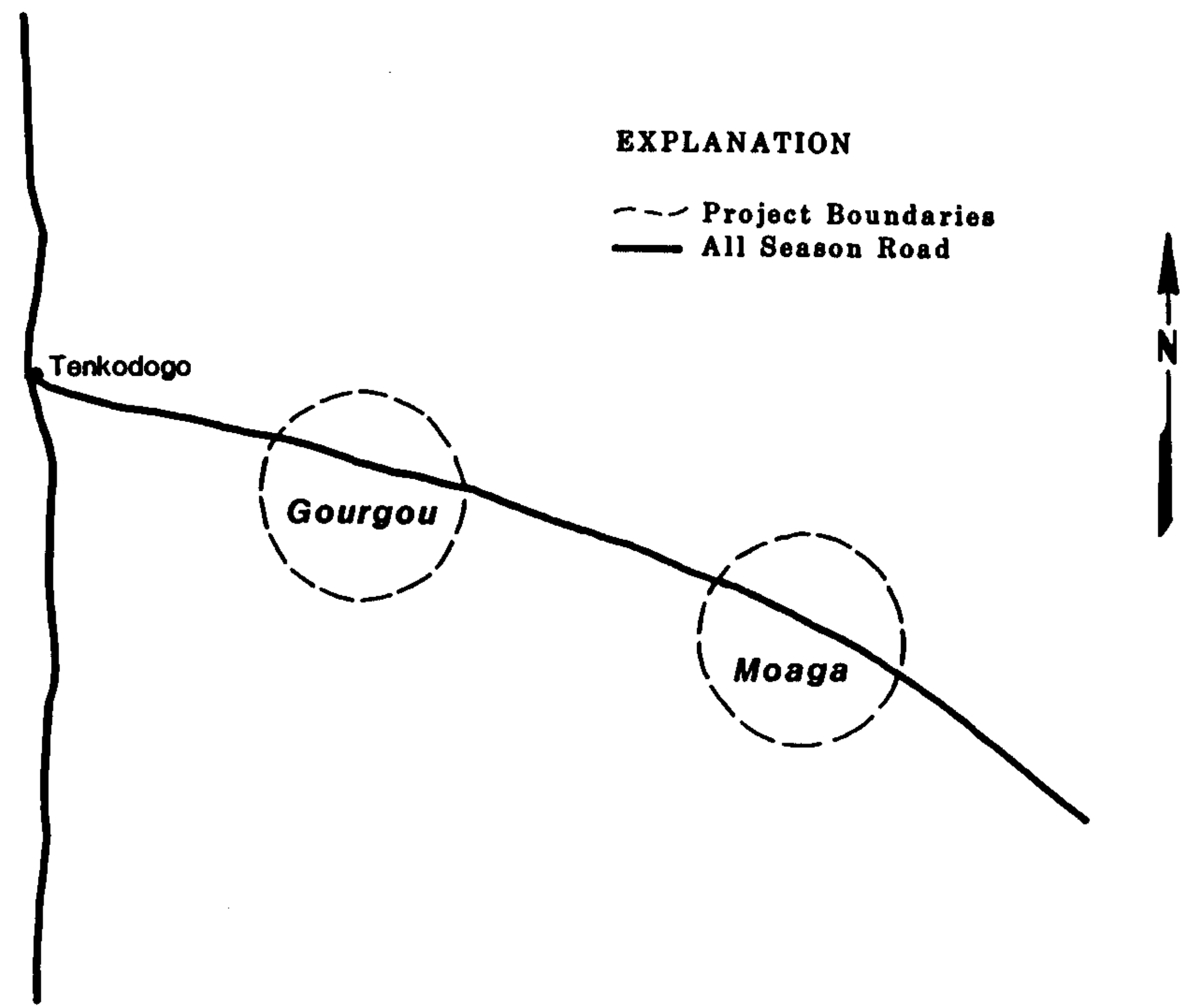

Figure 2.7 GOURGOU-MOAGA SITE

TABLE 2.7

GNANGUEDIN VILLAGE POPULATION

	Adults	Compounds	Total Population
Bissa	155 (23.2%)	38 (24.5%)	282
Mossi	489 (73.2%)	108 (69.7%)	890
Fulani	19 (2.8%)	5 (3.2%)	35
Other	6 (0.9%)	4 (2.6%)	11
TOTAL	688	155	1,218

NOTE: Number of persons per compound for the majority of the population (Bissa and Mossi) = $\frac{688 - 25}{155 - 9} = \frac{633}{146} = 4.5$.

TABLE 2.8

HUMAN POPULATION AND INFLUENCE ZONES FOR GNANGUEDIN AREA OF GNANGUEDIN SITE

Diameter of Sample* (mm)	Area of Sample (ha)	Number of Samples	Influence Zone (ha)	Number of Concessions (total)	Populations (4.5 pers/con.)**
Gnanguedin Area, Parcel A (see Figure 2.6):					
1	.20	39	8	1(39)	176
2	.79	44	35	1(44)	198
2.5	1.23	19	23	2(38)	171
3	1.77	9	16	6(54)	243
3.5	2.4	7	17	6(42)	189
4	3.14	3	9	6(18)	81
4.5	3.98	5	20	6(30)	135
5	4.9	1	5	7(7)	32
5.5	5.94	1	6	7(7)	32
6	7.07	1	7	7(7)	32
6.5	8.30	--	--	--	--
7	9.62	3	29	7(21)	95
7.5	11.05	--	--	--	--
8	12.57	1	13	23(23)	104
8.5	14.19	2	28	23(46)	207
9	15.9	--	--	--	--
9.5	16.8	--	--	--	--
10	19.6	--	--	--	--
11	23.76	1	24	50(50)	225
21	86.6	1	87	85(85)	383
Sub-total for Parcel A			327	(511)	2,303

Table 2.8.--Continued

Diameter of Sample* (mm)	Area of Sample (ha)	Number of Samples	Influence Zone (ha)	Number of Concessions (total)	Populations (4.5 pers/con.)**
Gnanguedin area, Parcel B:					
2.5	1.23	2	2	2(4)	18
Total for Gnanguedin area			329	(519)	2,321

*Sampled from aerial photographs, scale 1:50,000.

**Estimated by Vengroff in Gnanguedin Village Population Survey (see Table 2.7).

TABLE 2.9

HUMAN POPULATION & INFLUENCE ZONES--BITTOU EAST AREA OF GNANGUEDIN SITE

Diameter of Sample* (mm)	Area of Sample (ha)	Number of Samples	Influence Zone (ha)	Number of Concessions (total)	Populations (4.5 pers/con.)**
Bittou east area, Parcel D (see Figure 2.6):					
1	.20	3	1	1(3)	14
2.5	1.23	3	4	2(6)	27
3	1.77	10	18	6(60)	270
4.5	3.98	2	8	6(12)	54
5	4.9	1	5	7(7)	32
6.5	8.30	1	8	7(7)	32
7.5	11.05	1	11	7(7)	32
8	12.75	1	13	10(10)	45
8.5	14.19	1	14	12(12)	54
10	19.6	1	20	22(22)	99
12	28.28	1	28	23(23)	104
30	176.5	1	177	280(280)	1,260
Sub-total for Parcel D			307	(449)	2,023
Bittou east area, Bittou east Parcel E:					
2.5	1.23	4	5	2(8)	36
Total for Bittou east area			312	(457)	2,059
Total for Gnanguedin area (from Table 2.8)			329	(519)	2,321
Total for Gnanguedin site			641	(976)	4,380

*Sampled from aerial photographs, scale 1:50,000.
**As estimated by Vengroff see Table 2.7.

national density figure for the whole country of .219 persons/ hectare of 21.9 persons/kilometer^2.

The Gourgou-Moaga site is composed of two villages. The village of Gourgou is a combination of Mossi, Bissa and Fulani. Of 76 compounds, 22 (28.9%) are Mossi, 44 (57.9%) are Bissa and 9 (11.8%) are Fulani. The village chief is Mossi but 6 of the 8 neighborhoods are Bissa. There is one neighborhood each for the Mossi and Fulani. The village of Moaga, 10 km further east, is predominantly Mossi with 123 (75.0%) Mossi compounds and 41 (25.0%) Fulani compounds.

Both sites in the Koupela ORD are under the sub-prefecture of Tenkodogo. Traditionally, both areas fall under the purview of the chief of the ancient Mossi kingdom in Tenkodogo. The chiefs in the Gnanguedin site are directly under the chief of Bané, who in turn owes allegiance to Tenkodogo.

Settlement patterns are relatively tightly knit, especially among the Bissa. The main crops are red and white sorghum, millet and cowpeas. Maize, manioc and other garden crops are intensively grown in fertilized plots and lowlands. Livestock production is an integral part of the local production system.

The principal site in this ORD, Gnanguedin, is unique in that there is a large area between the main north-south road and the Nuahao River to the east which is almost totally devoid of agriculture. The Volta Valley Authority (A.V.V.) is planning to take away the principal grazing areas to the west of Gnanguedin and establish a zone of irrigated farms near the White Volta River.

2.2 DETAILED NATURAL RESOURCES INVENTORY

The Village Livestock Project (VLP) consists of six widely separated and extremely variable village sites scattered within three Regional Development Organizations (ORD's); two in the eastern ORD near Fada N'Gourma, two in the Mossi plateau ORD at Kaya, and two in the central eastern ORD at Koupela. Namoungou and Ougarou sites in the Eastern ORD are east of Fade N'Gourma. Koukoundi, a single village site near Kongoussi, and the larger Tafogo site near Tougouri are the project sites found in the Mossi plateau ORD. A small, mostly agricultural community of Gourgou, five kilometers east of Tenkodogo, and Gnanguedin Site 60 kilometers south of Tenkodogo are the sites in the Central east ORD (see Figure 2.1).

Two principal sites were chosen for detailed surveys of natural resources including vegetation, soils, and water. Major emphasis for range management activities included the establishment of range vegetation inventories, range demonstration plots and continual dialogue with livestockmen's groups, including the formation of a site range management subcommittee. The Tafogo site and the Gnanguedin site were the principal sites (see Figures 2.2 and 2.6).

The Tafogo range management inventory was completed in 1978, the range sub-committee was formed late in 1978, and the 50-hectare exclosure/inclosure demonstration plot was fenced in early 1979. At the end of Phase I dialogue continued within this site concerning two proposals made in May 1979: (1) the creation of a range management community grazing scheme on 1,000 hectares, and (2) the creation of community or family reforestation plots on denuded lands.

Gnanguedin site range management activities started early in 1978, but were shortly thereafter abandoned because of conflicts encountered with a large resettlement project in the area (AVV). However, VLP efforts restarted in mid-1979 and continued until September 30, 1980.

2.2.1 Range Resource Inventory--Tafogo Site

2.2.1.1 Physical Boundaries of the Site

The Tafogo site is situated in a well-defined low mountain range just north of Tougouri in the northeast corner of the Kaya ORD (see Figure 2.1 for regional overview and Figure 2.2 for site details). It is in the Kaya prefecture and the northernmost limit of the Boulsa sub-prefecture within the Cercle of Tougouri.

The project site boundary starts at a point where the northeast corner of the Tourgouri Reservoir meets National Highway Number 14 going north and continues along the highway northeasterly past Taparko to where the highway reaches the Tougouri-Yalogo divide. It continues toward the north/south divide (the crest) of the mountain range and the boundary of the drainage basins between the towns of Bougou and Narbingou. From the intersection of the mountain crest and National Highway 14, the site boundary follows westerly along the escarpment (south of the town of Damkarko). Near the trail connecting Tofogo and Damkarko the line continues to follow the escarpment as it turns southward, remaining east of the village of Petago, and then drops south following the rocky pedicels east of Zougountenga and Kougroussoukou. It then crosses the most easterly tributary of the Pelga lowlands at the last rocky mountain and passes southeasterly between the two knobs southeast of Silgre, continuing directly south where it passes within 500 meters west of Yoda and then turns easterly along the large drainage to the Tougouri reservoir and again to the north-east corner of the dam. The shoreline at low water is the southern boundary. With few exceptions the site acts as a natural watershed catchment for the Tougouri Reservoir. Boundaries of traditional areas within the site are discussed in Section 2.1.1.

2.2.1.2 Surface Area of Site and Adjacent Mapped Areas

Total mapped area	57,129 ha
Data collection area (Tafogo site)	39,872 ha
Adjacent areas (3)	17,257 ha

2.2.1.3 Geographical Vegetation Zone

The site is in a transition zone between the Sahel to the north and the Sudan Zone to the south or in what is called the Sudan-Sahel Vegetation Zone.

2.2.1.4 Climate

Figure 2.8 shows the location of the project sites in relation to each of all isohyets and isolines for the duration of the rainy season.

Rainfall. (data collected at Tougouri)

10-year average (1968 to 1977) . . . . . . 619 mm

Normal rainfall season . . . . May to Oct.

Assured rainfall season (86% of total) . . June to Sept.

Early rains (May*) . . . . 18 mm

Late rains (October*) . . . . 30 mm

*Averaged over a 10-year period (1968 to 1977)

Temperature. Monthly temperatures for Kaya and Dori, the nearest stations, are given in Table 2.10.

2.2.1.5 Priority Uses

In 1978 and 1979 rain-fed agriculture and stock raising, cutting wood for fuel and construction, cutting tall perennial grass culms for weaving mats and thatching roofs, the use of various plant materials for making rope, the growing of mangos and guavas for fruit, the harvesting of wild fruits, and the use of plants as herbs and medicines, and soil for making dwellings and pots are but a few uses of natural resources in Tafogo.

2.2.1.6 Description of Vegetation Types

Biomass data concerning individual plant species and their abundance and distribution within a plant community were collected. Plant communities were examined and if found to be homogeneous were considered as a sample area and described in detail separately with an assigned designation. The combination of sample areas was used to determine the carrying capacity of rangelands. The grouping of similar sample areas constitutes a vegetation type. The dominant

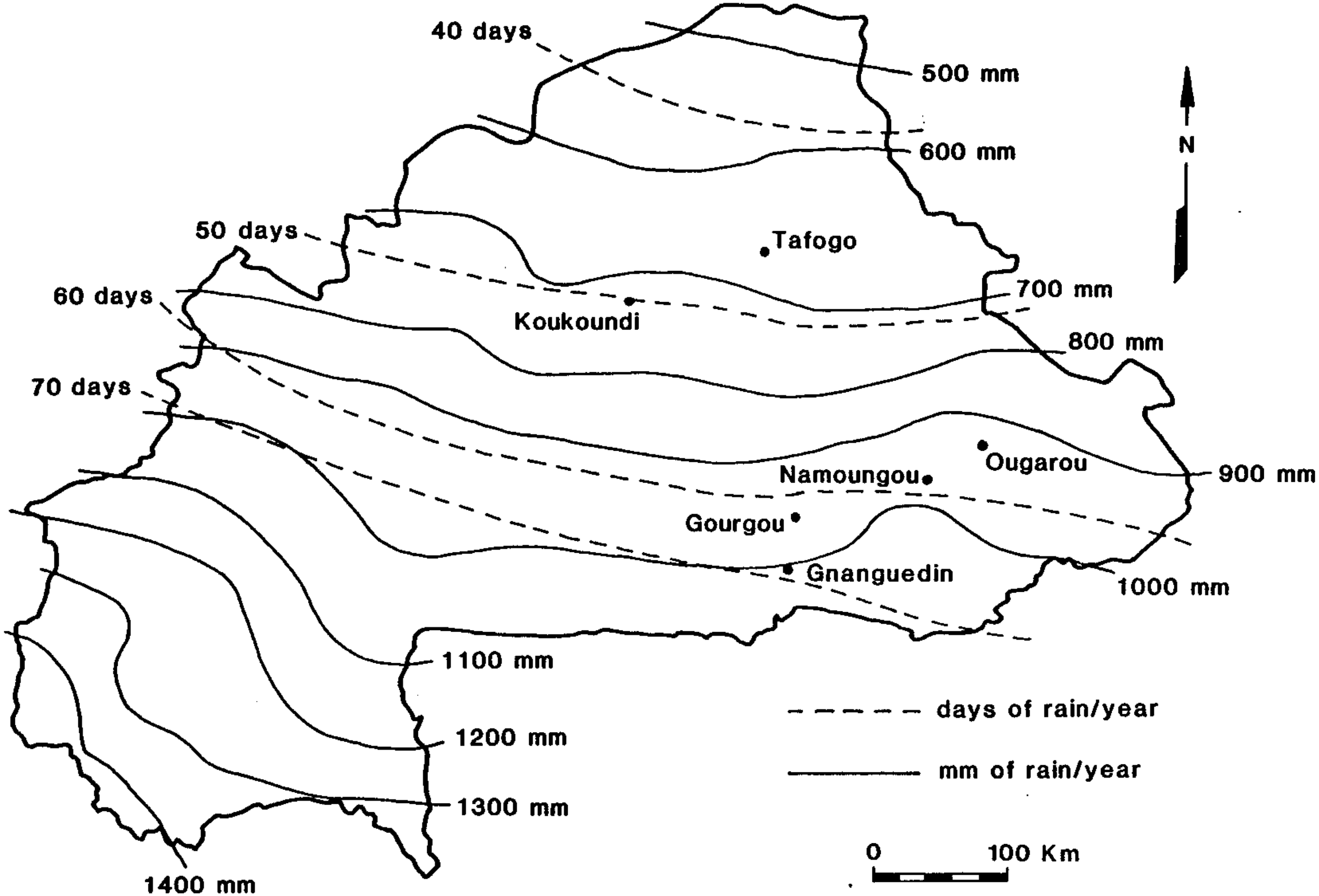

Figure 2.8 RAINFALL DURATION AND AMOUNT

TABLE 2.10

MONTHLY TEMPERATURES

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Kaya												
1978												
High	32.7	36.6	39.9	37.5	37.4	34.1	31.3	31.9	32.0	36.7	34.8	-
Low	18.1	21.2	23.4	26.0	23.0	20.5	21.7	22.0	20.8	24.4	21.2	-
10 year average (1968-1977)												
High	32.1	35.4	40.0	39.3	38.4	35.5	32.2	30.8	31.9	36.1	35.4	33.0
Low	17.0	19.8	21.0	25.4	25.2	23.3	21.9	21.2	21.6	22.7	19.7	17.7
Dori												
1978												
High	33.7	38.0	37.9	40.4	40.6	37.7	34.1	34.8	35.8	39.8	35.3	35.0
Low	14.7	17.3	23.2	26.4	27.8	25.4	23.6	24.4	23.8	24.4	19.1	15.1
10 year average (1968-1977)												
High	32.5	36.3	39.3	41.3	41.3	39.1	35.3	35.4	35.4	38.8	36.7	33.8
Low	13.8	16.5	20.7	25.0	27.1	26.6	24.1	23.4	23.7	23.0	17.4	14.8

visual aspect was used to distinguish one zone from another. For example, a homogeneous plant community composed of Combretum glutinosum, Pterocarpus lucens, and Balanites aegyptiaca (tree species) might be judged to be 60% of the composition of a plant community. Grasses such as Loudetia togoensis, Schoenefeldia gracilis, and Andropogon fastigiatus might be in secondary dominance with 40% of the plant composition. The Vegetation type would be designated Tree and Gramineae. Variations could occur by having more than 10% incidence of rock material within a sample area, as indicated by ground sampling techniques. In this case the Vegetation type would then be Tree-Gramineae-Rocky.

Thirteen vegetation types were identified and are described below. Reservoir Fringe type, the lone non-vegetal zone, represents the difference between the high and low water line of the Tougouri Reservoir. Summary maps of the vegetation are included in Appendix 6.2. Detailed maps of vegetation types are on file at The University of Arizona and at the National Livestock Service offices.

1) Cultivated Perimeter Type

	Tafogo	Damkarko Daga
Land area (ha)	1,929 ha	346 ha
Total biomass (kg/ha)	909 kg	384 kg
Forage biomass (kg/ha)	364 kg	153 kg
Erosion factor (% land area)		
advanced	-	65%
moderate	24%	-
minor	76%	35%
Area under cultivation (ha)	258 ha	21 ha
Principal crops (% area cultivated)		
peanuts	85%	85%
sesame	15%	15%
Total ground surface cover		
bare soil	50%	60%
rocks	2%	4%
green litter	39%	29%
dry litter	9%	7%

Surface soils	shallow and variable; denuded gravels and bare laterite with deeper soil fringes toward fallow or cultivated
Actual grazing season	12 months
Recommended grazing season	5 months (Dec. through Apr.)
Major plant species and % vegetal composition	Pennisetum pedicellatum, Schoenefeldia gracilis, Diheteropogon hagerupii, Andropogon gayanus, Andropogon fastigiatus, Loudetia togoensis, Microchloa indica (65% grasses), Acacia spp., Balanites aegyptiaca, Tamarindus indica, Sclerocarya birrea, Anogeissus leiocarpus, Combretum glutinosum (6% trees), Bauhinia reticulata, Guiera senegalensis, Combretum nigricans, Ziziphus mauritiana, Zimenia americana, Combretum micranthus (26% shrubs), Others (4% forbs).

2) Rain-fed Cultivation and Fallow Type

	Tafogo	Damkarko Daga
Land area (ha)	5,057 ha	1,289 ha
Total biomass (kg/ha)	389 kg	384 kg
Forage biomass (kg/ha)	156 kg	149 kg
Erosion factor (% land area)		
advanced to severe	39%	72%
moderate to advanced	61%	28%
Area under cultivation (ha)	1,943 ha	527 ha
Principal crops (% area cult.)		
Sorghum	55%	55%
Millet	33%	33%
Peanuts	11%	11%
Others--lazai and sesame	1%	1%

	Tafogo	Damkarko Daga
Total ground surface cover		
bare soil	73%	70%
rocks	4%	7%
green litter	16%	19%
dry litter	7%	6%
Surface soils	shallow or pockets of deeper alluvials	
Actual grazing season	12 mo.	
Recommended grazing season	5 mo. (Dec.-Apr.)	
Major plant species and % vegetal composition	Pennisetum pedicellatum, Schoenefeldia gracilis, Diheteropogon hagerupii, Andropogon gayanus, Andropogon fastigiatus, Loudetia togoensis, Microchloa indica (56% grasses), Acacia spp., Balanites aegyptiaca, Tamarindus indica, Sclerocarya birrea, Anogeissus leiocarpus, Combretum glutinosum (15% trees), Bauhinia reticulata, Guiere senegalensis, Combretum nigricans, Ziziphus mauritiana, Ximenia americana, Combretum micranthum (23% shrubs), Others (6% forbs)	

3) Intensively Cultivated Type

	Tafogo	Damkarko Daga
Land area (ha)	1,715 ha	1,070 ha
Total biomass (kg/ha)	294 kg	73 kg
Forage biomass (kg/ha)	294 kg	73 kg
Erosion factor (% land area)		
moderate	26%	14%
minor	13%	86%
null	61%	-
Area under cultivation (ha)	1,303 ha	738 ha

	Tafogo	Damkarko Daga
Principal crops (% area cult.)		
sorghum	45%	50%
millet	21%	23%
peanuts	15%	17%
maize	4%	5%
lazai	3%	3%
manioc	1%	1%
sesame	1%	1%
truck gardens	2%	-
mangos and guava	8%	-
Total ground surface cover		
bare soil	61%	83%
rocks	-	-
green litter	15%	3%
dry litter	24%	14%
Surface soils	deep and located in extensive drainage ways, alluvial with underneath clay	
Actual grazing season	7 mo. (Dec.-June)	
Recommended grazing season	3 mo. (Dec.-Feb)	
Major plant species % vegetal composition	*Andropogon gayanus*, *Pennisetum pedicellatum*, *Brachiaria stigmatisata*, *Schoenefeldia gracilis*, *Andropogon* sp., *Dactyloctenium aegyptium*, *Cymbopogon giganteus* (47% grasses), *Sclerocarya birrea*, *Tamarindus indica*, *Acacia* sp., *Butyrosperum paradoxum varparkii*, *Ficus* sp., *Kaya senegalensis*, *Diospyros mespiliformis*, *Mitragyna inermis*, *Terminalis avicennoides*, *Balanites aegyptiaca* (27% trees), *Bauhinia reticulata*, *Guiere senegalensis*, *Ziziphus mauritiana* (20% shrubs), Others (6% forbs).	

4) Gramineae and Shrub Type

	Tafogo	Damkarko Daga
Land area (ha)	7,293 ha	809 ha
Total biomass (kg/ha)	223 kg	423 kg
Forage biomass (kg/ha)	112 kg	212 kg
Erosion factor (% land area)		
advanced or severe	57%	81%
moderate/advanced	43%	19%
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-
Total ground surface cover		
bare soil	74%	66%
rocks	3%	3%
green litter	16%	23%
dry litter	7%	8%
Surface soils	shallow over lateritic gravel	
Actual grazing season	12 mo.	
Recommended grazing season	6 mo. (Aug.-Jan.)	
Major plant species and % vegetal composition	Loudetia togoensis, Schoenefeldia gracilis, Andropogon fastigiatus, Diheteropogon hagerupii (55% grasses), Bauhinia reticulata, Combretum micranthum, Boscia senegalensis, Guiere senegalensis, Acacia macrostachya, Dalbergia melanoxylon (32% shrubs), Combretum glutinosum, Balanites aegyptiaca (9% trees), Others (4% forbs).	

5) Gramineae, Shrub, and Rocky Type

	Tafogo	Damkarko Daga
Land area (ha)	846 ha	408 ha
Total biomass (kg/ha)	123 kg	128 kg
Forage biomass (kg/ha)	49 kg	51 kg
Erosion factor (% land area)		
advanced or severe	39%	94%
moderate/advanced	22%	6%

	Tafogo	Damkarko Daga
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-
Total ground surface cover		
bare soil	54%	48%
rocks	29%	35%
green litter	12%	12%
dry litter	5%	5%
Surface soils	shallow, gravel and rocky, depending on vegetation cover and slope for existence	
Actual grazing season	12 mo. (mostly Aug.-Dec.)	
Recommended grazing season	5 mo. (Aug.-Dec.)	
Major plant species and % vegetal composition	Loudetia togoensis, Schoenefeldia gracilis, Cymbopogon schoenanthus subspecies proximus, Andoropogon fastigiatus (52% grasses), Combretum micranthus, Guiera senegalensis, Boscia senegalensis, Bauhinia reticulata (32% shrubs), Balanites aegyptiaca, Pterocarpus lucens, Combretum glutinosum, Acaci spp., Anogeissus leiocarpus (6% trees), Others (10% forbs).	

6) Shrub and Gramineae Type

	Tafogo	Damkarko Daga
Land area (ha)	3,168 ha	1,623 ha
Total biomass (kg/ha)	311 kg	242 kg
Forage biomass (kg/ha)	155 kg	121 kg
Erosion factor (% land area)		
advanced or severe	47%	57%
moderate/advanced	53%	43%
Area under cultivation (ha)	-	trace
Principal crops (% area cult.)	-	millet peanuts

	Tafogo	Damkarko Daga
Total ground surface cover		
bare soil	73%	73%
rocks	2%	5%
green litter	17%	16%
dry litter	8%	6%
Surface soils	shallow over laterite or gravel or lateritic gravel	
Actual grazing season	12 mo. (mostly from Aug.-Dec.)	
Recommended grazing season	5 mo. (late July-Dec.)	
Major plant species and % vegetal composition	_Guiera senegalensis_, _Acacia macrostachya_, _Combretum micranthum_, _Boscia senegalensis_, _Grewia flavenscens_, _Dalbergia melanoxylon_ (45% shrubs), _Loudetia togoensis_, _Andropogon fastigiatus_, _Schoenefeldia gracilis_, _Elionurus elegans_, _Diheteropogon hagerupii_ (38% grasses), _Combretum glutinosum_, _Combretum_ sp., _Commiphora africana_, _Pterocarpus lucens_, _Anogeissus leiocarpus_, _Sclerocarva birrea_, _Adansonia digitata_ (12% trees), Others (4% forbs).	

7) Shrub, Gramineae, and Rock Type

	Tafogo	Damkarko Daga
Land area (ha)	144 ha	109 ha
Total biomass (kg/ha)	141 kg	206 kg
Forage biomass (kg/ha)	56 kg	82 kg
Erosion factor (% land area)		
advanced or severe	87%	-
moderate/advanced	13%	100%
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-

	Tafogo	Damkarko Daga
Total ground cover		
bare soil	46%	62%
rocks	28%	16%
green litter	16%	15%
dry litter	10%	7%
Surface soils	shallow with lateritic gravel and rock	
Actual grazing season	12 mo. (mostly during Aug.-Dec.)	
Recommended grazing season	5 mo. (Aug.-Dec.)	
Major plant species and % vegetal composition	*Combretum micranthum*, *Guiera senegalensis*, *Boscia senegalensis*, *Acacia macrostachya* (58% shrubs), *Loudetia togoensis*, *Schoenefeldia gracilis*, *Andropogon fastigiatus*, *Diheteropogon hagerupii*, *Elionurus elegans* (33% grasses), *Ptercarpus lucens*, *Combretum glutinosum*, *Balanites aegyptiaca* (8% trees), Others (1% forbs).	

8) Shrub Type

	Tafogo	Damkarko Daga
Land area (ha)	7,860 ha	165 ha
Total biomass (kg/ha)	182 kg	464 kg
Forage biomass (kg/ha)	73 kg	185 kg
Erosion factor (% land area)		
advanced or severe	58%	-
moderate/advanced	42%	100%
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-
Total ground surface cover		
bare soil	79%	69%
rocks	2%	2%
green litter	11%	20%
dry litter	8%	9%
Surface soils	shallow over laterite	
Actual grazing season	4 mo. (Aug.-Nov.)	

Recommended grazing season	5 mo. (Aug.-Dec.)
Major plant species and % vegetal composition	Combretum micranthum, Guiera senegalensis, Boscia senegalensis, Grewia flavescens, Acacia macrostachya, (60% shrubs), Pennisetum pedicellatum, Loudetia togoensis, Diheteropogon hagerupii, Andropogon fastigiatus, Elionurus elegans, Microchloa indica (30% grasses), Pterocarpus lucens, Combretum glutinosum (10% trees), Others (0% forbs).

9) Rocky Shrub (Upland) Type

	Tafogo	Damkarko Daga
Land area (ha)	735 ha	1,254 ha
Total biomass (kg/ha)	108 kg	99 kg
Forage biomass (kg/ha)	43 kg	40 kg
Erosion factor (% land area) advanced or severe	100%	100%
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-
Total ground surface cover		
bare soil	15%*	34%
rocks	50%	38%
green litter	5%	2%
dry litter	30%	26%
Surface soils	lateritic red rock fragments and gravel over a cuirasse; cuirasse actually exposed.	
Actual grazing season	rainy season	
Recommended grazing season	5 mo. (Aug.-Dec.)	

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*Pterocarpus lucens, Combretum micranthum, and Acaci macrostachya had shed most of their dry leaves by the time the sample was taken, accounting for low value for bare soil and high value for dry litter.

Major plant species and % vegetal composition	Combretum micranthum, Acacia macrostachya, Guiera senegalensis, Boscia senegalensis (75% shrubs), Pterocarpus lucens, Combretum sp. (12% trees), Schoenefeldia gracilis, Pennisetum pedicellatum, Elionurus elegans, Microchloa indica, Others (3% forbs).

10) Tree and Gramineae Type

	Tafogo	Damkarko Daga
Land area (ha)	596 ha	-
Total biomass (kg/ha)	230 kg	-
Forage biomass (kg/ha)	92 kg	-
Erosion factor (% land area) advanced/severe	100%	-
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-
Total ground surface cover		
bare soil	83%	-
rocks	2%	-
green litter	11%	-
dry litter	4%	-
Surface soils	shallow over dense lateritic gravel	
Actual grazing season	all year long (12 mo.)	
Recommended grazing season	5 mo. (Aug., Sept., Oct., Mar., and Apr.)	
Major plant species and % vegetal composition	Acacia sp., Balanites aegyptiaca, Sclerocarya birrea (50% trees), Schoenefeldia gracilis, Loudetia togoensis, Pennisetum pedicellatum, Andropogon fastigiatus (30% grasses), Bauhinia reticulata, Ziziphus mauritiana (20% shrubs).	

11) Gramineae and Tree Type

	Tafogo	Damkarko Daga
Land area (ha)	1,149 ha	-
Total biomass (kg/ha)	412 kg	-
Forage biomass (kg/ha)	165 kg	-
Erosion factor (% land area)		
advanced/severe	17%	-
moderate/advanced	25%	-
moderate	58%	-
Area under cultivation (ha)	-	-
Principal crops (% area cult.)	-	-
Total ground surface cover		
bare soil	58%	-
rocks	4%	-
green litter	30%	-
dry litter	8%	-
Surface soil	shallow (4-20 cm) with lateritic gravel substructure	
Actual grazing season	12 mo.	
Recommended grazing season	5 mo. (Apr., May, June, Oct., and Nov.)	
Major plant species and % vegetal composition	*Cymbopogon schoenanthus* subspecie *proximus*, *Loudetia togoensis*, *Andropogon gayanus*, *Schoenefeldia gracilis*, *Andropogon fastigiatus* (51% grasses), *Combretum glutinosum*, *Acacia* spp., *Pterocarpus lucens*, *Balanites aegyptiaca*, *Commiphora africana* (32% trees), *Combretum micranthum*, *Guiera senegalensis*, *Acacia macrostachya*, *Ximenia americana*, *Bauhinia reticulata* (16% shrubs), Others (1% forbs).	

12) Gramineae Type

	Tafogo	Damkarko Daga
Land area (ha)	1,779 ha	383 ha
Total biomass (kg/ha)	565 kg	517 kg
Forage biomass (kg/ha)	339 kg	310 kg
Erosion factor (% land area)		
severe	-	20%
advanced	15%	1%
moderate	77%	79%
minor	8%	-
Area under cultivation (ha)	trace	-
Principal crops (% area cult.)	millet	-
Total ground surface cover		
bare soil	54%	36%
rocks	17%	35%
green litter	22%	17%
dry litter	7%	8%

Surface soil — rocky, soil is bound by plant stubble and rocks

Actual grazing season — 12 mo.

Recommended grazing season — 5 mo. (Aug. and Sept., and Jan.-Mar.)

Major plant species and % vegetal composition — *Loudetia togoensis*, *Schoenefeldia gracilis*, *Cymbopogon schoenanthus* subspecies *proximus*, *Andropogon fastigiatus*, *Andropogon gayanus*, *Andropogon ascinodis* (70% grasses), *Bauhinia reticulata*, *Guiera senegalensis*, *Boscia senegalensis*, *Combretum micranthum* (15% shrubs), *Combretum glutinosum*, *Acacia* spp., *Balanites aegyptiaca* (12% trees), Other (3% forbs).

13) Reservoir Fringe Type

	Tafogo	Damkarko Daga
Land area (ha)	146 ha	-

The type represents the difference between the high water line of the Tougouri Reservoir.

	Tafogo	Damkarko Daga
Total biomass (kg/ha)	ØØ kg	-
Forage biomass (kg/ha)	ØØ kg	-

2.2.1.7 Crop Production

Land used primarily for crop production was categorized into three types and mapped: (1) Cultivated Perimeter, (2) Rain-fed Cultivation and Fallow, and (3) Intensively Cultivated. Areas of individual crops were calculated (see Table 2.11). The crop production types represent 29% of the area of the site, and are concentrated in areas where top soil is of high quality. Forty percent of the forage production for the whole site is produced on land used for farming.

Of the total 11,400 hectares classified as farming area about 42% was actually cultivated in 1978. Most of the remaining 58% was either fallow or village compounds. The actual surface area containing compounds is about 3500 hectares; however, this later figure is the total Occupancy Zone and includes a certain proportion of cultivated area. This is most true in the Intensively Cultivated type (see Figure 2.9) where it is difficult to separate occupancy zone and cultivation.

Cultivated Perimeter Type. Of the total 2,300 hectares only 6% was actually cultivated in 1978. Geographically it is on the fringes of the Intensively Cultivated type. It contributes 13% of the forage production to the site.

Rain-Fed Cultivation and Fallow Type. This type is comprised of small fields, between .5 and 3 hectares, well dispersed throughout the midland areas between the main lowlands and the elevated plateaus and mountains, and includes a limited number of secondary lowlands. Most fields are in shallow pockets of soil. Cropping success in these fields is directly related to the interval between rains rather than quantity. Rainfall intervals must not exceed 5 days throughout the growing season to assure an adequate harvest. Seventy-three percent of the ground surface was bare.

TABLE 2.11

AREAS DEVOTED TO CROP PRODUCTION IN 1978 FOR THE TAFOGO AND DAMKARKO DAGA AREAS OF TAFOGO SITE IN HECTARES

	Cultivated Perimeter		Rain-Fed Cultivation and Fallow		Intensively Cultivated		Total	
	Tafogo	D.D.	Tafogo	D.D.	Tafogo	D.D.	Tafogo	D.D.
Sorghum	-	-	1,100	290	590	370	1,690	660
Millet	-	-	640	170	270	170	910	340
Peanuts	220	20	210	60	200	130	630	210
Mangos and guavas	-	-	-	-	100	T	100	T
Maize	-	-	-	-	50	40	50	40
Truck gardens*	-	-	-	-	30	T	30	T
Cassava	-	-	-	-	10	10	10	10
Others**	40	T	20	10	50	30	110	40
Totals	260	20	1,970	530	1,300	750	3,530	1,300

*Bananas, sugar cane, potatoes, tomatoes, lettuce, carrots, and beans.

**Lazai and sesame.

T = Trace.

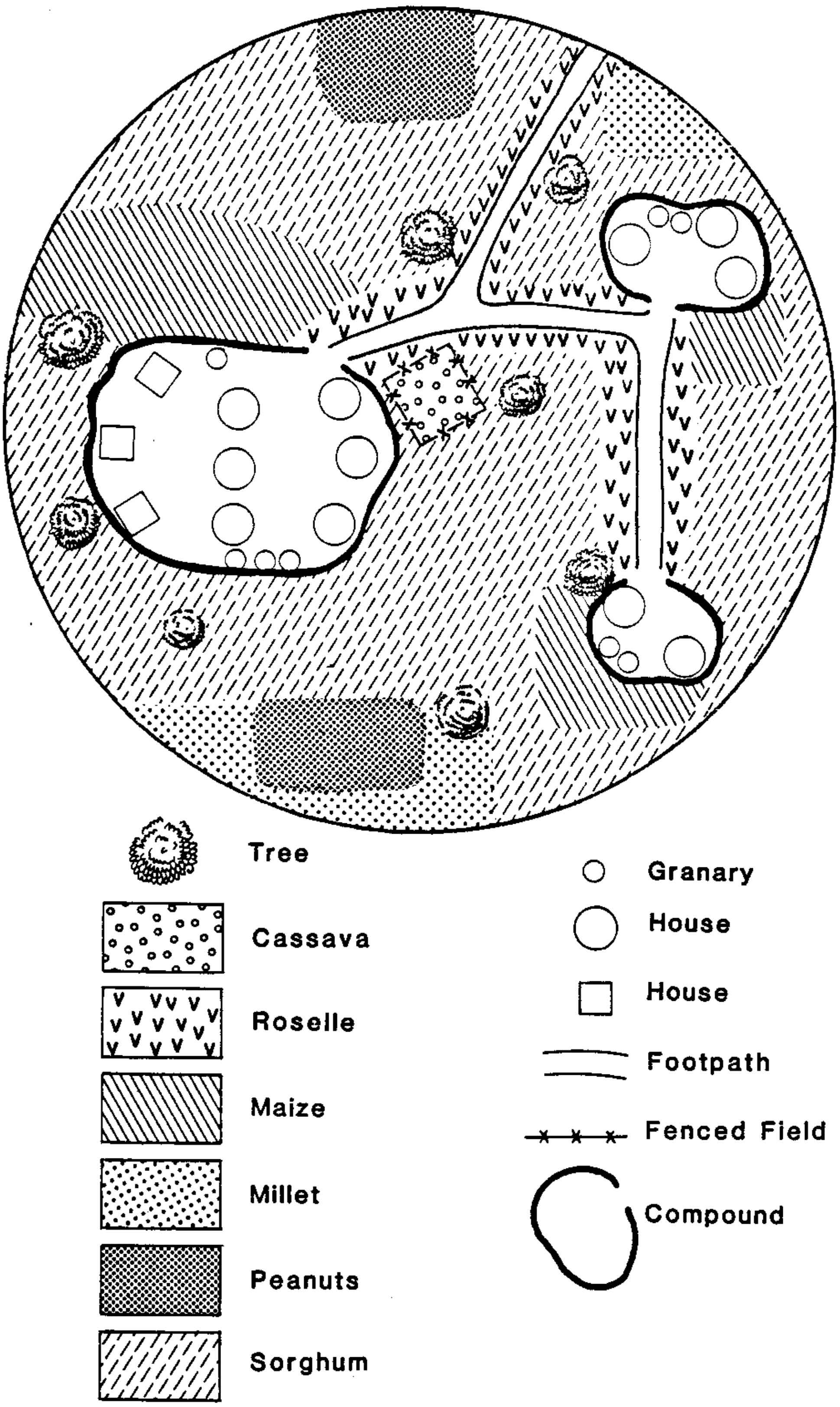

Figure 2.9 TYPICAL ZONE OF HUMAN OCCUPANCY INCLUDING THREE COMPOUNDS

Reseeding of grasses might be attempted in this zone. Only 38% of the 6,300 hectares was actually cultivated in 1978. Seventeen percent of all the forage production for the site is produced in this vegetation type.

Intensively Cultivated Type. This type is found along the principal lowlands of Tafogo and Damkarko Daga. Deeper soils and a higher water table assure crop production even in the lower rainfall years. The human population is concentrated along this north to south zone.

Seventy-six percent of the total 1,300 hectares in the Tafogo area of the site were under cultivation in 1978, and 69% of the smaller and drier 750 hectares in the Damkarko Daga area were cultivated. Ten percent of the total forage production of the site are produced here. In addition to the actual forage production, which includes resprouting millet and sorghum roots, cut crop residues contribute to supplemental livestock feed.

2.2.1.8 Forestry

The importance of leaves and fruits of certain tree species in the diets of not only sheep and goats, but cattle, cannot be over-emphasized. *Acacia* species, *Balanites aegyptiaca*, *Pterocarpus lucens*, *Combretum glutinosum*, *Commiphora africana*, and *Dalbergia melanoxylon* are but a few contributors. *Balanites* are used all year round as forage, as are some of the *Acacias*, and *Combretum glutinosum*, although the *Combretum* is less desired during the dry season, but because of scarcity of feed it is often eaten during the drier months. The others are available during mid-July to November, when they start losing leaves.

Tree products also provide firewood for cooking and heating, and materials for the construction of houses and storage structures.

When reviewing aerial photos taken in 1955 and 1956 there are larger areas and denser stands of tree associations (tree types) than were sampled during this inventory. When discussing the forest conditions, residents agreed, "Not too many years ago the forests were very thick and that is why it was difficult to see the lions."

There are two forest associations in the site with 32% or greater tree cover. Both are found in the Tafogo area. The extensively cultivated association contains 27% tree cover but the composition is one with relatively few harvestable species. Five other vegetative associations contribute 10 to 15% in tree cover (see Section 2.2.1.6 for details).

Wood Production. Estimated forestry growth rate for the site is 0.5 m^3/hectare/year (Gorse, 1978), on a base area of 36,900 hectares for a total production of about 2,600 m^3/year (Table 2.12). There is obviously a decline in forest inventories from year to year and/or a substitution of other materials, e.g., sorghum and millet stalks for fuel.

A more detailed study of the process of commercialization of wood in the Tafogo region is presented in Section 5.9.

Wood Consumption. Firewood accounts for 87% of the total wood harvested. The remainder is used for construction of houses, grain storage facilities and shelters. Firewood consumption is estimated at .5 m^3/person/year and construction timbers are estimated to account for an additional .46 m^3/compound/year.*

Forest wood consumption estimates are given for Tafogo site, adjacent areas, and that sold for outside the area use (designated as outside of Cercle) (see Table 2.13).

Total wood consumption for the Site is estimated to be 4,100 m^3/year for a population base of 6,800 people living in 1,300 compounds, including a limited amount of firewood being sold to transporters along National Route 14 near Taparko. This enterprise appears to be increasing in volume. The harvesting of certain amounts of the wood sold in this area is from the area east of the Tafogo Site limit. Therefore, only 100 m^3/year has

*12 construction poles/yr, @ .07 m radius and 2.5 m long.

TABLE 2.12

TOTAL WOOD PRODUCTION ESTIMATES/YEAR

Vegetation Type*	Area ha	Forest Cover %	Production/Year** m^3
1	2,275	6	68
2	6,346	15	476
3	2,785	27	376
4	8,102	9	365
5	1,254	6	38
6	4,791	12	287
7	253	8	10
8	8,025	10	401
9	1,989	12	119
10	596	50	149
11	1,149	32	183
12	2,162	12	130
13	146	-	-
Total	39,873	-	2600

*See Section 2.2.1.6 for description of vegetation types.

**Total production = $\frac{\text{area x \% forest cover x .5 } m^3/yr}{100}$.

TABLE 2.13

WOOD CONSUMPTION ESTIMATES/YEAR 1978-1979

Consumer Origin	Consumer Population	Firewood Consumption* m^3	Construction Materials*** m^3	Year Total m^3
Tafogo site	5,000	2,500	440	2,940
Adjacent areas	1,800	900	160	1,060
Outside of Cercle	-	100**	-	100
Total	6,800	3,500	600	4,100

*.50 m^3/person/yr.

**Bundles of firewood sold along National Route 14 near Taparko harvested within site. Bundle of firewood: 1.20 m x .5 m x .5 m (-15% airspace) + .225 m^3.
Estimated 400 bundles sold/year x .255 m^3 = 100 m^3 yr.

***.46 m^3/compound/yr.

been estimated to be that harvested from within the site. The value used for adjacent area consumers does not represent the population of the adjacent areas, but is only the approximate number of people close to the site that are using the site wood resources.

Summary. The annual rate of wood consumption in the Tafogo site was estimated as more than 4,400 m^3. The site regrowth rate was estimated to be only about 2,600 m^3. No estimate of standing wood biomass was made, but obviously what biomass is there is being depleted.

2.2.1.9 Burning

Burning of rangeland is not a common practice in the Tafogo site. However, in the perennial grass associations, where the cover is dense enough to burn, burning is used to eliminate old perennial woody growth on *Andropogon* spp. and *Cymbopogon proximus*.

In the annual grass areas there are so many islands of hard bare soil that it would be difficult to get a burn of much size established. Burning, in general, is not a problem, nor is it a tool in managing drier Sudan-Sahel rangelands characteristic of the Tafogo site.

Burning of residual organic materials in cultivated types prior to the planting season in June-July is a common practice.

Shrubs, tree trunks and surface residues are burned off to prepare for cultivation of small areas from .5 to 3 hectares that are scattered throughout rangelands.

2.2.1.10 Soil Erosion

Soil surfaces were classified according to levels of severity:

Classification	Severity	Description
0	null	Plant and litter cover adequate for soil protection, rock and pavement where present normal and in place; gullies, if present, completely stabilized and healed.

Classification	Severity	Description
1	minor	Isolated bare soil openings characterize this stage. Erosion confined more or less to the individual bare opening.
2	moderate	Bare soil openings larger and frequently joined together. Indicators may include one or more of the following: (1) soil hummocking due to lowering of soil surface in the bare areas, (2) pedestalling of plants, (3) erosion pavement evident in gravelly soils, (4) rills conspicuous after storms, (5) gullies occasional and moderately active (cutting after heavy storm), (6) sheet erosion has removed less than half the upper horizon of soil, (7) some noticeable alluvial deposition.
3	advanced	Soil movement advanced and bare ground dominates the site. Indicators are: (1) soil loss heavy and continuing with subsoil exposed in places, at least half the upper horizon having been lost, (2) where soils are gravelly, heavy erosion pavement occurs, (3) gullies frequent and active, (4) plants pedestalled or partially buried due to dislodging and redeposition of the soil, (5) wind scouring on exposed sites, (6) exposure of root crowns and roots of shrubs.
4	severe	Soil movement severe with most of area bare and uninfluenced by vegetation or litter. Indicators are: (1) subsoils mostly exposed, (2) heavy pavement on gravelly soils, (3) gullies frequent and deep and actively cutting with each storm, (4) large soil deposits.

The soils of the Tafogo site were classified according to erosion status including estimated erosion factors and areas affected. The results are given in Table 2.14.

2.2.1.11 Water Resources

First, the five types of water sources that are available within the site were identified: (1) traditional wells, (2) developed cement-lined wells, (3) seasonal stock ponds and natural depressions, (4) swamps, and (5) the major water source at Tougouri Reservoir. It is not necessary to distinguish between human and stock waters; the same sources are used by both. Location of various water sources were mapped. An inventory of wells was made in May and December 1978. Quality of water and the seasonal availability, production in cubic meters, are described when possible (see Tables 2.15 and 2.16).

Traditional wells are hand dug, unlined or sometimes lined with small branches of trees or shrubs, and are located in high water table areas (usually lowlands). Beginning with the rainy season, around June, these wells collapse, and the next dry season they have to be redug. Because of their low storage and production capacity many wells can be side by side. Traditional wells average about 5 meters in depth; they represent 94% of all wells at the Koukoundi site and 77% of all wells at the Tafogo site.

The water taken from these sources is heavily silted and of poor quality. Traditional wells produce 68% of the drinking water for the interior of the site in the dry season, and 53% during the post rainy season.

Production per unit is variable. Seasonal fluctuations in the water table are the main reason for production variations. Production is estimated to be 60 to 120 liters per hour per well.

Seasonal Production of Traditional Wells, 1978/79 (daily):

December: 43 wells x 90 l/h x 12 h.
+ 14 m^3 initial storage*
= 60 m^3 per day (maximum production)

*Represents that amount stored during non-use nighttime period of 12 h.

TABLE 2.14

EROSION FACTORS FOR EACH AREA BY VEGETATION TYPE

Tafogo Site

Vegetation Type*	Tafogo Area		Damkarko Daga Area	
	Erosion Factor	Area Affected (ha)	Erosion Factor	Area Affected (ha)
1	1.34	1929	2.30	346
2	2.89	5057	3.22	1289
3	0.65	1715	1.14	1070
4	3.07	7293	3.31	809
5	1.57	846	3.44	408
6	2.97	3168	3.07	1623
7	3.37	144	2.50	109
8	3.08	7860	2.50	165
9	3.50	735	3.50	1254
10	3.50	596	n.a.	-
11	2.38	1149	n.a.	-
12	2.07	1779	2.41	383
13	n.a.	-	n.a.	-

*See Section 2.2.16 for descriptions of vegetation types.

n.a. = not available.

TABLE 2.15

CEMENT LINED AND TRADITIONAL WELL INVENTORY TAFOGO SITE--MAY 1978

(Incomplete Sample)

	Cement Lined Wells			Traditional Wells			
Villages	No.	Volume m^3	Depth m	No.	Volume m^3	Depth m	Total Volume m^3
Boalin	-	-	-	-	-	-	-
Bissinga	-	-	-	-	-	-	-
Bougou	1	4	4.95	4	.94	17.5	4.94
Damkarko Daga	-	-	-	6	3.94	31.5	3.94
Damkarko Daga compound	-	-	-	3	5.38	18.75	5.38
Djamkoka	-	-	-	6	4.8	26.17	4.8
Kamboinciberi	1	.49	8.2	6	.68	38.9	1.17
Gouadre	-	-	-	-	-	-	-
Kossonkore	-	-	-	-	-	-	-
Litoera (Zitoera)	-	-	-	-	-	-	-
Longouzou	-	-	-	1	.24	7.55	.24
Masboule	-	-	-	-	-	-	-
Ok Moanga	-	-	-	-	-	-	-
Seno	-	-	-	-	-	-	-
Tafogo (1)	1	.68	6.52	7	6.69	32.35	7.37
Tafogo (2)	-	-	-	4	1.48	18.6	1.48
Tafogo (3)	2	3.92	10.45	-	-	-	3.92
Tafogo Marche	1	2.85	4.9	-	-	-	2.85
Tampelga	1	.07	7.25	-	-	-	.07
Zougountenga	-	-	-	-	-	-	-
Totals	7	12		37	25.2		37.2
11 villages sampled							

TABLE 2.16

CEMENT LINED AND TRADITIONAL WELL INVENTORY TAFOGO SITE--DECEMBER 1978

Villages	Cement Lined Wells No.	Cement Lined Wells Volume m^3	Cement Lined Wells Depth m	Traditional Wells No.	Traditional Wells Volume m^3	Traditional Wells Depth m	Total Volume m^3
Boalin	-	-	-	1	.09	5.0	.09
Bissinga	-	-	-	5	1.37	24.4	1.37
Bougou	1	2.15	8.4	1	.23	5.7	2.38
Damkarko Daga	-	-	-	8	1.68	65.86	1.68
Djamkoka	-	-	-	6	1.75	28.11	1.75
Gouadre	1	6.38	13.3	-	-	-	6.38
Kamboinciberi	1	6.30	9.2	1	.59	4.0	6.89
Litoera (Zitoera)	-	-	-	6	1.43	20.35	1.43
Kossonkore	1	2.15	6.7	-	-	-	2.15
Longouzou	-	-	-	1	.04	7.0	.04
Nasboule	-	-	-	2	1.4	12.05	1.4
Ok Moanga	-	-	-	1	.54	4.4	.54
Seno	-	-	-	2	.06	9.4	.06
Tafogo (1)	1	2.30	6.75	3	.58	14.4	2.88
Tafogo (2)	1	2.00	5.85	4	2.74	15.35	4.74
Tafogo (3)		3.00	21.5	1	.39	3.9	12.3
Tafogo Marche	1	5.20	8.15	1	1.06	4.3	6.32
Tampelga	2	6.50	13.15	-	-	-	6.50
Zougountenga	1	3.10	7.55	-	-	-	3.10
Totals	13	48.05		43	13.95		62.0
19 villages sampled							

May: 52 wells x 60 l/h x 12 h
+ 29 m^3 initial storage*
= 66 m^3 per day (maximum production)

Water is lifted by hand using ropes and small capacity containers such as calabashes or rubber buckets (constructed from old automobile tire inner tubes). Metal food cans are becoming more popular as lifting containers.

Cement-lined permanent wells are deeper, averaging about 10 meters depth, and are located on the fringes of the high water table lowlands. These wells are few. Average depth of cement-lined wells at four sites are as follows:

Site	Average Depth**	No. of Wells
Namoungou	8.75 m	3
Ougarou	10.66 m	5
Tafogo	7.76 m	7
Koukoundi	23.60 m	1

There are seasonal fluctuations in water production; post-rainy season production is about twice that of the dry season. Cement-lined wells are permanent, clean water sources, whose storage capacities are much larger. Production is approximately 120 to 200 liters per hour.

Seasonal Production of Cement-Lined Wells 1978/79 (daily):

December: 8 wells x 200 l/h x 12 h
+ 30 m^3 initial storage*
= 48.8 m^3 per day (maximum production)

May: 7 wells x 120 l/h x 12 h
+ 17 m^3 initial storage*
= 27.1 m^3 per day (maximum production)

Water is hand lifted using ropes and small metal, rubber, or plastic containers of 4 to 20 liters.

---

*Represents that amount stored during non-use nighttime period of 12 h.

**Measured by Alan Johnston.

A solar energy pump is pumping water from a cement-lined well 8 kilometers southwest of Taparko market along National Road 14, on the southeast side of the road (on the other side of the lowlands). The unit was installed in 1978 and has worked off and on, but appears to have had its share of breakdowns. It feeds one watering trough of about 400-liter capacity. The well is not sealed so that water also can be hand drawn.

Production of the Well with Solar Pump (estimated daily production)

December: 1 well x 200 l/h x 12 h
+ 3 m^3 initial storage*
= 5.4 m^3 per day (maximum production)

May: 1 well x 120 l/h x 12 h
+ 3 m^3 initial storage*
= 4.4 m^3 per day (maximum production)

Stock ponds and natural depressions are water points that normally fill up during rains and are used during and shortly after the rainy season. Three stock ponds, built almost side by side and obviously machine dug some years ago, are situated 2.5 kilometers north of Bissinga. The rains were so few last year (1978) that water hardly got above the silt in the bottom, and that quickly disappeared by the first of October.

Several catchment basins are located in the major lowlands. Some are difficult to get to because of crops. Through the years the basins have been enlarged from the process of manufacturing earthen bricks.

Natural depressions throughout the range areas hold adequate waters for stock during the peak rainy season. Water quality is poor and silt is high.

Swamps are located in the southwest corner of the site. During the rainy season they become part of the west end of the Tougouri Reservoir; as the dry season progresses they become three separate swampy areas heavily used by livestock. Livestock using the swamps are from south of the Site.

*Represents that amount stored during non-use nighttime period of 12 h.

Dry season storage:

1) Most westerly pond
   750 m x 250 m x .5 m (depth)
   = 94,000 m^3

2) Middle pond
   1,700 m x 200 m x .5 m (depth)
   = 170,000 m^3

3) Most easterly pond
   1,500 m x 175 m x .5 m (depth)
   = 131,000 m^3

   Total storage: 395,000 m^3

The Tougouri Reservoir has a normal volume at peak period of 1,890,000 m^3; however, the summer of 1979 (June 1979) the estimated volume was 351,000 m^3.

Storage:

1) Full capacity
   1,575,000 m^2 x 1.2 m average depth
   = 1,890,000 m^3

2) June 1979
   780,000 m^2 x .45 m average depth
   = 351,000 m^3

The reservoir is a central watering point for animals within a 10 kilometer or more distance during the dry season.

Human requirements for water have frequently been stated as 20 liters per person/day where more available sources and modern distribution systems exist. However, the difficulties in lifting and carrying water over long distances to a storage facility tend to regulate the amount of water consumed by a rural family. Probably 10 liters per day per individual is more within reason for the Tafogo site.

Water is hauled to the compound from the source by the female members of the families. Clay pots of 20 liter capacity are carried on the head. At times one sees a galvanized bucket (15-20 liter capacity) in use.

Water may be drawn from an open water holding depression during the rainy season, or from a well if no other source is available. In the dry season water is drawn by hand from wells, either traditional or developed. Those living near swamps, ponds, or Tougouri Reservoir seem to prefer water from the open sources within the site. About 190 people depend on the Tougouri Reservoir, and the additional 4,800 or so obtain water from well sources. The daily consumption by well users is assumed to be 10 liters per person/day; those few using the reservoir and other open sources tend to use more per person (est. 15 liters/day).

Daily human consumption:

4,834 people x 10 l/day = 48.3 m^3/day
(wells)

190 people x 15 l/day = 2.9 m^3/day
(reservoir)

Meeting livestock requirements for water from July through September is normally no problem because of the numerous depressions found throughout the range areas. Some of the depressions retain water into November and December in good rainfall years.

Starting in November and early December water is lifted from wells to water all livestock. An animal is usually watered once a day under these conditions.

In a June 1979 aerial survey of the site, 20% of the cattle and 25% of the sheep and goats were found within 5 kilometers of the Tougouri Reservoir. The remaining animals were well distributed in vicinities of existing wells. An earlier survey indicated the same percentages. So about 78% of all animals are being watered at wells, with a probable occasional watering at the reservoir, especially cattle.

The daily post-rainy season consumption is estimated as 20 liters average per cow, and 3 liters per sheep or goat. The June period (dry season) average is estimated as 25 liters per cow and 3 liters per goat or sheep.

Daily Livestock Consumption (post-rainy season):

From wells

2,000 head cattle x 20 l/head (average)
= 40 m^3 daily

931 head goats and sheep x 3 l/head (average)
= 2.8 m^3 daily

35 donkeys and horses x 20 liters/head (average)
= .7 m^3 daily

Total consumption from well sources per day
= 43.5 m^3.

From reservoir

599 head cattle x 25 l/head (average)
= 15 m^3 daily

241 head goats and sheep x 3.8 l/head (average)
= .9 m^3 daily

Total consumption from reservoir source per day
= 15.9 m^3.

Daily Livestock Consumption (dry season):

From wells

1,112 head cattle x 25 l/head (average)
= 27.8 m^3 daily

705 head goats and sheep x 3 l/head (average)
= 2.1 m^3 daily

35 head donkeys and horses x 25 l/head (average)
= .9 m^3 daily

Total consumption from well sources per day
= 30.8 m^3.

From reservoir

279 head cattle x 30 l/head (average)
= 8.3 m^3 daily

240 head goats and sheep x 3.8 l/head (average)
= 1.9 m^3 daily

Total consumption from reservoir source per day
= 9.2 m^3.

Estimated human and livestock requirements for water from wells and potential water production from wells on a daily basis are given in Table 2.17 (December 1978 survey) and in Table 2.18 (May/June 1979 survey).

Summary. The daily water use requirements for humans and animals is estimated as less than 50 m^3. Their water needs seem to be met adequately from local wells and reservoirs except in severe drought periods. Seasonal shortages occur in isolated areas requiring long treks to permanent water sources and/or carrying water long

TABLE 2.17

ESTIMATED HUMAN AND LIVESTOCK WATER REQUIREMENTS FROM WELLS AND POTENTIAL PRODUCTION 1978-1979 (Post-Rainy Season)

Type of Well	Daily Human Require-ments*	Daily Livestock Require-ments**	Total Daily Require-ments	Potential Daily Total Production***
Traditional				60.4 m^3
Developed cement-lined	48.3 m^3	43.5 m^3	91.8 m^3	48.8 m^3
Solar pump/ cement-well				5.4 m^3
Totals	48.3 m^3	43.5 m^3	91.8 m^3	114.6 m^3

*4,834 population x 10 l/day.

**20 l/head/bovine/donkey, horse, and 3 l/head/sheep or goats and livestock inventory Dec. 1978.

***Samples Dec. 1978.

TABLE 2.18

ESTIMATED HUMAN AND LIVESTOCK WATER REQUIREMENTS FROM WELLS AND POTENTIAL PRODUCTION 1978-1979 (May/June)

Type of Well	Daily Human Require- ments*	Daily Livestock Require- ments**	Total Daily Require- ments	Potential Daily Total Production***
Traditional				66.4 m^3
Developed cement lined	48.3 m^3	30.8 m^3	79.1 m^3	27.1 m^3
Solar pump/ cement-well				4.4 m^3
Totals	48.3 m^3	30.8 m^3	79.1 m^3	97.9 m^3

*4,834 population x 10 l/day.

**24 l/head/bovine, donkey, horse, and 3 l/head/sheep or goats, and livestock inventory June 1979.

***Samples May 1978.

distances. No data were available to determine trends in ground water levels or surface water supplies, but reduction of vegetative cover of all types results in decreasing water availability because of reduced infiltration to ground water aquifers and reduced reservoir capacity (more sedimentation). If not actually reduced, surface runoff becomes more difficult to manage because of higher instantaneous flow rates.

2.2.2 Carrying Capacity and Stocking Rates

2.2.2.1 Carrying Capacity

Annual carrying capacity for the Tafogo site is summarized in Table 2.19. Forage is sufficient for 2,500 A.U. on that basis. Monthly carrying capacities for each vegetation type are given in Tables 2.20 and 2.21 for the Tafogo and Damkarko Daga sub-areas, respectively. Of great importance here is the fact that optimal carrying capacity is less than 200 A.U. in May and June.

A sample of the Range Resource Inventory Analysis Form is included in Appendix 6.2 as is the guide for the use of this form.

2.2.2.1.1 Sampling Criteria

Gramineae species were measured leaving a 30% stump (30% of height); all other species were measured by foliage and fruit weights. Green weights were recorded and later converted to dry weight using air-dried samples. Air-dry species samples were collected and dried separate from transect samples.

The strata sampled was from ground level to a height of 1.5 m. Aerial photography of 1974 vintage, 1:50,000 scale, was used in obtaining ground data and in mapping.

Ninety-two sample areas were described in analyzing range and related data for the site, and 819 individual 1-m^2 study plots were weighed and analyzed.

2.2.2.1.2 Natural Forage

The sample areas also represent the basic units for expressing biomass production. Biomass is plant production over a given area or within an ecosystem and is expressed in kilograms per

TABLE 2.19

CARRYING CAPACITY IN ANIMAL UNITS (12 MONTH BASIS), TAFOGO SITE BY AREA AND VEGETATION TYPES

Vegetation Type*	Tafogo Area: Forage Biomass kg/ha	Tafogo Area: Area ha	Tafogo Area: A.U.	Damkarko Daga Area: Forage Biomass kg/ha	Damkarko Daga Area: Area ha	Damkarko Daga Area: A.U.
1	364	1,929	308	153	346	23
2	156	5,057	346	149	1,289	84
3	294	1,715	221	73	1,070	34
4	112	7,293	358	212	809	75
5	49	846	18	51	408	9
6	155	3,168	215	121	1,623	86
7	56	144	4	82	109	4
8	73	7,860	252	185	165	13
9	43	735	14	40	1,254	22
10	92	596	24	-	-	-
11	165	1,149	83	-	-	-
12	339	1,779	264	310	383	52
13	-	146	-	-	-	-
Total	4,810,000 kg	32,416	2,100	920,000 kg	7,456	400

Tafogo Site Total: 2,509 A.U.

*Numbers refer to vegetative types described in Section 2.2.1.6.

TABLE 2.20

OPTIMAL SEASONAL CARRYING CAPACITY BY VEGETATION TYPE (TAFOGO SITE - TAFOGO AREA)

1978-1979

Vegetation Type*	Total Biomass kg/ha	Desirability Rating	Forage Biomass kg/ha	Adjusted Animal Units (A.U.) Optimum Monthly Carrying Capacity					
				Jan.	Feb.	Mar.	Apr.	May	June
1	909	(.4)	364	739	739	739	739	-	-
2	389	(.4)	156	830	830	830	830	-	-
3	294	(1.0)	294	884	884	-	-	-	-
4	223	(.5)	112	716	-	-	-	-	-
5	123	(.4)	49	-	-	-	-	-	-
6	311	(.5)	155	-	-	-	-	-	-
7	141	(.4)	56	-	-	-	-	-	-
8	182	(.4)	73	-	-	-	-	-	-
9	108	(.4)	43	-	-	-	-	-	-
10	230	(.4)	92	-	-	58	58	-	-
11	412	(.4)	165	-	-	-	199	199	199
12	565	(.6)	339	-	635	635	635	-	-
13	-	-	-	-	-	-	-	-	-
Total				3,169	3,088	2,262	2,461	199	199

Table 2.20--Continued

Vegetation Type*	Total Biomass kg/ha	Desirability Rating	Forage Biomass kg/ha	Adjusted Animal Units (A.U.) Optimum Monthly Carrying Capacity July	Aug.	Sept.	Oct.	Nov.	Dec.
1	909	(.4)	364	-	-	-	-	-	739
2	389	(.4)	156	-	-	-	-	-	830
3	294	(1.0)	884	-	-	-	-	-	884
4	223	(.5)	112	-	716	716	716	716	716
5	123	(.4)	49	-	44	44	44	44	44
6	311	(.5)	155	431	431	431	431	431	431
7	141	(.4)	56	-	8	8	8	8	8
8	182	(.4)	73	-	604	604	604	604	604
9	108	(.4)	43	-	34	34	34	34	34
10	230	(.4)	92	-	58	58	58	-	-
11	412	(.4)	165	-	-	-	199	199	-
12	565	(.6)	339	-	635	635	-	-	-
13	-	-	-	-	-	-	-	-	-
Total				431	2,472	2,530	2,094	2,036	4,290

*Numbers refer to vegetation types described in Section 2.2.1.6.

TABLE 2.21

OPTIMAL SEASONAL CARRYING CAPACITY BY VEGETATION TYPE (TAFOGO SITE - DAMKARKO DAGA AREA)

1978-1979

Vegetation Type*	Total Biomass kg/ha	Desirability Rating	Forage Biomass kg/ha	Adjusted Animal Units (A.U.) Optimum Monthly Carrying Capacity					
				Jan.	Feb.	Mar.	Apr.	May	June
1	384	(.4)	153	56	56	56	56	-	-
2	373	(.4)	149	202	202	202	202	-	-
3	73	(1.0)	73	137	137	-	-	-	-
4	423	(.5)	212	150	-	-	-	-	-
5	128	(.4)	51	-	-	-	-	-	-
6	242	(.5)	121	-	-	-	-	-	-
7	206	(.4)	82	-	-	-	-	-	-
8	464	(.4)	185	-	-	-	-	-	-
9	99	(.4)	40	-	-	-	-	-	-
10	-	(.4)	-	-	-	-	-	-	-
11	-	(.4)	-	-	-	-	-	-	-
12	517	(.6)	310	-	125	125	125	-	-
13	-	-	-	-	-	-	-	-	-
Total				545	520	383	383	-	-

Table 2.21--Continued

Vegetation Type*	Total Biomass kg/ha	Desirability Rating	Forage Biomass kg/ha	Adjusted Animal Units (A.U.) Optimum Monthly Carrying Capacity					
				July	Aug.	Sept.	Oct.	Nov.	Dec.
1	384	(.4)	153	-	-	-	-	-	56
2	373	(.4)	149	-	-	-	-	-	202
3	73	(1.0)	73	-	-	-	-	-	137
4	423	(.5)	212	-	150	150	150	150	150
5	128	(.4)	51	-	22	22	22	22	22
6	242	(.5)	121	172	172	172	172	172	172
7	206	(.4)	82	-	9	9	9	9	9
8	464	(.4)	185	-	32	32	32	32	32
9	99	(.4)	40	-	22	22	22	22	22
10	-	(.4)	-	-	-	-	-	-	-
11	-	(.4)	-	-	-	-	-	-	-
12	517	(.6)	310	-	125	125	-	-	-
13	-	-	-	-	-	-	-	-	-
Total				172	532	532	407	407	802

*Numbers refer to vegetation types described in Section 2.2.1.6.

hectare. Total biomass and forage biomass are terms used to express total green and dry plant production and actual forage plant production. The difference between total and forage biomass represents that biomass or plant production not consummable, not at all preferred by grazing animals, or that lost because of seasonal unavailability. See Figure 2.10 for seasonal changes in dry matter content of biomass.

The forage biomass was then converted into Animal Units (A.U.). An Animal Unit is that forage (dry weight) necessary to maintain one bovine of 250 kg for 12 months:

1 A.U. = 250 kg (bovine) x 2.5% body weight x 365 days/yr
= 2,280 kg dry matter forage/yr.

Small ruminants (Mossi type) are converted to bovine A.U. by dividing by 6.25:

1 A.U. = 6.25 sheep or goats (Mossi type)

Range carrying capacities then are referred to in Animal Units (A.U.).

2.2.2.1.3 Crop Residues

The forage biomass produced by crop residues is 84.2 kg per hectare of actual cultivated land (4,180 hectares) for a total of 352,000 kg forage biomass (Table 2.22). More than half of this total is consumed while still in the field, while 32% is stored as peanut hay. Crop residues are considered as supplemental feed, but resprouting millet and sorghum roots were included in the plot forage sampling measurements. The overall importance of using crop residues as animal feed is limited because the deterioration of stalk material is rapid. The amounts of stalk materials usable by animals cannot exceed 5% of the total dry weight. Peanut hay, already dry before storage, loses about 35% of total dry matter before the material is actually consumed by the animals. Periods of availability and quantities of the various crop residues are shown in Figure 2.11.

Crop residues are stored on roofs of houses or other structures found within the compound, and are used to feed animals

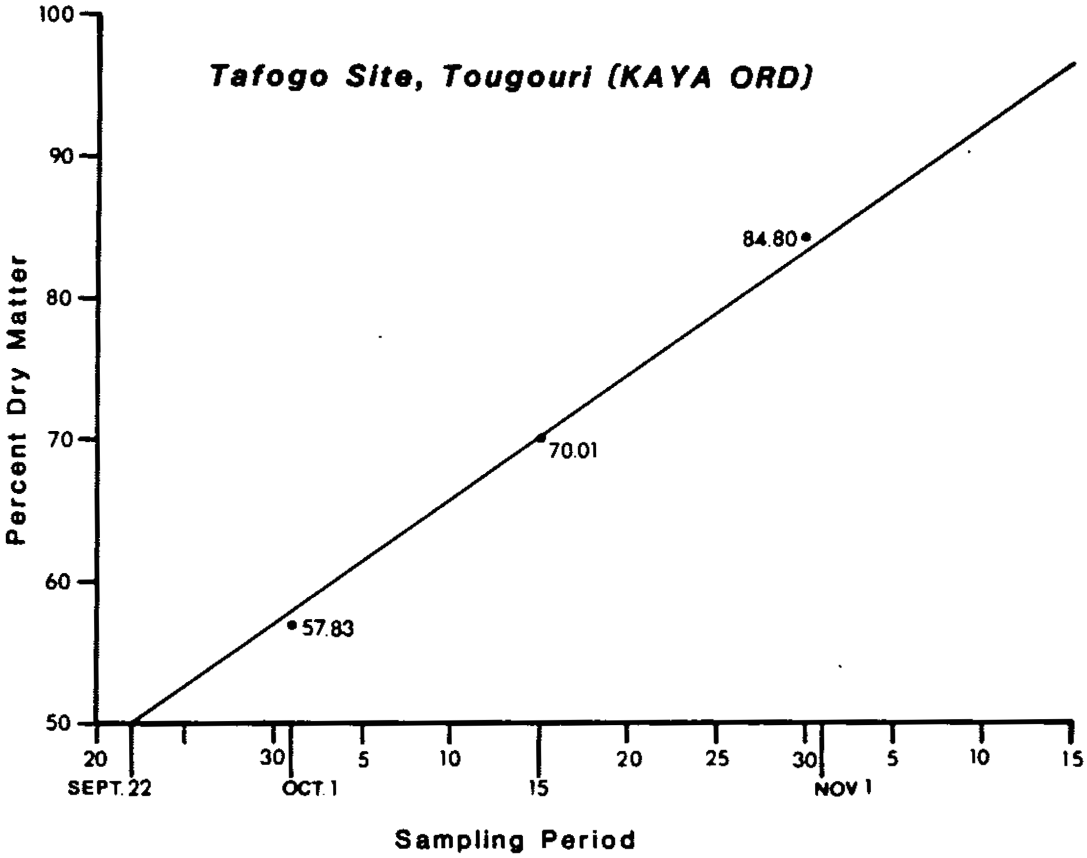

Figure 2.10 SEASONAL CHANGES IN DRY MATTER CONTENT OF BIOMASS

TABLE 2.22

CROP RESIDUES USED AS LIVESTOCK FEED (TAFOGO SITE)

	Area of Each Crop in Each Vegetation Type* (ha)			Total Area (ha)	Total Dry Matter (kg/ha)	Estimated % Usable Forage	Total Forage Biomass (kg)
	1	2	3				
Sorghum (stalks)	-	1,359	918	2,277	1,500	5	171,000
Millet (stalks)	-	815	428	1,243	1,000	5	62,000
Peanut (hay)	237	272	306	578	300	65	113,000
Corn (stalks)	-	-	82	82	1,500	5	6,000
Total	237	2,446	1,734	4,180			352,000

*Numbers refer to vegetation types described in Section 2.2.1.6.

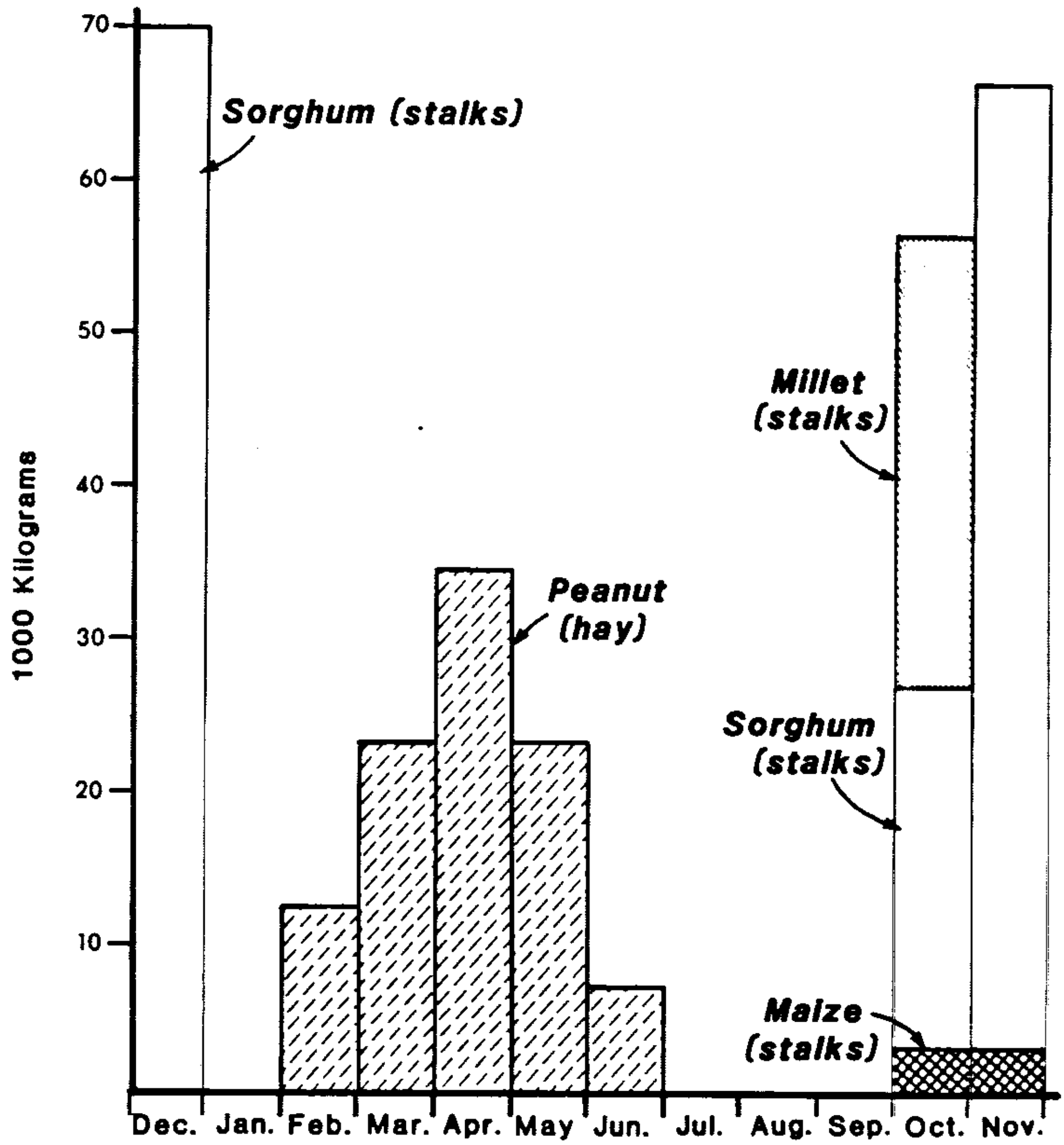

Figure 2.11 PERIODS OF AVAILABILITY AND QUANTITIES OF CROP RESIDUES

housed within the immediate compound such as draft animals, sheep, goats, horses, and rarely small suckling calves.

Cut stalks are left in the fields until goats, sheep, and calves have all but stripped the edible parts by the time they are gathered for storage. Dry stalks also are used in construction of temporary dwellings, as heating fuel during the cooler nights and mornings of November and December, and for cooking fires.

Bran from the pounding of millet and sorghum is fed to young calves, horses, and for fattening of sheep for special occasions. Chickens naturally profit from what is scattered on the ground between poundings.

2.2.2.2 Stocking Rate

Evaluation of forage and water resources requires a knowledge of the number of domestic livestock and wild animals within the site. This is called the stocking rate. Stocking rates vary from season to season depending on the availability of natural feeds, crop residues, and water sources. Because of the many variables involved, two low-level aerial reconnaissance surveys were made to inventory the numbers of animals. The first was made following the rains and just after harvest of grain crops, and the second just before the rainy season or near the end of the dry season (December 21, 1978 and June 26, 1979). Tables 2.23 and 2.24 present the results of the flights.

No importance is attached to specific ownership, origin, age, class or sex of livestock. No separation was made concerning whether small ruminants were sheep or goats. No wildlife were encountered in either of the inventories.

The survey of livestock conducted in December 1978 showed about 2,800 cattle in the site, and more than 1,200 small ruminants. However, because of the very poor rains and minimal crop residue in the area that crop year (1978), considerable numbers of locally owned livestock were outside the area at the time. Local residents estimated that as many as 40% of the cattle were outside at the time of the count. If this is a reasonable figure, the number of cattle normally in the area could be as high as 4,700. Also

TABLE 2.23

LIVESTOCK INVENTORY, OVERFLIGHT OF DECEMBER 21, 1978

Aerial Photo Ref. Number	Cattle Herds	Cattle Head	Head/Herd Average	Sheep/Goats Flock	Sheep/Goats Head	Head/Flock Average
1974 HVO 10/500 SAG 464						
Photo 1240	15	317	21.13	5	121	24.2
Photo 1239	15	692	46.13	8	192	24.0
Photo 1238	4	85	21.25	6	76	12.67
sub Total	34	1,094	29.50	19	389	20.29
Photo 1150	6	274	45.67	2	40	20.00
Photo 1151	18	479	26.33	12	247	20.58
Photo 1152	6	282	47.00	6	109	18.17
Photo 1153	8	267	33.38	2	14	7.00
Photo 1154	7	174	24.86	5	150	30.00
Photo 1155	7	79	11.29	7	136	19.43
Photo 1156	4	109	27.25	3	32	10.67
sub Total	56	1,664	30.82	37	728	17.98
1955-56 ND-30-XII						
Photo 327	2	35	17.50	6	128	21.33
Total	92	2,793	30.36	62	1,245	20.08

Note: Estimated: 20 donkeys

Estimated: 15 horses

TABLE 2.24

LIVESTOCK INVENTORY, OVERFLIGHT OF JUNE 26, 1979

Aerial Photo Ref. Number	Cattle Herds	Cattle Head	Head/Herd Average	Sheep/Goats Flock	Sheep/Goats Head	Head/Flock Average
1974 HVO 10/500 SAG 464						
Photo 1240	4	148	37.00	9	154	17.11
Photo 1239	5	110	22.00	12	250	20.83
Photo 1238	1	21	21.00	1	20	20.00
sub Total	10	279	27.90	22	424	19.27
Photo 1150	1	21	21.00	2	50	25.00
Photo 1151	5	109	21.80	6	80	13.33
Photo 1152	3	73	24.33	9	166	18.44
Photo 1153	12	344	28.67	3	52	17.33
Photo 1154	5	143	28.60	4	77	19.25
Photo 1155	2	93	46.50	1	2	2.00
Photo 1158	7	125	17.86	3	45	15.00
sub Total	35	908	25.94	28	472	16.86
Photo 1078	6	110	18.33	1	30	30.00
Photo 1079	1	28	28.00	-	-	-
sub Total	7	138	19.71	1	30	30.00
1955-56 ND-30-XII						
Photo 327	2	81	40.50	1	19	19.00
Photo 301	1	1	1.00	-	-	-
sub Total	3	82	27.33	1	19	19.00
Total	35	1,391	25.29	52	945	18.17

Note: Estimate: 20 donkeys

Estimate: 15 horses

animals from outside the site which might normally spend part of the time there did not come that year because of the poor rains. It is possible that during some seasons there are as many as 10 cattle per km^2.

Actual Stocking Rate for 1978-1979. Only cattle, sheep, and goats were used to determine the actual stocking rate. An estimated 20 donkeys and 15 horses make up the remainder of domestic grazers in the site.

Stockmen do adjust their animal herds and flocks to available feed conditions, but they appear to be more flexible with cattle than with small ruminants.

The fluctuations in both the number of herds and individual herd size were reflected in the livestock inventory samples. Cattle numbers were reduced by 59%, the number of herds went from 92 in December to 55 in June, and average individual herd size was reduced by 24%, the number of flocks from 62 to 52, and the average number of individual animals per flock was reduced by 10% (see Tables 2.23 and 2.24).

The overall stocking rate was reduced from 2992 Animal Units (A.U.) in December 1978 to 1542 A.U. in June 1979, or a stocking reduction of 48%.

2.2.2.3 Comparison of Carrying Capacity and Stocking Rate

The annual average carrying capacity of the natural forage of the Tafogo site is about 2,500 A.U. for about 40,000 ha of grazing land. Crop residues provide for another 130 A.U. on an annual basis. The average range carrying capacity of 1 A.U. per 16 hectares is not representative of some specific sample areas or vegetation zones, nor is it applicable over a 12-month period. Monthly forage-based carrying capacity is shown in Table 2.25 along with the additional carrying capacity of crop residues. Carrying capacities also are compared with monthly stocking rates in the table. The comparison is made graphically in Figure 2.12.

Animal feed is in excess from August through March and lacking (deficit) from April through July. During the surplus period natural feed balance is good with adequate grasses, shrubs,

TABLE 2.25

MONTHLY CARRYING CAPACITY AND STOCKING RATE,

FEED SURPLUS AND DEFICIT, TAFOGO SITE

	Carrying Capacity				
Date	Forage A.U.	Crop Residue A.U.	Total Feed A.U.	Stocking Rate A.U.	Surplus/ (Deficit) A.U.
Dec. 1978	4,671	370	5,041	2,800	2,241
Jan. 1979	4,403	-	4,403	2,992	1,411
Feb. 1979	3,330	65	3,395	2,818	577
Mar. 1979	2,783	120	2,903	2,458	445
Apr. 1979	2,289	185	2,474	2,500	(26)
May 1979	700	120	820	2,055	(1,235)
June 1979	254	40	294	1,750	(1,456)
July 1979	1,109	-	1,109	1,750	(641)
Aug. 1979	2,734	-	2,734	1,958	776
Sept. 1979	2,989	-	2,989	2,167	822
Oct. 1979	2,564	300	2,864	2,445	499
Nov. 1979	2,835	350	3,185	2,612	573
Dec. 1979	4,444	370	4,814	2,800	2,014
Jan. 1980	3,854	-	3,854	2,900	954

A.U. = Animal Units

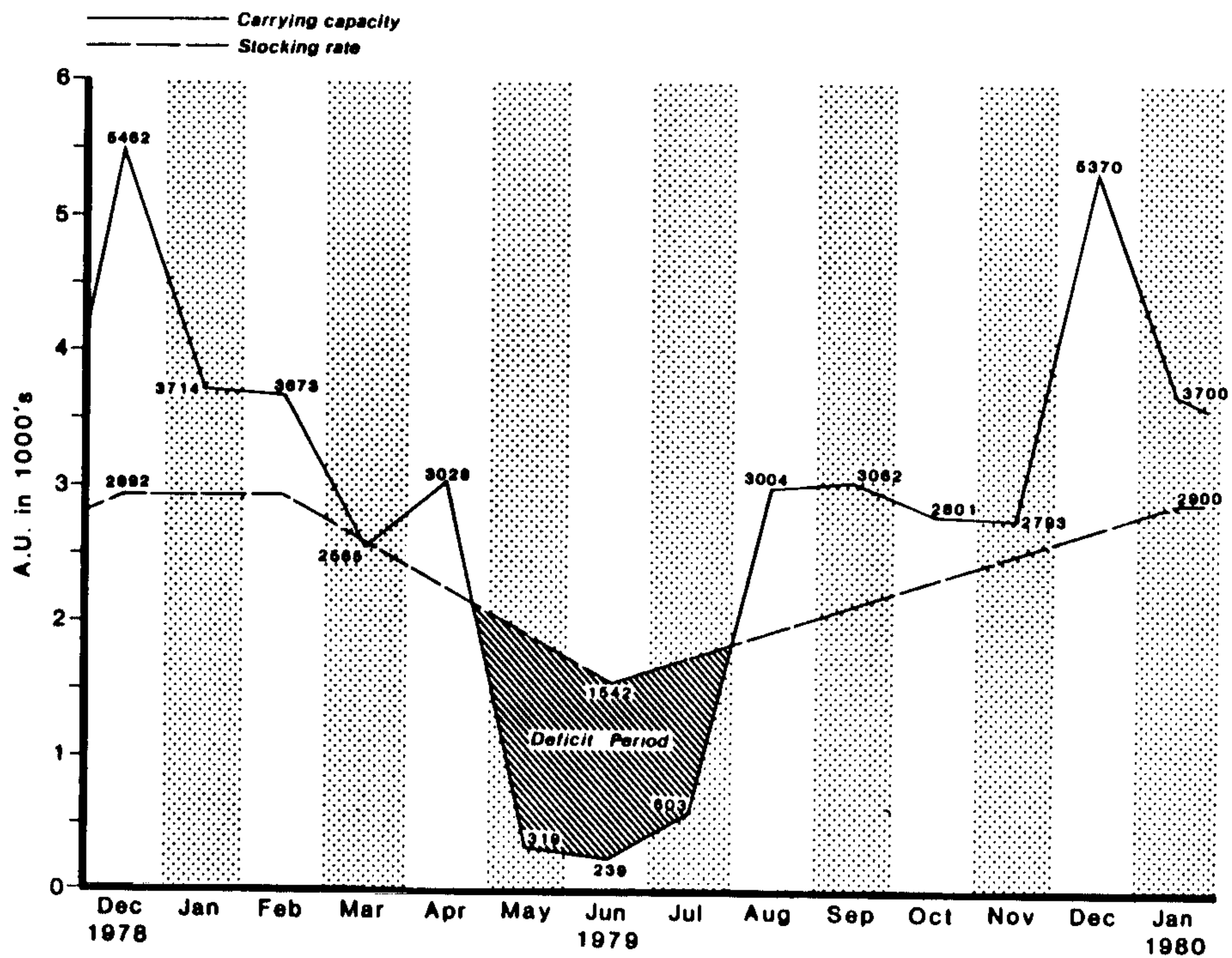

Figure 2.12 COMPARISON OF CARRYING CAPACITY AND STOCKING RATE, TAFOGO SITE

trees, and forbs available. The forbs, insignificant in volume and mostly of the Papilionaceae family dry very quickly, deteriorate and disappear, and by the end of December they are gone. Likewise, certain trees and shrub species lose their foliage beginning in October/November and do not regain substantial amounts until the following August, making them a very short-lived forage source. Pterocarpus lucens, Commiphora africana, and Dalbergia melanoxylon seed pods are retained a bit longer and are important forage.

The harvesting of cultivated areas starts in November and is terminated by mid-December and much short term forage is made available when these fields are opened up to livestock starting in early December. Important grass species include Andropogon gayanus, Pennisetum pedicellatum, Cymbopogon gigantus, Dactiloctenium aegyptium, Eleusine indica, Brachiaris spp., Paspalum spp. Cultivated Zones account for 41% of the carrying capacity; gravelly and rocky zones account for an additional 16%, and the Gramineae associations account for the remaining 43% of the forage production.

The deficit period is in the driest and hottest time of the year. Animal stocking rates are reduced by livestock producers during this period (Figure 2.12). Preferred forage sources have already been picked over, and secondary preferences are utilized, followed by almost anything green except Bauhinia reticulata and Calotropis procera, although camels have been observed to nip off Bauhinia reticulata pods and leaves. Secondary preferences might include Boscia senegalensis, Guiera senegalensis, Schoenefeldia gracilis, Cymbopogon gigantus, and Cymbopogon proximus, Diheteropogon hageruppi, Andropogon fasitgiatus, and even Loudetia togoensis can be used as a last resort.

Loudetia togoensis is the predominant grass in the site and is only viable early in its annual growth cycle. Once the awns start forming the plant is undesirable. A prickly needle sharp callus makes it even more so later on. Animals will not touch it even when the long awns and sharp callus fall away. This plant is becoming more prevalent in the site.

Livestock trailing to and from water points and in search of desirable forage species take their toll of vegetative cover, trampling and leaving soil surfaces exposed before the rainy season.

2.2.3 Range Resource Inventory--Gnanguedin Site Including Gnanguedin and Bittou East Areas

The Gnanguedin site is situated in the Koupela ORD (East Central ORD), the Tenkodogo Prefectorate, Tenkodogo Sub-Prefectorate, and the Cercle of Bittou. The site population consists of 73% Mossi, 23% Bissa, 3% Fulani, and 1% others. The range resource inventory took place between October 1979 and January 1980, the Water Resource Inventory in late December of 1979 and January 1980. Unlike the Tafogo site analysis, a livestock inventory was not carried out. Definition of human impact zones and physical features were made from aerial photographs taken in 1978.

2.2.3.1 Physical Boundaries

Gnanguedin site is located 240 kilometers east and south of Ougadougou; one travels 140 kilometers to Koupela, turning there to go roughly 100 kilometers south, passing through Tenkodogo. The town of Gnanguedin is 10 kilometers north of Bittou (see Figure 2.1). Within the Gnanguedin site, two areas are described: (1) the Gnanguedin area that is divided into three parcels (A, B, and C) and (2) the Bittou east area which is comprised of two parcels (D and E). Both are east of National Highway Number 12 (see Figure 2.6). The site is situated at latitude 11 degrees 20 minutes north and zero degrees 21 minutes west longitude. The watershed drains easterly into the Nouhao River by an extensive series of drainageways and feeders.

Gnanguedin Area. To trace the boundary of the Gnanguedin area (Figure 2.6), start at a point 2.5 kilometers north of the Gnanguedin Village along National Highway Number 12, where the Kiniguelro drainage is fed by a culvert running under the asphalt highway, continue south along the asphalt Highway 12 past Gnanguedin, past the microwave tower and down the highway to where

Old Bané Highway (1955) joins asphalted Number 12 two kilometers north of Bittou City. Turn north on Old Bané Highway and follow it north three kilometers until coming to the second drainage where the old roadway has been washed out and one must cross a sandy river bed. On the far bank is a small park of Cailcedrat (Khaya senegalensis) trees.

Follow the riverbed southeasterly approximately four kilometers where, to the north, a secondary drainage almost heads back in the same direction as you just came, and then head north across a saddle and almost immediately descend into an easterly secondary drainage. Continue easterly until coming to a large north-south riverbed--Nouhao River. Follow the Nouhao north nine kilometers to a major fork; take the west fork drainage and continue meandering seven kilometers westerly until arriving at another fork. Take the more westerly or left hand fork and continue along this drainage eleven kilometers or until coming to the culvert at National Highway 12, the starting point. Total surface area is 17,992 hectares.

Bittou East Area. Start at the point where the Old Bané-Bittou Highway meets the new asphalted National Highway 12 about 2 kilometers north of Bittou and follow the most southerly limits of Gnanguedin area to the Nouhao River. Then follow the Nouhao River south to the National Highway Number 12 bridge and follow the highway north through Bittou to the junction of the Old Bané-Bittou Highway. The land area is 7,104 hectares.

2.2.3.1.1 Traditional Boundaries

It is worth noting that the small fenced plot in the southern part of the site just to the east of the Old Bané to Bittou Highway is controlled by the chief at Bittou. The larger 55 hectare fenced plot, near the northern limit of the site to the west of Old Bané-Bittou Highway, is on the southern limit of the Gnanguedin chief's control.

In fact, the large granite rock just off the southeast corner of the fence is along the east-west limit between the chiefs of Bittou and Gnanguedin.

Both chiefs referred to are traditional and are responsible to the chief of the canton at Bapé, also a traditional ruler. Bittou east is under the jurisdiction of the chief at Bittou.

The range management activities were closely coordinated with the chief of the arrondissement at Bittou.

2.2.3.2 Surface Area of Site and Adjacent Mapped Areas

Total mapped area	25,096 ha
Data collection area (Gnanguedin Area)	17,992 ha
Bittou east area	7,104 ha

2.2.3.3 Geographical Vegetation Zone

The site is in the southern limits of the Sudan-Savannah Zone.

2.2.3.4 Climate

Rainfall (data collected for Tenkodogo*)

1979 rainfall data	not available
10-year average (1969 to 1978)	865 mm
Normal rainfall season	March-Oct.
Assured rainfall season	May-Sept. (91% of total)**
Early rains (mango rains)	Mar. (9.5 mm)**
	Apr. (24.3 mm)**
Late rains	Oct. (36.8 mm)**

(See Table 2.26 for monthly rainfall data.)

Temperatures (data collected for Tenkodo*). The average monthly temperature is 35°C (high) and 22.5°C (low) over a ten year period from 1970 to 1979. The lowest temperatures are recorded in December, 18.8°C average; and the highest temperatures are recorded in April, 39.4°C average. (See Table 2.27 for monthly temperature data.)

*60 km north of site.

**10 yr average (1969 to 1978).

TABLE 2.26

MONTHLY RAINFALL--TENKODOGO (1969-1978)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals in mm
	Month												
1969	0	0	22.5	14.0	42.4	107.2	166.5	348.9	216.7	26.9	14.5	0	959.6
1970	0	0	0	21.2	55.1	66.7	100.9	458.8	219.2	Tr	0	0	921.9
1971	0	0.5	27.7	14.0	107.3	116.6	261.2	310.2	166.5	9.8	0	7.2	1021.0
1972	0	0	0.4	126.4	42.7	86.4	220.3	181.9	163.3	90.4	0	0	911.8
1973	0	0	Tr	14.3	37.5	174.7	169.2	277.0	109.8	21.7	0.3	0	804.5
1974	Tr	0	7.4	18.3	40.3	39.7	131.9	196.8	184.2	65.9	0	0	684.5
1975	0	0	14.7	Tr	83.9	59.1	215.3	237.0	190.4	12.8	0	0	813.2
1976	0	0	0	12.0	154.5	77.7	133.8	93.3	211.9	114.7	0	0	797.9
1977	0	0	2.0	0	23.6	100.6	126.8	372.3	121.5	3.7	0	0	750.5
1978	0	0	19.8	22.8	173.8	78.8	109.4	191.7	140.3	49.2	Tr	0	785.8
Totals	0	0.5	94.5	243.0	761.1	907.5	1635.3	2667.9	1723.8	395.1	14.8	7.2	8450.1 = 845.01 mm ten-year av.

Tr = non-measurable rain traces, i.e., less than 0.1 mm.

TABLE 2.27

MONTHLY TEMPERATURES--TENKODOGO (1970-1979)

(Given in Degrees Centigrade)

		Month											
Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	High	36.3	37.3	40.0	39.6	37.5	37.0	32.0	29.4	30.8	35.6	35.7	33.4
	Low	21.1	22.2	24.7	25.6	25.1	24.3	22.0	21.5	21.4	23.0	21.6	19.7
1971	High	33.5	37.4	38.7	39.4	36.7	35.0	31.3	29.5	31.1	35.3	36.1	33.4
	Low	19.5	23.4	24.7	25.6	24.3	23.2	21.7	21.2	21.4	22.3	21.1	19.7
1972	High	34.7	37.2	39.2	36.7	36.8	34.4	32.3	30.8	32.2	34.3	35.3	35.3
	Low	19.9	22.4	25.1	24.9	24.7	23.2	22.0	21.8	22.1	21.9	21.2	20.5
1973	High	34.5	38.1	39.4	40.3	38.8	34.9	33.0	30.8	32.3	36.3	35.8	34.7
	Low	20.3	23.2	25.1	26.7	25.9	23.4	23.1	21.5	22.1	22.9	21.7	20.1
1974	High	32.3	36.0	39.6	40.1	38.1	36.3	31.6	31.0	30.7	34.6	35.2	32.9
	Low	19.2	21.4	25.0	25.9	24.9	24.5	22.1	21.7	21.3	22.4	21.2	19.0
1975	High	31.7	36.7	38.8	39.9	36.4	35.9	30.4	30.6	30.8	35.1	36.3	34.6
	Low	18.1	21.3	24.3	25.8	24.0	23.8	21.2	21.2	21.2	22.3	21.3	20.2
1976	High	33.9	36.4	38.5	39.4	35.4	32.0	32.0	30.5	32.5	32.4	35.2	35.3
	Low	18.9	22.6	23.7	25.5	24.7	22.1	22.2	21.6	22.2	21.8	21.5	19.7
1977	High	35.4	36.5	37.9	40.5	37.5	34.2	32.6	30.7	32.1	35.1	36.5	34.6
	Low	21.1	21.7	24.2	26.8	25.2	23.4	22.7	22.3	22.2	22.6	20.7	18.9
1978	High	35.1	38.4	38.8	37.6	35.4	33.7	30.9	32.1	32.5	35.1	35.9	35.7
	Low	19.5	23.1	24.3	25.5	24.1	23.0	21.7	22.1	22.0	22.7	21.5	21.0

TABLE 2.27--Continued

Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1979	High	36.2	37.0	39.1	40.3	36.3	32.9	31.7	30.6	31.8	34.8	36.7	33.5
	Low	21.0	21.4	25.5	26.4	24.6	22.9	22.3	22.3	22.1	25.1	22.3	19.5
Average		34.4	37.1	39.0	39.4	36.9	34.6	31.8	30.6	31.7	34.9	35.9	34.3
		19.9	22.3	24.7	25.9	24.8	23.4	22.1	21.7	21.8	22.7	21.4	19.8

Average high: 35°C
Average low: 22.5°C

2.2.3.5 Priority Uses

Gnanguedin area has been divided into three parcels. The far western parcel (A), that of Gnanguedin, is heavily cleared and cultivated and is under pressure from cultivation/human expansionism. The middle parcel (B), from Old Bané-Bittou Highway and west, is pastureland being exploited for firewood. The third parcel (C), from Bané-Bittou Highway and east, is pastureland and has been remote from humans except for an occasional adventuresome Fulani herdsman. In recent times, a few Fulani herdsmen have brought their cattle herds into the area between December and May. It has not been until the last ten years that local stockmen have allowed their herds to pasture beyond the cultivated perimeters of Gnanguedin and Bittou, and then only accompanied by Fulani herdsmen. Grazing pressure will increase even more over the next few years.

Bittou east area is divided by natural barriers into two parcels: (1) Bittou (D) and (2) Bittou east (E). Bittou parcel (D) is influenced by the large human population of Bittou, which occupies 317 hectares or eleven percent of the parcel. Twenty-five percent of the 2,910 hectares is cultivated, and an additional 14% is in fallow. The parcel has been severely exploited for firewood and cultivation. That same influence is starting to exploit firewood and construction timbers in the southern interior of Gnanguedin area and into Bittou east parcel. Bittou east is mostly rangeland, but is in the process of rapidly being exploited by an ever-expanding human population based in Bittou. Currently only 29 hectares are being cultivated, not even one percent of the 4,194 hectares. No fallow was measured.

Wildlife is present in the interior of the site, more toward the Nouhao River, away from the main asphalt road and the human concessions. Large baboon-like monkeys are commonly observed and roam between water holes in families of 30-40 head. Huge antelope are seen from time to time foraging on the fringes of the "burned out" grass benches. Wild pigs, small antelope, small grey monkeys and larger red monkeys are frequently seen, but not in large numbers. A fresh elephant dropping was recorded along a transect line going through a water hold bed-ground. There are not elephants in residence in either sampled area.

It is interesting to note the presence of cattle and wildlife existing side by side, but not without consequences for domestic stock. The ever-present biting flies transmitting trypanosomiasis and other diseases are reflected in the continually poor condition of the Zebu cattle in the area. The Taurin type cattle seem to be heavier and in better condition.

The Bittou east parcel (E), the Old Bané-Bittou Highway east parcel (C), and to a lesser degree the Old Bané-Bittou Highway west parcel (B), are natural wildlife habitats changed only by what man has done to them--by burning, cultivating, and excessively harvesting wooded lands.

The existence of wildlife should not be taken negatively; it is not detrimental, and is only reported to have complete records.

2.2.3.6 Description of Vegetation Types

2.2.3.6.1 Introduction

The first consideration in analyzing existing rangeland conditions is to know the production of vegetative communities in kilograms of dry weight. Individual plant species are identified and their presence in the community is estimated by percentage. Every plant, whether it is a grass, shrub, tree, forb or sedge, as long as it is within the one and a half meter height sampling zone is included in the measurement. It is also noted whether the plant is a perennial or annual, its acceptability to domestic grazing animals, and its seasonal accessibility. All these factors are used to determine the kilograms of useable or grazable biomass in a plant community.

A land surface is visually assessed simultaneously on the ground and on a recent aerial photo to identify areas of relatively homogeneous or similar vegetation. If the land area is deemed homogeneous, then a series of samples (each 1 meter^2) are randomly taken through the area at standard distances and recorded as a write-up. (See "Rangeland Inventory Analysis Guidelines" for Write-up Form, Appendix 5.3.)

The aggregation of data from the write-ups allows calculation of the carrying capacity of rangelands. The grouping of similar write-ups constitutes a description of a vegetation type. Vegetation types are visually distinct from one another. Six vegetation types are identified:

1. Cultivated Perimeter and Fallow
2. Cultivated
3. Gramineae
4. Gramineae-Tree
5. Tree
6. Riverbank

2.2.3.6.2 <u>Cultivated Perimeter and Fallow Vegetation Type (CP&F)</u>

This vegetation type is intermingled with the Cultivated type and is at times cultivated or often times is unsuited for cultivation because of its physical condition: excessively rocky, shallow soil, or eroded. The presence of humans has greatly influenced this ecosystem, and in fact has created it.

The two parcels (B and C) bordering on the Bané to Bittou Highway to the east and west in the Gnanguedin area are comprised of only 6% CP&F, but the Gnanguedin east of Highway 12 parcel (A) is 24% CP&F. Bittou east parcel (E) is also 6% CP&F, with Bittou parcel (D) composed of 14%.

Ground surfaces are 38% bare soil, 1% rocks, and 61% green and dry litter. Soils are sandy-clay-loams with frequent granite rocks and boulders exposed. In November, the soil humidity was observed starting at 15 centimeters depth. Also, there was an observed soil texture change at the same depth.

Soil erosion is minor to advanced but generally considered moderate with large bare soil openings frequently connected together. Plants are pedestalled and erosion pavement was evident in the more gravelly soil sites.

The total dry biomass is 1,235 kilograms per hectare for the Gnanguedin area and 2,385 kilograms per hectare for Bittou east area. The usable forage dry biomass is 425 kilograms per hectare and 960 kilograms per hectare for the respective areas.

The major plant species found in this type are listed below with the percentages of vegetal composition for each vegetation class, based on 100% total.

Gnanguedin Area:

Gramineae (73%): *Aristida kerstingii*, *Andropogon pseudapricus*, *Androp. fastigiatus*, *Panicum* spp., *Pennisetum pedicellatum*, *Andropogon gayanus* var. *bisquamulatus*, *Androp. ascinodis*, *Hyparrhenia glabriuscula*.

Shrubs (12%): *Bauhinia reticulata*, *Ximenia americana*, *Gardenia* sp.

Trees (11%): *Combretum* sp., *Terminalia* sp., *Mangifera indica*, *Acacia* spp., *Balanites aegyptiaca*, *Ficus* sp., *Bombax costatum*.

Forbs & Sedges (4%): *Cochlospermum tinctorium*, and others.

Bittou East Area:

Gramineae (75%): *Andropogon pseudapricus*, *Androp. fastigiatus*, *Androp. ascinodis*, *Androp. gayanus* var. *bisquamulatus*, *Pennisetum pedicellatum*, *Aristida kerstingii*, *Schoenefeldia gracilis*, *Loudetiopsis scaettae*.

Shrubs (5%): *Bauhinia reticulata*.

Trees (10%): *Combretum* sp., *Terminalia laxiflora*, *Acacia nilotica*, *Ac. gourmaensis*, *Ac.* sp., *Bombax costatum*, *Parkia biglobosa*, *Lannea acida*.

Forbs & Sedges (10%).

The actual grazing season is all year round by cattle, sheep, goats, and wildlife.

2.2.3.6.3 Cultivated Vegetation Type

Human populations are unevenly scattered throughout this type and greatly influence the ecosystem. Six percent of the land mass of Gnanguedin area is in the Cultivated type: Gnanguedin east of Highway 12 parcel (A) is 22% cultivated. Bittou east parcel (E) is comprised of 11% Cultivated type with Bittou parcel (D) 25% cultivated.

Ground surfaces are 50 to 75% bare soil, 5 to 10% rocks, and 33 to 45% green and dry litter. This represents the post-harvest condition when no crop residues were evident. Soils are sandy-clay-loams over clay, with clay being exposed from time to time. There is no appreciable soil texture change down to 12 centimeters.

In the Gnanguedin area, 83% of the surface area indicates a minor soil erosion factor. Isolated bare soil openings characterize this stage of erosion. Erosion is confined to the individual bare openings. Seventeen percent of the land is in an advanced erosion stage with soil movement advanced and bare ground dominating.

The erosion factor for Bittou east area is moderate with expanding bare soil openings frequently joined together; pedestalling of plants and erosion pavement are evident in gravelly soils.

The total dry biomass produced is 1,455 kilograms per hectare for Gnanguedin area and 964 kilograms per hectare for Bittou east area. The usable amount of dry biomass is 526 kilograms per hectare for Gnanguedin area and 276 kilograms per hectare for Bittou east area.

The major plant species found in this vegetation type are listed below with the percentages of vegetal composition for each vegetation class, based on 100% total.

Gnanguedin Area:

Gramineae (80%): Aristida kerstingii, Andropogon pseudapricus, Androp. fastigiatus, Androp. ascinodis, Androp. gayanus var. bisquamulatus, Pennisetum pedicellatum, Hyparrhenia glabriuscula, Schoenefeldia gracilis, Loudetiopsis kerstingii, Loudet. scaettae, and Schizachyrium sanguineum.

Shrubs (11%): Bauhinia reticulata, Grewia sp., Gardenia sp., Ziziphus mauritiana.

Trees (5%): Acacia gourmaensis, Ac. nilotica, Balanites aegyptiaca, Bombax costatum, Sclerocarya birrea, Lannea acida, Pterocarpus erinaceus, Combretum sp., Terminalia laxiflora, Ficus sp.

Forbes & Sedges (4%): Cochlospermum tinctorium, and others.

Bittou East Area:

Gramineae (75%): Andropogon pseudapricus, Androp. fastigiatus, Loudetiopsis scaettae, Hyparrhenia glabriusculs, Pennisetum pedicellatum, Artistia kerstingii, Eragrostis tremula.

Trees (10%): Terminalia laxiflora, Butyrospermum paradoxum, Lannea acida, Acacia gourmaensis, Combretum spp., Parkia biglobosa.

Forbes & Sedges (10%): Cochlospermum tinctorium, and others.

The actual grazing season follows the rainy season and harvesting of crops in November through February, after which, trailing continues through these cultivated areas until crops are replanted in May.

2.2.3.6.4 Gramineae Vegetation Type

The Gramineae type contains greater than 50% grass cover based on a 100% vegetal composition. Thirty-five percent of the available forage biomass is produced on 30% of the Gnanguedin area surfaces. Sixty-seven percent of the total available forage biomass is produced in 52% of the Bittou east area surface.

Ground surfaces vary somewhat between the five sampled parcels, but generally all areas east of Highway 12 (except A) were 62% bare soil, 7% rock, and 32% green and dry litter. The Gnanguedin parcel east of High 12 (A) had 44% bare soil, 11% rocks, and 45% green and dry litter.

Soils are slightly variable in texture with sandy-loamy-clays predominating with gravelly variants. Most soils possess a 1 to 3 centimeter dark organic layer on the surface. Soil depths are extremely variable with normal sub-surface laterites being as deep as 1 to 2 meters or exposed on the surface.

The soil erosion factor is presently moderate with some indications of movement toward the advanced stage. The bare soil openings were large and joined together with active soil movement between bare openings. Soil loss is moderate, gullying moderate, and pedestalling of plants moderate and progressing.

Only slight variations occur between parcels concerning total dry biomass, and forage dry biomass production:

	Total Dry Biomass in kg/ha	Usable Dry Biomass in kg/ha
Gnanguedin area		
Gnanguedin east (A)	2,423	815
Old Highway west (B)	2,501	845
Old Highway east (C)	2,480	944
Bittou east area		
Bittou (D)	3,030	1,128
Bittou east (E)	3,023	1,602

The major plant species found in this vegetative type are listed below with the percentages of vegetal composition for each vegetation class, based on 100% total

Gnanguedin Area:

Gramineae (73-77%): Loudetiopsis scaettae, Hyparrhenia glabriuscula, Hyparr. subplumosa, Hyparr. involucrata, Andropogon ascinodis, Schizachyrium sanguineum, Cymbopogon giganteus, Androp. gayanus var., Androp. pseudapricus, Aristida hordeacea, Arist. kerstingii, Monocymbium ceresiiforme, Diheteropogon amplectens, Schizachyrium sp., Schoenefeldia gracilis, Andropogon sp.

Shrubs (7-9%): Bauhinia reticulata, Gardenia sp., Ximenia americana, Ziziphus mauritiana.

Trees (10-13%): Balanites aegyptiaca, Acacia gourmaensis, Ac. dudgeoni, Ac. spp. (2), Pseudocedrela kotschy, Terminalia laxiflora, Lannea acida, Combretum spp. (2).

Forbes & Sedges (4-6%): Cochlospermum tinctorium, and others.

Bittou East Area:

Gramineae (71-72%): Loudetiopsis scaettae, Hyparrhenia involucrata, Andropogon fastigiatus, Androp. pseudapricus, Androp. gayanus var. bisquamulatus, Androp. ascinodis, Monocymbium ceresiiforme, Schizachyrium sanguineum, Artistida kerstingii, Hyparrhenia glabriuscula.

Shrubs (7%): Gardenia sp., Bauhinia reticulata, Grewia sp., Ximenia americana, Ziziphus mauritiana.

Trees (16%): Acacia gourmaensis, Ac. dudgeoni, Terminalia laxiflora, Combretum spp. (2), Balanites aegyptiaca, Butyrospermum paradoxum, Vitex sp., Tamarindus indica, Anogeissus leiocarpus, Acacia nilotica, Lannea sp., Sterculis tomentosa, Acacia seyal, Pterocarpus erinaceus, Bombax costatum.

Forbes & Sedges (5-6%): Cochlospermum tinctorium, and other Leguminoseae and Liliaceae.

The actual grazing season follows the grain harvest in November and continues through May.

2.2.3.6.5 Gramineae-Tree Vegetation Type

Slightly more than half of the total available forage biomass is produced in this vegetation type which constitutes about one-half the land mass of the Gnanguedin area. No appreciable amount of this type is found in the heavily human-influenced Bittou parcel (D) and only 14% of the land mass in Bittou east parcel (E) can be identified in a gramineae-tree association, and 12% of the available forage biomass is produced there.

Woodlot products are harvested from this vegetation type. It is here that pressure is being applied from expanding agriculture, fire, and wood product consumption. Accelerated degradation is occurring.

Ground surfaces away from the heavily human influenced zones of the Gnanguedin area are similarly covered. Bare soils account for 54-58%, rocks account for 6-8%, and green and dry litter cover 36-38% of the land area. However, when approaching the heavily human influenced zones such as Bittou parcel (D) and Gnanguedin east of Highway 12 parcel (A) condition of ground surfaces change.

Covering on Ground Surface	Bittou Parcel (D)	Gnanguedin East of Highway 12 Parcel (A)
Bare soil	57%	49%
Rocks	21%	2%
Green litter	10%	26%
Dry litter	12%	23%

Soils are variable from compact sandy-loam-clays to sandy-loams, with an occasional clay or gravelly variant. There was generally no texture change to a depth of 15 centimeters. The soils show moderate erosion characteristics and are in a progressive state, especially so in the Bittou parcel (D).

Extreme differences exist among the write-up samples taken within each of the sampled parcels and between parcels as well, concerning the amounts of total biomass and usable biomass production.

	Total dry biomass kg/ha	Forage dry biomass kg/ha
Gnanguedin Site		
Gnanguedin east (A)	2,633	1,372
Old Highway west (B)	1,733	803
Old Highway east (C)	2,147	728
Bittou East		
Bittou (D)	884	149
Bittou east (E)	4,019	879

The major plant species found in this vegetative type are listed below with the percentages of vegetal composition for each vegetation class; based on 100% total.

Gnanguedin Area:

Gramineae (45-48%): *Loudetiopsis scaettae*, *Andropogon ascinodis*, *Androp. gayanus* var. *bisquamulatus*, *Androp. pseudapricus*, Hyparrhenia glabriuscula, Schizachyrium sanguineum, Monocymbium ceresiiforme, Cymbopogon giganteus, Diheteropogon amplectens, Heteropogon contortus, Aristida kerstingii.

Shrubs (14-15%): Bauhinia reticulata, Gardenia sp., Ximenia americana, Grewia sp., Ziziphus mauritiana.

Trees (33-35%): Pseudocedrela kotschy, Terminalia laxiflora, Combretum spp. (2), Acacia nilotica, Ac. gourmaensis, Ac. spp., Lannea acida, Balanites aegyptiaca, Entada africana, Borassus flabellifer, Vitex sp., Bombax costatum, Sclerocarya birrea, Parkia biglobosa, Pterocarpus erinaceus.

Forbs & Sedges (4-5%): Cochlospermum tinctorium, and others.

Bittou East Area:

Gramineae (43-45%): Andropogon gayanus var. bisquamulatus, Androp. pseudapricus, Androp. ascinodis, Loudetiopsis scaettae, Schizachyrium sanguineum, Schiz. sp., Hyparrhenia involucrata, Hypar. subplumosa, Heteropogon contortus, Aristida kerstingii.

Shrubs (15-22%): Gardenia sp., Bauhinia reticulata, Grewia sp., Ximenia americana, Ziziphus mauritiana.

Trees (30-35%): Acacia gourmaensis, Acacia nilotica, Terminalia laxiflora, Combretum spp. (2), Balanites aegyptiaca, Pseudocedrela kotschy, Lannea acida, Pterocarpus erinaceus.

Forbs & Sedges (5%): Cochlospermum tinctorium, and others.

The actual grazing season is all year round with the animals concentrating in December through May period. This is a major wildlife habitat.

2.2.3.6.6 Tree Vegetation Type

One area in Bittoù east parcel (E) was defined as being a Tree vegetation type by virtue of its having dominate tree composition.

The surface area is 682 hectares or 16% of the land area for the parcel. It produces 136,800 kilograms of usable forage or 60 animal units on a year long basis. Note that the 60 A.U.'s only represent 4% of the forage produced in this parcel so it really isn't a high producing forage type.

Ground surfaces are 64% bare soil, 2% rocks, and 34% green and dry litter. Soils are sandy-clay-loams to gravelly sandy-loams. Texture is very fine and light like dust. No soil moisture was observed in the top 15 centimeters during the month of November. Soil surfaces show moderate erosion.

Total dry biomass produced is 692 kilograms per hectare and usable forage dry biomass is 200 kilograms per hectare, predominated by annual grasses.

The major plant species found in this vegetative type are listed below with the percentages of vegetal composition for each vegetation class, based on 100% total.

Bittou East Parcel (E):

Gramineae (20%): *Andropogon pseudapricus*, *Androp. fastigiatus*, *Loudetiopsis kerstingii*, *Schizachyrium sanguineum*, *Aristida kerstingii*, *Pennisetum pedicellatum*, *Androp. gayanus* var. *bisquamulatus*.

Shrubs (30%): *Gardenia* sp., *Bauhinia reticulata*, *Ximenia americana*.

Trees (40%): *Terminalia laxiflora*, *Acacia nilotica*, *Combretum* spp. (2), *Acacia gourmaensis*, *Strychnos spinosa*, *Lannea acida*, *Balanites aegyptiaca*, *Pterocarpus erinaceus*, *Pseudocedrela kotschy*.

Forbs & Sedges (10%): *Cochlospermum tinctorium*, and others.

Actual grazing season is from November to May. This type is an important habitat for wildlife.

2.2.3.6.7 Riverbank Vegetation Type

This type is found primarily along the Nouhao River and its major tributaries in the Old Highway east (C), Bittou (D), and Bittou east (E) parcels; only 5% of the total land area of the Gnanguedin area and 12% of the Bittou east area is classified as riverbank. It accounts for 18% of the usable forage production in the Old Highway east parcel (C), 15% in the Bittou east parcel (E), and 11% in the Bittou parcel (D)

Ground surfaces are comprised of 50% bare soil, a trace of rocks, and 50% green and dry litter in the Old Highway east parcel (C); 50% bare soil, no measureable rock area, and 41% green and dry litter for Bittou east (E). Soils are sandy, sandy-loam-clays, over clay and occasionally over gravel. No texture changes were observed in the top 15 centimeters of soil.

Soil erosion is minor but advancing. There are isolated bare soil openings with erosion confined more or less to the individual bare openings. There are some indications of bare soil openings enlarging, soil hummocking, and plant pedestalling.

The total dry biomass is 2,556 kilograms per hectare and 1,006 kilograms per hectare of usable forage produced in the Gnanguedin area. Figures for the Bittou east area are just slightly less at 2,532 kilograms per hectare dry biomass and 952 kilograms per hectare, usable forage.

The major plant species found in this vegetative type are listed below with the percentages of vegetal composition for each vegetation class, based on 100% total.

Gnanguedin Area:

Gramineae (30-39%): Heteropogon contortus, Vetiveria nigritana, Schizachyrium sanguineum, Andropogon pseudapricus, Andropogon gayanus var. bisquamulatus, Cymbopogon giganteus, Hyparrhenis subplumosa, Hyparr. glabriuscula, Schoenefeldia gracilis, Pennisetum pedicellatum, Aristida kerstingii.

Shrubs (13-25%): Bauhinia reticulata, Gardenia sp., Ximenia americana, Ziziphus mauritiana, Grewia sp.

Trees (40-45%): Balanites aegyptiaca, Terminalia laxiflora, Ficus sp., Anogeissus leiocarpus, Acacia seyal, Ac. gourmaensis, Combretum spp. (2), Sclerocarya birrea, Pterocarpus erinaceus, Borassus flabellifer, Pseudocedrela kotschy, Vitex sp., and Parkia biglobosa.

Forbes & Sedges (5%): Cochlospermum tinctorium.

Bittou East Area:

Gramineae (50%): *Heteropogon contortus*, *Andropogon ascinodis*, *Hyparrhenia glabriuscula*, *Androp. gayanus*, *Schizachyrium sanguineum*, *Vetiveria nigritana*, *Andropogon gayanus* var. *bisquamulatus*, *Aristida kerstingii*, *Andropogon pseudapricus*, *Androp. fastigiatus*.

Shrubs (8%): *Gardenia* sp., *Bauhinia reticulata*, *Grewia* sp., *Ximenia americana*, *Ziziphus mauritiana*, *Diospyros mespiliformis*, *Mimosa* sp.

Trees (38%): *Sclerocarya birrea*, *Balanites aegyptiaca*, *Anogeissus leiocarpus*, *Acacia seyal*, *Ac. nilotica*, *Ac. gourmaensis*, *Terminalia laxiflora*, *Lannea acida*, *Parkia biglobosa*, *Ficus* sp., *Pterocarpus erinaceus*, *Entada africana*, *Combretum* sp., *Vitex* sp., Bombax costatum.

Forbes & Sedges (4%).

Actual grazing season, because of the presence of year around water, is all year but November to May are peak months. This is an important habitat for wildlife.

2.2.3.7 Crop Production

The agricultural types classified are (1) Cultivated and (2) Fallow areas by hectares.

	Cultivated	Fallow
Gnanguedin Area		
Gnanguedin east	988 (288 A.U.)	1058 (197 A.U.)
Old Highway west	16 (4 A.U.)	16 (3 A.U.)
Old Highway east	--	--
	1004 (232 A.U.)	1074 (200 A.U.)
Bittou East Area		
Bittou parcel	735 (89 A.U.)	406 (170 A.U.)
Bittou east parcel	29 (4 A.U.)	--
	764 (93 A.U.)	406 (170 A.U.)

Together cultivated and fallow types represent 12% of the Gnanguedin Area and 16% of the Bittou east area. Almost all of it is located in two parcels: Gnanguedin east of Highway 12 (A) and Bittou (D).

2.2.3.8 Forestry

Trees in combination with other forms of vegetation retain soils, permit better penetration of moisture into soil, and the canopies protect the soil surface against downpouring rains that would normally wash the soil away.

Tree products provide medicines, firewood for cooking and keeping warm, and materials for the construction of structures for dwelling and storage.

Species such as Balanites aegyptiaca, Pterocarpus erinaceus, Combretum spp., Acacia spp., Terminalia laxiflora, and others contribute to the diets of grazing animals. Foliage unobtainable naturally to grazing animals because of being out of reach is frequently made available by felling branches, or in drought conditions by felling trees.

Also, an oftentimes overlooked aspect of tree environments is the shade provided to domestic stock.

The influence of human inhabitants on forestry products is evident in parcels A and B of Gnanguedin area, and both parcels in Bittou east area, but less so in parcel C of Gnanguedin area. Most woody species found in the human inhabitated zones are food producers and are not known for their wood uses. Parkia biglobosa, Néré, is frequently found in open Cultivated and Cultivated fringes and Fallow types, and provides fruits whose pith is eaten like candy, and seeds that are ground and used in food preparation. Butyospermum paradoxum var. parkii, Karité, though not found in abundance, is used in preparing a cooking oil (the nuts), and the fruit is eaten readily by children and adults alike. Bomba costatum has a red flower that is present when the tree is leafless. The flower base is used in preparing sauces. Fruits of the Diospyros mespiliformis are consumed mostly by animals and birds. Sclerocarya birrea produces a small mango-shaped fruit that is sugary, and is used by the Fulani to make an intoxicating beverage. Lannea acida in the early rainy season produces

TABLE 2.28

PERCENTAGE OF VEGETATION TYPES COMPRISED OF TREES

Vegetation Types	Old High. East (C)	Old High. West (B)	Gnang. East (A)	Bittou (D)	Bittou East (E)
Cult. Perimeter	--	11%	11%	10%	--
Cultivated	--	5%	5%	10%	10%
Gramineae	13%	13%	10%	16%	16%
Gramineae--Tree	34%	35%	33%	35%	30%
Tree	--	--	--	--	40%
Riverbank	40%	45%	40%	38%	38%

bunches of grape-like fruits that are pursued by anyone able to climb the tree. There of course is the Pseudocedrela kotschy tree whose young branches are split into pencil size pieces of wood and used, and widely sold, to cleanse teeth.

2.2.3.8.1 Forest Production

Wood production of any consequence is limited to 10,554 hectares in the Gnanguedin area and 1,541 hectares in the Bittou east area, or those areas classified as Gramineae-Tree, Tree, and Riverbank vegetation types. Table 2.28 summarizes the distribution of trees by parcel and by vegetation type, in percentages.

Gnanguedin area has 9,652 hectares presently classified as Gramineae-Tree type. This type, composed of 34% tree cover, produces 3,482 m^3 of wood yearly. Another 902 hectares of Riverbank produces 361 m^3 yearly. It has a 40% tree cover. Of the remaining 7,438 hectares, 13% are under tree cover. The Cultivated Perimeter and Fallow, and Cultivated types have been cleared of tree species except for an occastional grove of planted Mangifera indica (mango), and native Ficus sp., Parkia biglobosa (Néré), Bombax costatum, and Lannea acida. Almost 90% of the exploitable wood produced is found in the two parcels bordering on the Old Bané-Bittou Highway, west and east of the roadway (B and C).

The slow production of native species is further hampered by the annual bush fires that tend to retard and change growth forms from the norm and limit development of desirable species. Other practices detrimental to woodlot development and retention of species composition include such things as chopping down Bombax costatum trees to acquire their flowers desired for sauce making. Also, the barbaric practice of chopping off branches of Balanites aegyptiaca, Acacia spp., Pterocarpus erinaceus, and Khaya senegalensis to feed to animals during the dry season, seems to be done mostly by transhumant herders.

Yearly production is estimated at .5 meters/year/hectare for a 50% forest cover, taking into consideration the constraints stated above.

The only true forest type in the site would be Riverbank, consisting of 40% tree cover with such species as: Balanites aegyptiaca, Acacia seyal, Acacia gourmaensis, Ficus sp., Pterocarpus erinaceus, Borassus flabellifer, Vitex sp., Terminalia laxiflora, Combretum spp., Anogeissus leiocarpus, Sclerocarya birrea, Acacia nilotica, Parkia biglobosa, Entada africana, et al.

The riverbanks are being slashed and burned to open up new areas for cultivation. This is especially true in the wash between Bittou east parcel D and Gnanguedin area parcel B, and between Bittou parcel D and Bittou east parcel E.

Bittou east area has 682 hectares classified as Tree type, in combination with 676 hectares of Gramineae-Tree type and 865 hectares of Riverbank, to produce 805 m^3/year. Only 31% of the two parcels have tree composition over 30%. Bittou parcel's (D) 39% Cultivated and Fallow only account for 17% of the annual wood produced.

The Cultivated Perimeters and allows are predominantly annual grasses, Andropogon fastigiatus, Andropogon pseudapricus, Pennisetum pedicellatum, Aristida kerstingii, and Schoenefeldia gracilis, with an occasional Bauhinia reticulata (Shrub). Few trees remain except for Combretum sp., Terminalia laxiflora, Parkia biglobosa, Lannea acida, an occasional Bombax costatum, and Acacia spp., all producing some useful fruit or flower for human consumption.

The slashing and burning of forest associated types in the ever-present expansion of cultivated fields, and the annual occurrence of bush fires are the major constraints in woodlot production. Total wood production estimates are given in detail on Table 2.29 for Gnanguedin area and Bittou east area for 1979-1980 and projections for 1989-1990. Total wood production for Gnanguedin area is 3,643 m^3/year on a 10,554 hectare base. Total wood production for Bittou east area is 805 m^3/year on a 2,223 hectare base.

TABLE 2.29

TOTAL WOOD PRODUCTION ESTIMATES 1979-1980

Native Species

Vegetation Type	Surface Area (ha)	Percentage Forest Cover	Total Production Factor*	m^3/yr Production
Gnanguedin Area				
Gramineae-Tree	9,652	34	.34	3,282
Tree	--	--	--	--
Riverbank	902	40	.4	361
	10,554			3,643
Bittou East Area				
Gramineae-Tree	676	30	.3	203
Tree	682	40	.4	273
Riverbank	865	38	.38	329
	2,223			805

$$\text{*Total Production Factor} = \frac{\text{actual \% forest cover}}{\text{50\% base}} \times .5\ m^3/\text{yr.}$$

TABLE 2.29--Continued

PROJECTED TOTAL WOOD PRODUCTION FOR 1989-1990

Native Species

Vegetation Type	Surface Area (ha)*	Percentage Forest Cover	Total Production Factor**	m^3/yr Production***
Gnanguedin Area				
Gramineae-Tree	8,348	28	.28	2,337
Tree	--	--	--	--
Riverbank	780	35	.35	273
	9,128			3,610
Bittou East Area				
Gramineae-Tree	585	26	.26	152
Tree	682	36	.36	246
Riverbanks	748	34	.34	254
	2,015			652

*Reduction of 1.6% per year by agriculture expansion and land clearing.

**Total Production Factor = $\frac{\text{actual \% forest cover}}{\text{50\% base}} \times .5\ m^3/yr.$

***m^3/year production = surface area x total production factor.

2.2.3.8.2 Wood Consumption

Construction poles and timbers account for 17% of the total wood harvested; and 83% is used for firewood. Construction of dwellings, hangers, and grain storage facilities consume the larger timbers, while many smaller species such as *Acacia seyal* are sacrificed for making hoe and axe handles. These materials are usually cut green and used immediately.

Wood collected for firewood is largely dried forest material. The clearing of woodlot areas for cultivation one year can provide dried firewood a few months later. The distance between wood source and consumer has been shortened and the quantity hauled per load increased by the introduction of two-wheeled donkey drawn carts.

There is only a very small amount of firewood regularly sold to truckers along this portion of National Highway 12. Estimated firewood consumption is .50 m^3/person/year, and construction timbers account for an additional .46 m^3 per concession per year.* Recognition must be given to the rights of human inhabitants in adjacent areas to obtain and consume forest products from within sampled areas.

Total wood consumption for Gnanguedin area is 1,398 m^3/year for a population base within the site of 2,321 people living in 515 concessions. Total wood consumption for Bittou east area is 1,240 m^3/year for 2,059 people in 457 concessions. See Table 2.30 for estimates of current firewood use and projections for 1989-1990.

Conclusions. Taking into consideration current native woodlot productivity and consumption in the 17,992 hectares of the Gnanguedin area and the 7,104 hectares of the Bittou east area, one finds the present growth rate, after harvest, to be .21 m^3/hectare/year for Gnanguedin area and -.20 m^3/hectare/year for Bittou east area. Annual growth rate for the total 25,096 hectares is presently 1,500 m^3/year above consumption. However, by projecting

*12 construction poles/yr @ .07 m radius and 2.5 m long.

TABLE 2.30

FOREST WOOD CONSUMPTION ESTIMATES AND PROJECTIONS

Consumer Origin	Population (Concessions)	m^3/yr Firewood*	m^3/yr Construction**	m^3/yr Total
1979-1980				
Gnanguedin area	2,321 (515)	1,161	237	1,398
Bittou ast area	2,059 (457)	1,030	210	1,240
	4,380 (972)	2,191	447	2,638
1989-1990				
Gnanguedin area	2,921 (649)+	1,461	299	1,760
Bittou east area	2,592 (576)+	1,296	265	1,561
	5,513 (1,225)	2,757	564	3,321

+1980-1985 population increase 2.5%/yr.

1986-1990 population increase 2.7%/yr.

4.5 persons/concession.

*.50 m^3/person/yr consumed.

**.46 m^3/person/concession/yr consumed.

population growth and expansion of agriculture into forest-woodlot producing areas, indications are that by the year 1990 there will be negative growth rate. Meaning the consumer will have less native wood to use, will need to find alternative sources of fuel for cooking, or import wood from outside the sampled areas.

Consideration must be given to the constraints or production by slashing and burning, and also the 20-30 year period necessary for desired native species to reach harvestable age.

2.2.3.9 Burning

Burning in these mid-to-tall perennial grass savannas is a traditional practice, for whatever the reason. They are annually burned to eliminate dry vegetative matter: (1) to expose green matter and stimulate new green growth for livestock feed, (2) to destroy natural hiding places for wild animals and snakes, and (3) to clear the land for cultivation. Burning periods differ slightly as do the philosophies for burning among livestockmen and other land users, i.e., cultivators, hunters, and grass thatchers.

By January 25, 1980, it was determined through plot analysis that 54% of the 17,992 hectares were burned (52% occurring in November and 46% in December 1979). In March an additional 7% was burned in the open gramineae areas east of Gnanguedin to the Inclo-Exclo plot near the Old Bané-Bittou Highway. Fire destroyed 5,000 tons of grazable dry biomass or 2,188 Animal Units on a year-long use basis.

Tables 2.31 and 2.32 indicate burning times and hectares for each parcel. The timing of the burn is very important. Burns in October, occurring when above-ground perennial grass is still partially green, decrease the amount of material burned, the extensiveness of the burn, and appear to decrease the period of time required for a plant to recover and show green growth. Normally soil moisture is adequate in October and November to assure regrowth, and to a lesser degree in December and January. Limited soil moisture was found to 15-cm depths in January.

Fires occurring when leaves and culms have completely dried up tend to burn with hotter intensity and tend to consume more

TABLE 2.31

TIMING AND EXTENT OF BURNING, GNANGUEDIN AREA

Parcel (Total Area, ha)	Date of Burn	Area Burned (ha)	% of Total Area
A	November	504	11
(4,393)	December	448	10
	March	926	21
B	November	1367	41
(3,316)	December	105	3
	March	405	12
C	October	255	2
(10,283)	November	2404	23
	December	3169	31

TABLE 2.32

TIMING AND EXTENT OF BURNING, BITTOU EAST AREA

Parcel (Total Area, ha)	Date of Burn	Area Burned (ha)	% of Total Area
D	December	49	2
(2,910)			
E	November	69	2
(4,194)	December	386	9

plant material burning down to grass clump or ground level. Recovery time is prolonged and often does not occur until after May and June rains. The late burns leave soil surfaces exposed to wind and especially water erosion at the onset of heavy rains in late June and July.

Also important in late burns, or any burn for that matter, is whether or not the plants have adequate recovery times before grazing animals are allowed to graze them. Adequate recovery time should be allowed on any burned area before animals graze the green sprouting plants. Relief from grazing should be mandatory at a minimum stubble height of 10 cm, and not at such a time when the plant is leveled to the ground.

A note concerning effects on the existing tree and shrub species such as Combretum spp., Entada africana, Ficus sp., Lannea sp., Pseudocedrela kotschy, Pterocarpus erinaceus, Sclerocarya birrea, Terminalia sp., and Vitex sp., Gardenia sp., Ximenia americana, and Bauhinia reticulata: all are dormant during burning period. Starting in October their leaves dry and fall, and new leaf buds do not emerge until April-May. These species, the grasses, forbs, and others found in the site, are survivors of annual burns, fire resistant; an ecosystem known as a pro-fire climax.

There is no uniform community burning policy, nor is there any traditional control over present burning practices. Vengroff (1979) reports that sociologically the burning of pasture areas (in project sites) is a very controversial issue. Livestockmen surveyed are roughly evenly split regarding the advantages and disadvantages of this practice. Of the 52.3% who feel that there are benefits to be obtained from burning, the most common benefit sited was that new, fresh grasses will grow quickly after burning. There is a more favorable connotation associated with burning in the east and south (project sites) than in the north. Ethnically, only the Mossi are very reluctant to burn pasture areas. The Fulani, Gourmantche, and Bissa regard burning in a more positive light.

Vengroff (1979) also reports that there is a great deal of conflict in the minds of livestockmen regarding the issue of burning. While they find their own motivation for burning justified, they are strongly opposed to much of the burning being done by non-livestockmen. For example, burning designed to clear bush areas for planting often destroys significant areas of pasture. It comes in the wrong season to be of use in regenerating grasses. Fires lit by hunters in search of small game also cause considerable damage. The most common times of burning by livestockmen are October-November and May. In October-November livestockmen explain that the grasses are still moist, therefore fire will not destroy everything and there will be enough moisture left so that new grasses can spring up. Similarly, in May they suggest that by burning just before the rains come, good quick growth of grasses will be insured with the first rains. In very few cases, however, did livestockmen seem to examine the long-term impact of these actions.

2.2.3.10 Soil Erosion

An explanation of the indices for evaluating soil erosion is given in Section 2.2.1.10 and Table 2.33 brings together the average numerical erosion factor for each vegetation type within each of the five parcels sampled. The entire area is moderately eroded with signs of advanced erosion near drainages. The cultivated type showed above-average stability, especially in the Gnanguedin area. However, with the indiscriminate selection of new cultivation sites, entire areas are being subjected to high water erosion and soil loss. The selection of fragile sites near principal drainages is not only washing fertile top soil down stream, but the act of clearing the site of valuable trees and shrubs is destroying the stability of the drainageway and its wood resources. The trees and shrubs near drainageways bind the soil together when it comes under pressure of rains and flowing water.

It is worth noting that samples taken in the Riverbank vegetation type did not reflect the advanced state of erosion of waterways, principal and secondary channels. This type is more realistically rated as a 3.

TABLE 2.33

NUMERICAL EROSION FACTOR FOR EACH SITE AND PARCEL BY VEGETATION TYPE

Vegetation Type	Gnanguedin Area			Bittou East Area	
	Gnanguedin East (A)	Old Highway West (B)	Old Highway East (C)	Bittou (D)	Bittou East (E)
Cultivated Perimeter & Fallow	2	2	--	2	--
Cultivated	1.4	1.4	--	2	2
Gramineae	2.1	2.5	2.4	1.5	2.1
Gramineae-Tree	2	2.3	2.3	2.5	2.2
Tree	--	--	--	--	2
Riverbank	1.5	2	1.7	1.8	1.8

Ground Surface Coverage. Although 58% of the 7,104-hectare Bittou east area was void of vegetative biomass or rocky material, 34% was covered with dry and green litter, leaving 8% of the ground surface occupied by rocky substance, visually of granitic origin. These are pre-burn, post-rainy season conditions, that is, ideal conditions. (Only 374 hectares were actually recorded as having been burned.)

In the Gnanguedin area, where 53% of the region was burned by 25 January 1980, there was a 40% cover of vegetative biomass, both dry and green, 57% of the soil surface was bare, and 6% was of various rock material. Fires set in November and December decraased the amount of green matter and increased the amount of dry matter. Tall grasses were not consumed entirely by fire. Grass culms were knocked down, and many leaves were singed by fire but not entirely burned up. Areas burned in March were consumed by fire and only minor amounts of green or dry vegetative matter were found.

2.2.3.11 Water Resources

An attempt is made to identify the types of available water supplies found in the Gnanguedin area and Bittou east area. Water sources have been located on maps on file at The University of Arizona.

Nouhao River. The Nouhao River, acting as the eastern limit to the areas sampled, is a north- to south-flowing tributary of the White Volta River. Its seasonal flow is regulated by the intensity of secondary streams feeding into it during the rainy season and dependent to some degree on the underground flow through fractured granite following the intense rainy season. The upstream watershed starts approximately 70 kilometers above the Gnanguedin site and continues some 30 kilometers below the site, or until the Nouhao reaches the White Volta River.

Literally the watershed is limited to the west by National Route 12 from just south of Bittou (in the south) to Lloulogu, 15 kilometers south of Koupela; and to the east by a line from Sanga (in the south) northerly to Yondé and from Yondé on north to Bissiga, and from Bissiga north to Dianga on the Koupela-Fada N'Gourma

Highway; National Highway No. 4. The surface area for the watershed is 3,800 square kilometers (100 kilometers long x 38 kilometers wide).

The Nouhao riverbed is 30-50 meters wide and 4-8 meters deep, with deep-collected sand and intermittent exposed granite boulders.

Stream flow is July through September with pockets of residual water prevailing to March/April after which water is extracted from small dug pits in the remaining residual water holes. In most cases the residual watering holes are fed by subterranean sources that flow through February or March.

Cattle frequent the Nouhao watering holes following the rains and stay until April or May. Wildlife, as earlier described, frequent the Nouhao all year round.

The fringes of the Nouhao are full of biting flies. During the frequent sorties into various spots along the river, flies were never lacking from November through January.

Secondary Streams. The secondary streams feeding the Nouhao River are abundantly present throughout the areas studied. The active stream flow found during the intense rainy period and immediately afterwards is followed by mostly dry drainageways with occasional underground water flowing around or under a huge granite rock structure to form a pool of water. Infrequently there was secondary flow along the stream
smaller pools. These areas are alive usually until March or April at which time the flowing water stops completely and the pool of water, depending on its size and basin makeup, will either dry up or the remaining water becomes stagnant.

These water holes are the main water source for both humans and livestock. Secondary streambeds are also frequently tapped for human water needs. Holes are dug down through the sandy layers into the clay aquifers. Usually some water is found at about 2-3 meters. This source is available until December-January. Small groups of animals are watered by this source.

Small Reservoirs. Holes left by excavation of fill material in constructing the paved Highway 12 south of Gnanguedin and south of Bittou persist as numerous small reservoirs on both sides of the road that hold rainwater until November. These are important water sources during and immediately following rains, for livestock and humans along Highway 12.

Bittou Reservoir. The reservoir just outside of Bittou to the north on the west side of the highway has an estimated capacity of 600,000 cubic meters peak and 250,000 cubic meters minimum. Irrigated truck gardens are on the west bank. Water is hauled by donkey-drawn carts to Bittou and environs, and livestock water all year round from the reservoir. Downstream there is only seepage from the spillway after the water level goes below the crest of the spillway.

Permanent and Traditional Wells. As of January 1980, Gnanguedin village area has five (5) cement-cased permanent wells and four other wells of non-permanent nature known as traditional wells. The permanent cased wells produce 9.13 cubic meters of water and the traditional wells produce 2.97 cubic meters. There is one hand pump-equipped drilled well at the concession of the chief of Gnanguedin. The section of Bittou town, east of Highway 12, has 23 wells of traditional type producing a total of 18 cubic meters in January 1980. Only eight of those have water all year round. The remainder all dry up sometime between January and May each year. No ground-surface to bottom-of-well distances were recorded. All wells are used almost exclusively for human use.

2.2.4 Carrying Capacity and Stocking Rates

2.2.4.1 Carrying Capacity

A vegetation type is the basic unit for analyzing and describing vegetative and forage production. Production for a measured area is expressed in kilograms per hectare, air-dried weight.

Total dry biomass produced is the total vegetative biomass produced in an area of one hectare. Forage dry biomass produced is that portion of the total deemed usable by domestic grazing animals. The difference between the two could have been used to repair roofs of houses, or used in weaving mats totally lost by burning, or just that portion not eaten by grazing animals because of some undesirable characteristic.

The forage dry biomass is a calculated measure using a series of weighed samples from a known surface area. The calculated measure should be confirmed by actual grazing experiences and if necessary Animal Units adjusted up or down to effectively utilize available forage biomass produced without detriment to the overall measured area.

When converting forage dry biomass of an area into Animal Units, one divides by the amount of dry biomass required to maintain an average weight bovine for 12 months.

Example:	250	--kg is weight of average bovine
	x 2.5%	--maintenance ration/day
	6.25	--kg dry biomass required/day
	x 365	--days/yr
	2,281.25	--or 2280 kg dry biomass/yr

One Animal Unit in this text is equivalent to 2,280 kilograms dry biomass per year, using 2.5 percent live weight as a daily intake requirement for maintenance diet. Six and one-quarter (6.25) sheep and goats (Mossi type) equal one bovine Animal Unit. Range carrying capacities are hereafter referred to in Animal Units (A.U.'s).

2.2.4.1.1 Criteria Concerning Sampling

The height of strata sampled was from the ground surface to 1.5 meters. Gramineae species were measured leaving 30% stump (or 30% of height); for all other species only the foliage and fruit were measured. No buds or new growth were observed during the sampling period. Green weights were recorded and later converted to dry weight using air-dried samples. Air-dried samples were dried and weighed every two weeks until no further weight loss occurred.

2.2.4.1.2 Carrying Capacity--Gnanguedin Area

Recorded measurements of biomass productivity are for two seasons: (1) the pre-burn period, and (2) the post-burn period. The pre-burn period is prior to October when grasses have matured and started drying. The post-burn period usually occurs by the end of December with small additional decreases occurring as late as March. See Figure 2.13.

Table 2.34 presents carrying capacities of each vegetative type for both pre- and post-burn conditions. Because of the impossibility of restricting stock to specific vegetation types, an optimum carrying capacity is given for the entire Gnanguedin area. Remember, however, that the analysis is a guideline to assist in fixing stocking rates. Follow-up on-the-ground adjustments should be made as conditions change.

The optimal carrying capacity for the pre-burn period is 2.9 hectares per Animal Unit. The optimal carrying capacity for the post-burn period is 4.5 hectares per Animal Unit.

Figure 2.13 shows the carrying capacity and estimated existing stocking rate, and the sequence of events affecting plant growth, and animal use of the area. The indication of the existence of year-round surplus feed is also apparent, but do not overestimate the availability of this forage.

The effects of annually set fires are very important in knowing whether to use an area freshly burned. The destruction of the biomass although variable is severe and difficult to measure. Tree growth norms have greatly altered. Grasses, depending on heat generation may burn down to soil level leaving soils exposed to the natural elements, wind, water and trampling.

2.2.4.1.3 Carrying Capacity--Bittou East Area

Again because of the impact fire has in eliminating biomass a pre-burn and post-burn analysis has been attempted to assist in determining a guideline for the carrying capacity.

Figure 2.14 shows the changes in carrying capacity, and some of the events affecting biomass production and availability. Also, an estimate is made of the actual stocking rate; including

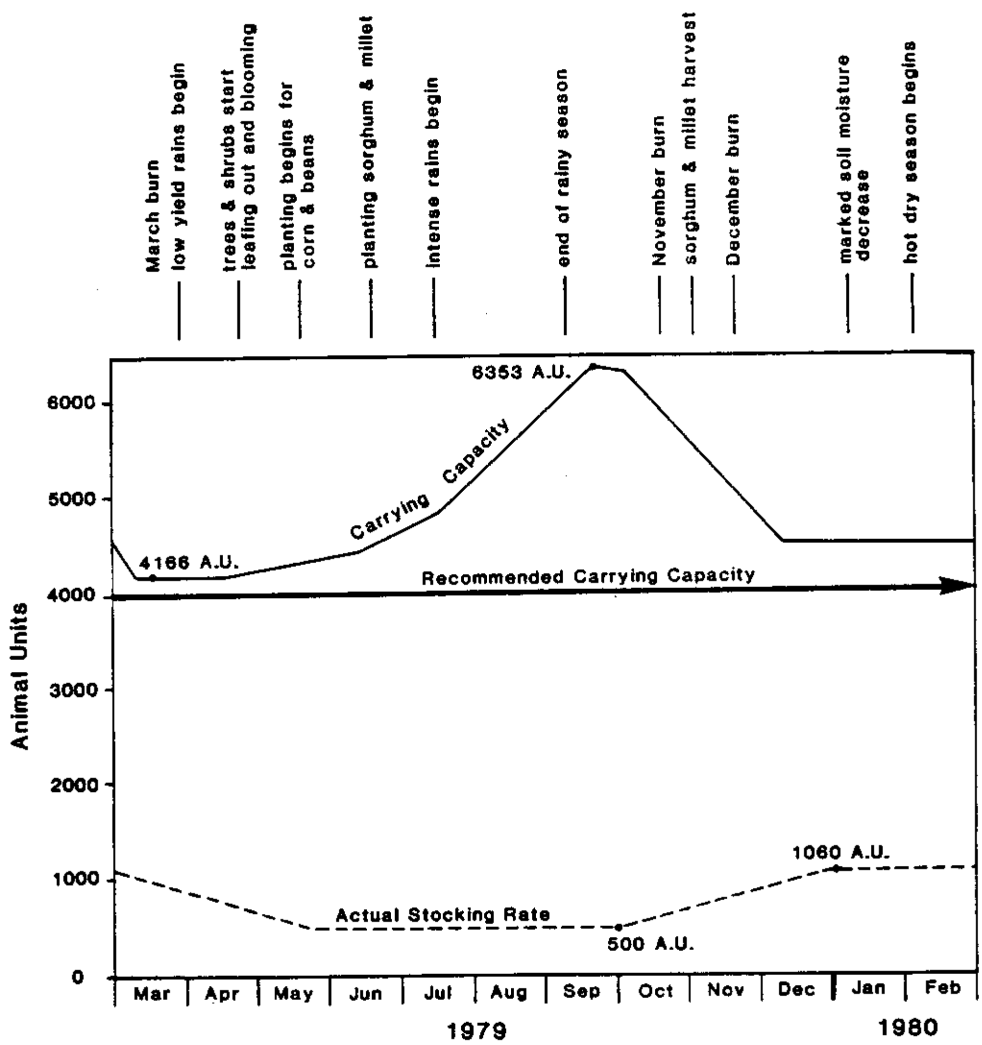

Figure 2.13 CARRYING CAPACITY OF GNANGUEDIN AREA AND ESTIMATED STOCKING RATE

TABLE 2.34

PRE- AND POST-BURN CARRYING CAPACITY IN ANIMAL UNITS

Gnanguedin Area, Gnanguedin, East of Highway 12, Parcel A

Vegetation Type	Pre-Burn Conditions				Post-Burn Conditions			
	Forage Biomass kg/ha	Surface in ha	A.U.	Ha per A.U.	Forage Biomass kg/ha	Surface in ha	A.U.	Ha per A.U.
Cultivated Perimeter & Fallow	425	1,058	197	5.4	411	1,058	191	5.5
Cultivated	526	988	228	4.3	406	998	176	5.6
Gramineae	815	1,216	435	2.8	478	1,216	255	4.8
Gramineae-Tree	1,372	1,121	675	1.7	876	1,121	431	2.6
Riverbank	1,275	10	6	1.7	1,022	10	4.5	2.2
Totals		4,393	1,541	2.9		4,391	1,058	4.2

Note: 2,280 kg dry biomass per A.U. for 12 mo.

TABLE 2.34--Continued

PRE- AND POST-BURN CARRYING CAPACITY IN ANIMAL UNITS

Gnanguedin Area, Old Bané-Bittou Highway West, Parcel B

Vegetation Type	Pre-Burn Conditions				Post-Burn Conditions			
	Forage Biomass kg/ha	Surface in ha	A.U.	Ha per A.U.	Forage Biomass kg/ha	Surface in ha	A.U.	Ha per A.U.
Cultivated Perimeter & Fallow	425	16	3	5.3	411	16	3	5.3
Cultivated	526	16	4	4	406	16	3	5.3
Gramineae	845	1,693	627	2.7	577	1,693	428	4
Gramineae-Tree	803	1,533	540	2.8	529	1,533	356	4.3
Riverbank	847	58	22	2.6	650	58	17	3.4
Totals		3,316	1,196	2.8		3,316	807	4.1

Note: 2,280 kg dry biomass per A.U. for 12 mo.

TABLE 2.34--Continued

PRE- AND POST-BURN CARRYING CAPACITY IN ANIMAL UNITS

Gnanguedin Area, Old Bané-Bittou Highway East, Parcel C

Vegetation Type	Pre-Burn Conditions				Post-Burn Conditions			
	Forage Biomass kg/ha	Surface in ha	A.U.	Ha per A.U.	Forage Biomass kg/ha	Surface in ha	A.U.	Ha per A.U.
Cultivated Perimeter & Fallow		No measurable amount				No measurable amount		
Cultivated		No measurable amount				No measurable amount		
Gramineae	944	2,451	1,015	2.4	605	2,451	660	3.7
Gramineae-Tree	728	6,998	2,234	3.1	439	6,998	1,347	5.2
Riverbank	1,006	834	368	2.3	803	834	294	2.8
Totals		10,283	3,617	2.8		10,283	2,301	4.5

Note: 2,280 kg dry biomass per A.U. for 12 mo.

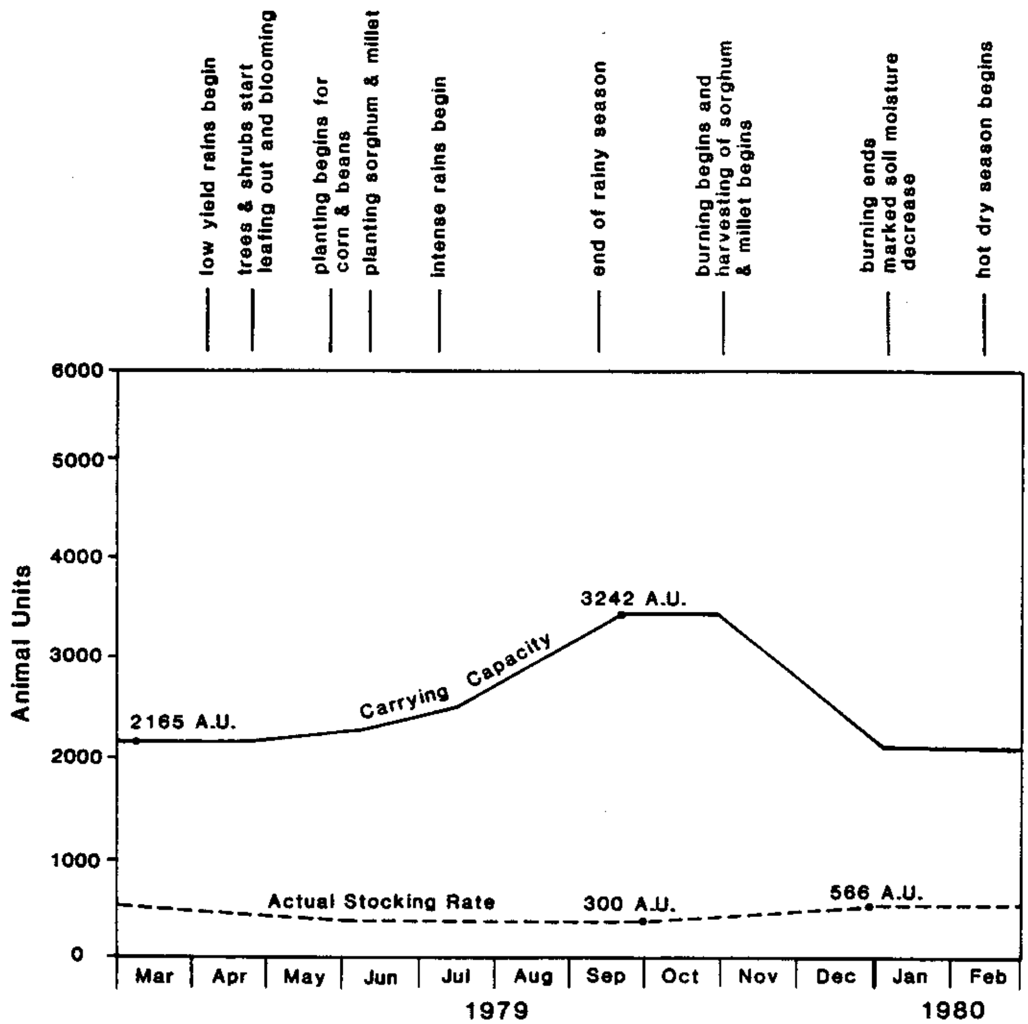

Figure 2.14 ACTUAL MONTHLY CARRYING CAPACITY OF BITTOU-EAST AREA AND ESTIMATED STOCKING RATE

domestic stock and wildlife. There is an apparent surplus of available forage but probably not the quantity illustrated in the figure.

Again, emphasis is on this analysis being a guideline to carrying capacity and existing ecological conditions. Resulting stocking rates and management should be monitored and adjusted according to existing conditions.

The optimal carrying capacity for the two Bittou parcels during the pre-burn period is 2.7 hectares per Animal Unit. The optimal carrying capacity for the same two parcels during the post-burn period is 3.9 hectares per Animal Unit (see Table 2.35).

2.2.4.1.4 Crop Residues

No data were collected in Gnanguedin concerning crop residuals.

2.2.4.2 Season of Use and Stocking Rates

2.2.4.2.1 Season of Use

Concentrations of cattle are found starting in November with slight increases in herds and numbers up through January, after which herds and their sizes seem to stabilize. Then about the end of April, herds and numbers decrease, and in May few herds are found in the interior parcels.

During the June through October period, it is rare to find domestic animals in the interior parcels. Their presence is more centralized around the Gnanguedin and Bittou parcels in the Fallow and Cultivated perimeters.

The transhumant cattle herds follow the January to April time frame and usually move completely out of the area in May. The herders will usually have a few sheep and fewer goats associated with their camps.

Sheep and goats are usually part of the permanent residents of the area and are herded by the youngsters of the concession, when they are herded. Their geographic distribution is limited to the Cultivated, Cultivated Perimeter and Fallow areas or just

TABLE 2.35

PRE- AND POST-BURN CARRYING CAPACITY ASSUMING 12-MONTH SEASON OF USE, BITTOU EAST AREA

	Pre-Burn Conditions				Post-Burn Conditions			
Vegetation Type	Forage kg/ha	Surface in ha	A.U.	Ha Per A.U.	Forage kg/ha	Surface in ha	A.U.	Ha Per A.U.
Bittou Parcel D								
Cultivated Perimeter & Fallow	96	406	171	2.4	928	406	165	2.5
Cultivated	276	735	90	8.2	213	735	69	10.7
Gramineae	1,128	1,391	688	2.0	662	1,391	404	3.4
Gramineae-Tree	149	75	5	15.0	95	75	3	25
Tree	--	--	--	--	--	--	--	--
Riverbank	952	303	127	2.4	763	303	101	3
		2,910	1,081	2.7		2,910	742	3.9
Bittou East Parcel E								
Cultivated Perimeter & Fallow	--	--	--	--	--	--	--	--
Cultivated	276	29	4	7	213	29	3	9.7
Gramineae	1,602	2,320	1,630	1.4	1,027	2,320	1,045	2.2
Gramineae-Tree	879	601	232	2.6	530	601	140	4.3
Tree	200	682	60	11.4	162	682	48	14.2
Riverbank	952	562	235	2.4	760	562	187	3
		4,194	2,161	1.9		4,194	1,423	2.9

Note: 2,280 kg dry biomass per A.U. for 12 mo.

beyond. It is rare to find sheep and goats away from the human-influenced areas.

Wildlife distribution is away from the human-influenced areas except for an occasional sortie into a cultivated field during the rainy season (July through September). Also, animals will extend their area of travel for feeding or watering. There is a large year-round water hole in the Old Bané-Bittou Highway west parcel (B), just 600 meters of the exclo-inclo plot. Antelope frequent this water hole in April, May, and June when other water holes are dry. Also, in this same period of time, shrubs and trees (Entada africana, Lannea acida, Pseudocedrela kotschy, and Cochlospermum tinctorium and others) are growing new green buds.

Season of use for wildlife is fairly evenly distributed in the Old Bané-Bittou Highway east parcel (C). It is in this parcel and closely neighboring riverbank types that most wildlife habitat is found. Rarely were observations of wildlife made in open Gramineae types where protective cover was lacking.

2.2.4.2.2 Estimated Stocking Rate for 1979-1980

No systematic inventory of livestock and wildlife was attempted in the sites analyzed. There were two reasons for not doing so: (1) there appeared to be no grazing problem, and (2) project funds were inadequate to finance overflights of the area.

Stock counts were taken during the actual collection of the range management vegetation inventory data. The timing for each parcel was different, enough so that the herds counted in one parcel could, in principle, be a part of the herds counted in another on a later date.

Counts are for cattle and wildlife. Sheep and goats were not accurately counted because there were very few in the Bittou east parcel (E), Old Bané-Bittou Highway west (B), and east (C) parcels at the time the inventory was implemented; except for 15 head of sheep in various Fulani camps. The count is not adequate to make more than a good educated guess at the number of cattle and other animals using the areas.

The existing estimated year long stocking rate for cattle in the Gnanguedin area is 896 Animal Units (A.U.'s), an additional 500 head of sheep and goats plus 15 donkeys for 92 A.U.'s plus 72 A.U.'s allowed for wildlife (Table 2.36).* The peak stocking rate for the Gnanguedin area, converted to cattle A.U.'s is 1,060 Animal Units.

The existing estimated year-long stocking rate for cattle in the two parcels in Bittou east area is 486 Animal Units, an additional 250 head of sheep and goats plus 25 donkeysfor 65 A.U.'s, plus 15 A.U.'s allowed for wildlife (Table 2.36). The peak stocking rate for the Bittou ast rea, again converted to cattle A.U.'s is 566 Animal Units.

Estimates of seasonal fluctuations in stocking rates are plotted on Figure 2.14.

Wildlife (herbivores only) accounts for an additional estimated 14 A.U.'s in the Bittou east area parcels (D&E) (see Table 2.35). The area is .415 that of Gnanguedin area and the hunting pressure is probably three times greater because of the large number of government employees stationed in Bittou, many owning firearms. The hunting pressure is even greater around Bittou City.

*Sheep A.U. is .15 equivalent of a bovine A.U.; donkey A.U. is equivalent to one bovine A.U.

TABLE 2.36

WILDLIFE ESTIMATES IN ANIMAL UNITS

Type of Animal	No. of Individuals	Conversion Factor to Bovine A.U.'s*	No. of A.U.'s**
Gnanguedin Area			
Elephant (2 mo.)	1	5	5
Large antelope	25	1.5	38
Small antelope	50	.08	4
Large monkeys	100	.03	3
Grey monkeys	100	.01	1
Red monkeys	25	.02	1
Wild pigs	29	.5	15
Rabbits	900	.01	9
Total			76
Bittou East Area			
Large antelope	3	1.5	5
Small antelope	6	.08	1
Large monkeys	12	.03	1
Grey monkeys	12	.01	1
Red monkeys	3	.02	1
Wild pigs	4	.5	2
Rabbits	355	.01	4
Total			15

*No. of A.U.'s = conversion factor to bovine A.U.'s x no. of individuals.
**No. of A.U.'s have been rounded off.

2.3 HUMAN AND INSTITUTIONAL RESOURCES

2.3.1 The Existing Cultural Milieu

In this section some important cultural differences and practices which have an impact, or potential impact, on livestock production are discussed.* This section is not intended as an ethnography of any of the four ethnic groups involved. That is a task which has already been largely completed by others, and is, in any case, beyond the scope of this report. Many of the important differences between ethnic groups in relation to livestock production are included in subsequent sections.

The most important issues to be examined from the perspective of the existing cultural milieu are the basic economic orientation of each group and the relationship of the ethnic group to the land. Both issues are closely related. It cannot be too strongly emphasized that the somewhat artificial polar types sedentary-nonsedentary and crop production-livestock production do not adequately describe the economic orientations of ethnic groups in Upper Volta (Swift, 1979).

2.3.1.1 Economic Orientation

An examination of the major ethnic groups in the areas covered by the VLP seems to indicate a slow convergence of modes of production. Significant proportions of people generally regarded as sedentary farmers, Mossi, Gourmantche and Bissa, are very much involved in livestock production. This applies to goats and sheep and poultry, which are very widely held, as well as to cattle which are held by a relatively small, but growing minority. In the village of Tafogo, for example, just under 25 percent of the Mossi compound heads own at least some cattle. Furthermore, there is an increasing trend on the part of the Mossi and Gourmantche to rely on their own children as herders. This trend is less pronounced

*See Appendix 6.1 for discussion of survey and analysis methodology.

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among the Bissa who continue to rely very heavily on the Fulani to herd their cattle.

On the other side of the coin, the Fulani, traditionally regarded as nomadic to semi-sedentary cattlemen, are becoming increasingly sedentary. It is difficult to find Fulanis who do not have their own fields in which they produce millet, sorghum, maize and cowpeas. In fact, of the 57 Fulani interviewed as part of the livestock management survey, 56 Fulani, or 98.5% have their own fields. Although Fulani fields are generally smaller than those of the Mossi, Bissa and Gourmantche, the grain produced still forms a significant portion of their annual consumption (Delgado, 1977). In fact, 12.5 percent of the Fulani sampled indicated that their own harvests produced enough to satisfy all their needs.

On the average the Fulani are growing 3.3 different crops, compared with 5.2, 6.6 and 7.3 for the Mossi, Bissa and Gourmantche, respectively ($F = 41.13$, $P < .0001$). The further south one moves the larger the number and variety of crops produced by all four ethnic groups. The Fulani take good advantage of the dung produced by their animals to fertilize their fields, especially those on which maize is grown. The result is relatively high output.

The major difference between the Fulani and the other ethnic groups sampled is the labor input into their crop production. The average male labor devoted to agricultural work per compound is 2.70 for the Fulani and 3.88, 3.59 and 4.07 for the Mossi, Gourmantche and Bissa, respectively. This difference ($F = 3.67$, $P < .02$) is further compounded by the fact that virtually no Fulani women work in the fields other than at the time of the harvest. The other ethnic groups average between 3 and 4 women in the fields on a regular basis. In total the Fulani average just under 3 farm workers per compound while the other groups muster 7.9 (Mossi), 8.4 (Gourmantche) and 11.1 (Bissa) ($F = 11.74$, $P < .0001$). Additionally and somewhat surprisingly the Fulani are much less likely than other cattle owners to use animal traction. Only 5.4% of the Fulani sample use this method while for the Mossi (46.9%), Gourmantche (41.2%) and Bissa (86.7%) cattle owners the figures are much higher ($X^2 = 44.21$, $P < .0001$, Cramer's $V = .54$). Thus total labor inputs, both human and animal, into farming are considerably lower for the Fulani than for the other ethnic groups.

The preferred life style for a Fulani is still the life of a herder. This ideal is, however, being eroded by the realities of the environment and the development of more reliable strategies for dealing with uncertainty.

Both traditional sedentary farmers such as the Mossi, Gourmantche and Bissa, and traditional herders, the Fulani, are recognizing the advantages of a mixed farming system. In the general sample which included both cattle owners and non-owners, of those who said they did not produce enough grain this year to make it through the year, 36.6 percent said they would sell animals to purchase grain (see Table 2.37). Many of those who merely said they would buy grain undoubtedly will also use resources gained from livestock sales. (This issue is more fully discussed in the section on marketing.)

Contrary to the conclusions suggested by Delgado (1977), a mixed farming strategy seems to maximize the survival capacity of all ethnic groups involved. Those who are primarily dependent on their crops are provided with a form of drought insurance by their livestock. This strategy can not cope with large scale drought such as that experienced in the late 1960's and early 70's but it does provide a means for coping with the shorter, more localized droughts experienced by farmers throughout the region.

When the extremely localized rains fail to fall in an area, farmers sell off some animals to pay for the grains needed to sustain their families. Furthermore, since livestock are mobile, the effects of localized droughts can be minimized by transferring the herds to areas which have received adequate rains.

The Fulani also benefit from this system. In good years they produce some of their own millet and sorghum, thus minimizing the number of animals which must be sold to purchase grain. In turn this increases the number of animals available for sale in bad years, without threatening the overall herd and its ability to

TABLE 2.37

HOW WILL YOU GET THE GRAIN FOR YOUR FAMILY TO FINISH OUT THE YEAR?

(Asked only of those who said they had not produced enough grain for themselves this year.)

	Number	Percent
No problem	2	2.0
Will buy	53	52.5
Sell animals	37	36.6
Borrow	9	8.9
Total	101	100.0

reproduce. The most rational strategy appears to be a convergence of production strategies (diversification) rather than the maintenance of a high degree of specialization. It is this strategy of diversification which many rural Voltaics appear to be following.

2.3.1.2 Traditional Sociopolitical Structure

There are several important distinctions in social structure between ethnic groups, which have an impact on organizational efforts as well as methods of managing livestock. The Mossi have a hierarchical social structure based on the nobility of their ancient, but to some extent still functioning, kingdoms. Administrative, judicial and religious policies were determined at the center. Although local variations occurred, the villagers were dependent on the local village chief and earth priest for most important decisions regarding ritual blessings and allocations (for example, of land) (Skinner, 1964; Hammond, 1966).

The Fulani fall at the opposite end of the spectrum with "chiefs" who did not so much rule as seek cooperation and compromise through a process of consensus building. Their positions, right up to the present day are lacking in any form of force or enforcement powers. Instead they depend on local moral consensus. The mobility of the Fulani herder provided the option to move away from unwanted or unacceptable authority. The patrilineage is the most important organizational tie, but the lineage head must also depend on his ability to build a consensus as a means of maintaining his authority (Dupire, 1962, 1970; Riesman, 1977).

The structure of the other two ethnic groups encompassed within this study, falls somewhere between that of the Mossi and Fulani. Authority among the Bissa is somewhat analogous to that among the Mossi but less hierarchical and less all encompassing. Except in times of warfare the Gourmantche have an even less rigidly structured political organization (Swanson, 1978). The power of the chief is somewhat diffuse. Even organizational units such as the clan and lineage have a relatively weak hold on the individual.

Two important points must be made relative to these organizational differences. Control of farm land is centralized among the Mossi, more diffuse among the Bissa and Gourmantche (generally centered on the lineage) and, with exceptions, virtually non-existent among the Fulani. Interestingly when livestock producers were asked where or how they obtained the land they are currently cultivating, the modal responses differed greatly by ethnic group. For the Mossi the most common response was from the village chief (53.8%). For the Gourmantche the most frequently cited source of land was from relatives (76.5%). In the case of the Fulani and Bissa the modal response was that they had asked no one, but merely cut an area of the bush for their fields (55.3% and 66.7% respectively).

Although land is communally held, normally as long as sufficient land remains unexploited or at rest in the rotation system, all families, whether local or strangers, are granted rights. For strangers this does not include the right to plant trees, an act which signifies permanent ownership. The rights of groups such as the Fulani, who merely cut bush fields, often without informing traditional sedentary authorities, are the subject of debate and in some cases interethnic conflict.

Grazing land and forest land are open to all. Even though such areas may formally fall within the territory of a chief (among the Mossi), no limitations are put upon use. Everyone has equal access to forage wood and wild fruits. Thus virtually all land used for grazing purposes is open and uncontrolled. Even grazing on village fields after the harvest is generally unrestricted. Some formal arrangements for use still exist, but by and large the system is unregulated. The emphasis placed by some on the value of the exchange of fertilizer for forage (crop residue) may be somewhat exaggerated.

Of equal importance is the fact that ownership of livestock, unlike ownership of farmland is not communal, but individual, or confined to a patrilineage. Livestock producers remain rigidly individualistic in this regard. The identification of ownership is hidden for several reasons. Most obvious among them is the government imposed tax of 200 CFAF per head of cattle. It is also viewed as preferable not to let one's neighbors and relatives know the extent of one's resources. Otherwise livestock owners may be called upon to share these resources with others to a greater extent than they would like.

From this perspective, it must be noted that successful interventions in the area of livestock production probably must rely on individual, rather than communal ownership. Given individual ownership and free access to grazing resources, it is obvious that for development purposes, grazing resources must in some way be managed in the interests of the collectivity. The alternative approximates the "tragedy of the commons."

2.3.1.3 Interethnic Conflict

There is considerable interethnic hostility, particularly between the dominantly farming groups, Mossi, Gourmantche, and Bissa, and the largely livestock-oriented group, the Fulani (Philippe, Sone and Diawara, 1977; Delgado, 1977). It is not uncommon to hear gross stereotypes and ethnic slurs, generally aimed against the Fulani. The major source of interethnic disputes centers around the issue of land use. In that sense, the conflict is really economic conflict which is compounded by cultural differences.

The problem is a general one between livestock producers and farmers, regardless of ethnicity. Almost half (49%) of the livestock producers interviewed said that they had problems with the farmers in their villages. When this figure is broken down by ethnicity it is interesting to note that a higher percentage of Mossi (60.0%) than Fulani (52.6%) livestock producers experience this problem (see Table 2.38). The figures are considerably lower for the Gourmantche (17.6%) and Bissa (26.7%).

The most important immediate source of conflict (96.1%) arises from the accidental destruction of crops by herds of cattle. Disputes center around culpability and compensation. Currently this issue is dealt with by agricultural agents employed by the ORD. These agents are charged with assessing crop damage

TABLE 2.38

PERCENTAGE OF LIVESTOCK PRODUCERS EXPERIENCING PROBLEMS

	Mossi	Fulani	Gourmantche	Bissa	Total	X^2	p<
Total number livestock producers	65	57	57	15	154	154	
Experiencing conflict with farmers (%)	60.0	52.6	17.6	26.7	49.4	13.0	.005
Access to water problematic (%)	43.1	52.6	11.8	53.3	44.2	9.13	.05

and awarding compensation. Since the judges are agricultural extension agents, the herders feel that they are held accountable to a system which is rigged against them.

The question of compensation remains a serious and difficult issue. Sometimes herders, in order to avoid payment, flee with their herds. More commonly, payment is made without the need for intervention by the national police. Where cattle consigned to others have caused crop damage, it is the herder who is responsible, but the owner usually makes a contribution to the settlement.

Access to water sources is an equally volatile issue. Over 43 percent of the livestock producers sampled identified this as a problem for them. Since there is no real concern on the part of the government for land use planning and little if any coordination between the livestock and agricultural services, streams, ponds and wells have been encircled by gardens and bush fields. Livestock producers are effectively denied access to vital traditional water resources. Because of the lack of adequate, or in some cases, any access routes, livestock producers are afraid that their stock will enter fields and gardens, causing crop destruction for which they will personally be held responsible.

A third important issue involves trust between a farmer-livestock owner and his herder, where cattle have been consigned to the Fulani. When an animal dies the herder generally brings the hide to the owner as proof of the death. In many cases there is a lingering suspicion on the part of the owner that his animal was not well cared for. Additionally, cases of animal theft create strong negative reactions toward the Fulani as a whole, rather than toward the culpable party. Both sides in the cattle consignment relationship seem less and less eager to want to continue this type of arrangement. (This is more fully discussed in the section on herding.)

2.3.1.4 Attitudinal Dispositions

It is important to know to just what extent both culture and experiential factors impact on the openness of diverse groups to development efforts and to innovation in general. Here we will attempt to examine some of these attitudinal dispositions among four ethnic groups. The dependent variables examined here include past contact with both central and regional (ORD) government officials, the effect of that contact (positive or negative), association membership, attitudes toward modernity and the sense of efficacy. Four major independent variables have been selected for examination: ORD (region), ethnicity, religion and site or village.

Before examining the data it will be useful to examine our expectations based on the ethnographic literature. It is generally believed that sedentary farmers are easier for government agents to contact than are herders. Given the mobility of herders this is not an unreasonable inference. To the extent that these distinctions correspond to ethnicity, it seems probable that the more sedentary groups will have more contact with both national and regional government, more positive reactions to that contact, a greater understanding of modernity and a higher sense of efficacy than less sedentary groups, notably the Fulani.

Religion is also expected to be related to attitudes toward modernity, and the sense of efficacy. Animists are believed to be less modern in their orientation than members of major world religious groups (Muslims and Christians). The samples were not stratified on the basis of religion. The number of Christians in the sample (14 of 205--a figure close to the distribution of Christians in the population of Upper Volta) is too small to make adequate comparisons possible. It also must be emphasized that ethnicity and religion covary. That is, virtually all Fulani are Muslim while virtually all Gourmantche sampled are animist. It is not possible to sort out the two.

Region, ORD and site, to the extent that they represent variations in the degree of isolation, are expected to be related to the dependent variables. That is, the more isolated sites are expected to manifest attitudes more traditional than those sites which have had the benefit of more direct contact with modern life. It must be specified that, although the ORDs vary in their degree of isolation from Ougadougou, the sites are about equivalent in their distance from their ORD centers (Tafogo 80 km and Koukoundi 85 km from Kaya; Gnanguedin 140 km and Gourgou 40 km from Koupela; Namoungou 30 km and Ougarou 70 km from Fada).

2.3.1.5 Communications Infrastructure--Contact with Government

Two communications factors are identified as important here: the degree to which people have had contact with government and the affective orientation generated by that contact. That is, do people who have experienced government contact regard such interaction in an affectively positive or affectively negative light? As can be seen from Table 2.39 there is a significant relationship between region (ORD) and the level of contact with representatives of the central government services. This relationship appears to vary directly with the distance of the ORD from Ougadougou. In the Kaya ORD just over half (54.5 percent) of those interviewed had some contact with government while the figures are 30 and 14 percent for the Koupela and Fada ORDs respectively. Ethnicity also covaries with the level of contact. Highest contact is experienced by the Mossi (42.2%) followed by the Fulani and Bissa (35.3%) and the Gourmantche (11%).

It appears that the degree of contact with government is influenced by a combination of region and ethnicity, with the former having the greater impact. Contrary to expectations the Fulani contact with government is not less than that of the more sedentary groups. However when a control is introduced for region, the impact of ethnicity disappears. There are no significant differences between ethnic groups within the same ORD. There does not appear to be any significant relationship between religion and contact with government.

For those who had contact with representatives of the central government services, the only independent variable which

TABLE 2.39

CONTACT WITH GOVERNMENT

Have you had any contact with government?

Independent Variable	Percent Having Contact	Number	X^2	p <	Cramer's V
ORD					
North central	54.4	57			
East central	39.0	41	30.60	.001	.39
East	14.0	107			
		(N=205)			
Ethnic Group					
Mossi	42.2	64			
Fulani	35.3	68	14.89	.002	.27
Gourmantche	10.9	55			
Bissa	35.3	17			
		(N=204)			
Religion					
Animist	26.8	71			
Christian	14.3	14	3.33	N.S.	N.S.
Muslim	35.0	120			
		(N=205)			
Site					
Ougarou	24.4	45			
Namoungou	6.5	62			
Gnanguedin	40.5	42	39.41	.0001	.44
Koukoundi	46.3	41			
Tafogo	75.0	16			
		(N=206)			

N.S. = not significant.

is significantly related to the positive or negative nature of that contact is ethnicity. Surprisingly the Fulani had a uniformly positive response (probably to Livestock Service vaccinators), followed by the Bissa and Mossi. The Gourmantche is the only group with a majority of negative responses to government contact (see Table 2.40).

The second level of government contact examined is contact with the regional government, the ORD, and its representatives.

Once again, one finds broad differences between ORDs. The relationship between ORD and contact with ORD officials is highly significant and the level of association is moderate. In Koupela 40 percent of those interviewed had some contact, while the comparable figures for Kaya and Fada are 32.8 and 6.8 percent respectively. Basic contact between the rural peasant and his government seems to be almost totally lacking in the Fada ORD.

The relationship between ethnicity and contact with ORD authorities is also significant and shows an even stronger level of association (see Table 2.41). Mossi and Bissa have relatively high levels of contact with ORD officials (40.6 and 47.1% respectively), while for all intents and purposes Gourmantche and Fulani have virtually none (11.3 and 4.5% respectively). Ethnicity and region interact to produce these relationships. When a control is introduced for region the impact of ethnicity is greatly weakened. Regional differences appear to be the crucial independent variable. Religion is not a factor that has any explanatory power.

When the question of effect is examined, although the numbers are relatively small (N=52), the same general trend holds. The relationship between ORD and a positive evaluation of past contact with the ORD is significant and reasonably strong (Cramer's V = .58). In both the Kaya and Koupela ORDs, the experience of contact is overwhelmingly positive. Contact in the Fada ORD is uniformly negative (see Table 2.42). The relationship

TABLE 2.40

CONTACT WITH GOVERNMENT

If you had contact did it help you?

Independent Variable	Percent Answering Yes	Number	X^2	p<	Cramer's V
ORD					
North Central	79.4	34			
East Central	68.2	22	1.33	N.S.	.13
East	66.7	18			
		(N=74)			
Ethnic Group					
Mossi	65.7	35			
Fulani	100.0	21			
Gourmantche	45.5	11	13.06	.005	.42
Bissa	75.0	8			
		(N=75)			
Religion					
Animist	66.7	27			
Christian	66.7	3	1.55	N.S.	.14
Muslim	79.5	44			
		(N=74)			
Site					
Ougarou	62.5	16			
Namoungou	100.0	2			
Gnanguedin	69.6	23	4.73	N.S.	.25
Koukoundi	89.5	19			
Tafogo	66.7	15			
		(N=75)			

N.S. = not significant.

TABLE 2.41

CONTACT WITH REGIONAL GOVERNMENT

Have you had any contact with regional government?

Independent Variable	Percent Answering Yes	Number	X^2	p<	Cramer's V
ORD					
North Central	32.8	58			
East Central	40.0	40	26.16	.0001	.36
East	6.8	103			
		(N=201)			
Ethnic Group					
Mossi	40.6	64			
Fulani	4.5	66	39.94	.0001	.42
Gourmantche	11.3	53			
Bissa	47.1	17			
		(N=200)			
Religion					
Animist	25.7	70			
Christian	15.4	13	1.31	N.S.	.008
Muslim	19.5	118			
		(N=201)			
Site					
Ougarou	13.0	46			
Namourgou	1.8	57			
Gnanguedin	41.5	41	41.02	.0001	.45
Koukoundi	21.4	42			
Tafogo	62.5	16			
		(N=202)			

N.S. = not significant.

TABLE 2.42

CONTACT WITH REGIONAL GOVERNMENT

If you had contact did it help you?

Independent Variable	Percent Answering Yes	Number	X^2	p<	Cramer's V
ORD					
North Central	76.2	21			
East Central	66.7	21	17.27	.0002	.58
East	0.0	10			
		(N=52)			
Ethnic Group					
Mossi	74.2	31			
Fulani	25.0	8	14.14	.003	.52
Gourmantche	0.0	5			
Bissa	66.7	9			
		(N=53)			
Religion					
Animist	64.7	17			
Christian	66.7	3	0.40	N.S.	.09
Muslim	56.3	32			
		(N=52)			
Site					
Ougarou	0.0	3			
Namoungou	0.0	7			
Gnanguedin	68.2	22	18.70	.001	.59
Koukoundi	66.7	12			
Tafogo	88.9	9			
		(N=53)			

also holds for ethnicity. Bissa and Mossi have generally favorable responses while Groumantche and Fulani are overwhelmingly negative. Religion is not a significant factor.

Another extremely important aspect of the administrative infrastructure for development is the degree of membership in associational groups. Elsewhere in Africa, associational groups have been found to provide the core around which individual participation in development efforts are stimulated (Vengroff, 1974, 1977). One finds significant variation in associational membership between the three ORDs considered here. The strength of the relationship is, however, rather weak. In accord with other findings presented in this section, the Fada ORD shows the lowest rate of group membership of the three ORDs, followed by Kaya and Koupela.

Ethnicity is also significantly related to organizational membership, again with a relatively weak level of association. The trend is clear (see Table 2.43). The Bissa have the highest level of group membership (64.7%), followed by the Mossi (30.8%), the Fulani (25.0%), and the Gourmantche (15.4%).

The problem of an infrastructure for development efforts is relatively clear. Although infrastructure development is generally weak throughout the country, in the Fada ORD the magnitude of the problem is greater. Contact with officials at all levels is minimal, and reactions to existing contact are generally negative. The same does not appear to be the case in project sites in either the Koupela or Kaya ORDs. The relatively non-hierarchical sociopolitical structure found among the Gourmantche (Swanson, 1978) as well as their Fulani neighbors further complicate efforts to undertake broad scale interventions in this area. The Mossi-Fulani and Mossi-Bissa-Fulani culture complexes do not present problems of the same magnitude.

2.3.1.6 Attitudinal Predispositions--Modernity and Efficacy

It is clear that the organizational basis for developmental efforts is highly variable. This does not mean that the willingness of local people to work closely with a project parallels the

TABLE 2.43

ASSOCIATION MEMBERSHIP

Independent Variable	Membership in Associa-tions (%)	Number	X^2	p<	Cramer's V
ORD					
North Central	31.0	58			
East Central	41.5	41	6.36	.05	.18
East	21.2	104			
		(N=203)			
Ethnic Group					
Mossi	30.8	65			
Fulani	25.0	68	16.11	.002	.28
Gourmantche	15.4	52			
Bissa	64.7	17			
		(N=202)			
Religion					
Animist	21.4	70			
Christian	46.2	13	3.86	N.S.	.14
Muslim	30.0	120			
		(N=203)			
Site					
Ougarou	18.2	44			
Namoungou	23.3	60			
Gnanguedin	40.5	42	7.92	N.S.	.20
Koukoundi	35.7	42			
Tafogo	18.8	16			
		(N=204)			

N.S. = not significant.

organizational strengths and weaknesses of the ORD or of past central government efforts. In fact the people, both Gourmantche and Fulani, of Ougarou in the Fada ORD were found to be very supportive and cooperative.

In examining several items designed to measure attitudes toward modernity, the pattern evident in the organizational and communications infrastructure is reversed. Attitudes toward modernity appear significantly more positive among the people in the Fada ORD than in either of the other two ORDs in which this research was conducted (see Tables 2.44, 2.45, and 2.46). Ethnic differences are also reversed. Significant differences in attitudes toward modernity between groups uniformly favor the Fulani. The Gourmantche score significantly better than both the Mossi and Bissa groups on two of the three items. It must be noted that broad contradictions have been found in the literature between attitudinal dispositions toward modernity and successful development efforts (Horowitz, 1969).

2.3.1.7 Efficacy

The key factor involved is not the degree to which affirmative attitudes toward development are held, but the sense of efficacy current in the population. By efficacy is meant the sense, or feeling on the part of an individual that his actions count; that he personally, has the ability to change events around him. Whether or not a person thinks modernity is a good thing or not, if he feels that he has no control over events or ability to bring about change, he is likely to take no action at all.

One of the principal aims of the community organization efforts of the VLP has been to generate an increased sense of efficacy on the part of local livestock producers. Locally selected animators must therefore constantly be encouraged to express their ideas and opinions. This alone is not enough. They must also see their suggestions bear fruit in the form of concrete projects, even if on a very small scale.

TABLE 2.44

MODERNITY

To have a better life it is necessary to return to the manner of living of our ancestors.

Independent Variable	Percent Agreeing	Number	X^2	p<	Cramer's V
ORD					
North Central	49.1	57			
East Central	42.5	40	7.05	.03	.19
East	29.0	107			
		(N=204)			
Ethnic Group					
Mossi	49.2	63			
Fulani	21.7	69	11.38	.01	.24
Gourmantche	40.7	54			
Bissa	41.2	17			
Religion					
Animist	51.4	70			
Christian	14.3	14	11.33	.005	.24
Muslim	30.8	120			
		(N=204)			
Site					
Ougarou	62.2	45			
Namoungou	4.8	62			
Gnanguedin	41.5	41	44.19	.0001	.46
Koukoundi	46.3	41			
Tafogo	56.3	16			
		(N=205)			

TABLE 2.45

MODERNITY

Smart men economize to satisfy their needs in the future rather than for immediate pleasures.

Independent Variable	Percent Agreeing	Number	X^2	p<	Cramer's V
ORD					
North Central	60.3	58			
East Central	70.0	40	29.67	.0001	.38
East	94.3	105			
		(N=203)			
Ethnic Group					
Mossi	64.1	64			
Fulani	92.6	68	22.10	.0001	.33
Gourmantche	88.7	53			
Bissa	64.7	17			
		(N=202)			
Religion					
Animist	72.5	69			
Christian	85.7	14	3.54	N.S.	.13
Muslim	83.3	120			
		(N=203)			
Site					
Ougarou	89.1	46			
Namourgou	98.3	59			
Gnanguedin	70.7	41	38.02	.0001	.43
Koukoundi	69.0	42			
Tafogo	37.5	16			
		(N=204)			

N.S. = not significant.

TABLE 2.46

MODERNITY

Before deciding on a new crop it's useful to know if it sells expensively or cheaply.

Independent Variable	Percent Agreeing	Number	X^2	p<	Cramer's V
ORD					
North Central	40.4	57			
East Central	17.9	39	99.05	.0001	.70
East	96.2	106			
		(N=202)			
Ethnic Group					
Mossi	33.9	62			
Fulani	79.1	67	62.98	.0001	.56
Gourmantche	94.5	55			
Bissa	29.4	17			
		(N=201)			
Religion					
Animist	67.6	71			
Christian	85.7	14	3.8	N.S.	.14
Muslim	60.7	117			
		(N=202)			
Site					
Ougarou	97.7	44			
Namoungou	95.2	62			
Gnanguedin	17.5	40	116.79	.0001	.76
Koukoundi	24.4	41			
Tafogo	81.3	16			
		(N=203)			

N.S. = not significant.

Significant relationships exist between ethnicity and region on the one hand and the sense of efficacy on the other. The responses to the efficacy items employed in this study clearly indicate that the lowest sense of efficacy exists among the interviewees in the Fada ORD (see Tables 2.47, 2.48, and 2.49). In fact the gap between the Fada ORD and the other two ORDs, Koupela and Kaya, included in the study is very large. These results are at least partially a function of ethnicity. The Gourmantche are consistent in manifesting the lowest sense of efficacy of all ethnic groups (Swanson, 1978). The Fulani are a close second. The gap between these two groups and the Mossi and Bissa is considerable. Since the sample in the Eastern ORD is composed of Gourmantche and Fulani the gap between ORDs is also quite large. However, since the relationship between ORD and efficacy is stronger (Cramer's V) than the relationship between ethnicity and efficacy, it seems that at least part of the gap must be accounted for by the experience of people in the region with governmental or other development efforts.

The overall conclusion to be drawn from this examination of attitudinal differences between regions and ethnic groups is that the successful introduction of new techniques of production will probably require more time and greater effort in the Fada ORD than in either the Kaya or Koupela ORDs. In this sense it is wise to proceed slowly and cautiously with efforts there. It is perhaps best to initially concentrate only on interventions which have been at least moderately successful elsewhere. Small-scale activities are probably the best to pursue initially. Thus, it makes sense to phase the VLP so that activities in Fada will be initiated after similar efforts have been successfully undertaken in the other two project ORDs.

2.3.2 Women's Role in Livestock Production

2.3.2.1 Introduction

The social, economic and physical environment in which rural Voltaic women live is described in this section.

TABLE 2.47

EFFICACY

It is difficult to adopt new techniques of production.

Independent Variable	Percent Agreeing	Number	X^2	p<	Cramer's V
ORD					
North Central	38.6	57			
East Central	59.0	39	15.55	.001	.28
East	70.5	105			
		(N=201)			
Ethnic Group					
Mossi	45.2	62			
Fulani	62.1	66	10.40	.02	.23
Gourmantche	72.7	55			
Bissa	47.1	17			
		(N=200)			
Religion					
Animist	64.3	70			
Christian	42.9	14	2.45	N.S.	.11
Muslim	57.3	117			
		(N=201)			
Site					
Ougarou	82.2	45			
Namoungou	61.7	60			
Gnanguedin	57.5	40	23.66	.0001	.34
Koukoundi	46.3	41			
Tafogo	18.8	16			
		(N=202)			

N.S. = not significant.

TABLE 2.48

EFFICACY

Some work is for foreigners, not villagers like us.

Independent Variable	Percent Agreeing	Number	X^2	p<	Cramer's V
ORD					
North Central	36.2	58			
East Central	60.0	40	52.72	.0001	.52
East	91.6	95			
		(N=193)			
Ethnic Group					
Mossi	43.8	64			
Fulani	80.9	68	31.46	.0001	.40
Gourmantche	88.4	43			
Bissa	58.8	17			
		(N=192)			
Religion					
Animist	63.3	60			
Christian	78.6	14	1.48	N.S.	.09
Muslim	69.7	119			
		(N=193)			
Site					
Ougarou	91.4	35			
Namoungou	91.7	60			
Gnanguedin	61.0	41	61.81	.0001	.56
Koukoundi	47.6	42			
Tafogo	6.3	16			
		(N=194)			

N.S. = not significant.

TABLE 2.49

RESPONSIBILITY FOR DEVELOPMENT EFFORTS

	Government	Influential Villagers	All Villagers	Government and Villagers	Number
ORD					
North Central	23 (41.1)	1 (1.8)	7 (12.5)	25 (44.6)	56 (100.0)
East Central	12 (31.6)	1 (2.6)	3 (7.9)	22 (57.9)	38 (100.0)
East	75 (70.1)	12 (11.2)	9 (8.4)	11 (10.3)	107 (100.0)
Ethnic Group					
Mossi	24 (39.3)	1 (1.6)	4 (6.6)	32 (52.5)	61 (100.0)
Fulani	38 (55.1)	11 (15.9)	13 (18.8)	7 (10.1)	69 (99.9)
Gourmantche	40 (74.1)	2 (3.7)	2 (3.7)	10 (18.5)	54 (100.0)
Bissa	8 (47,1)	0 0.0	0 0.0	9 (52.9)	17 (100.0)
				Total =	201

Numbers in parentheses are % of respondents.

Five major areas are highlighted: (1) the social setting; an analysis of organizational bases for village cooperation among women, (2) women's current activities concerning livestock, (3) daily and seasonal time constraints (such as those involved in farming, craft and domestic activities) on the potential expansion of the role of women in livestock production, (4) an identification of leading women and women's groups within the community, and (5) potential future livestock activities for women.

The research site was the village of Koukoundi in Kaya ORD, 100 km north of Ougadougou (see Figure 2.1 for regional overview and Figure 2.3 for site details), with a mixed Fulani, Rimalbe, and Mossi ethnic composition and an estimated population of 504 (including an adjacent settlement at Sorgho which is almost entirely Fulani). The number of adult females was estimated at 150.

2.3.2.2 Methodology

The study entailed two major procedures: (1) systematic observation of women's daily economic activities in each of the major ethnic groups; and (2) development, administration and analysis of a questionnaire. The VLP team member making the study resided in a hut in the Fulani chief's compound and thus was continually (if marginally) involved in village life. The interpreter and research assistant, a French-speaking Mossi woman of rural background, lived in a nearby Rimalbe compound. Thus, there were established bridges to each of the ethnic groups.

As more awareness was acquired of village interactions, it became apparent that Rimalbe (decendants of people enslaved by the Fulani) needed to be examined separately from the Fulani, and they are treated as a separate ethnic group throughout this discussion.

During the observational phase, we used varying research procedures such as open-ended interviews, participant observation, daily record keeping of women's work activities, and discussions with groups of neighborhood women about their problems in regard to livestock. Numerous women from each ethnic group were interviewed, and frequently whole days were spent with the team member observing and participating in agricultural and domestic tasks. At neighborhood meetings the names of those women attending were noted and efforts were made to ascertain if there was a strong relationship between the ethnic and religious affiliations of these women and their participation in the livestock extension-related groups that the team encouraged. By tracing neighborhood and ethnic social networks, women's leaders in the wider community were identified.

The questionnaire drew both on separately gathered data on the village (including a household census and extensive interviews with local cattle-owning men), and on information that was obtained during the observational phase.

The major aim is to delineate economic activities of these women in general, with attention to the differences among the ethnic groups. Religion and age have been cited only when they appear to be important variables. In general, "adjusted frequencies" are given. All numbers and percentages refer to results from the questionnaires. Although the sample was relatively small (N=71), it is hoped that the findings provide useful background information on ethnic differences among these women in regard to their livestock holdings, work and consumption patterns, and may help lay a realistic basis for future development planning for rural women in this area of West Africa.

Sample Characteristics. The population sampled was defined by a census list of 64 household heads and the adult males and females living with them. A stratified random sample was drawn on the basis of ethnic group and for the Mossi, religion (animist and Muslim). Of the total sample of 71 women, 34 were Mossi, 11 Rimalbe, and 24 Fulani; two others, who identified themselves as Setba and Harga were classed as "other." The questionnaires were given following procedures outlined in Appendix 6.1.

The majority of the sample was Muslim (73.2%) including all 24 Fulani, all but one of the 11 Rimalbe, and 16 of the 34

Mossi women. Eighteen Mossi women identified themselves as "animists" and one Rimalbe woman was Catholic.

None of the women had been to a western-type school. Although almost all of the Fulani and Rimalbe females had received some formal religious training, less than half of the Muslim Mossi had done so.

Fifty-eight out of the 71 women interviewed were between 20 and 50 years of age, and they also made up the largest category of female livestock owners. The modal age range of 20-29 contained 23 women. Most women interviewed were either first or only wives while 20 were second or additional wives (28.2%). Almost half of all women interviewed (46.5%) said they lived in single-wife households.

These village women had not experienced much first-hand contact with government agencies or extra-village influences. They frequently said that although government agents visited the village regularly, these officials "only spoke to men." Only one woman said she had talked with a government agent during the past year, and none said that they received any help.

Very few Koukoundi women have lived outside Upper Volta; two women said they had lived in Ivory Coast (one in Abidjon), another in Ghana. A slightly larger number, seven, have spent some time in a large city such as Ouagadougou, Bobo-Dioulasso. The women reported, however, that it was not uncommon for their husbands to work in large cities in Upper Volta or abroad (48.5%).

2.3.2.3 The Social Setting: Organizational Bases for Village Cooperation Among Women

Before considering the economic data, it may be useful to examine elements of social organization that may either provide bases for areas of cooperation among women or may tend to divide them.

Fulani Women. The Fulani are highly individualistic and do not tend to think in terms of community efforts. According to Riesman (1977), cooperation for the common good hardly exists, though reciprocal exchange of help on a one-to-one basis is frequent. If one turns to the patrilineage as a possible organizational base for women's community efforts, one finds there are not many routine occasions that call the lineage together. Male members of the same patrilineage have in common certain vaguely defined territories, may herd their cattle together at times, and tend to live in minimal clusters near closely related members.

Within the compounds or groupings of compounds, there is no female head of women as defined by kinship or marriage relations. Even among wives of one man, none can tell another what to do. Riesman, writing of the Fulani of Djibo (1977), notes that the influence a woman can have on the community cannot be related to her social structural position (her birth order or prestige of her family), but depends entirely on her personality. Although women help each other, each woman works primarily by herself with the aid of her children. This is not to say, however, that Fulani women are uninterested in social activities. Within Koukoundi, there is a high degree of kinship-relatedness among the women. Visits are frequent, especially to the compounds of parents, but these do not appear to be strongly work oriented.

The neighborhood is the major communication network for the Fulani women, but even when several Fulani compounds are located relatively close to one another it is hard to mobilize these women to come together on the basis of common interest. Most neighborhoods also include Mossi women, with whom the Fulani appear to have little socially in common. Indeed, none of the Fulani livestock discussion groups (formations), though based in neighborhoods, included even one individual from the Mossi ethnic group. The same exclusiveness was also evident in the Mossi formations.

Religion might be viewed as a possible organizational base. Islamic rites, especially a child's baptism, bring women together--in particular those women of the mother's patrilineage. Marriage, funerals and the Doiga ceremony (which celebrates a youth's new ability to read and write the Koran), can mobilize almost all the Fulani women in Koukoundi. Such ceremonies, however, occur only occasionally. Women pray daily but individually, not in prayer groups even at festival times.

The market, though it attracts Fulani women as sellers and buyers, does not provide an organizational basis for them. Women come individually and sporadically, though they do often sit in clusters of related women.

Rimalbe Women. Rimalbe women appear to be a rather close-knit group. The patrilineage does not have the same meaning for the Rimalbe as it does for the Fulani, even though they take the same family name as their former owners and are, to some extent, attached to their patrilineal segments. Investigation of the nature of Rimalbe identification with Fulani patrilineages should be an important area for future research among these two groups. Fulani men do not marry Rimalbe women and many of the resident women have come from Rimalbe communities outside Koukoundi.

These women participate in the same patrilineage-wide activities as do Fulani women. They interact daily with Fulani women on a friendly basis, for example, pounding millet together. Some of the older women appear to perform certain menial tasks for Fulani women, presumably for pay. The neighborhood network of the Rimalbe women overlaps with that of the Fulani patrilineage segments, but also includes somewhat more interaction with Mossi women. Islamic religious ceremonies bring together the Rimalbe and Fulani women, but neither group participates in mixed prayer groups. Some Rimalbe women attend the market on a fairly regular basis. Although Fulani women told us they could easily work with Rimalbe women, the Rimalbe women expressed concern that, in any community-wide plan for women, the Fulani women would try to exert undue influence by virtue of their former high status vis-a-vis their former slaves.

Mossi Women. Among the Mossi, the patrilineage forms a closely-knit group, perhaps more so among the animists than among the Muslims. The patrilineal extended family with some members residing together tends to be larger than among the Fulani or the Rimalbe. Joint farming activities are extremely important. Mossi wives within a compound and neighboring patrilineally related compounds form an especially tight communications network. The wives' collective activities can be organized by the paquiema (Skinner, 1964, refers to the "pughtiema") or head of the lineage wives. This leader does not act without the authorization of the males of the patrilineage, but her influence is considerable.

Neighborhoods often consist of patrilineal segments. Where neighboring groups are not patrilineally related, the communication network is less effective, unless religion (specifically Islam) becomes an intervening variable. With the Mossi Muslims religion unites women from unrelated compounds. It does not, however, unite Fulani Muslim women with Mossi Muslims. While both animist and Muslim women participate primarily in their own groups' religious activities, some ceremonies, especially funerals of patrilineally related individuals of different religion, unite the two groups. Mossi Muslim women's ties are further strengthened by their joint prayer activities.

Perhaps more so than for the other two groups, the market is a potential organizational base for Mossi women. Women from large extended families tend to sit together, selling similar merchandise. This common activity also strengthens their communication network.

2.3.2.4 Women's Current Activities Concerning Livestock

An important task of this research has been to ascertain to what degree Mossi, Fulani and Rimalbe women have livestock and what rights they have in livestock. The rights of women in such property are frequently closely related with those of other family members and involve problems of acquisition, inheritance, divorce, sales and general maintenance of the animals. We shall discuss women's rights in cattle, goats, sheep, chickens, guinea fowl and animal by-products in this section. In regard to cattle ownership, Fulani women will be discussed separately.

2.3.2.4.1 Cattle

Fulani women in Koukoundi are generally reluctant to talk about ownership of cattle, especially when they are being interviewed in the presence of other village women. They frequently deny having animals with their husband's, father's or son's herds. Others claim that once a woman has sons, her cattle belong to them. These reports are consistent with data gathered on the Fulani in other areas where women are said to hold cattle for their children, especially their sons (Hopen, 1958). In our sample, only seven Fulani women and one Rimalbe said that they currently owned cattle (see Table 2.50). Some said they had been given cattle in their youth or at marriage but had left them in the herds of male relatives or sold them for jewelry. A woman is considered relatively rich in cattle if she has six. There appears to be, however, no clear relation between being married to a man with large family herds and having cattle. Wives of the largest cattle owners in Koukoundi reported having few or no cattle. Three-fourths of the cattle-owning women said that the source of their cattle was their relatives one-fourth listed their husbands. None of the women interviewed said they had purchased cattle themselves, although many women from the village as a whole (45.1%) and 12 of the Fulani women said they would be interested in buying cattle as an investment if they had sufficient money.

Gifts of cattle are usually given to women at the time of Muslim baptism and marriage. Such gifts are not mandatory, however, and many Fulani women apparently do not receive cattle at either of these ceremonies, probably because their parents' herds are not large enough to afford the loss. In our sample, nine Fulani and one Rimalbe said they had received gifts of cattle in their youth, but only three Fulani claimed to have received them at marriage.

Gifts of cattle at marriage appear to be less frequent here than in other Fulani areas (Stenning, 1959; Dupire, 1963). It is also much more likely for a male child to receive gifts of cattle at baptism than it is for a female, though by Islamic law both sexes should receive animals. Our survey indicates that cattle which have been given initially to a daughter may later be

TABLE 2.50

WOMEN'S LIVESTOCK OWNERSHIP AND SALE

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	x^2	p<	Cramer's V
Own livestock	58.8% (20)	66.7% (16)	90.9% (10)	100% (2)	67.6% (48)		N.S.	
Own goats	35.3% (12)	20.8% (5)	45.5% (5)	50% (1)	32.4% (23)		N.S.	
sold goats last year	23.5% (8)	4.2% (1)	9.1% (1)	50% (1)	15.5% (11)		N.S.	
Own cattle	0%	29.2% (7)	9.1% (1)	0%	11.3% (8)	12.31	.0064	.416
sold cattle last year	0%	8.3% (2)	0%	0%	2.8% (2)		N.S.	
Own sheep	5.9% (2)	4.2% (1)	18.2% (2)	0%	7% (5)		N.S.	
sold sheep last year	2.9% (1)	0%	9.1% (1)	0%	2.8% (2)		N.S.	
Own poultry	58.8% (20)	41% (10)	81.8% (9)	100% (2)	57.7% (41)	6.63	.0845	.305
sold poultry last year	38.2% (13)	33.3% (8)	45.5% (5)	50% (1)	38% (27)		N.S.	

N.S. = not significant.

taken away from her and given to a newborn son at the latter's baptism.

Rules governing disposition of cattle through sale, at divorce, and at the death of the owner shed some light on the question of the limitations on women's ownership of cattle. A woman wishing to sell cattle must ask permission from her husband or the man in whose herd the animal is kept. No one with whom we talked, however, could remember a case of a Fulani man denying his wife or female relative the right to sell her cow. A woman cannot sell the animal directly, but only through a man. She is not thereby committed to paying anything to the seller, though she may give him a gift. The money from the sale is hers to spend as she wishes, but she will probably discuss its use with her husband.

At marriage, a common reason given for sale of the baptismal cow is the purchase of personal jewelry. After marriage, a woman rarely sells her cattle except to purchase medicines for illness or millet for her family in times of famine. Only two women interviewed said they had sold cattle during the previous year and only one other woman indicated that she had sold cattle in the past during a famine period.

Men claim that they can, on occasion, sell one of the woman's cows for the good of the family. They should, under these circumstances, inform the woman. Apparently, cases have appeared in the courts of Kongoussi of women accusing their husbands of selling their cattle for private purposes without obtaining the woman's permission. The chief of Koukoundi, however, knew of no such cases in his village.

Women sometimes prefer not to bring all their cattle with them when first married, but rather to wait until their marriage bond is made more secure by the birth of children. When a woman with children divorces, she leaves most of her cattle with her husband's herd for the children's future use.

If a woman has no children when she divorces, she takes with her all cattle that she brought into the marriage or obtained by purchase or through gifts from her natal family. Cattle given to her by her husband, however, must remain with the husband's herd unless the husband forces the woman to leave against her will and without justification. Allocation of the offspring of the woman's cows is governed by the same rules (Delgado, 1978; Dupire, 1963).

When a childless woman dies, any cattle she owned are divided among her father, brothers and possibly her sisters. If children survive, they inherit their mother's cattle, the greater number going to the sons. Theoretically, women may also inherit cattle from their fathers. Women's inheritance rights are to some extent governed by Islamic law, but from a Fulani woman's point of ivew, it often seems that only sons inherit cattle. For another Fulani area, Hopen (1958) has discussed measures men take to avoid leaving many cattle to their daughters. Childless widows may be given cattle from their deceased husband's herd.

The chief of Koukoundi said that since women did not take care of cattle, they could not be the clear owners of them. All of the cattle-owning women interviewed said their animals had been left in the herds of husbands or male relatives, and when questioned on the breeding and marketing of cattle, the women did not appear to be as well informed as their husbands. Women are, however, familiar with many general facts about cattle and three-fourths of the women interviewed said they went with their husbands on transhumance each year.

Women do not pay much attention to the diet of their cattle, leaving this matter to the youths guarding the animals. A woman may, however, give her milk cows millet stalks and salt and carefully tend a sick animal in front of her house, even giving it millet from her husband's granary.

Six of the seven Fulani women interviewed who owned cattle said that their animals were vaccinated each year. Vaccinations, medicines, and feed supplements are, however, paid for by the men. Half of the cattle-owning women in our sample reported losses of cattle during the past year with an average loss of three cattle (see Table 2.51).

TABLE 2.51

ANIMAL HEALTH

ANIMAL LOSS AND VACCINATION

	Mossi	Fulani	Rimalbe	Other	Total	p<
Lost animals past year	N=34 44.1% (15)	N=24 50% (12)	N=11 45.5% (5)	N=2 50% (1)	N=71 46.5% (33)	N.S.
Lost cattle last year	N=32 0%	N=18 22.3% (4)	N=11 9.1% (1)	N=2 0%	N=63 7.9% (5)	N.S.
Vaccinated cattle each year	N=32 0%	N=24 25% (6)	N=11 9.1% (1)	N=2 0%	N=69 10.1% (7)	N.S.
Lost sheep last year	N=32 9.4% (3)	N=18 5.6% (1)	N=11 18.2% (2)	N=2 0%	N=63 9.5% (6)	N.S.
Lost goats last year	N=32 28.1% (9)	N=18 22.3% (4)	N=11 36.4% (4)	N=2 50% (1)	N=63 28.4% (18)	N.S.
Vaccinated small ruminants	N=33 6.1% (2)	N=24 4.2% (1)	N=11 9.1% (1)	N=2 0%	N=70 5.7% (4)	N.S.
Lost chickens last year	N=32 37.5% (12)	N=20 35% (7)	N=11 18.2% (2)	N=2 50% (1)	N=65 33.8% (22)	N.S.

N.S. = not significant.

For the Rimalbe and Mossi ethnic groups in the village, little need be said concerning women and ownership of cattle. A few Rimalbe (1 in our sample) have cattle, usually received as gifts from parents. The rules of inheritance and allocation in cases of divorce are similar to those for the Fulani. For the Mossi women in the village, there are no known cases of women owning cattle. Although it is rare in Koukoundi for women in ethnic groups other than Fulani to own cattle, 38.2% of the Mossi women and 54.5% of the Rimalbe said that the best animals for women to purchase were cows, since they gave milk.

2.3.2.4.2 Goats and Sheep

The majority of the women interviewed kept livestock. Looking at Table 2.50 we can see that the Rimalbe are proportionately the most heavily represented, though livestock owners make up more than 50% for each ethnic group. Taking ownership of small ruminants first, more women owned goats than sheep. A larger percentage of Rimalbe women owned goats than did Mossi or Fulani. Women between the ages of 20-49 made up the largest age category of livestock owners. Half of the women between the ages of 40-49 (N=18) owned goats compared to approximately a fifth of those from 20-29 (N=23). Middle-aged women have had more time to establish themselves financially than have younger women. No women indicated that they owned animals other than cattle, sheep, goats and poultry.

Although some goats and sheep are acquired by women as gifts from parents and spouses, many are purchased by the women themselves. Of the six women who said they owned sheep, two-thirds had purchased the animals themselves. Of the 23 women sampled who owned goats, nine said they bought them themselves, the majority of the others receiving them as gifts from their husbands.

For Fulani women animal purchases are frequently financed by the sale of milk, for the Rimalbe by the sale of millet flour balls (fourah), and for the Mossi by the sale of agricultural produce and cotton thread. The purchase of livestock, especially goats and sheep, appears to be infrequent as seen in Table 2.50. Nonetheless, almost half of the sample (47.1%) advised the purchase of livestock if a woman wanted to invest her money.

All groups of women indicated that they considered small ruminants a good investment against a time of famine. Mossi women emphasized the importance of being able to sell animals to purchase millet during the difficult time at the beginning of the rainy season. More than one-half of those sampled, however, said they did not know the best time to sell. Approximately a third specified the dry season as the best time for animal sales.

Women stressed that although they might sell an animal to buy millet in a time of famine, the food would not simply be for the women who had owned the animals, but for the entire family including co-wives and their children. This, at least, is the cultural ideal.

As seen in Table 2.50, the most commonly sold small ruminants were goats, the Mossi women making up the majority of the sellers among the major ethnic groups. Of the women who said they sold goats during the past year, six were between the ages of 40-49. Only one Mossi and one Rimalbe woman said they had sold sheep during the past year.

Major items purchased through the sale of animals were clothing, condiments, and millet (see Table 2.52). None of the women said that they used the monies earned from the sale of goats and sheep to finance their business, pay for taxes or sacrifices, and none said they had sold the animals because their husbands had asked them to.

Almost all of the women interviewed said that their husband's permission was necessary for them to sell livestock. Men rarely refused, however. Only one woman said that she had sold animals herself, while 24 said their husbands had sold the animals for them. Half of the women who sold animals said they reserved the sale money for themselves while the rest said they shared the money with the actual seller (usually the husbands). Contrasting the women from different ethnic groups, the Rimalbe group had the largest percentage of women saying they kept the money themselves (80%) followed by the Mossi (41.2%) and Fulani (33.3%).

TABLE 2.52

FOR WHAT REASONS HAVE YOU SOLD ANIMALS? (cattle, sheep, goats)

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<	Cramer's V
To buy clothing	23.5% (8)	0%	9.1% (1)	50% (1)	14.1% (10)	8.79	.0321	.352
To buy condiments	17.6% (6)	0%	0%	50% (1)	9.9% (7)	9.77	.0206	.371
To buy millet	8.8% (3)	8.3% (2)	0%	0%	7% (5)		N.S.	
Animal was sick	2.9% (1)	8.3% (2)	0%	0%	4.2% (3)		N.S.	
To buy jewelry	2.9% (1)	0%	9.1% (1)	0%	2.8% (2)		N.S.	
For gifts	2.9% (1)	0%	0%	0%	1.4% (1)		N.S.	
To buy medicines	0%	8.3% (2)	0%	0%	2.8% (2)			
To get money to visit relatives	0%	0%	18.2% (2)	0%	2.8% (2)			
To buy pots	5.8% (2)	0%	0%	0%	2.8% (1)			
To buy meat	0%	0%	0%	50% (1)	1.4% (1)			

Multiple responses were possible.

N.S. = not significant.

Inheritance rules vary among the different groups to some extent. For the Fulani, the same rules apply to small ruminants as apply to cattle. Although a childless woman's goats are more likely to remain with her husband than are her cattle, he may distribute some to her brothers if he likes. If a woman has children, all the goats and sheep go to them. A boy who inherits goats or sheep may decide to gain more prestige by selling them and purchasing a cow with the money. Rimalbe appear to follow the same inheritance rules as Fulani. In both cases, female children inherit fewer animals than do male children. At divorce, if a woman has children, she leaves the animals for them. If childless, she takes the animals with her, or sells them.

Among the Mossi, if a man has animals but no children, the family of the deceased gives some to the widow, and takes the remainder. If a widow wishes to leave the compound of her deceased husband, she receives no animals. If a woman dies leaving animals and no children, they are distributed between her own family and her husband, the latter taking the larger share. If children survive her, they divide them, the larger portion going to males. Some may also be given to the family of her father. In case of divorce, a woman should leave her animals for her children.

Women give goats and sheep little care; approximately three-fourths of the women who have animals leave them with their sons. When their animals are located in the compound, however, women feed them millet stalks, millet, and bean and peanut vines which they have grown themselves. Sheep usually graze in the bush, while goats are more often kept near the compound since they are thought to get lost more easily in the far bush. During the rainy season, small ruminants, especially goats, must be constantly herded to protect the growing crops. A lactating goat will be staked in the grass near a woman's house and cared for by her (especially among the Fulani).

All groups of women expressed concern at the continual loss of considerable numbers of small ruminants through disease. Of the respondents, only six women out of 63 said they had lost sheep but

18 (N=63, 28.6%) had lost goats (Table 2.51). Ten of the women who lost goats were Mossi. One Setba woman living in Sorgo claimed to have lost 19 goats from diarrhea. Exclusing this woman, the average loss cited was between 3 and 4 animals with the mode at 3.

Vaccination of small ruminants was not common, only four women saying their animals were vaccinated last year (Table 2.51). Two of the women who vaccinated were Muslim Mossi, one Rimalbe and one Fulani. When asked why they had not vaccinated their animals, almost half of the 23 women responding said that their animals had been given pills, slightly less than one-fourth thought the vaccine was unnecessary, and a few said they simply did not know about a vaccine. Frequently women believed that pills and vaccine would have the same protective value.

Vaccines and medicines are most often paid for by the husband. Of those responding (N=70), 71.4% said the husband should pay for the vaccine and only 14.7% said they would pay for it themselves. Some ethnic variations appear here. Only one Fulani woman was inclined to pay for the vaccine herself, but seven of the Mossi and three of the Rimalbe said they would do so themselves.

Village women indicated interest in acquiring more small ruminants. But when asked what was the best animal for women to purchase, 45.1% of the women cited cattle as opposed to 26.7% who mentioned goats and sheep. Possibly these figures relate to women's greater familiarity with the health problems of small ruminants, and their fears that such animals will not survive. Because of their cost, animals cannot be easily replaced, and we did not ask the women to make a decision based on cost.

2.3.2.4.3 Poultry

More than half of the women said they owned chickens (Table 2.50). Ethnic differences are of interest here since the percentage of Rimalbe women owning poultry is almost twice as high as that of the Fulani. Mossi women ranked in the middle in regard to chicken ownership. Of the women who said they owned poultry (N=41), 66.8% were between the ages of 30-49. More Muslim Mossi (75%) than Mossi animist (44.4%) owned poultry. Approximately three-fourths of the female poultry owners bought the animals themselves.

Inheritance rules and rules governing allocation of chickens at divorce follow those described for goats and sheep, though few women have large enough numbers of chickens to consider them worthy of much concern. No women owned guinea fowl.

The majority of the women responding said they kept their chickens themselves, though many (N=41, 41.5%) said their husbands kept them. Somewhat higher percentages of Fulani and Rimalbe entrusted their chickens to their husbands than did the Mossi. Somewhat less than a third of the women said they had lost an average of six chickens during the past year.

Although chickens are not a major sale item, 38% of the women said they had sold them during the last two years (Table 2.50). Almost half of the respondents claimed to have sold chickens at earlier times. More Muslim Mossi had sold chickens in the past two years than had animist Mossi (56.3% vs. 22.2%). Seventeen women between the ages of 30-49 made up 62.9% of the total number of women selling poultry. Reasons given for selling poultry did not vary significantly among the different ethnic groups. Major purchases mentioned were condiments (7%), clothing (7%), kola nuts (14%) and tobacco (9.8%).

All of the women responding said it was necessary to obtain the husband's permission prior to selling poultry. However, more than one-third of the Mossi respondents qualified their responses slightly to indicate that while such permission was desirable, it was not mandatory.

Unlike the situation with cattle and small ruminants, the majority of the women who had poultry said they had done the selling themselves. Women as sellers were especially common among the Fulani and Rimalbe, i.e., eight out of nine Fulani sampled said they had sold poultry themselves as did five out of six Rimalbe. For the Mossi, husbands and sons made up half of the sellers.

Money from the sale of poultry was most commonly kept by the woman herself. Even though in the majority of cases, Mossi women did not say that they sold poultry themselves, they, more than the other ethnic groups, reported that they kept the money from the sale for themselves (Mossi 77.8%); (Fulani 66.7%); (Rimalbe 50%). One-third of the Fulani respondents and one-half of the Rimalbe said they shared the money with their husbands. If these data accurately represent the wider population, it appears that Mossi husbands sell their wives' poultry more often than do Fulani or Rimalbe men, but share less in the proceeds. As with other animals purchased by their wives, men in all ethnic groups state that they can sell a wife's chickens without her permission, but most inform her soon afterwards.

Chickens ranked second to cattle and above goats and sheep as an advised investment for a woman with some extra money. Slightly more Mossi women favored chickens than did women in other ethnic groups. Despite the high mortality rate for chickens, women often speak of their desire to buy poultry to give to their children as gifts. Clearly, they are the most affordable type of animal investment. Although men raise guinea fowl, women are not allowed to do so. No reason was given for this prohibition.

2.3.2.4.4 Animal By-products and Sale

Cows' Milk. All Fulani women sampled milked cows as did 3 of the 11 Rimalbe women. No Mossi women milked cows (Table 2.53). When Mossi men have cattle, they usually give them to Fulani herdsmen to tend and the latter's wives milk them. Part of the milk may be sent to the owner if there is sufficient quantity.

All but one Fulani woman sold milk, but no women from other groups did so (Table 2.53). Milk is clearly the major source of Fulani women's disposable income. The source of this milk is primarily the men's cows, which are allocated to the wives, each wife having her own allotment. The first wife may have a few more cows to milk than the others, but not necessarily. If one woman's cows multiply while another's do not, this is simply regarded as the latter's misfortune. Re-allocation of cows is not favored, but clearly a man must see that each wife has a reasonable supply of lactating cows. If one wife has many cows and another wife has

TABLE 2.53

USE AND SALE OF ANIMAL BY-PRODUCTS

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<	Cramer's V
Milk cows	0%	100% (24)	27.3% (3)	0%	38% (27)	61.741	.0000	.932
sell milk	0%	95.8% (23)	0%	0%	32.4% (23)	66.624	.0000	.968
make soap	0%	100% (24)	27.3% (3)	0%	38% (27)	61.741	.0000	.932
usually sell soap	0%	8.3% (2)	0%	0%	2.8% (2)		N.S.	
make butter	0%	95.8% (23)	18.2% (2)	0%	35.3% (25)	59.62	.0000	.916
usually sell butter	0%	0%	0%	0%	0%		N.S.	
make yogurt	0%	20.8% (5)	18.2% (2)	0%	9.9% (7)	8.04	.0450	.336
usually sell yogurt	0%	33.3% (8)	0%	0%	11.3% (8)	17.65	.0005	.498
Milk goats	2.9% (1)	4.2% (1)	72.7% (8)	50% (1)	15.5% (11)	35.78	.0000	.709
Eat chicken eggs	14.5% (5)	0%	0%	0%	7% (5)		N.S.	
Eat guinea fowl eggs	97.1% (33)	95.8% (23)	100% (11)	100% (2)	97.2% (69)		N.S.	

TABLE 2.53--Continued

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<	Cramer's V
Sell eggs	5.9% (2)	0%	0%	0%	2.8% (2)		N.S.	

N.S. = not significant.

many children but few cows, men say that the female children of the latter woman can help milk the cows of the former.

Women may also milk cows belonging to their children until the time of the latter's marriage. If a daughter leaves her cow in the herd of her father, her mother will continue to milk it, setting aside a portion of the milk money for her daughter's use.

All of the Fulani and Rimalbe women we interviewed who milk cows allocate part of each day's milk to their own nuclear family. In the rainy season, when milk is plentiful, more milk is sold than is retained for the household. For example, if a woman gets six liters of milk, she may sell four during the rainy season, keeping two liters for a "small" family of six persons. During this season a woman may hope to get 1.5 liters per lactating cow, milking both morning and evening. Beginning in December and January (early dry season) she can expect less than a liter from three cows together, milking only once in the morning. A liter of milk earns a woman approximately 85 CFAF.

When asked of uses for milk other than family consumption, almost all of the Fulani women (but none of the Rimalbe women) said that they sold it (Table 2.53). Again, almost all the women who milked said they also make soap and butter and a few also make yogurt. Soap and butter do not appear from our observations to be sold in great quantities, but are made especially for home use (Table 2.53). Yogurt was sold by one-third of the Fulani sample.

With the money from the sale of milk and milk by-products, Fulani women frequently purchase jewelry, condiments, cloth and millet (Table 2.54). No cases were given of a Fulani husband refusing to let his wife spend the milk money as she wished. Men say, "The cows are mine, but the milk is hers."

Since most Mossi men do not have cattle, their wives are entirely dependent for fresh milk on purchases from the Fulani. Fresh milk is usually bought in small scoops for 5-25 CFAF, primarily for consumption by children (N=48, 41.7%) and other family members (N=48, 47.9%). Only five women said they bought milk for themselves.

TABLE 2.54

WHAT HAVE YOU DONE WITH MONEY EARNED FROM SALE OF MILK?

	Fulani N=24	All Women N=70	χ^2	p<	Cramer's V
Purchase condiments	29.2% (7)	10% (7)	14.907	.001	.461
Purchase jewelry	79.2% (19)	27.1% (19)	49.983	.001	.845
Purchase cloth	20.8% (5)	7.1% (5)	10.32	.01	.383
Purchase millet	8.3% (2)	2.9% (2)		N.S.	
Purchase other	12.5% (3)	4.3% (3)		N.S.	

N.S. = not significant.

The Fulani women sell the milk on daily rounds through the Mossi and Rimalbe compounds. Of the Rimalbe, 81.8% said they purchased fresh milk with some frequency and of the Mossi, 53% said they did. One can see on Tables 2.55 and 2.56 that a considerable number of women use money from the sale of agricultural produce and crafts to purchase milk. Only one Fulani woman said that she bought fresh milk on rare occasions.

During the past year women in Koukoundi have begun purchasing dry milk and some have been reselling it in the form of yogurt and fresh milk. Nearly half of this overall sample said they had purchased dry milk. Differences were not marked within the ethnic groups, but it may be noted that Rimalbe women constituted the largest number of purchasers, followed by Fulani and Mossi. When women were questioned on the frequency of their purchases of dry milk, however, only one Fulani woman said that she purchased it often. Of the 69 respondents, 17.4% said they bought it "sometimes," while 26.1% said "rarely" and 55.1% said they never bought it. Dry milk was bought primarily for children and family members, not for oneself or for sale. Only two Fulani women admitted selling it, mixed with whole milk, as yogurt.

The dry milk is being given away as part of a well-baby clinic effort in nearby Sabsé village and then sold in the Sabsé market. Most Mossi women prefer to buy small quantities of Fulani cow's milk, the larger dry milk supplies being more expensive in the short term. To what extent Mossi and Rimalbe women will bypass Fulani vendors by direct purchase of this new commodity remains uncertain at this time, though there will surely be some tendency for this to occur.

Although Rimalbe women (like Fulani women) milk the cattle assigned to them by their husbands, the fact that 81.8% (N=11) of them purchased fresh milk "often" and "sometimes" suggests that often Rimalbe husbands may not have sufficient cows to supply milk for their families. Rimalbe women in Koukoundi do not sell milk, explaining that they do not have sufficient quantity. They do make soap and butter from milk, but rarely sell those products.

TABLE 2.55

WHAT DO YOU BUY (DO) WITH THE MONEY EARNED FROM SALE OF HANDMADE PRODUCTS?

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<	Cramer's V
Buy condiments	17.6% (6)	8.3% (2)	36.4% (4)	0%	16.9% (12)		N.S.	
Buy clothing	14.7% (5)	20.8% (5)	18.2% (2)	0%	16.9% (12)		N.S.	
Buy cloth	2.9% (1)	0%	9.1% (1)	0%	2.8% (2)		N.S.	
Buy jewelry	8.8% (3)	20.8% (5)	45.5% (5)	0%	18.3% (13)	8.01	.05	.335
Buy tobacco	29.4% (10)	8.3% (2)	9.1% (1)	0%	18.3% (13)		N.S.	
Buy kola nuts	26.5% (9)	12.5% (3)	27.3% (3)	50% (1)	22.5% (16)		N.S.	
Buy animals	2.9% (1)	4.2% (1)	18.2% (2)	0%	5.6% (4)		N.S.	
Buy milk	23.5% (8)	4.2% (1)	27.3% (3)	50% (1)	18.3% (13)		N.S.	
Buy millet	2.9% (1)	4.2% (1)	9.1% (1)	0%	4.2% (3)		N.S.	
Buy meat	2.9% (1)	0%	0%	0%	1.4% (1)		N.S.	
Buy medicine	2.9% (1)	0%	0%	0%	1.4% (1)		N.S.	
Money for husband	0%	0%	9.1% (1)	0%	1.4% (1)		N.S.	

N.S. = not significant.

TABLE 2.56

WHAT DO YOU BUY (DO) WITH THE MONEY EARNED FROM THE SALE OF AGRICULTURAL PRODUCTS?

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<	Cramer's V
Condiments	47.1% (16)	0%	9.1% (1)	0%	23.9% (17)	19.49	.0002	.523
Clothing	44.1% (15)	0%	27.3% (3)	50% (1)	26.8% (19)	14.54	.0022	.452
Cloth	5.9% (2)	0%	0%	0%	2.8% (2)		N.S.	
Jewelry	11.8% (4)	0%	36.4% (4)	0%	11.3% (8)	10.23	.0166	.379
Milk	61.8% (21)	0%	9.1% (1)	50% (1)	32.4% (23)	27.90	.001	.626
Given to husband	2.9% (1)	0%	0%	0%	1.4% (1)		N.S.	
Tobacco	44.1% (15)	0%	9.1% (1)	0%	22.5% (16)	17.77	.0005	.500
Kola nuts	52.9% (18)	0%	18.2% (2)	50% (1)	29.6% (21)	20.07	.0002	.531
Animals	11.8% (4)	0%	9.1% (1)	0%	7% (5)		N.S.	
Other (pots, calabashes, etc.)	14.7% (5)	0%	0%	50% (1)	8.5% (6)	9.41	.0243	.364

N.S. = not significant.

Goat Milk. Rimalbe women milk goats and give the milk to their children and families more often than do the Fulani or the Mossi (Table 2.53). It is possible that more Fulani women milk goats than admitted to us. We asked a Fulani woman if she milked goats, received a negative reply, and later in the day observed the same woman milking a goat. Goat milking for the Mossi appears to be truly rare.

Eggs. Most of the women in the village do not eat chicken eggs for fear that the eggs cause difficult childbirths (Table 2.53). Apparently husbands do not enforce this prohibition against eating eggs; the few women interviewed who ate eggs in their natal households said they continued to do so after marriage. Although women are prohibitied from raising guinea fowl, almost all of the women in our sample ate guinea fowl eggs (Table 2.53).

Only two Muslim Mossi women in the sample said that they sold eggs either directly or through a male relative (husband or son). Both women indicated that part of the sale money remained with the seller. Mossi women seem to be more likely to sell guinea fowl eggs, in season, than women from the other two ethnic groups. Some village men argued that selling eggs was inappropriate work for Fulani women. Some Fulani women, however, indicated interest in taking part in chicken raising projects.

Other Products. Only men in Koukoundi butcher animals and they generally do the smoking of meat, also, though some women claimed they do this if they wish. Fulani, Rimalbe, and Mossi women do not sell meat, skins or manure. Manure from penned goats is taken by men and often used on maize fields. Women may also use it in their small gardens. Mossi women may smoke and sell fish.

2.3.2.5 Daily and Seasonal Time Constraints on the Potential Expansion of the Role of Women in Livestock Production

2.3.2.5.1 Fulani Women

Farming. Unlike the women in the other two ethnic groups, Fulani women are not heavily involved in farming. Only eight women (a third of our Fulani sample) said they did any farming. Only a few women said they grew white millet, corn, cotton or beans (Tables 2.57, 2.58). None mentioned peanuts or sesame. Okra was a fairly popular crop. In conversations, women reported they may plant gardens near their houses growing okra, oseilles and pepper for use in cooking. None of these crops appear to be grown extensively.

It is very rare for a Fulani woman to sell agricultural produce, and none in our sample reported doing so. They agreed with Mossi and Rimalbe women, however, that a husband should give his permission before his wife sells her agricultural produce, or spends the money from the sale.

No Fulani women hired laborers to work on their land. Of four women who had garden land, three said they obtained it from their husbands, one from the village chief. No Fulani woman had her own millet granary, and all granaries belonged to the males of the household. Usually women do not cut millet or do much labor in the fields. Fulani women married to wealthy men do not help in the harvest at all. Most women (79.2%) do, however, help in harvesting, primarily by carrying already cut millet heads to the compound. In general, Fulani women assist only their husbands, not members of the extended family. A few women reported helping their neighbors.

Crafts. Among all ethnic groups, the major craft activity for a woman is spinning cotton during the dry season after the harvest. Twenty-one of the 24 Fulani women interviewed said they made cotton thread each year, especially during the time of low milk production. A woman may give the cotton thread to a weaver to make into cloth for her family and herself. Generally Fulani women do not sell cotton (only one woman in our sample reported doing so). Women obtain cotton for making thread either from their husbands who grow it, from purchase, or from barter for milk.

As mentioned earlier, when there is sufficient milk, women make butter, soap and yogurt, some of which is sold (Table 2.53). Several women (not included in the sample) were observed making soap in large quantities for sale outside of the village.

TABLE 2.57

WHICH CROPS DO YOU CULTIVATE ON COMMUNAL LAND OF YOUR COMPOUND?

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<	Cramer's V
Small millet	14.7% (5)	0%	27.3% (3)	50% (1)	12.7% (9)	8.24	.0412	.340
Sorghum	14.7% (5)	0%	0%	0%	7% (5)		N.S.	
White millet	100% (34)	4.2% (1)	81.8% (9)	100% (2)	64.8% (46)	59.62	.0000	.916
Corn	82.4% (28)	4.2% (1)	72.7% (8)	100% (2)	54.9% (39)	38.35	.0000	.735
Peanuts	32.4% (11)	0%	9.1% (1)	50% (1)	18.3% (13)	11.82	.0080	.408
Cotton	73.5% (25)	4.2% (1)	72.7% (8)	50% (1)	49.3% (35)	29.96	.0000	.649
Cassava	2.9% (1)	0%	0%	0%	1.4% (1)		N.S.	
Okra	5.9% (2)	25% (6)	18.2% (2)	50% (1)	15.5% (11)		N.S.	
Sesame	8.8% (3)	0%	0%	0%	4.2% (3)		N.S.	
Beans	91.2% (31)	4.2% (1)	90.9% (10)	100% (2)	62% (44)	51.46	.0000	.851
Roselle	2.9% (1)	0%	0%	0%	1.4% (1)		N.S.	

N.S. = not significant.

TABLE 2.58

CROPS GROWN ON YOUR OWN LAND (Fields/gardens)

	Mossi N=34	Fulani N=24	Rimalbe N=11	Other N=2	Total N=71	X^2	p<1	Cramer's V
Small millet (field)	5.9% (2)	0%	0%	0%	2.8% (2)		N.S.	
Sorghum/red millet (field)	5.9% (2)	0%	0%	0%	2.8% (2)		N.S.	
White millet (field)	64.7% (22)	0%	36.4% (4)	0%	36.6% (26)	26.57	.0000	.611
Corn (garden)	0%	0%	9.1% (1)	0%	1.4% (1)		N.S.	
Okra (garden)	91.2% (31)	16.7% (4)	72.7% (8)	50% (1)	62% (44)	33.86	.0000	.690
Bean (garden)	47.1% (16)	0%	27.13% (3)	0%	26.8% (19)	16.64	.0008	.484
Peanut (garden)	91.2% (31)	0%	54.5% (6)	50% (1)	53.5% (38)	47.03	.0000	.813
Sesame (garden)	64.7% (22)	0%	27.3% (3)	50% (1)	36.3% (26)	25.99	.0000	.605
Small peas (garden)	26.5% (9)	0%	9.1% (1)	50% (1)	15.5% (11)	9.69	.0214	.369
Roselle	5.9% (2)	0%	9.1% (1)	0%	4.2% (3)		N.S.	

N.S. = not significant.

A small number of women interviewed sold millet cakes, fritters and shea butter. Although it is part of the general ideology in Koukoundi that Fulani women do not sell flour, or millet flour balls (fourah), three women reported that they did. Approximately 70% of the women reported making mats, but few said that they sold them.

With the money from the sale of crafts, Fulani women buy clothing, jewelry, kola nuts, tobacco, condiments, animals and millet. When one compares Table 2.54 with Table 2.55 one can see that money from milk sales is considered more important in purchasing expensive items such as jewelry than is money from the relatively minor craft sales. No Fulani woman said she used craft-sale money to finance business ventures, buy meat, medicine, or give to her husband.

Domestic Activities. Millet processing, including pounding, sifting and repounding, is the most time-consuming daily activity. Each wife takes a turn preparing the evening and morning meals. If there are several wives in a compound each woman may have several days in a week free from this heavy time expenditure. While 13 Fulani women said they cooked the main meal every day, an almost equal number (11) said they had cooked more than four times during the previous week.

In some compounds, several wives prepare meals at the same time, giving the food to the entire household. Not uncommonly, however (due to illness in the family or co-wives' visits to parents), one wife or daughter-in-law may be left to prepare all the meals for the entire family for an extended period of time.

It is difficult to estimate the amount of time any Fulani woman spends processing millet, since she is frequently assisted by children, visitors or other members of the compound. For a family of eight persons, a woman may average over two hours daily in millet processing. The cooking of the millet will take somewhat over an hour. The sauce that accompanies the porridge is prepared more quickly.

Women are also responsible for collecting wood and water. All but two of the Fulani women sampled said they gathered the wood, and 91% of those collecting (N=20) had done so 2 to 4 times during the 8 days prior to the administration of the questionnaire. The modal number of times was four. These trips for wood may take close to an hour depending on the distance travelled. More wood is used during the cold periods of the dry season for heating the hut as well as for cooking. When soap is being made, extra supplies of wood must be brought in.

Of the women queried, 70.8% said they were responsible for collecting the family water. One-fifth said their children carried water. When asked how many trips for water they had made on the previous day, 79.1% reported having gone either two or three times. Women usually do laundry at the water source rather than in the compound.

Women also spend time collecting wild fruits and leaves for family consumption. Almost twice as many Mossi and Rimalbe women reported doing so as did Fulani.

During the rainy season until shortly after the harvest, a Fulani woman spends a considerable portion of her mornings travelling around the village selling milk. Women consider a three-hour period (e.g., 7:00 a.m.-10:00 a.m.) as a brief expenditure of time for this activity; some women must continue till the late afternoon in order to sell all their milk. Women also sell their milk in the village market held once a week.

Possible Expansion of Livestock Activities. In terms of the possible expansion of livestock activities, it is apparent that certain Fulani women have some free time during the day, especially after they complete their milk sales, until late afternoon, if a woman does not have to cook.

Fulani women may become involved in leisurely chatting in the late morning and early afternoon, particularly during the dry season when milk sales are low. It would theoretically be possible for women in a compound to participate in expanded livestock activities, e.g., poultry raising (which requires morning and evening feedings and waterings and weekly cleaning) or expanded soap production. Women would schedule turns to assure tasks were performed.

The fact that women have leisure time does not mean that they wish to take up new economic activities, however. One group of Fulani women said they did not work very hard at present, felt their current needs were being adequately met, and did not want to take on further tasks. Not all Fulani are so contented, however, and some complain of long hours spent pounding millet, carrying water and vending milk. Others worry about the lack of health facilities for their children and themselves. Such women may be interested in new income-generating activities.

2.3.2.5.2 Rimalbe Women

Farming. Like the Fulani, Rimalbe women milk cows, but they also plant, cultivate and harvest as do the Mossi. In our sample, 10 out of 11 Rimalbe women said that they farmed, and a large majority also grew white millet, corn, cotton and beans (Table 2.57) on compound land. Although eight (72.7%) claimed to have farm land for themselves, none said they had their own millet fields. A few said they had their own millet granaries, however. On land allotted to them by their husbands they raised okra, peanuts, white millet, beans and sesame (Table 2.58).

For those who planted millet, the majority (81.8%) said they were assisted in the harvest by their husbands. Other wives assisted in slightly more than half of the cases as did other men of the compound and, to a lesser extent, children. All Rimalbe women said they helped other people with their millet harvests, especially their husbands (90.9%). Only one woman said she had paid workers to help in her fields during the past year.

Among the Rimalbe women, slightly less than half said they usually sold their farm produce. The major crop sold was peanuts by one-third of the women. Rimalbe women said that though they farmed, they sold very little of the farm unprocessed produce, but conserved it for family use. For example, only one woman sold white millet, one beans, but none said they sold cotton, okra or corn.

Women used the money from selling agricultural produce to buy clothing, jewelry and kola nuts. When asked what would be the most important purchase, three women cited buying jewelry, and one each mentioned buying animals and spices. All but one of the Rimalbe women said that the husband's permission was necessary prior to selling agricultural produce.

Crafts. As with the other ethnic groups, the most common craft activity was making cotton thread. Five women said they made butter and the same number made soap each year. A large number of sampled women made flour (N=11, 2.7%, X^2=29.864, P<.001, Cramer's V=.648) and the same number said they sold it. Indeed, the selling of flour and millet flour balls is a specialty of the Rimalbe ethnic group and the primary marketing activity for women. Thus, although women do not sell the millet harvest directly, they may use millet to make flour for sale. About half of the sample make mats and a few make yogurt. Mats and millet cakes were the only other craft items sold. With the money from the sale of craft items, women bought jewelry, condiments, milk and kola (Table 2.55).

Domestic Activities. The Rimalbe women prepare food in a similar manner to that of the Fulani. Millet is pounded, not ground. Four of the women responding cooked three to four times a week while six cooked daily. In terms of percentages, these numbers are similar to those for the Fulani.

Rimalbe women are also responsible for collecting water and wood. Seven women said they carried the family water themselves and two said their children did. Women made two to three trips to the well or pond daily. All of the Rimalbe women interviewed said they collected the family wood. Nine had collected wood two to four times during the eight days prior to the questionnaire, the mode being four. In many ways, the domestic routine of the Rimalbe is similar to that of the Mossi and will therefore not be described in detail here. During the dry season, they have some periods of leisure time.

2.3.2.5.3 Mossi Women

Farming. Unlike the Fulani, Mossi women are heavily engaged in farming during the rainy season and up through the time of the harvest in late November. All of the 34 Mossi women interviewed said that they farmed. On the communal compound fields, all Mossi women sampled grew white millet. Unlike the women in other ethnic groups, some Mossi women grew sorghum (red millet) and small millet. Almost all women grew corn and beans. Cotton and peanuts were also grown on compound-family land (Table 2.57).

Far more Mossi women said that they had land of their own to farm (aside from compound fields) than did those from the other two groups. Thirty-three of thirty-four women had such land contrasted to four of twenty-four for the Fulani and eight of eleven for the Rimalbe (X^2=40.378, p<.00001, Cramer's V = .75413). On these fields and garden land women grew a variety of crops (Table 2.58) such as white millet, peanuts, okra, sesame, beans and small peas. The agricultural produce from these fields not only helps support their families, but also gives them, through its sale, their disposable income.

The majority of the Mossi women said that their husbands had allotted them their millet fields and their garden lands. A woman who has her own millet fields, often has her own granary and the majority of the sample had granaries. This is in sharp contrast to the Fulani (Mossi, 67.6%; Rimalbe, 27.3%; Fulani, 0%; X^2 = 29.538, p< .001, Cramer's V = .645).

Mossi women assist men in the planting and cultivation of most of the crops listed in the tables, including tobacco which is considered a man's crop. At harvest time, women of the compound work together with the man to harvest each family member's fields. Almost all of the women said their husbands and children assisted in the millet harvest and about half said that other wives and other males in the compound also help. Very few cited neighbors, villagers or other relatives as helping in their harvest.

When they were asked whom they helped in the millet harvest, almost all named their husbands, about two-thirds, other women in the household and one-half, neighbors. A few others cited the village chief and village relatives. Only two Muslim Mossi women had paid workers to help in their fields during the past year. If a larger work party is needed for the harvest, women can request the help of other women outside the immediate compound, but part of the extended patrilineal group. The head wife of the patrilineal segment informs all the neighboring households of the need.

In sharp contrast to other groups, the major source of disposable income for Mossi women is the sale of agricultural products. While 27 of the 34 Mossi women said they usually sold farm produce, only five of the Rimalbe did and none of the Fulani ($X^2 = 35.680$, $p < .00001$, Cramer's $V = .708$).

Mossi women frequently cited peanuts, white millet and beans as crops sold. Less often mentioned were sorghum (red millet), small millet, okra and sesame. Before selling agricultural produce, a woman must obtain the permission of her husband or head of her compound to insure that there will be a sufficient crop reserve against possible future famine. One-fourth of the women sampled said that such permission was not necessary.

The vast majority of the Mossi women sold their agricultural produce in the village market. Only two women sold to a village trader, three to a travelling merchant, and one to OFNACER. Three sold at markets outside the village. None of the women of other ethnic groups in the village sold produce outside the village markets and most did not even sell there.

Proceeds from the sale of agricultural products were used to buy milk, kola nuts, clothing, tobacco, jewelry and animals (Table 2.56). The four women who said they used money from produce sales for livestock purchases were all Muslims.

None of the Mossi women said they used their money to buy millet, meat or medicines. Mossi women considered milk and condiments to be the most important purchases. The majority of women said it was necessary to obtain the husband's permission prior to spending money gained through the sale of agricultural produce.

Crafts. All but one Mossi woman said they spun cotton thread. Other important craft or food processing activities are making shea butter, making soap and making sorghum beer. A few other women listed processing millet into flour, weaving mats and making pots. Eleven women reported that they made other items, particularly prepared foods, such as millet cakes, for sale.

The major sale items were all in the area of processed food. Fifteen women (44.1%) sold prepared millet cakes and fritters while millet beer, flour and shea butter were sold by only a few of the Mossi women sampled. Women also sell peanut oil, soumballa and other items which did not appear in our sample of responses. Money gained from the sale of processed foods and crafts was used primarily to buy tobacco, kola, milk, condiments and clothing (Table 2.55).

Domestic Activities. A significant portion of a woman's daily labor is expended in collecting water and wood. Twenty-two of the 34 Mossi women (64.7%) said they carried the family water themselves, but 12 (35.3%) said their children did it, a higher percentage than that given by Fulani or Rimalbe. Twenty-eight women (82.4%) made two to three trips a day, while 19 (55.9%) made only two. All of the Mossi women said they collected the family wood, 31 (91.1%) collecting between two and four times during the eight days prior to the interview. The mode was two trips (N=15). Female children often assist.

Mossi women process millet by grinding it, generally in the evening around a communal, waist-high circular adobe platform, equipped with embedded grinding stones. Grinding of millet for a large family may take over an hour. If a man's wives have friendly relations with one another, they take turns accepting the major responsibility for preparing the evening meal for the family of co-wives and children. Other wives often assist in grinding the millet. Approximately one-fourth of the sample, especially those women in families without co-wives, cook the main meal every day. The majority, however, said they cooked three to four times during the previous eight days (see Hammond, 1966 for details of Mossi domestic life).

A typical day during the rainy season begins when a woman prepares a morning meal of millet and sauce (often left over from the previous night), makes a trip to get water and completes her other domestic tasks. She usually engages in farm work until the late afternoon. During harvest, a woman returns home in the late afternoon, often to make yet another trip for water or wood and then to begin preparing dinner which may be served around 8:00 p.m. While men can relax after a day of farm work, only women with helping daughters will find time to do so.

During the dry season, Mossi women have somewhat more leisure time, but much of this time is devoted to spinning cotton with other women under a mat shed or inside a hut. As the dry season progresses, women must spend more and more of their leisure time walking to the more distant sources of water.

Possible Expansion of Livestock Activities. The Mossi women in Koukoundi are extremely industrious. Despite their generally very busy days, they often say that they are willing to take on even more work if they can see a benefit in it for their families and themselves. Difficulties concerning the water supply appear to pose significant obstacles in Koukoundi in regard to the development of livestock projects involving women. The rainy season, while best in terms of water supply for such projects, is poorest in terms of women's available leisure time. Expanded activities in regard to poultry raising may be feasible, however.

2.3.2.6 Identification of Leaders and Innovators within the Community

This section presents details on the meetings held by the VLP team members with Koukoundi women both as a town-wide group and in their respective neighborhood and ethnic groups. At the end of the descriptions of the meetings with each ethnic group, we discuss the distinctive characteristics of those women from each ethnic group who, when asked on the questionnaire if they belonged to an association, spontaneously replied that they belonged to the group initiated by the VLP team members, hereafter known as the "Koukoundi Women's Group," or "K.W. group."

The women who so identified themselves had attended our public meetings and apparently shared an interest in improving the economic situation of village women, especially in regard to livestock. (Many of the problems voiced at these meetings concerned other subjects than livestock, such as the health of villagers.) By comparing the responses of the members of the K.W. group in each ethnic category with the wider ethnic sample, we may assess whether these potential leaders and innovators have any distinctive social characteristics. Although the total number of women questioned who said they belonged to the K.W. group was small (a total of 34), hopefully, the evidence may help government agencies to identify rural women likely to have interests in livestock issues, and in a wider perspective, in economic development.

2.3.2.6.1 The Initial Community-Wide Meeting

During the first week in Koukoundi, we requested that the chief summon the women of the village to meet with us to learn about the purpose of our study. More than 80 Fulani, Rimalbe, and Mossi women came to this assembly on October 26, 1978.

It was briefly explained that hopefully through the work with the Village Livestock Project and the Livestock Service, knowledge could be obtained concerning the current nature of local women's activities with livestock, their problems in this domain, and their hopes for the future. We stressed that the Livestock Service was already working with the men in the village and now wished to expand its activities to include women. We explained that it would be necessary to understand the daily and seasonal time constraints under which women operate and the work groups in which they normally participate, in order for suggestions to be made as to feasible livestock activities for women. In order to do this, many compounds and neighborhoods would be visited to consult women concerning their ownership and maintenance of cattle, goats, and poultry. We would also be administering a questionnaire to women on their daily activities and their current involvement with livestock. Individual opinions were then solicited and we were repeatedly told that while women were interested in keeping livestock, they had many problems in this area due to the high mortality rate of the animals.

During this initial meeting, there was not much interaction between the three different ethnic groups, especially between the Fulani, who clustered near to the VLP team, and the Mossi, who gathered together at the edge of the crowd. Fulani women dominated the discussions.

On the day following this meeting, we were informed by a Mossi man that there was a large group of Mossi women who had been unable to attend the meeting because of a death in their neighborhood. They requested that we come and speak to them separately. This meeting, which involved more than 55 women from two large animist Mossi compounds, will be discussed below.

During the initial meeting, we noted the names of those individuals who asked questions, spoke at length, or raised relevant issues. Later the compounds of those women and those of women from other large family groupings were visited. During our visits, women from neighboring compounds would come by and join the discussion. The names and compounds of all women who attended such formal and informal meetings were recorded. In this manner, it was possible to widen the social network contacts with each ethnic group and perceive common patterns of female interaction.

2.3.2.6.2 <u>Meetings with Fulani Women</u>

With two groups of Fulani women, discussions were held about animal health and vaccinations, and demonstrations were given on supplementary foods for infants. The demonstrations were given in response to the Mossi village women's demand to be taught something that would help them in their daily lives. An infant food formula was devised using products available to the village women--fresh milk, millet, or peanuts. The recipe was modelled on one used by nutritionists elsewhere in the Sahel (Belloncle, 1975).

The first meeting with Fulani women held in the compound of a prominent El Hajj, on November 12, was attended by 13 women from this compound and neighboring ones. The women said they had no cattle and few goats. Some had had chickens but they had died. They were not familiar with medicines or vaccines available for animals, but were interested in learning about them. They also indicated they were interested in keeping livestock, though they lacked the money to buy new stock or replace animals that had died.

The second formal meeting with Fulani women, held on December 14, in the compound of another El Hajj was organized by one of the El Hajj's wives, a prominent middle-aged woman of the community, who was articulate in group discussions and well informed in private interviews. The meeting, however, was poorly attended, having only five participants.

Attempts were made to organize a meeting centered in the Fulani neighborhood near the Chief's home. The elderly widow of the former chief and mother of the most successful (in Western terms) man born in the community was identified as a potential organizer. She was unable to gather a sufficient number of Fulani women together and suggested that this meeting best be held conjointly with the meeting planned for a contiguous group of Rimalbe women.

The problems encountered with these meetings are indicative of the wider difficulties experienced in identifying effective leaders among Fulani women. As pointed out earlier, one has few structural guides in locating these leaders; a woman's personality, not the position of her husband or family is the primary factor (Reisman, 1977). These women may come forward, however, if they see the program as compellingly affecting their own interests.

2.3.2.6.3 Distinctive Characteristics of Fulani Women in K.W. Group

Of the 24 Fulani women interviewed, only six identified themselves as members of the K.W. group. We compared these six with the total number of interviewed Fulani women in terms of the following characteristics:

Agricultural Activities. Although only four Fulani women sampled said they had land to farm, two of these identified themselves as members of the K.W. group. In general, members of this group tended to cultivate somewhat more than the other Fulani, e.g., they were the only respondents to grow some "little millet," maize, cotton and beans on communal land. Also, two of the four who said they had okra gardens were in this group.

Cooperative Work Patterns. A higher percentage of women in the K.W. group (67%) said that other women assisted them in the harvest than did Fulani women in the wider sample (25%). The only ones who said they helped their neighbors and the only woman who said she helped the other wives of her husband were also found in this group.

Livestock Ownership. Five of the six women in the K.W. group said they owned livestock (83% compared to 66.7% in the general Fulani sample). Although the only Fulani sheep owner was in this group, there was only one goat owner as compared to five in the wider Fulani sample.

A slightly higher percentage of these women had received cattle in their youth than in the larger of the sample, but none of the women said they had received cattle at marriage.

A larger percentage of K.W. women owned poultry (67% compared to 41.7%), and all had bought it themselves. Most of the K.W. women kept their poultry themselves (67% compared to 44.4%).

Many of the women who had lost animals in the past year (83% compared to 50%) were in this group as were two of the total of four Fulani women who had lost cattle and more than half of those who had lost chickens. A slighly higher percentage of women in the K.W. group recommended livestock as an investment for women (67% as compared to 54.2%).

Milk and Animal Sales. K.W. women were less inclined to spend money from milk sales on jewelry and clothing than were women in the wider sample. None milked goats. One of the two women who had sold cattle last year was in this group as were half of the total number of Fulani women who said they had sold poultry in the past two years. Here, also was the only woman who said she bought animals with the money from the sale of crafts.

Contacts with the Wider World. One out of four Fulani women who said they had lived in a large city were in the K.W. group and a somewhat higher percentage of the women had husbands who had worked in a city or abroad (60% compared to 47.8%).

Age and Rank. The K.W. group women were somewhat older than the wider sample, with half of the women in their forties as compared to less than a third for the wider Fulani sample. Approximately two-thirds of them said they came from households where there was more than one wife, as compared to one-third for the total Fulani sample.

It is not possible to make very strong statements about Fulani innovators from these small sample statistics. The data do appear to suggest, however, that the Fulani women who saw themselves as part of our nutrition livestock extension group were characterized by more farming activity, somewhat higher mutual help patterns, older age and more interest in livestock, especially poultry, than the wider Fulani group.

2.3.2.6.4 Meetings with Rimalbe Women

From observations gathered at the initial mass meeting and from conversations with the Rimalbe groupings, an elderly wife of a prominent cattle owner was identified as a possible leader. She was asked to bring together a group of interested women from the neighboring compounds of Rimalbe women. Promptly at the appointed time on October 26, 12 women gathered in her house to discuss their livestock interests and problems and to see our infant-food demonstration. These women were very concerned about severe health problems with their animals, especially goats and poultry. The previous year many of their goats had died. Others talked about problems of ticks and chicken cholera. When we mentioned the possibility of poultry vaccinations, they were interested and said they could pay the 15 CFAF for the two vaccinations available for chickens.

Problems of human health were even more pressing to them. They spoke about the absence of medical facilities, the inadequacy of medical supplies in nearby towns and the lack of a human vaccination program. They talked about sicknesses of their children and difficulties in childbirth. After more than an hour and a half of discussion, the infant feeding demonstration was given and was well received.

The leader initially identified in this group was quite effective. She is clearly a woman of responsibility who possesses much insight into other women's problems. Differences in wealth did not appear to affect the cohesion of this group; several other middle-aged women who were active participants were not economically well-off. The two young Rulani women did not contribute to the discussion, but were interested in the demonstration.

2.3.2.6.5 Distinctive Characteristics of Rimalbe Women in K.W. Group

Because 8 of the 11 Rimalbe women sampled identified themselves as members of the K.W. group, it is difficult to discuss this subgroup apart from the wider Rimalbe sample. However, certain elements may be noted.

Agricultural Activity. The only Rimalbe woman who had paid workers for tending her fields during the last year was in the K.W. group. The only woman who said she used the money from agricultural sales to buy livestock was also a member.

Cooperative Work Patterns. Slightly more members of the K.W. group helped other wives of their husbands with the harvest (25% compared to 18.2%). The only Rimalbe women who claimed to have helped her husband's neighbors or village relations and the only one who said she had helped were also in this group.

Livestock Ownership. All the women in the K.W. group said they owned animals as compared to 90.9% for the total Rimalbe sample. The only two women to own sheep were members as were all five who owned goats, the four who had lost goats during the past year, and the only two who said they had lost chickens.

Milk and Animal Sales. In the total Rimalbe sample, only three women said they milked cows, and these three were in the K.W. group. Seven of the eight Rimalbe women sampled who milked goats were also members. None of the women sold milk.

The only two Rimalbe women who said they bought animals with the money from craft sales identified themselves as members of the K.W. group, as did seven of the eight women who said they would advise other women to invest money in livestock. The percentage of women selling goats was less, however, than the general Rimalbe sample (17% compared to 33%).

Contacts with the Wider World. The only Rimalbe woman sampled who said she had lived in another country (Ivory Coast) was in the K.W. group, as were the only four Rimalbe women who said their husbands have worked abroad. The only woman who had spoken to a government agent was also a member.

Age and Rank. The women in the K.W. group were slightly younger than those in the wider sample, but age cannot be said to be a significant factor in group membership. Households with only one wife were slightly underrepresented as compared to the wider Rimalbe sample.

This sub-sample of Rimalbe women has similar farming and marketing patterns to the wider Rimalbe sample, but female livestock owners are heavily represented in it as are those women whose husbands have been exposed to modernizing influences through their work outside the village.

2.3.2.6.6 Meetings with Mossi Women

Of the three ethnic groups, the most effective leadership and the largest turnouts at meetings occurred among the Mossi. On October 27, the day following our initial mass meeting, we attended a gathering of 55 Mossi women from two large contiguous patrilineal compounds. Although they did not normally meet together they were responding to the call to meet us given by the chief. The group, which was largely composed of animists, spoke about deaths of goats and chickens and the women's inability to replace lost animals because of lack of money. One partilineal group said that their husbands did not allow them to own animals. Men consider themselves not only the owners of the compound but also of all animals therein.

Both of these groups of women had traditional Mossi women's leaders called Paquiema, the senior wife (or widow) of the senior elder of the patrilineage, who traditionally mobilizes women for meetings and communal labor. Although at the outset we tried several times to organize more detailed meetings and demonstrations with these women, we were informed that such activities would have to wait until after the harvest of all crops.

Early in January, we did arrange meetings with these two groups, discuss livestock vaccinations, and give demonstrations of infant food. One group expressed interest in vaccinating their animals and were given detailed information on the subject by the VLP extension worker. They said they both wanted and could pay for poultry vaccinations. Even in the compounds where only men owned chickens, women said they would be allowed to participate in a government-backed poultry project if one were available. They stated, however, that if both men and women were in the same project the men would not share the money fairly with the women.

Initially, both of these groups were difficult to organize, probably because we had to rely solely on the traditional leaders, rather than younger, more instrumentally oriented women. Although they could see advantages to a livestock program, their primary interests were improvements in infant and adult health. They argued that if women had better health they would have more strength to develop livestock activities.

Of all the women's groups in Koukoundi, the best organized and most consistent in participating in our meetings was a group representing numerous Mossi Muslim compounds. On November 6, at their invitation, we went to discuss our project with this group of 22 women. They explained that they had not been able to hear us at the initial mass meeting due to the "noisy conversation" of the Fulani. These women were articulate in discussing the deaths of their animals and the needs of the community. Their request for infant health and nutrition information first led us to develop our demonstrations of infant food preparations. Upon request, three subsequent meetings were held with this group to discuss not only livestock matters but also first-aid measures and the possibility of communal gardening.

The concerns of this group were similar to those already outlined for the other Mossi. They differed from the others mainly in the effectiveness of their organization. There were two leaders, one the traditional, elderly Paquiema of a lineage segment, the other a middle-aged Mossi woman who appeared to be searching for ways to improve her own and other women's life situations. Neither woman had travelled much outside Koukoundi, but the younger leader's husband worked for the AVV Project thus providing a very important contact with the world outside the village.

Another factor in this group's cohesion was that the women were linked together not only by ethnicity and neighborhood, but also through religion. These Muslim women pray together prior to major Muslim holidays. Further, many of them sit together in the same adjoining stalls at the Koukoundi market, vending dried fish, millet cakes and agricultural products.

In the same neighborhood with the Mossi Muslim women's group was another cluster of Mossi women, animist and Christian, who though they shared many concerns with the Mossi Muslim women, had never been informed about the latter's meetings with us. These public meetings, held under a large tree, were probably visible to members of the animist households.

To this largely animist group we also gave vaccination information and the food demonstration. We suggested to both the Muslim and animist Mossi groups that they try to widen their communication network to include one another in matters of common interest.

2.3.2.6.7 Distinctive Characteristics of Mossi Women in K.W. Group

There were 20 Mossi women who identified themselves as members of the K.W. group. They were compared with the complete

Mossi sample of 34 women on the following characteristics:

Agricultural Activities. These women, while similar to the wider Mossi sample in agricultural practices, represented an especially active agricultural component, e.g., four of the five Mossi women who cultivated red millet on communal land were members of it as was the only woman to grow cassava and the only two Mossi women who had personally arranged to get extra farming land from the Chief. A slightly higher proportion of these Mossi women had their own millet granaries (75% compared to 67.6%).

Cooperative Work Patterns. The Mossi women in the K.W. group showed a higher degree of mutual cooperation in regard to farming than did the wider sample, e.g., while only 52.9% of the total 34 Mossi women interviewed said that other wives assisted them in the millet harvest, the percentage rose to 70% for the sub-sample. 85% said they helped other women of their husband's compound with the harvest as compared to 64.7% for the Mossi in general. A slightly higher number also said that they helped their neighbors and relatives in the village.

Market Activity. The K.W. women were innovative traders. The only two women in the village who sold to village traders were in this group as were two of the three (from a sample of 71) who sold to travelling traders. Only three women in the entire Koukoundi sample sold their goods outside the village market, and two of these women were in the K.W. group. The number of women who said they traded in the weekly market, however, was similar to that for the Mossi sample as a whole.

In terms of buying patterns, a larger percentage of women used their money from the sale of agricultural produce to buy clothing than in the wider Mossi sample (60% compared to 44.1%) and all of the Mossi women who said they used this money to buy jewelry were included.

Livestock Ownership. Livestock holdings were generally similar to the wider sample, but fewer women in the K.W. group owned goats (20% compared to 35.3%). They did, however, show a higher degree of initiative, e.g., the four Mossi women who said they would pay for the vaccination of their small ruminants themselves were in the K.W. group. The only Mossi woman who milked goats was a member, as were the only two women of the 71 who sold eggs. Only five women in the entire Koukoundi sample said that they ate chicken eggs, and four of them identified themselves as members of the K.W. group.

Looking at livestock sales, slightly more women in this subgroup said that their husbands' permission was necessary for an animal sale. Clothing ranked as the main reason for the sale of animals (38% here as compared to 20% in the general Mossi sample). Somewhat fewer women in this group, however, said they would advise other women to invest in animals if they had extra money.

Crafts Production. In the area of crafts, more women from the K.W. group made soap and more sold millet cakes than the wider Mossi sample. With the money from crafts and prepared food sales, women tended to buy jewelry and milk (6 of the 8 total Mossi milk-buyers are here).

Contacts with the Wider World. Unlike Fulani and Rimalbe, the percentages of women with husbands who had worked in large city or abroad were only slightly higher than the Mossi sample as a whole.

Age and Rank. Ages of group members were similar to those of the general Mossi sample, although there were a few more women in their 20's. Rather few women were members of one-wife households than in the general sample.

A pattern emerges of women active in trade and marketing, highly involved in cooperative work patterns, and interested in health measures in regard to livestock.

2.3.2.6.8 Distinctive Characteristics of Mossi Muslim Women in K.W. Group

Because of the important role that the Muslim women played in the mobilization of women in Koukoundi, it is important to delineate more fully the characteristics of those Mossi Muslim women who identified themselves as members of the K.W. group. This group continually sought us out and they were not an artificial construct of our presence as might be said of the other groups. Their cohesiveness as a group has continued after our departure as will be seen below. Eleven of the 16 Mossi Muslim women sampled said they were members of the K.W. group as compared to nine of the 18 Mossi animists. In general the differences specified here are also found when one compares the total Mossi Muslim sample (N=16) with the total Mossi animist sample (N=18).

Agricultural Activities. Farming patterns appear to be much the same as for the Mossi animists in the K.W. group. More of the animists, however, indicated that they had their own millet granaries (89% compared to 64%). In the entire Mossi sample (N=34) only two women said they paid laborers to work in their fields during the past year, and these women were Muslim members of the K.W. group.

Cooperative Work Patterns. The Mossi Muslim women relied less on assistance from other wives during the harvest than did the animists. These data may simply reflect the fact that fewer sampled Muslim Mossi than animists came from polygamous households. They relied more on help in the harvest from compound males than did the animist Mossi women in the K.W. group. Approximately half of the Muslim Mossi said they helped unspecified others in the harvest as compared to 11% of the animists.

Market Activity. Marketing patterns appear to be similar among the Muslims and animists in the K.W. group; though a slightly larger percentage of animists, indicated that they traded in the market. Consumption habits were somewhat different for the two subgroups. The animists more often said they used the money from the sale of agricultural products to buy clothing (78% compared to 45%), and milk (89% compared to 45%), tobacco (67% compared to 27%) and kola (67% compared to 45%). Almost a fifth of the subsample of Mossi Muslims used the money from agricultural sales to buy livestock, though none of the animists said that they did so.

Livestock Ownership. It is in this area that the most striking differences appear. Approximately three-fourths of the Mossi Muslims in the K.W. group said they owned livestock as compared to a third of the animists. One Muslim but no animists sold sheep during the past year. The number of women who sold goats in the K.W. group was divided evenly between Muslims and animists. One of the two Mossi women who said that she vaccinated small ruminants was in the K.W. group. One Mossi Muslim milked goats, but none of the animists reported doing so.

The major differences between the two subgroups occurred in ownership of poultry, with 88% of the Muslims saying they owned them compared to only 33% of the animists. Of the Muslims, 88% said that they kept their poultry themselves, as compared to only 33% of the animists. More of the Muslims said that they had lost chickens during the past year and more also indicated that they had sold them. The only two women who sold eggs were Mossi Muslims in the K.W. group. More of the animists ate chicken eggs (33%) than did the Muslims (9%). Mossi Muslim women in the K.W. group said they would advise a woman to invest in animals and jewelry, while the animists suggested millet and jewelry.

Contacts with the Wider World. One Mossi Muslim had lived in a large city (Ouagadougou). Sixty-four percent of the Muslim women's husbands as compared to 44% of those of the animists were said to have worked in a large city or abroad. Abidjan was the most popular city for both groups.

Age and Rank. Age differences do not appear to be significant, slightly more of the animists were in their 50s compared to the Muslims, but slightly less were in their 40s. All animists in the K.W. group came from polygamous households while 45% of the Muslims came from monogamous onces. Eighty-two percent of the Muslims were first (or only) wives while 78% of the animists were second (or third or fourth) wives. (These figures are not peculiar to the K.W. group, however, and merely reflect characteristics of the town-wide sample.)

We have here a subgroup of women who, while sharing many interests with the Mossi animists, directed more attention than did the other Mossi to poultry raising. Through their husbands, they had also experienced more contact with the world outside the village.

2.3.2.6.9 The Second Community-Wide Meeting

Before leaving Koukoundi, we asked each of the seven groups with whom we had met to select representatives to come together and form a central committee to represent the livestock interests of women to the VLP. These seven representatives consisted of two Fulani (1 from Sorgho), one Rimalbe, and four Mossi.

On 16 January, a group consisting of representatives of each of the four Mossi groups (three of which were animist), the chief's wife representing the Fulani, and a Rimalbe representative met together to restate their problems concerning livestock and their hopes for the future (Table 2.59). They presented as a major concern the need for water if there was to be increased interest in livestock, a desire for medicines for the animals, and a hope for better medical facilities for human beings in the village. The women affirmed that they would be interested in undertaking a poultry project. They also said that they would continue to meet and discuss issues with the local livestock project personnel.

2.3.2.6.10 Projects Undertaken by Koukoundi Women

After our departure, the Mossi Muslim women again expressed interest in a poultry project. With the cooperation of VLP personnel and the assistance and approval of their husbands, they decided to establish a small poultry project to which they would bring their own chickens and have, in addition, four to five roosters of an improved breed. They also agreed to vaccinate their chickens. The list giving these women's names (Table 2.60) shows clearly that almost all of the women present were Mossi Muslims. The Mossi animists, who had been in strong attendance at the last community-wide meeting, were either uninformed of this new activity, uninterested in joining it at this time, or uncomfortable in the presence of such a well-organized Muslim group.

The same group of Mossi Muslim women also intended to begin a communal garden with the hope of earning money from the sale of cash crops to buy medicines and other improvements for the village. They had been encouraged to undertake such an activity by the visit of a female extension worker from a neighboring area.

TABLE 2.59

KOUKOUNDI VILLAGE WOMEN'S LIVESTOCK COMMITTEE REPRESENTATIVES

16 January 1979

1. SAWADOGO Pogyaga (A21, Mossi Muslim)
2. SAWADOGO Mariam (A16, Mossi animist)
3. BOLY Abata (A4, Rimalbe)
4. BOLY Aminata (A1, Fulani)
5. __________ (Sorgho, Fulani)
6. OUEDRAOGO Paugbanega (A33, Mossi animist)
7. SAWADOGO Nobila (A35, Mossi animist)

TABLE 2.60

WOMEN IN KOUKOUNDI WHO ATTENDED MEETINGS CONCERNING

A COOPERATIVE CHICKEN PROJECT

Compound	Woman	Husband's Name
A-19	SAWADOGO Pougyoudou	SANKARA Yembila (Mossi Muslim)
?	Alizeto RABO	
A-14	SAWADOGO Pogyanga	
	(Pamolole)	SWADOGO Kimbila (Mossi animist)
A-13	Quedraogo Pousga	OUEDRAOGO Saidou (Mossi Muslim)
A-12	SAWADOGO Tene	SAWADOGO AMADOU "
(A-23)?	SAWADOGO Tene	Salif SANKARA "
A-19	SAWADOGO Fatimata	SANKARA Yembila "
A-12	SAWADOGO Ramata	SAWADOGO Alaye "
A-11	OUEDRAOGO Haoua	SAWADOGO Bangre "
A-19	OUEDRAOGO Minata	SANKARA Moussa "
?	DIARRA Mamounata	" " "
A-21	SAWADOGO Asseta	SAWADOGO Oumarou "

Links of the Mossi Muslims with Mossi animists, as well as with Fulani and Rimalbe, are tenuous at best. It might be possible for the VLP to reinforce these links by calling together the "official" women's livestock committee (Table 2.59) to discuss the poultry project, its impact on the wider ocmmunity, and other livestock matters relevant to women.

2.3.2.7 Some Possible Livestock Programs for Women

Animal health programs are already underway in Koukoundi and could have a favorable impact on the economic position of women. Fulani and Rimalbe women would be primarily affected if the health and milk production of cattle were improved. It must be stressed, however, that any program which proposes limiting Fulani women's access to milk in attempting to improve nutrition for calves could severely threaten the Fulani women's economy. These women turn for their disposable income, not to ownership of cattle or even increase in these cattle for sale, but rather to daily milk sales. Profits from the sale of cattle might never reach women, since their "ownership" of cattle is extremely limited. Any program advocating increased sale of animals must be undertaken in conjunction with opening up opportunities for cattle purchasing (perhaps through credit) by women.

Experimental efforts to improve the breeds of cattle for dairy purposes could also be advantageous to women. Milk is one of the major items purchased by the Mossi and Rimalbe. With increased milk production, increased soap production would also be a possibility. Projects to improve the quality of soap have had some success in other Fulani areas. This could occur in conjunction with a hygiene program related to food preparation and milking. The cost of this improved soap and its marketing outlets would, however, have to be considered initially.

Cheese making is another possible project but one that would only become feasible given an increased supply of milk. At present there is no local market for cheese and no milk surplus.

Female extension workers can play an important part in a training program directed toward fostering hygienic milking practices through educating women about the importance of personal cleanliness and cleanliness of utensils. Women also need to be educated about diseases transmitted to humans through the milk and meat from diseased animals. Male extension workers should pursue a similar program with the men.

An unplanned change that may have many consequences for Koukoundi women is the introduction during the past two years of dry milk, usually U. S. surplus, now sold at the Sabsé market for a price of only 150 CFA for 2 kilograms. It has been readily accepted by Fulani women and they are selling it to a limited extent. either as fresh milk or as yogurt. Obviously, over the short run this new commodity is good for the Fulani women's economy, enabling them to continue selling their major produce during slack periods in local milk production and potentially to increase their sales at other times.

The impact is not, however, entirely positive, even for Fulani women. After a demand has been created by the introduction of a surplus low-priced product, the supply may be affected by unforeseen changes in donor nation policies, which may adversely affect both supply and price. Further, it may be argued that reliance on dry milk may lower interest in future programs to improve the quality of dairy cows.

Another trend is slowly emerging which may be even less favorable for Fulani women. Rimalbe and Mossi women are learning about dry milk, and some of them are beginning to buy it, thus eliminating the need to purchase Fulani milk. So far most Mossi and Rimalbe women prefer to buy small quantities of Fulani milk for 5-25 CFA.

In spite of the negative features cited concerning dry milk, its use probably cannot be easily eliminated, nor can one say assuredly that it should be. The nutritional benefits for the community to be derived from the widespread use of powdered milk, while less than that of whole milk, cannot be ignored. One of the major hygiene problems is that dry milk is mixed with local water. Clearly, an educational campaign will be needed concerning the proper use and preparation of powdered milk, its benefits and its limitations (for example its tendency to cause diarrhea and its great inferiority to mother's milk in the diet of small children). Any such campaign should take care to emphasize the value of whole milk traditionally provided by Fulani women.

Sheep and goat vaccinations would be helpful to women in Koukoundi as would access to other medicines. At present, both female and male livestock owners often consider vaccinations and pills such as "Exhelm" to substitute for each other. More intensive information and demonstration programs on small ruminant diseases and remedies might be conducted in the various neighborhoods, using the male and female livestock committees to create links between the government agencies and the local population. Nutritional education programs should be part of all vaccination programs, and an education program to introduce controlled goat milking to the Mossi might also be considered.

As noted in the report, over half of the Koukoundi women sampled owned poultry, Rimalbe and Mossi women (especially Muslim Mossi) constituting the largest numbers of poultry owners. Although women in the different ethnic groups, especially the Mossi and the Rimalbe, expressed interest in a poultry project, the group of women who finally initiated such a project consisted almost entirely of Muslim Mossi.

Poultry projects involving the construction of decentralized chicken coops should be developed among the different ethnic groups as interest develops. Poultry projects involving communal efforts combining Mossi and Fulani, Fulani and Rimalbe and possibly Mossi and Rimalbe have, in my opinion, a high risk factor since these differing ethnic groups lack other cooperative organizational bases. This same problem also appears to affect relations between Muslim Mossi and animist Mossi women. Cooperation among these women could develop, however, from common interests growing out of joint service on the townwide women's livestock committee. The female livestock committee could coordinate a poultry vaccination program (which women would find highly acceptable), and also give direction as to which areas of the village are most feasible for vaccination and poultry projects and which groups of women most interested.

A nutritional program should be part of the developing poultry projects to encourage individuals to add more protein to their diets. Egg consumption, especially among children, could be increased. Most women of child-bearing age fear that egg-eating will cause difficult childbirth, but some modification of these beliefs might be possible through concerted effort by a local female extension worker. An investigation of possible poultry and egg markets should also be undertaken.

The goal of female extension workers should be first to provide the necessary training for village women to manage their own economic affairs, and thereafter to serve as resource personnel. Initially, programs on the village level should be as decentralized as possible, permitting women to work with others in whom they have confidence. Planners ought also to be sensitized to the fact that many women in Koukoundi believe they would be more fairly treated financially in projects involving only women.

The Livestock Service has an opportunity to help women expand their personal incomes and increase the nutritional level of their families. Even in those compounds where women at present hold little or no livestock, women repeatedly stressed that their men would accept changes if a government program, carefully explained and developed, initiated change.

2.3.2.8 Conclusions

Economic activities of women in Koukoundi are quite varied, as are their social interaction patterns. It is apparent that any program intending to improve the economic condition of rural women in this area must take into account the women's differing social orientations, work patterns, sources of disposable income, and consumption habits. At present there is little communication between two of the ethnic groups (Mossi and Fulani), and the Rimalbe (though they are in close contact with the Fulani) appear to have strong reservations about working with Fulani on cooperative development programs.

Initially, it would be advisable for officials planning development programs to encourage the formation of village women's committees, composed of representatives from neighborhood or patrilineal groupings from the different ethnic segments. (In Koukoundi a male livestock committee has been formed.) Traditional and innovative community leaders should be identified, including a significant number of middle-aged women, often the major female livestock holders. Cooperation between women can develop from interests growing out of service on a women's committee. The committee could work with planners on the type of programs suggested above, or on others which the women might initiate themselves.

As shown in the survey, government representatives from livestock and agricultural agencies have practically no contact with the women of the community, despite the fact that women have significant interests in both of these areas. For example, women are concerned about acquiring more animals and keeping healthy those they have. Livestock are often seen as a form of saving, but a rather uncertain one at present due to the prevalence of disease. Women are also interested in participating in communal gardening projects they are beginning to learn about from neighboring areas.

Most women from the three ethnic groups in the village want to improve their very difficult lives. Planners must, however, take great care that they do not initiate projects which will only add to the daily burdens that women already bear.

2.3.3 Livestock Producers' Committees

An integrated program of community development activities affecting the livestock sector was undertaken. The theoretical basis for the community development activities was derived from two complementary perspectives widely current in the development literature*: (1) the concept of social mobilization as put forth by Karl

*The aim of this discussion is not to present a thorough or even partial review of the relevant literature, but to explain project activities related to formation of local committees.

Deutsch, and (2) a modified version of the concept of institutionalization established by Milton Esman and others.

Social mobilization is the process whereby parts of existing attitudes, values and behavioral dispositions are broken down and people become ready to adopt new sets of attitudes, values and behaviors which are supportive of development efforts. A strategy of social mobilization is geared to decreasing the commitment of rural people to long standing ideas, traditions and actions which interfere with the adoption of modern technical innovations. In the most simple terms, the goal is to lay the groundwork for changing the mentality of the rural farmer or livestock producer.

Institutionalization is the process in which local organizations are established and become effectively linked with both the sociopolitical structure and the value system of the people. New organizations designed to assist with development efforts must not only be created but must become "valued" in the local context. People must come to regard these organizations in a positive light and as a legitimate means of promoting change in existing practices or production methods. Some form of positive reinforcement is thus a necessity in the early stages of organizational development.

At this point it would be useful to distinguish between community development as conceived here and the French concept of "animation rurale" implemented in Upper Volta in the 1960s and early 70s. According to Diarra Sadek Boubacar, the goals are basically the same, "to enlist the support and participation of the people in developmental operations designed to promote local as well as national progress." Animation, however, places emphasis on changing the attitudes of rural people but largely ignores the question of the creation of an organizational basis for the initiation and ongoing management of change.

The failure of programs of animation can in large part be attributed to the low priority attached to organizational development and institutionalization. Any successful effort to change people's attitudes, values and behaviors must provide some form of positive reinforcement for appropriate changes. Because animation lacked a solid organizational component, its links with central, regional and local authorities were tenuous at best and in many cases non-existent. Animators lacked both the organizational resources to garner outside support for their villages and the technical expertise and backup to implement purely local projects. Animators as well as villagers were soon discouraged.

The community development approach implemented in the VLP recognized the importance of social mobilization efforts, but also their inherent limitations. The CID team overcame these difficulties by carefully coordinating mobilization and organizational work. Livestock development organizations were established at each site (an area including from 3 to 25 villages). These organizations were developed in close coordination with traditional authorities (chiefs, earth priests and elders), local livestock producers, local administrative authorities, local representatives of the various technical services (Livestock Service, Agricultural Service, Water and Forests) and representatives of the project (project staff and extension agents).

The purposes served by these groups are:

1. To open regular communication channels between villagers, traditional authorities and local opinion leaders on the one hand, and the National Livestock Service and its representatives (at all levels) on the other.
2. To mobilize villagers . . . to raise the consciousness of villagers regarding the possibilities for the utilization of improved means of animal health and production, through educational efforts and practical demonstrations.
3. To provide villagers with organizational resources with which they can effectively express their needs and interests.
4. To provide villagers with the organizational resources necessary for the successful implementation and management of new techniques and practices.

These organizations provide the social means not only for changes to be introduced during the first stage of this project. They can also serve as a basis for future contracts and the initiation of innovations proposed by the National Livestock Service for this region. Finally, they may provide a model for the development, on a national scale, of local livestock producers associations and an expanded program of extension work.

Initially, a two-tiered system of local groups was envisioned. The first tier consists of site-wide committees composed of representatives of villages and neighborhoods within an area defined physically by a natural drainage basin. The second tier would consist of village groups of livestock producers to be established first in select "target" villages, and later in all villages which prove receptive to the idea.

2.3.3.1 Site Committees

The site level committees were designed to provide a linkage between all villages and ethnic groups within the site. These organizations are the initial contact points for project interventions.

The site committees disseminate information about project activities and also play important decision-making and administrative roles. Committee members are expected to see that local livestock producers are aware of vaccination campaigns. They have made decisions about the type of construction and location of vaccination corrals currently being built under the supervision of the CID team. In the case of the range management program, when a committee agrees to establish a controlled grazing scheme or grazing reserve, the committee members themselves are charged with much of the day-to-day administration and supervision. The committee helps choose the location for cement-lined wells for both human and livestock use. Finally, the results of village level project interventions are communicated to all site villages through their representatives.

Site committees of livestock producers were established and are functioning in all project sites. A description of the formation process and a list of the members of these committees can be found in Appendix 6.3. Each committee member is to talk to all the livestock producers in his village and be prepared to discuss their problems, questions, and ideas at committee meetings. They then report back to the villagers on the discussions, ideas, and proposals presented by other committeemen and the project team. Project extension agents (two in each site) inform representatives of the date and time of meetings and assist in providing explanations of project activities to villagers.

Meetings are held monthly in each site. Extension agents and, where possible, the local chef de post (livestock service), attend each meeting. The entire project team attends the meetings of each committee every second or third month. The project's Voltaic co-director and the chef de circonscription (livestock) in Kaya also attended several such meetings. Individual team members are also present at other monthly committee meetings when specific project interventions are being dealt with. A number of proposed project interventions, namely poultry, range, and animal health schemes were explained to the relevant committees.

The Tafogo livestock producers committee was organized and assembled for the first time in March 1978. Meetings are held approximately every two months, usually in the Tafogo Chief's compound. Project personnel assist representatives of the Livestock Service or the extension agents at the site. Discussions concerning difficulties within the community, project proposals, vaccination campaigns, and roject progress are part of the agenda. In addition to 16 members representing 13 villages, several interested visitors usually attend the meetings.

A range management subcommittee was formed there in December 1978, just prior to making the selection of range demonstration exclosure and inclosure plots to assist with the various range management activities and with selection of the demonstration plots, discussions and implementation. The function of the group is to advise the Project range manager in matters of traditional husbandry and range management.

Five members were chosen by the elders:

Name	Ethnic Group	Village
Bougourana Sabga	Mossi	Gougou
Rakimdian Hama	Fulani	Gougou
Diande Hamidou	Fulani	Tafogo

Name	Ethnic Group	Village
Ousmane Sawadogo	Mossi	Tafogo
Diande Yaro	Fulani	Tafogo

The sub-committee was activated two times for the following purposes:

1. to select range demonstration plot sites.
2. to view the newly fenced demonstration plots (the exclosure and inclosure plots).

2.3.3.2 Village Level Groups

Site committees, although serving their purpose quite well, could not by themselves effectively penetrate the belief systems of the rural livestock producers. For example, preliminary studies indicated that even livestock vaccinations, a widely accepted practice, were poorly understood. Large numbers of rural livestock producers have no comprehension of the use of vaccinations as preventative measures. When some of their animals become sick they begin to consider the need to vaccinate. Often this is too late. Obviously there is an intense need for the National Livestock Service to develop a direct means of contact with local livestock producers. Village level groups can provide at least a partial answer to this problem.

Village livestock producer groups are now in the planning stages. They will be established first in "target" villages (i.e., those villages which express a clear willingness to test proposed innovations). In these villages an intensive effort will be undertaken to organize, educate and train villagers in a specific project activity.

2.3.4 Institutional Resources

Activities pertaining to the livestock sector are concentrated in relatively few government institutions. The principal ones of these are outlined in this section. Shortage of trained personnel is the most fundamental obstacle to the development of the livestock sector in Upper Volta. Communication and coordination between agencies is, however, noticeably deficient. This inhibits the development of national-level livestock policies. Although charged with broad administrative functions, with limited budget and personnel, the National Livestock Service has increasingly concentrated its efforts on animal health measures. The National Office for Development of Animal Resources (ONERA) is concerned with the commercialization of animal products and the Water and Forests Bureau with environmental management.

The semi-autonomous nature of the ORDs can potentially reduce the functional divisions between bureaucratic units. Within each of the eleven ORDs many GOUV programs are subject to regional level integration. At this level the quality of leadership and degree of organizational development varies greatly; nonetheless, they are becoming important to the implementation of livestock programs and projects. The division between national agency and regional ORD has yet to be completely defined. The formation of national policy, the planning of broad programs, and the coordination of financial resources remain functions of the central bureaucracy. These agencies are located primarily and sometimes exclusively in Ouagadougou, the capital. The hierarchical administrative network necessary for translating these decisions into local actions is incomplete. The VLP represents an attempt to utilize and develop existing institutional resources to bridge the gap between national bureaucracy and local livestock producers. As it has been implemented within the organizational framework of the National Livestock Service, this agency will be analyzed in greater detail than others.

2.3.4.1 Livestock Production and Animal Industries Administration (DEIA)

The National Livestock Service is part of DEIA and is officially charged with the following general functions:

1. Carrying out necessary studies to formulate a livestock development policy.
2. Preparation of national livestock programs.
3. Control and evaluation of the execution of livestock production and animal industry programs.

4. Provision of technical assistance to other agencies carrying out applied research and experimentation.
5. Provision of a technical liaison with national and international planning agencies.
6. Research and experimentation, indirect and direct, into the livestock and animal industry sector.
7. Definition and execution of general and technical training programs.
8. Coordination of veterinary and zoological training programs.
9. Regulation and protection of the rural economy especially as regards livestock raising and animal industry.

Specific functions and internal organizations are discussed below.

Budget and Support. The Livestock Service is centered in Ouagadougou and falls under the administrative direction of the Ministry of Rural Development. The agency is budgeted annually by GOUV. Since independence the annual budget has decreased from 1.52% to .88% of the total national budget. At the same time the percentage of the Livestock Service budget spent on materials has decreased from almost one-third (31%) to the present 11%. The remaining 90% is alloted to the payment of salaries for personnel. In absolute terms, unadjusted for inflation, the annual budget of the Livestock Service increased from 116.5 million CFAF, in 1961 to 186.9 million CFAF in 1976. These changes are reflected in Table 2.61. The result has been that the Service is understaffed and has become almost totally dependent on foreign aid in the financing of its activities.

Organization and Personnel. The divisions within the Service can be seen in the organizational chart (Figure 2.15) and the breakdown of personnel is given in Table 2.62.

The director and the assistant director are responsible for relations between the Service and the Ministry of Rural Development. The director also has authority over all Service employees and is responsible on a national scale for research on livestock raising, animal production, animal pathology, animal health policy, and control of quality and healthfulness of animal foodstuffs.

TABLE 2.61

SHARE OF LIVESTOCK SERVICE IN PUBLIC EXPENDITURES FOR SELECTED YEARS

Year	National Budget (million CFAF)	Budget of Livestock Service: Total (million CFAF)	% of National Budget	Personnel (million CFAF)	Materials (million CFAF)	Share of Materials in Total Livestock Budget (%)
1961	7,664.5	116.5	1.52	80.4	36.4	31
1966	9,157.0	131.2	1.43	110.0	21.2	16
1971	10,515.2	128.6	1.27	114.1	14.5	11
1976	21,122.0	186.9	0.88	166.4	20.5	11

Source: Ministry of Planning and Cooperation.

TABLE 2.62

PERSONNEL OF THE LIVESTOCK SERVICE FOR

1972, 1976 and 1981

Personnel	1972	1976	Projected, 1981
Expatriate veterinary doctors	2	2	0
National veterinary doctors	9	8	18
African veterinaries	4	4	0
Contract veterinaries	0	1	0
Expatriate animal scientists	1	1	0
Construction engineers	0	0	28
Livestock assistants	32	43	63
Veterinary nurses	157	179	227
Livestock surveyors	0	0	30
Consultants, economic affairs	0	0	1
Chemical engineers	0	0	1
Total	205	240	373
Administrative secretaries	1	1	1
Administrative assistants	1	0	1
Office agents	5	5	9
Total	7	6	11

Source: Ministry of Planning and Cooperation.

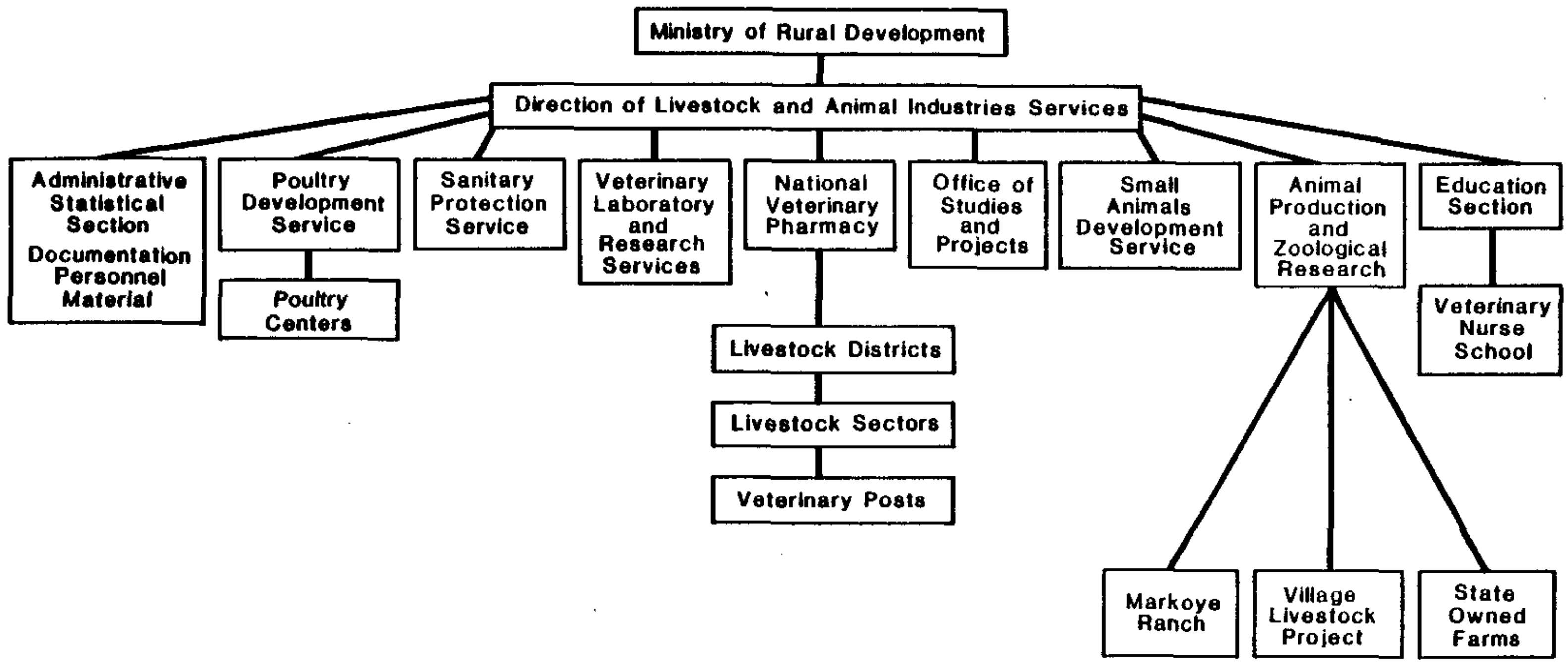

Figure 2.15 ORGANIZATIONAL STRUCTURE OF THE NATIONAL LIVESTOCK SERVICE

The National Livestock Service is composed of the following administrative subdivisions with the following responsibilities:

1. Administrative and Bookkeeping Service:

   Establishing the budget.

   Personnel management.

   Material and credit administration.

2. Archives Documentation and Statistics Bureau

   Collection, utilization, and distribution of all documents of interest to the technical services.

   Establishing livestock and animal industry statistics.

   Completing periodic reports.

   Managing the library.

3. Studies and Projects Bureau

   Carrying out studies and putting projects into action.

   Evaluation of existing livestock development programs.

   Conveying project information to agencies outside the Livestock Service.

4. Animal Health Protection Service

   Carry out national animal prophylaxis campaigns.

   Assist the ORDs to maintain active animal health programs.

5. Diagnostic Laboratory and Veterinary Research Service

   Preparing vaccines and serums.

   Research on animal disease.

   Collaboration with similarly oriented national and international organizations.

6. National Veterinary Pharmacy

   Provision and distribution of all veterinary and pharmaceutical products.

   Control of product use.

7. Zootechnical and Animal Production Service

   Research and implement animal reproduction programs.

Improve animal raising and feeding methods.

Range land water management.

Conservation and development of grazing lands.

Soil conservation programs.

Introduction and control of new animal breeds and exotic forage species.

Provide technical assistance to other organizations both public and private, concerned with the same subjects.

Management of livestock stations.

Assist ORDs in the elaboration and execution of animal production programs.

8. Poultry Development Service

Stimulate development of poultry production.

Management of the Poultry Centers.

Assist the ORDs in the elaboration and execution of poultry programs.

9 Small Animals Development Service

Stimulate the production of sheep, goats, and pigs.

Promote animal fattening programs among rural residents.

Develop and improve horse and donkey raising techniques.

Assist the ORDs in similarly related programs.

While this list represents an ambitious set of goals, in practice the efforts of the Service have become increasingly confined to maintaining and expanding animal health services. The orientation to animal health is evident when the employment structure is examined in detail. Table 2.62 shows the situation in 1976.

Programs. In addition to the programs indicated in the previous section, the Livestock Service operates a number of programs specific to certain regions. It runs a breeding program at the Markoye Ranch in the Sahelian ORD that sells improved breeds to local herders at below-market prices. They also manage two state-owned farms at Samandeni and Bamankeledaga. They have started a mobile audiovisual training program given on location to local livestock producers. In addition, the VLP comes under the direction of the Livestock Service.

2.3.4.2 National Office for Development of Animal Resources (ONERA)

ONERA is a young organization, hence many of its aims are still in the planning stage. ONERA was created in 1975 as part of the 1972-76 Development Plan. Initially it was a sub-agency within the Livestock Service but a 1976 decree established it as an independent parallel organization also under the Ministry of Rural Development. Although the Livestock Service retains in its name "animal industries" in fact, virtually all of these functions have been transferred to ONERA.

ONERA is charged essentially with the commercialization and modernization of the livestock sector. It assumed administration of the Tanning Center and the slaughterhouses from the Livestock Service and has been granted numerous additional functions. These are summarized below:

- develop market and transportation infrastructure,
- work with rural development to increase livestock production,
- train agents to work in animal marketing,
- encourage and stimulate industries using animal products, e.g., shoes, and those supplying the livestock sector, e.g., feeds,
- assist in the professional organization of livestock producers,
- search for ways to obtain and utilize vegetable by-products to feed animals,
- carry out research on the transport and marketing of animals and animal products,
- research, use and disseminate information on cattle routes, meat outlets, and animal prices,
- assist in the process and regulation of animal and meat export,
- cooperate with ORDs and AVV to achieve these aims.

Budget and Support. ONERA is budgeted by the state and receives heavy foreign financial support from the Netherlands and to a lesser extent from Germany. The Netherlands is committed to establishing a suitable infrastructure including the construction of a building to house the presently dispersed agency, modernizing the slaughterhouses, construction of modern centralized markets, and supplying equipment such as refrigerated trucks. They are also involved in training of the personnel to operate ONERA related concerns.

Organization and Personnel. The organizational structure is given in Figure 2.16. The agency is divided into administrative, production, industry, and marketing branches. Although many new enterprises have been proposed, only those currently underway have been listed. The general division and each of the four sub-divisions are composed of a single director and supporting staff. The commercial branch is, at present, the least well developed. Personnel trained and employed by ONERA include tanners, butchers, meat inspectors, animal husbandry specialists, and administrators.

ONERA Programs

Banfora Feedlot. This is a cattle fattening operation with anticipated capacity of 6,000 head per year. Beef is destined for Bobo-Dioulasso and foreign markets. The project will employ 53 persons when at full capacity.

Animal Feed Factory. Located in Bobo-Dioulasso, this plant is designed to complement the animal fattening and ranching programs being developed in surroundings.

Holding and Restoration Park, Loumbila. Construction of holding pens and watering facilities is to restore conditions of animals driven from Sahelian ranges to market for slaughter in the nearby Ouagadougou slaughterhouses. The project was initially sponsored by the European Development Fund (FED).

Bobo-Dioulasso and Ouagadougou Slaughterhouses. In both locations modern refrigerated meat packing plants replaced outdated and less hygienic facilities. This project was largely sponsored by funds from the Netherlands and is designed in part to maintain Upper Volta's competitive position in the meat markets of the coastal areas of West Africa.

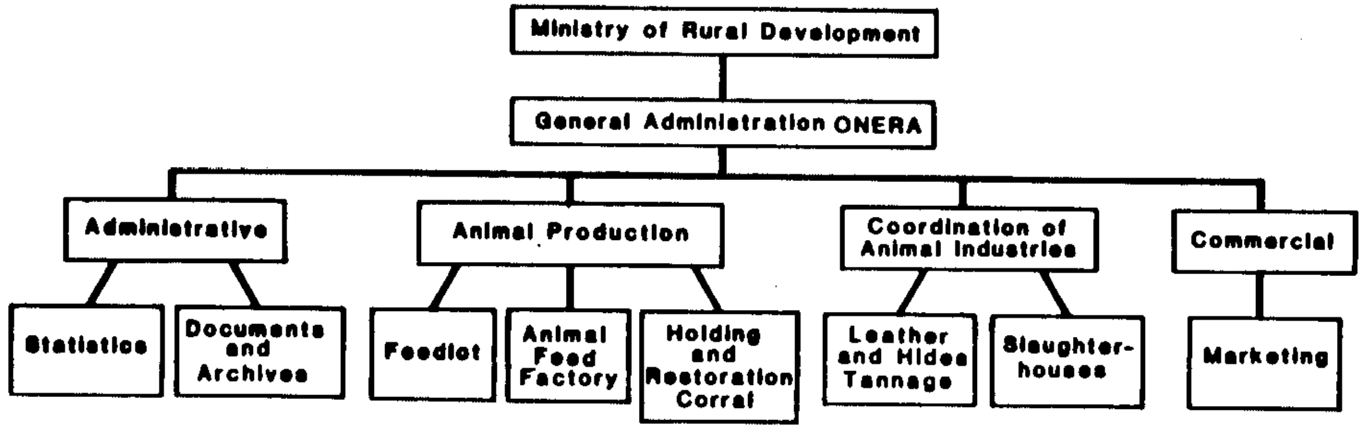

Figure 2.16 ORGANIZATIONAL STRUCTURE OF THE NATIONAL BUREAU FOR THE EXPLOITATION OF ANIMAL RESOURCES (ONERA)

2.3.4.3 Poultry Centers

The Poultry Centers are currently under the administration of the Livestock Service. They are administered by the head of the Poultry Development Service. Presently there are three centers, the principal of which is located in Ouagadougou. Secondary centers are located in Bobo-Dioulasso and Koudougou. There are tentative plans to transfer the centers from the Livestock Service to ONERA's administration. In either case it will remain within the Ministry of Rural Development.

Budget and Support. Presently the poultry centers are operated from the Livestock Service budget. Recent financial assistance was supplied by the European Development Fund (FED) to assist in the expansion of the Bobo-Dioulasso and Koudougou facilities.

Programs. The poultry centers exist to promote the development of poultry within Upper Volta. They are involved both in instruction and in supplying all materials, animals, and medicines necessary for raising poultry. The focus is on chickens, but ducks, turkeys, guinea fowl and rabbits are also bred and sold. Feed for each of the above animals is mixed and sold on location at the centers. Eggs, chicks, and young breeding stock and medicines are also sold. Facilities include an incubator, vaccination equipment, a feedmixer, animal pens and coops and a warehouse. No extension efforts are connected to the centers; thus, they benefit mainly urban and nearby rural populations and the poultry raisers servicing these markets. Instruction is in all aspects of poultry raising and is open to interested persons of all previous experience and education. Efforts are made to communicate information in the poultry raiser's native language. Instruction is primarily by demonstration and participation. Courses are of approximately one-month duration.

2.3.4.4 University of Ouagadougou

The University was created in 1974 and is divided into several schools of which the Polytechnical Institute (ISP) is most relevant for the livestock sector. It offers agronomy, livestock, and water resources and forestry options. The five-year program is now beginning to supply trained personnel to the various national agencies dealing with livestock and environmental management. The number of students currently enrolled totals 127 with an additional five students studying in the U.S. on scholarships provided by USAID. At present, eight professors teach the technical courses. The Institute operates an experimental farm, pasture, and forestry plantation. The students' fifth year consists of an internship with one of the related government agencies. For example, one such student, Marcel Somba, was attached to the VLP.

The University falls under the Ministry of Education which allocates 30.4% or 1147 million CFAF of its budget to higher education.

2.3.4.5 Other Schools

2.3.4.5.1 National School of Livestock Production and Health

For the moment this school remains within the National Livestock Service which also provides its funds. The program offers two options in the training of technicians. A three-year program leads to the classification of livestock assistant. This includes veterinary nurses. The two-year option produces technical agents. Graduates enter positions at Markoye Ranch, at the slaughterhouses, in the poultry centers, and in the rural livestock districts.

Organization and Personnel. Courses are taught by forty instructors who hold positions of responsibility in the national bureaucracy. Each contributes a couple of hours a week. Full-time staff at the school and the clinic it operates includes a director, a secretary, a librarian, a head of the clinic, and three veterinary nurses. Currently there are 52 students enrolled in the program.

2.3.4.5.2 Agricultural Training Center of Matourkou

This is a rural institution near Bobo-Dioulasso dedicated to the training of agricultural technicians and extension agents. An integrated approach to rural development is stressed. Important to livestock and grazing resources are training programs for veterinary nurses, water and forest agents, and livestock assistants. It has recieved significant donor support from the United Nations Development Program.

2.3.4.5.3 Farmana Center

This is a small experimental village site connected with the facilities at Matourkou. Here, the health and husbandry of sheep, hogs, and horses are stressed.

2.3.4.5.4 International School of Rural Equipment Engineers

This university-level institute is located adjacent to the University of Ouagadougou and trains people involved in rural water projects.

2.3.4.6 Water and Forests Bureau

Water and Forests was placed in the newly created Ministry of Environment and Tourism in 1976. Its rural network remains little changed. Divisions within Water and Forests are given in Figure 2.17.

The division of Forest Management and Reforestation is most directly related to the control of grazing resources. This division is potentially important if grazing districts or reserves are to be established in the country. Currently, however, the agency is significantly understaffed, and its management efforts are confined to maintaining forest reserves and environmentally monitored areas of the Sahel.

2.3.4.7 Other Relevant Government Agencies

2.3.4.7.1 Voltaic Scientific Research Center (CVRS)

CVRS is a research service within the Ministry of Education. Its aim is to carry out fundamental and applied research in both the social and natural sciences. Its budget is supplied equally by GOUV and France. It also receives contributions from various international funding agencies for specific projects. Personnel include 13 professional researchers, 3 service personnel, 23 skilled workers and 18 technical agents. Numerous botanical studies concerning forage plants have been initiated; social science research

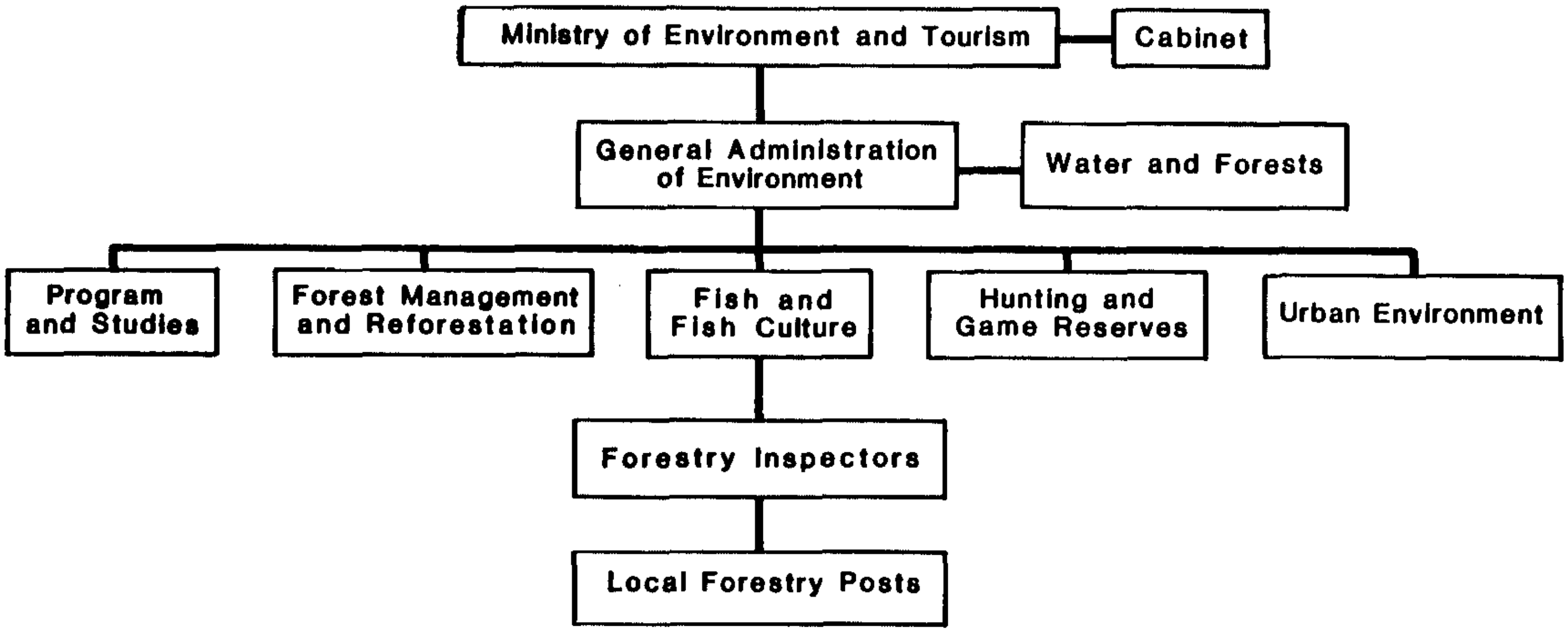

Figure 2.17 ORGANIZATIONAL STRUCTURE OF THE BUREAU OF WATER AND FORESTS

has explored the relationship between herders and farmers as well has been providing applied research prior to the implementation of various livestock development projects. CVRS has an annual budget of 142 million CFAF (1979).

2.3.4.7.2 Institute of Tropical Agricultural Research (IRAT)

One of IRAT's functions is to research forest plants. IRAT is loosely affiliated with the National Research Institute, CVRS.

2.3.4.7.3 Technical Center for Tropical Forestry (CTFT)

Also affiliated with the National Research Institute, the CTFT is principally concerned with silviculture and soil conservation and reclamation. It is involved in research concerning local browse species and their ecology. Its 1979 budget totals 45 million CFAF.

2.3.4.8 Permanent International Committee for Drought Control in the Sahel (CILSS)

CILSS is a regional organization composed of eight West African member states. It was formed after the drought of the early 1970s with the aim of deciding between development projects and funding for the eight member states. It serves to coordinate regional priorities and to prevent overlap among projects. It is the African counterpart to the donor organization, Club du Sahel. It is directly involved in very few projects, but instead works, as in the case of its regional livestock project, to bring donors and member states together. Within the Voltaic office there is one specialist on Sahelian livestock production, one specialist in forest-rangeland ecology, and one permanent extension specialist working in the livestock sector. Funding is derived from the eight member states, USAID, Canada, FAO, UNDP, and FAC.

2.3.5 Technical Assistance Programs

Foreign sponsored technical assistance programs are extremely varied and occur at all levels and degrees of integration into Voltaic society. They range from small and isolated cash donations (seed money) to large scale multi-million dollar projects. In almost every case some collaboration with national agencies takes place. The largest is the West Volta Livestock Project (PEOV), which has become a quasi-government agency. Unity under a single livestock policy remains an ideal of the future, while, at present, some programs even work at odds with one another, such as water resource development and ecological management in the Sahelian zone. An exhaustive description, even an enumeration, of all these programs, past and current, is beyond the scope of this report. However, enough examples are given to outline the major donor agencies and indicate the nature of the work being undertaken.

2.3.5.1 USAID Sponsored Projects

Previous (terminated) programs

Markoye Ranch Project

Entente Livestock Study (1975-77)

Parasite Control Program

Market and Cattle Trail Improvement (1975-76)

Pasture Fattening Project, Koudougou ORD (1973-74)

Livestock Infrastructure, Sahel ORD (1972)

Current AID financed programs

Education of Livestock Producers (1978-79)

Village Livestock Project (1977-80)

Sudanian Zone Parasite Treatment (1978-80)

Animal Traction Section of Eastern ORD Integrated Rural Development Project (1976-)

Livestock Program in Seguenega Integrated Rural Development Project

2.3.5.2 Other Multi-lateral and Bilateral Livestock Development Projects (1971-1979)

2.3.5.2.1 UNDP

Previous programs

Assistance to ONERA. Tanning techniques, skin diseases, rural slaughterhouses (1972-76).

Establishment of the Matoukou Training Center (1968-77).

Current programs

Financial assistance to Livestock Service.

Financial assistance for tse-tse control via IEMVT.

Forage cultures in the Sudano-Sahelian zone (1978).

2.3.5.2.2 FAO

Previous programs

Niemo-Diokeke plant management project (1977).

Current programs

Training of tanning technicians.

2.3.5.2.3 European Development Fund (FED)

Previous programs

Assist in the design of the West Volta Livestock Project (1972).

Pre-implementation study for the Loumbila holding corral (1972).

Contribution to the refrigerated slaughterhouse, Ougadougou (1971-73).

Contribution to Ougadougou cattle market (1973).

Construction of the restoration corral, Ouagadougou (1973-74).

Improvement of traditional livestock raising, S.E. ORD (1975).

Improvement of traditional livestock raising, Comee ORD (1977).

Western markets and cattle trains (1974-75).

Water management in the Sahelian ORD (1974-78).

Water management in the Yatenga ORD (1973-77).

Poultry center, Bobo-Dioulasso (1978).

Banakeledage station (1978).

Poultry center, Koudougou (1978).

Current programs

Animal fattening program, Banfora (1976-present).

Development of small animal raising, Yatenga (1978-80).

Livestock development, Sahel ORD (1978-80).

Animal receiving center, Koba (1979-80).

2.3.5.2.4 World Bank

Current programs

West Volta Livestock Project (1975-81). Nine million U.S. dollars, Dedougou and Bobo-Dioulasso ORDs. Under the Ministry of Rural Development. Project aims: bring commercial ranching to the traditional sector, establish group ranches, improve veterinary services, develop holding yard and improve roads to Bobo-Dioulasso, integrate farming and livestock, carry out related research.

2.3.5.2.5 France

Continuing efforts since colonial period of ORSTOM and IEMVT to carry out scientific research.

The projects involving French aid are too numerous to list. Some of the most important current programs are:

- Livestock development, Koudougou ORD
- Poultry development, in conjunction with EEC (1979-81)
- Tse-tse eradication (1979-81), in collaboration with Germany.

A protected grass plot was established at Bané near the Gnanguedin site two or three years ago by the IEMVT in conjunction with the AVV. The plot was established about 1977 by Mr. Klein, and later taken over by Mr. Toutain. Trials with legumes and grasses identified the following as having potential: (1) *Stylosanthes hamata*, (2) *Macroptilium atropurpureum* (*Siratro*), (3) *Dilichos lab lab*, (4) *Cenchrus ganda* (*Cenchrus ciliaris*).

2.3.5.2.6 Germany

Previous programs

Livestock adviser to the Livestock Service (1975-77).

Complementary study for ranch fattening, Banfora (1972).

Investment in Banfora feedlot (1977-78).

National Livestock Laboratory (1978).

Small-scale production of animal feed (1977-78).

Current programs

Tse-tse fly control.

National veterinary pharmacy (1978-80).

Reforestation program.

2.3.5.2.7 Netherlands

Besides their extensive commitment to the creation of ONERA's superstructure, the Dutch have undertaken a large-scale water development project at Tinarkathen.

2.3.5.2.8 Other Organizations

In addition to the major donor nations, other countries, notably Canada and Belgium, have been involved in livestock-related bilateral aid. Numerous voluntary organizations, both private and religious, contribute technical assistance to livestock development. Most are small-scale projects at the village level. OXFAM, Cathwell, and FEME (Federation of Evangelical Churches and Missions) as well as national volunteer services (e.g., Peace Corps) stand out.

2.4 THE LIVESTOCK [illegible]

2.4.1 General

Domestic animals raised in th[illegible] result of a very long natural and artificial s[illegible] [illegible]er very difficult conditions where the climat[illegible] [illegible]nditions are seasonally adverse and diseases ar[illegible] [illegible]ting. In the national development strategy of [illegible] [illegible]stock production plays a key role. Livestock pr[illegible] [illegible]nce for a large number of herders and sedentary [illegible] [illegible] supply of meat for an urban population. Livestock [illegible] [illegible]aluable source of by-products, particularly hi[illegible] [illegible] Animal manure also is quite important to cr[illegible] [illegible]try to increase the fertility of their fields [illegible] [illegible]vailable to animals of the migratory herders. [illegible] [illegible] is an investment and a form of savings f[illegible] [illegible]ntary producers that will assure them surviv[illegible] [illegible]tress. It also satisfies social obligations and [illegible] status. The government acquires, through direct ta[illegible] [illegible]derable revenue from livestock.

The raising of livestock in [illegible] [illegible]ming less and less a separate function from farm[illegible] [illegible]mals are used for traction. On a number of fa[illegible] [illegible]ing made to integrate farming with animal husba[illegible] [illegible]in turn leading to a reorganization of land h[illegible] [illegible] separate, consolidated areas for cultivation and [illegible], as well as to a recognized need for animal heal[illegible] [illegible] development of supplemental feeding with crop resi[illegible] [illegible]ts and high nutrient-level forages.

There are many constraints, th[illegible] [illegible]k raising in Upper Volta which are listed in brief [illegible] [illegible]t with in greater depth later in this section:

(1) Ecological conditions requiring [illegible] [illegible]f a large part of the livestock.

(2) Inefficiency caused by the temporary and mobile aspects of a herder's life.

(3) The late and low fecundity of females which results in a low reproduction rate.

(4) Uncontrolled reproduction.

(5) High mortality rates, especially among younger animals.

(6) Uneconomic composition of flocks and herds.

(7) Low annual growth rate.

(8) Impoverished and unsanitary water sources.

(9) Lack of a constant year around source of feed or grazing.

2.4.2 Cattle

2.4.2.1 Genetics, Physiology and Utility

All the breeds of cattle herded in Upper Volta and especially in the six project sites may be classified under general headings of Zebu (*Bos indicus*) and to a more limited extent Taurin (*Bos taurus*).

The Zebus live in the zones which are hot and dry (saharan-sahelian, sahelian-sudanian), the Taurins in the more hot and humid zones (guinean). In the areas between Taurin and Zebu zones there exists a non-stabilized population of mixed breeds.

The Zebus are tolerant of very high temperatures but not of humidity, and are sensitive toward rinderpest and trypanosomiasis, and very sensitive to pleuropneumonia.

The Taurins can well withstand the droughts, are very tolerant of high temperatures, can withstand conditions of high humidity and are tolerant to the trypanosomes. They are very sensitive to rinderpest and pleuropneumonia.

One can classify the numerous breeds of Zebus in Western Africa in two large groups: the Sahelian Zebus with short horns and Fulani Zebus with (more or less) long horns.

2.4.2.1.1 The Sahelian Zebu

Some characteristics common to all Sahelian Zebus are listed below:

Interval between calving and breeding	10 to 18 mo.
Average age at first calving	36 to 40 mo.
Average weight of calf at birth	Males - 18 kg Females - 16 kg
Age bulls are put into service	30 mo.
Fecundity	60 to 70%

A cow averages two calves every three years.

Zebu Maure. The Maure breed is adapted for portage and thus their conformation is not especially suitable for fattening. At the age of 8-12 years an ox with good muscular development and an average weight of 340 kilos can produce a first quality carcass, dressing out at 50-52 percent. Those on poor pastures can be expected to dress out at 42 percent.

Other characteristics of the Maure:

Weight males - 350 to 450 kg.
females - 250 to 350 kg.

Height males - 130 cm.
females - 125 cm.

Color varies from brown to fawn with white spots. The head is often white.

Mammary system and milking qualities well developed with large and long teats, with an average rated production of 4 to 5 liters of milk per day.

Zebu Azaouak. The Azaouak Zebu is an introduced breed in Upper Volta which originated in the Azaouak Valley near the western limits of Niger. Relatively few are raised in Upper Volta at this time but the numbers are increasing due to the emphasis being placed upon this breed because of its superior qualities. The future of this breed of Zebu appears to be promising for raising as pure breeds or for crossing with other breeds.

The conformation of the female shows aptitude for good milk production. It is, in fact, the breed for highest milk production of all the Zebus in western Africa. The length of lactation for the Azaouak cow is 7 to 8 months and it attains an annual production of 800 to 1000 liters of milk.

As a work animal the Azaouak is excellent; it is frequently used in this capacity after the male is castrated near two to three years of age.

As a meat animal it dresses out at about 48 to 50 percent.

Other characteristics of the Azaouak:

Weight	males	300 kg
	females	250 kg
Height	males	120 cm to 130 cm
	females	110 cm to 120 cm

2.4.2.1.2 <u>The Fulani Zebu</u>

The habitat of the Fulani Zebu is quite widespread and mostly coincides with the habitat of the Fulani livestock raisers. Below are listed some of the common characteristics of all Fulani Zebus:

Interval between calving and breeding	7 to 13 mo.
Average age at first calving	26 to 48 mo.
Average weight of calf at birth	males -- 16 kg
	females -- 15 kg
Age bulls are put into service	30 mo.
Fecundity of cows	60 to 70%

A cow averages two calves every three years.

<u>Zebu Fulani Sudanian</u>

Weight	males	300 to 350 kg
	females	250 to 300 kg
Color	dominant color is grey.	

It is a good meat animal which at an average weight of 320 kilograms will dress out at 48 percent. First quality carcasses will dress out 50 percent.

The milking qualities of the cow are poor, giving two or three liters of milk per day with a total production of 700 kilograms in 8 months.

They are used as traction animals in Upper Volta quite successfully. The bulls are castrated between 18 months and two years of age and used as work animals for two or three years.

Zebu Fulani from L'Adamaoua

Weight	males	450 kg
	females	330 kg
Color	coat is often white, speckled with red or black, red, or wheat colored.	

It is a good meat animal possessing good qualities for fattening. It will normally dress out 50 to 52 percent.

It is very docile and makes an excellent traction animal.

The milk production is medium with total production of 960 kilograms in 216 days of lactation.

Zebu Gobra

Weight	males	350 to 450 kg
	females	240 to 350 kg
Color	coat is generally white.	

It represents the best of meat animals among all the Zebus of western Africa. An animal slaughtered at the age of five years can be expected to dress out at 50-53 percent.

Milk production is medium, with a total production of 500 kilograms in a 7-month lactation.

As a work animal the Zebu Gobra is the best of all the Zebus of western Africa.

Zebu M'Bororo

Weight	males	300 to 400 kg
	females	250 to 300 kg
Color	variety le Djafoun has a coat that is entirely uniformly mahogany colored and the variety l'Akou has a coat color that is always white.	

As a work animal the M'Bororo has not been very successful because of its nervous disposition.

As an animal for meat it is mediocre, dressing out as a carcass at 45 percent. Also, the meat is fibrous and of second quality.

2.4.2.1.3 The Taurins

Some common characteristics of Taurins are listed below:

Fecundity as high as	80%
with average of	70%

Females reproductive period		4 to 5 years of age
Age of first calving		3 to 5 years
Length of herd life	cow	9 to 13 years
	bull	4 to 9 years

The Taurins of western Africa are represented by two main groups:

(a) Cattle with long lyre-shaped horns: N'Dama.

(b) Cattle with short horns: Baoule, Lagunes, and Kouri.

The outstanding characteristics will be listed separately because of the worthiness of some of these characteristics in a cross-breeding program. Cross-breeding trial results using the Taurin breeds have been successful in western Africa.

N'Dama. This breed is the most representative of all the Taurin breeds in western Africa. The following characteristics are stabilized:

Weight	males	250 to 350 kg
	females	240 to 275 kg
Height	males	118 cm.
	females	95 to 110 cm.
Color	fawn to wheat colored.	

Milking qualities -- The mammary system is not well developed. The production of milk is about two to three liters per day for a 7-to-8-month lactation period, for a possible total of 500 liters.

Meat qualities -- A good carcass will dress out 50 to 55%. The meat is well marbled and fine-grained.

Traction qualities -- When castrated at about the age of 18 to 24 months the N'Dama male makes an excellent traction animal.

Baoule. This short-horned breed, also found in Upper Volta, is used extensively in cross-breeding with Zebu with good results.

The following characteristics are well identified:

Weight	males	200 kg
	females	190 kg
	oxen	220 kg
Height	males	110 cm
	females	90 cm
Color	white with black spots, black with white spots, white with yellow spots or yellow.	

Meat qualities -- A good carcass will dress out 48 to 50%.

Milking qualities -- Very poor. About two liters a day for 5 or 6 months for a total production of 200 to 300 liters.

Traction qualities -- Not very good because of their small size.

Lagune. This breed is not found in Upper Volta. It is very small and has poor milking qualities. Because of its trypanosome resistant qualities it has been found to be useful in the Guinean Zone.

Kouri. This breed is found mostly in Tchad and is limited to that region. It is not found in Upper Volta. It is a large animal and crosses well with the Zebu.

2.4.2.2 Herding and Transhumance

In order to plan effectively successful interventions in the livestock sector it is necessary to have a firm understanding of those practices currently being employed by local livestock producers. Who are the individuals who herd the livestock? What are the relationships between herders and owners where the two differ? What are the major problems experienced by herders? Who, how, when, where, and why do people go in transhumance with their animals? How are grazing lands selected, utilized, allocated, and managed?

2.4.2.2.1 Herders

The owners of livestock (those who formally exercise control over a household herd), cattle in particular, are rarely the individuals who actually herd these animals. Of those livestock producers interviewed, only 3.2 percent actually were physically involved in herding. Owners do provide regular, sometimes daily direction and instructions to the herders. Most commonly, cattle herders (74.7%) are the sons of the owners, but a variety of other relationships exists.

A picture of those actually engaged in herding is presented in Table 2.63 for three different project sites in three different ORDs. The youth of most herders stands out. The average age of 178 male cattle herders is only 15 years (range 5-41).

There are differences between cattle herders from different ethnic groups. Pulani herders are on the average older ($\bar{X}$ = 17.2 years) than those of the other ethnic groups ($\bar{X}$ = 13.7 years).

TABLE 2.63

CATTLE HERDERS--SEX AND AGE BY SITE AND ETHNICITY

Site	Ethnic Group	Statistics	Cattle Boys	Cattle Girls
Gnanguedin	Bissa	Average age	12.50	-
		N	35	-
		Range	6-30	-
	Mossi	Average age	8.80	12.50
		N	5	2
		Range	7-13	8-17
	Fulani	Average age	16.19	-
		N	24	-
		Range	12-23	-
Tafogo	Mossi	Average age	13.90	8.50
		N	41	4
		Range	5-30	7-10
	Fulani	Average age	20.20	-
		N	13	-
		Range	10-30	-
	Black Fulani	Average age	12.00	-
		N	6	-
		Range	7-15	-
Ougarou	Gourmantche	Average age	15.40	-
		N	32	-
		Range	8-30	-
	Fulani	Average age	16.10	-
		N	28	-
		Range	9-41	-
Total	Fulani (all sites)	Average age	17.20	-
		N	65	-
		Range	9-41	-
	All others, Bissa-Mossi Gourmantche	Average age	13.70	-
		N	113	-
		Range	5-30	-
All sites, all ethnic groups		Average age	15.00	8-9
		N	178	6
		Range	5-41	7-17

There are several explanations for this age difference. Fulani herders generally are charged with guarding larger herds, covering greater distances with their herds, and staying away for longer periods of time (transhumance) than herders of other ethnic groups. Since livestock production provides the largest share of Fulani income, the potential labor losses to farm work are viewed as justified among this group to a greater extent than is the case with groups more oriented toward farming.

Because of the youth of the herders very little farm labor is actually lost. Furthermore, this serves as a kind of school for the young who may later be called upon to watch cattle. Often younger boys accompany their older brothers or neighbors when they begin herding cattle.

2.4.2.2.2 Contractual Herding Arrangements

Traditionally sedentary farmers, such as the Mossi, Bissa, and Gourmantche, who own cattle, entrust them to Fulani herders. This form of economic specialization seems to provide benefits to both groups. The farmers obtain the services of experienced herders without sacrificing any of their own labor force. This system enables the farmers effectively to keep secret, from both neighbors and government tax collectors, the number of cattle they own, or, in many cases, whether they own any cattle at all. Finally, the Fulani herders can be invited to let their herds graze in the fields of the farmers after harvest, thus providing both much needed fertilizer for future crops and valuable forage for the cattle.

From the perspective of the Fulani the main advantage of guarding the cattle of farmers is the milk. With little additional herding effort a Fulani can add 8-10 head of cattle belonging to someone else to his herd. All milk produced by the cows becomes the property of the Fulani herder (normally his wife). Additionally, the Fulani can expect small annual gifts of grain and clothing. A cash gift is also often provided to the herder for handling the sale of an animal entrusted to him.

This traditional relationship between ethnic groups seems to be declining. Significant numbers of sedentary farmers are now employing their own sons rather than the Fulani as herders. The major rationale provided for this change is distrust of Fulani herders (see Table 2.64). The most commonly cited fears are of theft, lack of adequate care and attention, and the potential destruction of crops. For their part, the Fulani indicate that the benefits often are not worth the difficulties encountered in dealing with farmers who do not really understand the problems of animal production. Some cattle are entrusted by farmers to other farmers, usually relatives, of the same ethnic group. Those entrusted with the cattle generally have larger herds and considerably more livestock experience than those who entrust them with their stock.

Of those livestock owners sampled, 26.5 percent (N = 153) entrust their cattle to others. The figure is only slightly higher (32.9%) when one excludes the Fulani from the calculations. As can be seen from Table 2.64 the Bissa tend to entrust their cattle to others to a greater extent (66.7%) than do the other ethnic groups. About one out of three Mossi (30.6%) and only about one of nine Fulani and Gourmantche do not guard their own cattle.*

The percentage of livestock producers who have others' cattle entrusted to them (28.7%, N = 157) is about the same as that for those who entrust their cattle. The variation among ethnic groups is much less than expected. Fully a third (33.3%) of the Fulani are herding the cattle of others, while the comparable figures are 27.7, 26.7, and 23.5 percent respectively for the Mossi, Bissa, and Gourmantche. Among the sedentary groups, those with just a few head of cattle often entrust them to relatives who have larger herds and presumably more experience in the care of livestock. There are also a few cases in which Mossi, for example, had cattle entrusted to them and then in turn entrusted these, plus his own cattle, to a well-known, reliable Fulani herder.

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*These figures probably slightly underestimate the number of cattle owners who entrust their cattle, especially those who own only one or two head.

TABLE 2.64

PERCENT WHO ENTRUST THEIR CATTLE TO OTHERS,
BY ETHNIC GROUP

	Mossi	Fulani	Gourmantche	Bissa
%	30.6	11.1	11.8	66.7
N	62	54	17	15
	PERCENT WHO GUARD OTHER PEOPLE'S CATTLE			
%	27.7	33.3	23.5	26.7
N	65	57	17	15

Those sampled who engage in the practice of entrusting cattle were asked to define the nature of the "contract" between the owner and the herder. In more than two-thirds of the cases (67.9%) the compensation given was the milk plus an occasional gift of grain, clothing, or cash. For an additional 30.2 percent the arrangement involved milk only. If the herder is asked to arrange the sale of an animal for its owner, he will usually be given cash for his efforts when the deal is satisfactorily concluded.

Only 20.5 percent of those involved in this relationship said they had problems as a result. The most commonly identified problem is the destruction of crops by cattle who accidentally enter fields or gardens before the harvest. Other areas of concern are theft and disease. When an animal becomes seriously ill the herder will usually personally inform the owner or send someone to inform him. The owner, if not too far away, will then come to inspect the animal and decide what to do. If the situtation is serious the animal will usually be slaughtered before it can die naturally. The meat will then be sold to a local butcher. If an animal dies before having its throat cut, the owner will still usually sell the meat, but only to non-Muslims. In cases where an animal dies or is slaughtered before the arrival of the owner, the herder will sell the meat and bring the hide and the money to the owner.

Necessary services are regarded as the joint responsibility of the owner and herder. Normally, the herder will inform the owner when it is time to vaccinate his cattle. The owner will then either advance him the money, or reimburse him after the vaccinations are completed. In only a few cases did owners reportedly refuse to pay or to have their animals treated. In cases where cattle are in transhumance at the time of the vaccination, the question may be a bit more complicated. Mutual trust between owner and herder is very necessary if the health of the herd is to be maintained properly.

An additional responsibility involves payment for crop destruction caused by a herd of cattle. Legally, the herder is the responsible party. In fact, owners of cattle involved are expected to, and do, make significant contributions to such settlements.*

A very important responsibility which universally rests with the owner is the payment of taxes (currently 200 CFAF per head). Some owners try to avoid payment by entrusting their cattle, and thus keeping ownership secret in their home areas. Rarely are such small-scale violaters apprehended or prosecuted.

2.4.2.2.3 Transhumance

Transhumance, the seasonal movement of livestock between grazing zones and water sources, remains an important part of the cattle production system of Upper Volta. This system provides the opportunity to exploit successfully seasonal and regional variations in environmental conditions. At the same time it allows for the regeneration of grasses in an area after the departure of the herds.

Although this practice is nowhere near as universal in the Sudanian zones as in the Sahel, *per se*, it is still widely employed. Of those interviewed, 57.9 percent either go on transhumance themselves or send their herds with their children, brothers, or contract herders. As can be seen from Table 2.65, 86 percent of the Fulani send their cattle on transhumance. In essence this represents the continuation of a long tradition. What is somewhat surprising is that nearly half of the Mossi (46.2%) and more than a third (37.5%) of the Gourmantche cattle owners also send their herds on transhumance. The figure for the Bissa, who like to have their livestock close at hand, is only 21.4 percent.

Of some interest is the surprising fact that a large percentage of the Mossi (52.9%) and Gourmantche (66.7%) who send

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*This is contrary to the assertions made by Delgado--who based his findings on judicial records rather than on actual payments made--usually without benefit of court proceedings (Delgado, 1977).

TABLE 2.65

THOSE WHOSE HERDS GO IN TRANSHUMANCE, BY ETHNIC GROUP

	Mossi	Fulani	Gourmantche	Bissa	Total
% who transhume	46.2	86.0	37.5	21.4	57.9
Number	65	57	16	14	152

their cattle on transhumance use sons and/or other relatives, rather than the Fulani as herders (see Table 2.66). This is indicative of the degree to which sedentary farmers have adapted to the demands of, and mastered the techniques of transhumant cattle production. Many Mossi and Gourmantche herders have learned their trade from the Fulani. Quite often, young Mossi or Gourmantche males will be sent on transhumance with local Fulani in order to become more familiar with local grasses, water sources, and problems and techniques of herding. This service, provided freely by the Fulani, has helped create a bond of friendship between livestock owners from the two ethnic groups.

Among both Fulani and other cattle-keeping people of Africa herds are often split and sent to different grazing areas (Swift, 1979). The main advantage is the minimization of risks from theft and disease. This practice is not generally followed in Sudanian Upper Volta. Less than nine percent (8.6%) of those going on transhumance either divide their herds or have ever divided their herds to follow different transhumance routes. This may be a function of herd size. Many Fulani said that when a herd approaches or is larger than one hundred head it becomes necessary to divide it for management purposes. The Fulani estimate that the optimal herd size for a herd in transhumance is about forty-nine. Beyond this size obtaining water, finding adequate grazing, and preventing crop damage become very difficult for the herders. Surveys of herds in the Tafogo site in 1978 showed average herd size of between 30 to 75.

Although the herds are not generally split for transhumance, some cattle are almost always left at home. For the Fulani it is especially important that some milk cows be left behind for the use of women, children, and elders who remain at the semi-permanent settlement site all year round. The milk is very important to the Fulani both as a dietary supplement and as a source of disposable income for women. Among the Fulani every married woman expects her husband to provide her with milk cows. The women regularly do the milking, milk processing, and marketing

TABLE 2.66

HERDERS FOR HERDS WHICH GO IN TRANSHUMANCE

	Herder in Transhumance (%)			
Owner	Sons and/or Brothers	Relative and Other Fulani	Entrusted to Fulani	Number
Mossi	59.2	7.4	33.3	27
Fulani	91.4	-	8.5	47
*Gourmantche	66.7	-	33.3	6
*Bissa	0.0	-	100.0	2
			Total	82

*Numbers for these two groups, i.e., those who send their cattle in transhumance, are too small to use as the basis for generalizations.

of the surplus. Fulani women regularly use milk to make yogurt, butter, and soap. Formerly, they also produced cheese, but this is an art which has been largely lost by the Fulani of Upper Volta. It has been reported that at the approach of the dry season some Fulani women are mixing powdered milk with fresh milk to increase their sales volume (see Section 2.3.2).

When the herds are in transhumance some milk cows are generally left at the more permanent Fulani settlement. If there are women accompanying their husbands in transhumance they take care of the milking of those cows in the herd. If there are no women in transhumance, it is the herders themselves who do the milking and consume the milk.

Among the other ethnic groups it is the males, usually the herders, who take care of the milking. Milk is generally consumed by young children, and, if in sufficient quantity, by the family as a whole. Milk is only consumed, it is not processed by non-Fulani. Often additional milk is purchased from Fulani women to supplement the family diet.

Normally, milking is done twice a day during the rainy season, and only once a day, or not at all during the dry season. First, the calf is allowed to drink, then the cow's hind legs are tied together and the calf is tied to a nearby tree or stake. Most of the milk is then taken from the cow, but some is left for the calves to finish off. The volume of milk obtained from a cow, even in the rainy season, is relatively low (about 1.5 liters per milking).

Often the question is raised about the tradeoff between milk offtake and the growth and survival of calves. During the rainy season, when milk production is highest, livestock producers say they wait, on the average, 25 days after the birth of the calf before starting to take the milk themselves. However, the median livestock producer waits only 15 days. There is considerable variation by ethnic group. The more milk-dependent Fulani average a wait of 22 days before milking, while the average for the Mossi is

35 days. Surprisingly, the Gourmantche and Bissa wait an average of only about 12 days.

In the dry season milk production tapers off considerably, if not completely. Forty-five percent of the livestock producers do no milking at all during the dry season. Those who do milk average a wait of 44 days. Both the median and modal time periods are one month. Differences between ethnic groups in the delay before milking are not significant during the dry season.

One important problem concerning current local milk production is health, both animal and human. Sanitary measures are rare. There is no refrigeration. Containers are not sterilized. Perhaps most important and dangerous is the fact that even sick cows, those with tuberculosis, for example, are milked and the milk is used for human consumption. The risk of transmitting the disease from animals to humans is thus quite high.

The seasonal transhumance movements tend to be fairly stable (over a five-year period). Less than one fifth (19.2%) of those going on transhumance had changed areas in the recent past. More or less the same route is followed each year. Often, close relationships with local livestock producers who reside along the route or in the area which is the eventual destination are maintained. In most cases the owners, or those actually with the cattle, send one of their number on ahead to survey the situation. The most crucial variable is the availability of water. This is closely followed by an evaluation of the quality and quantity of grazing resources in a given area. Also of some importance in the decision-making process are possible outbreaks of disease and the past history of conflict and cooperation with farmers. Thus, although the route is fixed, there are minor variations in grazing areas and water sources used in any given year. Based on the best available information the owner and/or the herders will decide exactly where the herd will go.

The season of transhumance varies considerably from one region to another. Table 2.67 provides a list of the months of departure and return from transhumance in all four project sites.

TABLE 2.67

TIME OF TRANSHUMANCE

	Month of Departure Percent (N=91)	Month of Return Percent (N=92)
January	-	2.2
February	-	5.4
March	-	-
April	3.3	-
May	14.3	18.5
June	4.4	12.0
July	-	7.6
August	-	-
September	16.5	-
October	20.9	14.1
November	27.5	29.3
December	13.2	9.8

The most common times of departure are between September and December, just before and during the harvest season. Additionally, May, the time of the first rains, is a common time to follow transhumance routes. The May departure is usually to search for water and new grasses in those nearby areas which receive the first rains.

The return from transhumance seems to be clustered in two periods. For those who go on transhumance for only a short period, October through December are modal months for the return. For those who depart for longer periods, a return in May or June is more common.

Before describing the specific transhumance routes for each site a methodological note is in order. Information on transhumance routes was gathered in several ways. First, several local livestock producers were asked where and when they transhumed. Secondly, samples of livestock producers were systematically surveyed to determine the routes and seasons in which they transhume. Finally, the routes were delineated on the ground with the help of experienced livestock producers who are familiar with the routes. However, the routes plotted are subject to slight variations from one village to the next in the same site, and to localized seasonal variations and yearly variations in environmental conditions (rain), (see Table 2.68).

The farther north one goes, the longer the transhumance routes tend to be. For the Tafogo area the most common transhumance route is to Dori, about 120 kilometers to the northeast. Normally, this route is followed in late October through November. Depending on environmental conditions, the stay outside the area may last through December. The main aim of the transhumance trip is to obtain the salt cures for the livestock in the area just east of Lamdamaol (49 km. northeast of Tafogo) and to take the animals to good grazing areas away from the millet fields, just before the harvest. Normally, the herds return to the village just after the harvest to graze on the millet stalks remaining in the fields.

TABLE 2.68

MODAL TIMES OF TRANSHUMANCE BY SITE

Site	Season	Destination	Distance (kilometers)
Tafogo	October-November	Dori	120
Gnanguedin	November-May	Zabre	45
Koukoundi	September-November May-June	Zinaire, Mane	70
Ougarou	Complex (about 40% go in transhumance twice a year)	NE Tapao River	20-30
Most common periods	May - June September - November December - February	SE Nassougou	35

The actual trip takes about five days. The first night after leaving Tafogo is spent in Djilimsombe, a neighborhood of Narbingou (22 km northeast of Tafogo). Subsequent nights are spent near Pelse, Lamdamaol, Gassi, and Dori respectively. Usually, the herds are allowed to graze near Dori for about a week before returning to Tafogo by the same route (see Table 2.69 and Figure 2.18). Cattle in the Tafogo area are in the local area almost all year long. Only this relatively brief period of transhumance interrupts their stay.

In the second most northerly site, Koukoundi, the transhumance routes and seasons more nearly approximate the typical expected pattern. The main goal is to find adequate grass and water (generally surface water). Cattle are taken to the southeast during the months of September through November. The route, about 70 km in length, goes due south to the White Volta River. Upon reaching the Volta the herds are moved east along the river to Mane and then south to the area just west of Ziniare (see Table 2.70 and Figure 2.19). The cattle return to Koukoundi in late November or early December to eat the crop residue. Some depart once again but generally stay within a short distance of their home village.

Formerly, some of the herds from Koukoundi transhumed as far south as Leo. This route has now been broken. There are numbers of cattle owned by Koukoundi Fulani which stay permanently in the better grazing areas of Leo all year round. These are herded by Fulani settlers from Koukoundi.

In the southernmost site, Gnanguedin, the transhumance route is relatively short (about 40 km), but the time spent in transhumance is very long (6-7 months). Most herds leave the area in November, just after the harvest, and stay away through the entire dry season. They return in May after the first rains. The route followed is from Gnanguedin directly west to the White Volta, and across the river to the village of Sampiema. Sampiema serves as the center of what is known as the Lere region. From here the various herders set out to either Barganze, 9 km to the

TABLE 2.69

TRANSHUMANCE ROUTE--TAFOGO SITE

Direction	Distance from Tafogo (km)	Name of Village or Landmark
Tafogo	0	Tafogo
N.E.	6.0	Siene Tanga Hill
N.E.	9.0	Kasokenga Streambed
N.E.	11.7	Seno Village
N.	14.7	Gorongo Streambed
N.	16.7	Kanchenga (Narbingou Quarter)
N.	20.3	Kontanga Hill
N.	21.5	Narbingou Village
N.	27.2	Leonroung Village
N.E.	30.3	Pelse Hills
N.	34.7	Kilichoko Village
N.	41.7	Pelse Village
N.	39.7	Lamdamaol Village (salty earth east of village)
N.E.	62.7	Gassi Village
N.E.	70.8	Sorsala Village
N.E.	79.5	Fetobali Village
E.	87.2	Malboogo Village
N.E.	93.6	Nelba Village
N.	100.3	Mallere Village
N.	104.2	Dantchiadi Village
N.	108.4	Thioumtonga Village
N.	120.4	Dori Village

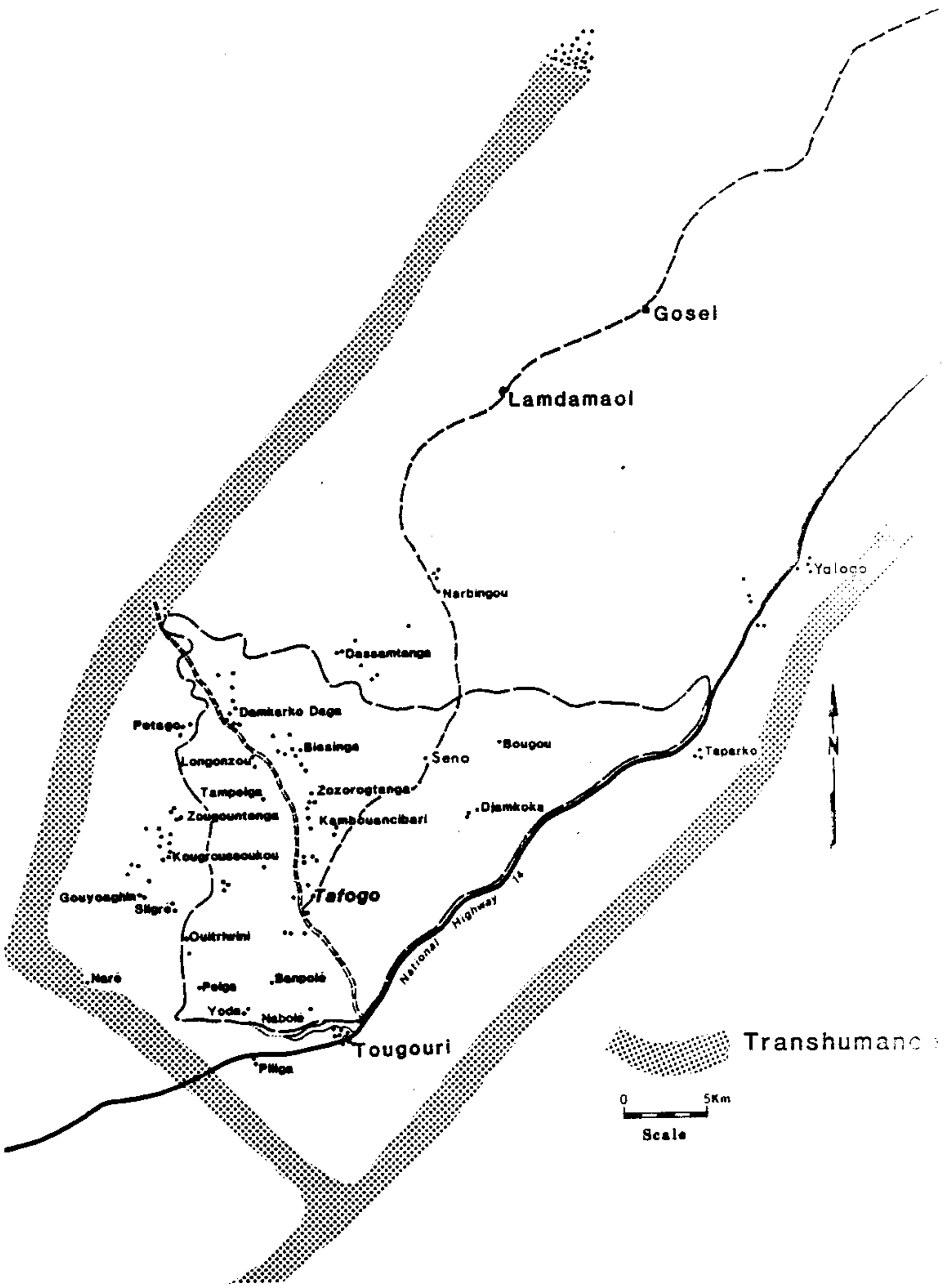

Figure 2.18 TRANSHUMANCE ROUTE - TAFOGO

TABLE 2.70

TRANSHUMANCE ROUTE--KOUKOUNDI SITE

Direction	Distance from Koukoundi (km)	Name of Village or Place
S.	7	Liliga
S.	17	Goren
S.	33	Koukoure
S.E.	58	Mané
S.E.	70	Ziniaré (via Rassenaga, Salabo, Bafui)

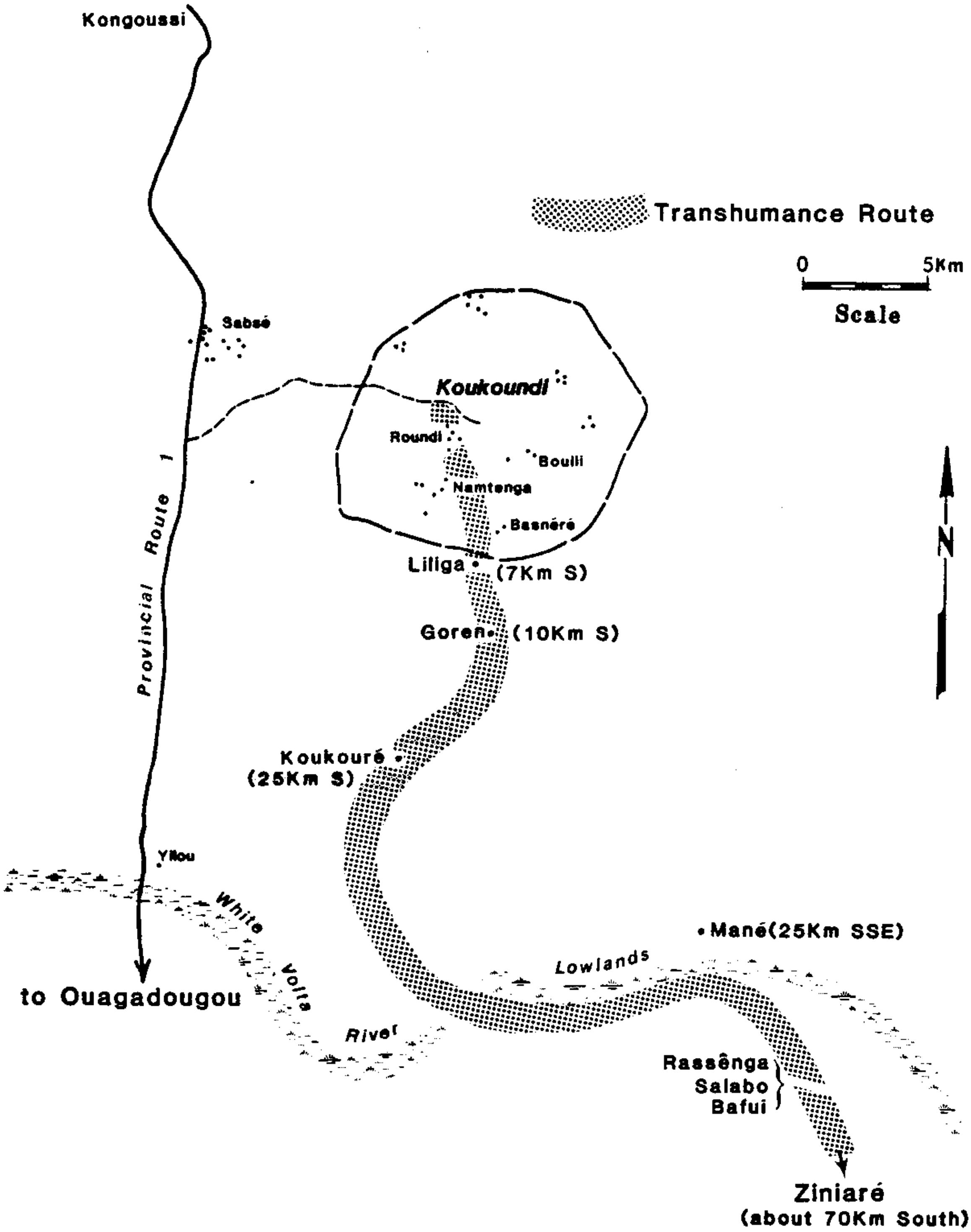

Figure 2.19 TRANSHUMANCE ROUTE - KOUKOUNDI

south, or Zabré, 18 km to the southwest (see Table 2.71 and Figure 2.20). Alternatively, there are some herders in the Gnanguedin area who go 20 km. to the east or southeast to the Nouhao River. The grazing land along the White Volta is, however, generally preferred to that of the Nouhao. The transhumance route and grazing area to the west will in the near future be converted by the A.V.V. (Volta Valleys Authority) into an area of irrigated cropland. Transhumance patterns will at that time probably be redirected to the east.

The situation in the easternmost site, Ougarou, is quite complex. Transhumance routes tend to be relatively short, between 20 and 40 kilometers. The people in the area go in transhumance in the planting season, May through July. Many leave again in September and return after the harvest in November. There are also some herders who leave after the harvest and spend the months of December through February in transhumance.

Most cattle owners in the Ougarou site who transhume choose between two grazing areas, the Tapao River (25 km northeast) and the region around the village of Nassougou (40 km east). There does not appear to be a strong preference for one over the other, and several herders indicated that they switch from one to the other from one year to the next (see Figure 2.21).

In sum, transhumance routes in Upper Volta tend to be relatively short. Communication between the owners and the herders of cattle is not a major problem. The length of time the herds spend away from their home villages is highly variable. This is largely a function of the availability of water, especially surface water. The duration and timing of the stay in transhumance are crucial factors to be considered in evaluating and planning prospective interventions in the areas of health, feeding, and range management.

2.4.2.3 Breeding Management

Breeding management by livestock producers is largely done by culling with very little controlled breeding of livestock being carried on. Observations of annual calving intervals in all six sites of the project substantiate that most calves are dropped

TABLE 2.71

TRANSHUMANCE ROUTE--GNANGUEDIN SITE

Direction	Distance from Gnanguedin (km)		Name of Village or Landmark	
	0		Gnanguedin	
W.	4		Dema	
W.	6		Loba	
W.	12		Lembila River	
W.	16		Lembila River	
W.	18		Lembila River	
W.	20		White Volta	
W.	25	Lere Region	Sampiema	Center of trans-humance area
S.	37	Lere Region	Panganze	Center of trans-humance area
S.W.	43	Lere Region	Zabré	Center of trans-humance area

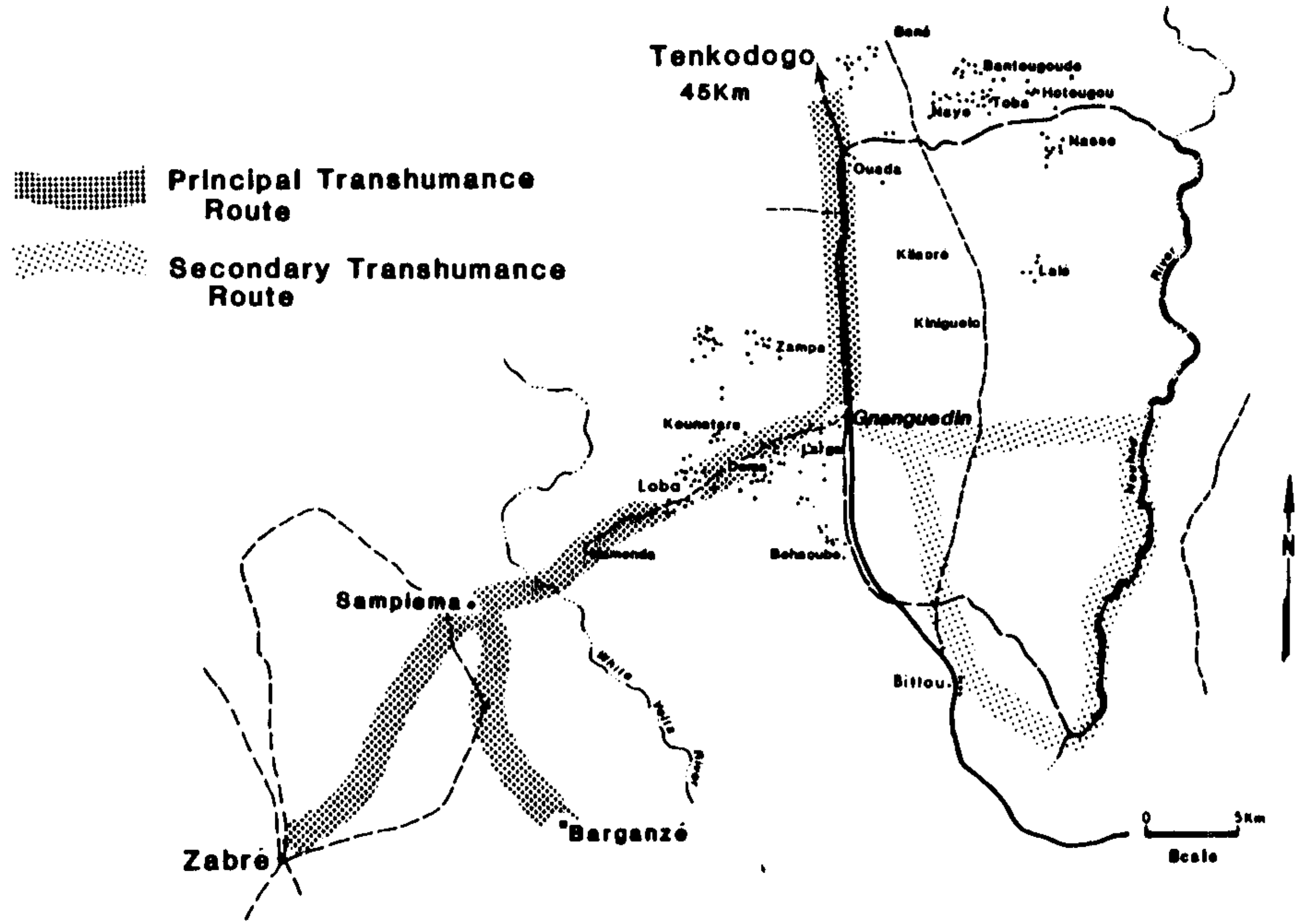

Figure 2.20 TRANSHUMANCE ROUTE - GNANGUEDIN

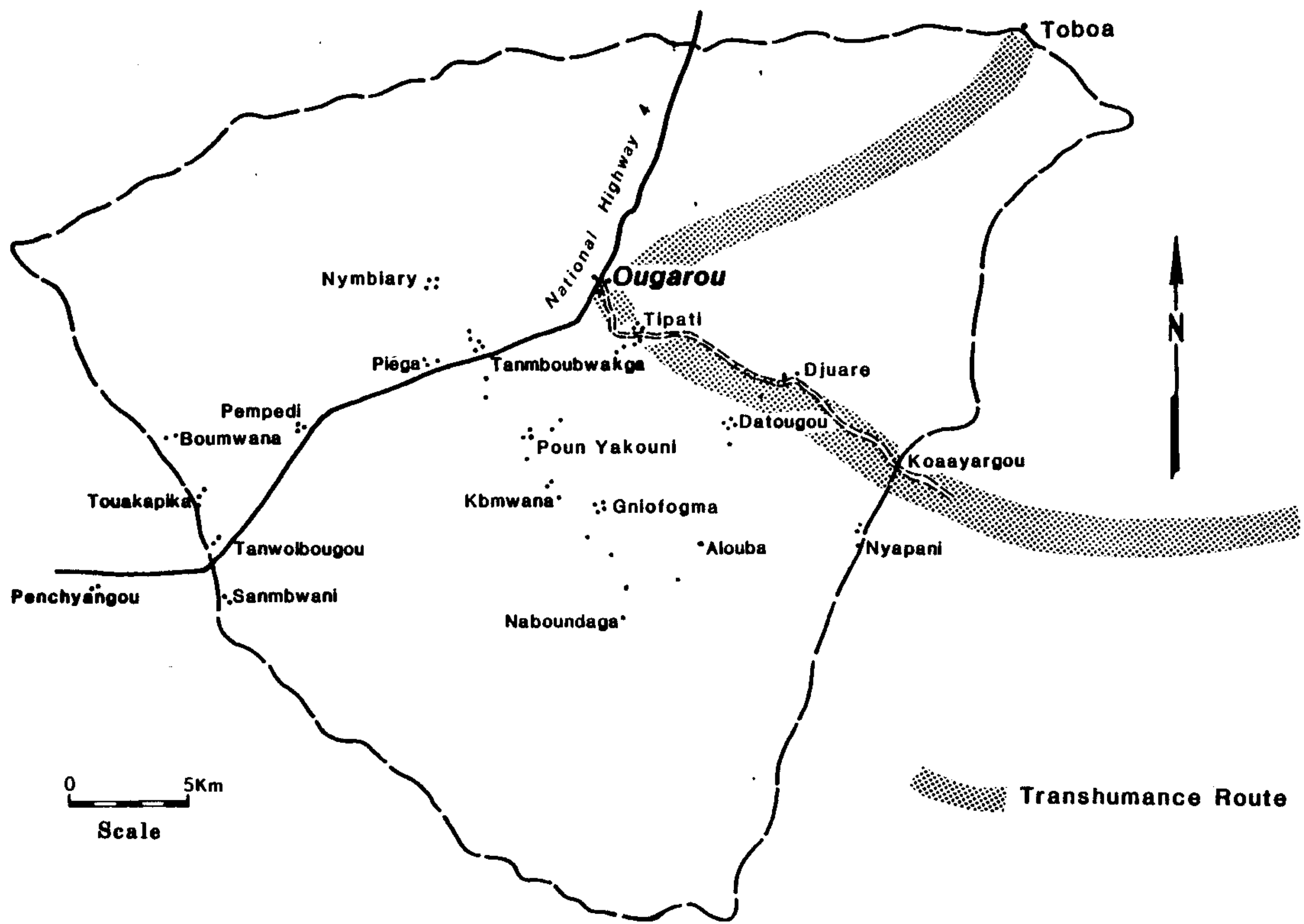

Figure 2.21 TRANSHUMANCE ROUTE - OUGAROU

near the beginning of the rainy season while grass is becoming more abundant, thus assuring sufficient milk production for the calf at birth. By counting back, then, it would bring the breeding season near the middle or during the last half of the good grass growing season. At that time the grasses begin to mature and have a higher nutrient value. The cows have sufficient good grazing to raise their their level of nutrition, a process called "flushing."

Is this natural or contrived by the livestock producers? Either way, the livestock producers know that this is actually what happens. In their conversations with interviewers they have indicated that a calf born out of season is indeed a problem to them. Of 46 Fulani livestock producers interviewed in the Koukoundi and Tafogo sites, 44 stated that their calves were dropped seasonally, at the beginning of the rainy season.

All the 46 Fulani livestock producers interviewed testified to some degree of selection of male breeding animals. In line of importance, and in their own terminology, the livestock producers used the following criteria in selection of breeding males:

1. Strength (22).
2. Color of coat (11).
3. "They give good calves" (10).
4. "They are easy to work with" (2).
5. Good breeders (1).

Also, the Fulani livestock producers make their breeding animal selections for aesthetic reasons, choosing animals with variegated-color coat patterns that make the animals stand out in the herd.

It is true that the Fulani livestock producers know little of genetic dominancy of certain characteristics, but they do know that a "strong" bull will come nearer to begetting a strong calf than will a weak bull. But their desire to have a strong bull for a breeding animal is sometimes overridden by their desire to have a strong ox to sell when they have need of money. Many times one observes good quality bulls being castrated at the age of four years. It is often the case, though, that there are enough other good quality bulls in the herd to take care of the breeding needs.

The Fulani livestock producers realize that a large strong bull will grow into a large meat animal more readily than a weaker animal.

The Fulani livestock producers are increasingly thinking in terms of livestock management in their consideration of the milking qualities of their cows. This is especially true of Fulani groups who are becoming more sedentary in their life-styles. All livestock producers interviewed admitted to a knowledge of the superior milking qualities characterized by the Azaouak breed of Zebu, imported from the Azaouak Valley in Niger. This breed is being perpetuated in such places in Upper Volta as Markoye, Matourkou, and Banfora. Dissemination of the Azaouak breed for breeding purposes is progressing as fast as possible, considering that deaths from trypanosomiasis are making serious inroads into the breeding stock, especially in the Sudanian zone.

2.4.2.4 Nutrition and Supplemental Feeding

2.4.2.4.1 Range Management

Very little is known by local livestock producers about the general concept of range management. Most livestock producers have an excellent knowledge of the grasses and shrubs which are preferred by their cattle (Swift, 1979). Similarly they are aware of the process whereby grazing land is regenerated or degraded by overgrazing and/or burning. Problems do not result from a lack of knowledge of the environment and the interrelationships which govern it. Difficulties instead result from the inability of the individual livestock producer to manage these resources. Without the generation or imposition of effective management procedures and enforcement mechanisms, there is little that can be done.

Currently grazing land in Sudanian Zone of Upper Volta is completely open. There are no restrictions on who can use it, how long they can use it, during what seasons it can be used, and how many head can be kept there. The rational strategy for the individual is to maximize his own utility function without regard for the long term environmental impact. The potential result is the classic "tragedy of the commons."

Most livestock producers say that they leave their cattle in a grazing area until they have consumed all, or almost all the available grasses and leaves. The key factor is water. If water is available all the forage in the area will be used. If not, the length of time spent in an area will be considerably less, and more vegetative resources will survive the season. There is no real conception of a system of grazing area rotation (99.4% said they did not leave any grazing areas at rest) and many livestock producers laughed at the suggestion. Some elderly Fulani said that at one time they employed such practices. Now, however, with increasing population pressure and more intensive crop cultivation, such a system is impossible. Any good grazing land, if left to regenerate for a period of time, will merely serve to feed other peoples' herds. Not only will no long term saving or protection result from an individual livestock producer undertaking a rest-rotation system, but such an effort will merely result in the sacrifice of some of the grazing resources he regularly utilizes to others.

2.4.2.4.2 Burning

The burning of grazing areas is a very controversial issue. Livestock producers surveyed are roughly evenly split regarding the advantages and disadvantages of this practice. Of the 52.3 percent who feel that there are benefits to be obtained from burning, the most common benefit cited was that new, fresh grasses will grow quickly after burning.

There is considerable regional variation in the propensity to burn. In the north the practice is not common and is opposed by a significant majority of livestock producers. In the east and south, burning has much more favorable connotations for livestock producers. Only the Mossi are very reluctant to burn grazing areas. The Fulani, Gourmantche, and Bissa regard burning in a more positive light (Table 2.72).

It must be noted that the burning being discussed here is not indiscriminate. It is carefully controlled, both in terms of area and season. The most common times for burning by livestock

TABLE 2.72

PERCENT OF LIVESTOCK PRODUCERS BY ETHNICITY
WHO FEEL THAT BURNING IS USEFUL

	Mossi	Fulani	Gourmantche	Bissa	Total
%	21.5	67.2	94.1	80.0	52.3
N	65	58	17	15	155

$X^2 = 46.37$ $p < .0001$; Cramer's V = .55.

producers are October to November, and May. In October and November livestock producers explain that the grasses are still moist. Therefore fire will not destroy everything and there will be enough moisture left so that new growth can spring up. Similarly in May they suggest that by burning just before the rains come, good quick growth of grasses will be insured with the first rain. In very few cases, however, did livestock producers seem to examine the long term impact of these actions (Table 2.73).

There remains a great deal of conflict in the minds of livestock producers regarding the issue of burning. While they find their own motivations for burning justified, they are strongly opposed to much of the burning done by farmers. For example, burning designed to clear brush areas for planting often destroys significant areas of grazing resources. It also comes in the wrong season to be of use in regenerating grasses. Fires lighted by hunters in search of small game also cause considerable damage to grazing areas. For their part, farmers say that if the herders can burn for their purposes, why should farmers not use burning when it suits them.

Unfortunately, the agency charged with regulating burning, the Water and Forestry Service, is understaffed in the field and often issues contradictory directives to its field personnel regarding enforcement procedures. Until a firm national policy is established for burning, and adequate enforcement procedures are instituted, little change can be expected in this practice. Successful demonstrations can be instituted only within the context of a broader national policy.

2.4.2.4.3 Supplemental Feeding

Supplemental feeding has been the subject of much discussion and research, especially in regions of Upper Volta where by-products of various industries and farm grown feedstuffs are available. Among those livestock producers interviewed, 64.9 percent said that they used certain supplements for at least some of their animals. Normally, however, supplemental feed is provided

TABLE 2.73

MONTHS WHEN LIVESTOCK PRODUCERS SAY IT IS USEFUL TO BURN THE GRAZING AREA

Month	Percent of Livestock Producers
January	1.3
Feburary	-
March	-
April	2.6
May	11.5
June	7.7
July	-
August	-
September	7.7
October	46.2
November	19.2
December	2.6

only to traction animals, milk cows, calves, and animals too sick to graze.

The owners of the large proportion of the livestock, the Fulani, are least likely to provide supplemental feed for their animals. Only 28.1 percent of the Fulani said they feed any cattle at all. The Mossi (87.7%), Gourmantche (82.4%), and Bissa (86.7%) are fairly uniform in the high degree to which they provide supplemental feeds to at least some of their cattle (see Table 2.74). Much of this feeding is accounted for by the ownership of traction animals. Furthermore, it must be stressed that much feeding is only seasonal. Even traction animals are often sent out to graze around the village when they are not needed for plowing or weeding.

The most common forms of feed provided are millet stalks, peanut hay, and to a lesser extent, bean hay. All of these are by-products of the normal farming processes. Most livestock producers, 72.2 percent, who use such supplements produce them in their own fields. The remaining 27.8 percent either buy them (5.0%) or both. There is considerable variation from year to year. After a good harvest livestock producers may collect millet stalks, peanut hay, and/or bean hay. They will store these items on the top of a small shed or lean-to for later use. In a bad year there may be little, if anything, which can be used as supplemental feed.

The Fulani, whose crop production is more limited than that of the other ethnic groups, tend to buy feed supplements rather than grow them. Only a small minority of Fulani use such supplements. Their traditional concentration on utilization of grazing land also militates against the use of such supplements.

Most livestock producers are currently using all the surplus crop materials they produce. The idea of planting forage crops for their animals is a totally foreign concept. Given the existing labor intensive farming system and the fact that forage crops must be grown at about the same time as food crops, there is not adequate labor available for such an effort. Furthermore, in many areas there is not adequate surplus land on which forage crops can be grown. No one is willing to convert grain-producing crop

TABLE 2.74

SUPPLEMENTARY CATTLE FEEDING BY ETHNIC GROUP

	Mossi	Fulani	Gourmantche	Bissa	Total
% Yes	87.7	29.3	82.4	86.7	64.9
Number	65	58	17	15	155

land to forage use. If forage could be grown on fields at rest in the crop rotation system, without degrading the soil, some livestock producers might be convinced to undertake such an effort. The Fulani, who generally do not produce enough grain to feed themselves, can hardly be expected to plant forage crops. It should be noted that many livestock producers who use supplements clearly state that they prefer to have their animals feed on local grasses and leaves. Outside of traction animals, forage will not be furnished to the herd as a whole. In sum, supplemental feeding does not appear to be a strategy with a high chance of success.

An additional supplement to the diet of many animals is salt. Traditionally this was obtained by taking the cattle to an area with salty earth. The animals would eat the earth until they were satisfied with salt. This is presumed to help improve their appetites as well as their general health. Presently, salt is more commonly applied in the form of sea salt, rock salt, and/or manufactured salt and mineral blocks. The latter, the preferred form, is currently utilized by 62.4 percent of the livestock producers surveyed.

Once again, these supplements are not provided for the whole herd, but generally for traction animals, milk cows, and certain prized cattle only. The average cow receives very little, if any, of this supplement except where areas of salty earth are still available (e.g., the transhumance route from Tafogo).

2.4.2.5 Protection, Diseases, and Pests

Several important infectious diseases and internal and external parasites are known to debilitate West African cattle in all three zones: the Sahelian, the Sudanian, and the Guinean.

The dominant infectious diseases, as agreed upon by most practicing veterinarians, are trypanosomiasis, rinderpest, contagious bovine pleuropneumonia, blackleg, anthrax, hoof and mouth disease, pasteurellosis, brucellosis, and streptothricosis. Seasons of greatest disease incidence are shown in Figure 2.22. The accuracy of these data are not known, since there is no continuing collection of data on disease incidence.

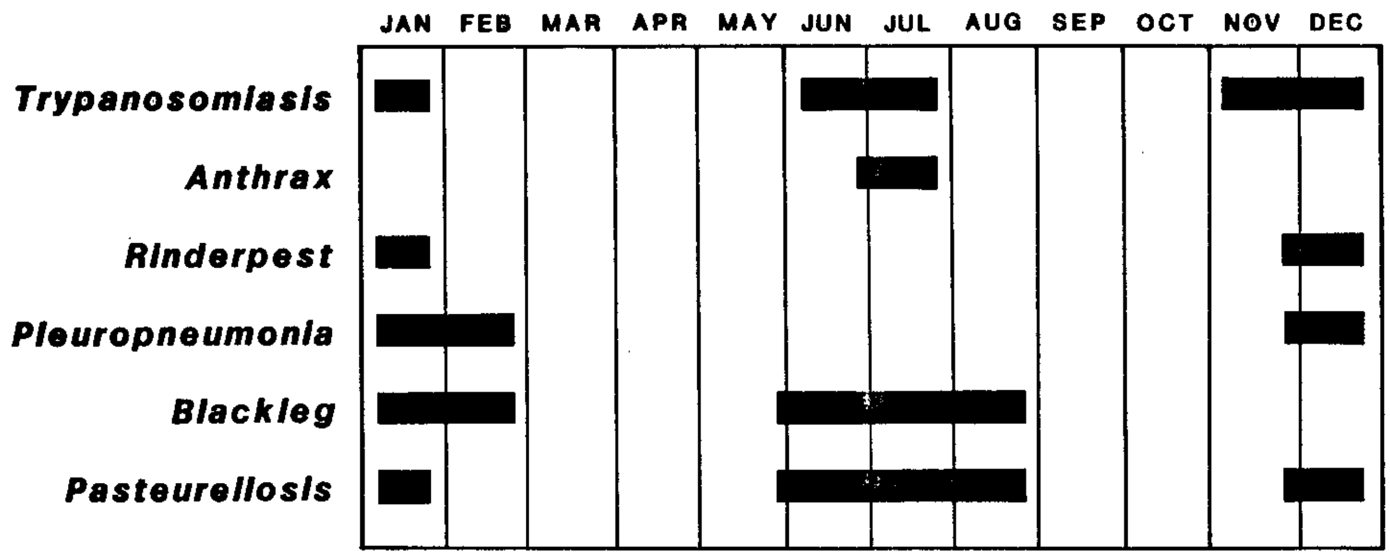

Figure 2.22 SEASONS OF LIVESTOCK DISEASE

In 1964-1969, in West and Central Africa, a multi-donor supported campaign was conducted against rinderpest. It was known as the JP-15 campaign. It succeeded in wiping out rinderpest in nearly all Africa and as a consequence there was no alert against the disease for several years. However, there was no follow up with prophylactic treatment of offspring which led to a recurrence of rinderpest in some countries. Upper Volta has not had a recurrence of the disease yet, but with widespread animal transhumance between countries (e.g., Mali and Niger) there is much danger.

Trypanosomiasis is a health problem of special importance and is a barrier to the introduction of modern livestock production based on the Zébu breed in the Sudanian and the Guinean zones. Measures taken against the disease vector, the tsetse fly, such as chemical treatment, are very costly. Nigeria did this in 1976 on more than 6 million hectares at a cost of almost $25.00 per square kilometer. There is no record of this extreme measure having been taken or strongly considered in Upper Volta. Neither has there been the total eradication of brush that hosts the vector fly.

In the opinion of veterinarians associated with the project the above mentioned diseases are the most dominant in Upper Volta. Of them all, trypanosomiasis is the most important because of livestock transhumance into zones where the vector fly is prevalent.

There are a number of other cattle diseases not properly identified because of lack of veterinarians and diagnostic services. These may be bovine lumpy skin disease, heartwater, theileriosis, brucellosis, and tuberculosis. In the case of tuberculosis this has been well-established by the meat inspectors of the Ouagadougou and Bobo-Dioulasso abattoirs. Further clinical tests and diagnoses are needed.

The commercial loss of revenue from ticks or mange infected animals has never been precisely determined but it is well understood that ticks are often disease vectors, to say nothing about the direct debilitating effects they have on animals.

The following statements were translated from the summary of a graduate thesis by Ouedraogo Abdoulaye Managadlawinde of Upper Volta at the University of Dakar:

> We have at this time knowledge of the presence of 33 species of ticks in Upper Volta, distributed as follows: Family Ixodidae: Amblyomma (2); Aponomma (3); Bophilys (3); Haemaphysalis (7); Hyalomma (6); and Rhipicephalus (10). Of the Family Argasidae: Argas (2).
>
> The ticks of Upper Volta are relatively well understood from the standpoint of their life cycles, their biological functions, their actions and their economic and medical importance.

Within the six sites of the VLP minimal countermeasures are taken against these ticks. Dipping vats have not been introduced although the possibility of such structures being established is worthy of consideration to test their acceptance and use by the livestock growers. One of the main reasons for the lack of dipping vats is that an abundant supply of water is necessary. The structure itself is quite expensive and more study must be done concerning the justification for the expense.

The establishment of dipping vats would, for the most part, serve the sedentary livestock population. The very nature of the different kinds of ticks complicates the treatments against them because of their different lifestyles. One must deal with what are generally known as 1-host ticks and 2- or 3-host ticks. The 2- or 3-host ticks require shorter intervals between dips than the 1-host ticks, as well as different concentrations of materials (Ixodicides). To expect transhumant herds to be dipped at 5-7 day intervals, as is necessary with the 2- or 3-host ticks, is not realistic.

Hand dressing with ixodicides is a more logical answer to the problem, and this procedure can be applied at the vaccination corrals at the time of vaccine administration. It is possible that the presently established vaccination corrals could be altered and adapted to accommodate this procedure, or where water is available, dipping vats.

Spraying by hand is already being used on a very limited scale at this time. Some of the more sedentary livestock growers, especially those with small ruminants, are using hand spray rigs, but their treatments are quite intermittent and not planned to consider the life cycles of the ticks being treated. It seems that the attitude that "a little treatment is better than none at all" prevails.

The central Livestock Service pharmacy has stocked a supply of "Ixogal D20" which is being sold to livestock growers for use in the arid zones. "Ixogal" is a very strong insecticide, especially effective against mange infestation. For ticks it has approximately an 8-day residual effect so, therefore, it is only effective against the 1-host ticks. The emergence of injectable insecticides (and ixodicides) should allow the development of improved tick-control procedures.

The Livestock Service in Upper Volta does not have a program for the control of ticks in livestock.

Internal parasitism of livestock in Upper Volta is fairly well documented and the data show that a high percentage of cattle are parasitized by strongyle nematodes. However, the level of parasitism has never been defined.

The Veterinary Laboratory in Ouagadougou has data showing that strongyle eggs were found in 2 of 14 cattle from Tenkodogo, 21 of 30 young cattle from Nakouy, and 8 of 20 cattle from Bandougou (Campaore, 1979).

Data are on file at the Veterinary Clinic in Ouagadougou covering a three-year period of worm collections from the slaughter house in Ouagadougou where the worms had all been identified but not counted.

The fecal egg counting method now in use in the Veterinary Laboratory is not standardized and in its present form cannot give quantitative data, although changes are now being made. The personnel at the Laboratory are well trained and in a short period of time, will be able to handle most problems in parasitology as well as in microbiology and pathology (Schrecke, 1979).

In general, unless an animal has been treated, it is a rare one that has no strongyle eggs in the feces.

The symptoms of animal sickness because of gastrointestinal nematodes are quite numerous, among them loss of weight, low milk production, subcutaneous swellings, and intense diarrhea.

The above symptoms are only suggestions that an overload of nematodes may exist. Since other agents may produce these signs a laboratory examination must be made for confirmation.

The results of laboratory tests serve to:

1. Confirm a diagnosis.
2. Precisely identify an agent causing the problem.
3. Allow recommendation of the most effective product for use in prophylaxis or therapy.

4. Establish useful background information of symptoms to be recognized.

Poisonous plants cause some mortality, particularly at the beginning of the rainy season.

At this time the Livestock Service in Ouagadougou is in the process of setting up a National Diagnostic Laboratory and a National Veterinary Pharmacy Service. The aim is for a general improvement of the veterinary service. The activity is being financed by the German Agency of Technical Assistance under the Upper Volta Ministry of Foreign Affairs.

There are three steps to be taken in setting up the Veterinary Laboratory. The first step will be to equip and develop the Laboratory for parasitology work. Following that will be the development of the Laboratory to include microbiology and then pathology (Schrecke, 1979).

For the development of the Veterinary Pharmacy, Step 1 includes technical supervision of the construction of suitable buildings and facilities. Step 2 will include drug distribution and the setting up of a revolving fund (Fink, 1979).

The following animal health statistics were gathered as part of the livestock management survey conducted in VLP sites. These data are not strictly veterinary in nature. First, the data are based on what local livestock producers perceive to be the causes of actual deaths. The data are not diagnostic. No blood samples or other formal procedures were undertaken to verify these data from a veterinary perspective. In fact, such a capability is limited but is being developed within the Livestock Service.

Secondly, it should be noted that the four ethnic groups included in the survey differ greatly in the depth of their experience with, and understanding of livestock diseases and their symptoms. Even linguistic problems occur where people do not know the names of certain diseases in their own language, confuse various names, or use the same name for several diseases. Their reports are therefore not of uniform quality. For this reason the data have been broken down, not only by site, but by the ethnic group of those reporting the losses. It is expected that reports provided by the Fulani are in general more accurate than those provided by the other three ethnic groups. However, it must be noted that due to different management practices, particularly transhumance, Fulani herds may in fact differ from the herds of the other ethnic groups in terms of the types of diseases they are exposed to and contract. Thus, there may be real differences in the actual causes of livestock mortality for different ethnic groups (see Table 2.75).

Thirdly, the figures presented here do not strictly deal with the prevalence of various diseases, but rather with the perceived causes of animal mortality. Various diseases or conditions (e.g., parasites) which may be debilitating, thereby decreasing the resistance of animals to other fatal diseases or simply resulting in production losses (weight for example) but not causing deaths, are underreported. What is being examined here are the number of animals reported, by livestock producers sampled, to have died (the sample includes 157 livestock owners with reported losses for 1978 of 456 cattle, 671 sheep, and 55 goats). Thus we have a

TABLE 2.75

NAMES OF MAJOR CATTLE DISEASES IN LOCAL LANGUAGES

English	French	More (Mossi)	Fulani	Bousansi (Bissa)	Gourma (Gourmantche)
Trypanosomiasis	Trypanosomiase	Massere	Peowa	Poum	Blisse
Pasteurellosis	Pasteurellose	Bako	Boorabudo	Kienyaba	Poary blisse
Rinderpest	Peste bovine	Saaga	Charrah/Chaada	Saaga	Yakiama tougpouadou
Pleuropneumonia	Pleuropneumonie	Fulufubaaga	Boukge	Hohonrouyaba	Yamkiamo
Blackleg	Charbon symptomatique	Kaargabaaga	Kweengale	Foufouyaba	O Touado
Anthrax	Charbon bacteredian	Tindrebaaga	Saamo	Yamba gonfa	Yampayebry
Tuberculosis	Tuberculose	Konsogokengo	Soyou	Danyaba	O Kgarou
Lumpy skin disease	Dermatose nodulaire	Zanggo	Gwiiya	Maibollgi	Mogary
Mange*	Gale	Zankada Zankara	Yaayade	Maiboyaba	Mogary
Brucellosis	Brucellose	-	-	-	-
Foot-and-mouth	Fièvre aphteuse	-	Suffa saffa	Niniyaba	Saffa

*Exact type unknown.

picture of the relative frequency of various causes of animal losses.

Fourthly, it is believed that in spite of possible errors of perception and local diagnosis,* there is a probable positive correlation between perceived causes of livestock losses and the actual causes. These data can be reasonably well employed as a proxy measure for actual animal diseases until a more adequate diagnostic service can be put in place.

Finally, while we are dealing only with perceptions of causes of animal deaths, these figures should not be disregarded by the professonal veterinarians. People may perceive certain factors to be the causes of their losses, even if these are not in fact the causes. It is these perceptions which will guide their efforts to obtain either preventive or curative treatment. That is, if livestock producers believe that their animals are dying from trypanosomiasis and the cause is in fact pasteurellosis, they will still seek treatments for trypanosomiasis. The overall result will be (1) improper therapeutic and/or prophylactic measures will be applied and (2) when these measures fail to have the desired effect the credibility of the agents of the Livestock Service, in particular, and of modern veterinary medicine in general, will be decreased. It is imperative that these data be supplemented by more adequate local diagnosis.

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*Diagnosis by local livestock producers includes lay post-mortem examinations in most cases.

2.4.2.5.1 Cattle Losses

An examination of overall reported cattle losses during 1977-1978 identifies the most commonly attributed causes of death. Cattle trypanosomiasis presents the largest single problem; over 49 percent of all cattle losses were attributed to this single cause. Other important perceived causes of losses are pasteurellosis (15.3%) and blackleg (14.8%) (see Table 2.76).

The regional incidence of the reported causes of livestock losses may differ significantly. This possibility will be further examined in the following paragraphs. First, however, it may be useful to look at the age and sex distributions of animals lost. Since males are sold off at a relatively young age, while females are likely to be kept with a herd much longer, it is necessary to examine mortality figures for male and female animals separately (see Table 2.77).

Many more female than male losses are reported. This again is probably a function of the fact that males are sold off and slaughtered at a younger age, thus not having the same opportunity as females to contract disease.

For male cattle, the average age of mortality is 2.88 years (range 1-9, median 2-3, mode 1-2). The comparable figures for females are 5.92 years on the average (range 1-20, median 6-7, mode 3-4). The average age of all animals lost is 5.78 years (median 4.5). These figures are broken down by age category and site in Table 2.78. There do not, however, appear to be any significant differences in the age of mortality between the various research sites.

As reported, the incidence of the various reported causes of cattle losses greatly varies from one region to another. There is also considerable variation in reported causes of cattle losses between ethnic groups within each region. Trypanosomiasis is identified as the major killer of cattle in Ougarou and Tafogo. Over half of all cattle losses in these areas are attributed to this cause. It is also important in Gnanguedin where it accounts for about 20 percent of all cattle losses. The problem in the

TABLE 2.76

PERCENTAGE OF ANIMAL LOSSES ATTRIBUTED TO EACH CAUSE FOR FOUR SITES*

Disease or Cause of Death	Cattle	Sheep	Goats
1. Trypanosomiasis	49.19	24.59	42.88
2. Rinderpest	0.00	12.82	9.01
3. Blackleg	14.77	0.89	1.26
4. Anthrax	0.45	1.79	0.00
5. Pasteurellosis	15.34	33.09	12.43
6. Pleuropneumonia	0.66	0.00	0.72
7. Diarrhea	0.90	11.47	14.24
8. Tuberculosis	0.44	0.89	0.90
9. Bronchitis	0.00	0.11	3.60
10. Parasites	0.00	5.21	7.92
11. Hunger and thirst	11.41	0.11	0.00
12. Cold	0.00	0.74	3.60
13. Mange	0.00	0.29	0.00
14. Lumpy skin disease	4.66	0.00	0.00
15. Constipation	0.44	0.00	0.00
16. Aborted	0.22	0.00	0.54
17. Birth	0.44	0.00	0.18
18. Accident	2.85	0.74	0.00
19. Wild animals	2.41	3.38	3.61
20. Unknown disease	9.43	16.84	9.91
Total animal mortalities	456	671	555

*Gnanguedin, Koukoundi, Ougarou, Tafogo.

(The sums of the percentages are greater than 100 because many animals were thought to have several diseases at the time of death.)

TABLE 2.77

AGE AND SEX OF CATTLE LOSSES--FOUR SITES*

Age	Males	Females
Average	2.88	5.92
Maximum	9	20
Minimum	1	1
Median	2-3	6-7
Mode	1-2	3-4

Median age--males and females: 5-6 years.

Average age $\bar{X}$: 5.78 years; median 4.5 years.

Maximum: 19-20.

Minimum: 0-1.

*Gnanguedin, Koukoundi, Ougarou, Tafogo

TABLE 2.78

AGE AND SEX OF CATTLE LOSSES FOR EACH SITE

Age:*	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-20	Total
Site													
Koukoundi													
Males	6	3	2	4	4	5	4	-	-	1	-	-	29
Females	3	4	1	4	2	7	10	4	2	1	1	3	42
Ougarou													
Males	-	9	3	5	3	-	-	-	-	-	-	-	20
Females	-	9	8	3	4	4	4	2	6	6	1	2	49
Gnanguedin													
Males	1	3	2	1	1	-	1	1	-	-	-	-	10
Females	1	3	-	17	1	4	1	2	2	1	1	2	35
Tafogo													
Males	-	8	13	2	7	4	2	1	-	-	-	-	37
Females	-	-	1	3	6	8	4	11	5	8	12	3	61
Total (N)	11	39	30	39	28	32	26	21	15	17	15	10	283
Males (from all sites)	7 (7.3)	23 (24.0)	20 (20.8)	12 (12.5)	15 (15.6)	9 (9.4)	7 (7.3)	2 (2.1)	0 -	1 (1.0)	0	0	96
Females (from all sites)	4 (2.1)	16 (8.6)	10 (5.3)	27 (14.4)	13 (7.0)	23 (12.3)	19 (10.2)	19 (10.2)	15 (8.0)	16 (8.6)	15 (8.0)	10 (5.3)	187
% of animal mortalities	3.89	13.78	10.60	13.78	9.89	11.31	9.19	7.42	5.30	6.01	5.30	3.53	100

*Omitted from these results are cattle for which the age and/or sex was not given.
0-1 = 0-.99; 1-2 = 1-1.99; etc.

Ougarou site is clear. It is a relatively wet area, with low population density, a high degree of bush type ground cover, and in close proximity to a game reserve. Conditions are ideal for the maintenance of the disease's principal vector, the tsetse fly. The problem is further complicated by the generally low level of veterinary services (principally the shortage of personnel) available to the population in the Fada ORD in the past. The area of Gnanguedin is generally wetter than other VLP areas. Veterinary service coverage of the area has been above average. Thus, while the disease continues to be important in the area, it seems to be at least partially under control. The high incidence of this cause of animal death in Tafogo cannot be adequately accounted for.

A high incidence of blackleg can be noted for both Koukoundi and Gnanguedin, especially among the herds of the Fulani. The incidence is also quite high among the Mossi and Bissa of Gnanguedin and the Gourmantche of Ougarou. Pasteurellosis appears to be an important killer in Ougarou and to a lesser extent in both Tafogo and Gnanguedin. Koukoundi appears to be relatively free of the disease. However, the incidence of undetermined causes of death is much higher in Koukoundi than elsewhere. The differences in causes of death between this site and the others may result from an inability to identify certain diseases, the influx in the recent past of a disease formerly unknown in the area, or the fact that the veterinary nurse, Boniface, is a good diagnostician willing to admit when he doesn't know the cause.

The distribution of cattle deaths attributed to undetermined causes by ethnic group (see Table 2.79) tends to indicate that the Fulani are much more familiar with and better able to diagnose animal diseases than are livestock producers of the other three ethnic groups. The margin of the difference is not nearly as great as expected.

An extremely important issue from the perspective of animal production is the impact, or potential impact, of livestock losses on individual livestock producers. It should be noted that 57.8 percent of cattle owners interviewed reported losing at least one head in the last year.

TABLE 2.79

PERCENTAGE OF CATTLE LOSSES ATTRIBUTED TO EACH CAUSE BY SITE AND ETHNIC GROUP

Disease or Cause of Death	Koukoundi (Kaya ORD)		Ougarou (Fada ORD)		Gnanguedin (Koupela ORD)		Tafogo (Kaya ORD)	
	Mossi	Fulani	Gour-mantche	Fulani	Mossi + Bissa	Fulani	Mossi	Fulani
1. Trypanosomiasis	15.38	0.00	49.09	93.74	2.00	20.00	65.05	29.31
2. Rinderpest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Blackleg	2.56	58.80	27.27	2.68	2.00	40.00	1.21	0.00
4. Anthrax	5.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Pasteurellosis	0.00	0.00	7.27	44.65	13.33	3.33	7.23	10.34
6. Pleuropneumonia	0.00	2.90	0.00	0.00	0.00	0.00	2.41	0.00
7. Diarrhea	5.13	6.00	0.00	0.00	0.00	0.00	0.00	0.00
8. Tuberculosis	0.00	0.00	1.82	0.90	0.00	0.00	0.00	0.00
9. Bronchitis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10. Parasites	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11. Hunger and thirst	25.64	0.00	12.73	0.00	0.00	0.00	6.02	51.72
12. Cold	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13. Mange	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14. Lumpy skin disease	0.00	0.00	0.00	0.00	0.00	35.00	0.00	0.00
15. Constipation	0.00	0.00	0.00	0.00	13.33	0.00	0.00	0.00
16. Aborted	2.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17. Birth	0.00	0.00	0.00	0.00	13.33	0.00	0.00	0.00

TABLE 2.79 (Continued)

Disease or Cause of Death	Koukoundi (Kaya ORD)		Ougarou (Fada ORD)		Gnanguedin (Koupela ORD)		Tafogo (Kaya ORD)	
	Mossi	Fulani	Gour-mantche	Fulani	Mossi + Bissa	Fulani	Mossi	Fulani
18. Accident	2.56	8.80	0.00	0.00	6.67	1.67	9.64	0.00
19. Wild animals	2.56	2.90	10.91	2.68	0.00	0.00	0.00	0.00
20. Unknown disease	41.02	20.60	3.64	0.00	20.00	0.00	14.46	8.63
Total %	102.56	100.00	112.73	144.65	106.66	100.00	106.12	100.00
Total Number	39	34	55	112	15	60	83	58

As can be seen from Table 2.80 the percent of livestock producers suffering cattle losses is similar for three of the four ethnic groups studied. The exception appears ($X^2 = 9.66$, $p < .05$) to be the Bissa. Several explanations for this anomaly are possible. The Bissa sampled are all in the Koupela ORD in the site of Gnanguedin. Stock losses in this area tend to be lower than for the other two ORDs for all types of animals. In general veterinary services (vaccinations) in the Koupela ORD are better than those in Kaya or Fada. The Bissa take advantage of livestock vaccinations to a greater extent than do the other ethnic groups studied. Animal losses for the Mossi also tend to be relatively low in Gnanguedin. Bissa herds also tend to be smaller than those of the other ethnic groups. The result is lower total losses per livestock producer and decreased chances of losing an animal in a given period of time.

In examining the actual losses per livestock producer, it is important to keep herd size in mind. In general Fulani herds in all sites are larger than the herds of the majority ethnic groups (Mossi, Bissa, Gourmantche) in the same sites. Therefore, the livestock losses per Fulani are expected to be higher than those suffered by the other groups. In comparing areas it therefore makes sense to compare the Fulani of each site only with the Fulani of other sites, and the Mossi, Bissa, and Gourmantche with each other (Table 2.81).

As expected, the average cattle losses per livestock producers are higher for the Fulani in each site than are those of their counterpart ethnic group(s) ($F = 4.02$ $p < .01$). The same holds true for maximum losses suffered. Median losses are also consistent except in the case of Tafogo where median Mossi cattle losses are higher than those of the Fulani.

A look at the median figures indicates that the typical livestock owner loses about one or two head of cattle per year. However, the distribution also indicates that some livestock producers suffer rather severe losses in any given year. In some cases, once one animal in a herd contracts a particular disease

TABLE 2.80

PERCENT OF LIVESTOCK PRODUCERS (BY ETHNIC GROUP) HAVING LOST CATTLE IN THE LAST YEAR

Ethnic Group	Number of Livestock Producers	% Losing Cattle in Last Year
Mossi	65	63.1
Fulani	58	60.3
Gourmantche	17	58.8
Bissa	15	20.0

TABLE 2.81

REPORTED ANIMAL LOSSES PER LIVESTOCK PRODUCER BY SITE AND ETHNIC GROUP

Site	Number of Animals Lost	Number of Livestock Producers	Losses per Livestock Producer		
			Mean	Median	Range
Koukoundi	73	38	1.92		0-15
Mossi	39	28	1.39	1.0	0-5
Fulani	34	10	3.40	1.5	0-15
Tafogo	141	49	2.88		0-15
Mossi	83	30	2.77	1.5	0-15
Fulani	58	19	3.05	1.0	0-12
Gnanguedin	75	37	2.03		0-16
Mossi + Bissa	15	23	0.65	0.0	0-7
Fulani	60	14	4.29	1.5	0-16
Ougarou	167	33	5.06		0-30
Gourmantche	55	17	3.24	1.0	0-22
Fulani	112	16	7.00	4.0	0-30

and is not immediately isolated, many other cattle in the same herd catch the same disease. Once again this phenomenon is associated with the vaccination process. Most livestock producers vaccinate their whole herd at one time. Thus, where disease strikes an unvaccinated animal, the whole herd is often subject to the consequences. The failure to vaccinate may thereby have rather dire consequences for the affected cattle owner. Unfortunately, many livestock producers wait until a disease strikes their own or a nearby herd before seeking vaccinations for their animals.

In examining the cattle losses per livestock producer in the different sites, a clear distinction appears. Livestock losses in Ougarou (Fada ORD) are significantly higher than in any of the other sites. The mean, median, and maximum losses for the Fulani of Ougarou are higher than those for the Fulani elsewhere. Similarly, the mean and maximum figures for the Gourmantche are higher than those for the Mossi and Bissa elsewhere. There are several possible explanations for this difference. It is partly accounted for by the environmental conditions in Ougarou which are supportive of animal diseases, notably trypanosomiasis, which is often fatal. Additionally, because of the vast area covered and the relatively low population density in the Ougarou area, herd size tends to be larger than in the more confined territories of the other sites (Phillipe et al., 1977). Thus, at least part of the difference is expected.

2.4.2.5.2 Animal Health Measures

The preventive health measures available to and employed by local livestock producers in Upper Volta are principally, if not exclusively, vaccinations* against known diseases. The Livestock Service has made vaccines available but the record of vaccinations given (Table 2.82) does not seem to be related closely to disease incidence. This form of preventive measure is widely accepted,

*The product used against trypanosomiasis is not in fact a vaccine. For the sake of simplicity the popular term vaccination is used here to cover the use of both vaccines and chemoprophylaxis.

TABLE 2.82

KAYA ORD VACCINATIONS 1975-1978

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rinderpest	75	20,093	29,645	25,119	2,467	448	-	-	152	-	529	1,381	19,062
	76	2,222	4,736	1,504	1,281	477	311	889	859	243	331	187	911
	77	3,938	6,260	8,162	7,221	1,466	350	-	-	-	52	394	2,731
	78	2,761	5,830	6,312	-	-	-	-	-	-	-	-	-
Anthrax Cattle	75	-	44	120	-	489	498	-	40	40	-	-	-
	76	634	1,500	847	443	386	221	374	106	199	122	200	428
	77	120	2,044	835	1,117	1,558	806	2,790	250	832	91	562	360
	78	1,252	926	592	-	-	-	-	-	-	-	-	-
Sheep and goats	75	-	-	-	288	-	16	420	-	-	-	-	-
	76	40	18	63	406	-	307	52	43	-	-	-	-
	77	-	64	98	-	-	-	1	-	25	160	30	-
	78	524	492	-	-	-	-	-	-	-	-	-	-
Blackleg	75	200	60	540	-	-	1,851	693	987	1,571	560	1,180	824
	76	1,303	1,485	1,617	2,690	1,914	2,505	1,768	2,059	1,304	2,356	4,444	3,483
	77	3,630	1,621	2,226	4,544	2,266	737	2,375	1,298	895	937	879	1,980
	78	1,820	3,681	11,817	-	-	-	-	-	-	-	-	-
Pasteurellosis Cattle	75	-	-	-	-	180	287	19	-	40	128	154	-
	76	1,193	2,413	1,593	3,445	1,970	2,403	2,655	1,985	2,838	1,446	5,526	6,076
	77	3,825	1,741	2,764	5,704	2,471	544	2,768	2,264	1,845	443	1,675	1,012
	78	1,820	3,681	11,817	-	-	-	-	-	-	-	-	-
Sheep and goats	75	526	82	162	340	6	315	55	-	1,404	885	938	430
	76	710	52	179	50	80	475	449	242	141	250	1,650	2,961
	77	567	990	1,802	306	700	81	782	430	446	2,492	598	645
	78	643	2,742	7,398	-	-	-	-	-	-	-	-	-
Pleuro-pneumonia	75	20,093	29,645	25,119	2,467	443	-	-	152	-	529	1,381	19,062
	76	958	589	545	642	357	573	587	859	243	904	1,636	911
	77	2,244	2,100	2,687	2,234	1,528	1,760	-	1,260	350	52	432	3,044
	78	4,007	5,882	5,837	-	-	-	-	-	-	-	-	-

Source: Livestock Service Records

although poorly understood at the village level. The degree of acceptance of cattle vaccinations is, as can be seen from Table 2.83 very high. Over 9 out of 10 livestock producers of each ethnic group claimed to have vaccinated their cattle. This figure is undoubtedly much higher than normal because of the presence in these areas of project extension agents who vaccinate livestock. It is possible that individual responses were geared to please the interviewer. However, when one examines the comparable figures for sheep and goat vaccinations, the notion that respondents purposely distorted their responses does not appear to be supported. If they were, one might expect these figures to be as high as those for cattle.

What are the vaccines which livestock producers say they use, or think they use? A number of cases have been observed in which people thought they had vaccinated their animals against one disease, but in fact their animals had received a vaccine for another. When cattle owners were asked what diseases their animals had been vaccinated against, the livestock producers, themselves, had to name the disease. They were not given a list to select from. Thus, the result are clearly not an artifact of the interview schedule. The most common disease named was trypanosomiasis (81.1%), followed by blackleg (56.8%). Vaccinations against rinderpest (37.8%), pleuropneumonia (23.0%), pasteurellosis (21.6%), and anthrax (8.1%) were mentioned by a minority of livestock producers (see Table 2.84).

The average number of different vaccinations individuals give their cattle in a given year is 2.28 for the entire sample. Only 10.8 percent of those sampled had administered four or more of the six available cattle vaccines. None received all six. Given the fact that vaccines must be paid for by the livestock owners, it is not surprising that the number is relatively low (see Table 2.85). Livestock producers in general will only vaccinate against a disease if they perceive it as a real threat to their herds. Added to this is the fact that the Livestock Service lacks the logistical support to mount successfully broad

TABLE 2.83

PERCENT OF CATTLE OWNERS WHO VACCINATE THEIR ANIMALS, BY ETHNIC GROUP

Ethnic Group	Percent	Number
Mossi	98.4	63
Fulani	93.0	57
Gourmantche	94.1	17
Bissa	100.0	15
Total	96.1	152

$X^2 = 3.13$; $p < .4$, not significant.

TABLE 2.84

PERCENT OF LIVESTOCK OWNERS WHO VACCINATE THEIR CATTLE AGAINST SPECIFIC DISEASES

	% Vaccinating	N = 148
Trypanosomiasis*	81.1	
Blackleg	56.8	
Pleuropneumonia	23.0	
Pasteurellosis	21.6	
Anthrax	8.1	
Rinderpest	37.8	

*The product used against trypanosomiasis is not a vaccine. For the sake of simplicity the popular term vaccination is used here to cover the use of both vaccine and chemo-prophylaxis.

TABLE 2.85

NUMBER OF DIFFERENT CATTLE VACCINATIONS GIVEN TO AN INDIVIDUAL'S CATTLE

Number of Vaccinations	Number of Individuals	Percent
0	6	4.1
1	23	15.5
2	61	41.2
3	42	28.4
4	13	8.8
5	3	2.0
Total	148	100.0

$\bar{X} = 2.28$.

vaccination campaigns. Finally, certain vaccines (anthrax, for example) are only made available in those areas in which there has been an outbreak.

There is considerable variation in the number of vaccinations done by ethnic group and region (see Table 2.86). As a group, the Bissa and Gourmantche claim to employ more vaccinations than either the Fulani or Mossi. However, this is more a function of region (site and ORD) than ethnicity. Differences between sites are highly significant ($p < .0001$). Livestock producers in Gnanguedin (Koupela ORD) average almost 3 vaccines a year for their animals, while those in Ougarou (Fada ORD) receive 2.48. Livestock producers in the Kaya ORD receive fewer vaccines than those in other ORDs. The mean number of vaccines administered are 2.18 and 1.71 for Koukoundi and Tafogo, respectively.

An examination of the distribution of various types of vaccinations by site and ethnic group is in order. In three of the four sites treatments against trypanosomiasis are almost universal, regardless of ethnic group (see Table 2.87). In Tafogo, an area with relatively high losses from this disease, only about half of the livestock producers vaccinated against it. Vaccinations against pasteurellosis are most common in the wetter areas, Gnanguedin and Ougarou. Anti-blackleg vaccinations are widely given in Koukoundi and Gnanguedin, moderately given in Ougarou, and rarely administered in Tafogo. Vaccinations against rinderpest and pleuropneumonia, because of the need to keep the vaccines refrigerated, are irregularly given during government vaccination campaigns. Anthrax vaccinations are employed only in those areas in which known corridors for the disease exist.

Interestingly, reported animal losses are generally lower in the Gnanguedin site than elsewhere. Ease of access to the area for the Livestock Service is one possible contributing factor. The main paved north-south road to Togo passes through the site. The relatively high number of vaccinations in Ougarou (Fada) is coupled with high mortality rates. In Ougarou, vaccinations are a rational response by livestock producers to an environment which is heavily infested with disease.

TABLE 2.86

AVERAGE NUMBER OF VACCINATIONS GIVEN
TO CATTLE BY ETHNICITY AND SITE

Ethnic Group	Number of Livestock Producers	Mean Number of Vaccinations	Standard Deviation
Mossi	62	2.15	0.90
Fulan			
Fulani	56	2.25	1.08
Gourmantche	16	2.50	1.32
Bissa	12	2.92	0.90

F = 2.16; $p < .10$, not significant.

Site			
Koukoundi	38	2.18	.77
Tafogo	45	1.71	.84
Gnanguedin	34	2.97	.80
Ougarou	31	2.48	1.29

F = 12.58; $p < .0001$.

TABLE 2.87

TREATMENT LEVELS FOR CATTLE DISEASES BY SITE AND ETHNIC GROUP

Site	Ethnic Group	Trypanosomiasis		Pasteurellosis	
		Number of Live-stock Producers	Percent Treating	Number of Live-stock Producers	Percent Treating
Tafogo*	Mossi	12	40.00	1	3.34
	Fulani	11	57.90	0	0.00
	Total		46.94		2.05
Gnanguedin*	Mossi	8	86.60	4	43.48
	Bissa	12		6	
	Fulani	13	92.86	5	35.70
	Total		89.19		40.54
Ougarou	Fulani	13	81.25	4	25.00
	Gourmantche	15	88.24	8	47.06
	Total		84.85		36.37
Koukoundi	Mossi	26	92.86	3	10.72
	Fulani	10	100.00	1	100.00
	Total		94.74		10.53

TABLE 2.87 (continued)

TREATMENT LEVELS FOR CATTLE DISEASES BY SITE AND ETHNIC GROUP

Site	Ethnic Group	Blackleg		Rinderpest	
		Number of Livestock Producers	Percent Treating	Number of Livestock Producers	Percent Treating
Tafogo*	Mossi	3	10.00	19	63.34
	Fulani	2	10.53	9	47.37
	Total		10.21		57.15
Gnanguedin	Mossi	8	82.60	4	34.78
	Bissa	11		4	
	Fulani	14	100.00	8	57.14
	Total		89.19		43.24
Ougarou	Fulani	5	31.25	8	50.00
	Gourmantche	11	64.11	3	17.65
	Total		48.49		33.34
Koukoundi	Mossi	20	71.43	1	3.58
	Fulani	9	90.00	0	0.00
	Total		76.32		2.64

TABLE 2.87 (continued)

TREATMENT LEVELS FOR CATTLE DISEASES BY SITE AND ETHNIC GROUP

Site	Ethnic Group	Pleuropneumonia		Anthrax	
		Number of Livestock Producers	Percent Treating	Number of Livestock Producers	Percent Treating
Tafogo*	Mossi	15	50.00	0	0.00
	Fulani	6	31.58	0	0.00
	Total		42.86		0.00
Gnanguedin	Mossi	0	4.35	0	0.00
	Bissa	1		0	
	Fulani	0	0.00	0	0.00
	Total		2.70		0.00
Ouagarou	Fulani	8	50.00	0	0.00
	Gourmantche	3	17.65	0	0.00
	Total		33.34	0	0.00
Koukoundi	Mossi	2	7.15	11	39.29
	Fulani	0	0.00	3	30.00
	Total		5.27		38.85

*The figures for these sites are the percentages of <u>all</u> livestock producers who vaccinated their cattle against this disease.

The relatively low number of vaccinations in the Kaya sites may be the result of the inability of the service to operate effectively because of a lack of support by the ORD, or the perception of the existence of fewer important diseases in the area, or both. An additional contributing factor in the case of Tafogo was the extremely poor harvests over the last two years. As a result most disposable cash was required for the purchase of grain. Few people had the money to vaccinate their livestock.

Medicines, principally "Exhelm," are being widely used against internal parasites for both large and small ruminants. The overall distribution and effectiveness of these drugs have, as of this time, not been determined.

2.4.2.6 Marketing and Transportation

In any effort to ameliorate the conditions of animal production it is necessary to have an understanding of the likely outcome of increased production. The issue of cattle marketing in Upper Volta has been examined by Herman (1977). His data present a picture of behavior in and around some of Upper Volta's major cattle markets, Djibo, Kaya, Pouytenga, and Ouagadougou (see Figure 2.23). The individual level data he gives are restricted to the Fulani of Djibo.

In order to round out the marketing picture, this issue has been examined for four ethnic groups (Mossi, Fulani, Gourmantche, and Bissa) and for four areas in three ORDs (Kaya, Koupela, and Fada N'Gourma). In none of the four sites is a large cattle market in the immediate vicinity. The site nearest to a large cattle market is over 70 km away. Thus, we are able to present a picture of the marketing behavior of the more typical Voltaic cattle owner.

2.4.2.6.1 Marketing Motivation

Since livestock are viewed by both the Fulani and their more sedentary neighbors as a repository of wealth, the decision to sell is quite serious. In general, livestock producers, regardless of ethnic group, are target vendors. Livestock are

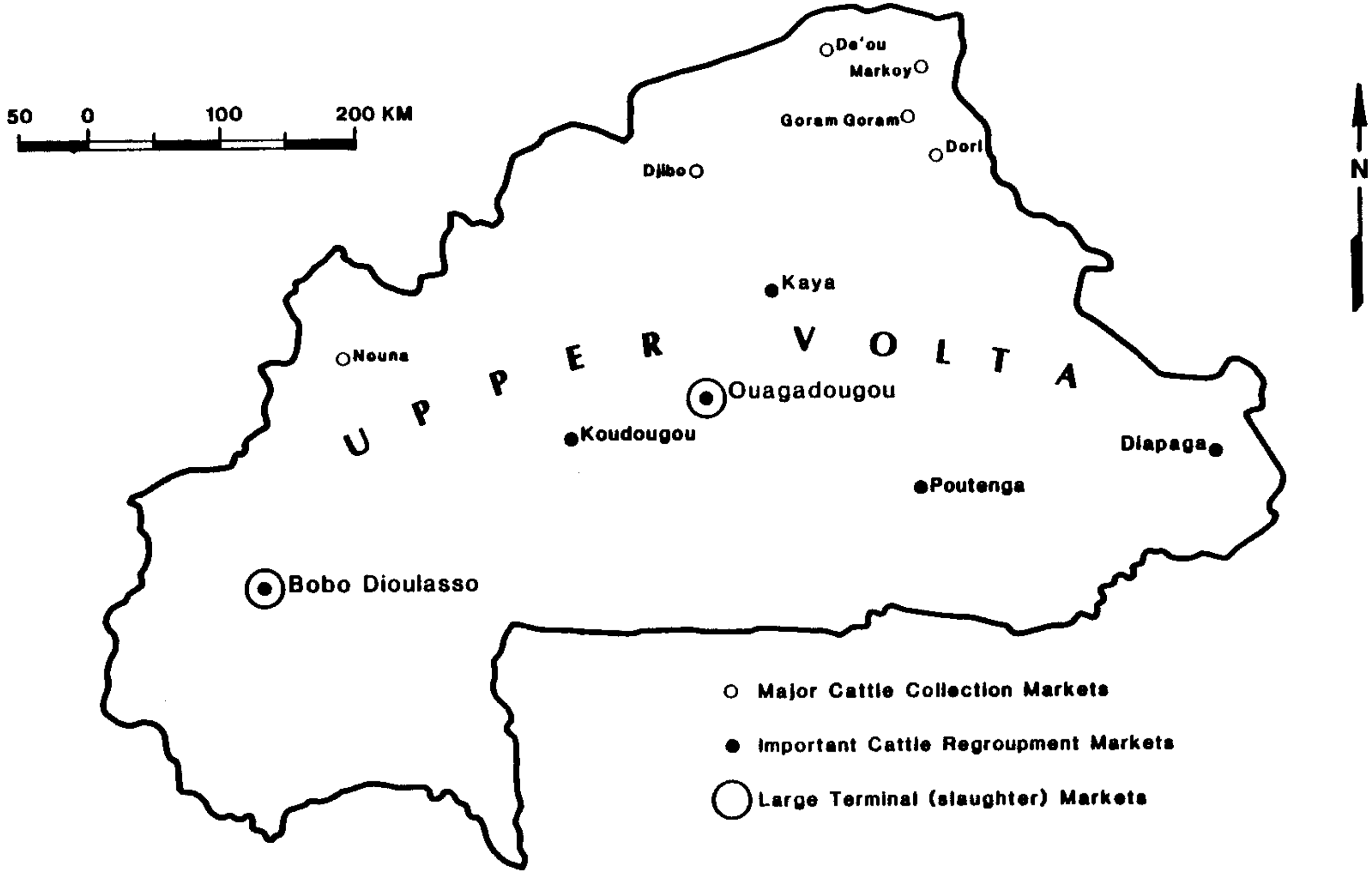

Figure 2.23 CATTLE MARKETS

sold only to meet specific needs or to pay for very specific goods. Market conditions, although important, seem to be a secondary consideration.

A survey of 157 livestock producers reveals what they regard as important reasons for selling livestock (see Tables 2.88 and 2.89). The responses are reasonably uniform from one ethnic group to another. The purchase of grain, millet, and/or sorghum is both the most frequent and most important among the Fulani, regardless of region. Among the more sedentary groups the importance attached to the purchase of grain as a motivation for selling livestock varies inversely with the quality of the last harvest. In two of the four survey sites last year's harvest (November 1978) was quite good. In the other two, the failure of the rains resulted in a very poor harvest. Only 30 percent of the Mossi in the two sites experiencing a good harvest (Koukoundi and Gnanguedin) identified the purchase of millet as the most important reason for selling livestock. In the Tafogo site, an area which had a very poor harvest, 93.1 percent of the Mossi identified the purchase of grain as the main motivation for marketing cattle. In Ougarou, another area having a poor harvest in 1978, 93.8 percent of the Gourmantche ranked grain purchases as the number one reason for selling livestock.

Other important reasons for sales are to purchase cloth or finished clothing and to pay the annual head tax and cattle tax. Cash for the purchase of medicines, both for humans and animals (vaccines) is another important immediate need. Additional reasons revolved around the condition of the animals. When an animal is regarded as too old and either unproductive or unable to follow the rest of the herd to grazing areas, or in transhumance, it is likely to be sold. Similarly, when an animal is sick the owner may try to sell it before its condition becomes apparent to potential buyers. More frequently, when an animal is very weak and judged not likely to survive its sickness, it will be slaughtered (have its throat cut) and the meat will be sold to local butchers. The meat from animals which die a natural death may also be sold,

TABLE 2.88

REASONS FOR SELLING LIVESTOCK

	Percent
To buy grain	73.5
To buy clothing	47.0
To pay taxes	39.1
To buy medicine	9.9
Animals are old	6.0
Animals are sick	5.3

Responses of 157 producers.

TABLE 2.89

MOST IMPORTANT REASONS FOR SELLING LIVESTOCK

	Number of Producers	Percent
To buy grain	108	73.0
To buy clothing	17	11.5
To pay taxes	13	8.8
Animals are old	4	2.7
To get a wife	3	2.0
To buy medicine	2	1.4
Animals are sick	1	0.7
Total	148	100.0

but only animists will eat it under these conditions.

The results of this survey among Fulani, Mossi, Gourmantche, and Bissa cattle owners in the Sudanian regions of Upper Volta are very similar to those obtained by Herman (1977) among a Fulani sample in the Sahelian region of Upper Volta. The purchase of grain was listed as the prime marketing motivation by 69 percent of his sample and 73 percent of our sample (a statistically insignificant difference). The second most important reason, the purchase of clothing, was cited by 12 percent and 11.5 percent of those interviewed by Herman and the VLP surveys, respectively. The third most important reason, the payment of taxes, was named by 9 and 8.8 percent of the respective samples.

There is one clear and important difference in the marketing motivation of one of the four ethnic groups examined, the Bissa. Among the Bissa the payment of the bride price is an enduring tradition. Normally, the bride price consists of four to eight head of cattle, a number of sheep and goats, a guinea hen, a rooster, and perhaps some cash. The Bissa have a long tradition as livestock owners. Cattle, sheep, and goats are retained primarily for payment of the bride price and for religious purposes (sacrifices).

Bissa livestock owners are even more secretive about their ownership of cattle and the size of their holdings than are members of the other ethnic groups. A known cattle owner may be put under constant pressure from young male relatives to loan them the animals required to formally obtain a bride. The possibility of repayment is somewhat remote. Furthermore, the owner may want to retain the cattle for his own use in obtaining additional wives, or for the use of his sons when they reach the age of maturity. Thus, livestock sales among the Bissa are very limited (see Table 2.9C). Cattle are retained as a form of wealth which can be converted into what many regard as the most important values, brides and hence children.

Among the Fulani the ownership of cows is a necessity. Every Fulani male is expected to provide cows for his wife (wives)

TABLE 2.90

AVERAGE AGE OF CATTLE SOLD BY ETHNIC GROUP

Average Age at Sale	Males		Females		Males + Females	
All ethnic groups	4.99	(N=267)	7.33	(N=63)	5.71	(N=330)
Fulani	4.06	(N=154)	7.38	(N=47)	4.84	(N=201)
Mossi	6.48	(N=75)	7.62	(N=13)	6.65	(N=88)
Bissa	*	(N=4)	*	(N=1)	*	(N=5)
Gourmantche	5.47	(N=34)	*	(N=2)	5.67	(N=36)

*Because of the small sample size, averages would be meaningless and are therefore not included.

to milk. Women engage in the milking, processing, and marketing of milk and milk products. As this provides the primary source of disposable income for Fulani women, a husband who does not place an adequate number of cows at the disposal of his wife will run the risk of losing her. Fulani males state quite clearly that a man who has no cows will have no wives. The Fulani are therefore very reluctant to sell cows, except when they have proven to be dry and unproductive.

2.4.2.6.2 Where Cattle are Sold

One major difference between the data presented here and that gathered by Herman is the nature of the locale in which cattle are sold. In his Djibo survey, livestock producers had ready access to a large nearby cattle market. This is not the case for most livestock producers in Upper Volta. Since most livestock owners sell only one or two head of cattle in a given year, it is not economical for them to walk these animals to one of the larger markets. The cost in labor (herders) and the risks of weight loss, accident, or disease along the route can not be justified for such a small transaction.

Only 7.6 percent of those interviewed sell their cattle in one of the larger, or even middle size, cattle markets. For Herman's data from Djibo the figure is 84 percent sold in the large livestock market. In our sample the largest single group, 48.6 percent, sell their livestock to cattle buyers who come to their home villages or to local businessmen who act as middlemen (see Table 2.91).

Visiting buyers generally go directly to the home of potential sellers, past clients, or to the local village market. These merchants then take responsibility for getting the cattle to the larger regional or even the international markets.

A surprisingly large number of livestock producers, 38.2 percent, sell their animals in their own or nearby villages to other local livestock producers. This is especially the case during the rainy season when commercial buyers rarely come to the village. It must be emphasized here that most livestock sales

TABLE 2.91

WHERE CATTLE WERE SOLD

	Number	Percent
Cattle market	11	7.6
To buyers who come to the village	70	48.6
In the village	55	38.2
Village market	8	5.6
Total	144	100.0

take place in or very close to the home villages or settlements of the producers.

2.4.2.6.3 Cattle Sold

The percentage of cattle sold which are males is 80.1. The average age at which all cattle are sold is 5.71 years (N = 330), 4.99 years for males and 7.33 years for females (see Table 2.90).

There are some differences between ethnic groups regarding the age at which cattle are sold. The Fulani, for example, sell male animals which are much younger ($\bar{x} = 4.06$ years) than those sold by the Mossi ($\bar{x} = 6.48$ years) and the Gourmantche ($\bar{x} = 5.47$ years). There is no significant difference between ethnic groups for the age at which females are sold (see Tables 2.90 and 2.92).

There are differences in the distribution by age and sex of cattle sales reported here and those reported by Herman (1977) for the Djibo area. These figures are presented in Table 2.93. Since virtually all of the animals sold in the Djibo sample are owned by Fulani, figures for the VLP sample are presented as a whole, as well as for the Fulani sub-sample. The distributions of animals sold on the basis of sex are very similar.

Several differences between the two samples are immediately evident. The Djibo cattlemen are apparently selling off young males to a much greater extent than are the livestock producers in the Sudanian areas of the VLP. Sixty-two percent of the cattle sold in the Djibo market are young males ($\leq$ 4 years of age). Only 34.5 percent of the cattle sold in our sample are young males. When one compares the data for only those cattle sold by the Fulani in our sample with the Djibo data, the differences are not as great (45.3 percent of all sales are young males), but still considerable. For older male animals ($\geq$ 5 years of age) the situation is reversed. Only 13 percent of the sales in the Djibo market are accounted for by older males, while 46.4 percent of the VLP sample are so composed. The exact reasons for this difference between the age of cattle sold between the two samples remains unclear.

The existence of this difference is especially surprising since, as will be seen later, there is a strong positive correlation

TABLE 2.92

AGE AND SEX OF CATTLE SOLD BY EACH ETHNIC GROUP FOR FOUR SITES (KOUKOUNDI, GNANGUEDIN, OUGAROU, TAFOGO), IN PERCENTAGES

	Ethnic Group					
	Fulani			Mossi		
Age / Sex	Male	Female	Total	Male	Female	Total
1 - 1.9	7.14	4.26	6.77	-	-	
2 - 2.9	25.32	29.79	27.60	1.33		1.14
3 - 3.9	14.94	2.13	12.50	4.00		3.41
4 - 4.9	11.69	6.38	10.94	6.67	7.69	6.82
5 - 5.9	11.69	4.26	10.42	21.33	7.69	19.32
6 - 6.9	16.23	6.38	14.58	17.33	-	14.77
7 - 7.9	5.84	2.13	5.21	25.33	61.54	30.68
8 - 8.9	4.55	2.13	4.17	4.00	-	3.41
9 - 9.9	1.95	6.38	3.13	13.33	15.38	13.64
10 - 10.9	0.65	2.13	1.04	6.67		5.68
11 - 11.9						
12 - 12.9		4.26	0.52			
13 - 13.9		4.26	0.52			
14 - 14.9		19.15	3.13			
15 - 15.9		4.26	0.52			
$\geq$ 16.0		2.13	0.26		7.69	1.14
N =	154	47	201	75	13	88

TABLE 2.92 (continued)

	Ethnic Group					
	Bissa			Gourmantche		
Age / Sex	Male	Female	Total	Male	Female	Total
1 - 1.9						
2 - 2.9				5.88		5.56
3 - 3.9				20.59		19.44
4 - 4.9				14.71	50.00	16.67
5 - 5.9		100.00	20.00	11.76		11.11
6 - 6.9	25.00		20.00	20.59		19.44
7 - 7.9	-			5.88	50.00	8.33
8 - 8.9	25.00		20.00	5.88		5.56
9 - 9.9	25.00		20.00	8.82		8.33
10 - 10.9	25.00		20.00			
11 - 11.9				5.88		5.56
12 - 12.9						
13 - 13.9						
14 - 14.9						
15 - 15.9						
$\geq$ 16.0						
N =	4	1	5	34	2	36

TABLE 2.92 (continued)

	All Ethnic Groups		
Age / Sex	Male	Female	Total
1 - 1.9	4.12	3.17	3.94
2 - 2.9	15.73	22.22	16.97
3 - 3.9	12.36	1.59	10.30
4 - 4.9	10.49	7.94	10.00
5 - 5.9	14.23	6.35	12.73
6 - 6.9	17.23	4.76	14.85
7 - 7.9	11.24	15.87	12.12
8 - 8.9	4.87	1.59	4.24
9 - 9.9	6.37	7.94	6.67
10 - 10.9	2.62	1.59	2.42
11 - 11.9	0.75	-	0.61
12 - 12.9		3.17	0.61
13 - 13.9		3.17	0.61
14 - 14.9		14.29	2.73
15 - 15.9		3.17	0.61
$\geq$ 16.0		3.17	0.61
N =	267	63	330

TABLE 2.93

COMPARISON OF AGE AND SEX OF CATTLE SOLD IN DJIBO AND VILLAGE LIVESTOCK PROJECT SITES, AS PERCENT OF CATTLE SALES

Age and Sex of Cattle Sold	Village Livestock Project		
	All Ethnic Groups N=330	Fulani Only N-201	Djibo* N=311
Males 4 yrs. and younger	34.5	45.3	62
Males 5 yrs. and older	46.4	31.3	13
Females 4 yrs. and younger	6.7	10.0	7
Females 5 yrs. and older	12.4	13.4	18
All males	80.9	76.6	75
All females	19.1	23.4	25

*Source: Heiman, 1977.

between age and the sale price of male cattle. It is possible that the difference results from the fact that the majority of Herman's sample livestock were sold in a large market, while those in our sample were predominantly sold in the local village. Young males may be preferred in larger markets, while more mature males may find a more ready market at the local level. Ethnic differences between cattle owners in the two samples provide at least a partial explanation. Non-Fulani clearly prefer to hold their cattle until they are older before selling them. Fulani prefer to sell young males (see Table 2.94).

When the data are broken down by site and ethnic group, cattle sales by the Fulani of Tafogo are markedly different from those found elsewhere. For the Fulani in the other three areas, young male cattle account for over half of all cattle sales. For the Fulani of Tafogo, the figure is only 13.6 percent. Poor rainfall in the Tafogo area during the last few years may have severely hindered the production of calves. If this is the case, the few calves born might be held in reserve to protect the future of the herd.

2.4.2.6.4 Cattle Sales Per Livestock Producer

To what extent is the average livestock producer involved in the livestock marketing system? Within the Sudanian zone, in which our sample is drawn, the average cattle owner sold 2.3 head of cattle (Figure 2.24) in a one-year period. This number is low when compared to that obtained in the Sahelian area (Djibo) by Herman.

These differences in the number of cattle sold largely disappear when we control for ethnicity. Since the Djibo sample is almost 100 percent Fulani, it makes sense to compare only the Fulani in our sample with the Fulani in Herman's sample. By so doing, the differences between the samples diminish considerably. The Fulani in our sample actually sell more cattle on the average than do those of Djibo ($\bar{x} = 3.93$ and 3.56, respectively).

The Fulani, the group most dependent on livestock for the purchase of vital grains, and the group with the largest herds,

TABLE 2.94

PERCENT OF TOTAL CATTLE SOLD BY EACH ETHNIC GROUP
IN EACH SITE BY SEX AND AGE CATEGORY

Site (Ethnic Group)		4 Years and Younger	5 Years and Older
Koukoundi			
Fulani	Male	50.0	38.9
	Female	5.6	5.6
Mossi	Male	6.3	78.7
	Female	0.0	14.9
Ougarou			
Fulani	Male	51.5	12.1
	Female	21.2	15.1
Gourmantche	Male	38.9	55.5
	Female	2.8	2.8
Gnanguedin			
Fulani	Male	57.5	19.2
	Female	5.5	17.8
Mossi	Male	33.3	22.2
	Female	11.1	33.3
Bissa	Male	0.0	80.0
	Female	0.0	20.0
Tafogo			
Fulani	Male	13.6	77.3
	Female	2.3	6.8
Mossi	Male	7.9	84.2
	Female	2.6	5.3

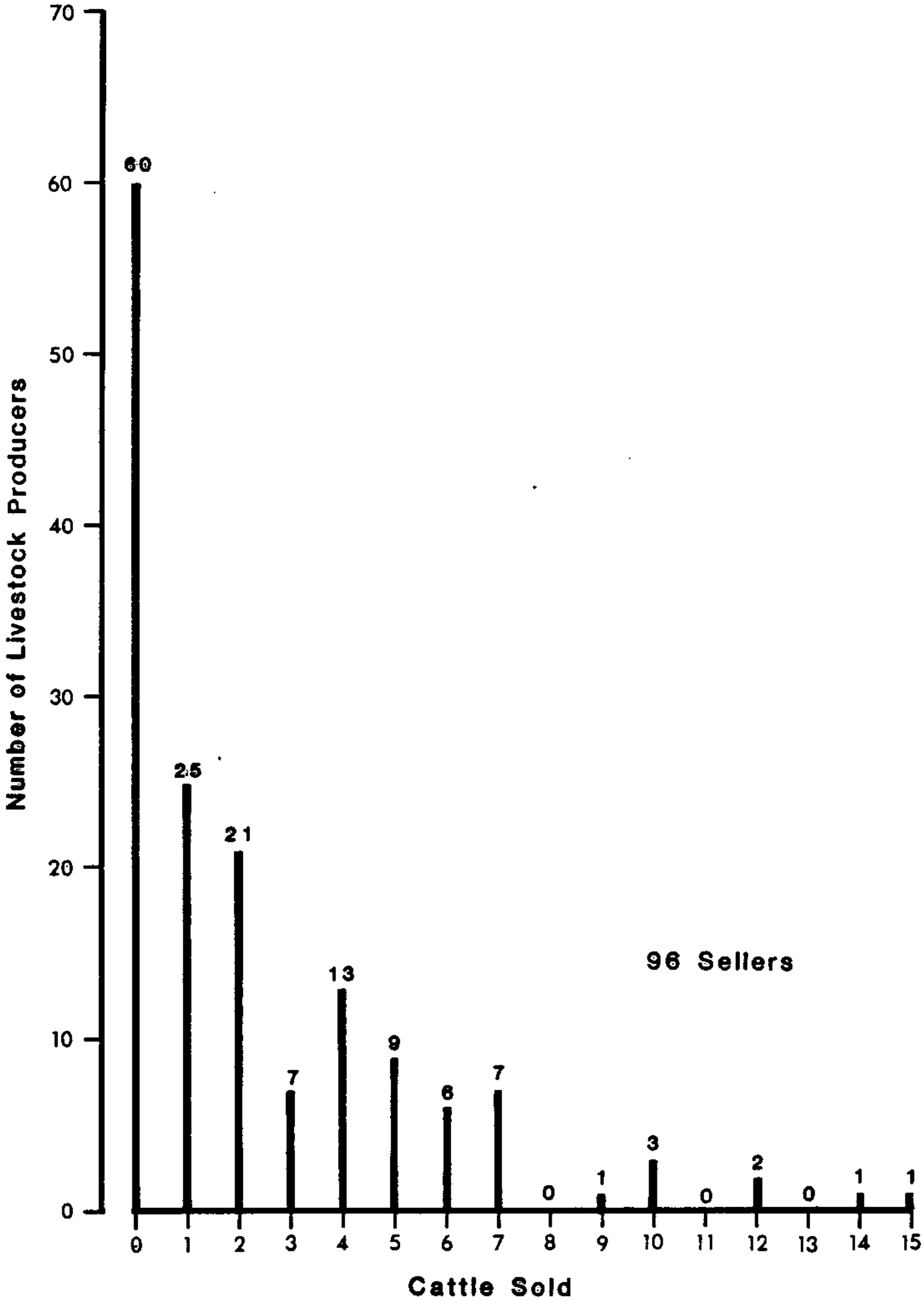

Figure 2.24 CATTLE SOLD PER LIVESTOCK PRODUCER

sell more cattle ($\bar{x} = 3.85$) than all the other ethnic groups regardless of location.

Gourmantche cattle owners, on the average, sell more cattle per livestock producer than either the Mossi or Bissa. In fact, their sales in Ougarou surpass the average cattle sales of the Fulani in both Koukoundi and Tafogo. Gourmantche cattlemen tend to specialize in cattle production (see Table 2.95).

The Mossi average sales of 1.32 head of cattle per year. The Bissa, who generally do not sell their cattle and have very small herds, average sales of only about one-third of a head of cattle per year.

2.4.2.6.5 <u>Income From Cattle Sales</u>

The yearly cash income earned by livestock owners is considerable. This holds true not only for the Fulani, who place more emphasis on livestock than on crop production, but also for the more sedentarized farmers. The average livestock producer in our sample, for whom there were no missing data on the sales price of any of the three types of animals (N = 150), earns 65,000 CFAF ($295 U.S.) in a year (1977-78) from the sale of stock (see Table 2.96).

The Fulani, as expected, show the highest annual earnings, 93,000 CFAF ($422 U.S.), the largest share of it from the sale of cattle. The most surprising group is the Gourmantche. Gourmantche cattle owners reported annual sales averaging 78,000 CFAF ($354 U.S.), a remarkable figure for a group that is generally regarded as composed of sedentary farmers. These results are not artifact of distortions introduced in the mean of a small sample (N = 16) by a few livestock producers who made very large sales. The median income for Gourmantche cattle owners is 75,000 CFAF ($340 U.S.).

The Mossi, who on the average sell fewer cattle than either the Gourmantche or the Fulani, still obtain a substantial sum from sales. The average yearly earnings of 45,000 CFAF ($205 U.S.) from cattle sales is enough to provide sufficient income to offset grain deficits in a bad year. These earnings can also be used to meet many additional family needs in better times.

TABLE 2.95

AVERAGE NUMBER OF CATTLE SOLD BY ETHNIC GROUP AND AREA

Village	Ethnic Group	Cattle	Number of Livestock Producers
Koukoundi	Mossi	1.51	27
	Fulani	2.33	9
Tafogo	Mossi	1.23	30
	Fulani	2.37	19
Gnanguedin	Mossi	1.00	8
	Bissa	0.33	15
	Fulani	5.21	14
Ougarou	Gourmantche	2.76	17
	Fulani	5.40	15
Ethnicity only:	Mossi	1.32	65
	Gourmantche	2.76	17
	Bissa	0.33	15
	Fulani	3.86	57

TABLE 2.96

AVERAGE YEARLY EARNINGS PER LIVESTOCK PRODUCER FROM THE SALE OF CATTLE

Village	Ethnic Group	Earnings CFAF*	Number of Livestock Producers
Koukoundi	Mossi	55,000	26
	Fulani	58,000	9
Tafogo	Mossi	42,000	30
	Fulani	68,000	19
Gnanguedin	Mossi	24,000	8
	Bissa	13,000	15
	Fulani	124,000	14
Ougarou	Gourmantche	78,000	17
	Fulani	117,000	14
Ethnicity only	Mossi	45,000	64
	Fulani	93,000	56
	Bissa	13,000	15
	Gourmantche	78,000	17

*220 CFAF = $1.00 U.S.

Only the Bissa among the ethnic groups sampled showed relatively small cash earnings from cattle sales. The average earnings of 13,000 CFAF ($59 U.S.) is certainly a useful addition to annual income, but it can not meet other than very short-term family needs for grain or other items. These low earnings are the result of generally small herds and the tendency to save livestock for social (marriage) rather than commercial purposes.

The income figures reported by livestock producers in our sample are not very different from those reported by Herman for Djibo. The average livestock producer in our Sudanian area sample earns 65,000 CFAF ($295 U.S.) while the average Sahelian livestockman earns 78,000 CFAF ($354 U.S.) per year (calculated from Herman, 1977). However, when we control for ethnicity the order is reversed. Sudanian Fulani earned an average of 14,000 CFAF more than their Sahelian brothers. The Gourmantche also earned more on the average than the Djibo Fulani by 6,000 CFAF a year. The Mossi and Bissa have, as expected, lower average earnings from livestock sales than the Sahelian Fulani.

The difference in earnings between Fulani in Djibo and Fulani in the Sudanian areas cannot be accounted for solely by the differences in the number of animals sold (3.93 vs. 3.56 head of cattle). It is the average sale price which seems to be the most important factor. The average sale price for all cattle in the Djibo market is 24,000 CFAF ($110 U.S.) (calculated from Herman, 1977). The comparable figure for our sample is 29,000 CFAF ($130 U.S.). The difference in average sale price, however, is not so much a function of better markets and higher prices in the south, but of the type of animal sold. The major difference between the two areas is that in Djibo there is a tendency to sell young males while in the more southerly areas the more sedentary ethnic groups sell many more older males. The overall difference may therefore be a function of higher prices paid for more mature males.

2.4.2.6.6 Seasonal Variations in Cattle Sales

There is considerable seasonal variation in the sale of, and price obtained for cattle. The important questions to be examined here revolve around when cattle are sold, price differences from month to month, what livestock producers perceive to be the best times to sell their cattle, and the relationship between these three. By examining the relationship among these three variables we can determine to what extent livestock producers are aware of seasonal market variations in price and the extent to which they are able to take advantage of these variations.

Livestock producers were asked to identify the season or month when they felt it was "best" to sell cattle. As can be seen from Figure 2.25 most livestock producers feel that the time to sell cattle is between August and December. When questioned further an overwhelming number said that at that time their cattle have eaten well, both on grasses and on crop stubble. The cattle are fat and generally in good condition. However, more than one in five (22.7%) said there was no best time to sell cattle, other than when you needed money. An additional 9.3 percent gave the dry season (undifferentiated) as a response. This season runs roughly from November through May.

Most cattle are sold between August and November (see Figure 2.25). November is the modal month identified by livestock producers as the best season to sell cattle and the month when they are actually sold. The rank correlation between the best months to sell and actual months of sales is .56 (Spearman's Rho). This might be even stronger if we could successfully divide up those who gave the relatively undifferentiated responses, e.g., dry season, wet season, as the time of the sale.

How are these two distributions, perceived optimal selling time and actual time of sales, related to reported sales prices by the same livestock producers? Cattle prices seem to be at their highest in February and March (this is partially substantiated by Herman, 1977, for February--he has no data for March). This is also the period when livestock producers report their lowest volume of sales. Quite clearly prices are adjusted in relation to the supply. Since few animals are marketed in February-March, prices are quite high. Prices decline from March through July and begin to rise again between August and late November. It is

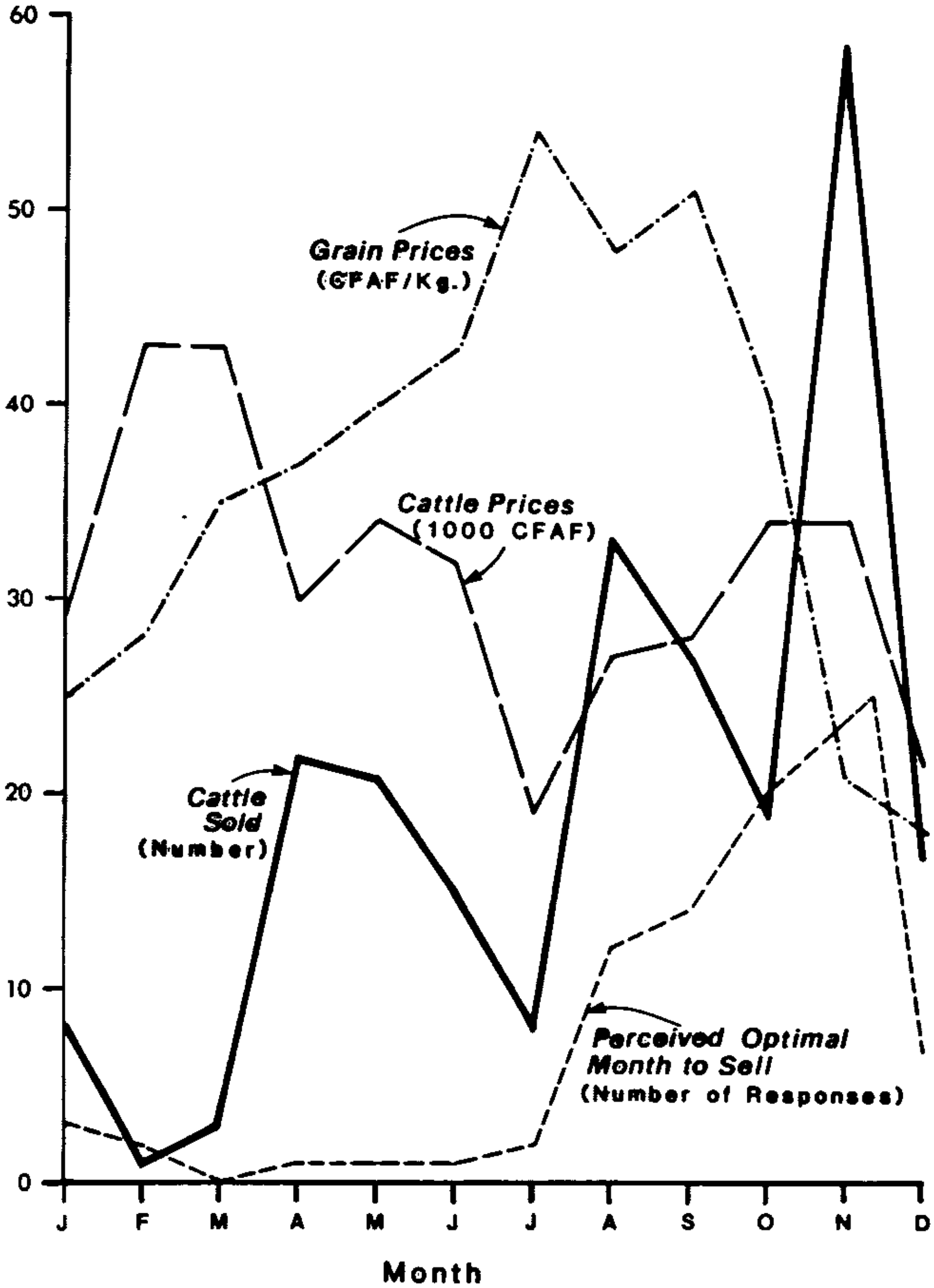

Figure 2.25 SEASONAL VARIATIONS IN CATTLE SALES, PRICES, PERCEIVED OPTIMAL MARKETING PERIODS AND GRAIN PRICES

during this latter period that the largest volume of cattle sales takes place (see Table 2.97).

In general the marketing situation seems to be very rational. Both the supply and the price per animal increase between August and November because at this time cattle are in their best condition. Cattle merchants who buy at the village level find this to be the best season to trek cattle from the village to the larger markets with minimal weight loss. Thus, livestock producers are marketing their cattle during what they regard as the optimal marketing period.

The price per head between March and July declines because the condition of the cattle during these extremely hot dry months rapidly deteriorates. Not only is there little available feed in the way of grasses, but the cattle also become very lethargic in the heat, often only eating at night or in the early morning.

The major anomaly in the marketing year appears to be the months of February and March. In February the condition (weight) of most animals has not yet significantly deteriorated. Disease becomes an important factor in the cold period of January and February, but not to as great an extent as during later months when the cattle are weak and undernourished. Why then do more livestock producers not take advantage of this period to sell their stock? The explanation probably lies outside the livestock sector.

Since the principal reason for selling livestock is to purchase grain, seasonal variations in grain prices must also be examined. In general grain prices in Upper Volta are at their lowest in January. Prices gradually rise from January to a peak in July (see Figure 2.25). In August grain prices begin to decline until they bottom out again in January (CILSS, 1977).* Monthly livestock sales vary inversely with the price of grain and directly with the condition of the cattle. Since grain prices are at a minimum in January and livestock are in their best condition between August and November, livestock producers prefer to sell

*Monthly grain prices presented here are figures averaged over 6 markets in Upper Volta.

TABLE 2.97

AVERAGE PRICE PAID FOR ALL CATTLE, BY MONTH (CFAF)*

	$\bar{X}$	N
January	29,000	8
February	43,000	1
March	43,000	3
April	30,000	22
May	34,000	21
June	32,000	15
July	19,000	8
August	27,000	33
September	28,000	27
October	34,000	19
November	34,000	58
December	21,000	17
Rainy season (month not stated)	28,000	24
Dry season (month not stated)	30,000	60
Total	30,000	341
Dry season	31,000	205
Rainy season	28,000	111

*Approximately 220 CFAF = $1,00 U.S.

their animals during this period. Sales reach a peak with the approach of the harvest in October and November, when the exact size of an individual's grain deficit becomes clear. Thus, livestock producers are seeking cash to buy enough grain to make up their own deficit at the time when grain prices are lowest.

Under these conditions the individual livestock producers can very rationally maximize their own utility function by examining the relationship between the sales price of livestock and the purchase price of grain. This strategy is apparently being followed by many of them. February, although bringing some of the highest cattle prices, also is a period of rising grain prices. Figure 2.26 indicates the best return in sacks of grain (millet and sorghum) per animal sold occurs in November. If the purchase of grain is lagged one month after the sale of livestock, the purchase price of grain in head of cattle is even further minimized in November. It is this period that produces the highest cattle sales.

Those who have overestimated their own grain production and/or underestimated usage, and those who experience other pressing needs for cash must sell during other, less desirable periods. It is clear, however, that many livestock producers correctly perceive the seasonal market situation. These data from the VLP are supported by monthly sales figures from the large cattle markets of Djibo, Kaya, Pouytenga, and Ouagadougou (Herman, 1977). Presumably, if an adequate credit system could be developed, livestock producers could purchase grain in December when prices are lowest, while withholding some of their cattle for sale in February and March when cattle prices are highest.

2.4.2.6.7 Factors Influencing the Sale Price of Cattle

Numerous factors exert an influence on the sale price of cattle. The independent variables to be examined here are age, sex, health, season of sale (see previous section), and the location (site) at which cattle are sold. It would be useful first to examine the distribution of the independent variables in our sample. Overall the sample included 341 cattle sold during 1978-79. More

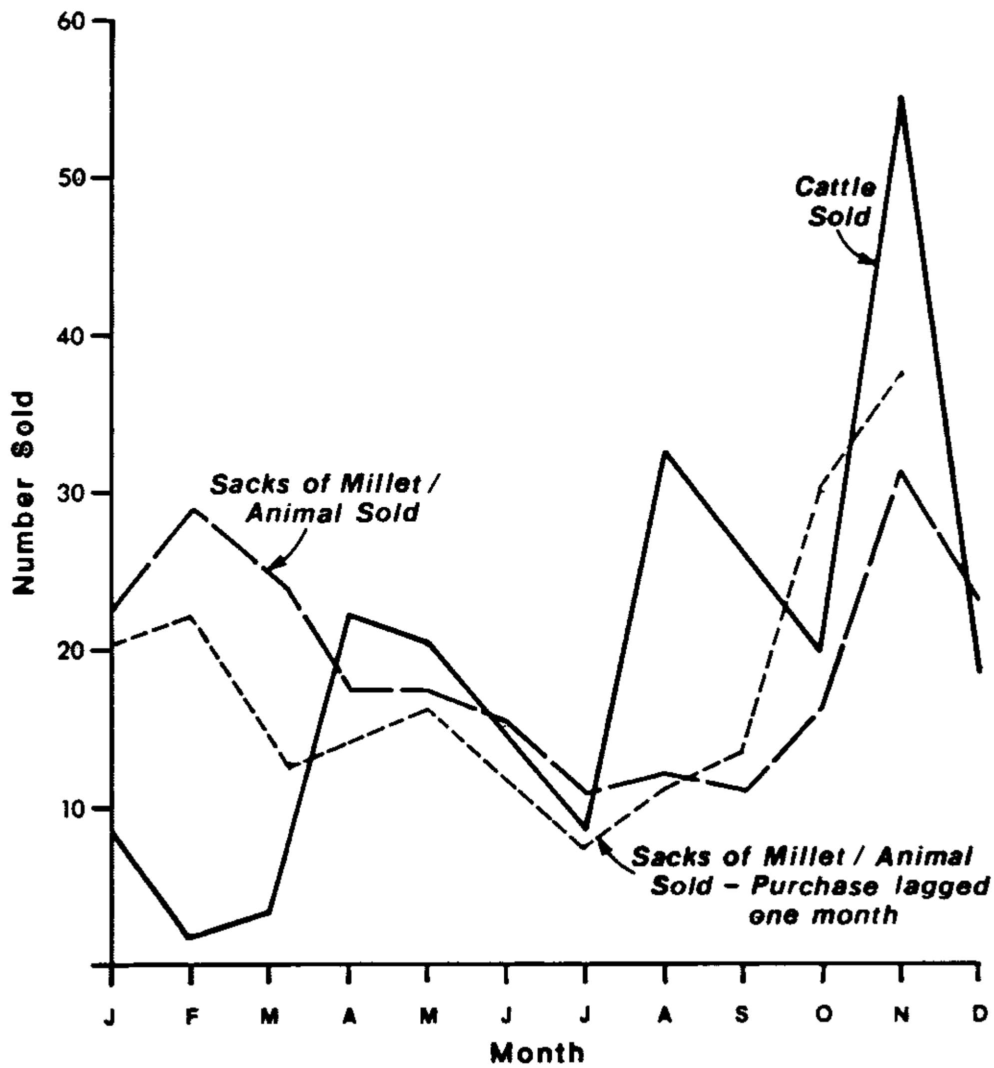

Figure 2.26 SEASONAL VARIATIONS IN CATTLE SALES AND AVERAGE NUMBER OF SACKS OF MILLET OBTAINED PER HEAD OF CATTLE SOLD

male than female cattle are sold (80.1% male). Most of the animals reported sold (94%) were healthy at the time of the sale. The average age of cattle sold is 5.45 years, with a range of 1 to 16 years. The average price obtained is 29,000 CFAF ($133 U.S.), with a range of 2,500 to 67,500 CFAF.

The bivariate relationships between the independent variables and our dependent variable, price, present an interesting picture (see Table 2.98). The effect of the health of an animal on its sale price is clear and significant. Many sick animals are sold directly to local butchers at relatively low prices. They are slaughtered by either the owner or the butcher almost immediately. Since the meat cannot pass government inspection it must be sold in the village. The meat is sold to animists and Christians but generally not to Muslims. The health of an animal (when it is obvious) is, before all else, a prime determinant of price. It is necessary to take this factor into consideration when examining all other relationships.

Among healthy animals, males generally bring more money than females. The margin of difference is 3,000 CFAF on the average. This can be partially accounted for by the fact that females weigh less than males and are usually sold only when they are unproductive. This relationship is examined in depth below.

As previously discussed, season is an important factor in determining price. Since the amount of grasses and forage available to cattle varies greatly between season, this is a proxy for weight. Cattle sold just after the rainy season and/or the harvest (October, November, December) are in their best condition. Those sold during the early rainy season (June, July) have not yet recovered from the hungry period (March, April, May). The average sale price for healthy animals sold in the dry season is 2200 CFAF higher than for those sold in the rainy season.

The influence of location (site) is of some importance. Only in Koukoundi are prices significantly higher than in the other sites. This is probably a function of the Koukoundi area being closer to the abattoir in Ouagadougou, about 100 km away, than the other sites.

TABLE 2.98

INDEPENDENT VARIABLE RELATED TO PRICE OF CATTLE SOLD

Independent Variable		Mean Price (CFAF)*	N	F	p <
Health	Healthy	31,000	315	66.77	.0001
	Sick	6,000	19		
Sex					
Healthy	Male	31,000	267	2.28	.14 N.S.
animals	Female	28,000	49		
Season					
Healthy	Dry season	32,000	202	1.96	.17 N.S.
animals	Rainy season	29,000	104		
Site	Koukoundi	35,000	61	4.14	.01
Healthy	Tafogo	31,000	81		
animals	Gnanguedin	27,000	77		
	Ougarou	30,000	97		
Age	1-4 years	23,000	134	54.76	.0001
Healthy	5-8 years	36,000	140		
animals	9-17 years	37,000	42		

*220 CFAF = $1.00 U.S.

N.S. = not significant.

Age is generally regarded as a proxy for weight and an important predictor of price. Age is our only independent variable which is continuous. The impact of additional independent variables will be considered at the same time in the form of controls. The Pearson product moment correlation (r) between age and price for all cattle ($N = 330$) is a rather low .27 ($p < .0001$). This explains only about 7.6 percent of the variance in price. When a control is introduced for health, the relationship between age and price for healthy animals ($N = 316$) jumps to .42 ($p < .0001$). When a second control is introduced for sex, the relationship becomes an extremely strong .76 ($p < .0001$, $N = 267$) for males. For females, surprisingly, a negative relationship exists ($r = -.29$, $p < .1$, $N = 49$).

An examination of the scattergram (Figure 2.27) of age by price for healthy male animals reveals that the relationship is truly linear and not merely the result of several outliers. The equation used to predict price from age for healthy males is:

$$Y = 4116.7(X) + 10329$$

where (Y = Price in CFAF and X = Age in Years).

This simple equation explains almost 58 percent of the variance in price for male animals ($R^2 = .58$). It is clear that although scales are rarely, if ever, used cattle are sold on the basis of good estimates of weight.

When one examines the same relationships for females, it becomes obvious that there are factors other than age involved. The main factor in the relationship between age and price for males is the production of meat (weight). This increases with age, at least until an age of 8-10 years. There are other intervening factors for female animals, most notable among them, productivity. For young females the average sales price increases with age for the first four years. It is at this point that the productivity of the animal in terms of both calves and milk becomes important. Very few cows aged five or six years are sold. Those few which are sold have generally proven to be sterile. The price is thus very low (see Figure 2.28). Cows in the age category 7-9 years are sold at relatively high average prices. There is considerable internal

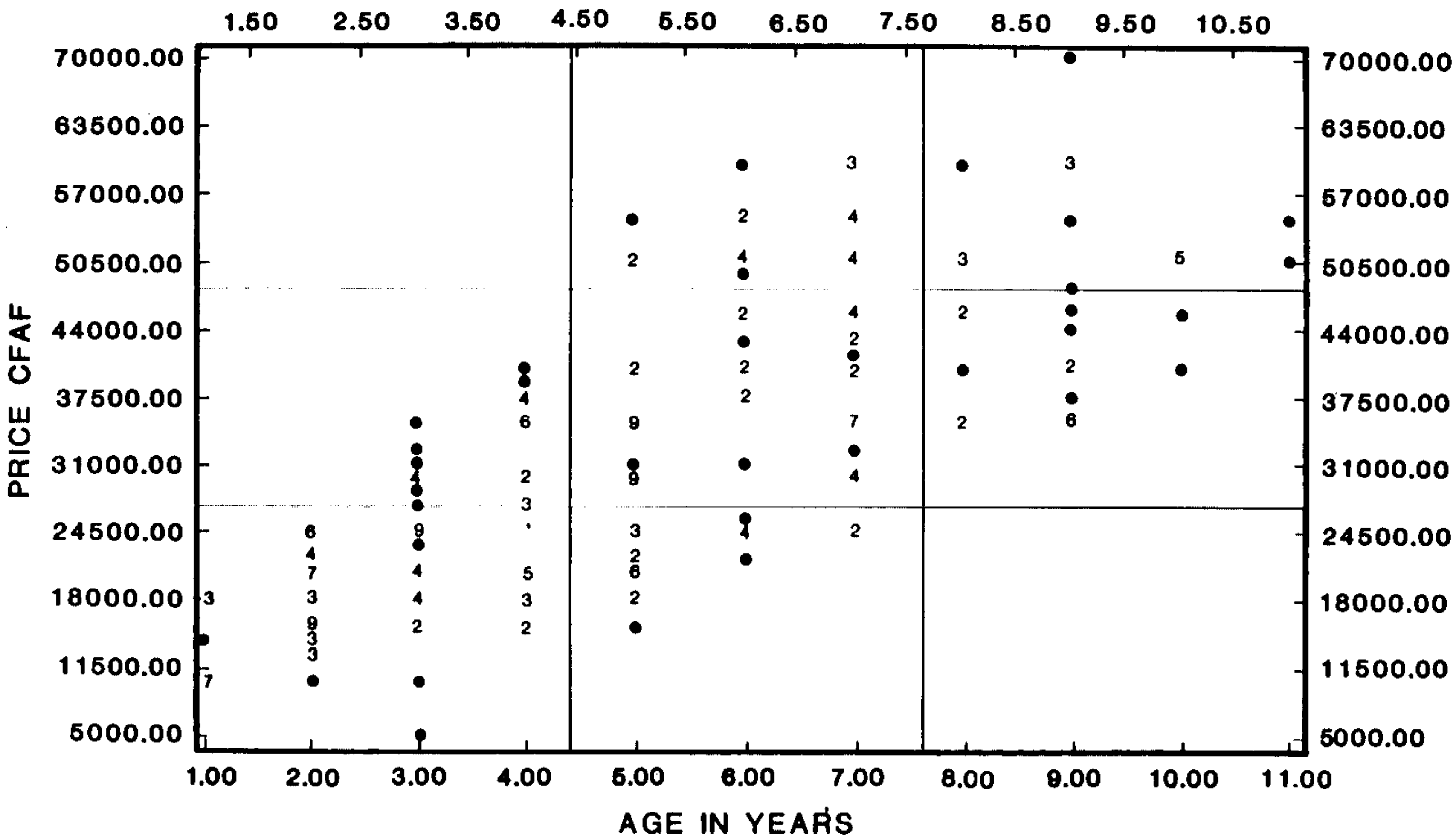

Figure 2.27 SCATTERGRAM AGE AND PRICE OF HEALTHY MALE CATTLE SOLD

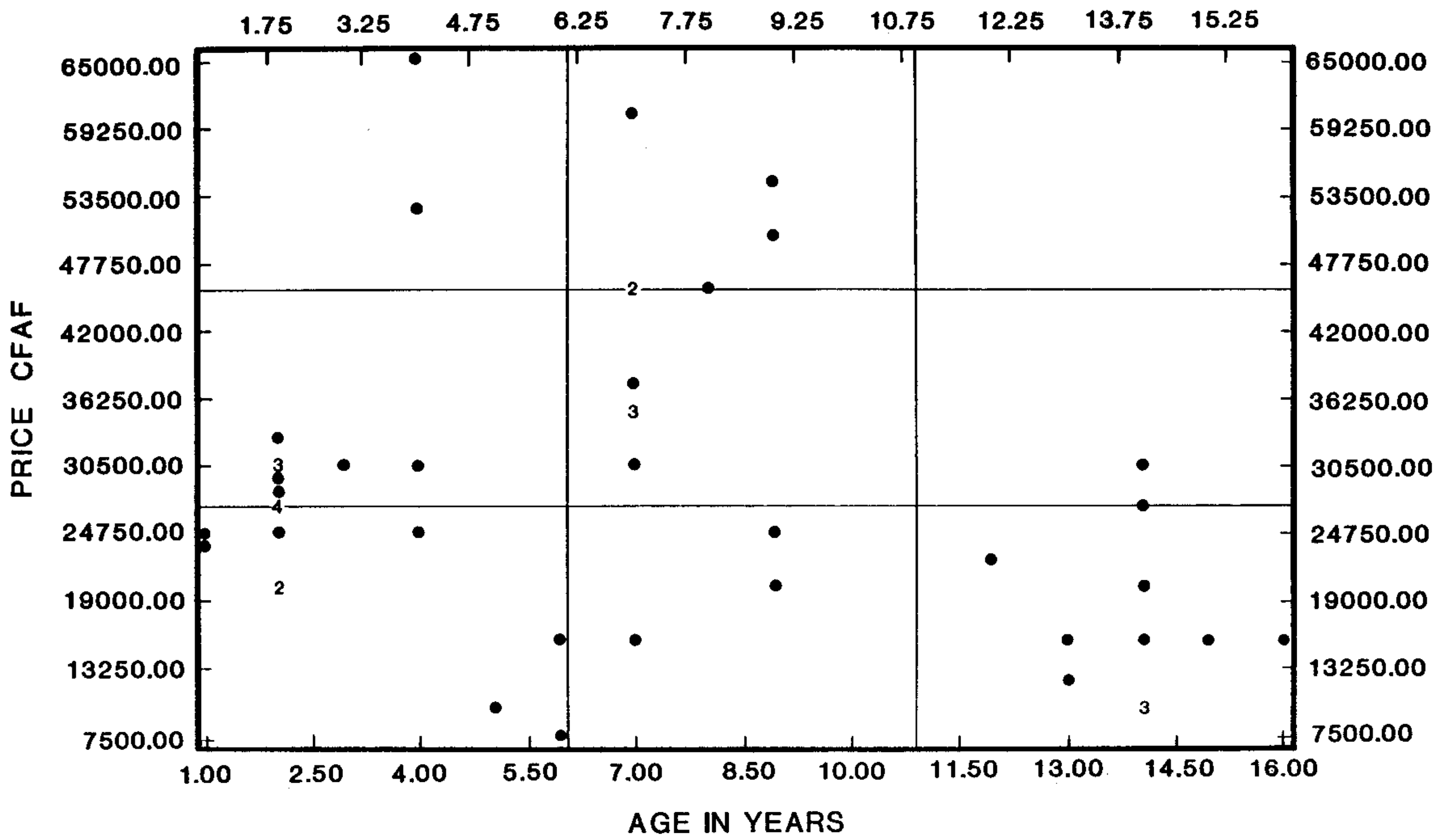

Figure 2.28 SCATTERGRAM AGE AND PRICE OF HEALTHY FEMALE CATTLE SOLD

variation in price in this group, depending on relative productivity. After the age of nine years there is a rapid decline in the price of cows. This follows from the decline in potential and real productivity of these animals.

The findings reported here are corroborated by the findings of Herman in his Djibo sample. This applies to both male and female animals (Herman, 1977). The same factors which enter into the determination of price in the Sahelian regions of Upper Volta also affect prices in the Sudanian zone, approximately in the same way.

At this point one should examine the combined impact of age, sex, and season on cattle prices when we control for health. That is, we will look at the simultaneous impact of all these variables, but only on healthy animals.

As can be seen from Table 2.99 average sale prices differ by sex. For males, the sale price increases with age and is generally higher in the dry than the rainy season. For females prices are generally highest during the dry season and for cows in the age category 5-8 years.

2.4.2.7 Cattle Slaughter, Processing, and By-Products

Large and modern abattoirs exist only in Ouagadougou and Bobo-Dioulasso. In other localities meat traders depend upon local installations such as slaughter slabs which are operated by a local village administration.

These simple abattoirs consist usually of a shed with a concrete floor and mounted beams containing hooks to support the dressed carcass. Availability of water is frequently a problem. Village butchers kill only to the extent that the animal can be sold on the day of slaughter. In some of the larger towns where storage facilities are available, meat is sold seven days a week, but slaughter takes place only on specific days, most generally on days the local market is functioning.

The result of the situation facing the traders and butchers is that there is a preference for small animals which produce a more manageable quantity of meat at each slaughter.

TABLE 2.99

PRICE OF CATTLE BY AGE, SEASON SOLD, AND SEX
(HEALTHY ANIMALS ONLY)

Age	Season	Sex	$\bar{X}$ Price--CFAF	Number
1-4 years	Dry	F	31,000	13
	Dry	M	22,000	70
	Wet	F	29,000	4
	Wet	M	21,000	41
5-8 years	Dry	F	41,000	6
	Dry	M	36,000	81
	Wet	F	23,000	6
	Wet	M	37,000	46
9-17 years	Dry	F	23,000	8
	Dry	M	46,000	24
	Wet	F	26,000	5
	Wet	M	59,000	2

$F = 58.00$, $p < .0001$.

Meat inspection in the larger communities is the responsibility of the Livestock Service. In the village the judgment and the inclination of the butcher must be relied upon as to the wholesomeness of the meat.

Ouagadougou Abattoir. This is a relatively new installation completed in 1974 and financed by FED grants of 600 million CFAF. The production capacity is about 13,000 tons of meat per year. The slaughter floor is equipped with two cattle dressing lines. The plant is equipped with a modern chilling section. Meat is prepared for both local and export markets. Processing is limited to whole or quartered carcasses.

The abattoir, officially named Abbattoir Frigorifique de Ouagadougou, is managed as a public agency. It is administered under the Ministry of Plan, B.N.D., and the Livestock Service which supplies the management staff.

The abattoir is about one-half km north of Ouagadougou close to the cattle route from Gorom and Markoye. About 21,000 head of cattle pass along that route annually, many of them supplying the abattoir.

Slaughter service is offered to butchers and meat traders at a set fee which is around CFAF 25 per kg carcass weight. The abattoir, in addition to providing this service, maintains a buying center and engages in marketing meat on its own account to the Ivory Coast.

By-Products of the Animal Slaughter. In the village abattoirs, with the exception of hides and skins, most of the carcass and the viscera is used for human consumption. Often blood is mixed with stomach contents, spread out on a platform, and allowed to attract egg-laying flies. The resulting maggots are sold locally as a high protein chicken feed.

In the more modern abattoirs of Ouagadougou and Bobo-Dioulasso there are small by-product plants whose main output is blood-meal which is used in poultry rations. No rendering or bone grinding is done because the method of selling whole or quartered carcasses does not make it worthwhile.

Hides and Skins. Hides and skins are collected for processing in all parts of the country. The skins are dried locally in the sun and in sheds and sold through the SVCP (Voltaic Hides and Skins Agency). The quality and degree of curing is far from uniform. The SVCP is attempting to bring about quality control by training butchers to prepare hides and skins. Dry cattle hides weigh an average of 4.8 kg each. There are about 200,000 cattle hides available for processing each year in Upper Volta.

2.4.3 Sheep and Goats

2.4.3.1 Genetics, Physiology, and Utility

Sheep in Africa are composed of two very distinct types and are similar only in that they belong to the same genus. These are the so-called "wool" sheep and the "hair" sheep. For the purpose of identifying sheep and their characteristics in Upper Volta we can dismiss the wool-bearing types as unimportant and concentrate on the hair sheep.

In Upper Volta and especially within the six sites of the VLP two breeds of sheep named Mossi and Voltaic Fulani are generally recognized. There are a great number of crossbreeds between these two classifications, thus making the two breeds almost unidentifiable in some areas.

In comparison one will find that the Fulani breed is the larger of the two, averaging 6 to 8 kg more than the Mossi, up to the age of 36 months and 12 kg more at four years of age.

Weight-gaining characteristics are good for both breeds but the Fulani sheep can show more spectacular results. An adult Fulani sheep can attain a weight of 32 kg in one year and it is not unusual for one to gain 40 kg of weight between three and five years.

Both the Mossi and the Fulani sheep give birth to their first young at 11 months. The rate of fecundity for the Fulani sheep is 106 percent and for the Mossi sheep it is nearer to 112 percent.

The coat colors of the Mossi breed are dominant white (19%), cream colored (14%), white-maroon spotted (7%) brown-white or black-white (60%).

The coat colors of the Fulani breed are dominant white (26%), cream colored (30%), red-white spotted or maroon-white spotted (24%), brown-black (19%), and dominant black (1%).

Principal goat breeds are referred to as Sahelian and Mossi. Other more localized terminology is often found.

Goats are capable of producing a satisfactory carcass of edible meat but they are somewhat inferior in conformation for meat production capabilities when compared to sheep. The weight of the Sahelian goat at 4 to 9 years of age reaches 26 kg, and for the Mossi breed at the same age the weight is about 19 kg.

The milk production of the goat is of great importance to the livestock producers in the north, but details of how they make use of the milk production have not been studied. The Sahelian goat has the capability of producing 100 to 120 kg of milk in a 120-day lactation. The meat is of excellent quality in both breeds, especially for the castrated male. The dressing-out percentage is 50 to 52 percent. The skins of the goat are excellent and very important to the livestock producers for water bags and other leather articles.

The reproduction rate of the goat breeds is higher than that for sheep; the rate of fecundity is 141 percent and the first birth is at 11 months.

The coat color of the Mossi goat is dominant white (4.8%), wheat-cream-white spotted (3.6%), fawn-red (9.6%), maroon-red-white spotted (15.7%), brown-black spotted (21.6%), grey (27.8%), and dominant black (16.9%).

The coat color of the Sahelian goat is dominant white (r9.3%), wheat-cream-white spotted (6.9%), maroon-white spotted (2.7%), red-white spotted (26%), brown-black-white spotted (6.8%), and dominant black (8.3%).

2.4.3.2 Herding and Transhumance

2.4.3.2.1 Herders

Most commonly, the sheep and goat herders are the sons of the owners, but a variety of other relationships exist. The daughters of owners may also be involved in sheep and goat herding as shown in Table 2.100. Male herders of sheep and goats are much younger than those who herd cattle, the average being 9.2 years. Many girls are also employed to herd small ruminants (26.6% of the herders). The average age for a girl herder is only 8.7 years.

As can also be seen in Table 2.100, there are no significant differences between the sites of ethnic groups regarding male herders of sheep and goats. In the case of females, fewer Fulani than other ethnic groups use girls as herders. Very young children, often only 5 or 6 years of age, are sent to herd sheep and goats around the village. This takes place generally during the growing season. After harvest, sheep and goats are allowed to run free in the fields and to search for feed wherever they can find it.

The larger herds of sheep and goats are generally attended to by older males. Female herders are usually employed out of necessity, sometimes because of the lack of sons, rather than as preference on the part of the family head. However, there does not appear to be any strong negative connotations to having young females engage in this work.

2.4.3.2.2 Transhumance

Small ruminants are not as flexible in their transhumant distribution as cattle. Distances traveled by small ruminants in search of feed increase as the dry season approaches, but rarely do they go beyond 5 km from home, although there is a history of outside or transhuming flocks of small ruminants using the sites for dry season refuge. The origin of this transhumance is traditionally in the drier northern regions.

2.4.3.3 Breeding Management

Ten sheep growers in the Koukoundi site and ten in the Ouagarou site were interviewed and their responses recorded

TABLE 2.100

SEX AND AGE OF SHEEP AND GOAT HERDERS BY SITE AND ETHNIC GROUP

Site	Ethnic Group	Statistic	Boys	Girls
Gnanguedin	Bissa	Average age	8.60	8.30
		N	18	7
		Min-Max	6-15	7-12
	Mossi	Average age	8.40	8.40
		N	5	5
		Min-Max	5-12	6-12
	Fulani	Average age	7.70	9.30
		N	9	3
		Min-Max	5-12	6-14
Tafogo	Mossi	Average age	9.30	7.70
		N	34	10
		Min-Max	6-20	6-10
	Fulani	Average age	9.90	13.00
		N	7	2
		Min-Max	7-15	11-15
	Black Fulani	Average age	9.70	13.00
		N	7	1
		Min-Max	6-12	13
Ougarou	Gourmantche	Average age	9.60	8.60
		N	16	10
		Min-Max	5-20	5-18
	Fulani	Average age	10.40	-
		N	9	-
		Min-Max	6-25	-
Total	Fulani, all sites	Average age	9.30	-
		N	25	-
		Min-Max	6-25	
	All others, Bissa-Mossi Gourmantche	Average age	9.20	-
		N	80	-
		Min-Max	5-20	
All Sites, All Ethnic Groups		Average age	9.20	8.70
		N	105	38
		Min-Max	5-25	5-18

concerning their sheep-raising activities.

Breeding management of sheep in those sites is almost absent. Very little selection for good breeding stock has been observed and some of the flock balance of males to females did not seem to be purposeful.

Castrations of male animals are carried out, not for control of breeding so much, but for bringing about better fattening-out qualities for sheep destined for slaughter. Even this is not a regular practice on a large scale. Many of the larger flocks driven down to Ouagadougou or Tabaski and/or shipped to the Ivory Coast have been observed to be made up entirely of uncastrated males.

The veterinary nurse at Kongoussi reported that he had castrated only 49 sheep and 17 goats over a year's period, all for small flock owners. Although the number of sheep and goats under his jurisdiction is unknown, the number of castrations he performed was quite minimal percentagewise (Bonfiace, 1977).

In the interviews with the sheep raisers in the two sites, quite removed from each other geographically, the ratio of rams to ewes in a flock varied as much as the breeding males to females ratio in a cattle herd. About one ram to ten ewes was the most prevalent ratio mentioned, but in one case it ran as high as one to fifty. This again shows a lack of standard management practices, or perhaps the true figures are not always revealed to interviewers.

The productive life of ewes is quite varied, ranging from 6-12 years. The first lambing usually takes place when the ewe is two or three years of age (as was stated by 60% of those interviewed) "at the beginning of the rainy season." Two of the sheepmen, though, stated that the majority of their lambs are born in September and October. It was noted through the interviews and by observation that lambs are born at any time of the year. It is desirous for the births to take place at the beginning of the rainy season because it is a better feeding season for the flock, and there is more milk for the lambs.

2.4.3.4 Nutrition and Feeding

Goats and sheep are widely held by most of the sedentary farmers (Mossi, Gourmantche, and Bissa) as well as the Fulani livestock producers. Though all of these ethnic groups, for the most part, have their own fields which support part or all of their own grain needs, none of them raise feed grains for livestock *per se*. For sheep and goats crop residues are available only as they glean them from the fields after harvest. Sheep and goats are more or less left to roam without restraint after crop harvest.

In rough grazing sheep and goats consume considerable amounts of woody species, especially when young and in leaf. Some herders cut branches from trees and shrubs for the goats and sheep to eat.

An example of a tree which has many uses is the *Acacia albida*. This tree, which when not too high for sheep and goats to reach, has proven to be a valuable source of feed in the dry season. Its vegetative cycle is just the reverse of most other trees. In the dry season it produces edible leaves and fruit as well as shade at a time when crops are not planted. Livestock take advantage of the shade and naturally leave manure behind that is a boon to the soil. This tree is a legume and fixes nitrogen in the soil. When planting starts with the beginning of the rains the tree loses its leaves which are beneficial to the soil, and the sun is able to shine through the branches unhindered, so that crops can grow well beneath it.

The *Acacia senegal*, *Daniella oliveri*, *Balanites aegyptiea*, *Mangifera indica*, and the *Ziziphus mauritana*, also furnish green leaves for feeding livestock.

Some of the sedentary farmers do not have cattle and are totally dependent upon raising a small flock of sheep or goats. From their farming endeavors they are able to stockpile some feed around their compounds in the form of leaves of millet and sorghum or peanut vines. Rice straw remains in the field to be grazed. Large canes of millet or sorghum that are too fibrous are not utilized as feed. The storage methods used for these by-products of the grain harvest are not highly efficient. Usually they are stacked on a platform made of poles which also serves as a shaded area for resting during the dry season. The stored materials are subject to the weather, especially the hot season sunshine, and therefore lose much of their nutritive value.

Outside of the compounds certain of the forages, such as the pennisetums, dry up and fall to the ground in the dry season and are wasted. They have very little nutritive value in the dry unpreserved state. No hays or silages are being produced in any of the VLP sites, in part because such activities take place during the rainy season when farmers are most busy caring for crops. It has been observed, though, in each of the six sites, that excellent quality hays and silages can be made from grasses growing in the lowlands.

Only a few livestock producers are beginning to provide a mineral supplement to their sheep and goats. Each year the sales of mineral-salt blocks are increasing. In the last three years the Kaya factory, the fabricators of mineral-salt blocks, has increased its output 75 percent. A mineral-block containing cottonseed which will add a high level protein supplement to an animal's diet is now being introduced.

Water is often a constraint. Sheep and goats have the ability to do without water in the rainy season and often for 3-4 months afterwards into the "cold" dry season, but they do need watering in the "hot" dry season. This is not to say that they would refuse water, but they can survive much longer than cattle and without as large an investment in water development. It is estimated that ten sheep or goats will require no more water than one full sized cow. But the sheep and goats in general do not have sufficient drinking water that is fresh and unpolluted.

2.4.3.5 Protection, Diseases, and Pests

From the livestock management survey conducted in VLP sites, data are presented which show what livestock producers of different ethnic groups perceive as the actual causes of death of small ruminants. The number of livestock producers sampled included

157 owners who reported losses for 1978 of 671 sheep and 555 goats (see Table 2.101).

The most important reported killers of sheep are pasteurellosis (33.1%), trypanosomiasis (24.6%), and rinderpest of small ruminants (12.8%). A symptom, diarrhea which could be attributed to a number of diseases, but is probably the result of internal parasites, is also quite important (11.7%).

Losses of goats show a slightly different pattern. Trypanosomiasis is the most important reported killer (42.9%) followed by pasteurellosis (12.4%) and rinderpest of small ruminants (9.0%). The somewhat questionable category of diarrhea (14.2%) is actually the second largest cause of mortality reported. If much of this can be attributed to internal parasites, then the combined parasite category (7.9%) and diarrhea category reportedly cause over one-fifth (22.1%) of all goat losses.

Trypanosomiasis appears to be a major killer of both goats and sheep (more so for the former than the latter) in Ougarou and Tafogo, and to a lesser extent in Gnanguedin. Pasteurellosis is the other major cause of mortality, with the incidence being higher among sheep than goats. Pasteurellosis appears to be most important in Ougarou and Gnanguedin and much less so in Tafogo and Koukoundi. There is some indication that some livestock producers confuse the symptoms of pasteurellosis and trypanosomiasis in small ruminants, especially in the Tafogo area (see Table 2.101). It is thus possible that the incidence of pasteurellosis is higher and that of trypanosomiasis somewhat lower than reported for this site.

Livestock Service personnel have indicated a high level of incidence of internal parasites in small ruminants (Nicolas, 1979). A normal healthy sheep will pass 300 strongyle eggs per gram of feces at almost any time (Marquardt, 1979). Marquardt in his evaluative study of the Entente Parasite Control Program, carried on a small number of host examinations with the intestinal tracts and lungs from two goats and a sheep obtained at the abattoir in Ouagadougou. Feces from these animals was used to obtain quantitative egg counts. Concerning helminth infestations of animals on such limited evidences as are available, Marquardt stated:

TABLE 2.101

PERCENTAGE OF SHEEP AND GOAT LOSSES ATTRIBUTED TO EACH CAUSE BY SITE AND ETHNIC GROUP

	Koukoundi				Ougarou			
	Mossi		Fulani		Fulani		Gourmantche	
Disease/Cause	Sheep	Goats	Sheep	Goats	Sheep	Goats	Sheep	Goats
Trypanosomiasis	-	-	-	-	14.81	74.35	21.54	40.28
Rinderpest*	-	-	-	-	-	-	-	-
Blackleg	-	1.24	-	-	-	-	-	-
Anthrax	-	-	26.27	-	-	-	-	-
Pasteurellosis	-	-	-	15.79	88.89	25.64	32.31	27.78
Pleuropneumonia	-	-	-	-	-	-	-	5.58
Diarrhea	35.10	56.79	8.89	21.05	-	-	-	-
Tuberculosis	-	-	-	-	-	-	-	-
Bronchitis	-	-	-	-	-	-	1.54	27.78
Parasites	3.19	16.05	-	-	-	-	26.15	23.61
Hunger and thirst	-	-	-	-	-	-	1.54	-
Cold	-	-	-	-	-	-	-	-
Mange	-	-	-	-	-	-	-	-
Lumpy skin disease	-	-	-	-	-	-	-	-
Constipation	-	-	-	-	-	-	-	-
Aborted	-	3.70	-	-	-	-	-	-
Birth	-	1.23	-	-	-	-	-	-
Accident	3.19	-	-	-	-	-	1.54	-
Wild animals	-	-	-	-	3.71	25.64	-	-
Unknown causes	58.52	20.99	64.44	63.16	-	-	15.38	4.16
Total number mortalities	94	81	45	19	135	39	65	72

TABLE 2.101 (continued)

Disease/Cause	Gnanguedin				Tafogo			
	Fulani		Mossi + Bissa		Mossi		Fulani	
	Sheep	Goats	Sheep	Goats	Sheep	Goats	Sheep	Goats
Trypanosomiasis	10.25	6.46	-	-	54.17	65.85	50.00	54.96
Rinderpest*	41.03	12.90	25.50	52.38	37.50	21.74	3.05	-
Blackleg	15.38	19.35	-	-	-	-	-	-
Anthrax	-	-	-	-	-	-	-	-
Pasteurellosis	48.73	25.80	101.96	94.00	-	-	10.21	7.64
Pleuropneumonia	-	-	-	-	-	-	-	-
Diarrhea	82.06	64.51	-	-	-	-	8.16	6.87
Tuberculosis	-	-	1.97	-	3.47	3.10	-	-
Bronchitis	-	-	-	-	-	-	-	-
Parasites	-	-	11.76	-	3.47	8.69	4.09	-
Hunger and thirst	-	-	-	-	-	-	-	-
Cold	-	-	-	-	-	-	5.09	15.26
Mange	-	-	-	-	1.39	-	-	-
Lumpy skin disease	-	-	-	-	-	-	-	-
Constipation	-	-	-	-	-	-	-	-
Aborted	-	-	-	-	-	-	-	-
Birth	-	-	-	-	-	-	-	-
Accident	-	-	1.95	-	-	-	-	-
Wild animals	-	-	-	-	2.08	-	15.30	7.64
Unknown causes	-	16.13	5.89	-	16.67	3.72	4.08	9.16
Total number mortalities	39	31	51	21	144	161	98	131

Some animals died while having several diseases at the same time--this explains why the totals for certain columns are greater than 100%.

*Rinderpest of small ruminants.

Only relatively small numbers of 5 kinds of nematode parasites were found in the intestinal tracts of the 3 animals. The abomasum did not contain significant numbers of Haemonchus. In only one animal, the sheep, was found what I consider to be a moderate number of intestinal worms. There were 1900 worms in the small intestine. In my experience with animals in an arid climate this number is about normal and I do not consider it to be of economic significance. The number of nodules of Oesophagostomum and the number of worms found, I also consider insignificant. The nodules on the large intestine were firm and calcified indicating a longstanding infection.

What does this investigation indicate? To me, the small number of nodules of Oesophagostomum implies that the animal was never exposed to large numbers of infective larvae of this parasite. The egg counts are at about level which I would expect for normal, low-level parasitism in sheep in an arid climate. The data is fragmentary but I conclude that a properly constructed epidemiologic study involving host examination should be undertaken (Marquardt, 1979).

The percent of livestock producers suffering small ruminant losses is similar for three of the four ethnic groups (Table 2.102). The exception is the Bissa. As pointed out earlier the Bissa sampled are in the Koupela ORD where losses tend to be lower and veterinary services better. Also the Bissa tend to have smaller herds.

Sheep losses show a high degree of variation between sites but much less so between ethnic groups. In general, Fulani suffer greater losses than other ethnic groups, but the margin of the difference is not as great as with cattle. Highest sheep losses are reported for the Tafogo site (Kaya ORD) for both Mossi and Fulani (see Table 2.103). In that area a typical sheep owner lost between four and five head in a year. The Fulani of Koukoundi (ORD of Kaya) also suffered high sheep losses. Typical losses in Ougarou were about 3 head (excluding one livestock owner who reported losing 100). Losses suffered in Gnanguedin were again lower than for the other sites for both ethnic groupings.

The pattern of goat losses follows that for sheep. Greatest losses were found in Tafogo where the typical Mossi lost 5 animals and the typical Fulani, 7. Typical goat herd size in this area on

TABLE 2.102

PERCENT OF LIVESTOCK PRODUCERS (BY ETHNIC GROUP)
HAVING LOST SHEEP AND GOATS IN THE LAST YEAR

Ethnic Group	Number of Livestock Producers	Percent Losing Sheep and Goats in the Last Year
Mossi	64	75.0
Fulani	57	63.2
Gourmantche	17	82.4
Bissa	15	33.3
Total	153	

TABLE 2.103

REPORTED SHEEP LOSSES PER LIVESTOCK PRODUCER BY SITE AND ETHNIC GROUP

Site	Number of Deaths	Number of Livestock Producers	Mean Losses per Livestock Producer	Median Losses per Livestock Producer	Range of Losses per Livestock Producer
Koukoundi (total)	139	38	3.66		0-15
Mossi	94	28	3.36	1	0-15
Fulani	45	10	4.50	5	0-10
Tafogo (total)	242	46	5.26		0-20
Mossi	144	28	5.14	4.5	0-15
Fulani	98	18	5.44	4.0	0-20
Gnanguedin (total)	90	34	2.65		0-16
Mossi + Bissa	51	22	2.32	0.0	0-12
Fulani	39	12	3.25	0.0	0-16
*Ougarou (total)	200 (100)	27 (26)	7.41 (3.85)		0-100
Gourmantche	65	15	4.33	3.0	0-20
Fulani	135 (35)	12 (11)	11.25 (3.18)	3.0	0-100

*Figures in parentheses represent the total excluding one livestock producer who reported losing 100 sheep in the year.

the edge of the Sahel is greater than for the other regions studied. Ougarou is a distant second, followed by Koukoundi and Gnanguedin. Fulani losses are higher than Mossi and Bissa losses in Tafogo and Gnanguedin respectively. Oddly, in Ougarou, Gourmantche goat losses are higher than those for the Fulani, while in Koukoundi, the same holds for the Mossi over the Fulani. This probably reflects ownership patterns more than anything else. The size of herds of goats generally decreases as one moves south into the higher rainfall areas. It does not seem, however, that the disease problem in Tafogo and Ougarou is of a different magnitude from that in either Koukoundi or Gnanguedin (see Table 2.104).

Vaccinations for small ruminants are much less widely understood, accepted, and employed than for large ruminants, as indicated in Table 2.105. Only 42.6 percent of those owning sheep and/or goats vaccinated their animals against pasteurellosis (the vaccine locally available for small ruminants). The Mossi are the most frequent users of this vaccine (52.4%) followed by the Fulani (40.7%), Bissa (40.0%), and Gourmantche (23.4%).

The lack of understanding of small ruminant vaccinations is quite clear. For those who did not vaccinate their animals the most frequent explanation offered (52.9%) was that they did not know that there was such a vaccine available. Of those who claimed that they had vaccinated their small ruminants only a little more than half (54.8%) correctly identified the vaccine as being employed against pasteurellosis.

2.4.3.6 Marketing and Transportation

2.4.3.6.1 Marketing Motivation

Small ruminants are generally sold locally by all ethnic groups in all of the VLP sites. The purchasers are usually local butchers in need of meat, or villagers looking to increase their own small ruminant stock. These animals are sold to meet small immediate expenses. They are also sold in response to the high demand and high prices which accompany the arrival of both Islamic and animist holidays.

TABLE 2.104

REPORTED GOAT LOSSES PER LIVESTOCK PRODUCER BY SITE AND ETHNIC GROUP

Site	Number of Deaths	Number of Livestock Producers	Mean Losses per Livestock Producer	Median Losses per Livestock Producer	Range of Losses per Livestock Producer
Koukoundi (total)	100	38	2.63		
Mossi	81	28	2.89	0.5	0-15
Fulani	19	10	1.90	1.5	0-6
Tafogo (total)	292	46	6.35		
Mossi	161	28	5.75	5.0	0-25
Fulani	131	18	7.28	7.0	0-20
Gnanguedin (total)	52	34	1.53		
Mossi + Bissa	21	22	0.95	0.0	0-7
Fulani	31	12	2.58	1.0	0-10
Ougarou (total)	111	27	4.11		
Gourmantche	72	15	4.80	2.5	0-20
Fulani	39	12	3.25	2.0	0-10

TABLE 2.105

PERCENT OF SHEEP AND GOAT OWNERS BY ETHNIC GROUP WHO VACCINATE THEIR ANIMALS AGAINST PASTEURELLOSIS

Ethnic Group	Percent Vaccinating	Number of Livestock Producers
Mossi	52.4	63
Fulani	40.7	54
Gourmantche	23.5	17
Bissa	40.0	15
Total	43.6	149

$X^2 = 5.02$; $p < .2$, not significant.

2.4.3.6.2 Sheep and Goat Sales by Age and Sex

The largest number of sheep and goats sold are males, 75.3 percent for goats and 58.9 percent for sheep. The mean age for sale of sheep is 2.49 years of age, 2.32 years and 2.74 years, respectively, for males and females. For male goats the mean age for sale is 1.95 years and for females 1.75 years (see Table 2.106 and Figures 2.29 and 2.30).

Different ethnic groups sell animals at different age levels for both male and female (see Tables 2.107, 2.108, 2.109, and 2.110).

There are also significant differences between the VLP sample and the CRED sample in Djibo regarding the age at which small ruminants are marketed. The average ages at which sheep and goats are sold in Djibo are 1.40 and 1.65 years, respectively. For the VLP survey the average age at the time of sale is considerably older (sheep--2.49 years, goats--1.90 years). The difference for goats is not very great and can be adquately accounted for by ethnic group. The average age of goats sold by the Fulani in our sample is 1.43 years, slightly younger than those in the Djibo sample.

2.4.3.6.3 Where Sheep and Goats are Sold

In the case of sheep, region appears to be an important factor. Sudanian zone livestock owners do not sell young sheep to as great an extent as is the case in Djibo. The smaller size of the Sudanian sheep and goats, compared with the breeds found in the Sahel, is also a contributing factor.

Some differences exist between the small ruminants sold in the Sahelian zone and those sold in the Sudanian zone. The differences regarding goats can be at least partially explained by the fact that goats do better in the drier Sahelian climate and therefore goat herds in the north tend to be larger and more frequently commercialized. This can be seen when one looks at the breakdown of sales per livestock producer by site. Average goat sales in Tafogo, an area bordering on the Sahel, are double those for the other, more southerly sites (see Table 2.111).

TABLE 2.106

AVERAGE AGE OF SHEEP AND GOATS SOLD, BY ETHNIC GROUP

	Average Age at Sale		
	Males	Females	Males + Females
Goats			
All ethnic groups	1.95 (N=61)	1.75 (N=20)	1.90 (N=81)
Fulani	1.30 (N=23)	1.66 (N=12)	1.43 (N=35)
Mossi	2.29 (N=35)	1.90 (N=7)	2.21 (N=42)
Bissa	*	*	
Gourmantche	*	*	
Sheep			
All ethnic groups	2.32 (N=56)	2.74 (N=39)	2.49 (N=95)
Fulani	2.15 (N=27)	3.20 (N=15)	2.52 (N=42)
Mossi	2.44 (N=27)	2.33 (N=18)	2.40 (N=45)
Bissa	*	*	
Gourmantche	*	*	

*The sample is too small but the results are included in the totals.

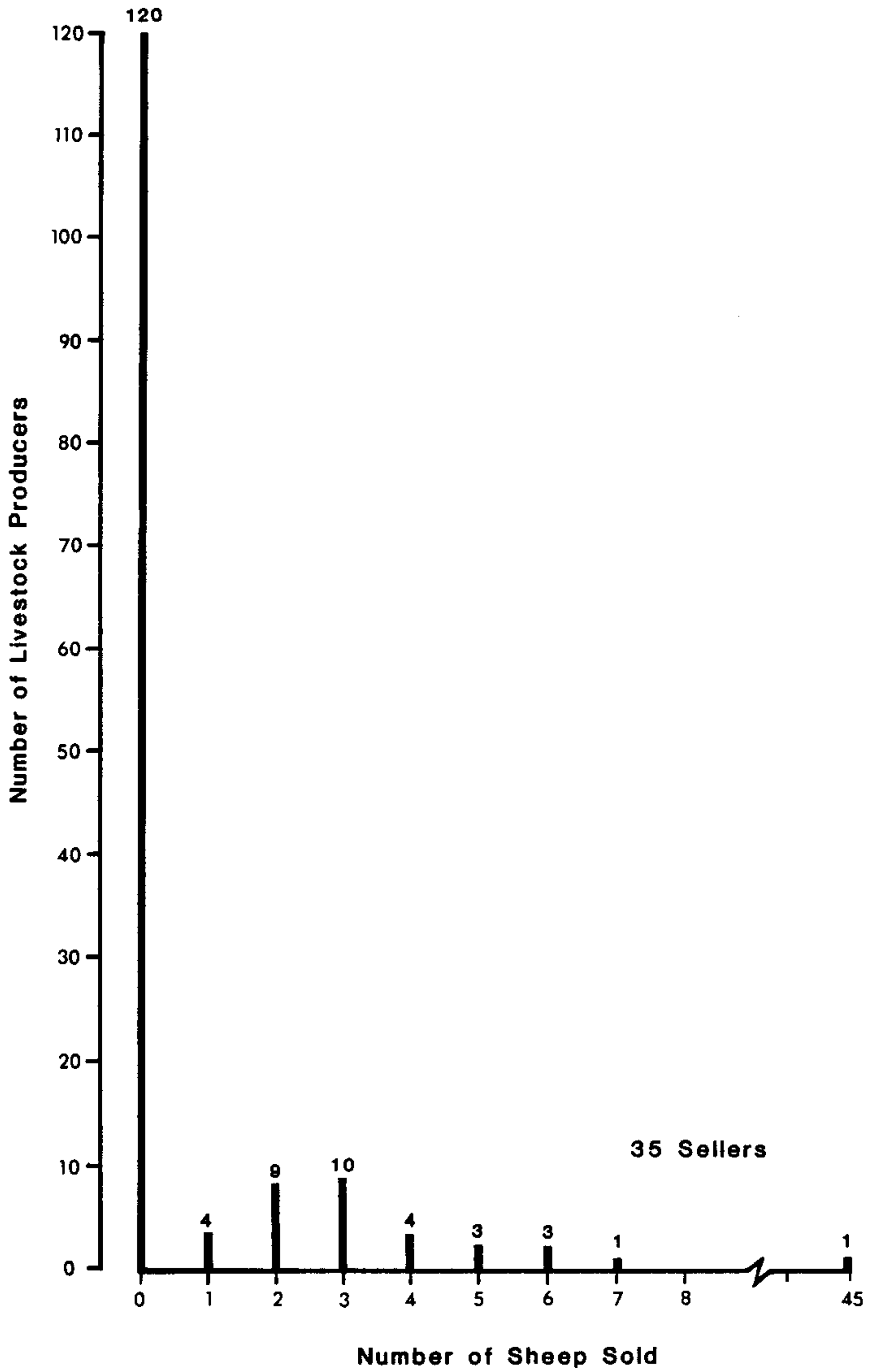

Figure 2.29 SHEEP SOLD PER LIVESTOCK PRODUCER (CATTLE OWNERS)

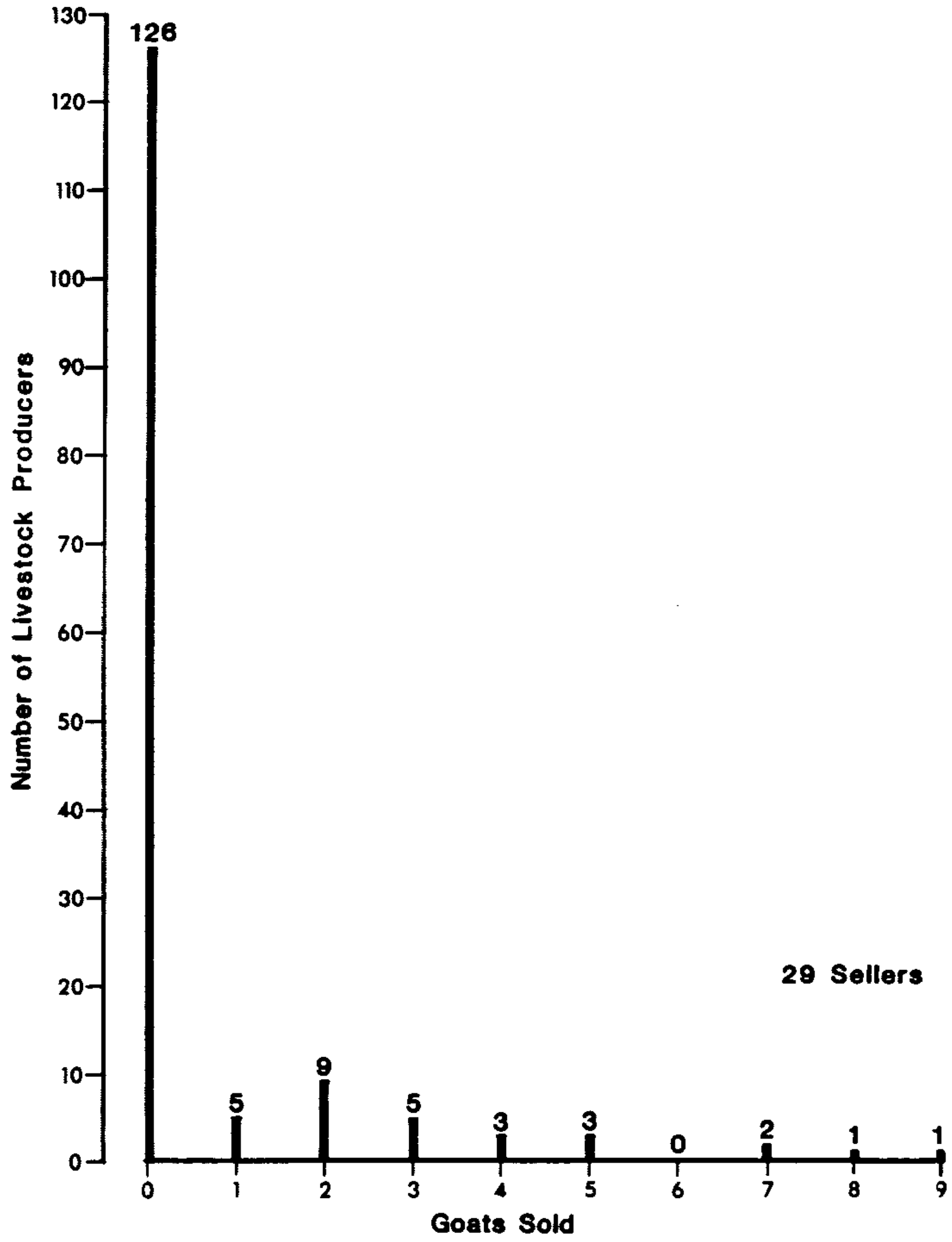

Figure 2.30 GOATS SOLD PER LIVESTOCK PRODUCER (CATTLE OWNERS)

TABLE 2.107

AGE AND SEX OF SHEEP SOLD BY EACH ETHNIC GROUP, IN PERCENTAGES
FOUR SITES*

	Fulani			Mossi			Bissa		
Age (years)	Male	Female	Total	Male	Female	Total	Male	Female	Total
1 - 1.9	40.74	20.00	33.33	3.70	16.67	8.89			
2 - 2.9	29.63	20.00	26.20	48.15	33.33	42.22		20.00	20.00
3 - 3.9	3.70	13.33	7.14	48.15	50.00	48.89		60.00	60.00
4 - 4.9	25.93	13.33	21.43					20.00	20.00
≥ 5.0		33.33	11.90						
Number sold	27	15	42	27	18	45	0	5	5

	Gourmantche			All Ethnic Groups		
Age (years)	Male	Female	Total	Male	Female	Total
1 - 1.9				21.43	15.38	18.95
2 - 2.9		100.00	33.33	37.50	28.21	33.68
3 - 3.9	100.00		66.67	28.57	25.90	31.58
4 - 4.9				12.50	7.69	10.53
≥ 5.0					12.82	5.26
Number sold	2	1	3	56	39	95

*Koukoundi, Gnanguedin, Ougarou, Tafogo.

TABLE 2.108

AGE AND SEX OF GOATS SOLD BY EACH ETHNIC GROUP, IN PERCENTAGES
FOUR SITES*

	Fulani			Mossi			Bissa		
Age (years)	Male	Female	Total	Male	Female	Total	Male	Female	Total
1 - 1.9	73.91	58.33	68.57	14.30	42.86	19.05			
2 - 2.9	21.74	33.33	25.71	42.86	28.57	40.48		100.00	50.00
3 - 3.9	4.35		2.86	42.86	28.57	40.48	100.00		50.00
4 - 4.9									
5 - 5.9		8.33	2.86						
Number sold	23	12	35	35	7	42	1	1	2

	Gourmantche			All Ethnic Groups		
1 - 1.9				36.07	50.00	39.51
2 - 2.9				32.79	35.00	33.33
3 - 3.9	100.00		100.00	31.15	10.00	25.93
4 - 4.9						
5 - 5.9					5.00	1.23
Number sold	2	0	2	61	20	81

*Koukoundi, Gnanguedin, Ougarou, Tafogo.

TABLE 2.109

SHEEP SOLD BY SITE, ETHNICITY OF OWNER, AGE AND SEX (PERCENT)

Site -- Ethnicity		Age (Years) 1-1.9	2-2.9	3-3.9	4-4.9	5-5.9	Total
Ougarou (N=9)							
Fulani	Males	33.33	-	-	-	-	33.33
	Females	33.33	-	-	-	-	33.33
Gourmantche	Males	-	-	22.23	-	-	22.23
	Females	-	11.11	-	-	-	11.11
	Total	66.66	11.11	22.23	-	-	100.00
Koukoundi (N=36)							
Fulani	Males	19.44	5.56	-	-	-	25.00
	Females	-	-	-	2.78	13.89	16.17
Mossi	Males	8.33	19.44	11.11	-	-	38.88
	Females	8.33	8.33	2.78	-	-	19.44
	Total	36.11	33.33	13.89	2.78	13.89	100.00
Gnanguedin (N=20)							
Fulani	Males	5.00	-	5.00	-	-	10.00
	Females	-	5.00	10.00	5.00	-	20.00
Mossi	Males	-	15.00	15.00	-	-	30.00
	Females	-	15.00	-	-	-	15.00
Bissa	Males	-	-	-	-	-	-
	Females	-	5.00	15.00	5.00	-	25.00
	Total	5.00	40.00	45.00	10.00	-	100.00
Tafogo (N=32)							
Fulani	Males	-	18.75	-	21.88	-	40.63
	Females	-	6.25	-	-	-	6.25
Mossi	Males	-	9.38	18.75	-	-	28.13
	Females	-	-	25.00	-	-	25.00
	Total	-	34.38	43.75	21.88	-	100.00

TABLE 2.110

GOATS SOLD BY SITE, ETHNICITY OF OWNER, AGE AND SEX (PERCENT)

Site -- Ethnicity		1-1.9	2-2.9	3-3.9	4-4.9	5-5.9	Total
		Age (Years)					
Koukoundi (N=19)							
Fulani	Males	10.53	-	-	-	-	10.53
	Females	5.26	-	-	-	5.26	10.52
Mossi	Males	15.79	10.53	26.32	-	-	52.64
	Females	15.79	10.53	-	-	-	26.32
	Total	47.37	21.06	26.32	-	5.26	100.00
Gnanguedin (N=7)							
Fulani	Males	14.29	14.29	-	-	-	28.57
	Females	-	14.29	-	-	-	14.29
Mossi	Males	28.57	-	-	-	-	28.57
	Females	-	-	-	-	-	-
Bissa	Males	-	-	14.29	-	-	14.29
	Females	-	14.29	-	-	-	14.29
	Total	42.86	42.86	14.29	-	-	100.00
Tafogo (N=50)							
Fulani	Males	26.00	8.00	2.00	-	-	36.00
	Females	10.00	6.00	-	-	-	16.00
Mossi	Males	-	24.00	20.00	-	-	44.00
	Females	-	-	4.00	-	-	4.00
	Total	36.00	38.00	26.00	-	-	100.00
Ougarou (N=4)							
Fulani	Males	25.00	-	-	-	-	25.00
	Females	25.00	-	-	-	-	25.00
Gourmantche	Males	-	-	50.00	-	-	50.00
	Females	-	-	-	-	-	-
	Total	50.00	-	50.00	-	-	100.00

TABLE 2.111

AVERAGE NUMBER OF SHEEP AND GOATS SOLD BY
ETHNIC GROUP AND SITE

Site	Ethnic Group	Sheep	Number of Livestock Producers	Goats	Number of Livestock Producers
Koukoundi	Mossi	0.52	27	0.37	27
	Fulani	2.00	9	0.44	9
Tafogo	Mossi	0.59	29	0.83	29
	Fulani	1.05	19	1.74	19
Gnanguedin	Mossi	1.13	8	0.25	8
	Bissa	3.73	15	0.47	15
	Fulani	0.64	14	0.43	14
Ougarou	Gourmantche	0.18	17	0.29	17
	Fulani	0.47	15	0.33	15
All sites	Mossi	0.63	64	0.56	64
	Gourmantche	0.18	17	0.29	17
	Bissa	3.73	15	0.47	15
	Fulani	0.95	57	0.84	57

2.4.3.6.4 Sheep and Goat Sales by Individual and Ethnic Group

The Fulani sell more sheep and goats than all other ethnic groups except the Bissa, while the Gourmantche sell few, if any, sheep or goats. The Mossi sell on the average one small ruminant yearly. The Djibo Fulani sell many more small ruminants, particularly goats, than the Sudanian zone Fulani.

There are livestock owners who concentrate on small ruminants and who own no cattle. These individuals rely on sales of these animals to meet any grain deficit (see Tables 2.88 and 2.89).

2.4.3.6.5 Amounts Received from Sheep and Goat Sales

The marketing of small ruminants, goats and sheep, is of less importance in the Sudanian areas than in the Sahel. In general, both sheep and goats in the Sudanian zone are much smaller and bring a significantly lower price than those raised and sold in the Sahel. Sales by the Fulani of small ruminants provide a very small portion of their total income from livestock while the Bissa attribute 41 percent of their income from livestock sales to sheep and goats (see Table 2.112).

Among the livestock producers in our sample the prime motivation for the sale of small ruminants is to meet small, often unpredictable needs for cash. When asked to identify the optimal months or periods in which to sell goats and sheep, 28.9 percent said there is no optimal time. One sells these animals when one has a need for cash, regardless of season.

Among those who identified a particular period the vast majority (73.0%) felt it was best to sell small ruminants during the dry season. During the dry season goats and sheep are allowed to roam free to eat as they will. They are also less plagued by parasites during the dry than wet season. On the contrary, during the wet season goats and sheep are often tethered close to home or carefully herded in order to avoid the potential destruction of crops. Livestock producers clearly state that as a result goats and sheep are in the best condition during the dry season. Their identification of this period as the best time to sell appears to be quite rational.

TABLE 2.112

AVERAGE YEARLY EARNING PER LIVESTOCK PRODUCER FROM THE SALE OF SHEEP AND GOATS*

Village	Ethnic Group	Earnings Sheep CFAF*	Number of Livestock Producers	Earnings Goats CFAF*	Number of Livestock Producers
Koukoundi	Mossi	1200	27	1300	27
	Fulani	4300	9	600	9
Tafogo	Mossi	1900	30	2000	30
	Fulani	3600	19	2900	19
Gnanguedin	Mossi	3000	8	300	8
	Bissa	8000	15	300	16
	Fulani	1500	14	700	14
Ougarou	Gourmantche	400	17	900	15
	Fulani	1100	15	300	14
All villages	Mossi	1700	65	1500	65
	Fulani	2500	57	1300	56
	Bissa	8000	15	300	16
	Gourmantche	400	17	900	15

*220 CFAF = $1.00 U.S.

When we examine the actual time period during which livestock producers sell their sheep and goats a clear anomaly appears. While 73 percent say it is best to sell during the dry season, only 43.1 percent of the small stock they sold in 1978-79 was sold during the dry season. The distortion is greater for goats than for sheep (37.8% and 47.6%, respectively, of goats and sheep were sold in the dry season). The majority of all small stock sold (56.9%) is sold during the relatively short rainy season (July-October).

Apparently the Sudanian zone livestock producers sell their sheep and goats when both their cash and food reserves are at their lowest. However, when sale prices are examined the seasonal differences in prices for sheep are not statistically significant. Seasonal differences in goat prices approach the .05 level of significance. The greatest anomaly appears in the marketing of goats. The highly rational calculations that enter into the decision to market cattle do not seem to be carried over to animals whose cash value is considerably lower, most notably goats.

To what degree is weight a consideration in the sale price of small ruminants? In the case of the large ruminants it has been noted that there is a strong positive relationship between age (a proxy for weight) and the market price of males, but not for females. Other crtieria, most notably actual or potential productivity, determine the market value of females. The same pattern holds for small ruminants.

In the case of sheep the overall relationship between age and price is a low .28 (Pearson's r). However, when a control is introduced for sex, the relationship for males is a strong .54 ($p < .0002$). For females the same relationship is only a weak .20 (see Table 2.113).

For goats the relationship parallels that for sheep. Age and sale price are strongly correlated for males ($r = .49$, $p < .0001$) and weak and not significant for females ($r = .28$, $p < .14$). Females are sold on the basis of productivity rather than weight. Within any given age category for females one finds a wide range of prices

TABLE 2.113

PEARSON PRODUCT MOMENT CORRELATIONS FOR AGE AND PRICE OF SMALL RUMINANTS

		r	r^2	N	$p <$
Sheep	Both sexes	.28	.08	95	.005
	Male	.54	.29	59	.0001
	Female	.20	.04	33	.13 N.S.
Goats	Both sexes	.41	.17	82	.0001
	Male	.49	.24	58	.0001
	Female	.28	.08	17	.14 N.S.

N.S. = not significant.

which reflect, on the low side unproductive, and on the high side productive females.

An additional significant independent variable examined here is the region or site. The sale price of sheep in Tafogo ($\bar{X} = 3742$ CFAF) located on the edge of the Sahel, is significantly higher than for the other areas ($\bar{X} = 2336$ CFAF). The mean age of male sheep sold in Tafogo is 2.88, while the age for sheep sold in the other sites is only 2.00 years. This age difference, possibly brought on by the drought conditions in the Tafogo area, accounts for the regional variation in sheep prices (see Tables 2.114 and 2.115).

A significant regional distinction also exists for goats. In this instance, it is Koukoundi which shows markedly higher prices ($\bar{X} = 3018$ for Koukoundi and $\bar{X} = 1962$ CFAF elsewhere). Male goats sold in Koukoundi are older than those sold in the other sites ($\bar{X} = 2.2$ and 1.9 years, respectively). This alone does not explain the average price difference. There are some of the larger Sahelian goats in the Koukoundi herds. Since the sample for this site is relatively small, the inclusion of only a few high prices for Sahelian goats would serve to account for these differences.

2.4.3.7 Small Ruminant Slaughter, Processing, and By-Products

Simple abattoirs, previously described, are used by village butchers to kill small animals and then sell them on the same day of slaughter usually on the day the local market is functioning. Meat is inspected by the butcher. The abattoir in Ouagadougou offers slaughter service and has one killing line reserved for small ruminants.

The main by-products realized from the slaughter of sheep and goats are the hides and skins. Hides and skins are collected for processing in all parts of the country from the slaughter at both the large and small abattoirs. The skins are most generally dried locally in the sun and in sheds and sold through the SVCP.

The average weight of a dry sheepskin is .60 kg and that of a dry goatskin is .43 kg.

TABLE 2.114

INDEPENDENT VARIABLES RELATED TO PRICE OF SHEEP SOLD

		Mean Price CFAF	N	F	p <
Sex	Male	3300	64	29.05	.0001
	Female	1900	38		
Season	Dry	2700	50	0.20	.7 N.S.
	Rainy	2900	55		
Site	Koukoundi	2200	33	6.87	.001
	Tafogo	3700	34		
	Gnanguedin	2400	10		
	Ougarou	2400	29		
Age (years)	1	1900	18	5.57	.001
	2	2400	29		
	3	3500	38		
	4	4200	6		
	5	1800	4		

N.S. = not significant.

TABLE 2.115

INDEPENDENT VARIABLES RELATED TO PRICE OF GOATS SOLD

		Mean Price CFAF	N	F	p <
Sex	Male	2500	58	11.66	.001
	Female	1600	20		
Season	Dry	2400	34	3.91	.051
	Rainy	1900	56		
Site	Koukoundi	3000	14	3.92	.02
	Tafogo	2000	57		
	Gnanguedin	2200	4		
	Ougarou	1700	15		
Age (years)	1	1800	28	9.46	.0001
	2	1800	32		
	3	3200	21		
	5	2200	1		

A tanning center (CTMC) has been established to process goatskins into rugs, coverings, and miscellaneous suede or velvet type articles decorated with local designs. Custom processing of goatskins is now its principal activity. SVCP must provide the tannery with 8000 skins a month to keep it in operation.

2.4.4 Poultry

2.4.4.1 Genetics, Physiology, and Utility

At present almost all poultry are produced in the traditional sector with a typical farmer owning a few scavenger chickens and guinea fowl. For the most part the quality of the chickens is inferior, probably from long inbreeding for generation after generation without the infusion of new bloodlines to upgrade the individuals.

Farm families have little opportunity to purchase high quality cockerels for upgrading as the sources of good breeding stock are usually located at great distances from the villages. Limited transportation facilities, lack of credit, and even perhaps their not having knowledge of the availability of good breeding stock are constraints to upgrading of village flocks.

The Poultry Center in Ouagadougou has modern facilities for breeding and hatching baby chicks. They have carried on extensive research and have developed bloodlines which give promise to the poultry industry. Transportation problems and limited contact with the outlying villages prevent the extension of their influence to any degree. Producers who are interested in keeping poultry and live in the proximity of the larger cities and towns do take advantage of the service of the Poultry Center. Eggs, chicks for the home poultry yard, breeding stock, medicines, and balanced rations can be obtained there.

The Poultry Center has imported several strains of European and American bloodlines which they establish as foundation stock or cross with the native, though much smaller and hardier, chicken. Good crosses are made with the Barred Rock, Rhode Island Red, and White Wyandotte. No Mediterranean breeds except White Leghorns are involved at this time. For poultry raising in the bush areas, the crossbreeds seem to stand up better against the prevailing diseases. Villagers are willing to invest in purebred cockerels though, and seem to understand the benefits of having a superior cockerel for groups of 10-15 laying hens.

Native poultry as observed in rural villages are quite small in size, late maturing, and of an indistinguishable breed. Occasionally a European breed cockerel can be seen around the villages with a small hen flock which would give the impression that there is some recognition of the benefits of upgrading by the use of better breeding stock.

A native hen will range from .8 to 1.2 kg depending upon the degree of inbreeding and influence by exotic strains. These weights can be compared to weights of 1.5 to 2.1 kg for exotic breed hens.

The average rural villager seldom includes poultry in his diet except on holiday celebrations. Poultry are a traditional form of exchange and in many instances an acceptable gift to visitors and/or dignitaries. In some instances consumption of eggs is prohibited by custom.

2.4.4.2 Management and Feeding

Chickens around the compounds are scavengers, finding most of their food in household wastes, debris of crops being harvested, and insects. Some poultry raisers prepare a mixture of cereals, wastes from the abattoir, and termites to make an excellent protein ration for the very young chickens who cannot scratch for themselves.

Small buildings constructed of mud or brick with thatched roofs, similar to but smaller than those the villagers live in themselves, are provided to house the poultry at night to protect them from the elements and predators. Often these shelters are cleaned inadequately and thus are a source of disease and parasite infestations.

2.4.4.3 Protection, Diseases, and Pests

Despite the considerable effectiveness of poultry disease control, especially against Newcastle disease, which periodically ravages poultry flocks, sanitary protection in the farms and villages is nil. In a few locations some small scale interventions in poultry health are being made but not to the same extent that is being carried out by the large animal vaccination programs. Sometimes 90-100 percent of village flocks are wiped out by epidemics.

Extension work in poultry disease control is administered by the Poultry Center. This branch of the Livestock Service has established an effective vaccination program against both bacterial and viral infections in poultry and have vaccines on hand for sale to anyone wishing to follow a program of disease control in their poultry flock. The established program is as follows:

Vaccination Calendar

	Age:	Treatment:
1.	1 day	Vaccinate against Fowl Pox (variole). Transfusion through the membrane of the wing. Two vaccines are available: variphene. Price: 5 CFAF/dose.
2.	10 days	Vaccinate against "La maladie de Gumborro." Available vaccines are either French (2 applications) or American (1 application). Both may be taken mixed with drinking water. Price: 10 CFAF/dose.
3.	10 days	Vaccinate against Newcastle disease. Name of vaccine: Pestalo HB1. May be mixed in drinking water. Price: 5 CFAF/dose.
4.	20 days	La sota Pestalo--same as No. 3 above. Price: 5 CFAF/dose.
5.	30 days	Reyaccinate against "La maladie de Gumborro." Price: 10 CFAF/dose.

6. 90 days Revaccinate against Newcastle disease using Pesta-viform. Vaccinate against cholera using cholavil. Both are injectable. Price: 10 CFAF/dose.

7. 110 days (max) Inject Tri-avia against Newcastle disease, Fowl Pox, and Salmonella. Price: 15 CFAF/dose.

8. 210 days Reinject some cholavil. Price: 5 CFAF/dose.

(Most of these vaccines require refrigeration.)

2.4.4.4 Marketing

Poultry is sold around the end of the rainy season and up until the beginning of the cold season in the local or primary markets. Young cockerels are usually sold at the age of 4 months by villagers who bring them in from the bush on market day. At this point they are collected and purchased by traders who are better equipped to transport the assembled purchases to larger collection centers.

Chickens and guinea fowl are usually transported from the market on motorbikes and bicycles in baskets with capacities of 40 to 50 units. At the larger collection points the poultry are reassembled and cooped for shipment to the Ivory Coast where there is always a ready market.

A 1978 market analysis revealed that the prices for guinea fowl and chickens ranged from 350-450 CFAF each. The price range is governed by the season, but more by the proximity of the market to Ouagadougou, those closer to Ouagadougou having higher prices.

There are few material costs of feeding poultry under a production system based on scavenging.

The VLP, in a demonstration program of brooding and rearing chickens that had a background cross of European cockerels on native hens, produced a trial flock of chickens averaging 1.6 kg in five months. The cost, including baby chicks, medicines, and feed averaged 350 CFAF/bird. No study was made of labor input. Sales price for these birds averaged 500 CFAF (330 CFAF per kg) in the local markets and up to 800 CFAF (500 CFAF per kg) after being transported to Ouagadougou.

As very few eggs are sold in village markets, raising poultry for egg production is not important. In the larger towns where there is a foreign population, eggs are quite expensive. The lack of transportation and/or refrigeration prevents the villager from taking advantage of this marketing opportunity.

Greater profits could accrue to the villagers if they continued raising poultry in the traditional method but with the added advantages of using good quality breeding cockerels and a program of disease control.

2.4.5 Swine

2.4.5.1 Genetics, Physiology, and Utility

For the most part the breeds of swine found in each of the six sites of the VLP are a local breed or a cross with an exotic breed from Europe called the "Large White" (similar to the American Chester White).

Surprisingly, the reproductive rate of the swine observed here is quite adequate for the breed with a farrowing of 6-10 piglets at a time. Also the general conformation shows some background of breeding as opposed to the more rangy "wild hog" appearance which often characterizes swine which have been allowed to interbreed and deteriorate genetically. But there definitely is no formalized breeding program among the growers. There is no practice of castration or selection for quality being carried out.

2.4.5.2 Management and Feeding

The general condition of the swine observed is better as a whole throughout the seasons than other species of animals, especially in the dry season. They seem to be effective scavengers around a compound. The raising of swine is well implanted in Upper Volta in regions where people make millet beer (dolo). The animals are kept in confinement during the rainy season and hand fed garbage, fresh green weeds, and residues from making millet beer. During the dry season they are left to run around the village compounds but not too far away from habitation. They, like the chickens, then become scavengers and balance their diet by rooting in the earth for bulbs and corms of wild plants. Grain is considered much too valuable for human consumption to feed hogs.

2.4.5.3 Protection, Diseases, and Pests

There are no hygienic standards for raising swine. They are ignored for the most part by the Livestock Service as far as programs for vaccination are concerned.

2.4.5.4 Marketing

Swine in Upper Volta are not exported and the prices are quite stable in the local markets. Sales are lowest in January, increasing or doubling by August. Hogs are sold for butchering at 50-60 kg weight.

In the village markets growers receive 150-200 CFAF per kg for a dressed-out carcass. In the market in Ouagadougou pork with bone sells for about 300 CFAF per kg and in the modern meat shops, where it is prepared into household cuts, it sells for 400 to 600 CFAF per kg.

With the existing foreign population in Upper Volta, the exploitation of swine should enjoy a reasonably good future although on a relatively small scale. A survey of five modern butcher shops in Ouagadougou revealed that 12.5 percent of all locally raised fresh meat sold over the counter was pork.

Most of the butchering of swine takes place in the Ouagadougou abattoir because most pork is consumed in the larger cities. There is one slaughter line for small ruminants and swine. According to Muslim customs swine and small ruminants are slaughtered on separate days. The meat is inspected by representatives of the Livestock Service.

3 DESIGN OF PHASE II VILLAGE LIVESTOCK PROJECT

One of the tasks of the first phase of the VLP was the gathering of information and testing of ideas that would be useful in determining what kinds of development activities would be feasible and appropriate during the second phase of the project. This section of our report details the design process and the results of that process.

Background for the Phase II project came from the Baseline Report we prepared (Chapter 2 of this Final Report) and from our myriad experiences with the livestock production system at the six VLP sites in Upper Volta and at other locations.

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3.1 DESIGN PROCEDURE

The procedure for the design of Phase II of the Village Livestock Project involved five major steps as follows:

1. Problem Statements Review. Determine validity and completeness.
2. Idea Generation. Determine what can be done to solve the problems and with what priority.
3. Organizing the Project. Organize the activities and establish an administrative structure.
4. Preliminary Project Design. Determine how the activities will be carried out, integrated, and evaluated.
5. Final Project Design. Iterate the preceding four steps, prepare a time scale, and establish final personnel and budget requirements.

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3.2 DESIGN WORKSHOPS

After our initial work on the Phase II project design, a two-day workshop intended to stimulate Voltaic input was arranged for 28-29 February 1980. The original intent was to go through the five-step process outlined above with the Voltaic participants. This proved to be impractical, and only the first two steps and a part of the third were completed at that time.

A second workshop was held on 20-21 May 1980 following a similar format. The Phase II project design was finalized at that time.

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3.3 DESIGN CRITERIA

The overall Phase II project is to be broad in scope of activities but limited in areas where activities will be carried out. Our view is that it is better to carry out a wide variety of development activities for a small number of livestock producers in a few locations than to try to implement one or two changes in the livestock production system for everybody, everywhere. A third phase of the project can then be a time for expanding the most successful activities of Phase II to more livestock producers in more areas (villages).

Other desirable characteristics of the Phase II project that were agreed upon are as follows.

3.3.1 General Characteristics

Project activities are:

- decentralized to the extent possible;
- of an appropriate scale and technology;
- designed with emphasis on practical, field activities;
- planned for a limited number of locations with concern for logistics and infrastructure requirements;
- evaluated continually with feedback to change or modify activities as necessary;
- integrated within the VLP and with other sectors of the Voltaic economy, especially crop production;
- given an adequate and well-planned time frame;
- coordinated with other livestock development projects in Upper Volta and Sahelian countries;
- coordinated with ORD administrations;
- based on improving quality of life of village livestock producers;
- reported frequently in French to Livestock Service administration and counterparts.

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3.3.2 Social-Cultural Characteristics

Project Activities:

- recognize subsistence aspects of livestock production;
- recognize individual interests but also collective (community) needs;
- have strong local involvement including all segments of society;
- have Voltaic counterparts;
- promote improved relationships with ORD's;
- use existing knowledge and practices as resources where possible.

3.3.3 Training Characteristics

Project activities include training of the following:

- Livestock Service Personnel (male and female)
  - Professionals
  - Veterinary Nurses
  - Extension Agents
  - Other Field Assistants
- Livestock Producers
  - Adults
  - Young People
  - Women

3.3.4 Research Characteristics

Project activities include a research component where appropriate.

3.3.5 Economic Characteristics

Project activities:

- will be continually examined for economic viability in the long term;
- provide financial services (credit, savings) to livestock producers;

3.3.6 Technical Characteristics

Project activities:

improve the efficiency of the livestock production system through health care, range management, and dry season feeding;

correlate all resources development and utilization (vegetation, soil, water, energy);

include small animal production.

3.3.7 Philosophy and Operational Strategy

The VLP attempts to build lasting change into the Livestock production system by first acquiring the concurrence of the livestock producers. Only then does the technical team proceed with the administrative and infrastructural activities necessary to implement the proposed activities. Proposals to the village producers are based on what have been perceived to be the constraints to the long-term viability of the traditional livestock production system as it becomes increasingly tied to the world economic system. The balance of technical and social science inputs has proven particularly fruitful in this regard. We believe that changes in one aspect of the livestock producers lives affect many other often unforeseen changes. Every effort is made to respect the unity of the existing beliefs and values and to implement changes where the livestock producers themselves see the problems. At times this involves demonstrations to show both the existence of a problem and the potential for its solution. It is very unlikely that "solutions" imposed where no problem has been perceived will be of lasting value. This procedure sometimes has created the impression that the VLP is primarily a research-oriented project. The discussion in chapter one of this document clearly refutes this misconception and clarifies the positive step-by-step program of implementation being followed.

Phase II marks an increasing emphasis on concrete action based on the pilot programs and baseline data collection undertaken in Phase I.

Assessing the needs of the livestock producers before implementing programs serves as the most effective means of improving the capacity of the Livestock Service to extend services to the village level. By working directly with Voltaic counterparts the CID technical team is, in effect, working itself out of a job. The professional training component is aimed specifically at alleviating the shortage of expertise required to implement livestock development programs. Voltaic administrators and professionals will play a greater role in implementing Phase II than they were able to do in Phase I. By the end of Phase II, the need for U. S. expatriates should be greatly reduced and the capability of the Livestock Service greatly expanded from its former emphasis on animal health. The essential nature of the VLP--that is, working from "bottom to top"--will not be foregone even though the second phase of the project puts a heavy emphasis on capital and infrastructure investments. To the contrary the thrust of this assistance is aimed at the decentralization of the Livestock Service thus bringing an increasing proportion of its activities closer to the rural centers of livestock production. Involvement of the local producers is the only way national level grazing programs, policies, and legislation can possibly be effective.

3.4 DESIGN SUMMARY

Using the above guidelines we have designed the Phase II Village Livestock Project. The overall project consists of a set of subprojects organized as shown in Figure 3.1 and listed in Table 3.1 The subprojects are not at all independent, but provide us a way of detailing the activities and insuring as complete coverage as possible of the many problems needing attention.

3.4.1 Some Highlights of the VLP Phase II

Administration and core support are proposed for four activity areas: natural resources, human resources and social services, animal health, and animal production.

1. Administration and core support
   - establish livestock centers with buildings, equipment, and supplies in three ORD's which will furnish technical, social, and logistics support to Livestock Service and livestock producers;
   - increase integration and coordination with other livestock production improvement programs;
   - provide support services for all other VLP subproject activities to include such essentials as typing, translation, and motor pool.
2. Natural resources
   - implement range management practices through a process beginning with relatively small demonstration plots, then move to larger pilot projects and finally to large site management areas;
   - develop water resources for domestic and animal use coordinated with range (vegetation) resources;
   - plant village wood lots for energy, animal feed, and delineation of boundaries.
3. Human resources and social services
   - provide training for Livestock Service personnel in range management, animal health control, animal production, and extension methods;

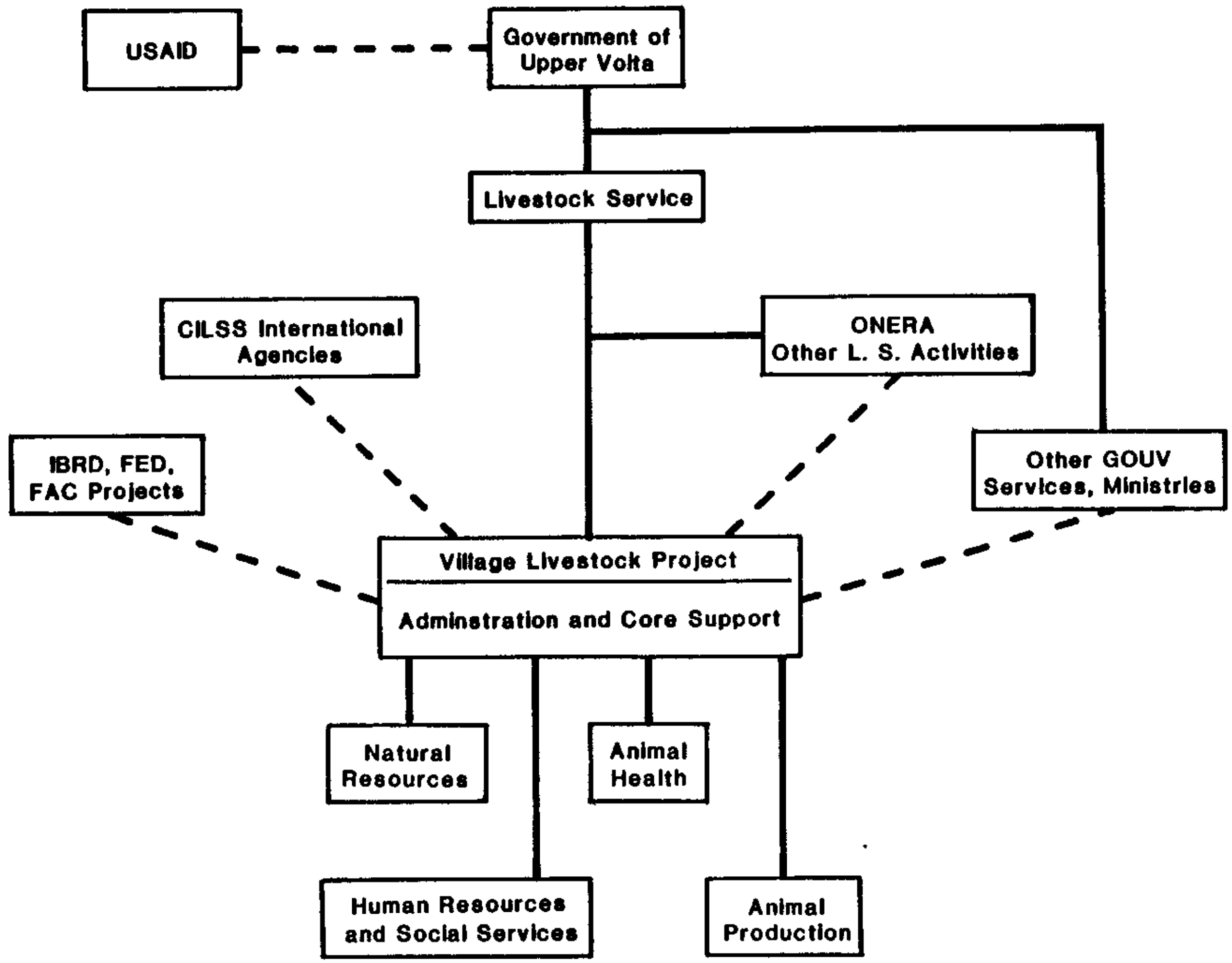


Figure 3.1 ORGANIZATION OF VLP PHASE II

Table 3.1 Village Livestock Project

Phase II - Sub-Projects List

Administration and Core Support

Natural Resources

- Range Management
- Water Resources Development
- Village Wood Lots

Human Resources and Social Services

Animal Health

Animal Production

- Cattle Production
- Small Ruminant Production
- Poultry Production

The Village Livestock Project Phase II is a decentralized, integrated rural development project with its focus on small-scale livestock producers and strong local participation. It is clearly based in the agricultural sector and proposes to increase production of meat, milk, and eggs for the benefit of the producers. It attempts to balance natural resources use and capability including range vegetation, water, wood (energy), and soil.

It provides education for rural livestock producers and families in areas of animal production and health, resources management, sanitation for humans and animals, and nutrition. It also provides education for Livestock Service personnel.

It addresses health aspects of the problem of livestock producers through provision of sanitary water, reduced disease transmission, and improved nutrition. This will be accomplished primarily by entrainment of existing health services.

Many of the activities of VLP Phase II will be carried out in cooperation with existing GOUV programs in other sectors or with complementary donor-funded programs.

- provide training for livestock producers and families in improved management of animal production and natural resources;
- provide financial services such as the caisse populaire for livestock producers;
- provide health services to livestock producers (primarily by entrainment of existing activities and bringing them to VLP-Phase II sites);
- improve curriculum in rural and primary schools in areas of livestock production and natural resources utilization and conservation;
- increase access to other government services (primarily by entrainment of existing activities and bringing them to VLP-Phase II sites).

4. Animal health
   - emphasizes close relationships between field diagnosis and central laboratory and provide more systematic coverage of problems as they are identified;
   - establish local "scouts" as the first line of animal health defense;
   - develop and apply disease and parasite prevention procedures.

5. Animal production
   - cattle: combine demonstration with range management, improve production efficiency, develop dry season feed resources;
   - small ruminants: improve production efficiency, analyze economics of production;
   - poultry: improve marketing, develop local feed resources, emphasize small-scale operations;
   - improve marketing of animals and animal products.

6. Personnel, schedule, budget
   - personnel summary: four full-time U.S. scientists (one serving 1/2-time as chief of party) with about 150 person-months of short-term assistance;

activity schedules based on an initial five-year period, but recognizing need for continuing project activities beyond that point;

budget for the initial five-year period of about $10 million.

3.4.2 Agreement with GOUV and USAID/UV Policies and Strategies

The VLP Phase II is consistent with GOUV policy in the following characteristics:

1. Coherent, integrated strategy for development.
2. Decentralized rural development administration emphasizing local participation.
3. Integrated rural development and improvement in rural infrastructure.
4. Agricultural strategy emphasizing the small producer.
5. Increased livestock production for greater participation in regional economy.
6. Significant emphasis on social developments.
7. Recognition of the shortage of middle-level managers and technicians.

In addition, the VLP-Phase II activities fall within the four priorities of the USAID development strategy for Upper Volta.

First USAID Priority is food production with activities in the agricultural sector, integrated rural development and rural development support. The VLP Phase II is clearly in the agricultural sector, aims at increased production of meat, milk and eggs, represents integrated rural development, and supports rural infrastructure.

Second USAID Priority is natural resources management. The VLP Phase II emphasizes balance of natural resources use and their inherent or managed capability and/or availability with activities in range management, water resources development, and village wood production. It includes an element of soil conservation.

Third USAID Priority is population and health-related activities. The VLP Phase II does not directly address the population issue, but through its emphasis on balanced resources use provides supportive background information from the field. Health-related activities include provision of sanitary water supplies, reduction of animal diseases and hence transmission of them to humans, improvement of nutrition through increased consumption of animal protein, and entrainment of the rural health care delivery system at the VLP-Phase II project sites.

Fourth USAID Priority is rural education. The VLP Phase II has a major training component. Village livestock producers will be trained in improved management of animals and natural resources, sanitation for animals and humans, and nutrition. An attempt will be made to encourage inclusion of livestock production and natural resources related matters in the primary and rural school curricula at VLP-Phase II project sites. Training will be provided for Livestock Service personnel and other GOUV employees in range management, animal health control, extension methods, and other subjects.

The role of women will be given strong attention in VLP-Phase II activities, particularly in small ruminant and poultry production and health projects, development of permanent domestic water supplies and village wood production, and training for their special needs.

3.5 SUBPROJECT DETAILS

Details of the five suggested sub-projects are given in this section. For each sub-project there is a name, a set of objectives, justification statements, a procedure, list of personnel required, support needed, location(s) of activities, evaluation criteria, a schedule, and budget information.

3.5.1 Administration & Core Support Sub-project (AD)

Objectives:

1. To coordinate VLP with other projects of the Livestock Service.
2. To coordinate VLP with administration of ORD's.
3. To link VLP with other ministries and services with programs in VLP areas.
4. To administer and integrate other VLP subprojects and provide their core (logistics) support.
5. To communicate VLP progress and problems to Livestock Service, sponsor, and news media.
6. To obtain local involvement in administration of other VLP subprojects.
7. To promote VLP activities with Voltaic people and all levels of government.
8. To establish a project library for project records and other related documents.
9. To train Voltaic personnel in project administration.
10. To optimize use of project resources (human and financial) in meeting overall project goals.

Justification:

1. Individual subproject activities must be coordinated (integrated) to utilize project resources most efficiently and effectively.
2. VLP activities will have more impact on the economy of Upper Volta if they are widely publicized.

3. A strengthened sense of community responsibility is necessary for long term resources management.
4. Gaps in continuity and changes in implementation strategy reduce project effectiveness.
5. Development projects lack coordination by donors and GOUV.
6. Most livestock projects have been too large and designed for "splash" effect rather than "spread" effect or carefully phased activities.
7. Lack of involvement of groups of local people who see their interests as vitally connected with project goals. Subproject activities will be more successful with strong local involvement. Local involvement may be lacking because programs are not perceived as benefitting the individual household.
8. Shallow relationship of projects with ORD's. Action is at the ORD level but ORD support is not always forthcoming. Lack of involvement of ORD's in planning stages reduces their participation during the period of implementation.
9. Logistics support for existing Livestock Service programs is not always able to meet local needs.

Procedure:

1. Provide initial briefing for all VLP personnel on all projects of the Livestock Service, and routine briefing thereafter at six-month intervals.
2. Brief other Livestock Service personnel on the VLP at regular meetings at least once every six months.
3. Arrange for regular briefing of ORD representatives on VLP activities every three months.
4. Gather information on development programs of other services, ministries in the VLP area and disseminate to all VLP personnel.
5. Prepare brief reports on VLP activities and submit to services, ministries in #4 above at three-month intervals.
6. Hold regular team meetings once a week to insure integration of subproject activities.

7. Prepare brief reports on VLP activities, problems, and progress and submit to sponsor at three-month intervals.
8. Submit reports on the VLP to the news media from time to time but at least once every six months.
9. Involve local livestock producers committees (existing) in decisions regarding subproject activities. Hold meetings with each site committee as necessary.
10. Sponsor (or co-sponsor) a village livestock fair at one site in the project area each year (rotating basis).

10.1 Plan and schedule annual livestock fairs:

timing -- period of low routine activity at sites (post harvest)

location -- at each VLP project site (near major village) on rotating basis

scheduling -- after start-up period, select sites three years in advance to allow time to develop associated demonstrations

10.2 Organize demonstration activities for fairs. Some potential topics include:

range management -- results of controlled use, effects of burning, identification of grasses, use of shrubs

water resources -- improved wells and pumps

wood production -- planting and caring for trees (use to mark fair site boundary)

animal health -- veterinary clinic, identification of diseases and parasites

animal production -- cheese and yogurt processing, by-product crafts, silage, and hay making

NOTE: Many of the demonstrations must be started several years before the fair.

10.3 Conduct contests and aware prizes:

animal judging

animal products and by-products

athletic events

10.4 Have GOUV agencies provide social services:

health clinic

short courses in family health and sanitation, resource conservation, literacy.

10.5 Prepare and distribute publicity on livestock fairs.

11. Provide logistics support (transportation, supplies, maintenance, typing and translation) for all VLP subprojects.

12. Construct new buildings or modify existing buildings to serve as livestock centers in three ORD's. The livestock centers will use existing Livestock Service buildings as a base from which to construct additional facilities.

    The livestock centers will provide the following:

    Office space and furnishings for various personnel assigned to the area such as veterinary nurses, field assistants, and extension agents (male and female), and for visiting professionals temporarily in the area. A U. S. professional will be based at each center.

    Pharmacy with refrigerated storage and associated supplies (medicines, vaccines) and equipment (for sale).

    Production supplies for cattle, sheep and goats, and poultry (for sale).

    Conference room, training facilities, supplies, and equipment.

    Marketing assembly facilities for poultry.

13. Provide general professional backstopping (in U. S.) for field team.

14. Provide training in project administration for Voltaic project director and other appropriate personnel. This may include both on-the-job training and advanced-degree training to be carried out in another country.

15. Coordinate short-term staff assignments with other project activities to optimize use of project human and financial resources.

Personnel required:

Professional: Project Directors (Voltaic & U. S.)
Professional backstopping personnel (various disciplines)
Chief of Party, Social Scientist
participation of all other VLP team members and Voltaic counterparts

Technicians: Administrative assistant, drivers/mechanics
bi-lingual secretary (1 U. S., 2 Voltaic)

Support:

Cooperation of Livestock Service, ORD's, other services, ministries, news media personnel, and local livestock Producers' committees

Location(s):

Ouagadougou, all project sites

Evaluation criteria:

Reports issued, record of briefings received and given, record of meetings (team, livestock producers' committees), press releases, annual livestock fair report, livestock centers built, project library, number of subprojects implemented, office equipment, housing, and miscellaneous support furnished

VLP PHASE II ACTIVITIES	FIRST YEAR	SECOND YEAR	THIRD YEAR	FOURTH YEAR	FIFTH YEAR
Administration and Core Support					
Arrival of U. S. technical staff					
Establish core support system					
Construct ORD livestock centers					
Make livestock centers operational					
Briefings for VLP personnel & Livestock Service					
Reports of VLP activities					
Livestock producers committee meetings					
Annual livestock fair					
Team meetings					
Collect information, other livestock projects					
Press releases	As appropriate, from time to time				
Professional backstopping	As needed				

Budget	Voltaic Funds (CFA)	U. S. Funds ($)
Salaries and Wages:		
U. S. Chief of Party (30 mm)	-	300,000
Voltaic Project Director (60 mm)	9,600,000 CFA	
Administrative Assistant (60 mm)	-	30,000*
Bi-lingual Secretaries		
U. S. (Tech. Team)	-	35,000*
Voltaic	-	55,000*
Secretaries in Service Centers (3)	-	54,000*
Other Office Help (12)	-	100,000*
Drivers & Mechanics	-	161,000*
Professional Support (U.S. Based)		
Project Director (30 mm)		100,000
Professional Backstopping (50 mm)		150,000
Secretary/Bookkeeping (30 mm)		60,000
Office Expenses		25,000
Other Technical Support such as Extension Agents & Field Assistants		173,750*
Incentive Awards, Voltaic Functionnaires, Not Automatic	-	32,000*
TDY Technical Support (12 mm)	-	120,000
(undefined)		
Range Manager		
Parisitologist		
	9,600,000 CFA	$1,395,750

*Local Cost Item

Operations:	Voltaic Funds (CFA)	U. S. Funds ($)
Travel & per diem		
Air travel to review Range management/nat'l res./ livestock projects in other African countries	-	$ 10,000*
Administrative per diem 79 mm @ $27/day	-	64,000*
U. S. Language Training 5 full-time experts + 10 part-time experts	-	100,000
Vehicle Maintenance Fuel, parts, repairs	-	1,144,268-1/2*
Office Supplies & Maintenance	-	
Paper supplies		20,000*
Postage, Telex, telegram		2,000*
Xerox supplies & repairs		6,000*
Livestock Fairs (4)	-	12,000*
Professional Staff Housing Support in 3 ORD's, contingency fund to assist with rent, repairs, water 12 units		96,000*
		$1,454,268

*Local Cost Item

Capital:	Voltaic Funds (CFA)	U. S. Funds ($)
Vehicles		
2 504 type touring cars plus 2 replacements	-	$ 60,000
3 1-ton 4 x 4 pickups heavy duty (no replacements) ball hitches	-	60,000
9 1-ton economic type 2 x 4 pickups plus 6 replacements (heavy duty) ball hitches		225,000
4 3-ton 2 x 4 trucks heavy duty (no replacements) ball hitches		120,000
1 5-8 ton heavy duty 2 x 4 truck		40,000
18 100-cc trail bikes plus 18 replacements		36,000*
Special Vehicles		
6 motorized drilling rigs to place on 1-ton pickup (4-6" hole) with spare bits		120,000
3 compressors, trailer units, two-wheel (towed by 1 ton pickup) ball hitches		36,000
3 portable arc welders, 2-wheel trailer unit (ball hitch)		15,000
6 1000-liter (250 gallon) water tanks, 2-wheel heavy duty trailer	-	12,000
		$724,000

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Electric Generators		
3 40 KUA electric generators diesel, 220/380 volts 50 Hz	-	$ 50,000
3 25 KUA electric generators diesel, 220/380 volts 50 Hz	-	35,000
3 1.5 KUA electric generators portable, gasoline powered 220 volts 50 Hz	-	12,000
	-	$ 97,000
Office Equipment		
Furniture, office	-	53,000
Copy machines	-	18,000
Calculators	-	4,500
Typewriters	-	26,500*
Photo equipment	-	6,000
	-	$108,000
Infrastructure (Buildings)		
3 project site service centers in each ORD	-	180,000*
3 center warehouses, generator housing, water development, & vehicle park	-	180,000*
1 project headquarters in Ouagadougou	-	80,000*
1 project headquarters warehouse Vehicle park	-	40,000*

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Fencing of 3 service centers (1600 m2)		25,150
Housing for 3 women extension agents & 12 encadreurs @ $1500	-	22,500*
Miscellaneous Items		
6 1000-liter fuel tanks	-	10,000
	-	$ 537,650
	-	$1,466,650
	9,600,000 CFA	$4,316,668

*Local Cost Item

3.5.2 Natural Resources Sub-project (NR)

Objectives:

1. To conserve natural resources through land use planning and plan implementation.
2. To conserve soil resources (control erosion, maintain fertility).
3. To optimize productivity of grazing land in project sites without degradation.
4. To develop acceptable systems of controlled grazing for Upper Volta.
5. To balance land use and land capability in project sites.
6. To develop sanitary, permanent domestic water supplies.
7. To develop sanitary livestock water supplies without harmful impact on grazing resources or future water supply.
8. To plant village wood lots which will meet wood needs on continuing basis (balance production and consumption).
9. To involve villagers in activities to meet their own needs (for energy).
10. To utilize land not presently suitable for other purposes.
11. To lessen the burden for people in search of wood.
12. To provide browsing for animals during stress periods.

Justification:

1. Livestock producers live in an environment with poor soil quality, and soil that is lacking in organic matter.
2. Rainfall is sparse and variable in time and space.
3. Soil moisture retention is lacking.
4. Soil shows extensive degradation from human and animal use and abuse.
5. Natural resource/human population ratio is becoming continually smaller due to degradation of the environment and increasing human and animal numbers.
6. Animal stocking rates exceed in most cases the carrying capacities of the grazing resources, especially during the latter part of the dry season and early rainy season. Degradation of vegetation leads to accelerated runoff,

increased erosion and deterioration of soil structure, low infiltration of rain water, and less recharge to ground water.

7. Increased erosion leads to more rapid sedimentation of reservoirs, thus loss of reservoir storage capacity.
8. Cropping of fragile marginal soils is not discouraged.
9. Distance in trailing animals from range forage to water sources is excessive.
10. There is a lack of community control over grazing land and lack of effective range management procedures and enforcement.
11. Random trekking of animals through area tramples vegetation; trails are not well defined.
12. Forage production on gravel-lateritic soils is not feasible or of low value.
13. Water resources are limited.
14. Both animal and human diseases are maintained at high levels, partly by the unsanitary and ephemeral water supplies, and supply points and the joint use of them by humans and livestock.
15. No water quality analyses are made routinely.
16. Infiltration, groundwater recharge, and surface water flow all have been affected adversely by land degradation factors and, in turn, affect land degradation.
17. There is inadequate correlation of water resources and water resources development (for animals) with vegetative resources. A high demand for permanent or improved wells still exists although provision of water for livestock is not the limiting factor at many sites.
18. Rate of water use may exceed recharge and accelerate depletion.
19. A natural resources survey needs to be made at other VLP sites to include surface and groundwater resources.
20. Wood is being consumed at twice the regrowth rate.
21. Loss of trees contributes to overall problem of soil degradation and erosion.

22. People have to spend increasing amounts of time in search of wood.
23. Crop residues used as fuel are unavailable for animal feed.
24. Loss of tree cover in most instances means a loss of forage for sheep, goats, and cattle.
25. Loss of tree cover increases runoff and decreased water infiltration to groundwater layers (aquifers).
26. Full advantage has not been taken of opportunities to provide browsing resources in combination with wood production.

Procedure:

1. Inventory village sites to determine and map appropriate land use/soil types as follows:
   Human areas
   Cultivated areas
   Range areas
   Woodlot areas
   Non-use areas
   Watershed drainage areas.
2. Demonstrate value of managed land uses.
3. Encourage appropriate land uses in village sites (3).
4. Establish well-defined lines between various use areas, e.g., between Range Areas and Cultivated Areas.
5. Attempt to create similar land zoning in adjacent areas.
6. Coordinate sub-project activities with village livestock producers' committees, range management subcommittees, traditional and administrative authorities.
7. Implement accepted sub-project activities using local human resources.
8. Make a complete natural resource inventory for Ougarou/ Namoungou site: quantify forage production, seasonal water availability, crop production area, crops, woodlot production, wood consumption, human density, animal density (domestic & wild), basic soil types and depths.

9. Establish a herbarium with mounted samples of representative species.

10. Develop range management demonstration plots (50 ha) as follows:

	Demonstration Plots		
Factor	1	2	3
Use	Uncontrolled	Controlled	None
Stocking rate	Local standard	Based on resources inventory	0
Seasonal use	Year-round	Based on plant productivity availability	0
Supplemental feeding	None	As required	0

Factors to be measured or evaluated:

Range condition

Cattle weight & condition*

Offtake (meat, milk, other)*

Labor input*

Supplemental feed*

*See animal production sub-project (AP/-1) description for additional details.

11. Develop pilot projects (600-1000 há); including rest and rotation grazing system, burning experiments where appropriate, and forest forage planting/protection. The pilot areas will include (as needed): (1) fire breaks, (2) water sources, (3) rest rotation area, (4) physical protection devices

12. Create site management areas (village-group <u>Sylvo Pastoral</u> zones). The communities involved (Tafogo, Gnanguedin, Ougarou, and Namoungou) will have control over the management of a known surface of grazing land and the natural resources within. Develop a flexible range management system for each site.

13. Survey water resources (ground and surface) in six major VLP sites.
14. Provide assistance in constructing permanent, sanitary domestic wells in six VLP sites.
15. Determine potential for developing surface water supplies for livestock; catalog these locations.
16. Construct surface water catchments with sanitary livestock watering facilities in each major VLP site/or provide alternative water source.
17. Conduct routine water quality survey in each major VLP site every six months; and samples analyzed at Ouagadougou hospital.
18. Investigate possibility of using low maintenance hand pumps for village wells such as was done in the Ghana/CIDA, Upper Region Water Development Project. Also investigate the use of windmills for pumping water.
19. Discuss wood production problem with representatives of six selected villages and get approval to proceed. Selection criteria include: history of village cooperation, available space, reliable dry season water supply, proximity to school, likelihood of outside interference (poaching).
20. Discuss problem and proposed solution with Waters and Forests Service; enlist their cooperation if possible, let them carry out as much of the activity as possible.
21. Determine with Waters and Forests Service wood needs of villages, appropriate trees, growth rates, number of trees to be planted initially and annually thereafter, space required, means of protection. Select for planting some trees with value as browsing resource during stress periods.
22. Select appropriate sites, determine with villagers means of watering and protecting young trees.
23. Organize villagers and children to participate in program initially and ultimately to manage it.
24. Plant, water and protect trees.

25. Replant as necessary to replace dead trees.

26. Cut trees for use and replant in continuing cycle starting at end of first year, recognizing that first cutting will be immature.

Personnel required:

Professional: range manager (U. S. & Voltaic), agricultural engineer (short term--water resources) forester (U. S. & Voltaic) social scientist

Technicians: well driller (possibly a Peace Corps volunteer) local laborers

Support: Livestock producers' committees and sub-committees, women's committees, children, Waters and Forests Service, Agriculture Service, traditional and governmental authorities, water analysis laboratory (Ouagadougou hospital)

Location(s): three village sites where site management schemes will be attempted, selected locations in all sites.

Evaluation criteria:

Soil erosion rates, head cutting in key drainage/management areas, use of established roads and trails (rather than newly created ones), quality of stored surface water, quantity of silt in surface water reservoirs and catchments, acceptance of resource management area boundary lines by land users, boundary lines marked, vegetation density, reduction of land clearing in drainage ways, range management committees organized and meetings held, forage plant condition.

Number of resource inventories completed, exclosures/inclosures installed, demonstrations implemented, pilot projects started, site management areas defined and created.

Number of wells constructed, number of surface water catchments constructed, reduced incidence of polluted water, soil erosion rate (limit degradation to immediate surface area of water development). Number of trees planted (hectares planted), survival rate, annual re-planting rate, rate of cutting, percent of needs supplied, number of participants and hours in planting and caring for trees.

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
Natural Resources (NR)															
Inventory & map land-use types	---														
Demonstrate in Ougarou & Namoungou				---			---			---			---		
Establish land use boundaries		---	--		---			--	--		---			---	
Coordinate/plan all NR activities	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

VLP PHASE II ACTIVITIES	FIRST YEAR	SECOND YEAR	THIRD YEAR	FOURTH YEAR	FIFTH YEAR
Range Management					
Resource inventory					
Ougarou/Namoungou					
Demonstration plots					
Ougarou/Namoungou					
Management of demonstration plots					
Tafogo & Gnanguedin					
Ougarou/Namougou					
Pilot areas					
Tafogo & Gnanguedin					
Ougarou/Namougou					
Village site management					
Tafogo & Gnanguedin					
Ougarou/Namougou					
Implement continual vegetation					
Measure in demonstration plots, pilot RM areas and community range management sites on site RM tours for livestock producers					

VLP PHASE II ACTIVITIES	FIRST YEAR	SECOND YEAR	THIRD YEAR	FOURTH YEAR	FIFTH YEAR
Water Resources Development					
Survey Ougarou/Namougou					
Domestic wells					
Water catchment survey					
Construct water or maintain existing water catchments/ wells					
Tafogo and Gnanguedin					
Ougarou/Namoungou					
Quality surveys/water level measure					

VLP PHASE II ACTIVITIES	FIRST YEAR	SECOND YEAR	THIRD YEAR	FOURTH YEAR	FIFTH YEAR
Village Wood Lots					
Define plantation sites/goals					
Tafogo	--				
Gnanguedin		--			
Ougarou/Namougou		--			
Establish nursery & protection					
Tafogo	--				
Gnanguedin, Ougarou/Namougou		--			
Protect plantation sites		--			
Plant seedlings		--	--	--	--
Forage harvest		--	--	--	--
Tree harvest					--

Budget	Voltaic Funds (CFA)	U. S. Funds ($)
Salaries and Wages		
Technical		
1 - Senior Range Manager (U.S.) (60 mm)	-	$ 600,000
2 - Range Manager (Voltaic) (120 mm)	15,723,480 CFA	-
1 - Forestry Engineer (Voltaic) (24 mm)	3,816,840 CFA	-
2 - Range Manager Trainee (120 mm)	-	22,000*
3 - Range Management Field Aid (180 mm)	-	33,000*
3 - Forestry Agent	9,721,080 CFA	-
Agricultural Engineer (12 mm) TDY - U. S.	-	120,000
Labor		
Range Management (132 mm) (132 mm x $55 = $7,260)	-	7,260*
Water Resource Development		
3-Skilled (180 mm x $150 = $27,000)	-	27,000*
3-Well contractors or PCUs (180 mm x $225 = $40,500)		40,500*
2700 mm labor x $100 for well and surface ponds	-	270,000*
Forestry/Forage Development		
1125 mm labor x $55 field labor	-	61,875*
9-Nursery Labor (540 mm) (540 mm x $100)	-	54,000*
	29,261,400 CFA	$1,235,635

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Operations		
Travel and per diem		
international travel 8 x $7,000	-	$ 56,000*
per diem 240 mm x 12 day/mo. x $27	-	122,472*
Camping equipment cots, sleeping bags, tents	-	6,000
Hand tools, measuring devices seeding/planting tools, seeds, sacks (plastic)	-	48,600
Earth moving equipment rental (120 hours)	-	75,000*
Water sample analysis	-	2,000*
Changing fence/repairs	-	15,000*
Training equipment		5,000
Aerial photos		1,000*
Airplane rental (30 hours)		4,500*
	-	$336,572

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Capital		
Establish Herbarium with mounted specimen (Contract with CVRS or University of Ouagadougou--2 year contract)	-	$ 50,000*
Herbarium ënvelopes (1000)		5,000
Microscopes with lights (2)		1,500
Fencing materials (39 km x 3500 = 136,500)		136,500
Boundary markers (200 km) (could be rows of trees)		20,000
Fencing spare material (10% of total)		14,000*
Supplies for well construction: cement, rod, tripods (3)	-	60,000*
Supplies for water catchment construction	-	60,000*
Supplies for livestock water points, troughs, windmills and equipment, hand pumps and equipment plus spares, and retention devices	-	195,000
Portable vegetation cages	-	5,000*
	-	$ 547,000
	29,261,400 CFA	$2,119,207

*Local Cost Items

3.5.3 Human Resources and Social Services Sub-project (HR/SS)

Objectives:

1. To improve capability of Livestock Service personnel to provide services to village livestock producers.
2. To increase capability of village livestock producers (adult, young, women) to deal with problems facing them.
3. To increase effectiveness of project activities in attaining overall objectives through improved understanding of human/natural resources/livestock production interactions.
4. To improve health of villagers through control of infectious diseases and parasites.
5. To improve nutrition of villagers, particularly infants, young children, and pregnant women.
6. To provide data on "quality of life" factors.
7. To assist national education personnel in adding livestock and natural resources matters to curricula of rural and public primary schools serving the project sites.
8. To seek other ways to lessen the drudgery and improve the quality of life of villagers.
9. To provide financial services (credit/savings) to livestock producers.
10. To improve access of villagers to markets and government services.

Justification:

1. There is a need to train specialists in fields where the current cadre is inadequate or non-existent.
2. There is a need to expand the in-country capacity to train young people in the resources management field.
3. Currently the National Livestock Service does not employ personnel with a background in social science/community organization despite the community level orientation of many of its services.

4. The present organization of the National Livestock Service is overly centralized with most men, materials, and services concentrated in Ouagadougou.
5. Livestock owners, both men and women, respond to organizational efforts that they see as advantageous to them.
6. Women have often been overlooked in livestock related development activities.
7. More information is needed concerning the roles played by women in Sudanian Zone livestock production systems.
8. Detailed socioeconomic information concerning the behavior of livestock producers and their families over time is needed to adapt and implement production, credit, and marketing interventions.
9. There has been a lack of sufficient number of female extension workers or women's committees to discuss problems and solutions with women.
10. Continuous monitoring and subsequent amendment of livestock services provided have not been important aspects of existing programs.
11. Many field Livestock Service employees have received no formal updating of their training and little exposure to new ideas and information since the beginning of their careers, sometimes 25 or more years prior.
12. Decentralization of the Livestock Service requires the expansion and integration of the roles and coverage of the rural representatives (chefs de poste, encadreurs).
13. Voltaic students receiving foreign scholarships often acquire little or no direct first-hand experience in dealing with the rural problems of their own country.
14. Students returning from foreign universities often enter directly into administrative positions with insufficient "on the ground" experience.
15. Technical introductions in livestock development projects often are poorly designed and/or inappropriately directed and exceed the local cultural capacity to absorb them.

16. Livestock producers and their families, particularly women, have a low "quality of life."
17. There are many human diseases and parasites, an often suboptimal diet and high mortality for humans.
18. Nutrition is inadequate and medical facilities are lacking.
19. There is little education on sanitation.
20. Human food resources are now barely adequate.
21. There is a lack of involvement of groups of local people who see their interests as vitally connected with project goals.
22. Baseline data on quality of life factors is needed for future evaluation of development projects.
23. With no credit and savings institutions, farmers' and herders' most viable investments are animals. This contributes to the excess of animals over carrying capacity in many areas.
24. Access by villagers to markets and government services is difficult, and during the rainy season, often impossible.

Procedure:

1. Train a Voltaic social scientist for social science/community development work with the Livestock Service by having him/her work directly with the VLP team social scientist.
2. Hold annual training session at central field location for all project encadreurs, that at the outset of Phase II being the most comprehensive. Periodic regional meetings will also be held in each of the three ORD's. The following topics will be emphasized: social animation, community development, animal health, diagnostic techniques, maintenance and use of veterinary equipment, administrative skills and requirements, esprit de corps and group problem solving, ecologic principles and treatments. Subsequent workshops will follow similar topical lines based on problems perceived during the year.

3. *Provide continuous on-site training of encadreurs to* accomplish project goals.
4. Determine optimal number of livestock agents (veterinary nurses) that can be assembled for retraining sessions. Organize and hold appropriate number of training sessions to achieve desired improvements in the rural livestock service network, emphasizing geographic areas in which the VLP is operating.
5. Bring in appropriate ORD based Livestock Service personnel to establish rapport and administrative hierarchical procedures that will insure the efficient functioning of the regional livestock centers.
6. Provide substantive training of Livestock agents including the following topics: animal health, disease and parasite control, diagnostic techniques, care and use of veterinary medicines and equipment, rural sociology and community development, introduction to ecologic principles and range management, administration. Use the existing facilities and staff of the National Veterinary School to the extent possible.
7. Hold workshops in the regional centers involving their staff, encadreurs and livestock agents. Follow initial intensive stages in a central field location after the regional centers become operational. Focus on regional specific organizational and substantive problems.
8. Train local livestock producers primarily through demonstration of and participation in VLP activities, such as poultry projects, range management trials, and demonstration plots. Continue to work through key figures in the traditional and VLP livestock producer's committee structure. Details of activities are elaborated in other sub-projects. Carry on a continuous two-sided dialogue between livestock producers and VLP personnel.
9. Use a supplemental audiovisual program to raise the awareness of local livestock producers concerning visible

indications of veterinary problems and treatments, ecologic problems and treatments, and other relevant subjects. Design these presentations to be at least as much motivational as substantive in their aim, including such topics as results (pictoral documentation) of the livestock fairs.

10. Provide scholarships for Voltaic students to study in the United States or other countries in fields of specialization whose curricula are not well developed in Voltaic institutions, e.g., natural resource management, arid lands livestock production, and feed storage engineering. Organize summer work/study programs for scholarship recipients to give them both project and local ecologic zone experience.
11. Provide opportunities for University of Ouagadougou students to do field research in Upper Volta as part of their degree program in coordination with VLP activities, and with supervision by a faculty member.
12. Establish three women extension agents based in the three ORD's to assist in organization and education of women.
13. Have women extension agents perform similar functions to those of the ORD's but concentrate on livestock related activities. Make them largely responsible for the organization and functioning of women's subcommittees and have them do such things as organize and encourage women's participation in the livestock fairs. They will also assist in the implementation of accompanying research.
14. Maintain livestock producers' committees and subcommittees and organize meetings as needed to accomplish project goals--generally monthly.
15. Determine necessary information to critically assess technical proposals against the socioeconomic and cultural needs of the livestock producers.

16. Get existing and proposed rural health programs to provide services to the VLP villagers, including such things as routine vaccinations for infants and children.
17. Have extension agents for women work with women's committees to improve nutrition of infants, young children, and pregnant women. Use locally available foods.
18. Have extension agents for women try to increase the local production and consumption of poultry meat, eggs, and goat milk (in cooperation with animal production sub-project).
19. Provide information on sanitation and prevention of disease and parasite invasion to village residents; help them adopt necessary practices.
20. Survey selected families in each project site to establish baseline quality of life data.
21. Assist national education personnel in developing curriculum materials concerning livestock production and natural resources conservation; attempt to have use of these materials implemented in rural and public primary schools serving the project sites.
22. Provide villagers with information on more efficient stoves to decrease need for wood; use Peace Corps volunteers if possible.
23. Establish a local revolving credit and savings fund in those sites where livestock producers express a desire for them. Use ORD trained officers to introduce and organize the caisse populaires among interested groups. If the ORD has no one trained, then provide funding to the ORD to send one of its officers to the CEAO training program in Bobo Diolasso.
24. Attempt to get government services to go to the villages in the project area or make their services in some way more accessible by the villagers.

Personnel required:

Professional: Social scientist (U. S. & Voltaic), agricultural education specialist, marketing specialist, agricultural engineers, range manager, agricultural economist

Technicians: Livestock agents, ORD Caisse populaire officer project encadreurs, women extension agents

Support:

Cenetrain (Ouagadougou), University of Ouagadougou, Ecole National des Veterinaires Infermiero

National health service

National education service

Peace Corps volunteers, VITA

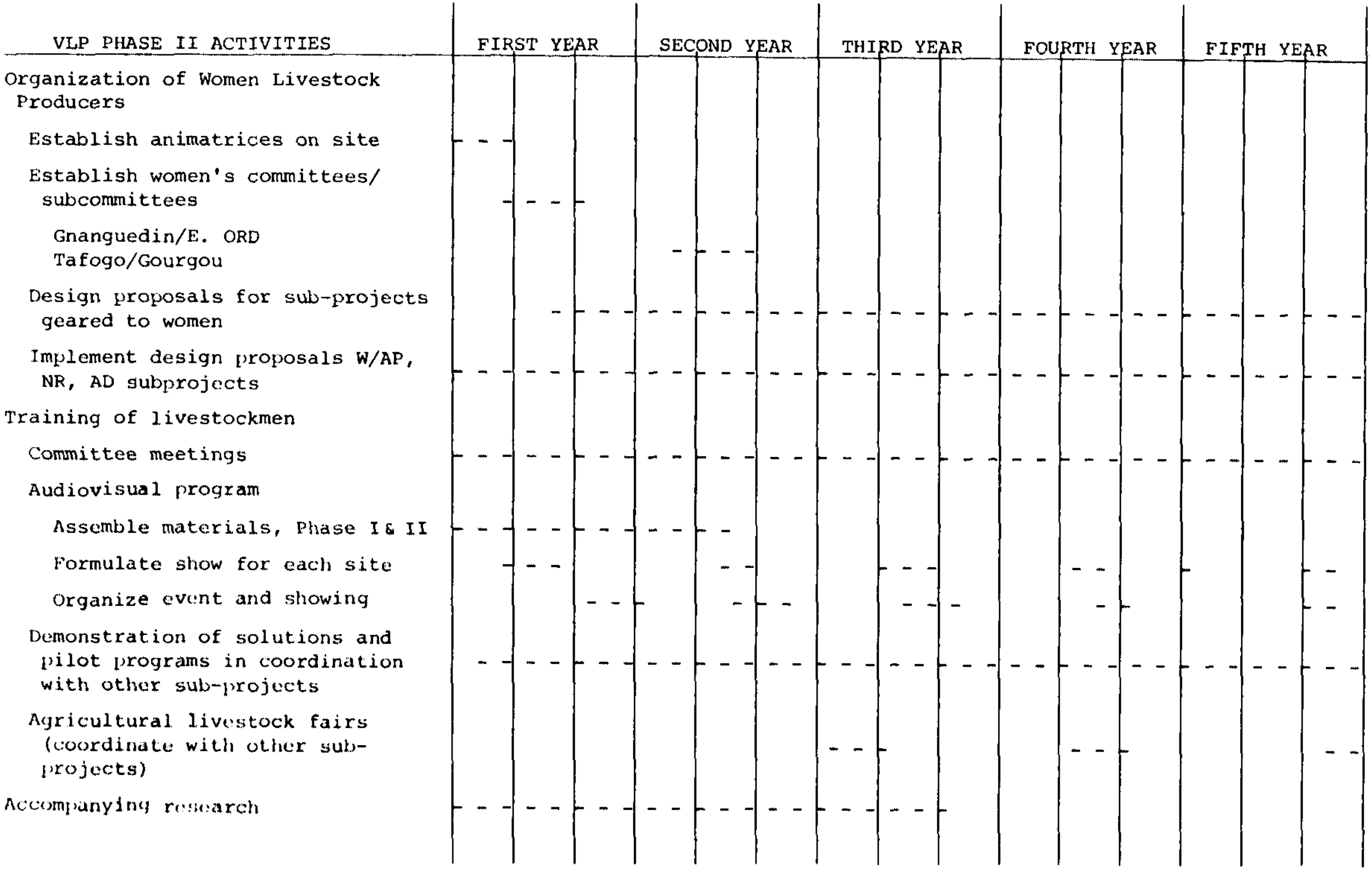
Women's committees

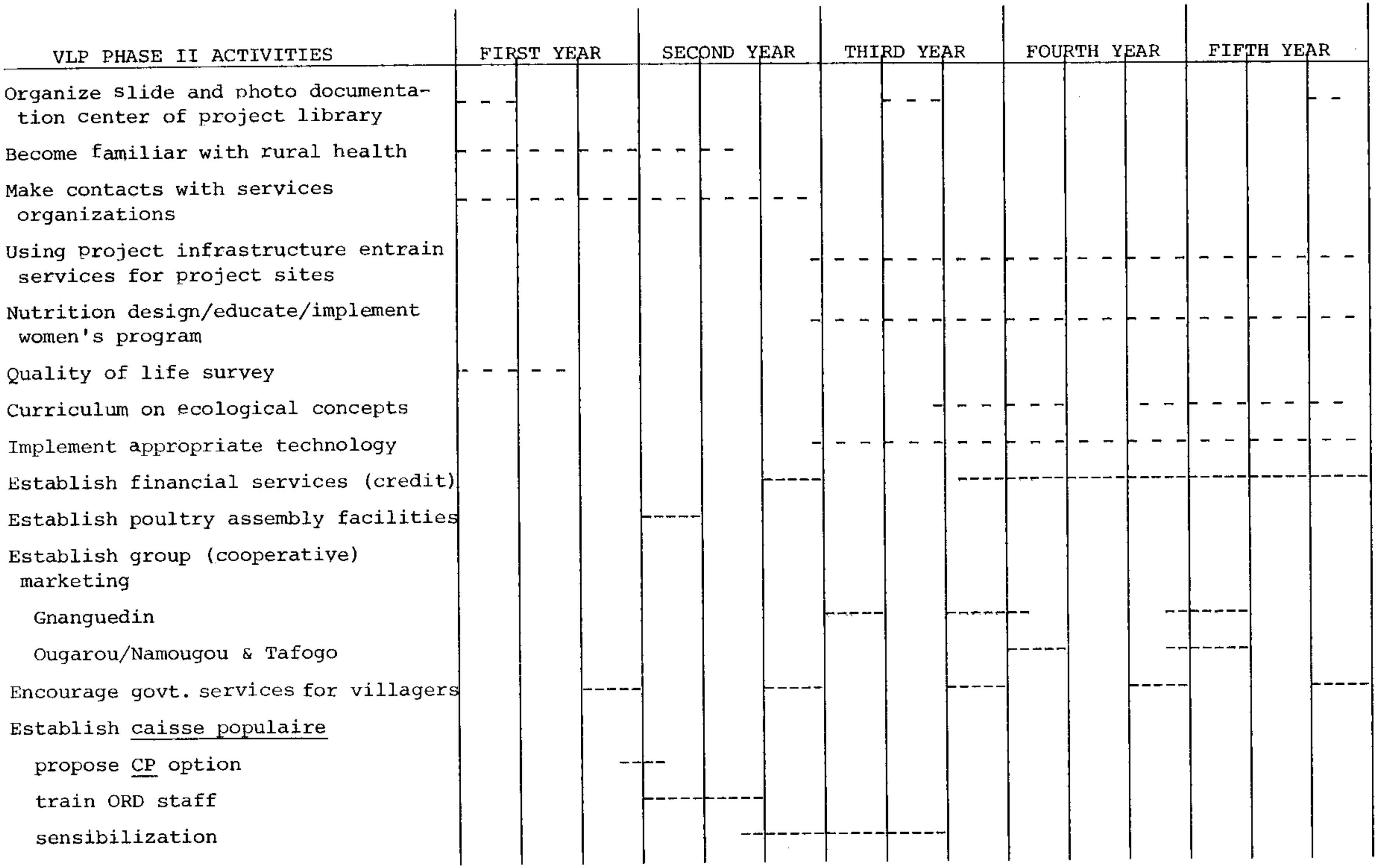
Location(s): All sites, regional livestock centers, Ougadougou

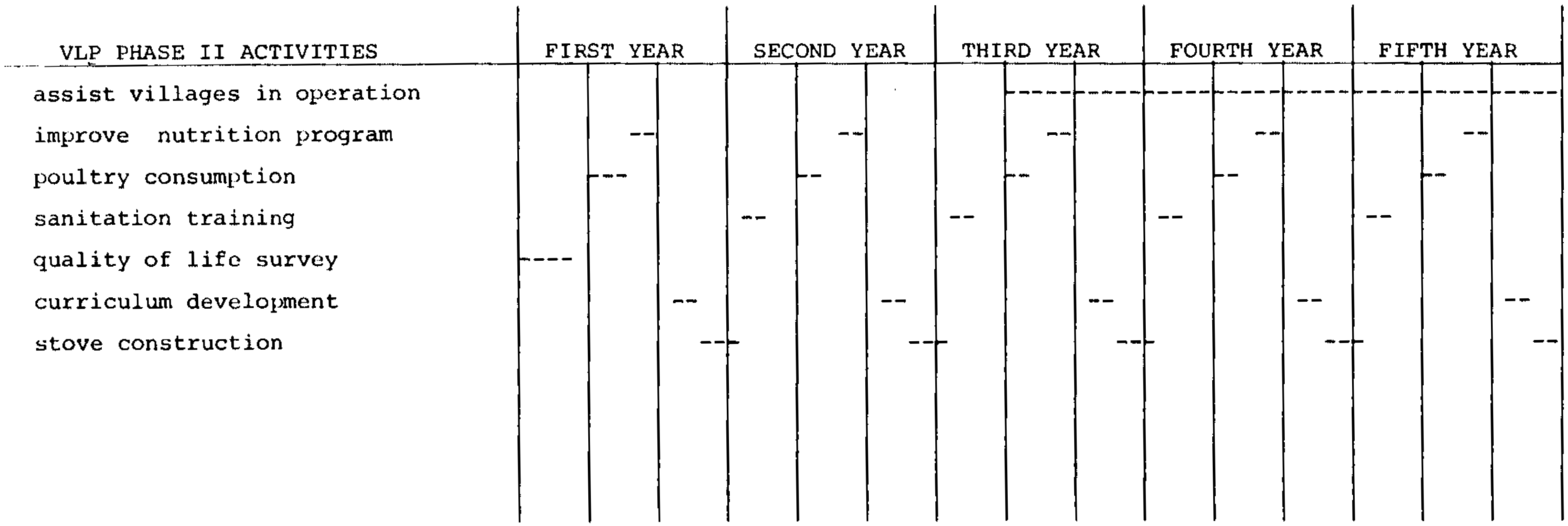
Evaluation criteria:

Increase of women's contribution to livestock production (increased ownership and sales income), trained Voltaics in areas previously needing foreign experts, expanded capacity of University of Ougadougou to train people in the area of natural resources management, field social scientist employed by the Livestock Service, training sessions on various topics for Livestock Service personnel and livestock producers, reports of accompanying research, presentations of audiovisual programs, women's committees in VLP sites, meetings of livestock producers committees and subcommittees, level of infectious diseases and parasites in humans, baseline data obtained, meetings held on various subjects, curricular materials prepared, evidence of use of materials improved access to credit, increased access to government services, existence of caisse populaire at some sites.

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
Human Resources and Social Services															
Training Livestock Service personnel															
Professional															
study/observation tours				--						--					
specialization		-			-			-			-			-	
Bachelors degree	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Masters degree				- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
short courses (various topics)		-			-			-			-			-	
Veterinary nurses															
diagnostic procedures			-												-
disease control						-									
parasite control									-						
livestock sanitation												-			
Extension agents															
extension methods	-												-		
resource management				-											
animal health							-								
animal production										-					


VLP PHASE II ACTIVITIES
FIRST YEAR
SECOND YEAR
THIRD YEAR
FOURTH YEAR
FIFTH YEAR
Organization of Women Livestock Producers
Establish animatrices on site
Establish women's committees/ subcommittees
Gnanguedin/E. ORD Tafogo/Gourgou
Design proposals for sub-projects geared to women
Implement design proposals W/AP, NR, AD subprojects
Training of livestockmen
Committee meetings
Audiovisual program
Assemble materials, Phase I & II
Formulate show for each site
Organize event and showing
Demonstration of solutions and pilot programs in coordination with other sub-projects
Agricultural livestock fairs (coordinate with other sub-projects)
Accompanying research


VLP PHASE II ACTIVITIES
FIRST YEAR
SECOND YEAR
THIRD YEAR
FOURTH YEAR
FIFTH YEAR
Organize slide and photo documentation center of project library
Become familiar with rural health
Make contacts with services organizations
Using project infrastructure entrain services for project sites
Nutrition design/educate/implement women's program
Quality of life survey
Curriculum on ecological concepts
Implement appropriate technology
Establish financial services (credit)
Establish poultry assembly facilities
Establish group (cooperative) marketing
Gnanguedin
Ougarou/Namougou & Tafogo
Encourage govt. services for villagers
Establish caisse populaire
propose CP option
train ORD staff
sensibilization


VLP PHASE II ACTIVITIES
FIRST YEAR
SECOND YEAR
THIRD YEAR
FOURTH YEAR
FIFTH YEAR
assist villages in operation
improve nutrition program
poultry consumption
sanitation training
quality of life survey
curriculum development
stove construction

Budget	Voltaic Funds (CFA)	U. S. Funds ($)
Salaries and Wages		
1 U. S. Social Scientist (60 mm)	-	$600,000
1 Social Scientist (60 mm)	9,542,100 CFA	-
1 Agricultural Education Specialist U. S. TDY (12 mm)	-	120,000
3 Interviewers (72 mm) $175/mo.	-	12,600*
	9,542,100 CFA	$732,600
Operations		
Travel and per diem		
120 mm x 12 days/mo x $27	-	38,880*
Technical conferences, tours and training	-	
Encadreurs		
705 man/days x $10		7,050*
Transport 15 men x $20 x 5 conferences		1,500*
Veterinary Nurses		
420 man/days x $12.50		5,250*
Transport 30 men x $20 x 4 conferences		2,400*
Administrative conferences (included in operations AD-1, under Admin. per diem)	-	P.M.
Transport of caisse populaire agents into field. 3 Agents x 24 trips x $15	-	1,080*
Instructors travel & per diem		
Per Diem $27 x 45 days x 5 men	-	4,050*
Travel $50 x 9 trips x 5 men	-	2,250*
Instructional fees, guest instructors University and CURS (10 people) 10 x 45 days x $25	-	11,250*
Conference & instructional material	-	4,000*
Copying and typing	-	1,000*
Survey materials, paper	-	1,000*
Data processing		150,000*

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Voluntary Services Accommodations allowance for PCUs or VITA 3 x 24 mm x $100		$ 7,200*
Film and processing		1,000
	-	$ 237,910
Capital		
Cabinet, dustproof for storing 35-mm slides, with built-in light table, lockable	-	1,500
Scholarships		
Local, 3 agent caisse populaire (3 months)	-	7,500*
U. S. or third country		
3 - 5 yr. x $13,600/yr.		204,000
2 - 3 yr. x $13,600/yr.		81,600
Home-based student research projects	-	25,000*
ULP, revolving credit fund	-	75,000*
	-	$ 394,600
	9,542,100 CFA	$1,365,110

*Local Cost Item

3.5.4 Animal Health Sub-project (AH)

Objectives:

1. To control levels of major diseases in cattle, small ruminants, and poultry.
2. To control level of parasites in cattle and small ruminants.
3. To reduce transmission of diseases carried by animals to humans.

Justification:

1. High mortality rates for animals. One hundred fifty-seven livestock owners reported losses in 1978--456 head of cattle, 671 sheep and 555 goats.
2. High morbidity and mortality rates among livestock result in inefficient use of labor and resources, and lead to a shortage of animals for milk production, slaughter, sacrifices and sales.
3. Infected animals transmit or serve as the reservoir for several important human diseases. High infection rates in livestock contribute to high prevalence of human morbidity and mortality.
4. The high incidence and prevalence of disease and internal and external parasites in domestic animals cause high morbidity and mortality (particularly among young animals), leading to decreased productivity and economic loss to producers and the GOUV.
5. Large populations of many animal parasites and infectious disease agents are not controlled effectively by the current program.
6. Milk and other products from diseased animals are consumed by humans with high likelihood of disease transmission.
7. The haphazard nature of the current disease and parasite control program may actually help to build up resistance to control agents in populations of disease causing organisms. The current program of vaccinations is spread very thinly and the understanding of consequences of problems and

preventive measures by livestock producers is inadequate, so that there is no regular schedule of vaccinations for regions of the country or for an individual's herd. No vaccinations are mandated.

8. There is little detailed knowledge of extent and seasonality of incidence of specific diseases and parasites as there are few field veterinarians and consequently few field studies of disease. Tabulation of stockowners own diagnosis of disease shows trypanosomiasis, blackleg and pasteurellosis to be the most common diseases of cattle. For small ruminants the most common are trypanosomiasis, rinderpest of small ruminants, and pasteurellosis. Stockowners' perceptions are the starting point for education about programs of disease control based on veterinary field surveys and laboratory work.
9. There is inadequate training in diagnostic procedures and control measures. Veterinary nurses and extension specialists are infrequently given opportunities for upgrading their training.
10. There is a high rate of injury to animals and humans during vaccination without corrals, therefore corrals are necessary.
11. Present methods and drugs used may in many cases be inappropriate. Drugs are not always selected for low cost.
12. Livestock owners do not clearly understand the purpose of the program. One vaccination was thought to be as good as another, and pills and injections were thought to be for the same purpose.
13. Water supply points and calf rearing pens are unsanitary and contribute to reinfection of animals.
14. The present program does not have enough logistical support. Transportation, vaccines and drugs, refrigerators and other storage facilities at sites, syringes and other equipment are lacking.
15. Traditional transhumance makes it difficult to provide veterinary service on a preconceived schedule.

16. Unrestricted transnational movement of animals allows reinfection and means that carriers of diseases and parasites are nearly always present.
17. Small ruminants are an important component of the livestock sector, but have been neglected in many animal health programs.

Procedure:

1. Implement animal health programs in the three ORD livestock centers with veterinary nurse, pharmacy, and supplies.
2. Develop a logistics support system for the animal health programs.
3. Install vaccination corrals at three locations.
4. Conduct an animal disease and parasite survey in six project sites.
5. Plan and implement a systematic animal health campaign for major diseases and parasites. Select most appropriate, low cost treatments.
6. Cooperate with Human Resources and Social Services subproject in providing training for Livestock Service personnel and livestock producers including women; train local "scouts" as a defense against major disease outbreaks (epidemics).
7. Include procedures for serving needs of herds in transhumance.
8. Construct improved, sanitary pens for calf rearing.
9. Cooperate with Natural Resources subproject in establishing sanitary watering points.
10. Install dipping vats for small ruminants at six locations.
11. Obtain three sets of spray equipment for hand dressing of cattle; adapt vaccination corrals for hand spraying.
12. Cooperate with central diagnostic laboratory, particularly in parasite control.

Personnel required:

Professional: Veterinarian (U. S. & Voltaic), agricultural engineer (short-term construction)

Technicians: Veterinary nurses, field assistants
local labor

Support: Diagnostic laboratory (Ouagadougou)

Location(s): All project sites, transhumance routes

Evaluation criteria: Level of parasites in livestock of all classes, level of various diseases in livestock of all classes, death losses, level of animal transmitted diseases in humans, number of vaccination corrals built, number of veterinary posts served, number of animals treated, number of dipping vats constructed

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS
Animal Health															
Include animal health centers and diagnostic labs in Fada, Kaya, Tenkodogo	O	M													
Develop logistic support animal health center personnel (3 ORD's)	O	M													
Install vaccination parks (one in each ORD)	JF			JF			JF			JF					
Install dipping vats--small ruminants (six sites)	JF			JF			JF			JF					
Obtain portable cattle spray equipment															
Training programs--cooperation with human resources															
Conduct animal disease & parasite survey (all sites)		A			A										
Plan & implement transhuman-sedentary animal health campaign (six sites)															
Experiment & construct sanitary calf pens (10 each site)				JF			JF			JF			JF		

Budget	Voltaic Funds (CFA)	U. S. Funds ($)
Salaries and Wages		
1 U. S. Veterinarian (60 mm)	-	$600,000
1 Voltaic Veterinarian (60 mm)	9,542,100 CFA	-
3 Livestock Assistants (180 mm)	11,957,760 CFA	-
6 Veterinary Nurses (360 mm)	19,442,160 CFA	-
3 Field Assistants (180 mm)	-	33,000*
Laborers (3 x 60 mm x $55)	-	9,900*
Skilled Laborer (3 x 60 mm x $150)	-	27,000*
	40,942,020 CFA	$669,900
Operations		
Veterinary supplies; apparatuses, equipment expendable	-	20,000
Medicines, drugs, vaccines, (revolving fund)	-	40,000
Insecticides	-	20,000
Kerosene $\frac{(31,200 \text{ liters} \times 183 \text{ CFA/l})}{230 \text{ CFA/\$}}$		24,824*
Refrigerator spare parts/maintenance		5,000*
	-	$109,824
Capital		
Construction materials		
Dipping vats	-	20,000*
Vaccination parks	-	10,000*
Calf pens	-	10,000*
Spray races	-	35,000*

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Diagnostic survey equipment	-	20,000
Spray equipment	-	10,000
6 Kerosene refrigerators plus 6 spares (sites)	-	7,200*
3 Large kerosene refrigerators plus 3 spares (centers)	-	6,000*
3 Electric ice boxes freezers 220/380 50 HZ	-	5,000
	-	$123,200
	40,942,020 CFA	$902,924

*Local Cost Items

3.5.5 Animal Production Sub-project (AP)

Objectives:

1. To provide opportunities for village livestock producers in processing (for storage, for sale) livestock products/ by-products.
2. To increase economic opportunity for young men in livestock production.
3. To improve marketing of livestock and livestock products/ by-products.
4. To increase the efficiency of cattle production in project sites.
5. To bring use of grazing lands by cattle into balance with their long term productive capability.
6. To determine the characteristics of the marketing system for sheep and goats.
7. To increase efficiency of small ruminant production.
8. To reduce the competition of small ruminants and cattle for the same vegetative resources.
9. To implement appropriate community-type poultry projects in villages in each of the six sites.
10. To improve the diet of the villagers by increasing the consumption of poultry meat and eggs.
11. To increase the income level of both men and women.

Justification:

1. Economic opportunity is limited, particularly for women and young men.
2. No cheese is produced locally.
3. Seasonal food shortages occur frequently.
4. Little is known about how to affect economic decisions such as when to sell an animal or how local market economic activity links to the larger national economy, at least in the East Central and North Central ORD's.
5. There is no quantitative information on seriousness of the weight loss problem or effects of "solutions" because animals are not weighed.

6. Large numbers of grazing and browsing animals are required to meet income and subsistence needs resulting in depletion and/or degradation of vegetative resources.
7. The milk production system is important to present producers and consumers, and has a real economic benefit for Fulani women. Sufficient numbers of low efficiency cows must be held to insure the supply of milk.
8. The concept of individual ownership of animals is deeply engrained and not likely to change.
9. There is no available land or labor to produce forage. The agricultural system is labor intensive and there is little time for forage production during the rainy season. Human food resources are now barely adequate and so it would be unwise to use agricultural land for forage instead of human food crops.
10. Forage production on gravel-lateric soils is not feasible.
11. Crop residues are not large and are also used for fuel and construction.
12. Some fodder storage practices are inefficient, e.g., ground nut plants are allowed to dry in the sun losing much of their nutrient value.
13. Animals are presently used as a bank account, insurance against times of poor crop production. Thus it is more important for livestock producers to keep larger numbers of inefficient animals than to sell off when they are at their peak value. No adequate alternative credit or savings mechanisms now exist that would permit increased offtake and bank accounts in cash instead of stock. Livestock producers of our survey indicate a preference for having greater numbers of animals and selling only for grain purchases, ceremonies, or gifts.
14. Market conditions change rapidly and greatly both seasonally and annually.
15. Sheep and goats may be more efficient producers of meat, milk and other products, but they have been neglected in

most livestock programs. They eat a wider variety of forage, produce more protein per unit of forage consumed, and are more drought tolerant.

16. The goat milk production system is important to present producers and consumers. Sufficient numbers of low efficiency goats must be held to insure the supply of milk.
17. Very little is known concerning the potential market for poultry.
18. Poultry marketing systems and commercialization outside of local markets are not extensively developed.
19. There are no marketing data on poultry.
20. Poultry represents a potential for increased economic activity for women as well as men.
21. Poultry can provide high quality, inexpensive protein on the local level.
22. Poultry raising is minimally harmful to the environment.
23. Poultry around the household are excellent scavengers.
24. Poultry production rates highly as a short-term farm enterprise, easy and inexpensive to undertake.

Procedure:

1. Investigate opportunities for processing livestock products and by-products at village level.
2. Survey relevant processing activities and methodologies currently in use that may be applicable in other countries.
3. If suitable processing opportunities are found, attempt to develop them.
4. Create group livestock marketing system option for Gnanguedin and possibly Ougarou/Namoungou and Tafogo.
5. Develop a demonstration project and/or pilot project in cooperation with the range management subproject at two sites.
   5.1 Purchase cattle or get volunteer herd (guaranteed no risk to owner); mark or tag them.
   5.2 Provide adequate health services to all test cattle.
   5.3 Construct separate corrals (two groups) and arrange for nearby, dependable, sanitary water supply.

5.4 Cut feed and store as hay or silage for supplemental feeding, use grasses, failed grain plants, or early harvested stalks. (See Range Management Subproject (NR/RM-1) description for additional details.)

5.5 eigh selected cattle at regular intervals, chart and analyze.

6. Test methods of improved storage of crop by-products for dry season feeding.
7. Determine feasibility of wet season grass cutting and storage for improved dry season nutrition.
8. Include cattle extension and service activities at the Livestock Center in each of three ORD's (see details sub-project AD-1).
9. Develop a demonstration of the establishment of edible woody plants for animal feed in each village site of the three ORD's (coordinate with natural resources subproject).
10. Conduct a cattle market survey
11. Work with livestock producers' committees to select older or cull cattle for consignment to feedlot operations at Banfora or other high crop producing area on a trial basis. Guarantee profitability to owners while investigating economic aspects.
12. Carry out a year-long survey, in each of three ORD's, of the marketing practices of livestock producers who sell sheep and goats. Include the following:

    Age, sex, weight, and breed sold
    Reasons for selling
    Location and method of sales
    Prices for sales (seasonal)

13. Use control flocks of 50 small ruminants (multiple owners) in each site to tabulate number of producing females, producing males, castrates over two years of age (determine near exact age), and ratio of breeding males to females.

14. Assist small ruminant producers in determining a more efficient flock composition by eliminating non-producers and crippled animals and by setting the ratio of males to females above two years of age at an appropriate level.
15. Initiate a periodic small ruminant weighing program in one site of each ORD using cooperator's flocks totaling at least 100. This will cover four three-month intervals to determine seasonal weight losses and gains of the entire flock.
16. Cooperate with Natural Resources sub-project in bringing vegetative resource consumption into balance with production of availability.
17. Include small ruminant supply and serve activities at livestock centers in each of the three ORD's.
18. Determine the economic role of small ruminants and how their production interacts with cattle production.
19. Determine the effect of goat milking (for humans) on goat kids.
20. Seek to remove barriers to use of goat milk.
21. Determine the potential market for live poultry and eggs away from the villages.
22. Study ways to increase consumption of poultry meat and eggs among the villagers; repeat study later to determine changes.
23. Explore possibilities to develop local feed and feed supplements such as slaughter wastes, and chaff of grains. Explore ways of making poultry competitive, as scavengers, with the large numbers of buzzards.
24. Identify family interests in poultry raising through livestock producer's sub-committees.
25. Select sites and build poultry housing facilities with local village labor.
26. Make arrangements with poultry center in Ouagadougou for baby chicks, starter feeds, brooding and feeding equipment, vaccines and medicines.

27. Prepare a program of poultry vaccination with the field assistants and provide them with sufficient refrigeration facilities for storage of vaccines.
28. Coordinate village poultry vaccination program.
29. Include poultry extension and service activities at the livestock center in each of the three ORD's.
30. Develop a suitable system of assembly at the livestock centers for village raised poultry, weighing and transporting them to distant markets.
31. Determine economic aspects of poultry production.
32. Explore possibilities of providing credit for poultry projects.

Personnel required:

Professional: Agricultural economics (short term), animal scientist (U. S. & Voltaic), agricultural engineer (short-term feed storage, construction, processions), social scientist, forester, marketing specialist

Technicians: Field assistants, women extension agents

Support: VITA

Location(s): Ougadougou, major trading centers, all VLP sites

Evaluation criteria: Surveys conducted, reports written, processing activities initiated, marketing studies completed, groups marketing options implemented animal weight records, demonstration projects established, storage reports, quantity of stored feed, livestock centers established (with cattle-related programs), experiments with edible woody plants established, market survey report, number of cattle involved in feedlot system, report of economic aspects of feedlot system. Marketing reports on small ruminants, average weight of small ruminants sold (particularly increases), percentage increase of numbers within each flock that are reproducers, amount of herbs, forages, etc. established that are acceptable to small ruminants. Report on poultry marketing, survey reports on poultry and egg consumption, poultry marketing facilities added, number of poultry projects implemented, number and weight of chickens passing through assembly point, quantity of chickens and eggs consumed by villagers.

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
Animal Production	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS
Survey relevant processing activities and methodologies currently in use in other countries which will be applicable	—	—		—	—	(does not need to be done on site after initial site visit)									
Investigate opportunities for processing livestock products at village level	J	M				JJ			JJ	O D					
Create a group livestock marketing system and possibly Ougarou, Namoungou and Tafogo		FM			FM			FM	- -	- -	- -	- -	- -	- -	- -
If suitable opportunities are found, develop them							—	— -	- -		— -	- -		— -	- -
Cattle Production															
Include Cattle Production Extension Center (3 ORD's)	O	M													
Training programs--cooperation with human resources		—	—	—	—	—	—	—	—	—	—	—	—	—	—
Weigh selected cattle periodically--seasonal gains & losses		—	—	—	—	—	—	—	—	—					
Establish edible woody plant nurseries (6 sites)		M	A		M	A		M	A		M	A			
Establish demonstrations edible woody plants as livestock feed (6 sites)		M	J		M	J		M	J		M	J		M	J

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS
Test methods improving storage crop by-products dry season			S	J		S	J		S	J					
Demonstrate improved crop by-product storage (6 sites)						S	J		S	J		S	J		
Research feasibility wet season grasses for hay and silage						J		A	- -	- -	- -	- -	- -	- -	- -
Establish hay-silage making demonstrations (6 sites)									J		A	- -	- -	- -	- -
Establish custom feedlot cattle fattening project at Banfora feedlots for Ivory Coast sales															
Develop cattle project demonstration with range management specialist															
Small Ruminant Production															
Include Small Ruminant Extension enter (3 ORD's)															
Formalize year-long survey sheep marketing practices of at least thirty flocks (3 ORD's)															
Marketing assistance program for sheep producers through extension centers (6 sites)		FM..			FM..			FM..			FM..			FM..	
Survey selected flocks to determine flock composition (6 sites)		F M													

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS
Set-up periodic weighing programs at 3-month intervals to determine seasonal weight gains or losses															
Determine economic role of small ruminants and how their production interacts with cattle production		FM			FM			FM			FM				
Assist sheep producers in establishing more efficient flock composition															
Seek to remove barriers to the use of goats milk for food and determine the effects of goat milking (for human use) on the goat kids															
Poultry Production															
Identify family interests in poultry raising through livestock producers' subcommittees															
Study ways to increase consumption of poultry meat & eggs among villagers															
Explore possibilities to develop local feed & feed supplements															
Include a poultry extension service center in each of 3 ORD's															
Develop a suitable system of assembly for village poultry weighing & for transporting them to markets															

VLP PHASE II ACTIVITIES	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR		
	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS	ONDJ	FMAM	JJAS
Make arrangements with Centre Avicole for baby chicks, starter feed, equipment, vaccines & medicines															
Select sites and build housing facilities with local labor															
Prepare program of vaccinations with site <u>encadreurs</u>															
Coordinate village vaccination programs															
Explore possibilities of providing credit for poultry projects															

Budget	Voltaic Funds (CFA)	U. S. Funds ($)
Salaries and Wages		
Technical		
1 U. S. Animal Scientist (60 mm)	-	$ 600,000
1 U. S. TDY Agricultural Engineer (15 mm) Feed storage, construction, and processing	-	150,000
1 U. S. TDY Marketing Specialist (12 mm)	-	120,000
1 U. S. TDY Agricultural Economist (12 mm)	-	120,000
3 Voltaic Animal Scientist (Engineer Elevage) (180 mm)	23,585,220 CFA	-
1 Voltaic Agricultural Economist (60 mm)	9,542,100 CFA	-
1 Voltaic Agricultural Engineer (60 mm)	9,542,100 CFA	-
Laborers		
3 Skilled laborers (180 mm x $150 = $27,000)	-	27,000*
6 Labor (360 mm x $55 = $19,800)	-	19,800*
	42,669,420 CFA	$1,036,800
Operations		
Travel and per diem	-	30,000*
Supplies for implementation of demonstrations/pilot projects (ear tags, record books, handling equipment)	-	10,000
Supplies for service centers	-	10,000
Cattle for demonstration purposes	-	10,000*
Sheep/goats for demonstration purposes	-	3,000*

*Local Cost Item

	Voltaic Funds (CFA)	U. S. Funds ($)
Survey materials	-	1,000
Processing supplies (village technology)	-	5,000*
	-	$ 69,000
Capital		
Feed storage construction	-	10,000*
Assembly cages and shed for poultry marketing	-	6,000*
Platform scales/large cattle (3)	-	6,000
Platform scales/to 200 kg (3)	-	1,500
Portable poultry scales (6)	-	300
Portable sheep/hog scales (3)	-	1,500
Processing equipment (village technology)	-	10,000*
	-	$ 35,300
	42,669,420 CFA	$1,141,100

*Local Cost Item

3.6 PERSONNEL REQUIREMENTS SUMMARY

Personnel requirements, both U. S. and Voltaic, for the VLP Phase II are summarized by individual subproject activity in Table 3.2. Job descriptions follow for each U. S. specialist including those on short-term assignments. A schedule of short-term assignments is given in Figure 3.2. Job descriptions for some of the Voltaic counterparts are included to demonstrate the close, collaborative relationship that will be developed.

3.6.1 Job Description, Chief of Party (1/2 time)*

Receive administrative direction from and report regularly to U. S. project director.

Meet regularly with Voltaic project director to exchange information and plan project activities.

Provide on-the-job administrative training as appropriate.

Meet regularly with USAID project representative to exchange information.

Conduct regular and special team meetings.

Brief team members as necessary.

Supervise report preparation by team members, contribute to reports as appropriate on administrative and technical matters.

Request professional backstopping in U. S. as required.

Assist team members in conducting their regular and special duties.

Assist team members in planning, scheduling, and coordinating short-term staff assignments.

Obtain necessary clearances for short-term staff and assign responsibility for local logistics and program arrangements to appropriate team member.

Assist team members with personal (and family) needs.

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*Other 1/2 time in technical or social science. Replaced for COP time with specialist in same discipline on short-term assignment.

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Table 3.2 PERSONNEL SUMMARY

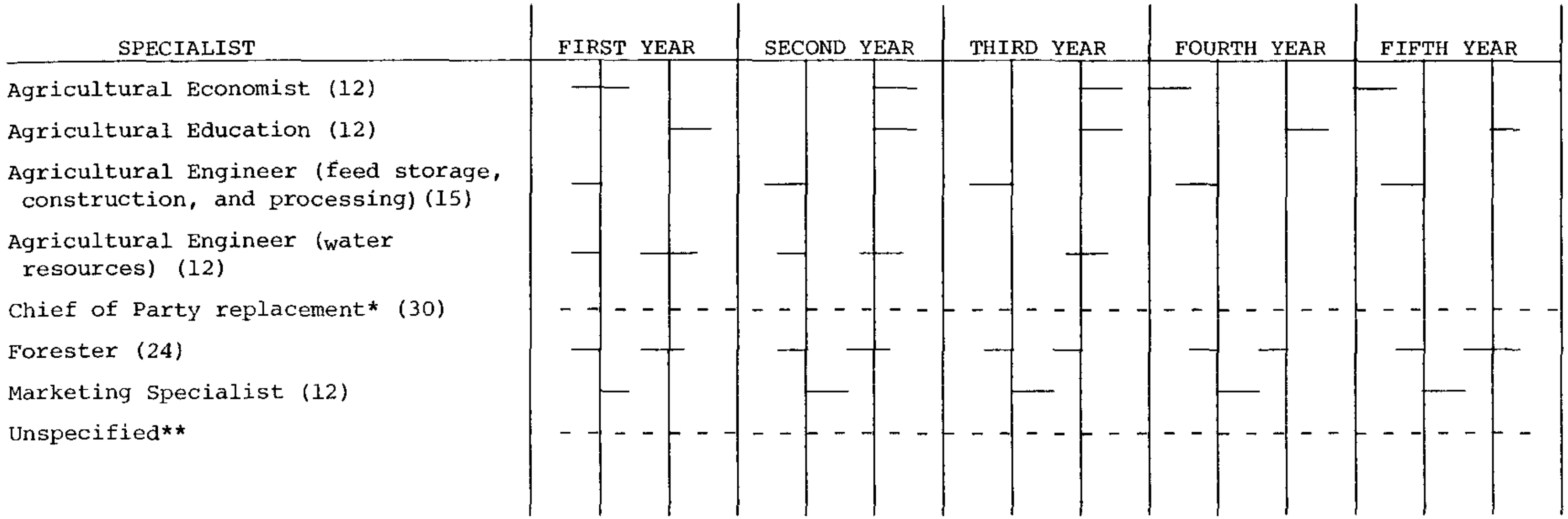
(Person-months for 5 years)

Upper Volta based

U. S.	Voltaic	AD	NR	HR/ SS	AH	AP	Total
	Project Director	40	5	5	5	5	60
Chief of Party		30					30
	Veterinarian	10		10	40		60
Veterinarian		10		10	40		60
	Animal Scientists (3)	30		30	30	90	180
Animal Scientist		10		10		40	60
	Range Managers (2)	20	80	20			120
Range Manager		10	40	10			60
	Social Scientist	10	5	35	5	5	60
Social Scientist		10	5	35	5	5	60
	Agricultural Economist			2		10	12
Agricultural Economist				2		10	12
Agric. Educ. Spec.				12			12
Agric. Engineer (SSP)				3		12	15
Agric. Engineer (WR)			10	2			12
	Forester		20	4			24
Forester			20	4			24
Marketing Specialist				2		10	12
Unspecified							12
	Administrative Asst.	60					60
	Veterinary Nurses				180		180
	Extension Agents	30	60	150	60	60	360
	Field Assistants	60	120	300	120	120	720
	Drivers/ Mechanics	480					480
	Secretary (bi-lingual)	120					120
	Local Labor						
Secretary (bi-lingual)		60					60

Table 3.2 --Continued

U. S.	Voltaic	AD	NR	HR/ SS	AH	AP	Total
U. S. based: Project Director							30
Professional (backstopping)							24
Secretary							30
Accountant							12
Sub-Total U. S.		130	75	90	45	77	513
Sub-Total Voltaic		860	290	554	410	280	2524
TOTAL		990	365	644	455	357	3037



*Chief of party replacement will be scheduled as required to assist in carrying out the activities of the chief of party's discipline.

**Discipline depends on need.

Figure 3.2 Short Term Staff Schedule

3.6.2 Job Description, Range Manager*

Coordinate activities of natural resource staff of project in all three sites.

Coordinate site data collection and interpretation, adjust natural resource management plans accordingly, and assist in proposing appropriate adjustments in project implementation.

Coordinate natural resource subproject with administration and Livestock Service.

Assist field staff in implementation of subproject in two major sites: Gnaguedin and Tafogo. Organize range management and other natural resource activities with Voltaic staff in Gnanguedin and Tafogo sites including: continuation of natural resources data collection, management of demonstration plots, implementation of pilot project areas and ultimately establishment of site grazing management areas, and the organization and marking of various land-use areas.

Assist agricultural engineer (short-term staff) in water resources development activities.

Provide on-the-job training for Voltaic counterparts.

Identify candidates for formal training in natural resources subjects.

Assist in preparation of training materi.ls and in conducting short courses for local support staff and livestock producers

Assist other project personnel in implementation of VLP activities where possible.

Prepare routine and special reports.

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*If COP, other half time supplied by range manager on short term assignments.

3.6.3 Job Description, Range Manager (Voltaic)

Coordinate natural resource sub-project implementation at Ougarou/Namoungou site.

Organize range management and other natural resource activities in Ougarou/Namoungou site at Fada N'Gourma including site natural resource inventory, demonstration plots, pilot management areas, and ultimately with the development and implementation of village site grazing reserve and in defining and marking the land-use areas.

Assist project personnel in implementation of other activities in site. Assist range manager (U. S.) in preparation of training materials and range management training.

3.6.4 Job description, Veterinarian*

Participate in regular and special team meetings.

Work with central diagnostic laboratory personnel to broaden diagnostic capability of laboratory.

Serve as link between central diagnostic laboratory and field animal health personnel.

Lead epidemiological investigations to determine extent and impact of various diseases and parasitism at six project sites.

Develop and implement disease prevention and parasite control programs including management practices.

Plan and develop field locations for veterinary facilities (i.e., animal health centers, corrals, dipping facilities).

Train field animal health personnel (veterinary nurses, and *encadreurs*) in diagnostic and disease prevention methodology.

Develop and supervise extension program in animal health directed at livestock owners.

Work in close collaboration with other professionals on the VLP team and with officials in the Livestock Service.

Prepare routine and special reports.

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*If COP, other 1/2 time replaced by veterinarian on short time assignments.

3.6.5 Job Description, Animal Scientist*

Participate in regular and special team meetings.

Keep detailed records of activities and prepare routine progress reports and trip reports.

Assist in planning for and implementing the annual livestock fairs. Prepare appropriate animal production displays and demonstrations for the fairs.

Assist in planning for ORD livestock centers and in implementing programs there. Attend and participate in livestock producers' committee meetings.

Cooperate with range management in implementing demonstration plots and pilot management areas. Activities include purchase of cattle, weighing and record keeping, supplemental feeding.

Cooperate with the natural resources experts and personnel in a scheme to balance animal forage consumption with existing rangelands productivity. This may also involve the selective removal of nonproductive livestock from the rangelands and placing them in a feedlot in another part of the country where by-products of certain farming enterprises are cheap and available for that purpose.

Assist in training Livestock Service personnel and livestock producers. Assist in selecting candidates for post-secondary education. Use University of Ouagadougou students as field assistants to give them on-the-job training.

Work with the veterinarians and the Livestock Service in planning and expediting a complete animal health program including external and internal parasite eradication which will serve as a country-wide model.

Assist short-term staff in investigating opportunities for processing livestock products and by-products at village level and in developing appropriate opportunities.

Experiment with and supervise demonstration of the more reliable methods of animal feed storage and preservation in cooperation with the agricultural engineering scientist.

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*If COP, other 1/2-time replaced by animal scientists on short-term assignments.

Establish a demonstration of edible woody plants in each VLP Phase II site.

Assist in making marketing surveys (cattle, small ruminants, poultry).

Work with livestock producers to improve efficiency of small ruminant production. Activities will include weighing of animals, herd composition determination and adjustment, supplemental feeding, effect of goat milking on goat kids.

Assist in determining the economic role of small ruminant production.

Assist in determining feasibility and interest in village poultry projects. Develop practical and innovative feed and feed supplement sources for farm poultry raising which will not substantially involve the uses of food grains otherwise needed for human consumption.

Assist and promote the establishment of farm family poultry enterprises for the purpose of augmenting the family diet with poultry meat and eggs to provide an additional source of farm family income. Work closely with the marketing specialist in identifying and developing marketing possibilities for poultry and poultry production.

Develop a system of assembly and transportation for marketing village-raised poultry.

Assist in developing curricular material for use in the rural and public primary schools.

Assist in establishment of local credit and savings system for livestock producers.

3.6.6 Job Description, Social Scientist*

Organize and conduct regular monthly meetings of livestock producers' committees at each site.

Organize additional committees, subcommittees as necessary.

*If COP, other 1/2-time replaced by social scientist on short-term assignments.

Continue to involve local residents in planning for and implementing project activities (in close cooperation with other team members).

Assist in investigation of relevant processing opportunities and in development of those found suitable.

Attend and participate in regular and special team meetings.

Keep detailed records of activities and prepare routine progress reports and trip reports.

Assist in planning for ORD livestock centers and in implementing programs there.

Make plans for and assist in training Livestock Service personnel and livestock producers. Topics will include importance and use of sanitary water supplies, use and maintenance of hand pumps, social animation, community development, animal health, diagnostic techniques, maintenance and use of veterinary equipment, administrative skills and requirements, maintaining esprit de corps, group problem solving, sociological principles and treatments, disease and parasite control, rural sociology, range management, veterinary problems and treatments. ecological problems and treatments, nutrition and infant feeding, efficient wood stoves, use of credit, and savings.

Assist in developing curricular material for use in the rural and public primary schools.

Assist in establishment of local credit and savings system for livestock producers that are socially appropriate.

Assist in planning for and implementing the livestock fairs. Organize social services to be provided at fairs.

Assist range manager in land-use planning and in implementing land-use plans.

Assist range manager and animal scientist in implementing demonstration plots and pilot management and site management areas.

Assist project personnel in implementing the village wood lot subproject.

Assume overall responsibility for human resources and social services, subproject.

Assist in selecting candidates for post-secondary school education.

Organize their program and train women extension agents.

Seek ways to increase local consumption of goat milk, poultry, and eggs; test results.

Arrange to get existing health and education services delivered to VLP sites.

Conduct survey to establish baseline quality of life data.

Explore the relationship between herding groups and their natural environment from a cultural perspective. Use this information to assist the range manager in achieving improved management of natural resources.

Carry out accompanying research focusing on clarifying the social, economic, and cultural characteristics of livestock producers' behaviors within the constraints imposed by the habitat and those imposed by the larger external social and economic systems. The research will be directed at understanding the unity and logic of the herders' adaptation to the socioeconomic and ecological conditions with which they are faced and will bring to light such factors as periods of labor availability, constraints of the marketing system, compensatory mechanisms in the absence of credit and savings institutions, importance of remittance money to the local economy and social structure, conditions prompting the sale or acquisition of animals, degree of economic and ecological integration of agriculture and livestock production and marketing, resistance of the villagers to new concepts and roles, villagers' perceptions of the environment and their capacity to affect changes within it, and other relevant topics.

Evaluate and amend ongoing programs and design new programs that best use the human potential to improve living conditions where they are most lacking and have a greater chance of long-term success.

Work in conjunction with other project personnel to establish an effective rural extension program.

Assist agricultural economist in the organization and interpretation of a microeconomic study monitoring economic behavior of selected households. Determine what impacts are resulting from project activities.

Assist with and, in many cases, direct the human organizational requirements necessary for the implementation of the project's technical interventions. Insure that such actions are both compatible with and appropriate to the communities involved.

3.6.7 Job Description, Voltaic Social Scientist

Coordinate all activities with the expatriate social scientist.

Organize and conduct regular monthly meetings of livestock producers' committees at each site.

Attend and participate in regular and special team meetings.

Keep detailed record of activities and prepare periodic reports.

Assist in the implementation of programs at the regional livestock centers.

Emphasize community development and social animation through training of livestock field agents and livestock producers. Topics will include importance and use of sanitary water supplies, use and maintenance of hand pumps, animal health, diagnostic techniques, maintaining esprit de corps, group problem solving, rural sociology, range management, ecological problems and treatments, use of credit, and savings.

Assist in the planning and implementation of livestock fairs. Help organize social services to be provided at livestock fairs.

Assist range managers in land-use planning and in the implementation of land-use plans.

Assist range manager and animal scientist in implementing demonstration plots and pilot management and site management areas.

Help organize human resources in implementing village woodlot subproject.

Help coordinate short-term staff activities and programs.

Help organize and train women administrators.

Determine obstacles to increased use of goat milk, poultry, and eggs.

3.6.8 Job Description, Short-Term Staff

Agriculatural Engineer (Water Resources)--12 mos.

Locate suitable sites for water catchments in consultation with range manager.

Plan and lay out water catchments including means of access control, e.g., fencing or tree belt, and staff gages.

Assist village residents in construction of water catchments.

Design and install animal watering facilities at each catchment.

Develop operation and maintenance procedures for the water catchments and associated watering facilities, including water level measurement, and train village residents in their use.

Establish ground water level measurement program and system of record keeping using village residents to the extent possible. Train them and supervisory personnel (Waters and Forest Service or Livestock Service).

Select appropriate village wells for improvement (lining and deepening, if necessary) in consultation with team members.

Select sites for new domestic wells in consultation with range manager.

Supervise construction of new wells and improvement of existing wells using village residents to the extent possible; emphasize sanitary protection.

Obtain and install hand pumps for domestic wells (consider Ghana Upper Region Water Development experience in selecting pumps).

Train village residents in operation and routine maintenance of pumps.

Prepare individual trip reports and overall water resources development report.

Agricultural Education Specialist--12 mos.

Assist COP in providing on-the-job training in project administration.

Assist project team in designing long-term training programs (probably for advanced degrees) to be carried out in another country.

Assist project team in designing and implementing short courses and in-service training for field assistants, extension agents, and para-professionals in such areas as range management--ecology, animal disease diagnosis, feed storage, sanitary water supply, planting and caring for wood lots, animal production, and animal disease control.

Assist social scientist in designing and implementing short courses and in-service training for field assistants and extension agents in such areas as social animation, community development, administrative skills and requirements, maintaining esprit de corps, and group problem solving.

Assist social scientist in designing and implementing short courses and workshop for livestock producers (through local livestock producers' committees) in such areas as ecology and natural resource utilization, personal health and sanitation, poultry production, small ruminant production, animal health, planting and caring for woodlots, dry season feeding, and use of credit and savings.

Determine what curriculum changes might be introduced into the rural schools attended by the livestock producers' children in order to better train them in the areas of agricultural production, livestock production, animal and human health, and other relevant fields.

Agricultural Engineer (structures, feed storage and processing)--15 mos.

Assist in investigation of opportunities for processing livestock products/by-products in villages.

Survey processing activities currently in use in other countries which may be applicable.

Develop suitable processing opportunities in villages. Enlist the cooperation of VITA, Peace Corps, and other agencies promoting appropriate technologies.

Design and prepare processing demonstrations for fairs.

Assess the problem of livestock feed storage and resources available.

Test methods of improved storage of crop by-products for animal feed.

Determine feasibility and methods of wet season grass cutting and storage as hay or silage for animal feed.

Design and prepare feed storage demonstrations for livestock fairs.

Prepare monthly activity report and appropriate technical reports.

Design and assist in constructing sanitary pens for calf rearing, dipping vats for small ruminants, and spray facilities for cattle.

Marketing Specialist--12 mos.

Assist in study of opportunities for marketing processed livestock products and by-products.

Prepare market survey (cattle).

Survey sheep and goat marketing practices.

Assist in determining economic role of small ruminants and interactions with cattle production.

Determine the potential market for poultry and eggs away from the villages.

Assist in determining the economic potential for consignment of older or cull cattle to feedlots.

Cooperate with social scientist and agricultural economist to determine marketing rationale of livestock producers under the current market structure.

Assist in the design of programs such as group marketing of cattle that improve the economic terms of trade for the livestock producer.

Agricultural Economist--12 mos.

Determine overall economic feasibility of consigning older or cull cattle to feedlots.

Assist in determination of feasibility of developing opportunities for processing livestock products and by-products.

Determine economic role of small ruminants and low their production interacts with cattle production.

Determine economic aspects of village poultry production.

Assist in the collection of baseline quality of life data.

Explore possibilities of providing credit for poultry projects.

Establish local revolving credit and savings funds (*caisse populaire*) in appropriate sites.

Determine the relative economic importance of livestock raising among families who derive part of their income from crop cultivation.

Assure that the subsistence strategies of livestock producers are adequately accounted for in the design and implementation of VLP marketing and credit interventions.

1/2 Time Replacement for COP in Area of Need/Discipline*

Assist chief of party in activities of greatest need--see details on appropriate job description.

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*Range manager, animal scientist, veterinarian, or social scientist depending on discipline of chief of party.

3.7 BUDGET SUMMARY

U. S. Contribution
$ - thousands

	AD	NR	HR/ SS	AH	AP	Total
Salaries and wages	1396	1236 775 +461	733	670	1037	5,072 (52%)
Operations	1454	337	238	110	69	2,208 (22%)
Capital	1467	547	395	123	35	2,567 (26%)
						9,847

Voltaic Contribution*

CFA Thousands

Project Director (60 mm)	9,542
Range Manager (120 mm)	15,723
Animal Scientist (180 mm)	23,585
Forester (24 mm)	3,817
Veterinary (60 mm)	9,542
Social Scientist (60 mm)	9,542
Extension Agents (360 mm)	23,916
Veterinary Nurses (180 mm)	9,721
Agricultural Economist (12 mm)	1,908
Agricultural Engineer (24 mm)	3,816
	111,112

*Limited here to direct salaries and wages only. In addition, the GOUV will contribute existing administrative support and infrastructure of the Livestock Service.

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5 APPENDICES

Chapter 5 is a collection of three sorts of materials: (1) sections on results and baseline information that were received too late to include in Chapter 2, (2) sections that support the main text by presenting methodologies used in data collection, and (3) sections providing additional details to support various parts of the main document.

The major headings of Chapter 5 are as follows:

5.1 Tafogo Site Wood Study
5.2 Study of Poultry Raising
5.3 Methodology for Social Science Research Used
5.4 Formation of Livestock Producers' Committees
5.5 Range Management Procedures and Forms Used
5.6 List of Reports Produced
5.7 Project Budget
5.8 Project Goal Documentation
5.9 Organizations, Agencies, Programs and Abbreviations
5.10 Glossary of Foreign Terms

5.1 TAFOGO SITE WOOD STUDY

As part of a general effort to become familiar with the northeastern portion of the Tafogo site and the adjacent region, a survey of the wood cutters and wood vendors residing in this area was undertaken between mid-March and the end of April of 1980.

Along a 15 km stretch of National Route 14 beginning 13 km north of Tougouri and continuing to 11 km south of Yalogo, the roadside is lined by a series of wood selling concessions (see Figure 5.1). Even to the casual observer there is an impressive amount of cut wood stacked along this section of road. What makes it impressive is the fact that the location is fully 200 km from the major terminal market for fire wood, Ouagadougou. An operation of this magnitude is obviously having an impact on the surrounding rangeland or sylvo-pastoral resources. For this reason it was evaluated by the VLP team.

The questionnaire (Section 5.1.5) represents part of an overall attempt to gauge the relevance of this area to the VLP and determine the potential relevance of the VLP for the area's residents. This attempt can be broken down into the following undertakings. It began with a tour of villages already actively represented in the Tafogo site village livestock producers' committee. Previous project efforts such as the wells program had been active in some of them. We met with committee representatives and ascertained that project installations were operating without problem. Representatives were informed that the purpose of our visit to the area was to determine the needs for tree planting to maintain forage and soil conservation capacities in the surrounding bush. We also surveyed by direct observation the extent to which farmland (in the form of <u>brousse</u> fields) and cart trails for wood hauling were encroaching into areas that had previously been used exclusively for grazing and hunting. In Yalogo the <u>agent forestier</u>, M. Ouedraogo André, was contacted, as was Peace Corps

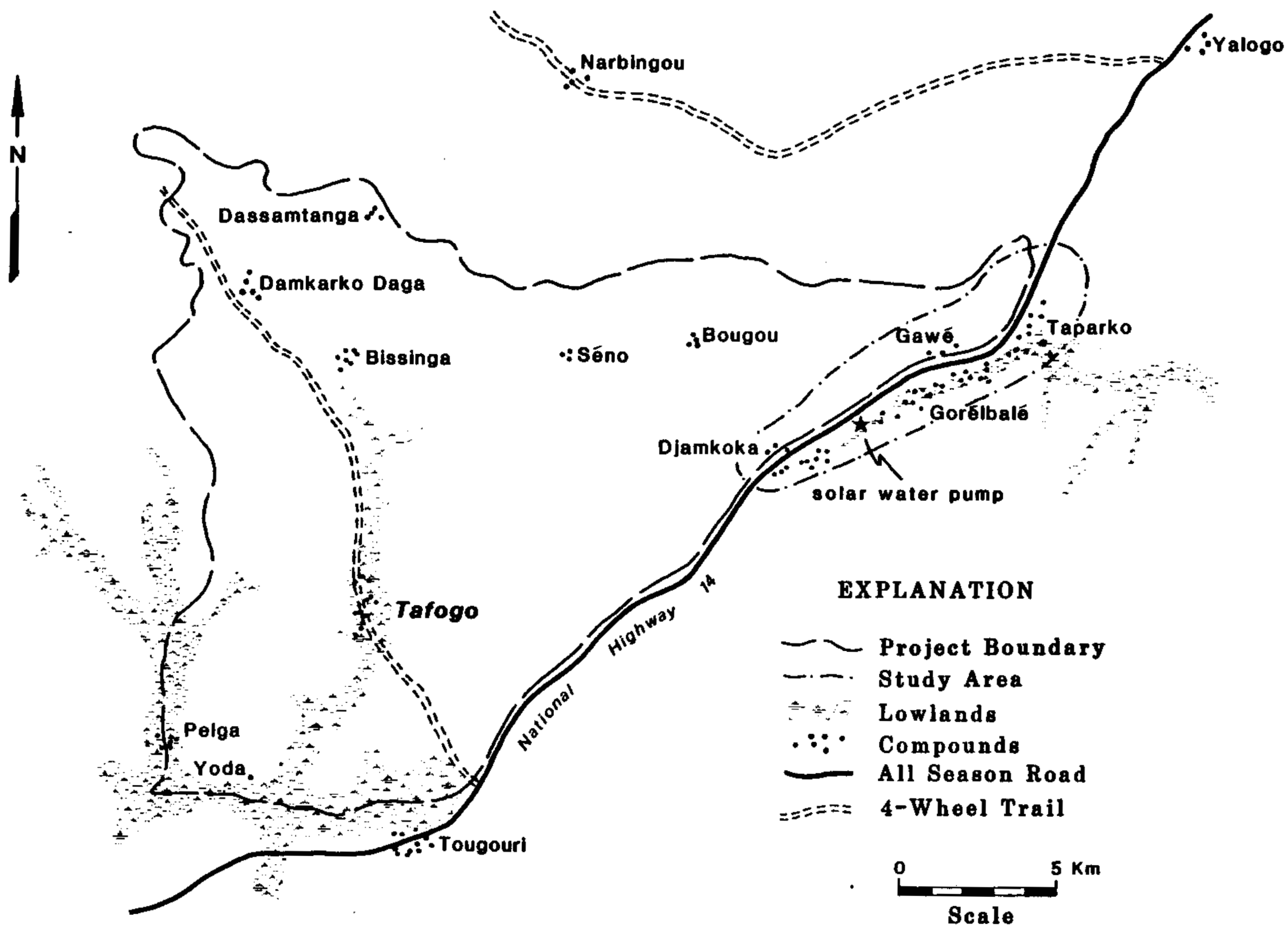

Figure 5.1 FIREWOOD STUDY AREA, TAFOGO SITE, VILLAGE LIVESTOCK PROJECT

volunteer Jack Odea. They together constitute the team of environmental management/forestry personnel in the entire Tougouri Arrondisement (now a sous-préfecture that includes Yalogo and the entire Tafogo site). There were several reasons for establishing this contact. Yalogo is the location of the nearest active tree nursery to the site and its capacity to produce seedlings for the VLP was unknown. Further, the number and species of seedlings already being produced would help determine the feasibility of undertaking a small demonstration planting during the spring 1980 season. The tree nursery is 4 ha and situated adjacent to the Yalogo dam. A canal leads from the dam to a water storage tank. The area is fenced and protected. There are 20 water taps distributed throughout. Its construction was originally financed by USAID and it has subsequently been operated by the German government, which has charge of the Forest Management and Reforestation activities for this area of the country. This rather highly developed facility is primarily servicing the existing industrial plantations located north and south of Yalogo along Highway 14. The Peace Corps Volunteer (PCV) is attempting to work with village level groups in villages just north of the present site boundary. He expressed interest in working with the VLP proposed sylvo-pastoral activities in the site. We determined that the Yalogo nursery could be used to supply seedlings to the project; however, because of distance factors, this would be preferable only until a second nursery is established near the Tougouri dam. A second Tougouri location would greatly expand the capacity for reforestation activities to serve a much larger population. This is highly desirable both from a range resource standpoint and in continuing to foster the integration of project installations and activities with the local residents. The damage to seedlings from transport would also be reduced. An existing nursery site already in Tafogo is also being considered for development. Both the Water and Forests representative and the PCV were informed of the planned survey of wood vendors and their knowledge of these activities was used in formulating the preliminary questionnaire. Later, M. André agreed to use his familiarity with the local villagers to assure them of the non-threatening nature of our visits. Two separate counts of the standing stock of wood were made. Finally, the questionnaire was pretested, revised, and implemented. (See Section 5.1.5)

5.1.1 Aims of the Study

This undertaking was applied and pragmetic in its aims. One goal of the project is to expand the activities undertaken in Phase I to surrounding environments. The area along the Tougouri-Yalogo Highway is partially within the site and partially outside the site boundaries. Therefore, any action taken affecting those within the site should be taken with regard to the overall community and not confined to those living on one side of the road or another. This road is regarded as an artificial boundary and represents one geographic direction of expansion of project assistance proposed by the technical team for the second phase of the VLP. Thus, in part, the wood vendor survey was designed to make an initial appraisal of the population occupying this boundary area with regard to such basic variables as ethnicity, principal economic activity, and relationship to traditional and administrative authorities.

A second related aim was to introduce the project to the farmer/herders in the area. It was described briefly at the outset of each interview. Given the uncertainty of future implementation of VLP programs, this was done in such a way as not to raise prematurely the hopes of the local populatin that they might become beneficiaries. At the same time, the potential for including them into Tafogo site subcommittees was preliminarily assessed. The interview also served to introduce the VLP encadreur to many of the local residents.

The substantive aim of the study was to supplement baseline data relating the activities of the local population to the capacity of the local environment to sustain these activities. It seems likely and justifiable in ecological terms that the activities slated for the Tafogo site will include an attempt to balance wood offtake (for household and economic as well as grazing purposes) with the rate of regeneration. Since informal observation over the course of the project had indicated that the commercial sales taking place along the road were increasing, a more precise examination of this activity was warranted. The study attempted to determine who was cutting and collecting the wood; for how long this activity had been taking place; whether the wood being collected was perceived as becoming increasingly scarce; what, if any, was the relationship between the wood vendors and the livestock producers using the area; and what is the approximate annual volume of wood being sold.

5.1.2 Characteristics of the Population

All vendors' bases of operation except one are adjacent to the owners' compounds and within a contiguous chain of four villages lining the highway. The principal of these villages, Taparko, is closest to Yalogo. To the south are Gawé, Gorélbalé, and Djamkoka. While the ethnic composition of these villages *per se* was not ascertained, there did seem to be a distinguishable ethnic differentiation among them. Unlike the predominant Mossi-Fulani cultural complex that occupies the major *bas-fond* in the site, the population of these villages is a mixture of several different ethnic groups. The indication is that this area lies in a zone of cultural and physical transition between the Mossi Plateau and the Sahel. The vendors themselves are confined to four ethnic groups: Mossi, Gourmantché, Fulani and Maransé. The presence of Gourmantché in the area is both surprising and significant from an organizational standpoint. This is quite far north and west for the Gourmantché. Their presence is probably due to the migration up the *bas-fond* from Kaolla and Liptougou. They are confined to the section of *bas-fond* closest to these towns and are in the villages of Taparko and, to a lesser extent, Gawé. The Mossi and Gourmantché account for over 75% of the sample, indicating that the wood selling is largely a supplementary income-generating activity for the sedentary agriculturalists. In fact, of the 27 vendors surveyed, 100% reported that they were also farmers.

All vendors also reported some degree of livestock raising. The table below shows the proportion of households involved in rearing each species of domestic animal. Three (11%) reported raising animals in all categories listed.

PORTION OF SAMPLE REARING ANIMALS

Animal	No. Raising Them (n = 27)	% of Total
Poultry	25	93
Sheep	14	52
Goats	18	67
Donkeys	4	15
Cattle	9	33

The predominance of livestock producers among the wood-selling concessions qualifies them as potential participants in project activities. The village least oriented to livestock production appeared to be Gawé. Gawé is between Taparko on the north and the Gorélbalé to the south (see Figure 5.1). The sample of 10 households indicated six (60%) Mossi and four (40%) Maranga. Although all households raised poultry, only one raised sheep, five raised goats, one raised donkeys, and none owned or raised cattle. Of the four villages, only Djemkoka is currently represented in the sitewide livestock producers' committee.

Beside farming and livestock rearing, wood selling was virtually the only economic activity reported except in Djemkoka where the three Mossi respondents are part of a weavers collective. One other respondent indicated that he was a seller of grass mats.

The total of 27 interviews did not include all of the wood-selling concessions but did sample all degrees and sizes of operations.

In all, a total of 45 different operations were counted. Sampling was done on the basis of whether a respondent was present at the compound. One attempt was made to contact those who were missed on the first round. Only two vendors refused to reply, and one of those later consented after being reassured by the village chief. In other cases, many vendors operated side by side and were present at the interview of their neighbors. These villagers were not interviewed because of the likelihood of introducing an unnecessary bias. Results are generalized to include the entire constellation of sellers along this stretch of road.

5.1.3 Description of the Wood-Selling Operation

The collection and sale of fire wood continues to become increasingly important as an issue of resource use in Upper Volta and a point upon which many resource development programs are based, yet little actual analysis of this activity and its importance within the rural community has taken place. This brief survey by no means fills the need for detailed information in this regard. One can envision harnessing the entrepreneurial spirit of the villagers and channeling it into small scale production (i.e., tree planting) and sale operations that are both economically more rewarding and ecologically more conservative. The existing mode of operation as it occurs in the Tafogo site is described below.

As mentioned, the wood is gathered and cut predominantly in the middle to later part of the dry season. The local people are above all farmers interested in producing sufficient grain to satisfy their subsistence needs. For this reason, wood gathering is delayed until after harvest, thrashing, storage and construction of granaries--early dry season agricultural activities. Sales are confined mainly to the dry season, because at the outset of the rainy season, all household labor available is again directed to agricultural enterprises.

5.1.3.1 Collection

The wood is collected in the bush surrounding the villages on both sides of the road. Only the north side is presently within the Tafogo site boundaries. Twenty-one respondents, or 78% of the sample, reported cutting more than one-half their wood supplies on the Tafogo side of the road. The wood being collected is not actually cut live. Some of the wood is dead wood lying about on the ground, and some is dead wood that is still standing. Once away from the habitation zones, one is struck by the quantity of dead wood; hence there is little reason to doubt the villagers when they reported collecting only dead wood. None felt there was a need to cut the wood one season and gather it the next. All wood in the standing stacks along the road appeared to be quite dry. Two farmers said that they collected wood cut previously by passing nomadic herders in feeding their animals. Most felt that wood cut by the herders was unsuitable either because it was too small or because it was thorny. All sellers attributed the abundance of dead and dry wood around the village to be a result of drought, lack of water or lack of rain. All suitably sized wood is collected, though some farmers reported a preference for Kanga and Kiperga. These species have not yet been identified. Once the wood is cut and collected, the farmer is faced with the problem of transporting it back to the roadside area near his compound.

5.1.3.2 Transport

Distances are somewhat difficult to interpret in kilometers from villagers' responses, but more important than distance travelled to and from the source of wood *per se* is the fact that each year the distance travelled to find wood is increasing. The commercialization of firewood in this area began in the 1974-75 dry season following the drought. Dead wood was to be found everywhere. The first household to begin operatins was a Mossi farmer in Gawé. He was followed the following year by several other Mossi and Maranga households in Gawé. After two years the activity had diffused to neighboring villages. The following table indicates the steady increase in the number of farmers engaging in the wood-selling business.

NUMBER OF YEARS IN WOOD-SELLING BUSINESS

Year	Number	%
1st	9	35
2nd	3	12
3rd	7	27
4th	6	23
5th	1	3

$\bar{x} = 2.5$

This greater exploitation of wood has meant that transport distances are becoming increasingly longer each year. Of 16 respondents who have been collecting wood for more than one year, all but one report less wood near the village than when the business was started. Even he reported, however, that he went farther and farther from the village to gather wood each year. This indicates the offtake is exceeding the natural production of dead wood. The result is a rural phenomenon similar to that observed around Ouagadougou: the evolution of concentric rings of increasing environmental disruption through the reduction in the existing vegetation cover. Whether or not this will place an upward ceiling on the scope of wood-selling activities is unclear. Already a few vendors have reported hiring carts to transport their wood to the roadside area. Average distance from gathering area to selling location is reported to be 3.5 km. Once transported to the selling area, the wood is trimmed and made into bundles that are secured with vines from the nearby bas-fonds. Transport is usually either in bundles carried on the head or in small bicycle loads, although carts are occasionally used. The cart trade is principally from merchants in Tafogo and Yalogo who come in search of firewood for these "urban" centers. Division of basic labor tasks is shown in the following table. Totals indicate many households in which more than one person contributes to a particular activity.

DIVISION OF LABOR IN THE PREPARATION OF FIREWOOD

Persons Responsible	Activity		
	Cut and Gather	Transport	Bundle and Stack
Head of Household	17	17	15
Wives of Head	4	5	4
Children of Head	3	6	4
Hired Labor	0	2	0

5.1.3.3 Sales and Marketing

Sales are made by anyone in the family, or if no one in the family is present upon the arrival of a potential buyer, then a friend or neighbor will handle the transaction. No one permanently tends the stacks, thus reducing the time commitment to the operation. In the town centers, particularly of Gorélbalé, there was usually someone around working with the wood. The concessions were adjacent to one another and the quantity of wood sold was greater than that in the more isolated concessions away from the centers. Although an economy of scale was operating and different vendors would help one another out with sales, there was no cooperative labor or profit sharing.

Who are the customers buying firewood fully 200 km from Ouagadougou and 100 km from Kaya? Surprisingly, most buyers were periodic customers. Some vendors had established a regular clientele, while others were not yet well-established with regular customers, and indicated little knowledge of who was buying the wood or for what market. Virtually all sales are made during the dry season to people on their way to Ouagadougou. Customers fall into three clearly distinguishable categories: passengers on taxi buses headed south, usually to Ouagadougou; military personnel traveling to and from Dori and the Sahel Departement; and regular truck traffic. The regular drivers are often material supply truckers (e.g., grain, animal feed, and soft drinks) who are trying to offset the costs of making a trip north and returning without a cargo. Smaller purchases are made by the chauffeurs to supply family and close associates' firewood needs. Many times the wood is bought for urban-based businessmen and government officials.

The wood is sold by the bundle or by the stack. Stacks are of 11 or 22 bundles. The 11th and 21st and 22nd bundles are included as gifts to those who purchase entire stacks. Total annual volume of sales is calculated below.

$$\frac{\text{(av. no. bundles sold)(av. sales/yr)(av. bundle wt.)(tot. no. sellers)}}{\text{average density of firewood}}$$

$$= \text{total number of m}^3 \text{ sold per year}$$

$$\frac{(20.36)(16.76)(9.87\text{ kg})(45)}{300\text{ kg/m}^3} = 505.2\text{ m}^3 \text{ (or 858.84 steres)}$$

Of this 505.2 m^3, approximately 75% was calculated to be extracted from Tafogo site area. This is about 380 m^3, which is almost four times the earlier estimate made by the project for the volume of this activity. It must also be borne in mind that an additional undetermined amount of wood is being removed for construction and cooking purposes by cart drivers for nearby Tougouri and Yalogo. Total income generated from the roadside sales is estimated to be:

$$\text{(av. no. bundles sold)(av. sales/yr)(price/bundle)(tot. no. sellers)}$$

$$= (20.36)(16.76)(50\text{ F CFA/bundle})(45) = 767{,}775\text{ F CFA}$$

This is a yield of 17,061 F CFA per family without amortizing the limited equipment used in carrying out this activity. This amount of income tends to substantiate respondents' claims that without the income from wood selling, they would not be able to purchase the necessary food to tide them over to the following year's harvest.

5.1.4 Conclusion

First, the information gathered tends to reinforce the VLP conclusion that concerning range resources, one of the most important activities that can be undertaken for this zone is to plant trees, especially forage trees. We are in the process of using what limited resources are available in Tafogo to plant certain forage species such as *Acacia albida* and *Prosopis* sp. supplied by the USAID Project Representative. Arrangements are being made through the *sous-préfet* in Tougouri and the *préposé* in Yalogo to have these seeds planted and raised on-site in Tafogo by the watchman of the rudimentary nursery mentioned earlier. It is unfortunate that the limited means of the VLP at this time do not permit the establishment of a full-scale, integrated agro-sylvo-pastoral program. This should be a priority in the future. If the social scientist's ground work for developing subcommittees for this purpose succeeds, then Taparko would make a likely center for a subcommittee based in the area studied above. It is farther from Tafogo and Damkarko Daga, the two existing principal centers, and is more independent in having a village chief who is responsible to the chief in Yalogo. Djamkoka already has a representative and Gawé seems to be less oriented to livestock production. Overall, the interest in wood could be channeled into reforestation programs if proper attention is given to social animation and community development. If expanded, the site could extend south of the road since the road itself is little more than an artificial boundary, and the people living around it could be unified by the transport opportunities it offers, as well as by the physical continuity of the *bas-fond* that the settlements follow.

5.1.5 Questionnaire

ENQUETE SUR LA VENTE DE BOIS -- SITE DE TAFOGO

Nom de l'Enqueteur:____________________ Date de l'Enquête:______

Nom du Vendeur de Bois:________________________________

1. Village (Encirclez)
   1. Taparko
   2. Gawé
   3. Gorélbalé
   4. Autre (Ecrivez) _______________

2. Ethnie (Encirclez)
   1. Mossi
   2. Peulh
   3. Bella
   4. Autre (Ecrivez) _________________

3. Combien de ménages est-ce-qu'il y a dans votre concession?______

4. Faites-vous de la culture? Oui_____ Non_____

5. Faites-vous de l'élevage? Oui_____ Non_____

   Si oui, quels animaux?
   _____ Volaille
   _____ Ovins
   _____ Caprins
   _____ Anes
   _____ Bovins

6. Pendant la saison sèche, qu'est-ce-que vous faites encore comme activité économique?
   _____ Vente de bois _______Autre (Ecrive)
   _____ Tisserand
   _____ Maçon

7. Dans la région du village, y-a-t-il beaucoup de bois mort et sec?
   Oui_____ Non_____
   Si oui, pourquoi pensez-vous qu'il y a beaucoup de bois mort dans la région du village? (Ecrivez)

8. Où est-ce-que vous ramassez le bois pour vendre? ______________

9. Devez-vous aller de plus en plus loin chaque année pour trouver du bois?
   Oui_____ Non_____

10. Depuis combien d'années vendez-vous du bois?__________________

11. Est-ce qu'il y a moins de bois près du village aujourd'hui que quand vous avez commencé à ramasser du bois?

Oui_____ Non_____

12. Quelles espèces de bois préférez-vous à vendre?

____

(Ecrivez) ________________________

_______N'importe laquel

13. Est-ce-que vous ramassez le bois déjà coupé par les éleveurs pour nourir leurs animaux?

Oui_____ Non_____

14. Comment est-ce-que vous transportez le bois de la brousse vers la route?

_____Charrette _____Tête

_____Anes _____Mobylette

_____Bicyclette _____Autre (Ecrivez)

15. Qui fait le transport?

_____Moi-même _____Manoeuvre

_____Les Enfants _____Tout le Monde

_____Ma (mes) Femme(s)

16. Quelle est la distance entre la route et le lieu où vous coupez le bois?

(Estimez la réponse en kilomètres)_______________

17. De quelle côté de la route coupez-vous la plupart du bois?

__________Tafogo __________l'autre coté

18a. Dans votre famille, qui coupe le bois? ______________

18b. Qui fait les fagots? ________________

19. Pendant quelle période (ou dans quels mois) coupez-vous le bois?

20. Est-ce-que vous coupez plus de bois au début ou à la fin de la saison sèc.

__________ Début

__________ Fin

__________ Même

21. Dans quelle période vendez-vous le bois?

__________ Toute l'année

__________ Saison sèche

__________ Saison de pluie

__________ Autre (Ecrivez)

22. Qui sont les acheteurs?

__________ Commerçants avec de gros camions

__________ Passagers d'occasions

__________ Les gens de Yalogo et Tougouri

__________ Gens de Kaya

__________ Gens de Ouagadougou

__________ Les Peulhs du village

__________ Chauffeurs de divers camions

__________ Autres (Ecrivez)

23. Les acheteurs, viennent-ils régulièrement ou par hasard?

Régulièrement__________ Par Hasard__________

24. Si vous vendez le bois pendant toute l'année, qui le vend pendant que vous travaillez au champs?

__________Personne __________Ma (mes) femme(s)

__________Mes enfants __________Manoeuvre

__________Les vieux __________Autres (Ecrivez)

25. Combien de fagots (en moyenne) vendez-vous à chaque acheteur?

_____1 _____4 _____7 _____10

_____2 _____5 _____8 _____11

_____3 _____6 _____9 _____Plus (Ecrive)

26. Combien de ventes faites-vous normalement par jour?__________

27. Quel est le prix d'un fagot?

28. Combien de fagots mettez-vous dans votre tas? __________

Pourquoi cette quantité?

29. Combien de fagots avez-vous vendu dans la semaine passé?__________

30. Quelle est la période la plus favorable pour le commerce de bois?

(ecrivez)

31. Combien de <u>tas</u> avez-vous vendu pendant le mois passé? __________

32. Dans une année, combine de tas vendez-vous? ___________

33. Est ce qu'il y a d'autres personnes dans votre concession qui s'occupent de vente de bois? ______________

Si qui, est-ce qu'ils travaillent indépendant de vous?

Avant de terminer l'enquette; regardez toutes les pages pour voir si vous avez posé toutes les questions. Est-ce-que toutes les responses sont claires? Si non reposez ces questions d'une autie manière.

Puis REMERCIEZ-LE pour sa cooperation.

5.2 STUDY OF POULTRY RAISING: BY OULA KOULIBALY

5.2.1 Interests in Problems with Poultry Raising

Throughout the villages of the sites and around the houses, hens, roosters, and guinea fowl are always seen. Their presence shows people's interest in poultry raising. They use poultry for many reasons:

To have social prestige.
To obtain a wife (part of the dowry).
To eat at home.
To give as gifts.
To supply food for feasts.
To make sacrifices.
To sell and have money to satisfy their current needs (taxes, purchase beer, clothing, things for school).
To barter for the products of the pharmacy.

But often their hens fall sick and die; are eaten by snakes, hawks, or wild animals; and have fleas or chiggers which make them thin. The causes of the lack of success in poultry raising are numerous:

1. Lack of chicken yards or hen houses.
2. Insufficient aeration of the hen house's, which are often dirty and disagreeable to the hens.
3. Overpopulation of birds.
4. In the same hen house, birds of different species and ages.
5. Total absence of litter.
6. Insufficient, unbalanced, and vitamin-deficient feed.
7. Absence of a health program--inadequate or no curative treatments.
8. Lack of hygiene, cleanliness, and sanitary care.
9. Lack of or insufficient cleaning and disinfection at the end of each lot and of non-occupied periods to break the life cycles of diseases and pests.
10. Absence of controls on poultry deaths, and on consumption and production.

If, however, one could eliminate sickness and error, one could reduce mortalities, thus saving hens. This would provide villagers more food and more money.

5.2.2 Improved Hen Houses

In most villages, birds live without houses day and night. This absence of hen houses exposes birds to bad weather, snakes, and wild animals. Losses are thus frequent and substantial--losses that could be reduced by the construction of a simple hen house.

To construct a hen house it is necessary to choose a location where soil is permeable to water, to use local materials (adobe, wood, straw), and to orient the building east-west to keep out the dominant winds. Constructing a good hen house means following a few simple principles:

- Keep it simple. Use local materials.
- Make it large enough: 8 hens per m^2--thus in a place 2 meters by 2 meters, one can put more than 30 hens. A house 3 meters in diameter can house 56 hens.
- Build it high enough, with a large door to facilitate the access of men during cleaning.
- Aerate it well. Have facing windows constructed on the north and south sides of the hen house.
- Keep it clean, with floors and walls properly tamped and smoothed or coated with cement.
- Make it agreeable for the hens: cover soil with litter frequently (wood chips, chopped straw, crushed peanut hulls). (Poultry raisers also can dispose of the roosts and the nests there.)

But even in the large, well-aerated, and clean houses, hens may become sick.

5.2.3 Improvement of Health

The principal diseases of birds are cocciodiosis, fowl cholera, diptheria or avian smallpox, Newcastle disease, and Gumboro disease.

To counter these diseases, take protective measures. The best prevention is good hygiene and vaccination, and as the saying goes, "It is better to prevent than to cure." The schedule for vaccination is as follows:

Age	Name of Vaccine	Disease
1) 1 day	"Vaccin W. Nobilis"	
2) approx. 10 days	"Pestalo HB1" (1st age)	Newcastle
3) 15 days	"Gumboral"	Gumboro
4) 30 days	Pestalo la sota (2nd age)	Newcastle
5) 3 months	Pestaviform and Cholavil	Newcastle and Cholera
6) 3 mo. 20 days	Triavia	Newcastle and smallpox-typhosis
7) 6 months	Cholavil	Cholera
8) every year	Triavia	Cholera

In spite of preventive measures, some diseases will occur in your chicken yard. So observe your poultry at all times. In case of abnormal behavior from a bird, isolate it and call the nearest veterinary nurse, who will be able to identify the disease according to the symptoms and apply the appropriate treatment.

MOST COMMON POULTRY DISEASES

Name of Disease	External Symptoms	Treatments and Prevention
Coccidiosis	Blood in the feces. Shaggy feathers. Hunched-over position. Wings spread out or dragging: one says that "the chicken is wearing a grand boubou."	Sulfamides: Sulfarerazine or sulfamezathine in solution in the drinking water, 1-2 g per liter given once a day for 3 days. Skip 2 days and again once a day for 3 days.
Smallpox or Avian diptheria	Appearance of greyish pustules on the beak, the comb, the wattles, and the eyes. False membranes in the beak throat (diptheria). Some mortality.	Narcox: Uroformine (40%): 2-3 cm^3 of solution/hen. Paint the pustules with tincture of iodine or mercurochrome. Vaccination: triavia intramuscular injection.

MOST COMMON POULTRY DISEASES (continued)

Name of Disease	External Symptoms	Treatments and Prevention
Fowl cholera	Black comb, rapid, noisy respiration. Greyish or yellowish diarrhea. Prostration. Other signs: swelling of the wattles. Autopsy shows the blood not well coagulated. High rate of mortality.	Sulfamides: sulfamezathine or sulfamerazine. Antibiotics: streptomycine (100,000 I/ hen). Vaccination: cholavil.
Newcastle disease	Panting and difficult breathing. Bird secretes when held upside down. Heavy diarrhea, colorless or greenish. Paralysis of limbs (legs, wings). Contraction of head and neck. High rate of mortality.	No treatment. Vaccinations when 3 days old and 3 weeks of age, with Pestalo (drinkable vaccination). When 3 months old, with triavia or Pestaviform.
Gumboro disease	Animal sitting or crouching. Ruffled feathers. Beak resting on ground. The hen lets herself be caught without reacting. High rate of mortality on the third day. If hen lives then symptoms disappear rapidly.	Try Choramphenical. Vaccination is gumboral.

5.2.4 Nutrition Improvement

In the villages, poultry range freely and hens forage for themselves. They peck here and there all day long but whatever they eat is not sufficient for high productivity.

To fatten your hens or to make them less subject to diseases and lay more eggs, you must help with their feeding. The saying is that "The hen lays through her beak." So put a basket of millet beer residues, sorghum and millet residues, chaff, Karité cake, or vegetable wastes (lettuce, tomatoes, fresh grass) in the chicken yard. Every morning, put out a container of clean, fresh water. Lack of water even for one hour is more stressful than lack of food for a day.

But even if your hens do not die, or are not sick, and are well fed, local breeds are small (hen 1 kg and rooster 1.5 kg) and lay very few eggs (60 to 80 eggs/year), and thus bring very little money per hen.

Although difficult and time consuming, it is not impossible to improve local breeds, producing birds that are more resistant and bigger (hen 2 kg, rooster 3 kg) and that lay many more eggs. Improving local breeds would increase earnings per hen.

5.2.5 Improvement of Local Breed: "Operation Rooster"

The "European" hen is much bigger than the local breed. It produces more meat, and its eggs are bigger and more numerous. But it is more expensive and less resistant than the African hen, which is adapted to our environment. Furthermore, its taste is not "as good."

Without having to buy European chicks, villagers can improve family poultry at a low cost, and in a profitable manner, by crossbreeding. Just buy a "European" rooster, leave it with about 10 local hens, and see the results. The chicks will resemble European roosters and local hens. If the rooster is big and the hen small, the chick will be bigger than the mother and smaller than the father. This chick is called a first-degree cross. It has the mother's resistance to disease, which is very important.

At the end of its first year, the chick is fatter than the mother, but its eggs are no bigger and it cannot lay more eggs than its mother.

Among the first-degree crosses, keep the young hens and slaughter the young cockerels for meat. The young hens will be crossed later with the big European rooster (10 young hens for a big European rooster).

The chick obtained will look more like its father than the local hen--not quite as big as its father but bigger than its mother (young hen of first cross).

The young hens issued from the second crossbreeding lay more than local hens (40-50 more eggs per year), and the eggs are bigger than those of local hens (58 g vs. 35 g).

Crossbreeding continues. After four or five crossings hens resemble their fathers almost completely. They also lay bigger eggs than local hens.

During these procedures, observe the poultry, keeping an eye on each bird. If a hen looks like a local hen, eliminate her right away, before she reproduces.

In order to have good results, it is necessary to isolate the hens. The European breed does not jump as much, and if one leaves the crossbred hens free, a small local cockerel is enough to lose everything that has been acquired.

In summary, first generation crosses have 50% of the characteristics of the European breed, second generation crosses have 75%, third generation crosses have 87%, and fourth generation crosses have 93%. Fifth generation crosses are just like the European breed, but much more resistant. For example, if one crosses a local hen that lays 150 to 200 eggs per years and a European rooster of 3.5 kg the following results:

Generation	Weight of Crossbred in kg	Egg Production/yr of Crossbred Hens
1	1.75 kg	60-80
2	2.60 kg	112-150
3	3.04 kg	130-174
4	3.25 kg	139-186
5	3.50 kg	150-200

Note: As part of this crossbreeding procedure, crossbred cockerels should be eliminated until the fourth generation. Only the cockerels from the fifth generation should be used for breeding--in a ratio of 10 hens for one cockerel aged 5- to 6 months old.

The whole procedure lasts about three years.

Whatever individual poultry raisers can do to improve their poultry stock can also be done by a whole village.

The work becomes more interesting and easier if the villagers can agree on breeding improvement and procedures. If the village roosters can be eliminated, inbreeding can be prevented and thus confinement and isolation of hens will not be necessary.

5.2.6 Conclusion

Since it is impossible for now to consider the village-wide use of improved breeds the best thing to do is to improve already existing local breeds and to put an end to the numerous mistakes that have been noted in village poultry raising. The construction of modern poultry yards in the villages must be, for the time being, a demonstration and training operation.

Since poultry raising is based on meat production, primarily, it would be better to intensify and improve this area of production. Egg production is linked more with egg marketing and intensification of this activity would require a greater effort in the areas of nutrition and marketing and also a great change in the eating habits of villagers who have not placed much importance on egg consumption up until now. So poultry meat production seems more profitable for the villagers.

Generally, the success of poultry raising is linked to health, nutrition, and improvement of breeds.

Health: It is important for Phase II of the VLP to make great efforts in several areas:

- Periodic censuses (every three months or twice a year) of poultry for sufficient and regular supplying of veterinary products.
- Improvement of village chicken yards.
- Vaccinating to prevent poultry diseases, particularly Newcastle disease, cholera, and smallpox.

Nutrition: Diet must be sufficient, balanced, vitamin supplemented. Nutrition should be based principally on local products (millet beer residues, chaff, vegetable wastes, cereals).

Breeding improvements: Roosters must be replaced by improved roosters, and over a few consecutive years (during Phase II of the project). These roosters must be raised in modern poultry yards of the village until the age of 5-6 months and then distributed in the villages by a barter system (one local rooster for one rooster of improved breed).

POULTRY RAISING FORM

Name of poultry raising enterprise ______________________________ Tape number _______________

Date of hatching ____________________________ Date of purchasing ____________________________

Number of chicks bought _____________________ Breed ____

Date	Type and quantity (in kg) of feed given	Number of Birds				Comments: diseases, treatments vaccinations, etc.
		Died	Sold	Given	Remaining	

POULTRY INVENTORY FORM

Name of poultry raiser Site Village Neighborhood

Date

Inventory number

Species	Number at Last Inventory	Deaths	Sold	Eliminated	Remaining	Recorded	Comments, disease, treatments, vaccinations, etc.
Roosters							
Hens	( )	( )	( )	( )	( )	( )	
Guinea fowl							
Ducks							
Turkeys							
Pigeons							

Note: In the "Hens" row, write the number of hens of improved breeds in parentheses.

5.3 METHODOLOGY FOR SOCIAL SCIENCE RESEARCH USED

Research findings and data analysis are never completely independent of the strategies and methods employed in the gathering of the data. In order for the reader to adequately assess the findings presented in this report and to be able to compare and assess them in relation to similar studies, it is important that one be at least familiar with the methods of data collection. The representatives of donor agencies should have the opportunity to assess the applicability or representativeness of applied research findings. Data gathered in the course of a project then can be properly evaluated and employed in the design of new, or revision of existing programs and projects.

A second and equally important issue involves the necessity of understanding two important concepts: (1) statistical significance, and (2) strength of association. The former refers to the probability that an apparent relationship between two factors is the result of chance. That is, what degree of confidence does one have that an observed relationship in the sample is indicative of an actual relationship in the universe from which the sample is drawn. For example, suppose in a sample of livestockmen one finds a higher percentage of Fulani than of Mossi who regularly vaccinate their cattle against trypanosomiasis. Is this observed difference a real difference between ethnic groups or an accident of sampling (i.e., is the sample representative of the population as a whole). Normally in the social sciences if there is less than one chance in 20 (.05) or one in one hundred (.01) of drawing a sample with the observed differences as great as they are by chance, then one will reject the null hypotheses (e.g., there is no systematic relationship between ethnicity and health practices employed with one's animals). The rejection of the null hypothesis leads to the acceptance of the hypothesis that such a relationship actually exists.

Tests of statistical significance enable one to state confidently that there is a relationship between two factors (our independent and dependent variables). It does not enable one to say precisely how strong the relationship is, that is, to what extent one can predict or explain the dependent variable on the basis of the independent variable(s). One only knows the two are in some way systematically related.

Usually there are many factors (independent variables) that enter into any explanation of a phenomenon (dependent variable) with which one wants to deal. In order to design or assess the probable impact of a technical intervention, it is necessary to know the relative importance of, and interrelationships between, the independent variables. Only then can one decide what independent variable(s) are most important; what is the most propitious way to intervene (what independent variables can or should one try to modify); what will be the probable effects of the intervention(s) on the dependent variable (that which one is trying to change); and finally what are some of the likely externalities (unintended effects) of these actions.

5.3.1 Sampling

Given the vast area, diverse ethnic groups, and tremendous distances between research sites, a large portion of the data gathering effort had to rely primarily on survey research. Where possible, direct observation of particular forms of behavior was used to supplement and verify the survey data. Two forms of interviewing were conducted. The first consists of open-ended, exploratory interviews with elites--village chiefs, elders, ritual specialists, and local government officials. The second type of interview, based on a formal, systematic survey instrument, is used to delineate the attitudes of and practices employed by the average livestock producer.

The first major sampling task was to decide on the unit of analysis. The immediate problem was to utilize a unit of analysis that was reasonably comparable between the four major ethnic groups (Mossi, Fulani, Gourmantche, and Bissa). The compound head, normally the eldest male, was identified as the most appropriate unit from the standpoint of livestock production. In terms of crop production this unit would not be comparable between ethnic groups. However, it does provide a reasonably common unit for the herding of animals, particularly cattle.

The second major task was to delineate the universe from which appropriate samples could be drawn for interviewing purposes. Two procedures were followed. First, in certain select villages in each site a complete census was conducted by VLP extension agents. This helped clarify population characteristics. Secondly, lists of compound heads broken down by ethnicity were compiled for other villages within each site. Thus, the samples could be drawn from a near universe of compound heads.

The first survey instrument employed was designed to test attitudes toward innovation, particularly differences in the sense of modernity, efficacy, and effect toward local and central government. Given great disparities in the distribution of the various ethnic groups and the expected importance of ethnicity as an independent variable, samples stratified on the basis of ethnicity were drawn in five sites (Koukoundi, Tafogo, Ougarou, Namoungou, and Gnanguedin).* Lists of compound heads were grouped by ethnicity in each site and assigned numbers. A table of random digits was then employed to draw a random sample within each ethnic group in each site (see Table 5.5). Replacements for those who could not be located were identified. The interviewing was satisfactorily completed in all sites except Tafogo. In that site interviewing was prematurely halted because of the illness of the extension agent assigned the task of conducting the interviews.

The second major survey, which examined livestock management practices, required a somewhat different sampling universe. After considering a wide variety of alternative strategies, and the goals of the survey, it was decided to limit the sample to cattle owners (of all important ethnic groups found in project sites). For these purposes cattle owners are defined as all male compound heads owning one or more cattle, other than, or in addition to traction animals.

---

*The sixth site had not been chosen at the time of the survey.

TABLE 5.5

SAMPLE SELECTION CRITERIA

ORD	Site	Sample Universe	Ethnicity	N
Central North	Tafogo	Compound heads	Mossi	15
			Fulani	1
			Total	16
Central North	Koukoundi	Compound heads	Mossi	30
			Fulani	12
			Total	42
East	Ougarou	Compound heads	Gourmantche	23
			Fulani	23
			Total	46
East	Namoungou	Compound heads	Gourmantche	32
			Fulani	30
			Total	62
Central East	Gnanguedin	Compound heads	Bissa	17
			Mossi	22
			Fulani	3
			Total	42
		Total N =	208	

The delineation of the sample universe was completed in the following manner. Lists of livestock (cattle) owners were compiled based on information gathered in the course of the attitudinal survey, other research efforts, from contacts and information gathered by VLP extension agents, and finally, from village chiefs. Lists of compound heads were read to traditional village chiefs who were asked to identify all cattle owners. This procedure proved most useful in completing and reconfirming lists of livestock producers already compiled by other means.

From the universe of cattle owners, stratified random samples of livestock producers were selected for interviewing. The samples in each of the four sites surveyed (Koukoundi, Tafogo, Ougarou, and Gnanguedin) were stratified on the basis of ethnicity (Mossi-Fulani for Koukoundi and Tafogo, Gourmantche-Fulani for Ougarou, and Bissa-Mossi-Fulani for Gnanguedin) and by village (see Table 5.6).

5.3.2 Testing

Both of the interview schedules were tested by two methods. First, VLP extension agents in all sites were given a draft of the instrument to examine. They freely commented on problems such as questions that would be difficult to pose in the local culture context and wording changes. Each instrument was also tested in an actual field situation to allow for further refinements.

5.3.3 Translations

The original research instruments were written in French. VLP extension agents are all native speakers of at least the dominant language in their respective sites. The principal language spoken by the 12 extension agents are More (6), Fulfulde (2), Bousani (2), and Gourma (2). Each extension agent was responsible for the translation of the research instrument into his own language. Translations of at least two speakers of each language were compared. Translators were brought together and a "best" translation of each question was decided on in each

TABLE 5.6

LIVESTOCK MANAGEMENT SURVEY
(Sample selection criteria)

ORD	Site	Sample Universe	Ethnicity		Selected Villages
Central North (Kaya)	Tafogo	Livestock owners*	Mossi Fulani	- 30 - 19	Tafogo Seno Dassamtanga DamkarkoDaga Djamkoka Bougou
Central North (Kaya)	Koukoundi	Livestock owners	Mossi Fulani	- 28 - 10	Koukoundi Sabse
East (Fada N'Gourma)	Ougarou	Livestock owners	Gourmantche Fulani	- 17 - 16	Ougarou Gnifogma Datougou Tibati PaunYakouni Nyimbiary Djuari
Central East (Koupela)	Gnanguedin	Livestock owners	Bissa Mossi Fulani	- 15 - 8 - 14	Gnanguedin Dema Loba Lalle Gaone
			Total N = 157		

*All male compound heads owning one or more head of cattle, other than, or in addition to, traction animals.

language. The completed translations were recorded on cassette tapes. These tapes were then used by extension agents to memorize the questions in their language (none are literate in a language other than French). Satisfactory translations were produced in More, Fulfulde, and Gourma. Bissa interviews were conducted in More, occasionally with the assistance of an agricultural service extension agent who was a native Bousansi speaker.

5.3.4 Training and Interviewing

All VLP extension agents were given a short training course on interviewing techniques, problems likely to be encountered in the interviewing process, and the means of dealing with them. This was supplemented by practice interviews conducted in the presence of a CID team member. When it was deemed that the interviewers were ready, they were sent in the field for actual interviews. The CID team member remained available for several days to clarify issues and answer any questions that might arise. All interviews in the first survey were conducted by the extension agents.

Training for the livestock management survey was conducted in the field. As a result of the extension agents' past interviewing experience, only a short training session was necessary. Mr. Gregory Garbinsky, a U. S. Peace Corps Volunteer livestock specialist, was given practical training in interviewing in the Koukoundi site.

Because of the complexity of the research instrument, the CID social scientist decided to conduct all interviews, except those in the Koukoundi site, personally. The extension agents acted as translators. Mr. Garbinsky conducted most of the interviews in the Koukoundi site, while the social scientist completed all the interviews in Tafogo, Ougarou, and Gnanguedin sites. Since most livestock producers and traditional authorities in VLP sites were familiar with CID team members and supportive of the VLP work, it was deemed both feasible and valid to proceed in this fashion. The opportunity this provided for probing into a variety of interesting areas clearly compensated for any losses, or errors introduced into the data by the cross-cultural contact entailed in the interviewing.

5.3.5 Processing

The surveys were designed so that all data gathered in the systematic interviews would be in machine readable form. The data were coded and programmed and then sent to the computer facility at Texas Tech University for key punching and processing. Dr. Lee P. Sigelman of Texas Tech University provided invaluable assistance with the logistics of this effort.

5.3.6 Additional Data

Much additional data involving subjects such as land tenure, kinship, and transhumance were gathered on the basis of in-depth interviews. These data were then used to supplement and corroborate more systematically gathered data. In the case of transhumance routes, several were verified by following the actual routes with the help of experienced guides. The fact that the VLP was able to provide a valuable service (animal vaccinations) to local livestock producers and support initial small-scale interventions, such as the construction of animal health facilities, wells, and poultry breeding units, provided an excellent basis for the acceptance of, and support for, the important applied research efforts of the VLP team. The opportunity for access and broad based communication through livestock producers' committees proved invaluable. The careful cultivating of relationships with traditional authorities is also regarded as a necessary and integral component of this process.

5.4 FORMATION OF LIVESTOCKMEN'S COMMITTEES

The process of selecting representatives varied from one village to the next, but in general the procedure was as follows. The project social scientist visited each village or neighborhood (where these represented clear ethnic or geographic distinctions). An ad hoc meeting was then held with the chief, village elders, and other villagers. The basic goals of the project were explained and the villagers' questions answered. The organization and functions of the site committees were also discussed. The villagers were then told that if they wanted to participate they could select a representative to serve on the site committee. Almost all villages chose representatives.

In general, representatives were chosen at village meetings, with the actual selection made by the chief and village elders. In the few villages that did not choose representatives, the main reason appears to center on inter-village jealousies. For example, the chief of Biega (Ougarou site, ORD of Fada) refused to send a representative because he felt that the VLP field assistants should have been stationed in his village. In the future, when village level committees are established, these committees, in cooperation with the village chief, will formally elect their representatives and the representatives will report directly to the committee.

The role to be played by each representative was explained during the initial contact, in follow-up visits by encadreurs, and at the first meeting of the committees.

5.4.1 Village Livestock Committee Members--Tafogo (ORD Kaya, Sector Tougouri)

Members	Village or Neighborhood	Ethnic Groups
Sawadogo Yobréan	Tafogo	Mossi
Yameogo Ousmane	Tafogo	Mossi
Kafondo Moussa	Tafogo	Mossi
Thoulbeogo Moné	Tafogo	Mossi
Ouédraogo Siongo	Damkarko Daga	Mossi
Zabré Sibiri	Pelga	Mossi
Djandé Hamidou	Koulponsgo	Fulani
Sawadogo Hamidou	Djamkouka	Mossi
Sebgo Bougourawa	Bougou	Mossi
Yambo Hamadé	Séno	Fulani
Ouédraogo Lougba	Bissinga	Mossi
Baloum Namb Sawadogo	Narbingou	Mossi
Sawadogo Houka	Loangjou	Mossi
Sebgo Pagomyaré	Zougountenga	Mossi
Yuingri Ouédraogo	Bamkarko	Mossi
Boukary Diandé	Rassamtanga	Fulani

5.4.2 Village Livestock Committee Members--Namoungou (ORD Fada N'Gourma, Sector of Fada)

Members	Village or Neighborhood	Ethnic Group
Djallo Moussa	Gentiangou	Fulani
Bolko	Kodiondi	Fulani
Dabindi Talardia	Kodiondi	Gourmantche
Onadja Nindia	Moadeni	Gourmantche
Bandé Amadou	Boulmanga (Kalmama)	Fulani
Bary Yaro	Sambiga	Fulani
Haram Sondé	Mabangani	Fulani
Oumarou Bâ	Diandiapangou	Fulani
Diallo Madiani	Sanipenga	Fulani
Rankangau Namono	Bandingui	Gourmantche
Hadi Thiombiano	Setougou	Gourmantche
Boungou Londé	Setougou	Fulani
Toushbingou Ouôba	Tidric	Gourmantche
Moardia Thiombiano	Mongodeni	Gourmantche
El Hadj Thiombiano	Namoungou	Gourmantche
Bary Diedé	Namoungou	Fulani
Samaurdia Dabini	Sanipenga	Gourmantche
Amadou Bary	Moabangani	Fulani
Saidou Amadou	Sanipenga	Fulani

5.4.3 Village Livestock Committee Members--Ougarou (ORD Fada N'Gourma, Sector Mathiakoala)

Members	Village or Neighborhood	Ethnic Group
Goula Kandia	Ougarou	Gourmantche
Soari Kandia	Ougarou	Gourmantche
Hamadou Djande	Ougarou	Fulani
Hamadou Diallo	Ougarou	Fulani
Idrissa Dicko	Nimbiary	Fulani
Boukari Dicko	Nimbiary	Fulani
Tankoano Youssarou	Gnifogma	Gourmantche
Djissibo Thiombiano	Tibati	Gourmantche
Tidié Thiombiano	Pogni-Kony	Gourmantche
Dapeigari Thiombiano	Djuari	Gourmantche
Yaya Bandé	Pogni-Kony	Fulani
Djallo Belko	Tibati	Fulani

5.4.4 Village Livestock Committee Members--Koukoundi (ORD Kaya, Sector Kongoussi)

Mahamadou Boly	Koukoundi Centre	Fulani
Boly Nagerma	Koukoundi Centre	Fulani
Oumarou Ouedraogo	Koukoundi Centre	Mossi
Alaye Sankara	Koukoundi Centre	Mossi
Ahadou Baré	Sorgho	Fulani
Belko Baré	Sorgho	Fulani
Sidzambo Ouedraogo	Riguila	Mossi
Reigema Sawadogo	Riguila	Mossi

5.4.5 Village Livestock Committee Members--Gnanguedin (ORD Koupela, Sector Tenkodogo)

Members	Village or Neighborhood	Ethnic Group
Chef du Village	Gnanguedin	Bissa
Golé Sarré	Gnanguedin	Bissa
Harouna Salakorogo	Gnanguedin	Mossi
Kaya Sarré	Gnanguedin	Bissa
Alassane Zabsonre	Gnanguedin	Bissa
Kanbonné Raogo	Gnanguedin	Bissa
Amadou Diallo	Lallé	Fulani
El Haji Belko Bandé	Loba	Fulani
Kanbonné Samandé (Chef du Village)	Loba	Bissa
Diallo Kemoko	Tingronomin	Fulani
El Haji Diallo Saidou	Ouada	Fulani
Barassa Diao	Tilahore	Fulani
Barré Yero	Gannin	Fulani
Diallo Baurema	Hotougou	Fulani

Formation of the Range Management Subcommittee for the Gnanguedin site was completed 23 October 1979. Members:

Bermouse Raogo

Hamadou Diallo (from Kankamogré)

Rasmané Yala

Sibiri Zané

Dabo Kéré

5.5 RANGE MANAGEMENT PROCEDURES AND FORMS USED

5.5.1 Rangeland Inventory Analysis: Guidelines for Write-Up Form

WRITE-UP NUMBER

ORD Kaya SITE Tafogo VILLAGE Tafogo

KTT - 001 - 3

WRITE-UP No. Number of pages

DATE 11-9-1978

day	month	year
11 -	9	- 1978

AERIAL PHOTO NUMBER

AERIAL PHOTO No. 74 HVO 10/500 SAG 464 - 1241

Upper left corner	Upper right corner
year and other flight data	photo number
(74 HVO 10/500 SAG 464)	(1241)

EXAMINER Name of Examiner

ORD, SITE, VILLAGE, AND COMPOUND

ORD	SITE	VILLAGE	COMPOUND
Kaya	Tafogo	Bougou	Chief's

PLOT SIZE

1. 1 meter square ($1m^2$)
2. 2 meters square ($2m^2$)

PLOT INTERVAL

Plot intervals were determined by diversity of vegetation: the more diverse the vegetation the closer the Plot Interval; the more uniform the vegetation the less frequent the interval.

1. 25 meters
2. 50 meters
3. 100 meters
4. ___ meters

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RESOURCE AREAS (Vegetation Types) -- Tafogo Site

No.	Map Symbol	Name
1.	/c	Cultivated Perimeter
2.	cs et J	Rain-fed Cultivated and Fallow
3.	C	Extensively Cultivated
4.	G-a	Gramineae and Shrub
5.	G-a-ca	Gramineae, Shrub, and Rocky
6.	a-G	Shrub and Gramineae
7.	a-G-ca	Shrub, Gramineae, and Rocky
8.	a	Shrub
9.	U	Upland
10.	A-G	Tree - Gramineae
11.	G-A	Gramineae - Tree
12.	G	Gramineae
13.	/G	Perimeter of Reservoir

RESOURCE AREAS (Vegetation Types) -- Gnanguedin Site

1.	Cultivated Perimeter and Fallow
2.	Cultivated
3.	Gramineae
4.	Gramineae - Tree
5.	Tree
6.	Riverbank

Figures 5.2 and 5.3 show generalized versions of the vegetation maps for Tafogo and Gnanguedin.

SURFACE AREA OF TYPE

Surface area of a VEGETATION TYPE was determined from aerial photos after types had been determined in the field and traced onto the overlays. Surface areas were then computed from the photo overlay in hectares. FORAGE PRODUCTION was then indicated in kilograms per hectare.

VEGETATION TYPE DETERMINATION

- Determine first the botanical composition of the Write-Up.
- Write-up the botanical composition by % of the total vegetation.

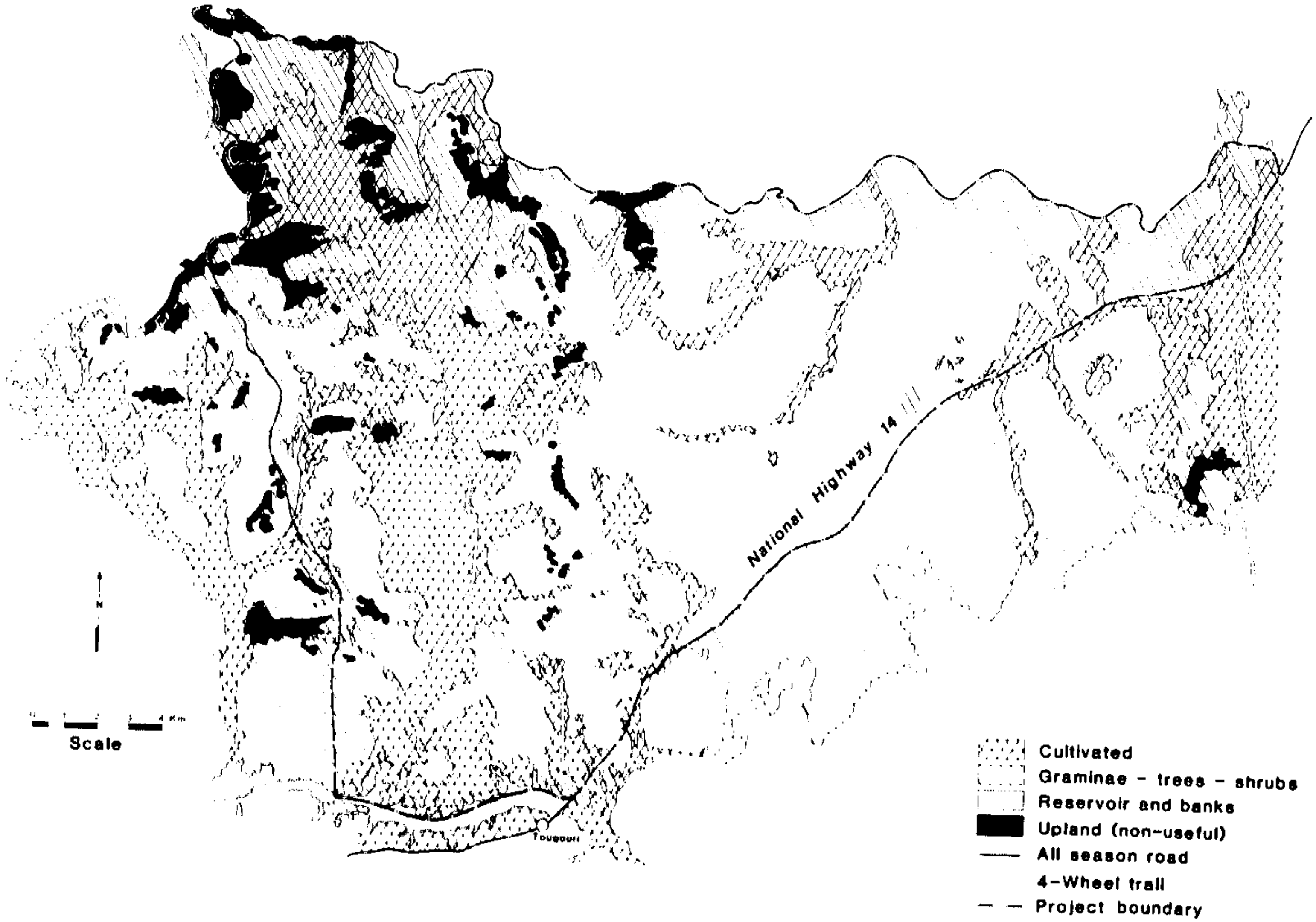

Figure 5.2 VEGETATION OF TAPOGO SITE

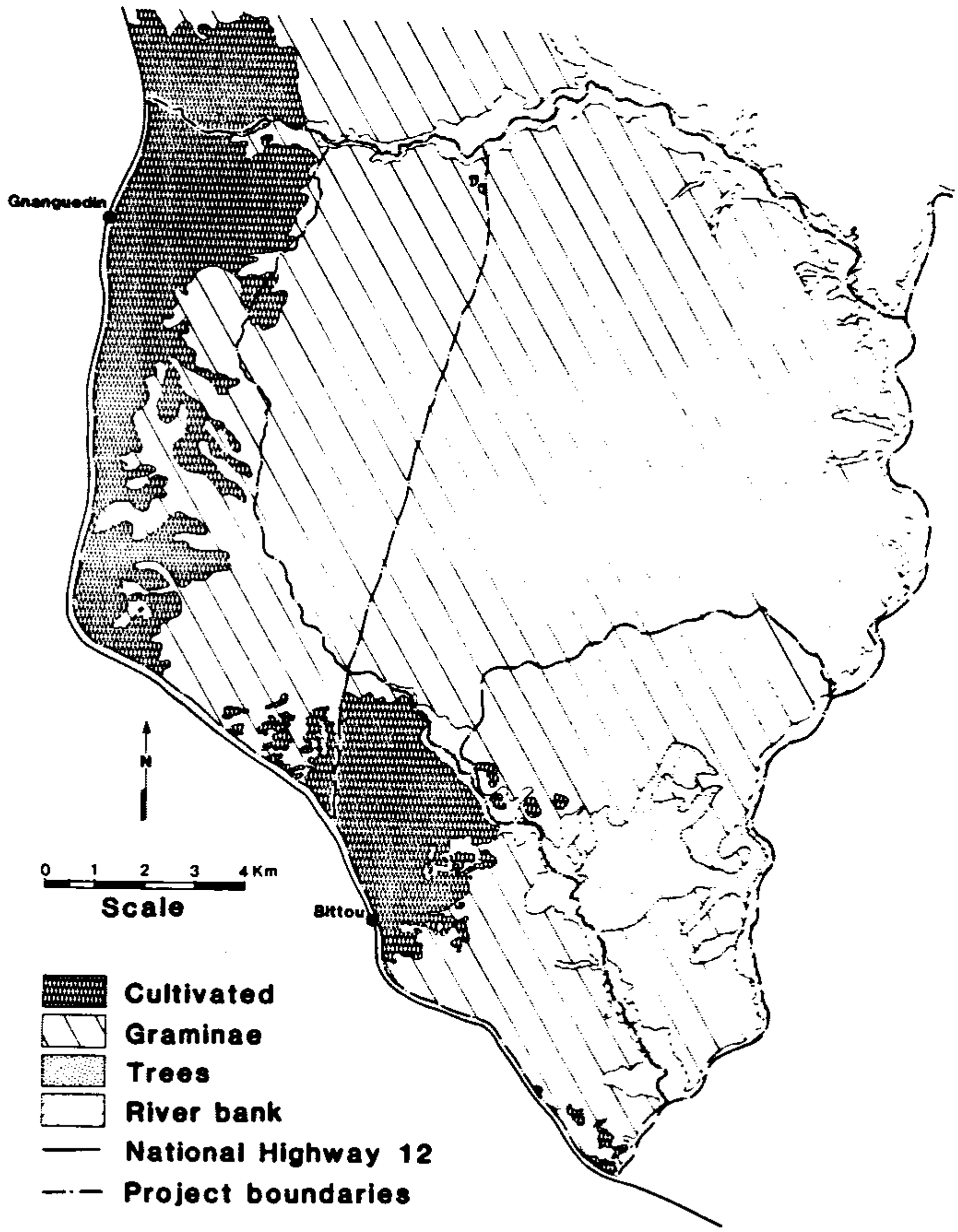

Figure 5.3 VEGETATION OF GNANGUEDIN SITE

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- Determine the importance of each species by its percentage composition.
- Indicate by using scientific symbol for each species present in composition.
- Indicate the three or four most abundant species by their percentage composition.

Example 1:

VEGETATION TYPE SPECIES	01 02 03 Cebi-Bare-Cosp % COMP.
01 Cebi	40
Anga	10
Scgr	5
Heco	20
et al.	35
	100% / 25%
02 Bose	25
Guse	25
Grbi	5
Bare	45
	100% / 15%
03 Acma	20
Acni	2
Acse	5
Baae	10
Cosp.	25
et al.	33
	100% / 60%
	100%

SPECIES

Species are recorded first by a type CODE and secondly by a SYMBOL.

CODE	SPECIES	SYMBOL	SCIENTIFIC NAME
01	Gramineae	Acam	*Acroceras amplectens*
02	Shrubs	Bose	*Boscia senegalensis*
03	Trees	Baae	*Balanites aegyptiaca*
04	Forbs (weeds)		
05	Cyperacae		
06	Juncaceae		

PREVIOUS PAGE BLANK

EXAMPLE:

SPECIES	PLOTS 1.	2.	3.	4.	5.
01 Acam					
02 Bose					
03 Baae					
04 -					
05 -					

A SPECIES CODING AND SYMBOL GUIDELINE is furnished to each examiner.

PLOTS

Random Plot Samples, of a predetermined size (PLOT SIZE) are taken along a transect line at predetermined intervals (PLOT INTERVALS). All available forage is weighed and dry weight determined for each forage species within plots, both green weight and dry weight.

When traversing a cultivated field plot, samples are recorded exactly the same as when sampling other vegetation types. Note, however, that the plot or plots were fields (specify crop). This is pertaining to fields (brousse fields) mixed in with rangelands.

Room is allowed on the recording form (RANGELAND INVENTORY FORMS) to record transects of 10 PLOTS. Each PLOT is recorded vertically by SPECIES.

If additional PLOT measurements are necessary to complete an adequate sample within any one VEGETATION TYPE additional FORMS can be used, but make sure that the WRITE-UP No. shows more than one FORM. This can be done by adding a dash and page number following the appropriate WRITE-UP No.; such as -2 or -3, if two or three pages are required to complete field analysis. Merely by adding a -1 on the first FORM indicates that there are other FORMS (-2 or -3, etc.) completing this particular WRITE-UP No. For a one-form WRITE-UP No., do not follow the WRITE-UP No. with a dash and page number.

Green weights are in grams.

Drv weights are in grams and are only recorded after there is no additional weight loss in the sample.

Green weight, forage used, and dry weight are recorded for each species and plot, followed by totals and percent humidity.

Example:

SPECIES:

	1	2	3	4	5	6	7	8	9	10	Total Prod.*	Grams Used*	% Utilized*	Total dry Wt. Prod.*	% Comp.*	Desir-ability*	Calculations
01 Cebi	10 - 5	5 - 2	7 3 3	15 4 7	20 - 10	2 - 1	3 - 1	0 - 0	15 5 7	30 10 15	129	22	17	61 49			52% Humidity
02 Anga																	

10	(Top) indicates green weight
-	(Middle) indicates grams used (estimated) green weight
5	(Bottom) indicates dry weight of green sample

*Explanations given on following pages.

TOTAL PRODUCTION

Green weight of all PLOTS + Total green weight estimated to be used = TOTAL PRODUCTION green weight.

GRAMS USED

Total of all PLOTS where forage was already consumed.

Estimate grams used in green weight.

Register or record on middle level of each plot box.

If no forage has already been consumed, put either a dash or zero (0) in the middle level of box.

% UTILIZED

GRAMS USED divided by TOTAL PRODUCTION = % UTILIZED.

TOTAL DRY WEIGHT PRODUCTION

$$\frac{\text{Dry weight of all PLOTS}}{\text{Green weight of all PLOTS}} \times 100 = \text{\% Dry Weight}$$

% Dry Weight = 100% = % Humidity in Sample

Total green weight estimated to be used x % Dry Weight = Dry Weight of Consumed Forage

DRY WEIGHT OF GREEN SAMPLE + DRY WEIGHT OF CONSUMED FORAGE = TOTAL DRY WEIGHT PRODUCTION

% COMPOSITION

Determination is by visual estimate made during the time the transects are being run on PLOTS analyzed. The estimate is made of the total VEGETATION TYPE, or 100%. The percentage of each SPECIES, 01, 02, 03, 04, 05 is estimated to be that percentage of the 100% total.

SPECIES

CODE	SYMBOL	
01	Cebi	40
	Agna	10
	etc.	50
		100% / 25%
02	Bose	25
		75
		100% / 15%
		etc.

DESIRABILITY

Desirability	Factor
- Never accepted 0/12 months	0
- Rarely accepted, as cut branches, or eaten very young, or eaten when nothing else is available	.1
- Periodically accepted, new growth or beginning of rains	.2
- Periodically accepted, during rainy season, or dry season (one season only) 5/12 months	.3-.4
- Periodically accepted 7/12 months	.5
- First rains through rainy season	.6
- Preferred 10/12 months	.7
- Most preferred, with certain seasonal restrictions, 12/12 months	1.0

Each individual SPECIES SYMBOL (plant species) is judged on grazing desirability.

CALCULATIONS AND NOTES

Space is provided for figuring weight of forage per hectare, percentage humidity in samples, etc.

SOIL DEPTH

Determine depth of top soil; to rocks or laterite layer.

PERCENT BARE SOIL, ROCKS, GREEN AND DRY LITTER

Each plot is judged visually to have percentages of bare soil, rock, green litter, and dry litter. The combination equals the whole plot area: 100%.

SOIL EROSION GUIDE:

Rating	Severity	Description
0	Nil	Plant and litter cover adequate for soil protection, rock and pavement where present normal and in place; gullies, if present, completely stabilized and healed.

Soil Erosion Guide (continued)

Rating	Severity	Description
1	Minor	Isolated bare soil openings characterizes this stage. Erosion confined more or less to the individual bare soil opening.
2	Moderate	Bare soil openings larger and frequently joined together. Indicators may include one or more of the following: (1) soil hummocking due to lowering of soil surface in the bare areas, (2) pedestalling of plants, (3) erosion pavement evident in gravelly soils, (4) rills conspicuous after storms, (5) gullies occasional and moderately active (cutting after heavy storm), (6) sheet erosion has removed less than half the upper horizon of soil, (7) some noticeable alluvial deposition.
3	Advanced	Soil movement advanced and bare ground dominates the site. Indicators are: (1) soil loss heavy and continuing with subsoil exposed in places, at least half the upper horizon having been lost, (2) where soils are gravelly, heavy erosion pavement occurs, (3) gullies frequent and active (4) plants pedestalled or partially buried due to dislodging and redeposition of the soil, (5) wind scouring on exposed sites, (6) exposure of root crowns and roots of shrubs.
4	Severe	Soil movement severe with most of area bare and uninfluenced by vegetation or litter. Indicators are: (1) subsoils mostly exposed, (2) heavy pavement on gravelly soils, (3) gullies frequent and deep and actively cutting with each storm, (4) large soil deposits.

WATER AVAILABILITY

Source of water; indicate which sources are available:

DW Developed Well

TW Traditional Well

S Spring

DR Developed Reservoir

NCB Natural Collection Basin

Distance of water from transect location:

less than 1 kilometer

1-5 kilometers

5-10 kilometers

10 + kilometers

Other ____________

Primary Use of the rangeland in transect location as observed by visual sighting, existence of droppings or bedgrounds. Animal types should be noted.

ADDITIONAL INFORMATION should be written on back of FORM

Examples: (1) proximity to compounds

(2) roads and trails.

SPECIES Coding and Symbols

Code	Species	Symbol	Scientific Name	Desirability Gnanguedin	Desirability Tafogo
01	Gramineae	Acam	Acroceras amplectens		
		Anas	Andropogon ascinodis	1.0	.5
		Anca	A. canaliculatus		
		Anfa	A. fastigiatus (annual)	.2	.2
		Anga	A. gayanus		1.0
		Anga	A. gayanus var. squamulatus		
		Anga	A. gayanus var. bisquamulatus	1.0	
		Anga	A. gayanus var. gayanus		
		Anin	A. incanellua		
		Anpe	A. perticulatus		
		Anps	A. pseudapricus (annual)	.2	.2

SPECIES Coding and Symbols

Code	Species	Symbol	Scientific Name	Desirability Gnanguedin	Desirability Tafogo
01	Gramineae	Ansc	A. schirensis		
		Arad	Aristida adsenionsis	.1	.1
		Arho	A. hordeacea	.1	.1
		Arke	A. kerstingii	.2	.1
		Arsi	A. seiberana		
		Beun	Beckeropsis uniseta	.2	.2
		Brbr	Brachiaria brachylopha	.3	.4
		Brju	B. jubata	.3	.3
		Brla	B. lata	.3	.3
		Brst	B. stigmatisata	.3	.3
		Cebi	Cenchrus biflorus		.8
		Chca	Chasmopodium caudatum		
		Chpi	Chloris pilosa		
		Chro	C. robusta	.3	.3
		Chac	Chrysopogon aciculatus		
		Chhi	Chrysochloa hindsii		
		Ctca	Ctenium canescens		.1
		Ctel	C. elegans (annual)	.1	.1
		Ctne	C. newtonii (perennial)	.1	.1
		Cygi	Cymbopogon giganteus	.3	.3
		Cypr	C. proximus (C. schoenanthus, subsp. proximus)	.3	.3
		Cyda	Cynodon dactylon		.8
		Daae	Dactyloctenium aegyptium	.2	.3
		Diga	Digitaria gayana		.2
		Diho	D. horizontalis	.2	.2
		Dile	D. lecardii		.2
		Dilo	D. longiflora		.2
		Diha	Diheteropogon hagerupii (annual)		.4
		Diam	D. amplectens (perennial)	.8	.8
		Ecco	Echinochloa colona		
		Ecpy	E. pyramidalis		

SPECIES Coding and Symols

Code	Species	Symbol	Scientific Name	Desirability Gnanguedin	Desirability Tafogo
01	Gramineae	Elin	Eleusine indica		.4
		Elar	Elionurus argenteus		
		Elel	E. elegans		.4
		Eleu	E. euchastus		
		Elpo	E. pobequinii		
		Elan	Elymandra androphila		
		Eras	Eragrostis aspera		.2
		Erat	E. atrovirons		.2
		Erci	E. ciliaris		.2
		Erga	E. gangetica		.2
		Ertr	E. tremula	.1	.2
		Ertu	E. turgida		
		Euco	Euclasta condylotricha		
		Hagr	Hackelochloa granularis	.3	.2
		Heco	Heteropogon contortus		.3
		Hygl	Hyparrhenia glabriuscula	.3	.3
		Hyin	H. involucrata (annual)	.1	.1
		Hyru	H. rufa	.3	.3
		Hysm	H. smithiana		
		Hysu	H. subplumosa (perennial)	.3	.3
		Hudi	Hyperthelia dissoluta		.2
		Incy	Imperata cylindrica		
		Isam	Ischaemum amethystinum		
		Isin	I. indicum		.2
		Ledr	Leersia drepanothrix		
		Leca	Leptochloa caerulescens		
		Loan	Loudetia annua		
		Loar	L. arundinacea		
		Lofl	L. flavida		
		Loho	L. hordeiformis		
		Loph	L. phragmitoides		
		Losi	L. simplex		
		Loto	L. togoensis	.2	.2

SPECIES Coding and Symbols

Code	Species	Symbol	Scientific Name	Desirability Gnanguedin	Desirability Tafogo
01	Gramineae	Loke	Loudetiopsis kerstingii	.1	.1
		Losc	L. scaettae	.3	.3
		Loth	L. thoroldii		
		Lotr	L. tristachyoides		
		Miin	Microchloa indica	.3	.4
		Moce	Monocymbium ceresiiforme	.3	.3
		Orba	Oryza barthii		.2
		Orlo	O. longistaminata		
		Paaf	Panicum afzelii		
		Pafl	P. fluviicola		
		Pala	P. laetum	.2	.3
		Papa	P. pansum	.2	.2
		Paph	P. phracmitoids		
		Pasu	P. subalbidum		
		Pawa	P. walence		
		Paor	Paspalum orbiculare		
		Papo	P. polystachyum	.3	
		Pavi	P. virgatum		
		Pepe	Pennisetum pedicellatum	.3	.4
		Pepo	P. polystachion		
		Pepu	P. purpureum		
		Pesu	P. subangustum		
		Phka	Phragmites karka		
		Rhre	Rhynchelytrum repens		
		Rhtr	Rhytachme triaristata		
		Roex	Rottboellia exaltata	.3	.8
		Sasp	Saccharum spontaneum		
		Saaf	Sacciolepsis africana		
		Sach	S. chevalieri		
		Scex	Schizachyrium exile	.2	.2
		Scno	S. nodulosum		
		Scru	S. ruderale		

SPECIES Coding and Symbols

Code	Species	Symbol	Scientific Name	Desirability	
				Gnanguedin	Tafogo
01	Gramineae	Scsa	S. sanguineum	.3	.3
		Scsc	S. schweinfurthii		
		Scur	S. urceolatum		
		Scgr	Schoenfeldia gracilis	.5	.6
		Sean	Setaria anceps	.2	.2
		Seba	S. barbata	.2	.2
		Sepa	S. pallidefusca	.2	.3
		Sesp	S. sphacelata		
		Seve	S. verticiallata		
		Sobi	Sorghastrum bipennatum		
		Soar	Sorghum arundinaceum		
		Sola	S. lanceolatum		
		Spfe	Sporobolus festivus		
		Spmi	S. microprotus		
		Sppy	S. pyramidalis		
		Spsp	S. specie	.2	
		Stdi	Stenotaphrum dimidiatum		
		Tece	Tetrapogon cenchriformis		
		Urmu	Urelytrum muricatum		
		Veni	Vetiveria nigritana	.8	
		Vocu	Vossia cuspidata		
02	Shrubs	Acdu	Acacia dudgeoni		.2
		Acma	Ac. macrostachya		.1
		Acpe	Ac. pennata		.1
		Anse	Annona senegalensis		
		Asaf	Asparagus africanus		.1
		Bare	Bauhinia reticulata	0	0
		Bose	Boscia senegalensis		.3
		Capr	Calotropis procera	0	0
		Comi	Combretum micranthum		.1
		Coni	C. nigricans		.1
		Cospp	C. spp.		

SPECIES Coding and Symbols

Code	Species	Symbol	Scientific Name	Desirability Gnanguedin	Desirability Tafogo
02	Shrubs	Dame	Dalbergia melanoxylon		
		Euba	Euphorbia balsamifera		
		Gaag	Gardenia agualla		0
		Gate	G. ternifolia		
		Grbi	Grewia bicolor		.3
		Grfl	G. flavescens		
		Grmo	G. mollis		.3
		Guse	Guiera senegalensis		.4
		Xiam	Ximenia americana		.2
		Zima	Ziziphus mauritiana		.3
03	Trees	Acal	Acacia albida		.4
		Acdu	Ac. dudgeoni		.2
		Acgo	Ac. gourmaensis		.4
		Acni	Ac. nilotica		.3
		Acse	Ac. seyal		.4
		Acsi	Ac. sieberiana		.4
		Addi	Adansonia digitata (baobab)		.1
		Anle	Anogeissus leiocarpus		
		Baae	Balanites aegyptiaca		1.0
		Baru	Bauhinia refuescens		.8
		Boco	Bombax costatum (kapokier)		
		Bofl	Borassus flabellifer (ronier)		
		Bosa	Boscia salicifolia		
		Bupa	Butyrospermum paradoxum var. parkii (karite)		
		Cogl	Combretum glutinosum		.4
		Coaf	Commiphora africana		.4
		Dame	Dalbergia melanoxylon		.4
		Dime	Diospyros mespiliformis		
		Enaf	Entada africana		
		Fica	Ficus capensis		
		Fisp	F. specie		

SPECIES Coding and Symbols

Code	Species	Symbol	Scientific Name	Desirability Gnanguedin	Desirability Tafogo
03	Trees	Khse	Khaya senegalensis (cailcedrat)		.3
		Laac	Lannea acida		.2
		Lami	L. microcarpa		.2
		Lave	L. velutina		
		Miin	Mitragyna inermis		
		Pabi	Parkia biglobosa (Nere)		.1
		Praf	Prosopsis africana		
		Psko	Pseudocedrela kotschy		
		Pter	Pterocarpus erinaceus		.4
		Ptlu	Pt. lucens		.4
		Sase	Saba senegalensis		
		Scbi	Sclerocarya birrea		.1
		Stto	Sterculia tomentosa		.1
		Stin	Strychnos innocua		
		Stsp	St. spinosa		
		Tain	Tamarindus indica		.2
		Teav	Terminalia avicennoides		
		Tela	T. laxiflora		
		Visp	Vitex specie		
04	Forbs and Sedges	Coti	Cochlospermum tinctorium		

WRITE-UP No.________ DATE______________19

AERIAL PHOTO No. ____________________ EXAMINER ______________________________

ORD__________ SITE___________ VILLAGE ______________ COMPOUND____________________

PLOT SIZE _________ PLOT INTERVAL___________ RESOURCE AREA ______________________

SURFACE AREA OF TYPE _________________________ VEGETATION TYPE _________________

SPECIES CODE SYMB.	1	2	3	4	5	6	7	8	9	10	Total Prod.	Crams Used	% Utilized	Tot.D. Wt.Pro	% Comp.	Desirability
										-						
TOTAL																
Soil Depth																
% Bare SOIL																
% ROCKS																
% Green & Dry Litter																
TOTAL	100	100	100	100	100	100	100	100	100	100						

CALCULATIONS and NOTES

SOIL EROSION RATING 0 1 2 3 4

WATER AVAILABILITY

Source DW TW S DR NCB OTHER________

Distance less than 1 1-5 5-10 10

Other ______________

PRIMARY USE: cattle _____, sheep _____, goats _____, donkeys _____, others_____.

5.5.2 Livestock Inventory

Low Level Aerial Reconnaissance Techniques Used

Sample lines (or transects) were predetermined within the "sampling zones" of each 1:50,000 scale aerial photograph covering the site. The same "sampling zones" and imagery were used in collecting ground data and mapping of vegetation types for the Rangeland Forage Inventory; '74 HVOSAG 464 series aerial photos.

The imagery was commercially available with in-country authorization, from the Institut Geographique de Haute Volta, Ouagadougou.

Sampling zones were predetermined, which are nothing more than the centermost portion of each photo, or that portion of the photo that is least distorted. The size of the "zone" varies among photos. Stereoscopic matching of zone boundaries between photographs was necessary and assured continuity when combining to make a mosaic.

Ten sample lines (or transects) ran north and south two kilometers apart. The length of the transect varied somewhat because of the shape of the site area. In predetermining the transect lines, predominant physical features such as mountains, pinnacles, distinct vegetation changes, or drainages were used to indicate each end of the transect.

The aircraft was a 4-seat, single-engine type, with high wing and low speed capability. The pilot was familiar with low level reconnaissance techniques. Two observers were used for actually counting stock. They were seated in the back seats, one looking out each side of the aircraft. Each was responsible for counting cattle and small ruminants on his side of the aircraft. Each was equipped with a mechanical hand tally. Forward with the pilot was the recorder and navigator who was responsible for directing the pilot along the transect points and recording the "head counts and groups" on to the aerial photos as the observers counted them off. When larger groups of animals were encountered the pilot circled them to insure that all animals were counted before rejoining the original transect line and flight path direction. Flight elevation was 800-1200 feet above the ground, and airspeed 85 nautical miles per hour. Cattle were usually strung out in lines. Counting started from the tail end of the line forward.

It was helpful that the recorder was familiar with the geographic area and the aerial photos.

The data were initially recorded on plastic overlays stapled over the 27 cm x 27 cm aerial photos. Later a mosaic was prepared from the individual plastic overlays.

Variants and Probably Errors

The probable errors in sampling were no more than one to two percent attributed to the inexperience of the observers, and the possible concealment of animals in the first count. Vegetation density was not a problem.

The site area flown over was 47,304 hectares and required approximately 2 hours of overflight time to complete, and an additional 2-1/2 hours coming and going from Ouagadougou.

Aircraft cost per 4-1/2 hour flight time, without pilot, was 76,500 CFAF.

5.5.3 Rangeland Trend Evaluation

A Trend Evaluation System incorporating permanent small plots strategically located over key species furnishes measurements of: (1) physical changes in specific plant reproduction and vitality, and (2) additional information concerning litter, rocks, bare ground, and soil erosion.

To effectively monitor improvements or degradation of inventoried natural vegetative areas over the years, permanently marked 1 meter^2 plots have been established for measurement and comparisons of changes in soil and vegetation at the Tafogo site. Trend Evaluation plots were established on natural inventoried pasture areas to follow increasing or decreasing vegetation species, reproduction, soil erosion, and to guide land managers and users in establishing correct stocking rates.

Key Species. Certain forage species are preferred by animals over others. Andropogon gayanus var. bisquamulatus, for example, is actually sought out by cattle and eaten off to ground level when in association with most annual species such as Schoenifeldia gracilis (less desirable), and Loudetia togoensis (least desirable). Therefore, the Andropogon gayanus var. bisquamulatus is a decreaser and a key species, one that should be monitored within a grazing plant community. Both the Schoenifeldia gracilis and Loudetia togoensis are increasers.

The Trend Evaluation System should be administered at 2-3 year intervals on permanently established plots. Following trends will provide information on the following important factors:

a. the vegetal cover by species and fluctuations in composition and vitality of individual plants;
b. soil erosion factor and effectiveness of existing vegetal cover to prevent erosion, and/or heal erosion, and indication of other surface abuse;
c. use of vegetation by grazing animals;
d. photographic record of individual Trend Evaluation Plot.

It will be necessary to periodically adjust stocking rates. Fluctuating rainy conditions can alter stocking rates slightly. Change of livestock class using the range may be necessary to better harvest the type of forage available. Adjustments can be made seasonally, but are more frequently beneficial over longer periods of time.

5.5.3.1 Establishing Trend Evaluation System

Trend Evaluation Systems are permanently established in 1 $meter^2$ plots. Initial actions included:

a. Identification of key species and the fixation of permanent marker.
b. Duplication on recording form of vegetal cover, by species. Perennial species are plotted by basal area (cm^2).

c. Estimation in percentage of vegetal composition, by species. Total plot represents 100% biomass.

d. Determination of the soil erosion factor and effectiveness of existing biomass to prevent erosion; indication of other surface abuse.

e. Determination of plant vigor by species.

f. Calculation of percent of biomass, by species, consumed by grazing animals, or cut by humans.

g. Photography horizontally and vertically of each individual 1 $meter^2$ plot.

<u>Sampling Period</u>. The best time to conduct the trend analysis each year is at or near the end of the growing season for the perennial species, and before the majority of species are cured to the pount of carrying range fires. For the most part, in Upper Volta, this period for analysis should be confined to early November (in heavy rainfall years) and as early as mid-October in dry years; that is to say, immediately following the rainy season.

<u>Equipment Needed</u>.

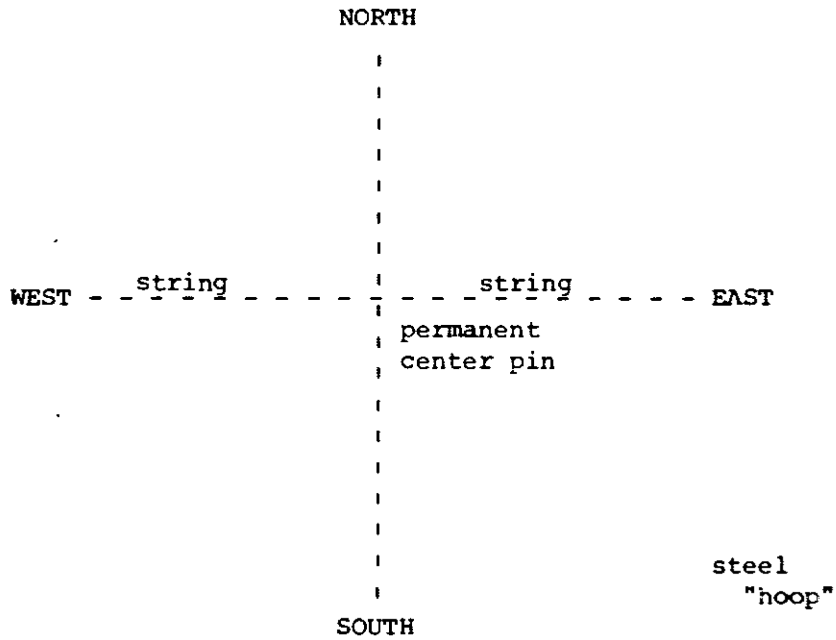
Recent aerial photos covering inventories area (50,000 scale).
Quantity of galvanized center pins (3/4" galvanized pipe), 50 cm long.
Hammer to drive center pin, 2 kg.
Quantity of recording forms/field use.
Quantity string.
Pocket meter measure.
Measuring wheel (metric).
Compass.
1 $meter^2$ round hoop (plot).
2 meter step ladder.
Chalk board (40 cm x 40 cm minimum dimensions)/white chalk.
35mm SLR camera w/28 mm lens.
Four survey pins.

RANGELAND TREND MONITORING SYSTEM

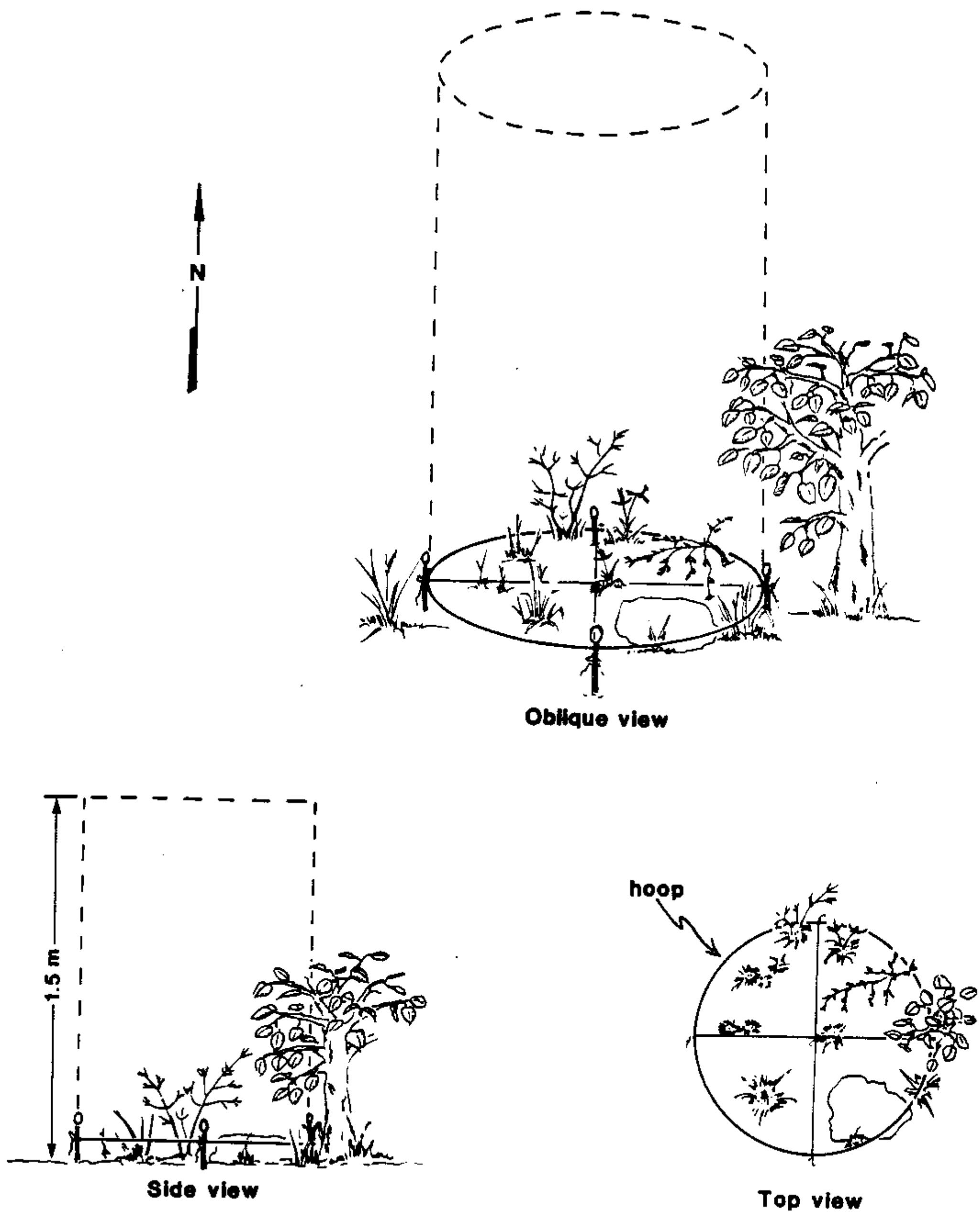
PHOTO-PLOT RECORDING TECHNIQUE

Sample (PLOT)

The sample area is a circular plot of 1 meter^2 divided into quarters. The center of the plot is permanently marked with a 1/2 - 3/4 inch galvanized pipe 50 cm long driven into the ground, leaving approximately 10 cm sticking out of ground for relocating the plot. The circular perimeter of the plot is temporarily marked by using an aluminum "hoop" cut and spliced from high tension electrical wire. The perimeter for a 1 meter^2 "hoop" is 3.545 meters (Figure 5.4).



The sample plot as vertically viewed.



Hoop Dimensions

area: 1 m^2 **diameter: 1.128 m**

radius: 0.564 m **perimeter: 3.54 m**

Figure 5.4 TREND ANALYSIS METHOD

The sample plot quarter divisions correspond with the points of a compass and are marked off by establishing a north-south magnetic compass reading over the center pin and placing survey pins 56 centimeters from the center of the center pin. The east-west quadrants are similarly established. A light string attached between the survey pins and falling over the center pin divides the plot in quarters and gives points of reference in which to reproduce locations of specific ground cover onto the recording form. Lastly, the 1 $meter^2$ "hoop" is placed inside the four survey pins forming the "sample plot."

Selection of Sample Plot(s). Rangeland trend monitoring plots are specifically selected within particular range types (ecosystems) that have already been mapped and analyzed. The number of particular plots relates to the homogeneity of the ecosystem. Sufficient number of plots to adequately monitor the ecosystem in desirable. Representative forage species, those preferred by grazing animals, should be targets of the monitoring system.

Plots should not be situated near drainages, livestock trails, roads, animal parks, watering points, villages, or vaccination parks.

Recording Ground Cover. Recording of trend plots' ground cover is by describing and duplicating on the recording form those conditions found actually within the sample plot, and quantifying their existence.

Photographs taken vertically and horizontally with color film will record the actual plot aspects and will assist in recognizing and identifying physical changes occurring within plot over the years. A 35mm single lens reflex camera equipped with a 28mm lens and Kodak Kodacolor II film is used to record the plots. A two-meter high step ladder is used to make the vertical photograph; the step ladder is placed one meter north of the "hoop."

Details are recorded by using distinct symbols for each plant species; litter and rocks are indicated by surface area in square centimeters. Everything within the 1 $meter^2$ sample plot to a height of 1 meter 50 cm is recorded.

Plant Reproduction. Plant reproduction (R) is noted by placing the appropriate letter for High (H), Medium (M), Low (L), or X-Low (X).

Plants Utilized. The part of the plant used by animals (U) is illustrated by estimating % of plant weight consumed by animal.

Plant Vitality. Plant vitality (V) is indicated by Robust (R), Maintenance (M), or Declining (D).

Vegetal Composition. The total vegetal composition (100%) is defined by composition percentage per species.

Basal Area. Basal area of plants, by species, is determined in cm^2.

Litter. Litter is measured and recorded in cm^2.

Rocks. Rocks are measured and recorded in cm^2.

Bare Ground. Bare ground is that portion of the 10,000 cm^2 not occupied by vegetation, litter, or rocks. Describe bare ground characteristics; e.g., smooth laterite, sandy, gravelly material, or alluvial soil.

Composition of Sample Plot. Compositin of trend plot is a factor of surface area over total plot surface of 10,000 cm^2.

Soil Erosion Factor. Soil erosion factor is selected from scale 0 (none) to 4 (severe). This is the same system used in analyzing erosion for the Range Inventory (see the "Guide to Range Resource Inventory"). If the erosion factor is going from one factor to another, indicate by an arrow in the direction of movement: e.g., $3 \rightarrow 4$.

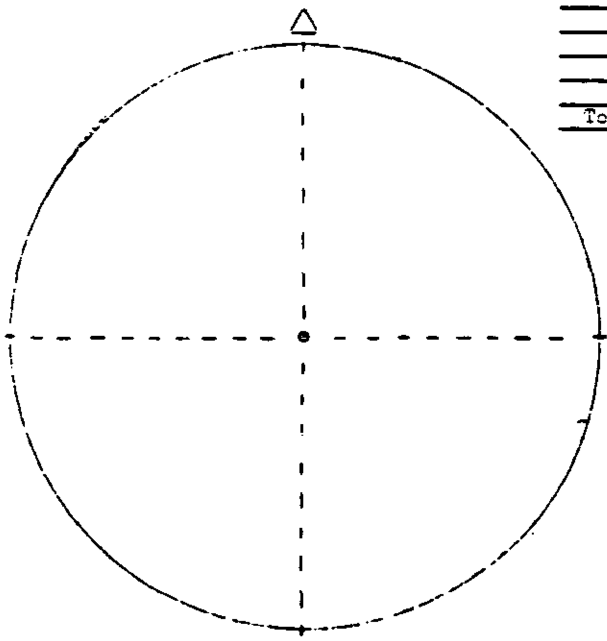
RANGELAND TREND MONITORING FORM

Write-up Number ____________ Date ____________ Site ____________ CRD ____________

Aerial Photo Number ____________ Examiner(s) ____________

Plot Location:

Plot Size ____________



GROUND COVER: % COMPOSITION:

Vegetation	*R-U-V-X	%	cm^2	
Total	X=	100		

Litter(X)	cm^2	
Total		

Rocks(X)	cm^2	
Total		

Bare Ground	cm^2	
Total		

TOTAL	10,000cm^2	100%

SOIL EROSION FACTOR: 0 1 2 3 4

* PLANT REPRODUCTION: High Medium Low X-Low

PLANT USED BY ANIMALS: % by weight

PLANT VITALITY: Robust Maintenance Declining

PROJET ELEVAGE VILLAGEOIS
GESTION DE PATURAGE NATURELLE
le 26-9-'79

5.6 LIST OF REPORTS PRODUCED

<u>1977</u> CID Team, 1977. Bi-Monthly Report. Village Livestock Program. 20 December, 1977. 7pp.

<u>1978</u> CID Team, 1978. Work Plan for CID Team. Upper Volta Village Livestock Project. February, 1978. (Second Revision)

CID Team, 1978. Plan de Travail pour l'Equipe CID. Project Elevage Villageois Haute Volta (Troisième revision) February, 1978.

CID Team, 1978. Semi-Annual Project Progress Report. CID Contract Team USAID, Village Livestock Project. ORD's Kaya, Koupela, and Fada. June, 1978.

CID Team, 1978. Village Livestock Project (Projet Elevage Villageois). Semi-Annual Progress Report. 1 July, 1978, through 31 December, 1978. Consortium for International Development, The University of Arizona, 85721.

CID Team, 1978. Bi-Monthly Report. Village Livestock Development. January 1, 1978, to March 1, 1978. 10pp.

CID Team, 1978. Bi-Monthly Report. Village Livestock Development. March 1, 1978 to May 1, 1978. 17pp.

CID Team, 1978. Bi-Monthly Report. Village Livestock Development. July 1, 1978 to September 1, 1978. 8 pp.

CID Team, 1978. Bi-Monthly Report. Village Livestock Development. September 1 to November 1, 1978. 17pp.

Guiao, Amadou. 1978. Rapport de stage. Project Elevage Villageois. Ministère du Développement, Direction des services de l'Elevage et des Industries Animales, République de Haute-Volta.

Koné, Abdoulaye. 1978. Rapport de Stage. Projet "Elevage Villageois." Ministère du Développement Rural, Direction des Services de l'Elevage et des Industries Animales, République de Haute-Volta.

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1978 Matlock, W. G. 1978. Trip Report. December, 1978. Village Livestock Project.

Vengroff, Richard. N.D. Local Livestock Management--Diseases and Health Practices. 31pp.

Vengroff, Richard. 1978. Report on Community Organization Work by the CID Team. Project Elevage Villageois.

1979 CID Team. 1979. Work Plan for CID Team. Upper Volta Village Livestock Project. January, 1979. (Fourth Revision)

CID Team. 1979. Bi-Monthly Report. Village Livestock Development. March 1 to May 1, 1979. 13pp.

CID Team. 1979. Bi-Monthly Report. May and June, 1979. 3pp.

CID Team. 1979. Bi-Monthly Report, Village Livestock Project. September-October, 1979. 17pp.

CID Team. 1979. Bi-Monthly Report, Village Livestock Development Project. January 1 to March 1, 1979. 11pp.

CID Team. 1979. Bi-Monthly Report, Village Livestock Project. July-August, 1979. 8pp.

CID Team. 1979. Baseline Report. Village Livestock Project.

Deffendol, Scotty. 1979. Rangeland Resource Inventory--Tafogo Site. Village Livestock Project. July, 1979. 123pp.

Henderson, Helen. 1979. Women's Role in Livestock Production; Final Report. The University of Arizona, Tucson, AZ. November, 1979. 53pp.

Maré, C. John. 1979. Village Livestock Project. Trip Report. 21pp.

Matlock, W. G. 1979. Trip Report. 19-24 September, 1979. Village Livestock Project. 9pp.

Matlock, W. Gerald. 1979. (Semi-) Annual Project Report. Upper Volta Village Livestock Project. 1 July to 31 December, 1979.

1979 McCullough, James. 1979. Assessment of Marketing Needs. Village Livestock Project. June, 1979. 12pp.

U. S. Agency for International Development. 1979. Amendment No. 4 to the Project Agreement Between the Government of the Republic of Upper Volta and the Government of the United States of America for Village Livestock Development. USAID Project No. 686-0203.

Vengroff, Richard. 1979. Baseline Data Report--Sociological Sector. Upper Volta Village Livestock Project. Consortium for International Development. 192pp.

1980 CID Team. 1980. Village Livestock Project. Supplemental Work Plan for Design of VLP Phase II. January, 1980.

CID Team. 1980. Village Livestock Project. Workshop Report. 3 March 1980. 7pp.

CID Team. 1980. Village Livestock Project Semi-Annual Report. January 1 to June 30, 1980. Consortium for International Development, The University of Arizona, Tucson, Arizona.

Deffendol, Scotty F. 1980. Rangeland Trend Evaluation System. Village Livestock Project, CID/AID. 11pp.

Kelly, Shawn T. 1980. Final Report. 28 January 1980. (Range Management)

Scott, Grant. 1980. Bi-Monthly Report. March-April, 1980. 11pp.

Scott, Grant. 1980. Livestock Sector Accomplishments. Village Livestock Project. October, 1980. 52pp.

Vengroff, Richard. 1979. Work Report, Sociological Sector. May-June-July, 1979. 2pp.

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5.7 BUDGET

(Estimate of Expenses to September 30, 1980)
Contract AID/afr-c-1338; Upper Volta

	Contract Budget	Expenses to June 30, 1980	Estimated Expenses Sept. 30, 1980	TOTAL Estimated Expenses
Salaries	$ 370,500.00	$350,434.27	$ 29,402.00	$379,836.27
Fringe Benefits	44,460.00	48,156.49	6,168.00	54,324.49
Allowances	181,695.00	42,570.16	7,465.00	50,035.16
Transportation and Travel	186,400.00	105,711.76	42,600.00	148,311.76
Other Direct Costs	108,684.00	57,010.41	20,000.00	77,010.41
DBA Insurance	(in other direct costs)	24,164.74	2,000.00	26,164.74
TOTAL DIRECT COSTS	891,739.00	628,047.83	107,635.00	735,682.83
Indirect Costs	156,611.00	122,292.79	22,651.00	144,943.79
G & A	125,802.00	84,492.42	13,000.00	97,492.42
TOTAL PROJECT COSTS	$1,174,152.00	$834,833.04	$143,286.00	$978,119.04

5.8 PROJECT GOAL DOCUMENTATION

This section presents the original versions of four documents which were important elements in the definition of the goals of the Upper Volta Village Livestock Project. Section 5.8.1 is the fourth amendment to the project agreement between the governments of the United States and Upper Volta. While Section 5.8.2 has been retyped, it is otherwise identical to the Operational Plan for the VLP as set forth in the Contract between the Agency for International Development (AID) and the Consortium for International Development (CID). The contract detailed the work to be performed by CID as part of the Project.

Section 5.8.3 is the final version of the CID team work plan containing the most detailed version available of the team's planned activities. Finally, Section 5.8.4 is a supplemental work plan for the design of the second phase of the Village Livestock Project.

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5.8.1 Amendment No. 4 to the Project Agreement

USAID Project N°686-0203

AMENDMENT N° 4

to the

PROJECT AGREEMENT

between

THE GOVERNMENT OF THE REPUBLIC OF UPPER VOLTA

and

THE GOVERNMENT OF THE UNITED STATES OF AMERICA

for

VILLAGE LIVESTOCK DEVELOPMENT

AMENDEMENT N° 4

à

L'ACCORD DE PROJET

entre

LE GOUVERNEMENT DE LA REPUBLIQUE DE HAUTE-VOLTA

et

LE GOUVERNEMENT DES ETATS-UNIS D'AMERIQUE

pour

LE DEVELOPPEMENT DE L'ELEVAGE VILLAGEOIS

FISCAL DATA:

Appropriation	: 72-11X1012
Allotment	: 812-52-686-00-69-91
Amount	: 181,000 $
Reference	: State 60629 March 11,1979

PROJECT N° 686-0203

The Project Grant Agreement between the Government of the Republic of Upper Volta and the Government of the United States of America, dated May 31,1976 (amended October 8,1976 and December 30,1976), the Project Grant Agreement dated December 30,1976,and the Project Grant Agreement Amendment N°3 dated March 29,1978 is hereby amended as follows :

Annex A, Section VII: Financial Contributions

To assist the Government of Upper Volta (GOUV) to meet the costs of carrying out the Project, USAID, pursuant to the Foreign Assistance Act of 1961, as amended, agrees to grant the GOUV under the terms of this Agreement not to exceed one million nine hundred ninety-four thousand United States Dollars (U.S. $ 1,994,000), consisting of $ 1,813,000 prevously obligated and $ 181,000 obligated by this Amendment.

The Grant may be used to finance foreign exchange costs and local currency costs of goods and services required for the Project under the following cost components:

ITEM	Amount
1. Personnel (Contract Services)	$ 1,181,700
2. Training (Participants)	92,600
3. Commodities	276,800
4. Other Costs	442,900
TOTAL USAID	1,994,000

PROJET N° 686-0203

L'Accord de Subvention pour le Projet entre le Gouvernement de la République de Haute-Volta et le Gouvernement des Etats-Unis d'Amérique conclu le 31 mai 1976 et amendé les 8 octobre 1976 et 30 décembre 1976, ainsi que l'Accord de Subvention pour le Projet, daté du 30 décembre 1976 et amendé le 29 mars 1978 est amendé comme suit:

Annexe A, Section VII: Les Contributions Financières

Pour assister le Gouvernement (GOUV) à financer les frais de l'exécution du Projet, l'USAID, conformément à la Loi de 1961 sur l'Aide Etrangère telle qu'amendée, accepte d'accorder au GOUV sous les termes de cet Accord une somme qui ne dépassera pas le montant de un million neuf cent quatre-vingt quatorze mille Dollars des Etats-Unis (E.U. $ 1 994 000) dont $1 813 000 précédemment alloués et $181 000 alloués par le présent Amendement.

La Subvention peut être utilisée pour financer les frais en devises étrangères et en monnaie locale pour les biens et services nécessaires au Projet et repris sous les rubriques suivantes :

DESIGNATION	Montant
1. Personnel (Services sous contrat)	$ 1 181 700
2. Formation (participants)	92 600
3. Aménagements	276 800
4. Autres frais	442 900
TOTAL USAID	$ 1 994 000

The Project Activity Completion Date (PACD) is hereby extended from September 30,1979 to September 30,1980.

All other conditions of the original Grant Agreements, as amended, remain unchanged.

IN WITNESS WHEREOF, the United States of America and the Government of the Republic of Upper Volta, each acting through its duly authorized representative, have caused this Amendment to be signed.

FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA

BY : ______________________
Thomas D. BOYATT

Title : Ambassador of the United States of America

Date

La Date d'Achèvement d'Assistance au Projet (DAAP) est ainsi prolongée du 30 septembre 1979 au 30 septembre 1980.

Toutes les autres conditions des Accords de Subventions originaux, comme amendés, restent inchangées.

EN FOI DE QUOI, les Etats-Unis d'Amérique et le Gouvernement de la République de Haute-Volta, chacun agissant par son représentant dûment mandaté, ordonnent que cet Amendement soit signé.

POUR LE GOUVERNEMENT DE LA REPUBLIQUE DE HAUTE-VOLTA

PAR : ______________________
Georges SANOGOH

Titre : Ministre du Plan et de la Coopération

Date :

FUNDS AVAILABLE :

By : ______________________
Gary L. Byllesby

Title : Acting Mission Controller

5.8.2 Contract No. AID/afr-C-1338, Appendix A--Operational Plan

APPENDIX A - OPERATIONAL PLAN

I. STATEMENT OF OBJECTIVES AND GENERAL PLAN OF WORK

A. OBJECTIVES

The major objective of the services to be performed under this contract is to assist the Upper Voltan National Livestock Service and three selected semi-autonomous Governmental Area Development Organizations (Kaya, Koupela and Fada N' Gourma) in planning, designing and implementing livestock projects and/or programs for small rural livestock producers at the village level. Specific objectives include:

1. Assisting selected villagers to improve animal health through a concentrated program of vaccination and internal and external parasite control, improved feeding practices, and animal selection.

2. Assisting livestock owners in exploring methods of farm finishing and fattening.

3. Exploring with indigenous village social and power structure the possibility of developing grazing reserves through the organization of grazing associations.

4. Initiating a controlled grazing program in one or more selected villages.

5. Assisting selected village leaders with determining the validity of present burning practices and developing methods for controlling excess burning of grasses, shrubs and forbs.

6. Providing training opportunities in livestock production management for extension agents, future leaders of livestock projects and village livestock personnel.

B. DESCRIPTION OF SERVICES

The Contractor shall provide the services of a team consisting of a Range Management Specialist, a Rural Sociologist and a Livestock Specialist. They will work under the technical direction an[illegible] guidance of the Upper Voltan Project Director and the AID Project Manager who is also Co-Director of the project. The services of a [illegible] Scientist, a Veterinarian, and an [illegible] Statistician will also be provided on a short term basis.

The technicians will carry out the following specific tasks:

1. Range Management Specialist

~~This specialist will:~~

Duties:

a) conduct a baseline survey to determine present range conditions and utilization

b) design and implement sound management practice schemes including reseeding, water development, grazing patterns, stocking rates, controlled burning, (as determined by the data), in support of the overall project.

c) design and set up range nutrition analytical laboratory (to include facilites for energy, nitrogen, phosphorous and in-vitro analyses).

d) conduct nutritional analysis of the forage in order to establish a research basis and to support experimental research basis and to support experimental reserarch.

e) train and advise a local counterpart in all pertinent aspects of range management.

f) assist the Livestock Specialist in carrying out his duties where possible.

g) work with village, local government, and expatriate individuals in demonstrating the need for, and the gain from, improved range practices.

h) design, conduct and implement resource development demonstration. The Range Management Specialist must be acutely aware of the sociological, religious and economic constraints of the developing country.

Qualifications:

a) minimum of a masters degree in Range Management

b) five years experience in livestock handling

c) two years experience in range laboratory and field techniques (preferred)

d) French speaking - S-2/R-2 level

e) professional overseas experience in a West African, preferably French speaking country, or other developing country

2. <u>Livestock Specialist</u>

This specialist will:

<u>Duties</u>:

a) conduct a baseline survey to determine present range conditions and utilization.

b) design and implement sound management practice schemes including reseeding, water development, grazing patterns, stocking rates, controlled burning, (as determined by the data), in support of the overall project.

c) design and set up range nutrition analytical laboratory (to include facilities for energy, nitrogen, phosphorous and in-vitro analyses).

d) conduct nutritional analysis of the forage in order to establish a research basis and to support experimental research.

e) train and advise a local counterpart in all pertinent aspects of range management.

f) assist the Livestock Specialist in carrying out his duties where possible.

g) train and advise local counterpart in all pertinent aspects of improved livestock management.

h) work with village, local government, ministry and expatriate individuals in demonstrating the need for, and the gain from improved livestock management.

i) in carrying out his duties, the Livestock Specialist must be acutely aware of the sociological, religious and economic constraints of the developing country.

<u>Qualifications</u>:

a) minimum of a Masters degree in Range Management

b) five years experience in livestock handling

c) two years experience in range laboratory and field techniques (preferred)

d) French speaking - S-2/R-2 level

e) professional overseas experience in a West African, preferably French speaking country, or other developing country.

3. Rural Sociologist

This specialist will:

Duties:

a) assist team members and COUV in selecting villages and village complexes where livestock program will have high degree of success.

b) assist team members in working with the indigenous social power structure in redefining the problem areas based on local traditions, values and conditions.

c) assist team members and village legitimizers in identifying alternative solutions to the identified problems and set priority for solutions.

d) assist team members and village hierarchy in devising practical methods for program implementation.

e) conduct studies in the selected villages and village complexes that will further clarify the complexity of land tenure, livestock ownership and grazing patterns.

f) assist in training ORD staff (directors, veterinary nurses and extension agents) in community development procedures.

Qualifications:

1) minimum of masters degree in rural sociology.

2) seven years experience in working with community leaders in community development type programs (preferred).

3) French speaking - S-2/R-2 level

4) professional experience in a French speaking country (preferred).

4. Veterinarian

This specialist will:

Duties:

a) assist the Livestock Specialist in instituting a continuing program directed at treating and controlling ovestock disease and disorders.

b) train local veterinary assistants in identification and treatment of livestock's diseases and disorders.

c) work with government level individuals in the Department of Veterinary Services in designing and implementing the livestock health program

d) returning periodically to conduct seminars or supporting work in the veterinary discipline.

Qualifications:

a) degree in Veterinary Medicine, with emphasis in Live-stock area.

b) experience in diagnosis and teatment of livestock maladies.

c) French speaking (preferred)

d) professional experience in a French speaking country (preferred)

5. Soil Scientist

This specialist will:

Duties:

a) assist the Range Management Specialist to conducting a baseline survey by implementing a detailed soil survey of the project area.

b) conduct chemical analysis of soil samples to aid in detecting possible deficiencies. The analyses will probably be done outside of Upper Volta, preferably in a U.S. university.

c) There exists the possibility that the individual described will be asked to return periodically to conduct similar or supporting surveys and experiments.

Qualifications:

a) minimum of a masters degree in Soil Science

b) experience in soil survey and analysis

c) French speaking (preferred)

d) university connected (preferred)

e) professional experience in a French speaking country (preferred)

C. REPORTS

Technicians assigned to the project will submit the following reports:

(a) Bi-Monthly Status Reports covering project endeavors, problems and required actions. This is a personal report to be submitted by each technician.

(b) Bi-Annual Project and Team Report covering all project activities including progress, adherence to implementation plan, areas of concern, future plans and required actions. This report will be submitted to the CDO/Upper Volta in 20 copies of which ten (10) copies will be in French.

(c) Others reports as may be required.

(d) TDY Personnel will submit one report covering each month of their TDY status.

5.8.3 Work Plan for CID Team

WORK PLAN FOR CID TEAM

UPPER VOLTA VILLAGE LIVESTOCK PROJECT

January 1979

FOURTH REVISION (Tentative)

TABLE OF CONTENTS

STATEMENT OF OBJECTIVES

Objectives:

The major objective of the service to be performed under this contract is to assist the Upper Voltan National Livestock Service and three selected semi-autonomous regional development organizations (ORD's of Kaya, Koupela and Fada N'Gourma) in planning, designing and implementing livestock projects and/or programs for small rural livestock producers at the village level. Specific objectives as provided in the Project Agreement include:

a. Assisting selected villagers to improve animal health through a concentrated program of vaccination and internal and external parasite control, and animal selection.

b. Exploring with indigenous village social and power structures the possibility of developing grazing schemes through the organization of livestockmen's associations.

c. Explore the feasibility of initiating a controlled grazing program in one or more selected sites, and the possibility of creating a major Range Management Research Reserve in at least one ORD.

d. Assisting selected village leaders with determining the validity of present burning practices and developing methods for controlling excess burning of grasses, shrubs and forbs.

e. Providing training opportunities in livestock production management for extension agents, future leaders of livestock projects, and village livestockmen.

f. Examine the possibilities for animal selection and farm feeding for special markets.

General Comments:

A team approach was used in developing the work plan to insure a multidisciplinary effort. Major responsibilities for each team member are based upon disciplinary specialization and are indicated in the plan. The work plan is written in greater detail for the first project year than for subsequent years.

The work plan consists of two parts. The first part is an overall time schedule and a personnel chart for AID contract, National Livestock Service, and Voluntary Service Personnel. Approximate scheduling of major activities is shown and will be refined from time to time. Short term AID Contract staff designated as "other" cannot be identified at the present time and will be added later. The second part is a detailed work plan identifying specific activities for each team member and a time frame for these activities.

PART I - TIME SCHEDULE (suite)

UPPER VOLTA VILLAGE LIVESTOCK PROJECT

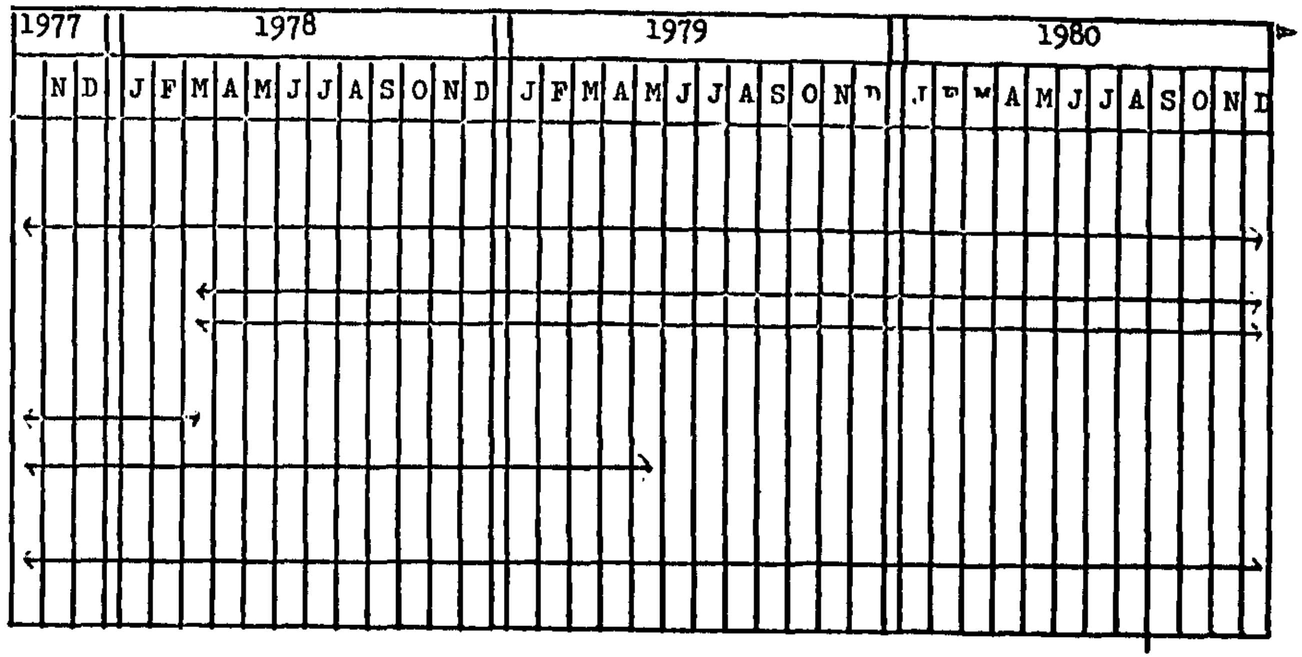
National Livestock Personnel

1 Project Director (Veterinary doctor)
0 Homologues
3 Veterinary Nurses

Voluntary Services Personnel

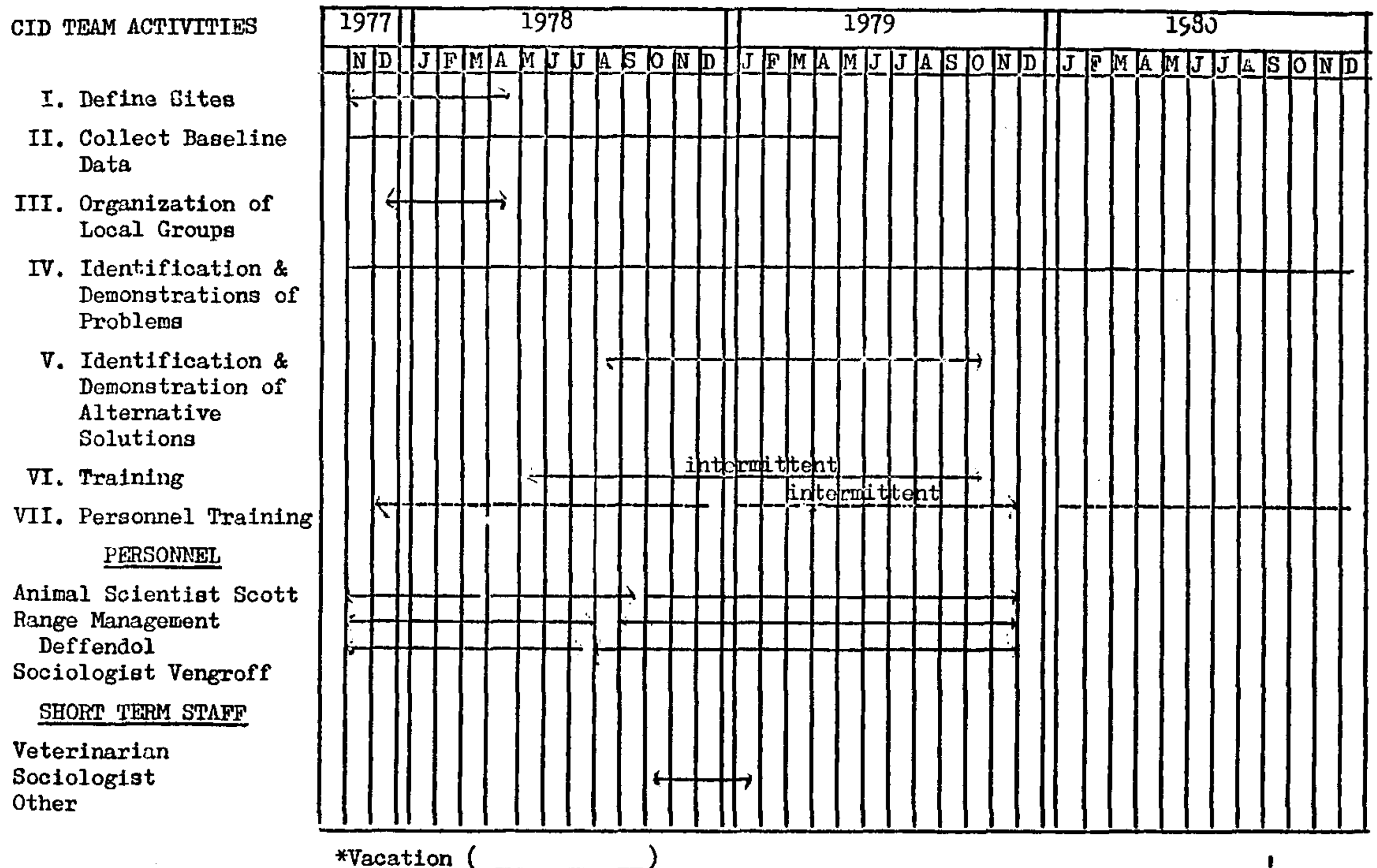
1 Dutch volunteer
3 American Peace Corps Volunteers

12 Extension Agents (Encadreurs)



PART I - TIME SCHEDULE

UPPER VOLTA VILLAGE LIVESTOCK PROJECT



PART II

PLAN OF WORK

I. DEFINING SITES

A. Introduction

All project "sites" had been selected before the arrival of the CID Team in Upper Volta. However, the general conception of what constituted a site was extremely vague. Each site was named for a village in which project encadreurs were based, but what territory or other villages were to be logically included remained undefined.

One major difficulty regarding site selection is the tremendous number of problems involved in any effort to conduct extensive and preliminary implementation activities in sites spread 300 km. from the base of operations in Ouagadougou. In order to make it possible to obtain realistic baseline data and to achieve project objectives, the team has found it necessary to order the sites in a more manageable fashion. Two sites have been selected, Gnanguedin (Koupela) and Tafogo (Kaya), in which extensive work will be done in the initial phase of the project. More limited well defined efforts will be undertaken in four additional areas: Ougarou site (Fada) and Moaga site (Koupela).

B. Activities and Time Frame

Time Frame: November 1977 through March 1978 (Team)

1. Initial contacts with local leaders-village chiefs, chiefs of quartier, canton chiefs, are being or will be made.

2. Initial contacts with ORD level personnel- Directors, Elevage, Agriculture, extension personnel, are being or will be made.

3. Sites, and tasks to be undertaken in each, are defined.

4. Site priorities have been proposed as follows:

   a. Extensive work in initial phases of project: Gnanguedin and Tafogo sites (15-30 villages per site)

   b. Limited preliminary efforts to be followed by extensive work in later stages of the project in Namoungou, Ougarou, Koukoundi and Gourgou-Moaga sites.

II. COLLECTION OF BASELINE DATA

A. Introduction

There is little reliable data on the livestock production systems in the project areas. The team will collect, analyse and assemble relevant data in a baseline survey. The baseline data will be employed to assist the team in identifying problems which exist and will serve as a standard against which changes resulting from project interventions will be measured.

The CID team does not view data collection as an end in itself. The goal will be to achieve a balance between the continuing demands for additional data and the need to initiate implementation activities.

B. Activities and Time Frame

1. Physical resources (Deffendol)
(Tafogo and Gnanguedin sites)
Time Frame: November 1977 to January 1980

Definition of physical resources, their conditions and utilization will be divided into resource areas: (1) immediate high density areas, (e.g. villages), (2) cultivated or agricultural areas, (3) grassland, and (4) wooded areas. With the aid of aerial photography (when available) each area will be clearly mapped and described.

The following data will be gathered:

a) Water resources and estimates of volume; including seasonal surface water, year round surface waters and man made barrages, traditional wells and permanent lined wells.

b) Vegetation will be described by scientific nomenclature in each Resource Area. Percentage, composition, and density of particular species will be determined. Range trend and carrying capacity studies will be initiated.

c) Burning areas will be defined in each Resource Area and effects on vegetation will be examined.

2. Human resources and interactions (Vengroff)
   Time Frame· November 1977 to January 1979

   a) Delineation of demographic characteristics (all sites)
      Time Frame: November 1977 to April 1978 (Gourgou-Moaga, April 1979)

      1) Population
      2) Ethnic composition
      3) Concession composition
      4) Quartiers
      5) Economic orientation and specialization

   b) Propensity for innovation (all sites): identification of characteristics associated with and possibilities for adoption of new techniques of production by villages populations: elite and mass surveys
      Time Frame: November 1977 to June 1978

      1) Questionnaire design
      2) Preliminary testing and modification of questionnaire
      3) Translations into (oral and written) More, Gourmantche, and Peulh
      4) Training of interviewers in use of questionnaire (on site)
      5) Test in a village site (Koukoundi)
      6) Sample design and selection
      7) Survey implementation in select villages in all sites and remaining secondary site
      8) Data coding, processing and analysis

   c) Land tenure (Ougarou, Tafogo and Gnanguedin sites)
      Time Frame: December 1977 to December 1978

      1) Delineate political boundaries between all villages in principal sites
      2) Determine land tenure rights- especially with reference to pastureland
      3) Examine dynamics of decision-making and change in village land tenure systems

   d) Social and economic relations between agriculture and animal husbandry (Ougarou, Tafogo, Gnanguedin,

Namoungou, Koukoundi)
Time Frame: December 1977 to February 1979

1) Expansion of the bush fields and gardens into pasturelands
2) Wells and water supply usage (livestock, human, garden)
3) Water rights

e) Social and economic basis for burning (Gnanguedin, Koukoundi and Namoungou)
Time Frame: January 1978 to February 1979

1) Burning by farmers
2) Burning by herders
3) Other causes of burning

f) Socio-economic interactions between ethnic groups (Gnanguedin, Koukoundi and Namoungou)
Time Frame: December 1977 to February 1979

1) Contractual herding relationships
2) Inter-ethnic perceptions
3) Contemporary interactions- positive and negative (e.g. fertilization of fields, destruction of fields by livestock)
4) Transhumance patterns

g) Livestock Management and decision making (village level)- (Ougarou, Tafogo, Koukoundi, Gnanguedin, Namoungou)
Time Frame: February 1978 to March 1979

1) Livestock management survey- animal health, traditional Pasture Management, Transhumance Patterns, local marketing rationality
2) Delineation of leadership patterns
3) Identification of traditional basis for influence
4) Administrative basis for influence
5) Decision making in the area of livestock raising
6) Identification of potential leadership cadres for organizations of livestock producers and grazing associations
7) Women's role in livestock production- with Helen Henderson, October 1978 - May 1979

3. Animal and poultry resources (all sites) (Scott)
   Time Frame: November 1977 to May 1979

   a) Breed types and herd composition
      Time Frame: November 1977 to May 1979

      1) Characteristics
      2) Functions or utility (Milk, meat, work, other)
      3) General herd or flock composition (sex, age, and seasonal condition)

   b) Ownership
      Time Frame: November 1977 to April 1979

      1) Transhumant characteristics: corridors of transhumance as related to pasturage and village cropping
      2) Sedentary characteristics: village herds or flocks and animal traction as related to village cropping system

   c) Diseases, disorders and their characteristics
      Time Frame: November 1977 to May 1979

      1) Communicable and non-communicable diseases
      2) External and internal parasites
      3) Degree of debilitation and/or economic factors of prevalent disorders
      4) Existing control or treatment
      5) Other

   d) Economic factors and marketing
      Time Frame: November 1977 to May 1979

      1) Market locations and livestock exports
      2) Sale trends and prices by month and reason in each location
      3) Abattoirs
         a) located in larger cities and their functional characteristics
         b) located in small towns and small villages and their characteristics
         c) quality control and animal health inspections
      4) Marketing as related to production market demands

4. Livestock production and range management

   a) Livestock production technology (all sites) (Scott)
      1) Production data collection

Time Frame February 1978 to May 1979

Genetics, physiology, nutrition and feeding, water supply, protection (diseases, pests and predators), environmental control, herding treatment and medication, offtake or sales, slaughter, processing by-products, storage, transportation and marketing.

2) Examination of current management practices
Time Frame February 1978 to May 1979

Record keeping, integration of all production activities, group action or cooperative membership, use of non-family labor, planning and timeliness of herd combinations and conservation of resources.

3) Examine existing infrastructures
Time Frame: February 1978 to May 1979

Transportation, storage, markets and marketing outlets, financial services, inputs, processing transfer of knowledge and policy.

b) Range management technology (Deffendol)
Time Frame: November 1977 to January 1979
(Tafogo and Gnanguedin sites)

1) Examine existing physical grazing/herding infrastructure
-herding hierarchy/daily/long term herding
-grazing land rights
-water rights
-allocation of agriculture land
-grazing patterns and seasonal use
-influence of burning
-water management
-forest and game reserves
-pasture reserves
-sale of animals and direction of sales
-cattle routes
-agriculture and livestock integration
-coping with drought

2) Examine vegetative change by comparing aerial photos of 1955 and 1974

   -tree canopy
   -forages species
   -vegetation classes

3) Land-use classification into resource areas (Management Areas)

   -immediate high density area (villages)
   -cultivated or agricultural area
   -grassland area
   -forest-wooded area

III. ORGANIZATION OF LOCAL GROUPS

A. Introduction

Local organizational efforts will be undertaken in each site in order to maximize mass input into the definition of problems, the setting of priorities, and the identification of solutions. Furthermore, local groups can provide a mechanism whereby village livestockmen may assist with project implementation and channel feedback regarding project efforts.

B. Activities and Time Frame (Team)

1. Community organization work in Tafogo, Ouagarou, Namoungou, Gnanguedin, Gourgou-Moaga sites to establish functioning committees of livestockmen.
   Time Frame: December 1977 to April 1978 (Gourgou-Moaga, April 1979) and to assist with committee operations
   Time Frame: January 1978 to September 1979 (periodic)

   a) Make contacts in all villages in each site to explain the project and its general goals
   b) Design and explain the functions of a site-wide committee of livestock producers
   c) Select villages and neighborhoods which will choose representatives
   d) Insure adequate (equitables) representation of all ethnic groups, types of livestock producers, local traditional leaders and local opinion leaders
   e) Instruct villagers in work of representatives and the

mechanism for selection

f) Coordinate timing of meetings of site village livestock committees with project team members

g) Observe interactions of/and assist each committee in coordinating its goals with project goals

h) Develop a regularized system for local inputs and feedback to project activities ideas and proposals

i) Develop village level livestock committee and increase contacts between extension agents and individual livestockmen.

2. Develop and implement a vaccine delivery system in all sites in coordination with the National Livestock Service, and local livestockmen's association (Team)
Time Frame: Duration of project

IV. IDENTIFICATION AND DEMONSTRATION OF PROBLEMS

A. Introduction

Problems which will be identified in the baseline survey. A preliminary set of priorities will then be established for dealing with these issues. Local perceptions of problems may not always be in accord with their technical identification. Where differences occur it will be necessary to design and implement demonstrations of the "need for change". These demonstrations must be carefully designed on a sound social and technical basis to achieve the desired effect in the given locale (environment).

B. Activities and Time Frame

1. Livestock and health (Scott)
Time Frame: April 1978 to April 1979

a) Measurement of livestock nutrition and livestock health problems and needs

b) Design of demonstration of needs for improved nutrition and improved animal health

c) Design of demonstration of needs for projects in livestock fattening and finishing

2. Resource depletion and quality (Deffendol)
Time Frame: March 1979 to May 1980

a) Vegetation: nutrition value, vigor, quantity, regeneration, and distribution

1) Start measuring long and short term vegetative trends by establishing permanent measuring points in Tafogo and Gnanguedin sites
2) Establish vegetative canopy inventory in Tafogo and Gnanguedin sites (tree inventory)

b) Water: distribution, accessibility and brief notation of quality

3. Burning (Deffendol)
Time Frame: December 1977 to January 1980 (Gnanguedin and Tafogo sites)

a) Quantitative surface area burned
b) Frequency of burn
c) Observed ecological effects of burning

4. Demonstration of Range Management (Deffendol)
Time Frame: March 1979 to May 1980

a) Establish in Tafogo and Gnanguedin sites fenced study plots of .5 and 50 hectares, and an exclosure plot of .5 has. at Koukoundi village site (pending availability of material and labor)

1) Exclosure plots are control plots where all domestic livestock are fenced out. These plots are .5 hectares.
2) Inclosure plots are grazed plots whereby a known number of a given type of domestic animal is contained within a known surface area for a known period of time. These plots are used in establishing carrying capacities of certain vegetative types. Plots are to be a minimum fenced area of 50 hectares.

b) Purpose of plots

1) Demonstrate useful, as well as harmful effects of burning; seasonal differences in burning: effect on vegetative composition and vigor of plants, as well as plant reproduction
2) Establish carrying capacities for a known vegetative type

3) Demonstrate to all livestock and management groups actual vegetative and animal condition differences between control plot (enclosure and pastures adjacent to it)
4) Demonstrate advantages of having control over animal movement within a certain pasture condition

5. Preparations of problems involving livestock, Tafogo, Koukoundi, Ougarou, Namoungou and Gnanguedin sites (Vengroff)
Time Frame: January 1978 to March 1979

   a) Preliminary identification of problems by:

      1) Regional (technical and administrative)
      2) Local level dealers
      3) Organizations (livestockmen's association)

6. Individual level identification of problems- Livestock Management Survey

   a) Methods of implementation

      1) Survey questionnaire design
      2) Preliminary testing and modification
      3) Translation into More, Gourmantche and Peulh
      4) Training interviewers
      5) Field testing: Koukoundi site
      6) Sample design and selection
      7) Data coding and processing
      8) Data analysis and final support

V. IDENTIFICATION AND DEMONSTRATION OF ALTERNATIVE SOLUTIONS

A. Introduction

Concrete activities, such as the implementation of the vaccination program, which have been initiated, will continue throughout the project life. Other activities, justified by analysis of the baseline data, will be tested or demonstrated before final implementation.

Lines of communication will be established with other organizations working in the livestock and related sectors to maximize the possibilities for coordination of efforts.

B. Activities and Time Frame

1. Controlled and coordinated grazing (Team)
Time Frame: Beginning August 1978 and continuing through the life of the project

It must be determined if it is possible on any level, local, regional, or national to establish nationalized land use policies which will allow for the establishment of voluntary controlled and coordinated grazing schemes.

Feasibility studies and an examination of implementation methods pertaining to these schemes are the tasks to be undertaken in the first few years of the project.

a) Administrative and social infrastructure (Team)
Tafogo and Gnanguedin sites

1) Organize and involve an ORD level planning committee (Regional Committee) in the feasibility of efforts and in the determination of implementation methods.
2) Coordinate efforts with other technical services and national projects; Elevage Service, AVV, and Agricultural Services
3) Develop understanding of land-use planning practices within the site of Livestockmen's Committees.

b) Develop a Site Grazing Scheme in the Tafogo site in which:

1) A known land surface will support a known number of cattle, sheep, and goats for a known period of time without adverse effect on the natural environment;
2) Grazing relief will be given certain vegetative areas during a growing, producing, and germination cycle (one year)
3) A livestockmen's group within each site will control and administer terms-of-use within each site, and safeguard the integrity of the site grazing scheme vis-a-vis agriculture production within an overall land-use plan;
4) Agricultural interest will not infringe upon

grazing zones for agricultural purposes;

5) Adequate stock water will be provided so as to have no adverse effect on the natural environment. Human water resources will also be an important consideration in high density (e.g. village) areas: so as to have no adverse effect on the natural environment.

c) Develop a site grazing reserve (Gnanguedin, ORD Koupela)

1) The purpose is to create a large Pasture Reserve Area whereby pressures from expanding agriculture would be eliminated and where long term practical grazing studies and more scientific environmental studies would be undertaken.
2) Management of the long term practical grazing studies would be undertaken by National Livestock Service Personnel trained in Range Management in close collaboration with the ORD and the Livestockmen's Committee of Gnanguedin. The ORD would be the planning and their constituents would be the users of the Pasture Reserve.
3) Livestock permitted on the Reserve Pasture Scheme (see "a" above) would herds with prior tenure (perhaps three years) in either the reserve area or the Gnanguedin site villages or pasture.
4) A small parcel within the reserve would be used for scientific range management studies:

a) Grass reseeding plots
b) Long range trend studies
c) Adjusted grazing capacities

5) The reserve would not be fenced but would depend on natural well-defined boundaries and regional and local administrative authority to guarantee its integrity.

2. Develop a livestock production scheme demonstrating what can or cannot be done about the following: (Scott)
Time Frame: November 1978 to September 1979

a) Animal and poultry health

1) Continued and strengthened vaccination programs for large and small ruminants
2) An expanded health program to include:

    a) farm poultry and swine vaccination activities (if feasible or profitable), and
    b) antiparasitic practices, both external and internal for all animals.
    c) the installation, as required, of properly constructed and adequate vaccination parks in all sites (depending upon availability of material and labor.)

b) Nutrition, including feeding facilities

1) Introduction, demonstration and establishment, with selected cooperating farmers of additional farm forage and hay crops to be grown in a program designed to alleviate low-level nutrition of animals during dry seasons and to maintain working and breeding animals in good condition until seasonal forage and grasses are available.
2) Establishment and production of high energy forages for preservation and use in a farm feeding program with selected cooperating farmers. This effort will be designed to increase farm income by providing fattened or better finished animals for local markets.
3) Mineral and salt feeding supplement for all sedentary ruminant livestock and for range livestock.
4) Country-wide investigations of the availability of high energy waste bi-products, at economical prices, that can be utilized as supplemental feed for fattening or finishing farm animals.

c) Management of livestock

1) An innovative livestock management program designed to synchronize breeding and partuition seasons with seasons of higher natural grass and forage production.
2) A program for the adoption of scientifically accepted livestock practices which will help to alleviate the high post-birth mortality rate of

young animals.

d) Poultry Production Project

1) Extension training encadreurs
2) Vaccination training encadreurs
3) Cost-benefit analysis to determine feasibility and/or profitability of poultry production for average farmer.

VI. TRAINING

A. Introduction

Expansion of knowledge concerning project activities and technical inputs such as range management principles, livestock, production, community organization, identification and treatment of livestock diseases are essential. Recycling and additional in-service training will occur regularly.

Training activities will commence early in 1978 and be conducted at intervals throughout the project life. Training for personnel of the Livestock Service will be arranged and coordinated with the schedules for programs and personnel established by the Livestock Service. Training for Extension Agents (Encadreurs) and local livestock procedures will be an on-going process throughout the life of the project. Training for local livestock producers will begin when the team has achieved an understanding of local conditions and problems.

B. Activities and Time Frame (Team)

1. Livestock Service Personnel:
Time Frame: Quarterly - 3 day
Training and Orientation Session Ouagadougou: 1978, April 3, 4, 5; July 5, 6, 7; October 2, 3, 4; 1979, January 8, 9, 10; April 2, 3, 4; July 9, 10, 11.

a) Personnel

1) Three Livestock Assistants
2) Six Veterinary Nurses

b) Topics:

1) Project orientation and discussion
2) Improved livestock production
3) Veterinary medicine
4) Principles of range management

2. Extension Agents (all sites)
Time Frame: Quarterly- training and refresher course, 1978-1984, Ouagadougou

a) Personnel: Twelve project encadreurs
b) Topics:

1) Extension Methods
2) Improved livestock production
3) Identification and treatment of diseases and disorders
4) Community Organization
5) Data gathering and recording
6) Principles of range management

3. USAID Participant trainees- July 1, 1978-July 28, 1978

a) Range Management trainees
b) Animal Production trainees

VII. REPORT PREPARATION

A. Introduction

Reporting of project progress is an on-going activity throughout the life of the project. The Baseline Survey Report will present information obtained about livestock production systems in the project area. It will be presented in June 1979. End of tour reports of the individual scientists will provide the basis for a final report. All short-term staff members will prepare narrative reports before leaving Upper Volta

B. Activities and Time Frame (Team)

1. Bi-monthly written progress report to GOUV and AID (November and December 1977 and every 2 months thereafter)
2. Semi-annual written progress report to GOUV, AID and CID. (December and June each year)
3. Planning, coordination and evaluation report to ORD staffs at Kaya, Koupela and Fada.

4. Baseline written progress report to GOUV, AID and CID (June 1979)
5. Final written progress report to GOUV, AID and CID (September 1979)

VIII. IMPLICATIONS FOR THE FUTURE

It is felt that the implementation of this program of work will serve to facilitate the development of programs which can:

1) increase the efficiency of livestock production;

2) develop successful range and livestock technical packages which can be implemented under similar conditions in other areas in Upper Volta;

3) increase the standard of living of rural livestockmen;

4) decrease environmental degradation and uncertainty brought on by intermittent drought conditions;

5) increase grassland productivity and accessibility;

6) establish a local organizational capacity for the introduction and management of new techniques of animal production;

7) improve the capabilities of the livestock service at the national and regional levels and provide the basis for the development within the National Livestock Service of a livestock extension program to the village level;

8) establish research and training capabilities between the project and University of Ouagadougou in range management.

Although a start will be made toward all these goals in the first two years of the project, it must be noted that their achievement is a long-term process which will require continued efforts by the GOUV and donor nations.

5.8.4 CID Village Livestock Project--Supplemental Work Plan for Design of VLP Phase II, January 1980

1. - hold a series of informal workshops to discuss proposed Phase II activities
2. - carefully select a small group of people who will participate actively and openly (Dr. Sionne, ORD representative, Livestock Service field personnel, male and female livestock producers, Rural Animation representative, ONERA representative, USAID representative, World Bank or German technical assistance team representative, all VLP personnel).
3. - procedure

   3.1. distribute discussion paper of identified problems (Chapter 4 of Baseline Report) to selected participants in advance; allow them time for its study. (Chapter 4 must be translated immediately into French and also somehow communicated to livestock producer participants.)

   3.2. develop subproject ideas according to the following format:

   name of subproject

   objectives -- what is to be accomplished

   justification -- why it's important enough to be done

   what will be done -- step by step process

   who will do it -- Voltaics/expatriates, professional/technical

   where it will be done -- locations, number of sites

   when it will be done -- year, season

   what parallel development is required -- infrastructure

   how much it will cost -- local/donor funds

   evaluation - how accomplishments will be measured

- subprojects may be action oriented or research oriented or a combination of the two
- VLP team is to do this internally first to "perfect" the form and become familiar with it
- some example subprojects:

  improved veterinary services

  training for Livestock Service personnel

  training for livestock producers

  range management

  poultry production and marketing

  core support activities
- subprojects should be written to deal with all problems identified in Chapter 4.

  The core support subproject is to include those activities which will be required by other subprojects to make the overall project function smoothly and efficiently

3.3. schedule a series of all-day workshops beginning about 1 March 1980 to discuss the problems and the subprojects proposed to resolve them.

3.4. devote first workshop to

- presentation of process for design of Phase II VLP
- discussion of problem statements previously distributed (Chapter 4)
- obtaining input from participants, particularly from Voltaics
- distribution of preliminary descriptions of proposed subprojects

3.5. devote subsequent workshops to discussion of proposed subprojects

3.6. revise subprojects on the basis of comments and inputs received during and subsequent to the workshops

3.7. prepare final Phase II VLP design document

5.9 ORGANIZATIONS, AGENCIES, PROGRAMS, AND ABBREVIATIONS

Acronyms	English	French
AID	Agency for International Development	Agence Internationale de Développement
AVV	Volta Valley Authority Lands	Autorités pour l'aménagement des Vallées des Voltas
BND	National Development Bank	Banque Nationale de Développement
CERCI	Center for Study and Research on Irrigated Crops	Centres d'Etudes et de Recherche en cultures irriguées
CFA	West African Franc	Communauté Francière Africaine
CID	Consortium for International Development	Consortium pour le Développement International
CIEH	Interafrican Committee for the Study of Hydrology	Comité Interafricain d'Etudes Hydrauliques
CILSS	Permanent International Committee for Drought Control in the Sahel	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel
CRED	Center for Research on Economic Development (University of Michigan)	Centre de Recherche pour le Développement Economique (Université de Michigan)
CRTO	Regional Remote Sensing Center in Ouagadougou	Centre Régional de Télédétection de Ouagadougou
CTFT	Technical Center for Tropical Forestry	Centre Technique Forestier Tropical
CTMC	Center for Tanning and Leatherworking	Centre de Tannage et de Maroquinerie des Cuirs
CVRS	Voltaic Scientific Research Center	Center Voltaique de Recherche Scientifique
DEIA	Livestock Production and Animal Industries Administration	Direction de l'Elevage et de l'Industrie Animale

Acronym	English	French
EEC	European Economic Community	Communauté Economique Européenne
FAC	Funds for Aid and Cooperation	Funds d'Aide et de Coopération de la République Française
FAO	Food and Agriculture Organization of the United Nations	Organisation des Nations Unies pour l'Alimentation et l'Agriculture
FED	European Development Fund	Fonds Européen de Développement
FEME	Federation of Evangelical Churches and Missions	Fédération des Egleses et Missions Evangéliques
GOUV	Government of Upper Volta	République de Haute Volta
HER	Hydrological and Rural Equipment	Direction de l'Hydraulique et de l'Equipement Rural
IEMVT	Institute of Livestock Raising and Veterinary Medicine for Tropical Countries	Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux
IGHV	Geography Institute of Upper Volta	Institut Géographique de Haute Volta
IRAT	Institute of Tropical Agricultural Research	Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières
ISP	Polytechnic Institute, University of Ouagadougou	Institut Supérieur Polytechnique
OFNACER	National Office for the Commercialization of Cereals	Office National des Céréales
ONERA	National Office for Development of Animal Resources	Office National d'Exploitation des Ressources Animales
ORD	Regional Development Organization	Organisation Régionale de Développement

Acronym	English	French
ORSTOM	Overseas Scientific and Technical Research Office	Office de la Recherche Scientifique et Technique d'Outre-Mer
OSFAM	British Aid Agency	Agence d'Aide Britannique
PCV	Peace Corps Volunteer	Volontaire du Corps de Paix
PEOV	West Livestock Project	Projet d'Elevage de l'Ouest de la Volta
PEV	Village Livestock Project	Projet d'Elevage Villageois
PNUD	United Nations Development Program	Programme des Nations Unies pour le Développement
REDSO	Regional Economic Development Service Office	Office de Développement Régional Economique
RFA	Federal Republic of Germany	République Fédérale Allemande
SVCP	Voltaic Society of Hides and Skins	Société Voltaique des Cuirs et des Peaux
UA	University of Arizona	Université d'Arizona
UNDP	United Nations Development Program	Programme des Nations Unies pour le Développement
USAID	United States Agency for International Development	Agence Internationale de Développement, Etats-Unis
VLP	Village Livestock Project	Projet de l'Elevage Villageois

5.10 GLOSSARY OF FOREIGN TERMS

French	English
agent forestier	forester
bas fonds	lowlands
brousse	bush
Centre Avicole	Poultry Center
chef	administrator of a village (traditional) or canton, or those higher in the tribal structure
chef de terre	earth priest or earth custodian
concession	compound
élevage	livestock production
éleveur	livestock producer, herder
encadreur	extension agent, field assistant
parc	corral
Peulh	Fulani
Peulh Noir	Black Fulani or Rimalbe
quartier	neighborhood
Soudanian	Sudanian

Administrative Units

département	province
circonscription	usually same as <u>département</u> but also used to describe former administrative units of each service
prefecture	administration of a province
sous-prefecture	subdivision of a province
arrondissement	subdivision of a <u>sous-prefecture</u>
canton	subdivision of an <u>arondissement</u>
secteur	subdivision of an ORD (see Section 6.5)
sous-secteur	subdivision of a <u>secteur</u>

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