AFRICAN RURAL ECONOMY PROGRAM

WORKING PAPER/DOCUMENT DE TRAVAIL

SPATIAL AND STRUCTURAL CHARACTERISTICS OF SETTLEMENTS IN THE EASTERN REGION OF UPPER VOLTA

by
Assefa Mehretu

Working Paper No. 39 January 1982

Department of Agricultural Economics
Michigan State University
East Lansing, Michigan 48824
U.S.A.

Organisme Régional de
Développement de l'Est
Fada N'Gourma
République de Haute-Volta

MSU is an Affirmative Action/Equal Opportunity Institution

SPATIAL AND STRUCTURAL CHARACTERISTICS OF SETTLEMENTS IN THE EASTERN REGION OF UPPER VOLTA*

by

Assefa Mehretu**

January 1982

*This paper was financed under a contract between the U.S. Agency for International Development (AID/afr-C-1314) and the Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.

**Visiting Associate Professor, Department of Geography and Associate Director, African Studies Center, Michigan State University, East Lansing, Michigan.

MSU is an Affirmative Action/Equal Opportunity Institution

TABLE OF CONTENTS

	Page
INTRODUCTION	1
I. GEOGRAPHICAL CHARACTERISTICS OF THE EASTERN REGION	2
A. Physical Background	2
1. Topography	2
2. Drainage	4
3. Climatic Features	6
4. Flora and Fauna	9
B. Population and Settlement Characterisitcs	12
1. Population Distribution	12
2. Population Pressure on the Land	13
3. Conditions of Land Use	15
4. Settlement Pattern in the Eastern Region	23
5. Population Migration in the ER	28
II. BASELINE VILLAGE CHARACTERISTICS	33
A. Village Structural Attributes	33
1. Permanent Structures in Villages	33
2. Village Transport Facilities	37
3. Village Educational Characteristics	45
4. Village Health Facilities	50
5. Village Water Supply	56
6. Pattern of Health Related Complaints	60
B. The Geographic Pattern of Non-Farm Activities in the Eastern Region	60
1. Food Related Production Village Activities	60
2. Patterns of Non-Farm Village Activities Excluding Food-Related Industries	65
3. The Distribution of Skilled Services	69
III. THE PATTERN OF RURAL MARKETS	73
A. Regional Distribution of Village Markets	73
B. Content Indices of Village Markets in the ER	73
C. Principal Markets Serving Villages in the ER	76
D. Market Periodicity in the ER	83
IV. CONCLUDING REMARKS	84
REFERENCES	87

LIST OF TABLES

Number		Page
1	Eastern Region River Basins	5
2	Distribution of Population According to the 1975 Census	16
3	Population Density in the Eastern Region Bases on Settlement Clusters	18
4	Land Under Cultivation	24
5	Distribution of Population Based on the 1980 Village Inventory Survey Estimates	25
6	Settlement Pattern: Number of Villages by Size of Concession in Each Sector	29
7	Population Migration: Movement of Households in and Out of the Village Over the Five-Year period 1975-80	30
8	Migration In/Out of Villages: Frequency Count of Villages by Number of Mover Households	31
9	Distribution of Fixed Village Structures by Village Size Classes: Percent of Villages in Size Class that Contain Characteristic	34
10	Inventory of Social Infrastructure by Sector: Fixed Structural Attributes of Village by Percent of Villages Containing Attribute	35
11	Road Lengths by Canton, 1979	38
12	Village Transport Facilities by Percent of Village Containing Facility and by Total Number of Facility in Village	41
13	Village Transport Facilities: Percent of Villages in Size Category That Contain Facility	42
14	Educational Facilities, Elementary Schools	46

Number		Page
15	Distribution of Primary Schools and Village Residents with Various Levels of Educational Achievements: Percent of Villages in Size Category That Have Characteristics	47
16	Village Educational Characteristics by Sector: Distribution of Primary Schools and Number of Village Residents With Various Levels of Educational Achievement	49
17	Mortality by Age Group and Cause Per 1000	52
18	Incidence and Prevalence of Principal Diseases	53
19	Distribution of Health Facilities by Sector	54
20	Distribution of Health Service Indicators: Percent of Villages in Size Class That Have	55
21	Village Source of Drinking Water and Seasonal Condition of Wells	57
22	Estimated Distances Travelled by Villagers to Fetch Water: Percent Villages Reporting Distance Magnitude	58
23	Frequency Count of 1st, 2nd & 3rd Ranked Selected Disease Related Complaints by Village in Eastern Region	61
24	Food-Related, Non-Farm Village Small-Scale Industry	63
25	Distribution of Food-Related Small Scale Establishments by Sector: Percent of Villages in Size Class That Have	64
26	Small Scale Establishments (Non-Food-Related) by Sector: Percent of Villages That Have and Number of Establishments in Each Sector	66
27	Distribution of Non-Farm, Non-Food Related Establishments by Village Population Size Classes: Percent of Village That Have	68
28	Village Skilled Services Distribution by Administrative Sector: Percent of Villages That Have and Total Number of Characteristic in Sector	70

Number		Page
29	Distribution of Skilled Services by Village Hierarchy: Percent of Villages in Size Class That Have	72
30	Distribution of Village Markets Within the Village Hierarchy	74
31	Number of Village Markets That Contain Certain Key Commodities as Percent of Total Numbers of Villages, and Percent of Total Number of Markets by Sector	75
32	Rural Markets in the Eastern Region That Serve More Than 5 Villages	77
33	Distribution of Village Markets in the Eastern Region by Mean Radius of Market Area	81
34	Market Periodicity: Percent of Village Markets with Varying Periodicity in Each Sector	82

LIST OF MAPS

Number		Page
1	Physical Characteristics (Eastern Region of Upper Volta)	3
2	Climatic Characteristics (Eastern Region of Upper Volta)	7
3A	Principal Types of Pastures (after Benoit)	10
3B	Tsetse Areas and Incidence of Zebu and "Taurin" (after Benoit)	10
4A	Principal Livestock Areas (after Benoit)	11
4B	Principal Livestock Areas in North Sudanic Eastern Region (after Benoit)	11
5	Population Density by Canton (Eastern Region of Upper Volta)	14
6	Population Density by Settlement Clusters	17
7	Village Populations Eastern Region of Upper Volta . .	27
8	Surface Transportation (Eastern Region of Upper Volta)	39
9	Location of Public Services (Eastern Region of Upper Volta)	51
10	Location and Size of Markets in the Eastern Region (mean market radius, crude distance)	79
11	Location and Size of Markets in the Eastern Region (mean market radius, weighted distance) . .	80

INTRODUCTION

This monograph is intended to provide a study of the geographic characteristics of the Eastern Region of Upper Volta. The type of data and mode of analysis used are those considered to be more pertinent to understand the regional structures of the Eastern Region with particular attention to those phenomena that are considered basic to regional development planning. The study will have three parts. The first part will deal with the physical attributes, population characteristics, patterns of land utilization, agricultural activities, and the spatial pattern of transport and social infrastructure. The second part will be devoted to the analysis of baseline village characteristics of the Eastern Region based on the results village inventory survey conducted in 1980. In the third and final section, a study of the pattern and articulation of village markets in the Eastern Region will be presented.

There are two major objectives in putting this study together. The first is to offer selected aspects of the geography of the region especially to those who need some baseline information as a prelude to more detailed work on development projects. The second objective of the study is to outline the physical and structural characteristics of the region which will have significant bearing on regional development potentials of the area. This study is a part of a larger effort by MSU personnel under a USAID technical assistance contract to organize an information system for use by the Eastern Regional Development Organization (ORD) of Upper Volta in its regional development plan.

The data for the study came from two sources. Archival data from Government publications and the 1975 National Census were used in the first part of the essay. The latter part of the report was based mostly on the village inventory survey collected in 1980 for each of the 635 villages in the Eastern Region by the MSU team of researchers centered in Fada N'Gourma.

I. GEOGRAPHICAL CHARACTERISTICS OF THE EASTERN REGION

A. Physical Background

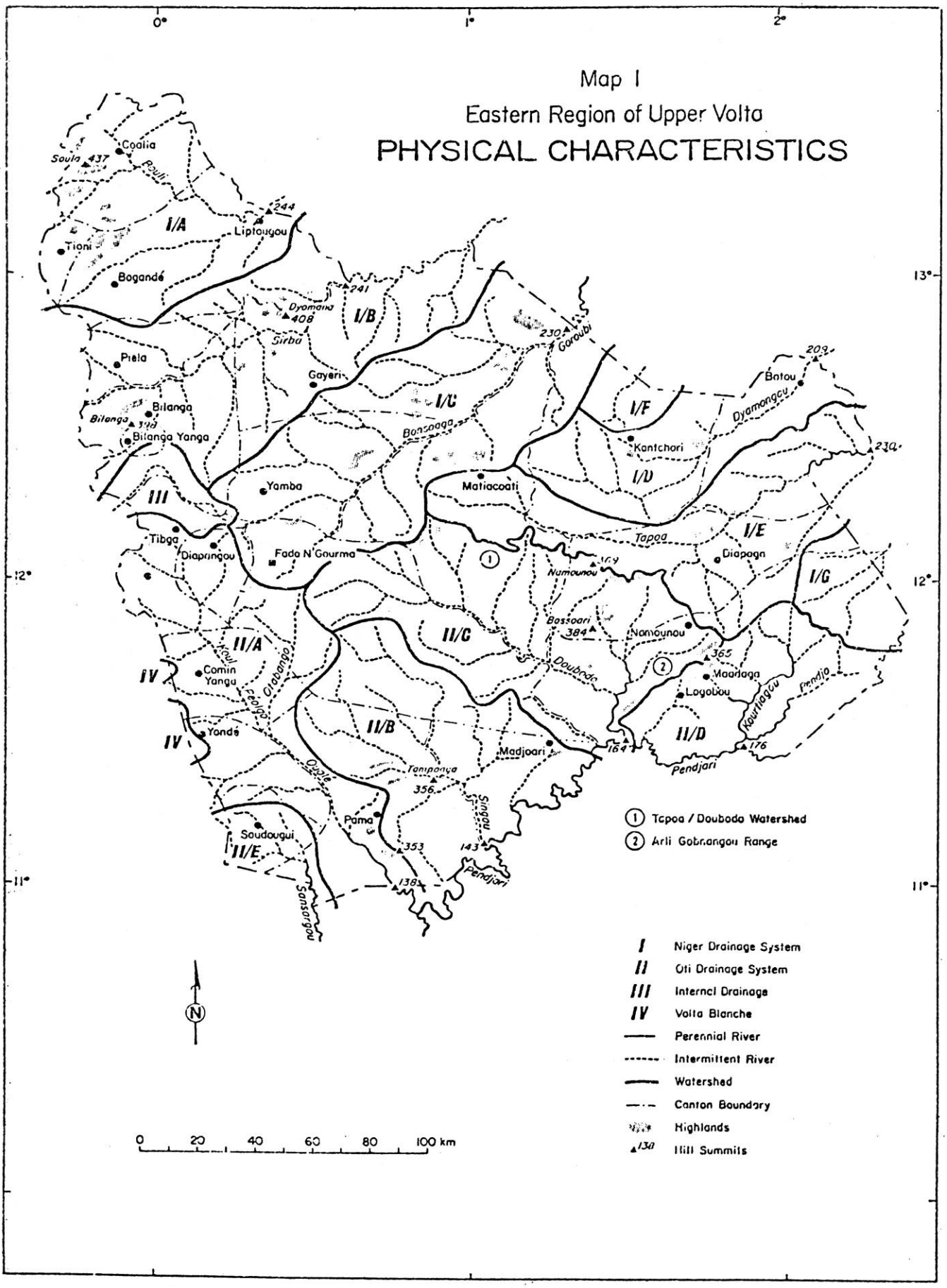
1. Topography

The Eastern Region of Upper Volta (ER) is a vast plain with very few contrasting topographic features. The highest elevation in the ORD is found in the Soula Hills, west of Coala in the north with a peak of 437 meters. The lowest elevation is where the Kpenbienga (Ouala) River reaches the border in the south with about 138 meters elevation (see Map 1). These two anitpodes, however, belong to two major physiographic systems in the ER.

The Soula (437 m.), Bilanga (398 m.) and Dyomana (408 m.) hills are part of the northern drainage system whose waters flow to the Niger River descending to elevations of 244 m. for Bouli/Tyanbaro, 241 m. for Sirba, 230 m. for Bonsoaga, 209 m. for Dyamongou and 230 m. for Tapoa at the points where all reach the border between Upper Volta and Niger. The northern topographic system has a maximum range of elevation between the highest point (Soula) and lowest elevation (Dyamongou) of about 228 meters.

The peak of the southern region, which comprises the drainage basin ending in the Oti River in Togo, is in the "Bossouri" hills north of Arli which reach to an elevation of 384 meters. The lowest elevation is recorded for the lower reaches of the Kpenpienga (Ouale) south of Pama which stands at 138 meters. The range in elevation in the south is therefore about 146 meters. Other major elevations in the south are recorded for the Namounou escarpment (369 m.), the Gobnangou range (365 m.) and the Pama hills (353 m.).

As indicated, the ER offers very weak regional contrast in topographic features. The range of elevation between high land and lowland features is relatively small and also occurs over vast distances. This gives the region the characteristics of a vast plain contrasted here and there by localized elevations (see Map 1).


Map I
Eastern Region of Upper Volta
PHYSICAL CHARACTERISTICS
0°
1°
2°
13°
12°
11°
Coalia
Soula 437
Rouli
I/A
244
Liptougou
Tioni
Bogandé
241
Dyomana
408
I/B
Sirba
230
Goroubi
Piela
Gayeri
I/C
Bilanga
Bilanga 398
Bilanga Yanga
Bonsoaga
I/F
Kantchori
I/D
Batou
209
Dyamongou
230
Yamba
Matiacoati
III
Tibga
Diapangou
Fada N'Gourma
Tapoa
I/E
Diapaga
Namounou
369
I/G
Bassoari
384
Namounou
II/C
II/A
Comin Yanga
IV
Otabango
Doubodo
365
Maadaga
Logobou
Kourtiagou
Pendjo
Yondé
II/B
II/D
164
176
Pendjari
Madjoari
Tampanga
356
Singou
Pama
Soudougui
II/E
353
143
Pendjari
138
Sansargou
① Tapoa / Doubodo Watershed
② Arli Gobnangou Range
I Niger Drainage System
II Oti Drainage System
III Internal Drainage
IV Volta Blanche
Perennial River
Intermittent River
Watershed
Canton Boundary
Highlands
138 Hill Summits
N
0 20 40 60 80 100 km

2. Drainage

The drainage system of the ER is characterized by rivers which flow in relatively flat river beds with considerable meanders along their courses. Almost all of the major rivers have poorly drained and swampy flood plains and bottom lands (bas fonds). Due to the difference in range of elevation between high and low points, the northern drainage system of the Niger, which has a higher range (228 m.), has dryer valleys than the Volta system which, with a lower range (138 m.), has more poorly drained lowlands and swamps.

The northern drainage system consists of seven separate sub-systems (drainage basins) which flow into the Niger. The largest and most important of these are the Souli/Tyanbaro, Sirba, Bonsoaga, Dyamangou and Tapoa. Altogether, the northern river basins comprise 56 percent of the area of the ER in which about 65 percent of the population of the region live. In terms of total water budget however, they share less than what their total area would warrant due to lower rainfall, being found north of the 900 mm. isohyet with declining moisture to the north and also a higher potential evapotranspiration (from 2,000 to 2,100 mm.) for most of the region (see Map 2). As a result, the northern rivers are intermittent along their entire course within the ER.

The southern system comprises four major drainage sub-basins, all of which drain into the Pendjari at the southern border of the ER. The major rivers of this region are the Kourtiagou, Arli, Doubodo, Singou, and Kpenpienga (Ouale). Inclusive of the Sansargou, the southern basins cover about 42 percent of the area of the ER. By virtue of their location south of the 900 mm. isohyet, higher precipitation probabilities and lower potential evapotranspiration, around 1,900 mm., (a good deal of the area having less than this), their water budget is higher than the northern system. The southern drainage system, however, contains only about 35 percent of the population and a good deal of the people of the region concentrate in the Kourtiagou, the upper reaches of the Kpenpienga (Ouale) and Sansargou. The Singou and Doubodo/Arli systems are very sparsely populated and a good deal of their area is within partial or total national reserves.

An important characteristic of the Volta tributaries as contrasted to those of the Niger is that virtually all of them acquire continuous annual flow of water before they exit the Eastern Region.

Table 1 EASTERN REGION RIVER BASINS

Map Code	Name of River	Area[a] Km^2	Area %	Average Rainfall mm[b]
I.	Niger Drainage Basin			
A	Bouli/Tyanbaro	4,590	9.4	670
B	Sirba	6,470	13.2	798
C	Bonsoaga (Goroubi)	7,010	14.3	905
D	Dyamangou	3,060	6.2	865
E	Tapoa	4,800	9.8	890
F	--	530	1.1	870
G	--	1,100	2.2	890
II.	Oti Drainage Basin			
A	Ouale (Kompienga)	5,600	11.4	920
B	Singou	5,010	10.2	1,025
C	Doubodo/Arli	6,200	12.6	952
D	Kourtiagou	2,900	5.9	960
E	(Soudougui)	780	1.6	975
III.	Internal Drainage			
	Nassoubdou	900	1.8	880
IV.	Volta Blanche Drainage Basin	100	0.2	880
		49,050	100.0	--

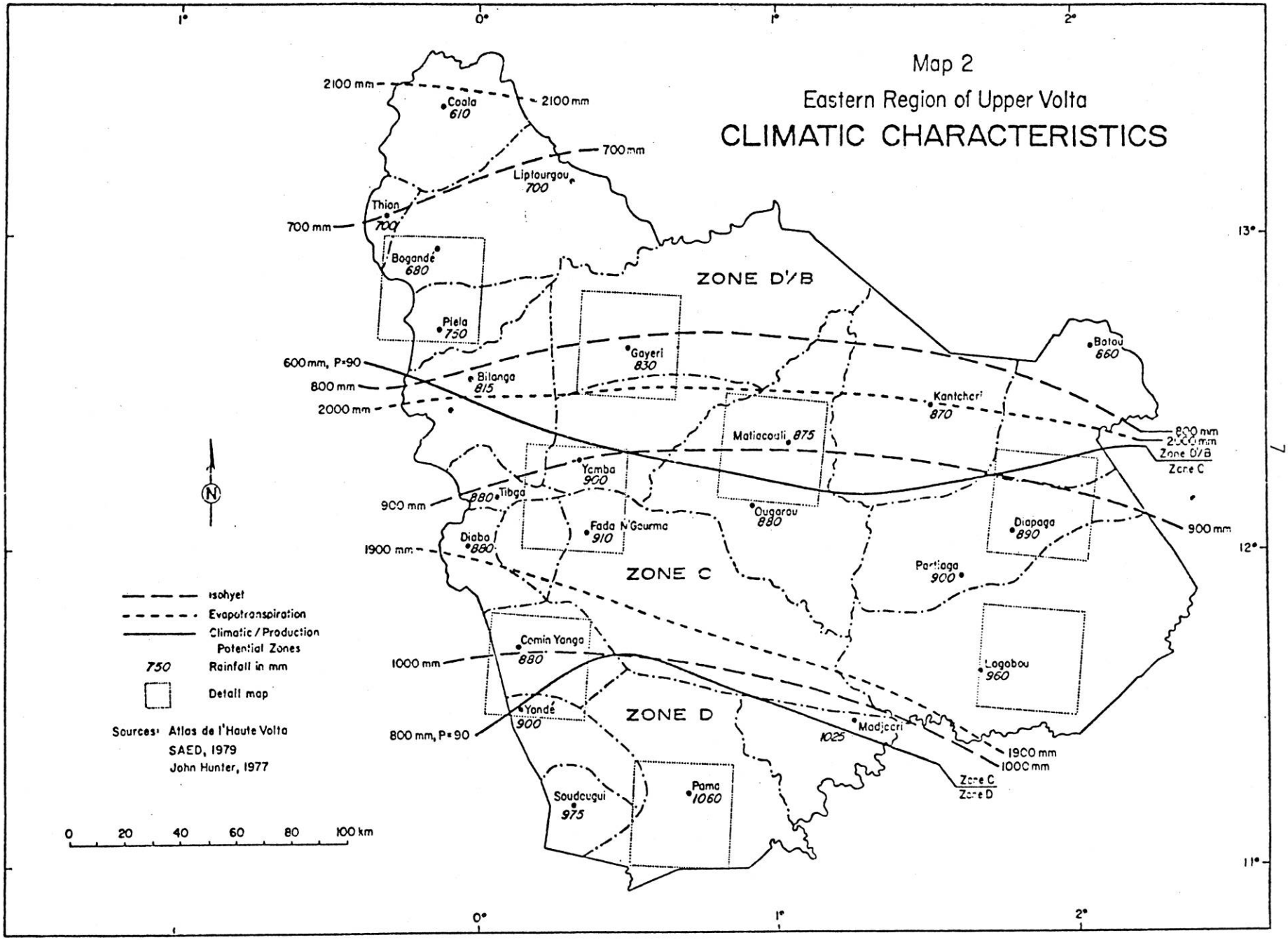
[a]Planimeter Measure (approx.) from 1:1,000,000 Map.

[b]For most representative station(s) (averaged), SAED (79).

3. Climatic Features

The climate of the region is dominated by the savanna and Sahelian character of that latitude where temperatures are generally high and rainfall is sparse and relatively unreliable. The ER has four seasons based on temperature variations and two seasons of rainfall. March-April-May and September-October-November comprise high temperature seasons, the former of which usually contains the highest recorded temperatures. Average temperatures around 33°C can be expected in the hot season. Two relatively cool seasons occur in June-July-August, which is also the rainy season, and December-January-February, corresponding with the sun's maximum declination, and also when the region is under the influence of continental air masses which bring the Harmattan. The latter season brings the lowest temperatures but with average temperatures not below 25°C. Average maximum and average minimum temperatures of 39°C and 16°C respectively can occur in April and January respectively (Renard, 1965; Remy, 1976).

With regard to precipitation there are two more or less distinct seasons--a short rainy season in which June-July-August and September receive the bulk of the precipitation and a long dry season. The length of the rainy season, of course, varies between the northern Sahelian margins where it is the shortest in the region, and the southern savanna lowlands, which experience not only more rainfall but receive it over a longer rainy period. Three important factors stand out with respect to precipitation in the ER. First, the amount received is low which is typical for the region. Amounts of precipitation vary between 1,000 mm. for locations like Pama and Madjoari in the south, and 600 mm. for Coala in the north. Second, the variability of precipitation is high and critical. The northern section of the ORD, which could get about 900 mm. of precipitation in any given year, can only count on 600 mm. at a probability of 90 percent (see Map 2; Hunter, 1977). The southern regions of the Eastern ORD are characterized by higher precipitation, but here again only 800 mm. can be expected at a probability of occurrence of 90 percent (P = 90). The third principal characteristic of precipitation in this region concerns the level of effective moisture that can be secured for use by man, flora and fauna. Here again, not only is there an excessive level of potential evapotranspiration for the ER as a whole, but also there is quite a variation between the Sahelian margins in the north and the savanna


Map 2
Eastern Region of Upper Volta
CLIMATIC CHARACTERISTICS
1°
0°
1°
2°
13°
12°
11°
2100 mm
2100 mm
Coala 610
700 mm
Liptougou 700
Thion 700
700 mm
Bogandé 680
Piela 750
ZONE D'/B
Gayeri 830
Batou 660
600 mm, P=90
800 mm
2000 mm
Bilanga 815
Kantchari 870
Matiacoali 875
800 mm
2000 mm
Zone D'/B
Zone C
900 mm
Yamba 900
Tibga 880
900 mm
Ougarou 880
Fada N'Gourma 910
Diapaga 890
Diabo 880
1900 mm
ZONE C
Partiaga 900
Comin Yanga 880
1000 mm
Logobou 960
Yondé 900
ZONE D
Madjoari 1025
800 mm, P=90
1900 mm
1000 mm
Zone C
Zone D
Soudougui 975
Pama 1060
isohyet
Evapotranspiration
Climatic / Production Potential Zones
750 Rainfall in mm
Detail map
Sources: Atlas de l'Haute Volta
SAED, 1979
John Hunter, 1977
0 20 40 60 80 100 km

margins in the south. A good portion of the ER north of the line stretching between Bilanga and Kantchari is characterized by potential evapotranspiration in excess of 200 mm., while around Coala about 2,100 mm. can be expected. The south has somewhat lower evapotranspiration, most of it below 2,000 mm. and a good part below 1,900 mm. (Renard, 1965), (see also Map 2).

An important regional implication of these climatic characteristics is the variation of land use potential and the duration of plant growth which to a major extent are determined by the moisture content of the soil. A measure of agricultural land use potential can be obtained by dividing total precipitation by potential evapotranspiration (Jean Renard, 1965) and the result demonstrates once again the relative superiority of the southern areas with indices of 0.50 and higher, whereas in the north indices of 0.40 and lower are obtained (see also Jean Kellerman, 1976, for a similar analysis). There is very little doubt that the agricultural potential of the ER rests on the careful management of this precarious balance of physical conditions.

Map 2 contains a summary of information on climatic zones and soil potentials for the ER as interpreted by John Hunter (1977) based on works by J. Cocheme and P. Franquin, D. Garcia, and the FAO/UNESCO world soil map. As shown on Map 2, the Eastern ORD contains only three of the five zones that have been used to describe the Sahelian regions. About half of the ER is found in zone classified as D^1/B which represents an annual rainfall of between 350-600 mm. with P = 90. This region is considered suitable for livestock and certain cereal crops.[1] The cantons of Coala, Bogande, Thion, Piela, Gayeri, Kantchari, Botou and sizable portions of Bilanga, Yamba and Matiacoali are found within this region.

The middle portion of the ER comprising the cantons of Tibga, Diabo, Diapangou, Fada, Diapaga and Gobnangou and portions of Bilanga, Matiacoali and Comin Yanga is classified in Zone C, which is characterized by annual rainfall of 600-800 mm. with P = 90. Zone C has the climatic resources to support extensive cultivation of cereal crops. In Zone D, where annual precipitation of more than 800 mm. with P = 90 can be expected, are found

---

[1] The five classifications are formed by combinations of A^1-D^1 for livestock, and A-D for crops. Ranging from drier to wetter margins, the five regions are A^1, B^1, C^1/A, D^1/B, C, and D (Hunter, 1977).

the cantons of Yonde, Soudougui, Pama and Madjoari and a small section of Comin Yanga. This zone not only supports cultivation of cereals but also is attributed to have greater potentials for cash crops such as peanuts, cotton and tobacco (see Map 2).

4. Flora and Fauna

The ER is characterized by two of the three major climatic zones covering the country. From its southern border to latitude 11°30' (around Yonde), the climate is "Southern Sudanic" (Savanna Margin). The northern part of the ER which is found within the latitudes of 11°30' and 14° is characterized by the climatic zone called "north Sudanic" (Sahelian Margins) (Kellerman, 1967). Because of its overall Savanna character the dominant vegetation types in the ER are limited to various forms of pasture. However, detailed data on natural vegetation is lacking (Benoit, 1974). Closed forest areas are a rarity in the ER. Few remnants may be found in the southwest in the drainage basin of (the Kpenpienga). Otherwise the most common feature of woodland is the more open savanna type in which trees dot the grasslands getting progressively scantier from south to north. Plant communities with degrees of concentration and specific species have been worked out by Martin Terrible (1975) for the entire nation. The information is mapped using square grids 100 km. by 100 km. The information is somewhat too detailed on species and too general on distribution to permit a meaningful summary. It appears, however, that it could be used as a basis for more localized investigation of the natural vegetation of the ER.

What is perhaps more interesting is the savanna vegetation of the ORD. From Benoit's (1974) work on the geography of pastoral areas in Upper Volta, three principal types of pasture could be identified for the ER (see Map 3). On the whole the suitability of grasslands for livestock raising in the ER seems to decline southward as incidence of tse-tse increases, especially south of the 800 isohyet (P = 90) (Hunter, 1977). As it may be observed on Map 4A, the degree of use of grasslands for traditional cattle raising has been concentrated to the north and east of the ER particularly to parts of Coala, Bogande, Gayeri, Matiacoali, Kantchari and Botou (Map 4B).

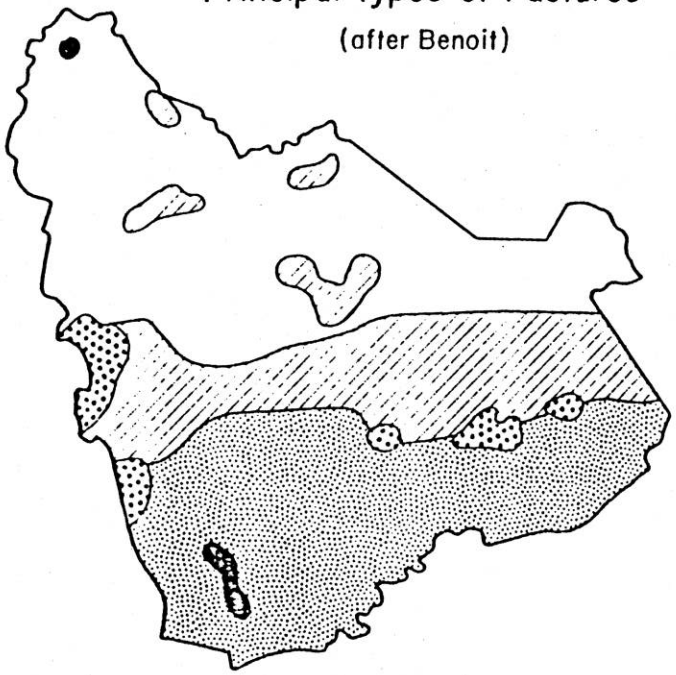
In as much as livestock raising may become one of the important rural activities of the Eastern ORD, the natural vegetation, particularly in the areas of long standing traditional livestock practices should be a focus of interest. Our treatment here is merely to take a sounding of the available information.

Map 3

A | B

Principal Types of Pastures

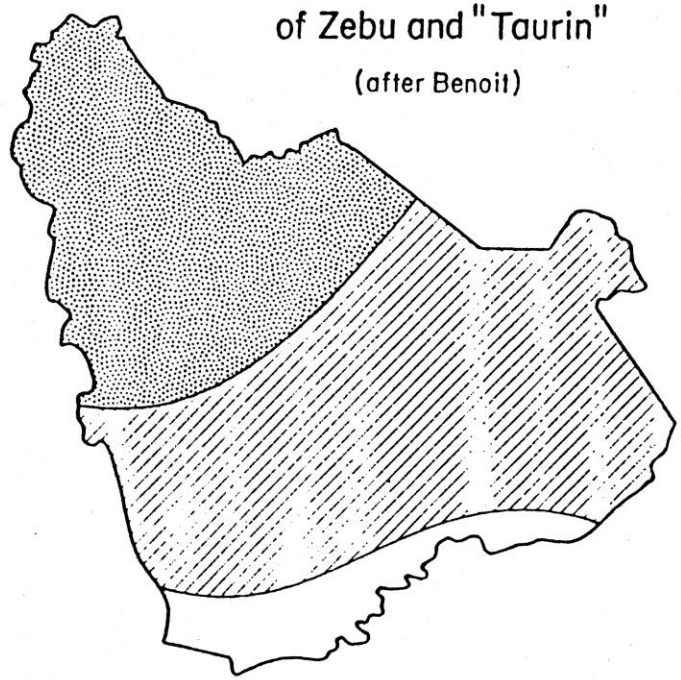
(after Benoit)



- Prairies hydrophiles
- Pâturage anthropiques
- Pâturage d'utilisation normale en fourage vert seulement
- Pâturage à graminées annuelles et à andropogonées vivaces
- Pâturage verts quasi permanents à gcminées vivaces

Tsetse Areas and Incidence of Zebu and "Taurin"

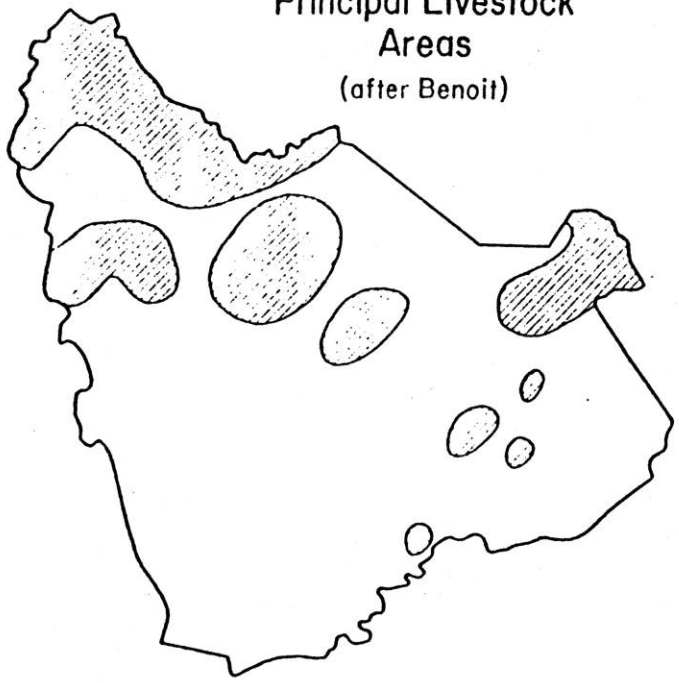
(after Benoit)



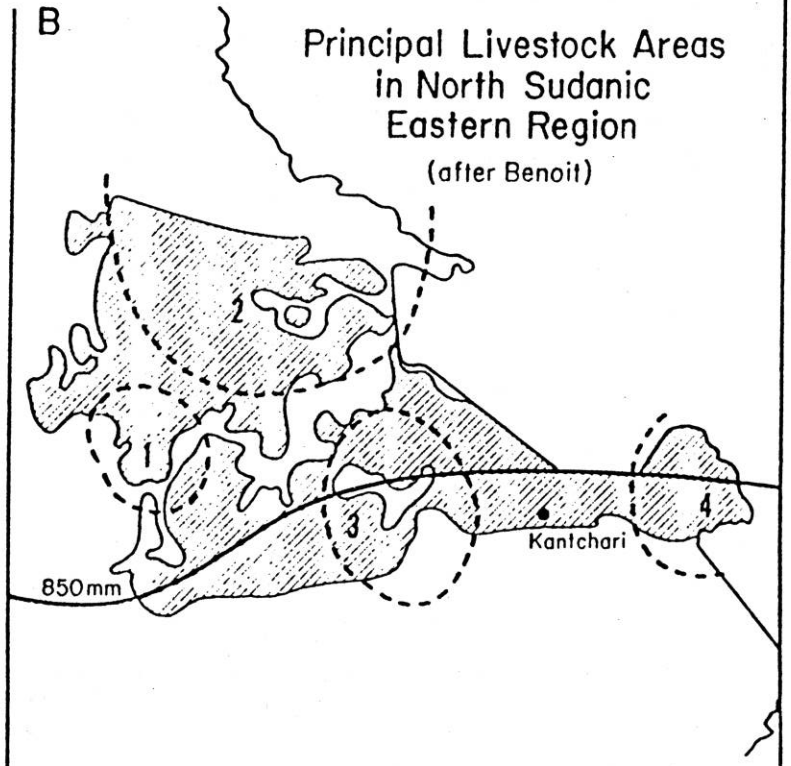
- Absence de la glossine et presence du Zébu
- Presence de la glossine et du Zébu
- Presence de la glossine et du Taurin

Map 4

A | B



Most of the livestock regions are characterized by transhumance and relatively sparse practice (about 6% of the land).



Principipau lieux d'habitat des pasteurs sudanien

1 Regions de Bogandé-Bilanga

2 Yaga méridional

3 Region de Gayeri-Matiacoali

4 Region de Boton

The wildlife of the ER is mostly concentrated in the southern savanna margins with particular concentration in the basins of Kpenpienga (Ouale), Singou and Arli rivers. Varieties of antelope, buffalo and other big game are found here. A good deal of this area is in partial or total reserve to safeguard the stability of the wildlife. This natural wealth is not only of importance at present for the tourist industry of the ER but of potential significance for future agricultural development of the region.

As part of the ecological system, pests and diseases also offer a major challenge to development in the ER. One of the most widespread diseases is malaria and is perhaps one of the most important health hazards in the country. According to a survey made by the Ministry of Health (1974), the incidence and prevalence of malaria in the country is 83 percent. Although this may be subject to regional variation, this is an extremely high incidence of infection. Even more constraining to the full exploitation of the land resources in the ER is the prevalence of trypanosomiasis and onchocerciasis. These diseases, which affect both man and animal are more prevalent in the southern and wetter parts of the ER. A good portion of the underpopulated but potentially valuable lands in the southeast, south and southwest of the ER are attributed to the incidence of these diseases. There is no doubt that they will pose a major challenge and constraint as attempts are made to venture into what has been called a "new lands" development strategy.

B. Population and Settlement Characteristics[1]

1. Population Distribution

According to the 1975 census of Upper Volta, the total population of the ER is 407,706 people.[2] This comes to approximately 7 percent of the national population. The ER however is one of the largest administrative units in Upper Volta with 49,992 square kilometers which takes up close to 20 percent of the country's surface. As a result of this the ER is one of the least densely populated regions of the country. Whereas the overall

---

[1] I am indebted to David Wilcock who was responsible for the computer work of the data processing for the village inventory.

[2] This total number will vary from table to table due to current estimates by the Village Inventory Survey and due to missing villages and other errors in aggregation.

population density in the country is close to 25 people per square kilometer, that of the ER is only 8 people per square kilometer. Population densities in the Mossi Plateau in the regions around Ouagadougou, the capital, and Bobo Dioulasso can reach as high as 160 persons per square kilometer. But in the ER very few regions come to even one-quarter of the density experienced in the Mossi plateau. The most densely populated areas in the ER are extensions of the Mossi populace which spills over to the western part of the ER giving the region pockets of high densities none of which however exceed 40 persons per square kilometer. According to a crude density map based on Cantons (administrative sub-divisions) only a few areas which touch the western boundary of the ER show relatively high density of population (10 to over 25 persons per square kilometer). The bulk of the ER, over 80 percent of the area, has less than 10 people per square kilometer (see Map 5).

Table 2, which shows the distribution of the population of the ER by administrative "sectors", demonstrates that those sectors that are strung out in a north-south line along the western boundary of the ER contain well over 50 percent of the population while covering hardly a quarter of the area. The Bogande sector, which is perhaps also one of the sections of the country which were the hardest hit in the drought conditions of the 1970s, contains over 25 percent of the population of the ER. Map 5 clearly shows that whereas all of the cantons west of Fada N'Gourma, the capital of the ER, feature double digit density conditions, none of the ones east of the town indicate more than one digit density. With the exception of the Logobou, Botou and Fada cantons, the regions east of Fada indicate less than 5 persons per square kilometer in overall density.

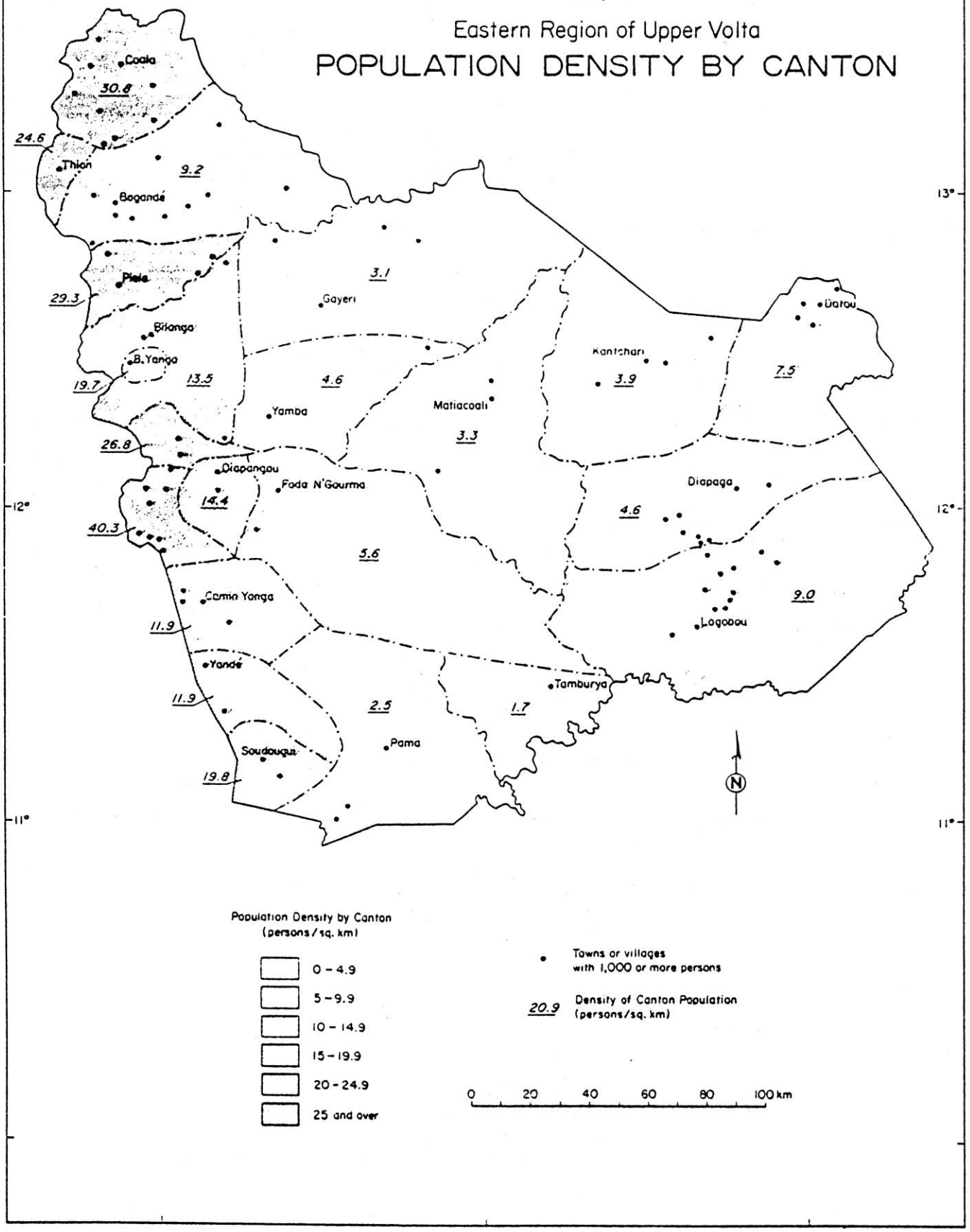
2. Population Pressure on the Land

Population density computations and illustrations such as the ones we used above for comparative purposes do not yield a realistic picuture of the pressure on the land. This is because the density figures are crude and their reliability depends on the scale of the area used in the computation of the density. For instance the density figures used on Map 5 are based on 22 cantons and the canton with the highest figure is Diabo with 40 persons per square kilometer. But if we look at Map 6, based on 94 settlement clusters, we observe that there are many areas in the ER which exceed the density condition. The major difference between Map 5 and Map 6

Map 5

Eastern Region of Upper Volta

POPULATION DENSITY BY CANTON



is that the latter computes density only for those areas "effectively" inhabited. This analytic procedure is not constrained by administrative boundaries as in Map 5. The principle of deriving the density areas is based on the approximation of "life spaces" of rural populations which inhibit villages enumerated in the 1975 census of the country and is also based on nearest neighbor considerations which assure the creation of homogenous density areas (Mehretu, 1980 (1)).

Map 6, therefore, can be regarded as a more realistic approximation of the population density condition in the ER than the rendering in Map 5. What is important to note in studying population/land balances is that people in less developed rural enviornments such as here are "spatially restricted" in their mobility and that settled areas are increasingly pressured until subsistence production levels reach critical minima. Although the overall density of the ER creates the impression that there is plenty of land for people to expand into, for a number of reasons, physical as well as infrastructural, the population continues to expand in the already densely populated areas to the point where environmental uncertainties become very detrimental to meeting nutritional requirements.

Earlier, it was indicated that the crude density of population in the ER was 8 persons per square kilometer. However, when we examine Map 6 and Table 3 we find that only very few areas have that level of effective density condition. Table 3 indicates that only about 22 percent of the "settled" areas have densities below 10 persons per square kilometer and that the overall density in the "settled" areas exceeds 20 persons per square kilometer based on the estimated effectively settled area of about 18,000 square kilometer which is only 36 percent of the total area of the ER.

3. Conditions of Land Use

There is obviously a high degree of spatial co-variation between high density of population and intensity of land use. In the ER the regions with the highest level of land use are those which are highly settled. Examples of high population density and high degree of land exploitation are those areas extending from Bogande to Diabo along the western boundry of the ER. In these areas the intensity of land use is marked by more than 50 percent of the land brought under cultivation at one time or another. Examples of low population density and low intensity in land use are also

Table 2 DISTRIBUTION OF POPULATION ACCORDING TO THE 1975 CENSUS

Village Population Site	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama			
	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	Total # of Villages	Total Pop '000
1. 399 - below	91	19.1	77	12.4	7	1.6	21	3.7	91	17.3	18	4.3	21	4.9	35	7.6	361	70.9
2. 400 - 799	44	24.7	12	6.3	5	2.8	9	5.2	26	14.4	9	5.6	10	5.5	16	8.0	131	72.5
3. 800 - 1199	12	12.5	6	6.2	7	6.9	3	3.0	5	4.8	5	5.4	7	6.8	5	5.4	50	51.0
4. 1200 - 1599	6	8.8	3	4.0	1	1.5	4	5.5	3	4.2	4	5.2	1	1.3	4	5.2	26	35.7
5. 1600 - 1999	9	15.5	1	1.6	2	3.8	0	--	4	7.3	1	1.8	3	5.0	0	--	20	35.0
6. 2000 - 2399	5	11.0	2	4.6	4	8.4	0	--	0	--	0	0.0	0	--	2	4.6	13	28.6
7. 2400 - 2799	1	2.8	0	--	2	5.2	0	--	2	5.4	0	0.0	1	2.7	0	--	6	16.1
8. 2800 - 3199	0	--	1	3.0	3	9.2	1	3.0	1	3.2	1	2.9	1	3.1	0	--	8	24.4
9. 3200 - 3599	0	--	0	--	0	--	0	--	0	--	0	0.0	0	--	0	--	0	--
10. 3600 - 3999	2	7.6	0	--	2	7.4	1	3.6	0	--	0	0.0	0	--	0	--	5	18.6
11. 4000 - above	3	18.9	0	--	4	20.1	0	--	1	12.5	0	0.0	0	--	0	--	8	51.4
	173	120.9	102	38.1	37	66.9	39	24.0	133	69.1	38	25.2	44	29.3	62	30.8	628	404.2

Map 6

POPULATION DENSITY BY SETTLEMENT CLUSTERS

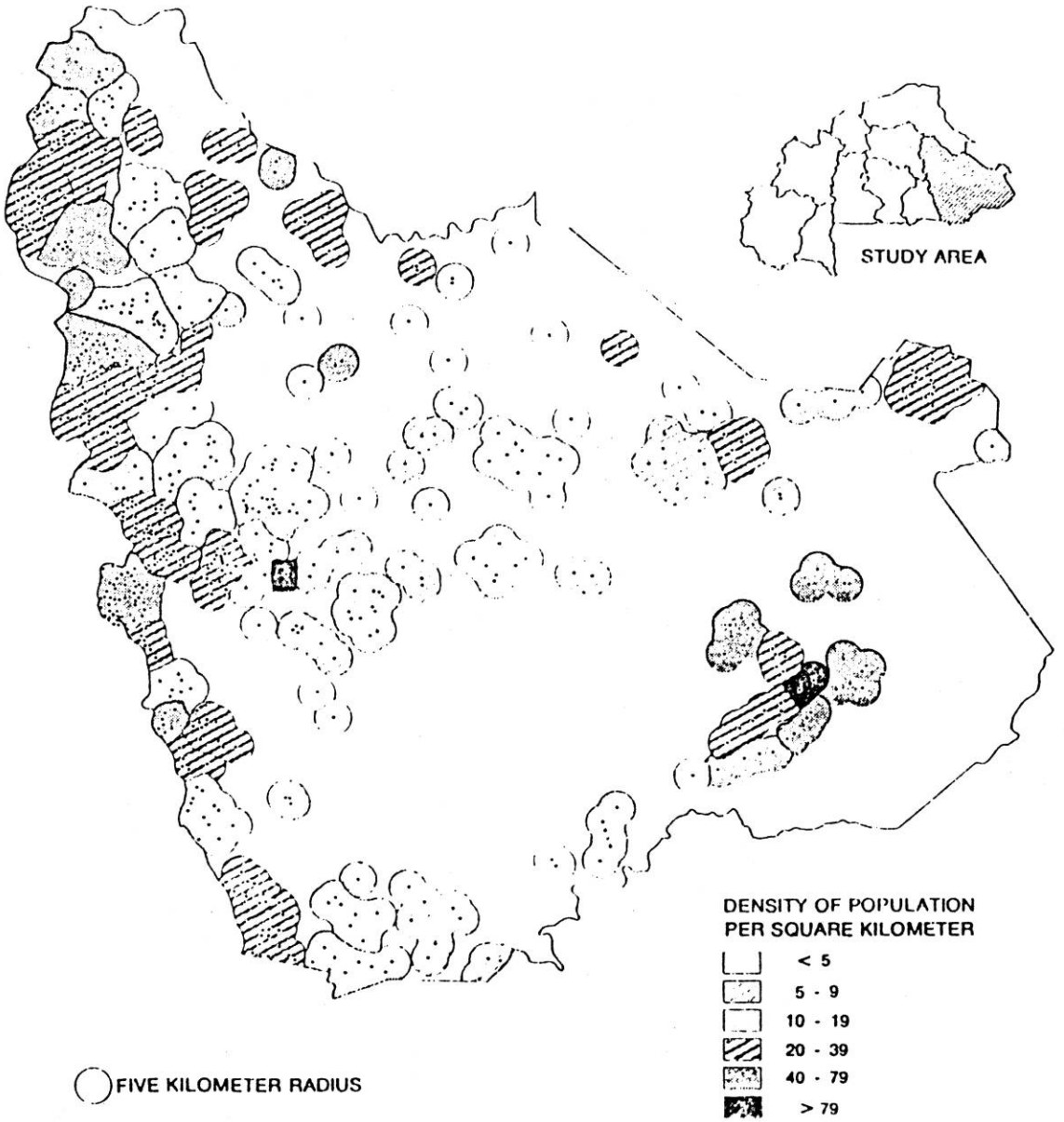


Table 3 POPULATION DENSITY IN THE EASTERN REGION BASED ON SETTLEMENT CLUSTERS (population data based on the 1975 census)

Density People per sq. km.	# of Settlement Clusters	Total Area of Settlement Clusters	% of Total ORD
1. less than 5	14	1,547	8.7
2. 5-9	14	2,409	13.5
3. 10-19	25	6,087	34.2
4. 20-39	25	5,244	29.4
5. 40-79	14	2,380	13.4
6. above 79	2	150	0.8
TOTAL	94	17,817	100.0

shown for regions around Matiacoali, Diapaga, Pama and areas which are to the east and south of the major population concentrations of the west (study maps 2, 6 and Plates 1 to 8).

In highly densely populated areas of the ER in the north, the western belt and in the southeast, crop cultivation and cash cropping is very important. In the middle belt, which covers a vast amount of land from Gayeri to Botou, livestock raising and crop cultivation seem to dominate. In the south and southwest we find some of the least populated and agriculturally unused parts of the ORD. The former also corresponds with the wild game reserves and parks of the ORD. Within these three major categories, there are many variations in intensity and cultural practices.

Based on a topographic map (1:200,000) of the region, some of the sheets of which were revised in 1972, we have attempted to get an idea of the degree of land under cultivation by taking a sample of eight quadrants, 36 by 36 km., for representative regions, and sketched in the area under cultivation. The sampled areas are given on Map 2 which shows approximate area covered by each quandrant on the topographic map. The rendering is shown on Plates 1 to 8. We have divided the land use intensity on the basis of this sampling into four categories. The first category is most typical of the region in the highly densely settled northern and western part of the ER. Plate 1 is perhaps typical of this level of land use intensity. This pattern drawn for the Bogande and Piela area, which also applies for areas around Tibga and Diabo, represents the highest degree of land use with perhaps close or even more than 50 percent of the land brought in under cultivation at one time or another (see Map 6 and Plate 1).

Plates 2 and 3 are typical of transitional zones from the high density areas of the west to sparser areas in the east. Both the Fada and Comin Yanga quadrants illustrate that their western margins are more intensely used than their eastern margins. These two represent a region of moderate intensity with land use ratios of approximately 25 to 30 percent. A third category is exemplified by plates for the Logobou, Diapaga and Pama areas where land use intensity is low, perhaps not more than 10 percent in most instances. Diapaga and Logobou show a slightly higher intensity of use but by and large these sectors of the country are characterized by a high degree of unused land (see Plates 4, 5, and 6). The fourth and final category of land use is that shown by Plates 7 and 8.

Plate 1

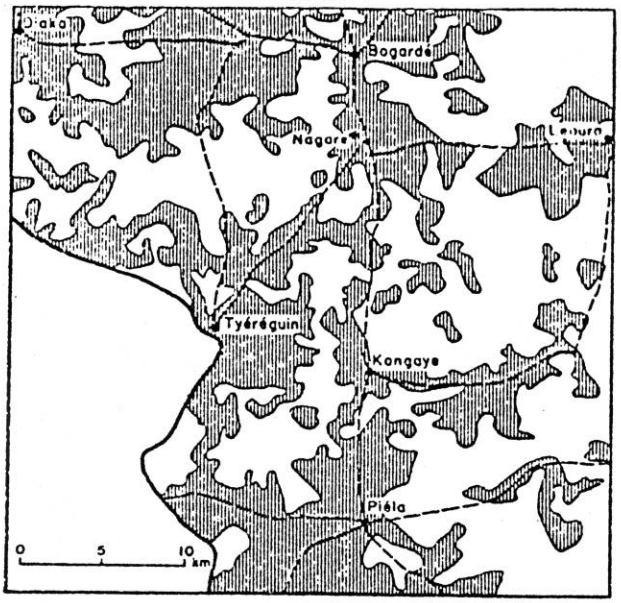


Plate 2

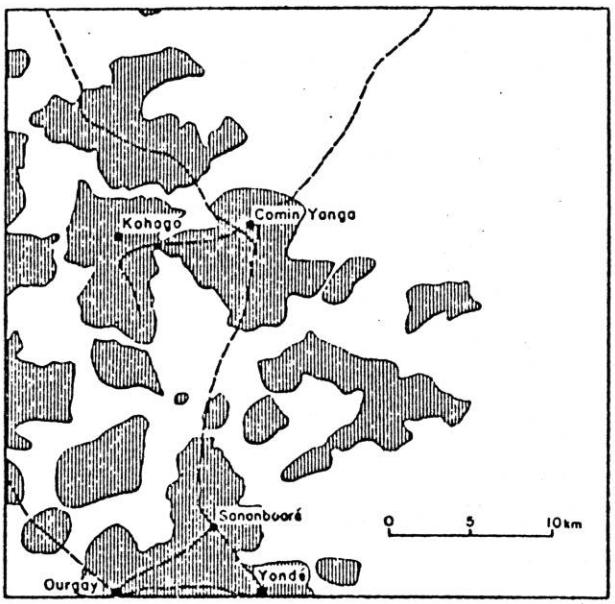


Plate 3

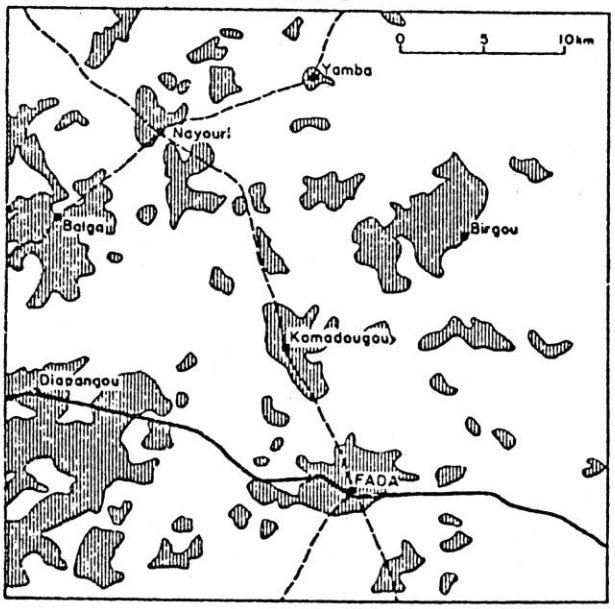


Plate 4

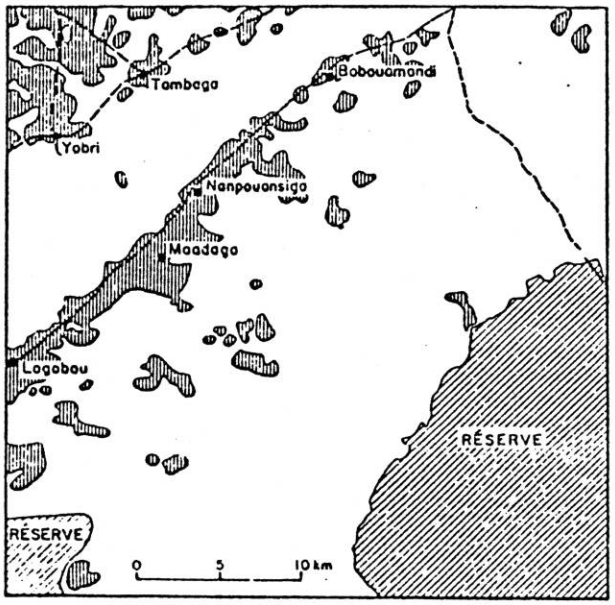


Plate 5

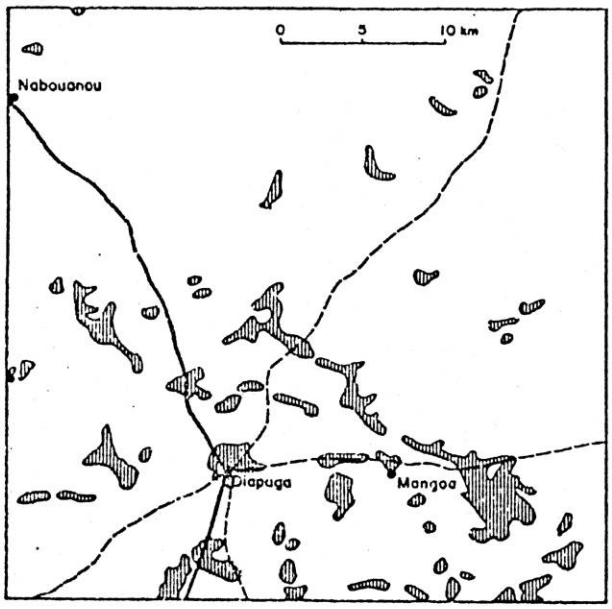


Plate 6

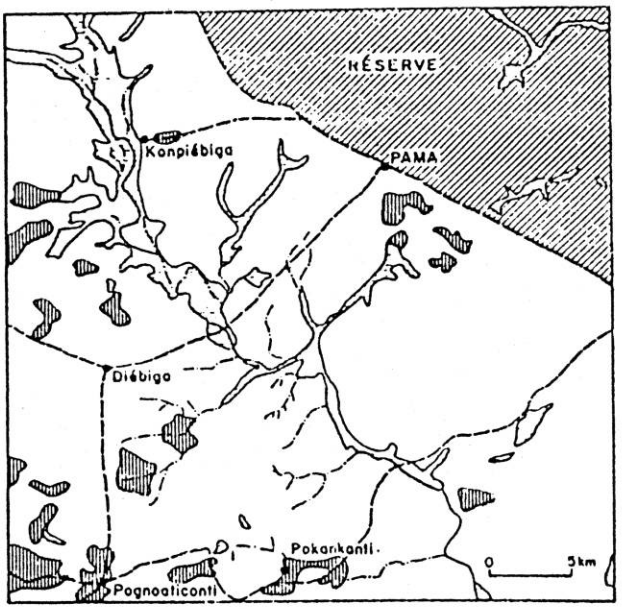


Plate 7

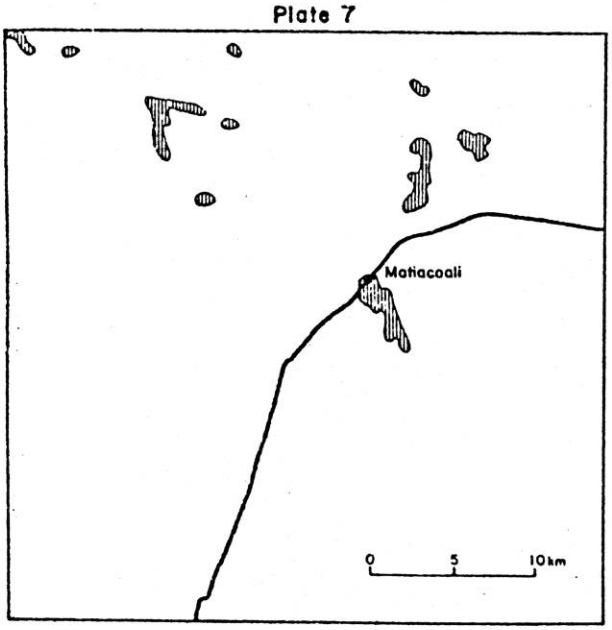
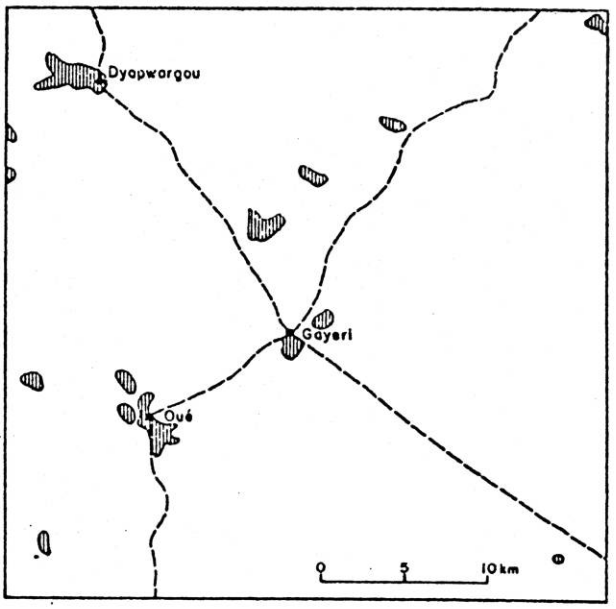


Plate 8



We have drawn these quadrants around Gayeri and Matiacoali and they are almost typical of the middle belt where land use intensity is extremely low. This, of course, corresponds with the low density of the population in this region (see Map 6). Areas of similar situation can be found as we move east to Botou. We may recall, of course, from an earlier discussion that these areas are, however, relatively more important traditionally for livestock rearing. In any case, the fourth "land use" area contains by far the lowest ratio of land used, perhaps not exceeding five percent. There is a fifth land use region for which we did not draw a map because a good part of it would have been blank. This represents the southern region of the Singou and Arli river basins. Here we find virtually no indication of use of land for cultivation, which, of course, is because of its traditional disease and pest problems and more recently because the area is reserved for natural fauna and flora.

We do want to caution here that the amount of land under cultivation that we have tried to estimate using the topo sheets for the ER can only serve as estimate. Not only are the topo sheets a bit dated but also the drawing in of cultivated areas does not differentiate between land under current use and land under fallow. So the result can only be used as indicative of relative regional magnitudes on land under cultivation and not as accurate portrayal of amount of land under crops currently.

Preliminary findings on intensity of land use in the eastern region are found in some SAED publications, particularly in the 1978/79 survey reports. Generally, there are three major categories of intensity which also correspond to future "new lands" capability. In the north and western margins we have relatively intensely used lands, and the search for "new lands" here is quite unlikely. The land resources here may also be under pressure with some instances of degradation. The second region, which includes the central, east and southeast portions of the country, is an area of extensive land use. The former two are also known for their traditional livestock rearing of the transhumance type (see Map 4). The second region offers perhaps the best potential for expanding the agricultural and livestock economy. Its only constraints are lack of population and infrastructure, particularly roads. The third region, which is found in the south, is perhaps the most "unused" in relative terms by agriculture and livestock. It is under-populated, lacks infrastructure and has more diseases than the other regions. However, this region contains some of the better potentials for "new lands" development.

According to the SAED survey results (SAED, 1979) the total cultivated area of the ORD is estimated at 144,090 hectares, which is about 3 percent of the total area of the ER (Table 4). As we mentioned earlier, there is a large degree of variation in intensity of land use for agriculture. Coala, Thion, Piela, Diapaga, Tibga and Diabo show magnitudes in land under cultivation unparalleled by other cantons.

It is apparent that the best endowed areas of the ER have not yet come under effective settlement. The population and the settlement patterns are at their heaviest densities in the regions of the ER which are marginal as far as physical resources such as precipitation, evapotranspiration, river discharge, bottom land moisture and pedological conditions are considered. In short, the ER is characterized by poor geographic covariation between settlement density and productive attributes for agricultural development (compare Maps 2 and 6).

It is well known that there are a number of obstacles to make ventures into what are called "new lands" of the Sahel in which the less or non-settled areas of the ER are classified. Considering present means of evaluation there does not seem to be any doubt that the southern and southeastern sections of the ER are superior in their environmental endowments. The problems for their use for agriculture lie in the following reasons:

1. High incidence of diseases such as malaria, onchocerciasis, and trypanosomiasis;
2. Current use of the area for wildlife reserve whose benefits are minimal and mostly accrue to interests outside the ER; and
3. Lack of transportation infrastructure which inhibits people from other areas to reconnoiter and possibly settle these areas and get their products to market.

The future challenge to alternative uses of land in the ER will definately focus on the "new frontiers" to the south, where, it appears that with good management and control of diseases, there seems to be enough land for both man and wildlife.

4. Settlement Pattern in the Eastern Region

The 1975 census of Upper Volta enumerates 645 villages in the ER. All but about 10 villages have been confirmed by the 1980 village inventory survey as shown on Tables 2 and 6. The pattern of settlement in the ER is dominated by small villages. In 1975 about 57 percent of the villages

Table 4 LAND UNDER CULTIVATION

SAED Code		Pop. 1978/79 SAED, Est.	Population %	Total Area Ha.	Area %	Area Under Cultivation Ha.	Cultivated Area %
01	Coala & Thion	67,403	15.9	213,900	4.3	23,152	16.1
02	Bogande	35,269	8.3	363,900	7.3	11,318	7.9
03	Piela	23,825	5.6	77,000	1.5	10,342	7.2
04	Bilanga & B. Yanga	30,225	7.1	204,800	4.1	9,961	6.9
05	Gayri & Yamba	25,869	6.1	698,700	13.9	8,129	5.6
06	Botou, Kantch, Matia	41,909	9.9	922,500	18.4	14,686	10.2
07	Biapangou, Tibga	22,710	5.4	108,500	2.1	9,601	6.7
08	Fada N'Gourma	22,696	5.4	447,200	8.9	8,068	5.6
09	Giabo	26,742	6.3	61,600	1.2	8,857	6.1
10	Comin Yanga & Yonde	25,887	6.1	205,400	4.1	8,370	5.8
11	Pama, Sond., Madj.	30,999	7.3	719,300	14.4	10,928	7.6
12	Gobnangou	46,732	11.0	496,700	9.9	10,920	7.6
13	Bizougou	23,419	5.5	480,000	9.6	9,758	6.8
		423,683	100.0	4,999,200	100.0	144,090	100.0

Source of Data: SAED 1978/79 Survey.

Table 5 DISTRIBUTION OF POPULATION BASED ON THE 1980 VILLAGE INVENTORY SURVEY ESTIMATES

Population Size Classes	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama			
	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	# of Vill	Pop '000	Total # of Villages	Total Pop '000
1. 399 - below	90	29.8	77	13.4	7	2.2	21	17.6	90	22.8	18	5.1	21	3.8	35	8.2	359	102.9
2. 400 - 799	44	31.1	12	8.8	5	2.6	9	5.7	25	8.3	9	8.8	10	3.0	16	8.7	131	77.0
3. 800 - 1199	12	10.3	6	6.2	7	4.9	3	6.2	5	13.8	5	8.0	7	3.0	5	6.4	50	58.8
4. 1200 - 1599	6	11.7	3	3.0	1	0.1	4	5.5	3	4.1	4	3.5	1	0.5	4	5.8	26	34.2
5. 1600 - 1999	9	13.0	1	3.0	2	.6.0	0	--	4	3.7	1	4.0	3	1.8	0	--	20	31.5
6. 2000 - 2399	5	9.0	1	2.5	4	6.8	0	--	0	--	0	--	0	--	2	12.8	12	31.1
7. 2400 - 2799	1	0.3	0	--	2	1.8	0	--	2	1.4	0	--	1	2.7	0	--	6	6.2
8. 2800 - 3199	0	--	1	3.5	3	10.4	1	3.9	1	0.9	1	4.0	1	0.5	0	--	8	23.2
9. 3200 - 3599	0	--	0	--	0	--	0	--	0	--	0	--	0	--	0	--	--	--
10. 3600 - 3999	2	13.5	0	--	2	6.8	1	3.0	0	--	0	--	0	--	0	--	5	23.3
11. 4000 - above	3	10.0	0	--	4	19.2	0	--	1	a	0	--	0	--	0	--	8	29.2
	172	128.7	101	40.4	37	60.8	39	41.9	132	55.0	38	33.4	44	15.3	62	41.9	625	417.4

[a]No 1980 estimate for the town of Fada N'Gourma.

had less than 400 people in each of them. A high proportion of the villages in this category is found in the administrative sectors located in the western part of the ER with all but the Fada sector touching the western boundary of the ER. The sectors of Bogande, Diabo, Comin Yanga, Fada and Pama have 60 to 75 percent of their villages with population of less than 400. The sectors in the eastern section of the ER contain on the average a lower proportion of villages in the lowest class. Diapaga has only 19 percent of its villages in this category. Kantchari and Matiacoali both have less than 40 percent of their villages in the lowest category. Map 7, which is a rendering of the distribution of the villages in the ER with graduated circles indicating population magnitudes, the same observation can be drawn. Furthermore, it is also clear that whereas villages in the west are highly clustered with relatively short distances between them, those in the east are more scattered with higher distances between the centers of population.

The number of villages with population less than 800 people is more than three-quarters of the total number of villages in the ER. But these villages have only 35 percent of the population of the ER. This means that about two-thirds of the population of the ER lives in villages with a population 800 and higher. This is critical since the minimum threshold given by the Ministry of Health for rural health posts lies around this figure. It is also encouraging to know that whereas the scattered villages of the east, which do not have the advantage of distance for sharing basic needs establishments with other villages, have a higher likelihood to meet thresholds individually, those in the west have less chances to meet thresholds individually, but have the advantage of distance because of their high degree of cluster. This means that in the west several villages can take advantage of one location without excessive population/distance magnitudes.

According to the 1975 Census, there are only 40 villages with populations above 2,000 in the ER. Although they comprise only 6 percent of all the villages, they have over 35 percent of the population of the ER, and 30 of these villages are located in only 3 sectors--Diapaga (15), Bogande (11), and Fada (4). As far as local urban development is concerned, these 3 sectors are by far the most important, being the only ones to have a significant number of villages with populations above 2,500.

Map 7

VILLAGE POPULATIONS
EASTERN REGION OF UPPER VOLTA

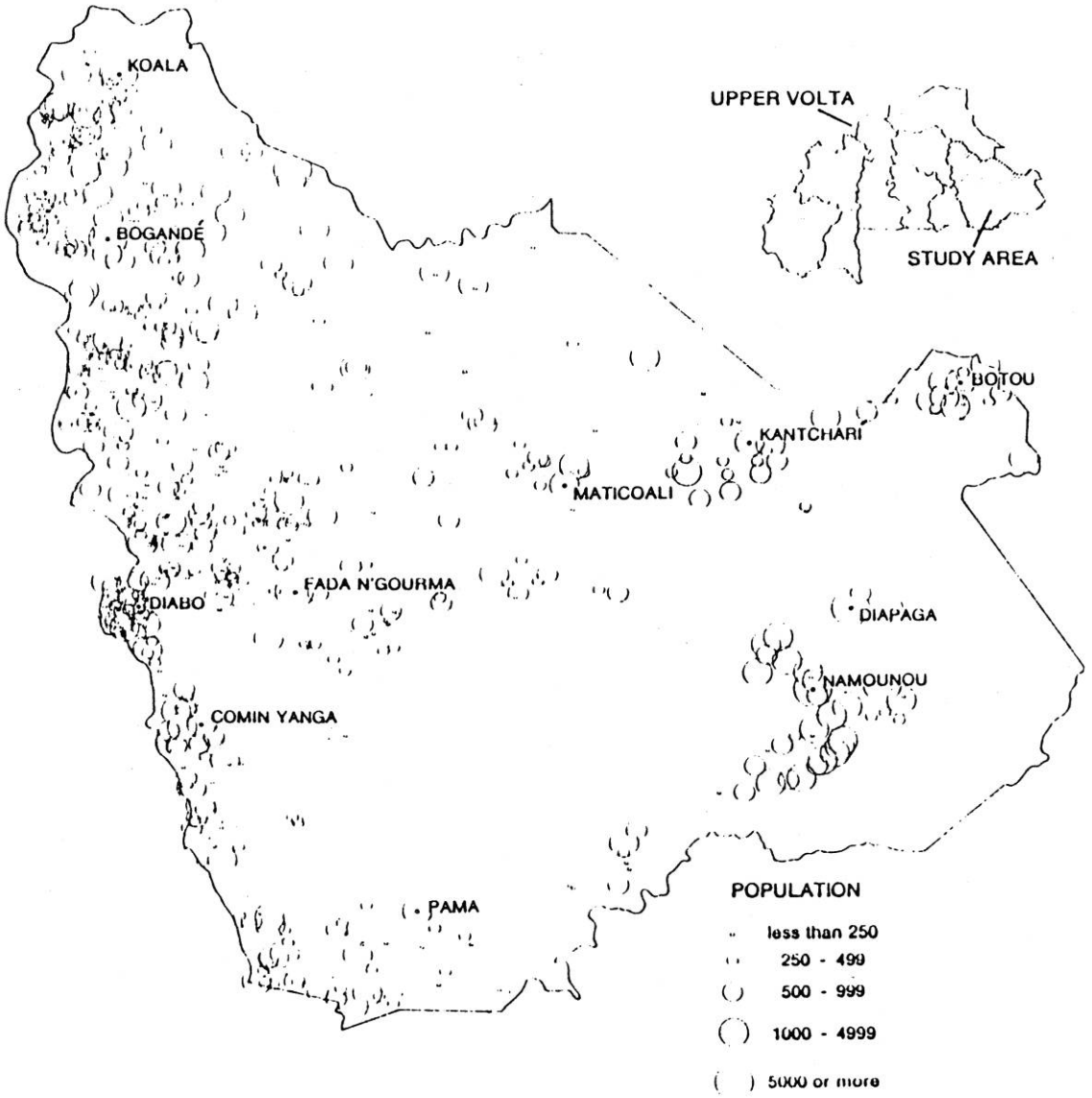


Table 5 is a summary of the population and village data gathered in the 1980 village inventory survey. First of all we can see that there is very little difference in the pattern of settlement between 1975 and 1980. The number of villages is almost the same and their distribution into the various population classes is almost identical. We do witness some growth in the size of the total population of the ER. Excluding the town of Fada N'Gourma, for which we do not have an estimate for the 1980 survey, the population of the ER has grown from 391,700 to 417,400 which shows an annual growth rate of 1.4 percent.[1]

The village population of the ER lives in what are known as concessions which contain an average of 5 to 10 families. Each concession is a compound surrounded by dwelling units which form like a fence around the concession. Spaces between individual houses are blocked by a fence and only one entrance leads to the compound. Villages are a collection of such concessions and over three-fourths of the villages of the ER contain less than 40 concessions. About 50 percent of the villages of the ER contain less than 20 concessions (see Table 6). The size of concessions however does not vary significantly with size of villages. Large villages are characterized by a larger number of concessions but the number of families in each concession remains more or less constant.

This aspect of the settlement pattern of the ER has an important implication for the planning of rural development interventions in the sense that it provides a ready made cluster of families who can be approached as a producing and consuming unit.

5. Population Migration in the ER

The data on Table 7 is based on responses obtained from 630 villages on movement of families in-and-out of the village over the last 5 years (1975-80). Village leaders were asked to give an estimate of the number of households who moved in and out of the village in the last 5 years. The data is therefore sensive not only to the problem of recall but also to the lack of reliable information especially with reference to large villages.

---

[1] The rate (r) was computed using the equation $P_2/P_1 = (1 + r)^n$ for $n = 5$. The national rate according to the 1975 census is 1.93 (INSD).

Table 6 SETTLEMENT PATTERN: NUMBER OF VILLAGES BY SIZE OF CONCESSION IN EACH SECTOR (SURVEY DATA)

Number of Residents in Concession	Bogande # of Villages	Diabo # of Villages	Diapaga # of Villages	Comin-Yanga # of Villages	Fada # of Villages	Kantchari # of Villages	Matiacoali # of Villages	Pama # of Villages	Total # of Villages	%
1. 19 and below	84	51	11	12	84	18	29	24	313	49.8
2. 20 - 39	48	31	11	9	30	16	10	22	177	28.2
3. 40 - 59	10	8	4	9	9	0	4	7	51	8.1
4. 60 - 79	13	3	4	4	4	1	0	4	33	5.3
5. 80 - 99	2	1	2	1	1	1	0	1	9	1.4
6. 100 - 119	6	3	2	2	0	1	0	0	14	2.2
7. 120 - 139	2	0	1	1	2	0	0	1	7	1.1
8. 140 - 159	1	1	1	0	1	0	0	1	5	0.8
9. 160 - 179	3	0	0	0	1	0	0	1	5	0.8
10. 180 - 199	1	1	0	0	0	0	0	0	2	2.3
11. 200 and above	3	3	1	1	1	1	1	1	12	1.9
TOTAL	173	102	37	39	133	38	44	62	628	100

Table 7 POPULATION MIGRATION: MOVEMENT OF HOUSEHOLDS IN AND OUT OF THE VILLAGE OVER THE FIVE-YEAR PERIOD 1975-80
(Survey Data)

Sectors	Number Moving In	Number Moving Out	Net In/Out
1. Bogande	195	203	-
2. Diabo	76	90	-
3. Diapaga	69	35	+
4. Comin Yanga	68	49	+
5. Fada	242	145	+
6. Kantchari	26	37	-
7. Matiacoali	110	56	+
8. Pama	152	222	-
Total	938	837	+

Table 8 MIGRATION IN/OUT OF VILLAGES: FREQUENCY COUNT OF VILLAGES BY NUMBER OF MOVER HOUSEHOLDS (Survey Data)

Number of Movers	In Migration		Out Migration	
	Number of Villages	%	Number of Villages	%
0	445	70.6	439	69.6
1	48	7.6	63	10.0
2	32	5.1	41	6.5
3	24	3.8	24	3.8
4	18	2.9	14	2.2
5	18	2.9	11	1.7
6	6	1.0	10	1.6
7	4	0.6	5	0.8
8	3	0.5	2	0.3
9	1	0.2	0	0.0
10 and over	31	4.9	22	3.5
Total	630	100.0	631	100.0

According to Table 8 only about 30 percent of the villages in the ER reported migration activity, and of those which reported movers, over 75 percent of the villages indicated 5 households or less moving into or out of the village. This to some extent supports the observation that was made earlier that the rural population demonstrates a high degree of "spatial restrictedness." There is however some pattern of the population movement that can be observed from Table 7. The migration activity over the five-year period involved about 1,800 households, which would make close to 2.5 percent of the total number of households in the ER.[1]

According to the village inventory survey the ER is a net receiver of migrants, and within the region the balance between in and out migrants shows that the sectors in the western part of the ER have shown signs of losing population while sectors to the east have gained migrants. The sectors of Fada and Diapaga show by far the highest gains. This is of course not surprising since they contain perhaps the most dynamic economic and urban activity in the ER. The losers of population are those that experience the highest densities of population, such as Diabo, and those that are also highly susceptible to drought conditions, such as Bogande.

Upon examination of the data on migration obtained from the village inventory survey, it may be concluded that migration is not a dynamic worth studying in the ER.[2] But this of course is not the case. In the first instance the data on the village inventory on this highly sensitive data should be taken only as cursory and indicative, with only limited quantitative significance. Second, even if the current magnitude of population movement seems to be weak, the trend that future movement is likely to take will be very valuable. The purpose of the question on migration in the village inventory questionnaire was to obtain such a general tendency.

---

[1] The average size of households according to the 1975 census for the ER is 5.4 (INSD).

[2] Some recent information on migration in the ER is presented in a World Bank Publication which deals with demographic aspects of migration for Upper Volta (World Bank, 1980).

II. BASELINE VILLAGE CHARACTERISTICS

A. Village Structural Attributes

1. Permanent Structures in Villages

One of the purposes of the village inventory survey was to collect data on individual village attributes with respect to fixed structures that demonstrated a relative degree of permanence of villages in varying levels of hierarchy based on population. The survey contained data, binary as well as quantitative, for key characteristics that were considered vital for the structural differentiation of villages the identification of nodal micro-regions. One such group of data is presented in summary fashion on Tables 9 and 10.

In Table 9 the data, summarized from individual village scores, indicate by population size classes, the distributional magnitudes of the presence of selected village features such as government buildings, churches, mosques and colonial silos. The overall magnitude indicates that these features are not too well represented in the villages of the ER. Only 10 to 16 percent of the villages of the region contain fixed structures like those shown on Table 9. There are of course variations based on population size and location. As may be expected the villages with small population figures have smaller percentages of them containing fixed features. Villages with populations that exceed 2,000 inhabitants seem to show that on the average over half of their number contain permanent fixed features. Villages with number of inhabitants less than 800 are mostly characterized by single percent magnitudes of the presence of fixed features.

Churches are by far the most widely distributed features of "permanence" for the small villages. In the inventory survey 100 villages reported as having Catholic churches and 67 Protestant churches. We have not extracted the exact number of villages that have Christian places of worship but indications are it is over 100. There were 79 Mosques reported, and the pattern of the distribution of the places of worship seems to be almost identical. However the Catholic church seems to penetrate more into the village system than the other two.

Table 9 DISTRIBUTION OF FIXED VILLAGE STRUCTURES BY VILLAGE SIZE CLASSES: PERCENT OF VILLAGES IN SIZE CLASS THAT CONTAIN CHARACTERISTIC

Population Size Class	Catholic Churches	Protestant Churches	Mosques	Tin Roofed Gov't Bldgs.	Colonial Silos
1. 399-below	6.6	3.0	5.8	2.2	1.4
2. 400-799	21.4	14.5	9.2	5.3	9.2
3. 800-1199	30.0	18.0	18.0	20.0	20.0
4. 1200-1599	34.6	15.4	30.8	23.1	15.4
5. 1600-1999	15.0	25.0	25.0	30.0	40.0
6. 2000-2399	46.2	38.5	53.8	46.2	38.5
7. 2400-2799	50.0	33.3	50.0	33.3	33.3
8. 2800-3199	62.5	50.0	37.5	75.0	75.0
9. 3200-3599	-	-	-	-	-
10. 3600-3999	60.0	60.0	80.0	80.0	80.0
11. 4000-above	37.5	62.5	50.0	75.0	37.5
Total %	15.9	10.7	12.6	10.0	9.4

Table 10 INVENTORY OF SOCIAL INFRASTRUCTURE BY SECTOR: FIXED STRUCTURAL ATTRIBUTES OF VILLAGE BY PERCENT OF VILLAGES CONTAINING ATTRIBUTE (Survey Data)

	Sectors							
	% of Villages Bogange	Diabo	Diapaga	Comin Yanga	Fada	Kantchari	Matiacoali	Pama
Tin Roofed Gov't Bldg.	9.1	7.8	27.0	9.3	8.2	10.5	6.8	11.3
Church, Catholic	17.6	14.6	24.3	9.3	20.1	21.1	9.1	3.2
Church, Protestant	14.8	4.9	40.5	0.0	8.2	7.9	11.4	3.2
Mosque	13.6	7.8	16.2	2.3	17.2	10.5	13.6	11.3
Colonial Silos	9.3	13.0	18.9	7.0	6.7	5.3	11.4	6.5

The other two types of village structures, government buildings and colonial silos, seem to be more sensitive to village population size than the structures of worship. First of all they are found in less number of villages overall. Second, they show preference for villages with higher size of inhabitants. Government buildings as well as colonial silos seem to show a higher sensitivity to nodality.

Table 10 shows that there is some variation in the distribution of the 5 types of social infrastructure in the ER. The Diapaga sector is by far the most developed in this respect. One obvious reason for this is that a relatively higher proportions of its villages have higher number of inhabitants. The sectors of Bogande and Fada do also show some stability in their settlement structure. The weakest in this respect are the sectors of Comin Yanga and Diabo, and to some extent, Pama.

There is some pattern that can be discerned by comparing the settlement pattern of the ER with the distribution of the social structures that we discussed above. First, as mentioned earlier, the sectors that showed a higher level of representation of villages with large numbers of inhabitants also showed a higher level of concentration of the social structures. Second, as the cases of Diapaga, Fada and Matiacoali indicate, it is also those sectors that have attracted migrants over the last 5 years that showed a higher concentration of the social infrastructure.

The utility of this observation is that it gives us an idea of the pattern of nodality in the region and some notion of the permanence of settlements in the various parts of the ER. More indicators of nodality will be examined subsequently. The pattern that has emerged thus far indicates that 3 nodal systems dominate the ER. In the order of their magnitude these are Fada, Diapaga and Bogande. But if the "primate town" of Fada N'Gourma is excluded from the rural settlement consideration, then the most dynamic settlement and nodality development is that shown by Diapaga. Further analysis may also yield one or two other nodal regions. Kantchari (a transport center) and Matiacoali may emerge as potential centers of development. What is most surprising is that high density population regions like Diabo and Comin Yanga show very weak central place developments perhaps because they come under the influence of Fada N'Gourma, which is the capital of the region.

2. Village Transport Facilities

The ER is poorly supplied by means of surface transport. The total length of roads varying in quality from all weather to dirt trails is only 2,823 kilometers. The length of all-weather roads is only 368 kilometers which makes up only 13 percent of all road length. This is very insignificant for a region which extends about 320 kilometers north to south and about 250 kilometers east to west. The accessibility index for the region assuming effective use of all weather roads to be limited within 10 kilometers perpendicular to the highway, comes to only 15 percent of the total area of the ER. If the dry weather roads motorable by all vehicles are included, the accessibility index rises to 37 percent. As the indices computed in this manner show for both all-weather and dry weather roads, the ER is poorly supplied with surface transport (see Table 11).

The present pattern of road network resembles that of the population and settlement pattern as laid out in Map 6. Two major axes are by far the most important. The north-south axis stretches from Coala in the north to Fada N'Gourma and then branches off into two lines, one reaching Soudougui in the southwest and another reaching the Togo border via Pama (see Map 6 and Figure 1). The major east-west axis runs from the western boundary of the ER to the Niger border. Nationally this is an important link since a considerable amount of the international trade flows through it. Regionally, it is also very important since it serves high density settlements and also connects the major settlements to the east particularly those in the sectors of Matiacoali, Kantchari and Diapaga with the capital of Fada N'Gourma. This east-west axis comprises of over 77 percent of all the weather roads in the ER. But its importance to potential regional accessibility to population within the ER is not as important to the potential for the north-south axis. The study of Map 8 and Figure 1 yields some clues with respect to setting future priorities for road improvement in the ER.

In the village inventory survey the respondent for each village has been asked some key questions that relate to the position of the village with respect to accessibility and the existence of transport facilities. The overall pattern of the responses is as shown in Tables 12 and 13. Two questions dealt with visits by cars or trucks to the village over the last 6 months. Close to 60 percent of the villages responded positively for cars and almost 50 percent for trucks. Four sectors, namely in the order

Table 11 ROAD LENGTHS BY CANTON, 1979

Canton	All Weather Km.	Dry Weather Km.	Motorable Trails Km.	Total Km.	Sq. Km. Area of Canton ÷ AW & DW	% of Area Having Access to AW/DW in 10 Km.
01. Bogande	0	33	222	255	110	18
02. Coala	0	48	71	119	37	55
03. Thion	0	0	52	52	0	0
04. Piela	0	31	81	112	25	81
05. Bilanga	0	52	123	175	37	55
06. Bilan-Yanga	0	0	12	12	0	0
07. Diapangou	5	0	8	13	114	18
08. Fada N'Gourma	60	104	28	192	27	73
09. Yamba	0	19	173	192	106	19
10. Diabo	29	0	61	90	21	94
11. Tibga	0	0	47	47	0	0
12. Gayeri	0	0	223	223	0	0
13. Matiacoali	59	0	74	133	71	28
14. Comin Yanga	0	24	31	55	53	38
15. Yonde	0	0	9	9	0	0
16. Madjoari	0	37	13	50	52	18
17. Pama	0	113	100	213	40	50
18. Soudougui	0	0	64	64	0	0
19. Botou	40	0	76	76	44	46
20. Kantchari	128	0	0	128	26	78
21. Bizougou	43	16	105	164	81	25
22. Gobnangou	4	78	327	409	61	33
Total	368	555	1900	2823	54	37

Road Map: Institute Geographique de Haute Volta (1978).

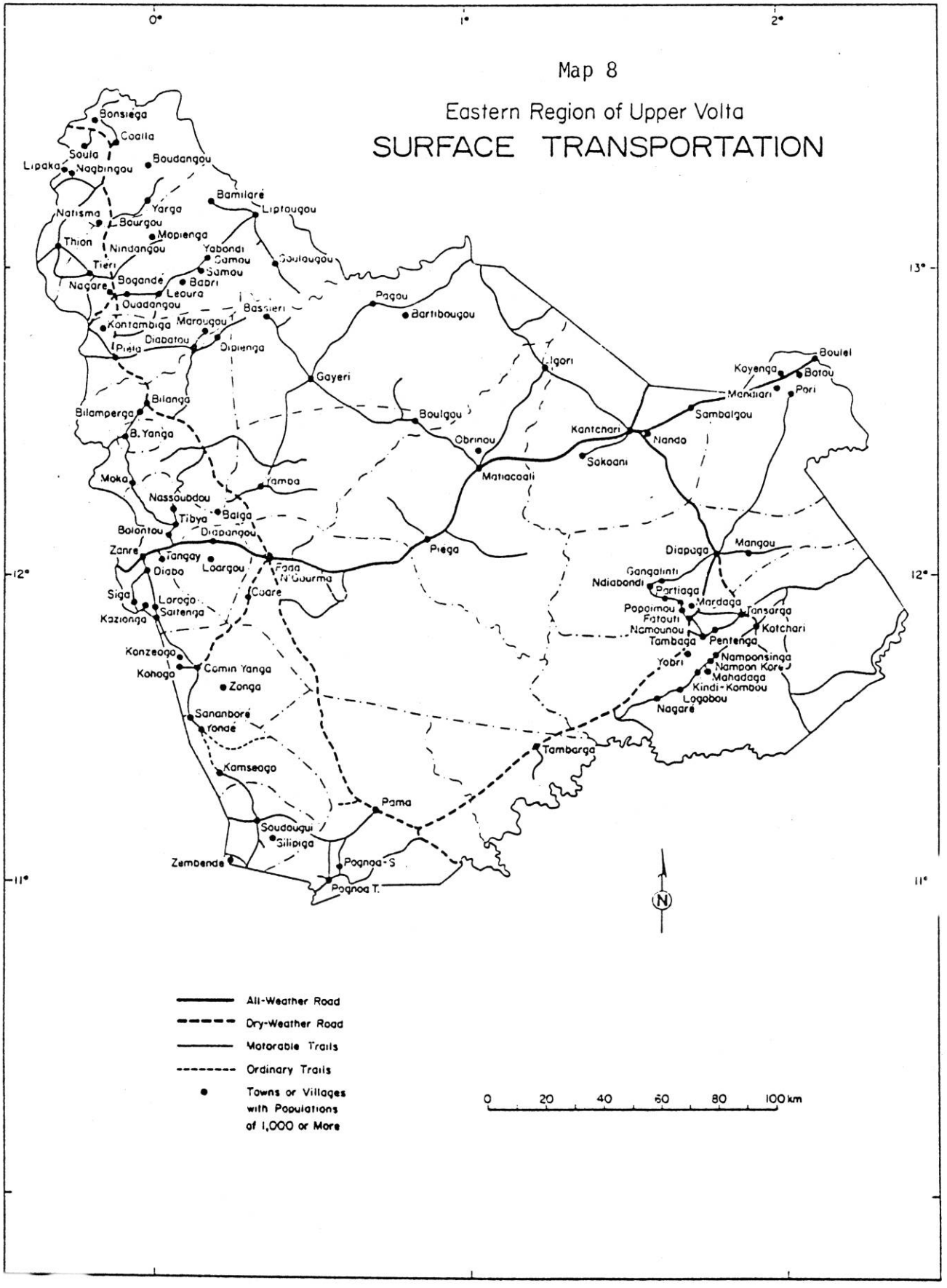
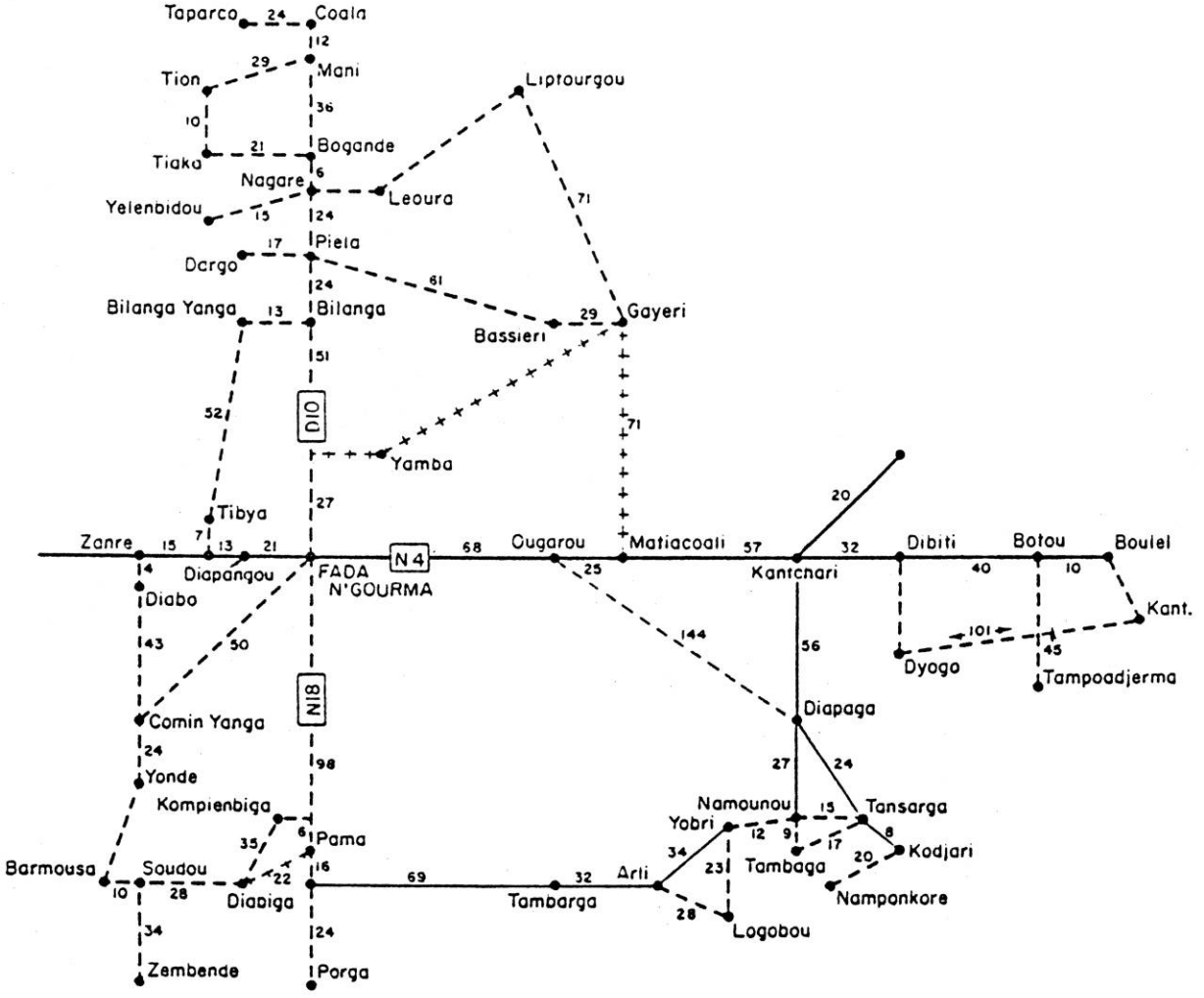

Map 8
Eastern Region of Upper Volta
SURFACE TRANSPORTATION
0°
1°
2°
13°
12°
11°
Bonsiega
Coalla
Soula
Lipaka
Nagbingou
Boudangou
Bamilaré
Liptougou
Yarga
Natisma
Bourgou
Mopienga
Thion
Nindangou
Yabondi
Samou
Tieri
Nagare
Bogandé
Babri
Leoura
Ouadangou
Bassieri
Kontambiga
Marougou
Diabatou
Piela
Dipienga
Pagou
Bartibougou
Gayeri
Igori
Boulel
Koyenga
Botou
Mandiari
Pori
Sambalgou
Bilanga
Bilamperga
B. Yanga
Boulgou
Obrinou
Kantchari
Nando
Sakoani
Matiacoali
Moka
Yamba
Nassoubdou
Tibya
Balga
Bolontou
Diapangou
Zanre
Tangay
Loargou
Diabo
Fada N'Gourma
Piega
Diapaga
Mangou
Gangalinti
Ndiabondi
Partiaga
Mardaga
Popoimou
Fatouti
Namounou
Tambaga
Tansarga
Kotchari
Pentenga
Yobri
Namponsinga
Nampon Kore
Mahadaga
Kindi-Kombou
Logobou
Nagaré
Siga
Lorogo
Saitenga
Kazionga
Coare
Konzeogo
Kohogo
Comin Yanga
Zonga
Sananboré
Yondé
Tambarga
Kamseogo
Pama
Soudougui
Silipiga
Zembende
Pognoa-S
Pognoa T.
N
All-Weather Road
Dry-Weather Road
Motorable Trails
Ordinary Trails
Towns or Villages with Populations of 1,000 or More
0 20 40 60 80 100 km

Figure 1
Eastern Region of Upper Volta

Graph of Existing Roads and Roads Proposed for Construction



All-weather existing
All-weather planned
Dry weather existing, no improvement indicated
Dry weather planned
Trails existing, no improvement indicated
96 Distance in kilometers
N4 Highway designation

Table 12 VILLAGE TRANSPORT FACILITIES BY PERCENT OF VILLAGE CONTAINING FACILITY AND BY TOTAL NUMBER OF FACILITY IN VILLAGE
(SURVEY DATA)

	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama			
	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	ER %	Total ER N
Car Visits	65.3	--	[illegible]	--	[illegible]	--	35.7	--	58.9	--	76.3	--	65.9	--	42.2	--	59.2	--
Truck Visits	74.7	--	[illegible]	--	[illegible]	--	16.3	--	47.4	--	28.9	--	47.7	--	24.2	--	49.4	--
Motor Bikes	63.1	654	[illegible]	[illegible]	[illegible]	[illegible]	27.9	56	46.3	240	52.6	189	50.0	120	30.6	93	50.8	1,773
Donkey Carts	50.6	422	[illegible]	[illegible]	[illegible]	[illegible]	27.9	37	29.9	186	44.7	132	13.6	18	12.9	21	36.6	1,007
Private Cars	5.1	24	[illegible]	[illegible]	[illegible]	[illegible]	0.0	0	3.7	77	36.8	28	2.3	1	0.0	0	6.8	157
Private Trucks	0.6	1	[illegible]	[illegible]	[illegible]	[illegible]	0.0	0	1.5	14	7.9	6	0.0	0	0.0	0	2.2	35

Table 13 VILLAGE TRANSPORT FACILITIES: PERCENT OF VILLAGES IN SIZE CATEGORY THAT CONTAIN FACILITY (Survey Data)

Population Size Classes	Donkey Cart	Motor-Bike	Private Car	Truck
1. 399-below	23.0	32.1	3.3	0.8
2. 400-799	46.6	67.2	3.8	0.0
3. 800-1199	56.0	78.0	6.0	4.0
4. 1200-1599	65.4	88.5	23.1	3.8
5. 1600-1999	50.0	90.0	15.0	10.0
6. 2000-2399	84.6	92.3	23.1	33.3
7. 2400-2799	50.0	66.7	16.7	0.0
8. 2800-3199	75.0	87.5	37.5	12.5
9. 3200-3599	-	-	-	-
10. 3600-3999	100.0	100.0	60.0	20.0
11. 4000-above	75.0	87.5	50.0	25.0
Total %	36.6	50.8	6.8	2.2

of their magnitude, Diapaga, Kantchari, Matiacoali and Bogande, showed a higher percentage of their villages which have experienced visits by cars, whereas sectors Diabo, Comin-Yanga and Pama demonstrated a poorer rating. The reason for this difference becomes quite obvious when we look at the road map diagram. Villages in Matiacoali, Kantchari and Diapaga are on or near all weather roads. The accessibility of villages to trucks presents a slightly different picture. Diapaga and Bogande by far exceed the regional percentage being the only two which exceed it. Over 86 percent of Diapaga's and 75 percent of Bogande's villages have had visits from transporters using trucks. This testifies their regional position as major producers of agricultural products. Bogande and Diapaga are the most important producers of one of the major cash crops in the region - peanuts.

The survey showed that the most widely distributed means of transportation is the motorbike. In the ER over 50 percent of the villages reported the use of motorbikes. The total number of motorbikes in the ER, according to the survey in 1980, was 1,773. The regional distribution of this mode of transportation once again favors the sectors of Diapaga, Bogande and Kantchari which have about 78, 63 and 53 percent of their villages indicating the presence of motorbikes. The reasons for these must lie not only in the relative economic importance of the three sectors but also in the concentration of high population settlements in these sectors particularly in Diapaga and Bogande [see Table 12].[1]

Two-wheeled, donkey drawn carts are also important means of rural transportation along with the bicycle and the motorbike. In the ER these carts are used for transporting agricultural products, firewood, water and domestic effects. They are mostly used for in-village or in-town hauling of bulk materials but they are also important in transporting agricultural products between producing areas and village markets. The 1980 inventory survey estimated 1,087 such carts in ER. Only about 37 percent of the villages of the ER have reported the presence of donkey carts. High concentration is once again observed in Diapaga, Bogande,

---

[1] It should be noted that the use of motorbikes in the ER, and for that matter in many parts of Upper Volta, is not restricted to the urban centers or villages. They are also important means of long distance travel between major markets and village centers.

Kantchari, and in this case also Diabo. As shown in Table 13 the distributional magnitude of the presence of donkey carts up the hierarchy of villages in the ER is similar to that of the motorbikes with the exception that the latter are more represented along the hierarchy than the donkey carts. Table 13 shows that over 32 percent of the villages of the ER have shown the presence of motorbikes whereas only 23 of the villages indicated the presence of donkey carts.

There are only a very limited number of private motorcars and trucks in the ER. According to the inventory survey there were only 157 cars and 35 trucks reported to belong to people living in the villages where they were reported. Virtually all of the motorcars are found in the sectors of Fada, Diapaga, Bogande and Kantchari. Fada has almost 50 percent of the private cars. The other three have equal number of cars. Only 6.8 percent of the villages of the ER reported the presence of cars and because of their small number, their concentration does not seem to be limited to a function of size of villages but also of location. This is obvious from the fact that Kantchari which hardly has any village with large population settlement shows an equal attraction to motorized transport as Bogande and Diapaga, which have many villages with large population sizes. Kantchari's location as a transport center has played a significant role in its development as an important node.

The presence of trucks in the ER is even more limited than motorcars. The sectors of Fada, Diapaga and Kantchari have virtually all of the trucks in the ER. All 3 sectors contain perhaps the most important transport centers in the whole of the ER. Therefore it is not surprising that they emerge as centers of transport operators. The reason why Bogande did not join in this importance may be because of its isolation in the rainy season. However as observed earlier the sector fares highly in being served by motorized transport.

The overall inadequacy of transport in the ER is quite obvious from the survey on surface transport and the inventory survey of modes of transportation. Accessibility to transport facilities is limited to villages with high number of inhabitants and to those which are around the traditional nodes of development, trade and transportation. All weather roads are limited and they do not serve the large concentration of the rural population. The mode of transport is dominated by private means of conveyance such as the motorbike and the donkey cart. The role of public or commercial transport is non-existent or minimal in the ER.

3. Village Educational Characteristics

The ER has one of the lowest rates of school enrollment in the country. Its rate of enrollment in 1979, which is 7.8% of the school-age population, exceeds only that of Dori which is about 5%. According to the "Situation de l'Enseignement du Premier Degre" published by the Ministry of Education and Culture [1979], the rate of enrollment of the ER is over 6% points lower than that of the national average. The Ouaga sector leads by about 52% of its school-age population enrolled. As indicated earlier, the distribution of the existing facility is highly concentrated. Close to 30% of the enrollment is in Fada town, and this is without including other schools in the town. The Gobnangou area has the second ranking concentration with 12% and Bogande follows with 8.3%. The four cantons of Fada, Gobnangou, Bogande and Bizougou account for over 55% of the region's total enrollment whereas they have only about 30% of the school-age population of the region [see Table 14].

The distribution of elementary schools within the region is affected by both size of village and location in the ER. Close to 20 percent of the villages in Diapaga have schools whereas only 1.9 percent in Diabo. The Fada sector with only 3.7 percent of its villages with schools is the next poorest. The rest of the sectors do not deviate from the regional mean significantly. As we can observe from Table 15 the distribution of elementary schools with respect to sizes of settlements indicates that villages below the size of 2,400 inhabitants are poorly supplied with elementary educational facilities. Village size is an important factor in the supply of schools. Seventy-five to 88 percent of the villages with number of inhabitants of 2,800 or more have schools whereas only about 2 percent of the villages with number of inhabitants of 1,200 and less have such facility.

The 1980 inventory survey collected data on the number of people living in the village with educational achievement ranging between elementary education and the university diploma, using the French systems of levels represented by CEP, BEPC, BAC,[1] and university diploma. The summary data are presented on Tables 15 and 16. Almost 24 percent of the villages in the region reported to have residents who have completed the first level of education (CEP). The total number of people in the ER who have completed this level of education

---

[1] CEP = Certificat d'Etudes Primaires; BEPC = Brevet d'Etudes Premier Cycle; and BAC = Baccalauréat

Table 14 EDUCATIONAL FACILITIES, ELEMENTARY SCHOOLS

Canton	1979 Number of Schools	Enrollment		Schoolage Pop.		% Schoolage Attending	Number of School Locations
		Number	%	Number	%		
01. Bogange	3	578	8.3	7,298	8.3	7.9	3
02. Coala	3	331	4.8	11,903	13.5	2.8	3
03. Thion	1	118	1.7	2,045	2.3	5.8	1
04. Piela	1	168	2.4	4,950	5.6	3.4	1
05. Bilanga	1	174	2.5	5,656	6.4	3.1	1
06. Bilan-Yanga	-	-	-	598	0.7	0.0	0
07. Diapangou	1	176	2.5	1,677	1.9	10.5	1
08. Fada N'Gourma	6	2,028	29.3	5,449	6.2	37.2	1
09. Yamba	1	37	0.5	2,024	2.3	1.8	1
10. Diabo	1	512	7.4	5,452	6.2	9.4	1
11. Tibga	2	344	5.0	3,022	3.4	11.4	2
12. Gayeri	1	56	0.8	3,329	3.8	1.7	1
13. Matiacoali	1	134	1.9	3,035	3.4	4.4	1
14. Comin Yanga	2	240	3.5	3,292	3.7	7.3	2
15. Yonde	-	-	-	2,065	2.3	0.0	1
16. Madjoari	1	40	0.6	705	0.8	5.7	1
17. Pama	1	201	2.9	2,446	2.8	8.2	1
18. Soudougui	2	254	3.7	3,253	3.7	7.8	2
19. Botou	1	110	1.6	2,857	2.9	3.9	1
20. Kantchari	1	208	3.0	2,781	3.1	7.5	1
21. Bizougou	2	375	5.4	4,846	5.5	7.7	2
22. Gobnangou	6	840	12.1	9.753	11.0	8.6	5
	38	6,924	100.0	88,436	100.0	7.8	33

Source of Data: Ministry of Education and Culture, 1979.

*Estimate.

Table 15 DISTRIBUTION OF PRIMARY SCHOOLS AND VILLAGE RESIDENTS WITH VARIOUS LEVELS OF EDUCATIONAL ACHIEVEMENT: PERCENT OF VILLAGES IN SIZE CATEGORY THAT HAVE CHARACTERISTICS (Survey Data)

Population Size Classes	Primary School	Number with CEP	Number with BEPC	Number with BAC	Number with Univ. Dip.
1. 399-below	0.6	14.4	3.9	0.3	0.3
2. 400-799	2.3	25.2	6.1	0.8	0.8
3. 800-1199	2.0	30.6	6.0	4.0	2.0
4. 1200-1599	19.2	38.5	26.9	0.0	0.0
5. 1600-1999	15.0	35.0	19.0	5.0	5.0
6. 2000-2399	38.5	84.6	38.5	23.1	23.1
7. 2400-2799	16.7	50.0	33.3	0.0	0.0
8. 2800-3199	75.0	75.0	87.5	50.0	0.0
9. 3200-3599	-	-	-	-	-
10. 3600-3999	80.0	80.0	40.0	20.0	20.0
11. 4000-above	87.5	87.5	75.0	62.5	50.0
TOTAL	5.9	23.6	9.1	2.9	1.8

was given at 822 which is only two-tenths of 1 percent of the population of the ER. Their distribution favors the sectors of Diapaga, Bogande and Kantchari, in that order. Poor representation is shown by Diabo, Fada,[1] and Matiacoali. Comin-Yanga and Pama have magnitudes close to the regional average. The pattern of diffusion of people with the achievement of the completion of the CEP is again highly influenced by village hierarchy but representation of smaller villages is better for this structural characteristics than location of schools, for instance. The survey shows that 14 to 25 percent of the villages with number of inhabitants of less than 800 report the presence of people who have completed CEP.

People with secondary education are few in the region. Only 260 were reported to be present in 9.1 percent of the villages of the ER. Regionally, there is once again greater concentration of people with secondary education (BEPC). The sector of Diapaga outstrips the others by a high magnitude with 27 percent of its villages reporting the presence of people with BEPC. As may be expected, BEPC holders are disproportionately represented in villages with high population. People with BAC are very few and almost all of them are located in the principal villages of Bogande, Diapaga and Diabo. There are only 61 in the whole region (excluding the town of Fada N'Gourma) and over two-thirds of them are in Bogande and Diapaga. People with university education are even more rare in the region. Bogande and Diapaga have 19 of the 22 reported present in the region.

In summary, the ER is not only poor in the supply of educational services but also with a distribution that is not equitable. Indicators of educational resources are concentrated in few major towns and their surroundings. We observed that a disproportionate size of the educational variables are by far concentrated in the town of FADA and the sectors of Bogande and Diapaga.

---

[1] In many instances, the quantitative data for the town of Fada N'Gourma are not made available. For this reason the binary information is more accurate for that sector than the quantitative information.

Table 16 VILLAGE EDUCATIONAL CHARACTERISTICS BY SECTOR: DISTRIBUTION OF PRIMARY SCHOOLS AND NUMBER OF VILLAGE RESIDENTS WITH VARIOUS LEVELS OF EDUCATIONAL ACHIEVEMENT (SURVEY DATA)

	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama		Total ER	Total
	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Villages	ER N
Primary School*	6.3	11	1.9	2	18.9	7	9.3	4	3.7	5	5.3	2	4.5	2	6.5	4	5.9	37
With CEP	31.3	338	10.7	63	56.8	180	23.3	69	11.2	38	26.3	58	13.6	28	21.0	48	23.6	822
With BEPC	8.5	106	5.8	18	27.0	67	4.7	2	10.4	22	5.3	16	4.5	10	11.3	19	9.1	260
With BAC	5.1	33	1.0	9	10.8	14	0.0	0	1.5	ND	2.6	3	0.0	0	1.6	1	2.9	61
With Univ Dip	3.4	13	1.0	ND	5.4	6	0.0	0	0.7	ND	0.0	0	0.0	0	1.6	3	1.8	22

*Percent and number of villages that have.

ND = No data.

4. Village Health Facilities

According to the "Departement de l'Est, Secteur Sanitaire N°2, Fada N'Gourma [1979]," the "rayon d'action des diverses formation sanitaire" (effective service radius) is about five kilometers. With only 27 units of dispensaire and maternité and one hospital with the same number of locations, based on the effective delivery radius for health locations mentioned above, only 4% of the ER's total area is covered by the current delivery system. Using a more realistic size of the inhabited area of the ER, as shown in Map 6, the ratio of the ER's area covered by health service outlets becomes about 10 percent which is still a very low rate of coverage, considering the many health afflictions the rural population faces in the ER [see Tables 17 and 18]. The data on Table 20 indicate that the few health facilities that exist in the region are concentrated in the villages with population higher than 1,200 from which over 85% of the villages of ER are excluded.

The village inventory survey included questions dealing with the diffusion of health services to explore to what extent the village hierarchy was integrated to the health maintenance of the ER. The village respondent was asked if within the last year an ambulance or a vaccinations team had visited the village. One hundred forty villages responded positively for ambulance and 362 for vaccination teams. This comprises of about 22 percent and 57 percent of the villages in the ER respectively. The regional distribution of ambulance visits favor those sectors which enjoy relatively good transport connectivity such as Diapaga, Kantchari and Fada. For vaccinations, Diapaga and Bogande show a disproportionate magnitude of receiving service in this regard. The distribution through the hierarchy shows a much better picture than many social service variables. But again villages with large number of settlements are favored. The vaccination teams do, however, penetrate into the lower hierarchy of settlements with magnitudes shown in Table 20. It should be realized that the inventory data shows only direct visits by the vaccination team to the village and does not demonstrate the extent of the outreach of the service which should take into account people from nearby villages coming to obtain inoculations. This could conceivably be the case for regions which have high density village settlements with short distances between villages such as Diabo, Comin-Yanga and Pama.

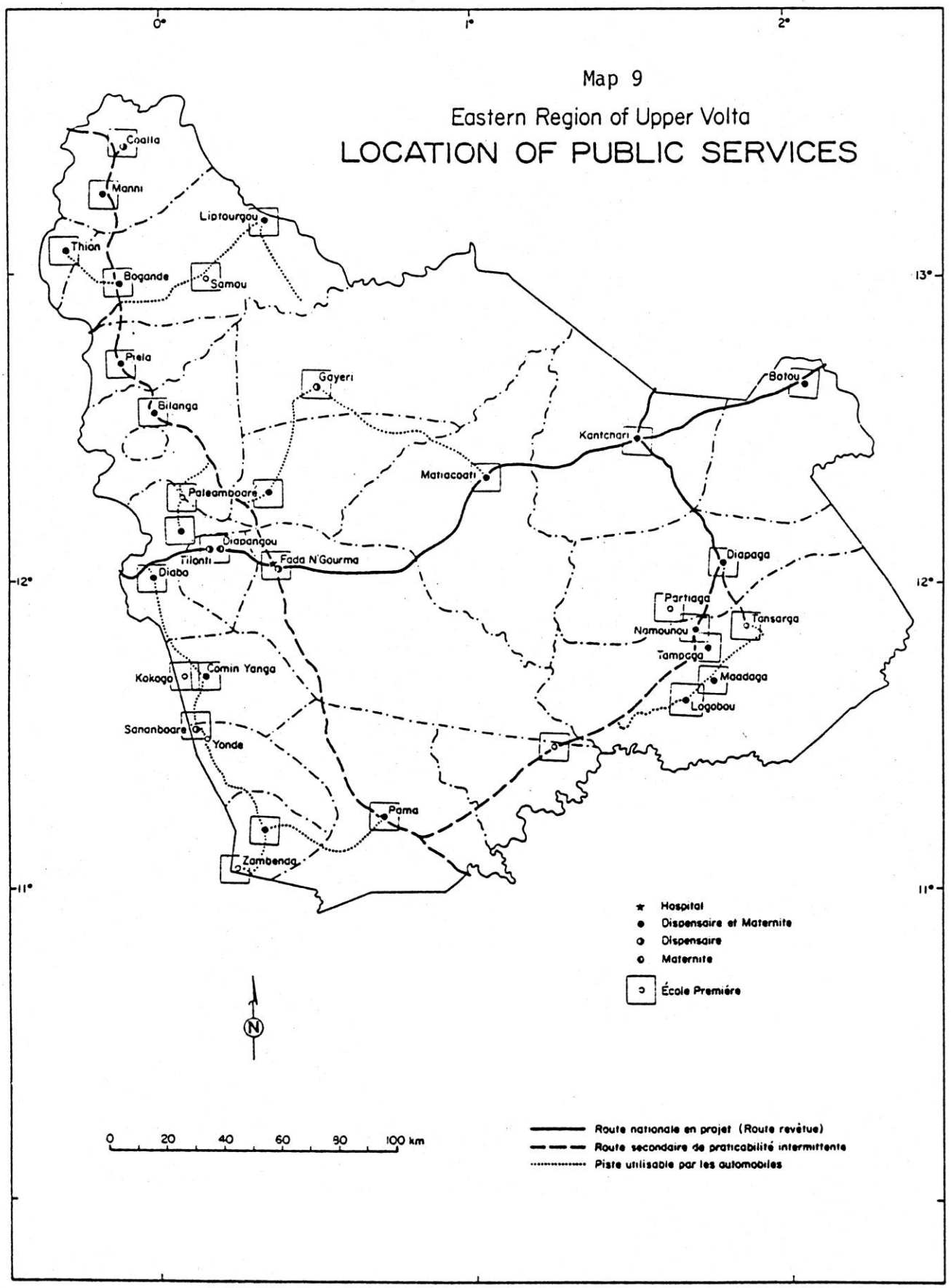

Map 9
Eastern Region of Upper Volta
LOCATION OF PUBLIC SERVICES
0°
1°
2°
13°
12°
11°
Coalla
Manni
Liptougou
Thion
Bogande
Samou
Piela
Gayeri
Botou
Bilanga
Kantchari
Matiacoali
Paleamboare
Diapangou
Tilonti
Fada N'Gourma
Diabo
Diapaga
Partiaga
Tansarga
Namounou
Tampoga
Comin Yanga
Kokoga
Maadaga
Logobou
Sananboare
Yonde
Pama
Zambenga
Hospital
Dispensaire et Maternite
Dispensaire
Maternite
École Première
N
0 20 40 60 80 100 km
Route nationale en projet (Route revêtue)
Route secondaire de praticabilité intermittente
Piste utilisable par les automobiles

Table 17 MORTALITY BY AGE GROUP AND CAUSE PER 1000

Cause	0-1	1-4	5-14	15-44	45-64	64+
Rougeole	26.1	26.1	4.6	0.4	0.1	-
Paludisme	40.5	4.9	0.5	0.6	1.8	6.0
Diarrhee	19.2	13.4	2.1	2.3	7.4	17.8
Meningite	4.5	1.8	1.1	1.1	1.1	2.5
Coqueluche	11.9	1.8	0.3	0.1	0.2	0.7

Table 18 INCIDENCE AND PREVALENCE OF PRINCIPAL DISEASES

Paludisme (1974)	83.0%
Rougeole (1975)	5.4
Onchocercose	1.8
Bilharziasis	4.0
Trachome	3.7
Lepre	15.0
Meningite	2.0
Diarrhees	14.0

Source: Ministère de la Santé Publique (1978).

Table 19 DISTRIBUTION OF HEALTH FACILITIES BY SECTOR
(SURVEY DATA)

	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama		Total ORD % of Villages	Total ORD N
	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N		
Dispensary	3.4	6	2.0	2	16.2	6	4.7	2	2.2	3	5.4	2	4.5	2	3.2	2	3.8	25
Maternity Clinic	4.5	8	2.0	2	13.5	5	2.3	1	6.0	8	7.9	3	2.3	1	3.2	2	4.8	30
Ambulance Visits*	19.1	33	10.0	10	41.7	15	20.9	9	29.8	39	21.1	8	36.4	16	16.1	10	21.8	140
Vaccinations*	74.4	131	35.9	37	78.4	29	53.5	23	50.0	67	50.0	19	52.3	23	53.2	33	57.0	362

*Number of Villages.

N = Frequency count of characteristic in villages that have.

Table 20 DISTRIBUTION OF HEALTH SERVICE INDICATORS: PERCENT OF VILLAGES IN SIZE CLASS THAT HAVE (Survey Data)

		Dispensary	Maternity	Ambulance Visits	Vaccinations
1.	399-below	0.0	1.1	14.1	44.6
2.	400-799	0.0	1.5	24.4	64.9
3.	800-1199	0.0	4.0	32.0	74.0
4.	1200-1599	7.7	11.5	30.8	88.5
5.	1600-1999	15.0	15.0	25.0	85.0
6.	2000-2399	23.1	23.1	30.8	84.6
7.	2400-2799	16.7	33.3	50.0	83.3
8.	2800-3199	63.5	37.5	75.0	87.5
9.	3200-3599	-	-	-	-
10.	3600-3999	80.0	80.0	80.0	100.0
11.	4000-above	75.0	50.0	75.0	87.5
	Total %	3.8	4.8	21.8	57.0

5. Village Water Supply

An important factor in village health maintenance is the ease in obtaining potable water. According to the inventory survey, over 80 percent of the villages of the ER depend on wells for the supply of domestic water needs. About 38 percent of the villages also said they use pot holes dug in the ground and less than ten percent of the villages reported to be using water accumulated from rain. In those sectors which show high counts of wells, there are relatively small counts of pot holes (Bogande, Diapaga, Fada, Kantchari and Matiacoali) whereas those sectors which have a small percentage of their villages with wells, showed a very high incidence of pot holes (Comin-Yanga and Pama).

Two important pieces of data are also available on village water supply from the inventory survey. These are presented in Table 21 and 22. Table 21 presents the regional aspects of seasonality of wells. As we have observed above the overall distribution of wells and pot holes does not look as bad as some of the social structures we have discussed. Over 80 percent of the villages contain some sort of water supply facility. However, only 60 percent of the villages in the ER have wells which have water in them all year round and only 39 percent of the wells have water all year round. This means during the dry season the accessibility of wells with water becomes an important problem to rural inhabitants. As Table 21 demonstrates over 30 percent of the villages report that all the wells dry up in April and May, which happen to be the hottest and driest months of the year. The perenniality of wells seems to have a relative concentration. As may be expected from previous patterns, the sectors of Diapaga, Kantchari and Bogande show a high level of concentration of wells with water all year round. Matiacoali and Fada also show concentration above the average for the ER. Diabo, Comin-Yanga and Pama show below average magnitudes. It is also interesting to note that the proportion of the dry wells for these sectors is the highest for the region whereas the other sectors all show magnitudes below the mean for the ER.

Villagers were asked how far they travel to fetch potable water. About 90 percent of the villages that gave a response, indicated travelling only 0 - 2 km. Only about 10 percent of the villages reported that villagers go from 3 to 10 kilometers and over to fetch drinking water. Although the enumerators are trained to help respondents to answer the question on distance

Table 21 VILLAGE SOURCE OF DRINKING WATER AND SEASONAL CONDITION OF WELLS
(SURVEY DATA)

	Bogande % of Vill	N	Diabo % of Vill	N	Diapaga % of Vill	N	Comin-Yanga % of Vill	N	Fada % of Vill	N	Kantchari % of Vill	N	Matiacoali % of Vill	N	Pama % of Vill	N	Total ER % of Villages	Total E N
Source of Water																		
1. Wells	91.5	1407	71.8	442	100.0	370	32.6	39	94.0	581	97.4	248	100.0	228	50.0	109	81.6	3,424
2. Pot holes	27.8	--	28.2	--	27.0	--	86.0	--	33.6	--	34.2	--	22.7	--	75.8	--	37.7	--
3. Rain water	17.0	--	9.7	--	21.6	--	0.0	--	3.0	--	10.5	--	0.0	--	1.6	--	8.9	--
4. Dams	11.9	--	6.8	--	0.0	--	0.0	--	6.0	--	2.6	--	0.0	--	0.4	--	5.8	--
Seasonal Condition of Wells																		
1. Water all- year-round	71.0	499	50.5	148	94.6	110	23.3	16	69.4	256	86.8	163	77.3	106	33.9	39	60.1	1,337
2. All wells dry April and May	31.4	--	44.8	--	10.8	--	42.9	--	33.8	--	5.3	--	22.7	--	50.0	--	31.6	--

Table 22 ESTIMATED DISTANCES TRAVELLED BY VILLAGERS TO FETCH WATER:
PERCENT VILLAGES REPORTING DISTANCE MAGNITUDE
(Survey Data)

Kilometers	Sector								
	Bogande % of Vill	Diabo % of Vill	Diapaga % of Vill	Comin Yanga % of Vill	Fada % of Vill	Kantchari % of Vill	Matiacoali % of Vill	Pama % of Vill	Total %
1. 0-2	88.8	79.6	97.3	88.4	89.1	97.4	93.2	93.5	89.3
2. 3-4	4.7	8.6	2.7	7.0	3.9	0.0	4.5	3.2	4.7
3. 5-6	1.2	6.5	0.0	2.3	5.4	0.0	0.0	3.2	2.9
4. 7-8	1.8	3.2	0.0	0.0	0.8	2.6	2.3	0.0	1.5
5. 9-10	1.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.7
6. 11-over	1.8	1.1	0.0	2.3	0.8	0.0	0.0	0.0	1.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

as accurately as possible, we realize that such data is fraught with difficulties. In any case what is important to observe is that, not only about 40 percent of the villages lack a reliable source of potable water but also that a significant number of them have to go long distances to fetch it.

Potable water supply is a basic need component and absolutely important for the maintenance of health and nutrition. Without it, many development goals and benefits can not be realized [see Saunders, et al., 1976].[1] Reliable clean water supply does not only fulfill goals in the area of health from sanitation to reduction of morbidity and mortality of the rural population, but also it has far reaching implications in the rural economy from serving as direct input in the production process such as in small scale gardening to releasing labor time which is currently trapped for searching and fetching it. It is of particular significance to women and children who share the most burden to supply the household with water in the sense that easy and ready access to potable water would increase their participation in other more renumerative and developmental tasks.

The current situation is far from adequate not only in quantity but also in quality. A goal to supply the settled area of the ER [see Map 6] with 1 kilometer maximum distance from a well would involve about 7,000 wells. If the goal were to make water available to every villager within half of a kilometer, then the number of needed water points (wells or faucets) would increase to 28,000. Compared to the present situation with only about 1,300 all-season wells (quality notwithstanding) the gap between what is needed and what is available is phenomenal.[2]

---

[1] A good summary on the importance of water supply in rural development is also treated in two World Bank publications, one on village water supply and another on health [World Bank, 1975, 1976].

[2] According to the village inventory of the most serious problems the villages face, among about 30 problems stated, rural water supply ranks number one. 418 villages reported potable water shortage as their number one, two or three problem whereas other highly ranked village problems such as education for their children ranked second with 203 villages reporting it; health service with 185 came third and food shortage with 151 came fourth.

6. Pattern of Health Related Complaints

Table 23 is the result of cummulative tally of 3 ranked complaints by villages of diseases which are important in the region. Table 23 presents only 9 of 28 specific complaints recorded for villages in the ER. Those included are the top ranking complaints. The respondent in each village was asked to rank the 3 most important health problems of the village. The result seems to indicate that measles (rougeole) tops the list in terms of being the most frequently cited complaint in the villages. This finding supports the report of the Ministry of Public Health in 1978 regrading the major disease problems of the country, which states that measles is responsible for the high mortality along with malaria [Mehretu and Wilcock, 1979]. Five diseases reported in the Ministry of Public Health's report appear on Table 23. These are measles, malaria, whooping cough, meningitis, and diarrahea. In addition other important diseases that appear in the village inventory are abdominal problems, onchocerciasis, and cholera.

The abundance of village complaints with particular reference to diseases which can be erradicted with primary health care and sanitation indicates the priority of this important basic service in the villages. The provision of potable water is a key variable to improve rural sanitation and reduce the incidence of disease [World Bank, 1975].

B. The Geographic Pattern of Non-Farm Activities in the Eastern Region[1]

1. Food Related Production Village Activities

One of the major findings of the village inventory survey is the number of non-farm activity operators who carry-out non-farm production activities for sale. According to the survey the number of operators (establishments) which produce non-farm village secondary products (excluding those engaged in skilled services) is 13,775, and just over 60 percent of these establishments are engaged in the production of food-related products. Village secondary activities that are classified in this category range from products. which are ready for consumption such as dolo (local beer) to flour milling.

---

[1]The purpose of this section is to describe the spatial pattern of the distribution of small-scale activities in the ER. The present organization, economic significance, and employment pattern of this section is treated in another report [Wilcock, 1981].

Table 23 FREQUENCY COUNT OF 1ST, 2ND & 3RD RANKED SELECTED DISEASE RELATED COMPLAINTS BY VILLAGE IN EASTERN REGION
(Survey Data)

Disease Name	Bogande N	Diabo N	Diapaga N	Comin Yanga N	Fada N'Gourma N	Kanchari N	Matiacoali N	Pama N	Total N
1. Measles	133	61	32	17	87	23	34	35	427
2. Meningitis	26	65	10	22	71	34	25	32	285
3. Whooping Cough	69	46	17	2	58	5	17	3	217
4. Abdominal Problem	51	19	8	19	17	4	11	13	142
5. Malaria	40	11	2	4	33	4	5	24	123
6. Headaches	19	20	11	6	13	1	9	2	81
7. Onchocerciasis	1	1	5	16	6	0	0	43	72
8. Cholera	26	9	1	0	23	0	4	0	63
9. Diarrhea	4	12	12	2	23	1	2	7	63

Tables 24 and 25 provide a summary of the data on non-farm food related activities. A number of patterns emerge from the study of the Tables.

With reference to the last 3 columns of Table 24, the activity that shows the highest magnitude in diffusion in the village hierarchy is not characterized by the largest number of operators. Dolo making is the most represented village non-farm activity with 42 percent of the villages of the ER indicating presence of this activity. But the industry that is more common among especially small villages is shea butter processing of which there are over 2,200. There is also an activity like butchery which has a relatively high rate (32 percent) of distribution with only 616 establishments whereas an activity with similar numerical magnitude like hand pounding of rice with 548 establishments is available only in 16 percent of the villages of the ER.

Three types of food-related non-farm activities emerge from Table 24. There are localized industries whose existence depends on the availability of a physical resource, such as fishing. In this activity Bogande, Diapaga, Fada and Matiacoali are the most important in the region, Bogande being the undisputed leader in this activity with over 65 percent of the total establishments in the ER. The second type are those activities which show a high level of dispersion among the villages of the ER. These are, in order of their dispersal, dolo making, butchery, shea butter processing, making soumbala, and making cous-cous. These activities are reported by over 20 percent of the villages in the ER. The third type of activity are those which are relatively highly centralized. In the order of their centrality these are bakeries, flour mills, processing peanut oil, and rice hulling.

The second pattern that is discernible is the regional variation in the overall magnitude of the distribution of food-related activities in the ER. At the bottom of Table 24 two rows of distribution quotients[1] are given, the first based on the division of the administrative sector's share of the number of establishments by its share of population, and the second based on the division of the activity share of each sector by its share of

---

[1]The distribution quotient is derived by dividing the percent of the sectors share of the ER total of the number of establishments (variable magnitude) by the percent share of the total population or total number of villages of the ER (base magnitude). Values more than unity demonstrate concentration and values less than unity show that that sector has less than what the base magnitude may warrant.

Table 24 FOOD-RELATED, NON-FARM VILLAGE SMALL-SCALE INDUSTRY
(SURVEY DATA)

	Bogande % of Vill	N	Diabo % of Vill	N	Diapaga % of Vill	N	Comin-Yanga % of Vill	N	Fada % of Vill	N	Kantchari % of Vill	N	Matiacoali % of Vill	N	Pama % of Vill	N	Total ORD % of Villages	Total ORD N
Fishing	17.0	263	2.9	8	8.1	40	0.0	0	4.5	44	5.3	8	4.5	34	1.6	6	7.2	403
Dolo Makers	21.0	117	63.1	356	81.1	298	67.4	99	45.5	338	37.6	145	15.9	26	45.8	202	42.0	1,581
Soumbala	10.0	112	43.7	432	75.7	419	37.2	60	36.6	385	15.8	40	6.8	11	16.1	101	27.2	1,560
Cous-Cores	30.7	431	9.7	18	13.5	25	16.3	21	31.3	248	10.5	25	25.0	51	11.3	25	21.3	844
Rice Shelling	14.2	130	35.0	195	24.3	88	16.3	20	10.4	56	5.3	12	0.0	0	14.5	47	16.1	548
Peanut Oil	13.6	208	9.7	41	32.4	70	14.0	15	3.0	28	10.5	30	0.0	0	14.5	36	11.0	428
Shea Nut Butter	14.8	405	47.6	447	45.9	296	25.6	82	38.8	673	7.9	64	20.5	47	17.7	198	28.3	2,212
Bakers	6.8	19	7.8	9	18.9	10	7.0	3	5.2	18	5.3	5	4.5	4	0.0	0	6.2	68
Flour Mills	5.7	15	12.6	17	21.6	20	4.7	3	6.7	22	5.3	7	2.3	4	9.7	11	7.8	99
Butchery	42.6	215	41.7	126	35.1	52	25.6	30	29.9	133	18.4	22	22.7	21	12.9	17	32.3	616
TOTAL	--	1915	--	1649	--	1318	--	333	--	1945	--	358	--	198	--	643	--	8,359
DQ/P	--	0.77	--	2.10	--	0.95	--	0.67	--	1.36	--	0.69	--	0.33	--	1.01	--	--
DQ/V	--	0.83	--	1.21	--	2.68	--	0.64	--	1.10	--	0.71	--	0.34	--	0.78	--	--

N = Total frequency count of establishment in villages that have.

Table 25 DISTRIBUTION OF FOOD-RELATED SMALL SCALE ESTABLISHMENTS BY SECTOR: PERCENT OF VILLAGES IN SIZE CLASS THAT HAVE (Survey Data)

Population Classes	Dolo	Soumbala	Cous-Cous	Rice Shelling	Peanut Oil	Shea Butter	Baking	Flour Milling	Butchers
1. 399-below	34.3	22.2	14.7	11.6	6.4	26.9	1.9	2.2	22.7
2. 400-799	44.3	27.5	26.0	13.7	9.2	27.5	3.1	5.3	35.1
3. 800-1199	52.0	36.0	30.0	20.0	16.0	30.0	14.0	8.0	38.0
4. 1200-1599	76.9	38.5	38.5	50.0	34.6	50.0	11.5	26.9	76.9
5. 1600-1999	50.0	20.0	40.0	10.0	15.0	40.0	10.0	20.0	45.0
6. 2000-2399	61.5	53.8	46.2	46.2	38.5	30.8	30.8	30.8	69.2
7. 2400-2799	50.0	16.7	0.0	0.0	0.0	0.0	33.3	33.3	33.3
8. 2800-3199	50.0	62.5	25.0	37.5	25.0	37.5	37.5	50.0	62.5
9. 3200-3599	-	-	-	-	-	-	-	-	-
10. 3600-3999	80.0	80.0	60.0	80.0	80.0	40.0	20.0	80.0	80.0
11. 4000-above	87.5	50.0	37.5	37.5	37.5	0.0	75.0	62.5	87.5
Total %	42.0	27.2	21.3	16.1	11.0	28.3	6.2	7.8	32.3

the number of villages. With the first computation we observe that only two sectors emerge showing relative concentration of food-related non-farm activities, namely Diabo and Fada, with Diabo showing a surprisingly disproportionate share of the establishments compared to its total population. The second row which gives the distribution quotient based on number of villages, presents a slightly different picture. First, the leading sector based on this measure is Diapaga with Diabo and Fada following with weak magnitudes, almost unity. The conclusion we derive from this pattern is that food-related non-farm activities are basically highly dispersed and their distribution is governed by size of villages as well as total population.

The third pattern of spatial distribution is that indicated by the magnitude of the presence of food-related non-farm activities up the hierarchy of village centers in the ER. In overall pattern we observe from Table 25 that all activities show higher magnitudes of presence with increasing size of villages. However some are more sensitive to the village hierarchy than others. As we have indicated earlier, activities like bakery, flour milling, processing peanut oil and rice hulling show relative concentration in higher order of villages whereas activities such as dolo making, processing soumbala and butcheries are highly dispersed with strong magnitudes of presence in all orders of villages.

2. Patterns of Non-Farm Village Activities Excluding Food-Related Industries

The total number of operations in this category for the whole of the ER comes to about 5,400 which is about 40 percent of all non-farm producing activities in the region. The most common activity in this cateogry is weaving of which there are about 2,500, which makes it the most common non-farm activity in the ER even exceeding that of shea butter making which is the most common food-related activity in the region. The comparison of of Tables 24 and 26 indicates the difference in the relative importance of the 2 types of non-farm activities in the ER. The non-farm, non-food related activities are represented in significantly higher percentages of the villages in the ER than the food-related activities. Virtually all of the non-food activities (with the exception of charcoal making) are reported to be present in over 20 percent of the villages. As we have seen earlier, this does not apply to the food-related activities. In short the non-farm

Table 26 SMALL-SCALE ESTABLISHMENTS (NON-FOOD-RELATED) BY SECTOR: PERCENT OF VILLAGES THAT HAVE AND NUMBER OF ESTABLISHMENTS IN EACH SECTOR (SURVEY DATA)

Type of Activity	SECTORS														Total ORD % of Villages Not Have	Total ORD N
	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama			
	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N		
Coal Makers	1.1	2	5.8	10	0.0	0	0.0	0	2.2	4	0.0	0	0.0	0	0.0	0	1.7	16
Potters	44.3	420	29.1	206	5.4	30	14.0	23	26.1	211	28.9	73	22.7	36	27.4	127	27.2	1,126
Weavers	55.1	947	57.3	417	64.9	291	46.5	141	54.5	446	42.1	126	18.2	57	29.0	74	47.9	2,499
Cloth Dying	33.3	260	28.2	126	51.4	72	0.0	0	9.7	46	26.3	92	0.0	0	1.6	3	20.4	599
Chair Makers	21.6	101	9.7	13	48.6	106	2.3	1	20.1	62	21.1	30	15.9	14	12.9	14	18.4	341
Tailors	28.4	116	17.5	43	32.4	45	16.3	14	26.1	132	13.2	27	27.3	40	8.1	11	22.6	428
Blacksmiths	39.8	122	15.5	41	75.7	85	4.7	1	20.9	65	28.9	25	34.1	40	30.6	28	28.1	407
Total	--	1968	--	856	--	629	--	180	--	966	--	373	--	187	--	257	--	5,416
DQ/P	--	1.21	--	1.68	--	0.70	--	0.56	--	1.04	--	1.11	--	0.48	--	0.62	--	--
DQ/V	--	1.32	--	0.97	--	1.97	--	0.54	--	0.84	--	1.14	--	0.49	--	0.48	--	--

activities such as those shown in Table 27 have exceedingly higher propensities for diffusion within the village structure than do food-processing type establishments. The reason for this may be obvious. In developing regions such as the ER food-processing is rarely a major cash-earning activity since rural households process their own necessities and rarely purchase such products from the rural markets. When it happens, it is mostly important in villages with large number of inhabitants. On the other hand, rural activities which are of non-food variety such as those presented in Table 26, are rarely made on a self-sufficiency basis by each household. Rather, each village or a cluster of villages have a few people engaged full-time or part-time for making and selling these things for cash.

The three most important activities in terms of their penetration in the village hierarchy are cloth weaving, blacksmithing, and pottery. Three others, local furniture making, cloth dyeing, and tailoring not only have fewer operators but also are concentrated and less dispersed [see also Table 27]. The pattern of the regional distribution of these activities can be discerned from the distribution quotients at the bottom of Table 26. As may be expected the sectors of Bogande, Diabo, Diapaga, Fada and Kantchari seem to portray a relatively higher concentration of non-farm activities. But once again, those sectors which have villages with high number of inhabitants such as Diapaga lead in the relative prosperity in the producers of secondary activity.

The distribution of non-farm non-food activities over the hierarchy of villages in the ER as Shown in Table 27 has a marked difference from the pattern shown by food-related activities as shown in Table 26. Whereas the overall pattern in food-related activities is to increase in magnitude with increasing size of villages, that of non-food activities does not necessarily follow the same pattern. As Table 27 shows, with activities like pottery, weaving, and cloth dyeing the magnitude of presence of activity first rises with size of village in the order of about 2,000 inhabitants and then declines, often in a fluctuating manner, with increasing size of village to the highest order of villages. The reason for this, which is perhaps one of the crucial findings to note, should be the presence of competition for markets for cottage industry items by manufacturers which becomes more intense with increasing size of villages.

Table 27 DISTRIBUTION OF NON-FARM, NON-FOOD RELATED ESTABLISHMENTS BY VILLAGE POPULATION SIZE CLASSES: PERCENT OF VILLAGE THAT HAVE (Survey Data)

Village Pop. Size Classes	Coal % of Villages	Potters % of Villages	Weavers % of Villages	Dying % of Villages	Crude Furn % of Villages	Tailors % of Villages	Blacksmiths % of Villages
1. 399-below	1.1	21.3	41.8	14.7	11.6	13.3	17.7
2. 400-799	1.5	34.4	54.2	16.8	20.6	25.2	35.1
3. 800-1199	6.0	42.0	60.0	28.0	20.0	28.0	46.0
4. 1200-1599	3.8	50.0	73.1	50.0	26.9	53.8	46.2
5. 1600-1999	0.0	70.0	75.0	50.0	20.0	40.0	75.0
6. 2000-2399	0.0	46.2	69.2	46.2	46.2	53.8	53.8
7. 2400-2799	0.0	33.3	50.0	16.7	33.3	33.3	50.0
8. 2800-3199	0.0	50.0	75.0	62.5	50.0	62.5	75.0
9. 3200-3599	-	-	-	-	-	-	-
10. 3600-3999	0.0	20.0	100.0	20.0	40.0	60.0	60.0
11. 4000-above	12.5	12.5	37.5	37.5	75.0	87.5	81.5
Total %	1.8	29.5	49.7	20.4	17.5	22.5	29.6

The purpose of this survey, as indicated at the outset, was to gauge the significance of non-farm activity in rural production pattern and to study the spatial pattern of its distribution. From the magnitude of its presence in almost all hierarchies of villages, and from the number of total operators, which exceeds 20 percent of the households in the ER, it is quite clear that non-farm activity is a major form of rural gainful occupation. Development strategies that are based on the improvement of conditions for the productivity of the rural non-farm sector will be very significant for households way down in the village hierarchy. As Table 27 shows, over 55 percent of the small-scale non-food establishments are found in villages with population less than 800. Eighty-five percent of the establishments are found in villages with less than 2,000 inhabitants.[1] Assuming that each establishment employs on the average 2 people [Wilcock, 1981], the implication of small-scale industry for the effective dissemination of development is phenomenal. This would be of particular significance for small villages in the ER of Upper Volta where people who reside in villages with population less than 2,000 show a higher degree of reliance on such products.

3. The Distribution of Skilled Services

In Table 28 are grouped village activities which are labeled skilled services and the criterion used to differentiate these from the preceeding 2 categories is that this third group is essentially involved in services which rarely culminate in the production of a final new product. Two types of services can be differentiated in Table 28. The first group are those services which are characterized by a high degree of spatial dispersion. At the top of the list in this category is the number of fortune tellers locally known as charlatans. They compose about 50 percent of the service category with over 1,300 of them in the ER. They are also the most highly diffused being found in over 40 percent of the villages. Mid-wives and

---

[1] This compares with the Sierra Leone study which indicates 89.7 percent of the small-scale industries to be located in localities with population less than 2,000 [Liedholm and Chuta, 1976]. The Jamaica non-farm enterprises study also shows a similar magnitude with 72.9 percent of small-scale establishments being found in districts with population less than 2,000 [Davies, Fisseha and Kirton, 1979]. We should note however that these studies refer to all small-scale enterprises including food processing.

Table 28 VILLAGE SKILLED SERVICES DISTRIBUTION BY ADMINISTRATIVE SECTOR: PERCENT OF VILLAGES THAT HAVE AND TOTAL NUMBER OF CHARACTERISTIC IN SECTOR (SURVEY DATA)

Activity Type	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama		Total ORD	Total ORD
	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N	% of Vill	N
Mid-wives	23.3	189	43.7	121	16.2	36	25.6	33	26.1	122	2.6	20	6.8	22	16.1	24	23.9	567
Fortune tellers	47.2	395	29.1	75	81.1	247	41.9	111	52.2	224	28.9	84	22.7	46	59.7	137	40.7	1,320
Trad. Healer	22.7	137	31.1	123	43.2	100	18.6	25	23.9	88	7.9	9	15.9	15	21.0	27	22.1	524
Barbers	2.3	6	2.9	4	10.8	12	2.3	1	2.2	8	5.3	6	6.8	7	3.2	2	3.5	46
Masons	6.8	20	5.8	7	16.2	13	2.3	2	6.7	13	7.9	3	0.0	0	3.2	8	6.1	66
Carpenters	5.7	10	4.9	5	8.1	4	2.3	1	4.5	12	2.6	1	0.0	0	1.6	2	4.2	35
Motor Bike Repair	13.1	36	6.8	8	13.5	8	0.0	0	6.7	24	10.5	6	6.8	5	3.2	2	8.3	89
Car Repair	0.0	0	0.0	0	0.0	0	0.0	0	1.5	5	2.6	1	2.3	2	1.6	1	0.8	9
TOTAL	--	794	--	343	--	420	--	173	--	496	--	130	--	97	--	203	--	2,656

N = Frequency count of characteristics in villages that have it.
N =

traditional healers are found in 24 percent and 22 percent of the villages respectively. Together, the 3 services comprise over 90 percent of the operators in the service category. The regional distribution of these 3 services is not characterized by significant spatial differences. However, it does seem that the fortune tellers show preference for more prosperous localities like Diapaga, Bogande and Fada which also have villages with large population. Mid-wives and traditional healers, on the other hand, indicate more rural orientation with relative concentration in areas with high village density. High concentration of both in Diabo and extremely low presence in Kantchari and Matiacoali support this argument.

The knowledge of the spatial pattern of mid-wives and traditional healers is of particular importance in planning future health delivery locations. The study of the pattern of traditional healers and their spatial organization in terms of accessibility to the rural population has become an interesting area to investigate because of its relative efficiency in service delivery to the rural population [Buschkens and Slikkerveer, 1980].

The second category of the rural services includes barbers, masons, carpenters, and mechanics. These services are significant only in some of the larger village centers and towns. They represent by far the most central type of function which can have threshold demand only in the large towns of the ER [see Table 29].

Table 29 DISTRIBUTION OF SKILLED SERVICES BY VILLAGE HIERARCHY: PERCENT OF VILLAGES IN SIZE CLASS THAT HAVE (Survey Data)

Population Size Classes	Mid-wife	Fortune Teller	Trad Healer	Barber	Mason	Carpenter	Mechanic
1. 399-below	25.2	37.1	20.5	1.4	2.8	1.9	3.0
2. 400-799	20.6	51.9	22.1	3.1	4.6	3.1	8.4
3. 800-1199	20.0	56.0	22.0	2.0	6.0	6.0	14.0
4. 1200-1599	30.8	69.2	46.2	11.5	11.5	15.4	11.5
5. 1600-1999	35.0	50.0	30.0	10.0	15.0	10.0	35.0
6. 2000-2399	38.5	76.9	53.8	7.7	38.5	30.8	23.1
7. 2400-2799	33.3	16.7	16.7	16.7	16.7	0.0	16.7
8. 2800-3199	12.5	62.5	50.0	25.0	37.5	12.5	25.0
9. 3200-3599	-	-	-	-	-	-	-
10. 3600-3999	0.0	100.0	40.0	0.0	0.0	20.0	20.0
11. 4000-above	0.0	75.0	62.5	25.0	37.5	25.0	75.0
Total %	23.9	40.7	22.1	3.5	6.1	4.2	8.3

III. THE PATTERN OF RURAL MARKETS

A. Regional Distribution of Village Markets

The inventory survey identified 178 village markets in the ER. Table 30 presents the overall distribution of these rural markets. As may be expected, the magnitude of presence of markets increases with size of villages. Whereas only about 10 percent of the villages of the ER with population less than 400 show the presence of rural markets, 100 percent of the villages with population of 2,800 and over have markets in them. In fact the percent of villages that have markets rises abruptly with village sizes of 400 inhabitants and above. On the whole 28 percent of the villages of the ER have markets. As was witnessed in earlier patterns, relative concentration of markets can be observed for sectors with villages that have large number of inhabitants. In the order of their importance with respect to this variable, the sectors that have values above the regional mean are Diapaga, Matiacoali, Bogande and Kantchari.

B. Content Indices of Village Markets in the ER

The survey contained some data to find out the extent to which certain key products have penetrated the hierarchy of village markets. Table 31 presents the aggregated result of the responses from each village. What becomes obvious from scanning the Table is that rural markets in the ER are more important for the exchange of primary commodities and products of local small-scale establishments than products of manufacture. Table 31 presents content indices based on percent of villages and markets that contain the product indicated at the top of the column. Variation of content are discernible between products as well as between sectors. The most common non-agricultural product in village markets based on the 6 products being considered in Table 31 is cloth. This product is present in about 50 percent of the village markets of the ER. The last column, which contains magnitudes of self-sufficiency in millet during the season of low stock, indicates that about 33 percent of the village markets contain millet in that season. Village markets that contain hoes and kerosene lamps are even

Table 30 DISTRIBUTION OF VILLAGE MARKETS WITHIN THE VILLAGE HIERARCHY
(SURVEY DATA)

Village Pop Size Class	Bogande		Diabo		Diapaga		Comin-Yanga		Fada		Kantchari		Matiacoali		Pama		Total ORD # of Vill	ORD %
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
1. 399 - below	16	17.6	6	7.8	1	14.3	1	4.8	2	2.2	2	11.1	2	9.5	4	11.4	35	9.7
2. 400 - 799	15	34.1	4	33.3	1	20.0	2	22.2	12	46.2	4	44.4	4	40.0	2	12.5	46	35.1
3. 800 - 1199	7	58.3	5	83.3	2	28.6	4	100.0	4	80.0	3	60.0	6	85.0	4	80.0	32	64.0
4. 1200 - 1599	3	50.0	2	66.7	1	100.0	1	25.0	3	100.0	1	25.0	1	100.0	3	75.0	14	53.8
5. 1600 - 1999	5	55.6	1	100.0	1	50.0	--	--	3	75.0	1	100.0	0	0.0	--	--	11	55.0
6. 2000 - 2399	5	100.0	2	100.0	2	50.0	--	--	--	--	--	--	--	--	1	50.0	10	76.9
7. 2400 - 2799	0	0.0	--	--	2	100.0	--	--	2	100.0	--	--	1	100.0	--	--	5	83.3
8. 2800 - 3199	--		1	100.0	3	100.0	1	100.0	1	100.0	1	100.0	1	100.0	--	--	8	100.0
9. 3200 - 3599	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10. 3600 - 3999	2	100.0	--	--	2	100.0	1	100.0	--	--	--	--	--	--	--	--	5	100.0
11. 4000 - above	3	100.0	--	--	4	100.0	--	--	1	100.0	--	--	--	--	--	--	8	100.0
TOTAL	56	32.4	21	20.6	19	51.4	10	25.6	23	21.1	12	31.6	15	34.1	14	22.6	178	28.3

% = Percent of villages in size class that have.

N = Number of villages in size class that have.

Table 31 NUMBER OF VILLAGE MARKETS THAT CONTAIN CERTAIN KEY COMMODITIES AS PERCENT OF TOTAL NUMBER OF VILLAGES, AND PERCENT OF TOTAL NUMBER OF MARKETS BY SECTOR
(Survey Data)

Rd.	Min. Sectors	Digging Tool			Kerosene Lamp			Clothing			New Bicycle			Millet in Time of Low Stock		
		# M	% of V	% of M	#	% of V	% of M	#	% of V	% of M	#	% of V	% of M	#	% of V	% of M
1.	Bogande	4	2.3	7.1	5	2.9	8.9	26	14.9	46.4	0	0.0	0.0	16	9.4	28.6
2.	Diabo	1	1.0	4.8	1	1.0	4.8	14	13.7	66.7	1	1.0	4.8	3	3.0	14.3
3.	Diapaga	4	10.8	21.1	5	13.5	26.3	12	32.4	63.2	1	2.7	5.3	11	30.6	57.9
4.	Comin Yanga	2	4.7	20.0	1	2.3	10.0	4	9.3	40.0	0	0.0	0.0	2	4.8	20.0
5.	Fada N'Gourma	6	4.6	21.4	8	6.2	28.6	12	9.2	42.9	1	0.8	3.6	3	2.3	10.7
6.	Kantchari	7	18.9	58.3	6	15.8	50.0	9	23.7	75.0	3	7.9	25.0	8	21.1	66.7
7.	Matiacoali	2	4.5	13.3	3	6.8	20.0	11	25.0	73.3	1	2.3	6.7	12	27.9	80.0
8.	Pama	1	1.6	7.1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	4	6.6	28.6
	Total	27	4.3	15.2	29	4.6	16.3	88	14.0	49.4	7	1.1	3.9	59	9.4	33.1

Number of Markets that contain product.

% of Villages that contain product.

% of total number of markets that contain product.

more limited with only about 16 percent of the markets reported to contain these products. The product that appears only in the highest order of markets in the ER is new bicycles. Only 7 markets of the total 178 in the ER are reported to contain new bicycles for sale.

The regional variations reinforce patterns that have been repeated earlier. Markets in the Diapaga and Kantchari sectors consistently show high magnitudes of content and diversity, often much higher than the regional average. Two markets in other sectors, Pama and Diabo show, once again, poor rating in terms of magnitude of content of processed items in their village markets.

C. Principal Markets Serving Villages in the ER

Table 32 contains major markets that attract more than 5 villages. There are 27 such markets in the ER. The market that attracts the maximum number of villages (263) is not included in this count because it is located outside the region. However, it deserves mentioning because it is perhaps the most important market for the whole region. The name of the market is Pouytenga and is a periodic market which attracts user villages from as far as 200 kilometers in the ER. The Pouytenga market is located to the west of the ER just outside the boundary, about 5 kilometers north of the Fada-Ouaga highway and controls major trade flows from the high density regions of the western part of the ER extending from Bogande in the north to Pama in the south.

In Table 32 the markets are arranged according to rank based on mean Eucledian distance in kilometers from the market to user villages. The highest ranking market is obviously Fada N'Gourma which is the regional capital and administrative center. The Fada market is exceedingly greater than the second ranking market. The Fada market serves 190 villages in the ER with a mean market radius of close to 42 kilometers. Its large population, its centrality and its administrative function have enabled the Fada market to make many specialized manufactured products available both for direct consumption by villagers in the vicinity as well as retail traders down the market hierarchy.

Table 32 demonstrates that the number of villages served by a market do not necessarily correlate with the extent of the mean radius of the market area. The principal reason behind this is the uneven population distribution of population in the ER. Whereas markets in densely populated

Table 32 RURAL MARKETS IN THE EASTERN REGION THAT SERVE MORE THAN 5 VILLAGES

Rank[a]	Location of Market	Village Population	Number of User Villages	Mean Market Radius (Crude) km	Mean Market Radius (Weighted)[b] km	Rank[c]
1	Fada	13,067	190	41.5	43.9	1
2	Kohogo	3,041	10	38.9	21.7	5
3	Diapaga	5,617	23	35.2	30.1	2
4	Namounou	5,048	35	31.3	17.1	10
5	Botou	1,839	16	27.3	21.7	5
6	Bilanga Yanga	1,573	32	23.3	23.5	4
7	Bogande	5,351	47	23.0	18.2	8
8	Namoungou	837	10	22.3	15.8	13
9	Kantchari	2,883	22	21.7	17.1	10
10	Pama	2,265	4	19.7	9.9	18
11	Diembende	1,472	23	18.7	15.7	14
12	Boulgou	1,116	8	16.1	26.2	3
13	Matiacoali	2,683	12	15.6	16.1	11
14	Comin Yanga	3,603	9	15.0	7.7	20
15	Piela	3,974	53	14.6	17.6	9
16	Manni	2,212	43	12.9	12.0	15
17	Tibga	3,004	21	12.9	11.3	16
18	Bassieri	1,324	7	12.8	19.0	7
19	Ougarou	547	6	11.3	8.6	19
20	Tiantiaka	940	13	11.0	6.8	23
21	Yamba	1,399	12	10.9	15.9	12
22	Boussirabogou	695	17	10.1	7.2	21
23	Diabo	1,277	54	14.9	20.1	6
24	Karkouri	105	7	8.0	6.9	22
25	Diapangou	1,249	18	7.6	10.6	17
26	Diaka	1,488	17	6.2	4.6	25
27	Pori Gourma	1,201	8	6.1	6.3	24

[a]Based on crude mean of market radius in km.

[b] $$\bar{d}_i = \frac{\Sigma[d_{ij} \cdot P_j]}{\Sigma P_j}$$

where,

$\bar{d}_i$ = weighted mean market radius for market i

d_{ij} = eucledian distance from market i to user village j

P_j = population of user village j.

[c]Based on (b) above.

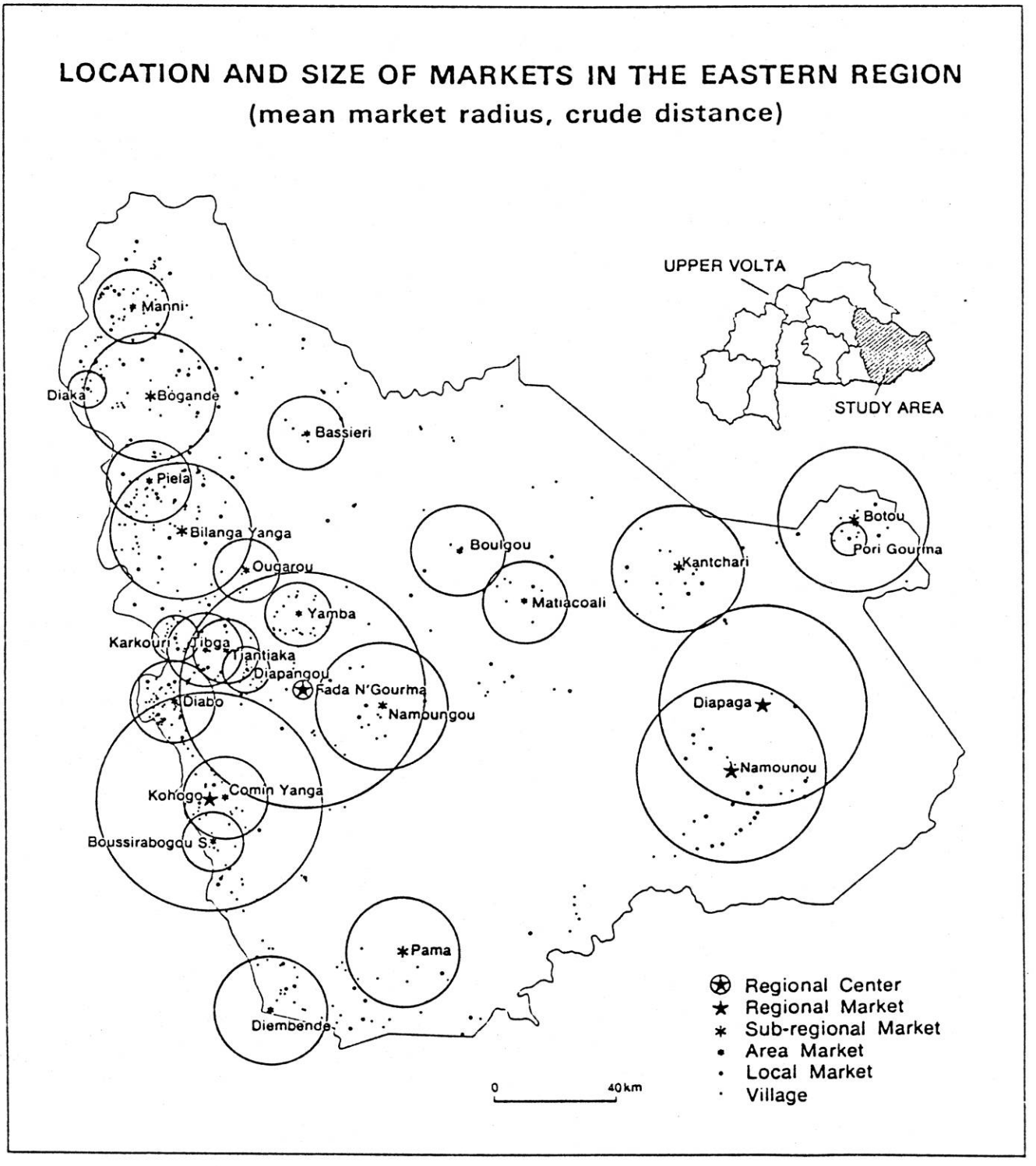
areas such as Diabo, Piela, and Manni are high on the hierarchy based on the number of villages served, they do not show high ranks in terms of their market radii. On the other hand markets in low density areas such as Kantchari, Pama, Boulgou and Bassieri show low counts in number of markets served but have relatively high values for market area radii (see Maps 10 and 11).

The last column in Table 32 contains the radius of each market in terms of weighted Eucledian distances to user villages using the population of the user village as a weighting factor. The weighted distance is derived by obtaining the sum of the product of the distance to each user market and its population (including the village population in which the market is located) and deviding the summation by total population of all the villages served including the village in which the market is located (see bottom of Table 32 for explanation). Map 11 is based on the weighted distances. On the whole there is no major difference between the crude estimate of the market area radius and that of the weighted radius. The overall impact of weighting the distances to user markets has been the compaction of the market area especially in areas of high population density. In areas of low population density, the weighted radius is larger than the crude estimate. Examples of the latter are Matiacoali, Boulgou, Bassieri, Yamba and Fada.

The weighted market radius is considered a better and more reliable estimate of market shed because it takes into consideration the sizes of the user villages. In Table 33 is presented the distribution of all markets in the ER into six classes based on both crude mean market radii and weighted radii. The result shows that the Fada market with mean market radius in excess of 40 kilometers stands out by itself as a regional center. Six to nine markets, depending on the type of estimate used, emerge as important regional or sub-regional markets. As could be observed in Table 32 there is almost no correlation between the ranks of markets based on the crude market radius and those based on the weighted market radius. Therefore the hierarchies on Table 33, market radii, do not identify the same markets in each of the class intervals in Table 33. However, in both market radii estimates, the ten top markets of the region are more or less similarly identified.

Maps 10 and 11 show all the markets in the ER and those markets with five or more user villages are shown with their mean market radii using crude Eucledian distances (Map 10) and weighted Eucledian distances (Map 11).

MAP 10


LOCATION AND SIZE OF MARKETS IN THE EASTERN REGION
(mean market radius, crude distance)
UPPER VOLTA
STUDY AREA
Manni
Diaka
Bogande
Bassieri
Piela
Bilanga Yanga
Ougarou
Yamba
Karkouri
Tibga
Tiantiaka
Diapangou
Fada N'Gourma
Diabo
Namoungou
Kohogo
Comin Yanga
Boussirabogou S.
Pama
Diembende
Boulgou
Matiacoali
Kantchari
Botou
Pori Gourma
Diapaga
Namounou
0
40km
Regional Center
Regional Market
Sub-regional Market
Area Market
Local Market
Village

MAP 11

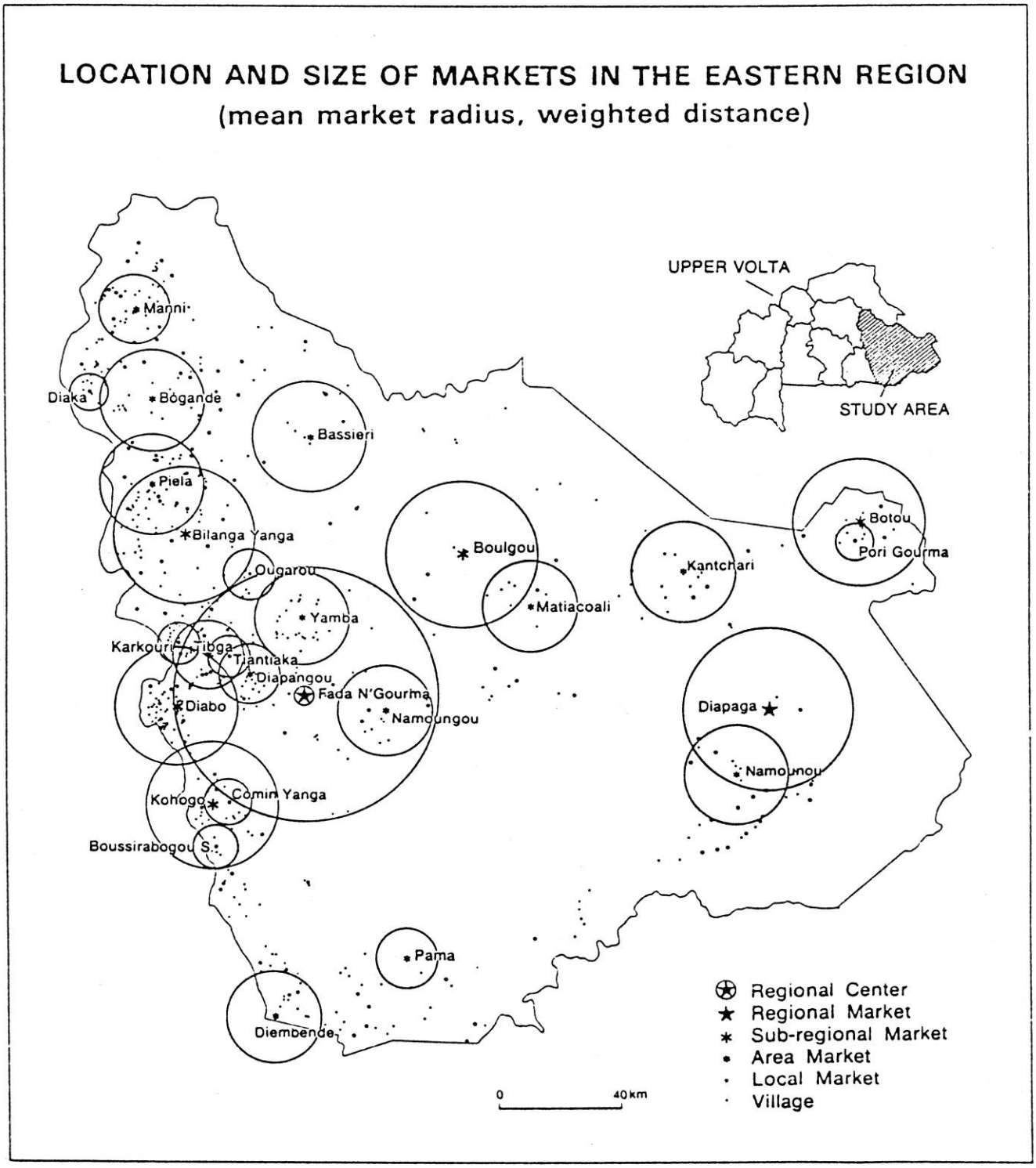

LOCATION AND SIZE OF MARKETS IN THE EASTERN REGION
(mean market radius, weighted distance)
UPPER VOLTA
STUDY AREA
Manni
Diaka
Bogande
Bassieri
Piela
Bilanga Yanga
Ougarou
Yamba
Karkouri
Tibga
Tiantiaka
Diapangou
Diabo
Fada N'Gourma
Namoungou
Kohogo
Comin Yanga
Boussirabogou S.
Pama
Diembende
Boulgou
Matiacoali
Kantchari
Botou
Pori Gourma
Diapaga
Namounou
Regional Center
Regional Market
Sub-regional Market
Area Market
Local Market
Village
0
40 km

Table 33 DISTRIBUTION OF VILLAGE MARKETS IN THE EASTERN REGION BY MEAN RADIUS OF MARKET AREA (crude Eucledian distance)[a]

		Mean Market Radius km	Number of Markets Based on Crude Distance	Number of Markets Based on Weighted Distance	Total # of User Villages
1.	Regional Center	40+	1	1	190
2.	Regional Markets	30-39	3	1	68
3.	Sub-regional Markets	20-29	6	5	131
4.	Area Markets	10-19	17	13	278
5.	Local Markets	<10	35	42	121
6.	Village Markets[b]	-	116	116	116
	Total	-	178	178	-

[a]The first four categories included on those market centers with 5 or more user villages.

[b]These are village markets which do not serve other villages besides their own.

Table 34 MARKET PERIODICITY: PERCENT OF VILLAGE MARKETS WITH VARYING PERIODICITY IN EACH SECTOR (Survey Data)

Market Frequency	Bogande	Diabo	Diapaga	Comin Yanga	Fada N'Gourma	Kantchari	Matiacoali	Pama	ORD Total
Every Day	3.4	4.8	5.3	0.0	3.6	0.0	0.0	0.0	2.8
Every 3 Days	91.5	90.5	0.0	100.0	92.9	8.3	33.3	71.4	70.6
Once a Week	5.1	4.8[a]	94.7	0.0	3.6	91.7	66.7	28.6	26.6

[a]Not classified.

Both maps show a greater concentration of markets in the western part of the region. Of the 27 markets that serve more than five villages, 20 are found in the western more populated region of the ER. The markets in the eastern part of the region are more scattered with relatively less overlapping market areas and they tend to be larger in diameter. Of the 178 rural markets reported, only 62 serve other villages. The rest, 116 markets, serve only the inhabitants of the villages in which they are located. The number of markets in the six hierarchical classes increases with decline in rank of markets as shown for both the crude and weighted market radii. As may be expected the increase in number with declining rank is exponential.

D. Market Periodicity in the ER

Three types of market frequency are observed in the market oganization in the ER. Table 34 presents the overall pattern by sector. The most common practice which is used by over 70 percent of the market of the ER is the once-every-three-days frequency. This frequency is particularly important in the western sector of the ER where from 90 to 100 of the sector markets practice this frequency. In the eastern part of the ER, in Diapaga, Kantchari and Matiacoali, the most commonly used frequency is the weekly market. For Diapaga and Kantchari over 90 of their markets follow this frequency. Matiacoali has about 67 percent of its markets with weekly frequencies. The daily market is not very common. Less than 3 percent of the markets in the ER use this frequency, and most of these markets are located in the major towns in the ER such as Fada N'Gourma.

What is interesting to note in the pattern of market periodicity is that in the most densely populated areas of the ER which have relatively very short mean distances between villages, the more frequent market periodicity is the most popular. In the parts of the ER where the population as well as the village density is lower with relatively large mean distances between villages, the most common market periodicity is that of the weekly market. We can even observe this tendency from the magnitudes of borderline cases such as Pama in the west and Maticoali in the east, where significantly larger magnitudes are shown for the periodicity that is not typical of the region, which probably largely depends on their density characteristics with respect to population as well as villages.

IV. CONCLUDING REMARKS

The survey on the hydrologic and climatic features of the ER demonstrates that one of the major challenges to development in this region is the physical resource base. The ER is one of the poorer regions in precipitation in Upper Volta. Not only is the amount of the annual rainfall small (about 900 mm) but also the potential evapotranspiration is high (about 2,000 mm). The flow of water in almost all of the rivers in the region is seasonal and intermittent. This means that major development efforts in agriculture will necessitate better management of the water resources of the region. A major policy issue connected with the physical resource base is the fact that the areas in the ER which have suffered over the years from erosion, deforestation and overgrazing, and also have higher evapotranspiration rates with lower rainfall, are some of the most densely populated areas of the region. On the other hand, there are areas in the south and the southeast which have higher rainfall amounts, lower evapotranspiration, and less erosion of soil but with extremely low densities of population. There is a need to consider a regional development program to reduce pressure on the land in less endowed areas and open better endowed areas of the ER for increased agricultural exploitation.

The survey of socio-economic structural characteristics of villages in the Eastern Region of Upper Volta shows that villages are poor in almost every form of technological attribute dealing with basic needs provisions, transport infrastructure, the rural economy, with special reference to non-farm small-scale occupations, and marketing. The village inventory survey data demonstrates that village performance of various scales of measurement of technological attributes depends on 2 important factors: (1) location in the village hierarchy, and (2) geographic location in the Eastern Region.

As we have witnessed, most of the developmental and technological variables are concentrated in the few large villages. Settlements which are characterized by small number of inhabitants, with population sizes less than 2,000, show very poor rating in containing structural attributes that may be considered developmental. Such attributes range from availability

of reliable potable water to elementary schools. In the ER a village with population of 2,000 has a probability advantage in excess of 40 to 60 percentage points of containing a technological attribute than a village with less than 400 inhabitants. For most structural characteristics the diffusion of technological attributes seem to be highly a function of village size. In a region that is dominated by small villages, and where villages that have less than 2,000 inhabitants contain close to 60 percent of the rural population, this is of course disconcerting. This is not to say villages that have population above 2,000 have it made. This is only a relative condition but sufficient enough to indicate to future planners that development administration should give proper focus to the way in which the rural people are organized in space, and to avoid the use of village size to apportion basic needs components and food production technology.

A second factor which determines the well-being of a village with respect to some of the structural attributes which have been examined, is location in the ER. From the inventory survey data, it appears that location in certain clusters such as Diapaga, Kantchari and Bogande has signficant advantages. Overall, it is observed that these areas experience relative prosperity in many of the attributes which we have examined. On the contrary location in clusters such as Comin-Yanga, Diabo, Pama and even Fada (with the exclusion of the city area) are characterized by poorer villages, size notwithstanding.

In the survey of the structural characteristics, some nodes of development have emerged. By far the leading center is the Diapaga area. Kantchari, surprisingly, has shown to be quite a dynamic center, and can easily qualify as the second pole of growth. Bogande has also shown consistently to be above average in many criteria. Matiacoali and Fada more often straddle around the regional mean, whereas sectors such as Diabo, Comin-Yanga, and Pama show relative poverty in virtually all of the criteria we have examined.

The study of rural markets yields a pattern that may be more pertinent in identifying future development transmitter (relay) and transport centers. Of the 62 rural markets that serve other villages besides the one they are located in, 8 to 10 of them can be considered major regional centers that should receive priority as development relay centers. These will include Fada, Diapaga, Bogande, Kantchari, Botou, Kohogo (Comin-Yanga), Pama, Diembende, Bilanga Yanga, Matiacoali, Boulgou and Bassieri.

The implication of the spatial characteristics of the socio-economic attributes of villages on rural development planning is that any attempt to integrate the majority of the rural population in the development process should recognize the disparity in the existing distributions and the reasons responsible for creating them. Among the settled areas, there are differences in basic resource endowments. This explains to some extent the relative prosperity of Diapaga and Bogande. It appears that high density localities such as Diabo do not have such blessings. Some areas enjoy good transport services with relatively good roads leading to them. Here again, Diapaga, Kantchari, Fada, Matiacoali and Bogande have relative advantages in this regard, whereas Diabo and Comin-Yanga are disadvantaged. As we have indicated earlier, there is no geographic association between high population density and areas of high resource potential. There is very little movement of people from regions of stress to regions of "new lands" because of a number of obstacles which we have addressed earlier. These are, therefore, some of the issues that would confront developmental intervention for both basic needs purposes as well as the whole question of farming systems.

REFERENCES

Benoit, Michel. 1974. Introduction à la Géographie des Aires Pastorales Soudaniennes de Haute-Volta. Ouagadougou: ORSSTOM.

Buschkens, W.I.L. and Slikkerveer, L.J. 1980. Illness Behaviour of the Eastern Oromo in Harerghe, Ethiopia. Leiden, The Netherlands: Institute of Cultural and Social Studies.

Centre Voltaique de la Recherche Scientifique. 1968. Atlas de Haute-Volta Carte des Densités de Population. Ouagadougou: CVRS.

_____. 1973. Atlas de Haute-Volta, Cartes des Principaux Eléments Climatiques. Ouagadougou: CVRS.

Comité Inter Africain d'Etudes Hydrauliques, (CIEH). c. 1978. L'Utilisation des Resources en Eau et de Terres des Régions de Savane. Vols. 1, 2, 3, 4. Ouagadougou: CIEH/USAID.

Dallaire, Louise. 1979. Inventaire Essentiellement Descriptif des Conditions Soud-économique de la Région de Fada N'Gourma, Haute-Volta. Project HABITAT.

Davies, Omar; Fisseha, Yacob; and Kirton, Claremont. 1979. Small-Scale, Non-Farm Enterprises in Jamaica: Initial Survey Results. East Lansing: Department of Agricultural Economics, Michigan State University.

De Greling, C. 1978. Développement des Resources Forestières, de la Faune Sauvage et de la Pêche, Un Schema Directeur d'Aménagement Pour le Parc National d'Arli. Rome: PNUD, FAO.

Funel, Jean-Marie. 1976. Le Développement Régional et Sa Problematique République Francaise. Paris: Ministère de la Coopération.

Haute-Volta, Gouvernement de. 1978. Document de Programmation Sanitaire Nationale (1980-1990), Avant-Projet. Ouagadougou: Ministère de la Santé Publique.

_____. 1978. Rensensement Général de la Population, Decembre, 1975. Institut National de la Statistique et de la Démographie (INDS). Vols. I et II.

_____. c. 1978. III ieme Plan de Développement Economique et Social, Avant-Projet. Ouagadougou: Ministère du Plan et de la Coopération.

_____. 1979. Situation de l'Enseignement du Premier Degre. Ouagadougou: Ministère de l'Education Nationale et de la Culture.

Hunter, John. 1977. Zones d'Exploration pour les Terres Neuves du Sahel. Club du Sahel: CILSS.

INSD, Institut National de la Statistique et de la Démographie. 1978. Résensement Général de la Population, Décembre, 1975. GOV. INSD.

Kellerman, Jean. 1967. Etude des Possibilités de Diversification de la Production Rurale en Haute-Volta. Ouagadougou: Secretariat d'Etat aux Affaires Etrangères Chargé de la Coopération.

Liedholm, Carl and Chuta, Enyinna. 1976. The Economics of Rural and Urban Small-Scale Industries in Sierra Leone. East Lansing: Department of Agricultural Economics, Michigan State University.

Matlei, E.G. and Solomon, S.I. 1976. An Evaluation of Climatic and Water Resources for Development of Agriculture in the Sudano-Sahelian Zone of West Africa. Special Environmental Report, No. 9. Geneva: World Meteorological Organization.

Mead, Tom. 1979. Urban Functions in Rural Development, Upper Volta. Quarterly Report. March 12 to June 11, 1979.

Mehretu, Assefa. 1977. Area/Regional Planning for Rural Development Strategies with Special Reference to the Eastern ORD of Upper Volta. East Lansing: Department of Agricultural Economics, Michigan State University.

_____. 1978 (1). Planification Régionale Pour le Développement Rural Dans L'ORD de l'Est de la Haute-Volta, Rapport de Consultant. Fada N'Gourma: ORD de l'Est.

_____. 1978 (2). Regional Planning and Spatial Aspects of Rural Development. East Lansing: Department of Agricultural Economics, Michigan State University.

_____. 1978. Regional Planning for Rural Development in the Eastern ORD of Upper Volta: Consultant's Report. East Lansing: Department of Agricultural Economics, Michigan State University.

_____. 1980. Procedures for Locating Basic Needs Services in Rural Areas: An Application to Problems in the Eastern Region of Upper Volta. East Lansing: Department of Agricultural Economics, Michigan State University.

_____. 1981. Spatial Design for Locating Primary Health Services in the Eastern Region of Upper Volta - Program Results. East Lansing: Department of Agricultural Economics, Michigan State University.

Mehretu, Assefa and Wilcock, David. 1979. Regional Planning Working Paper No. 1: Eastern Region of Upper Volta. East Lansing: Department of Agricultural Economics, Michigan State University.

Michel, Kabore T. 1979. Etudes Pédologiques du Perimètre Mani-Dakiri, E. ORD. Mémoire de Fin d'Etudes. Ouagadougou: Organisation des Nations Unies pour l'Alimentation et l'Agriculture.

Michigan State University Contract Team. 1978. Sixth Month Report, December 1977 - May 1978. Fada N'Gourma: USAID Integrated Rural Development Project.

ORD de l'Est. 1978. Rapport Annuel, Campagne 1977-78. Fada N'Gourma: E. ORD.

_____. 1979. Projet Vivrier de l'ORD de l'Est. Fada N'Gourma: E. ORD.

Organisation des Nations Unies pour l'Alimentation et l'Agriculture. 1979. Etude Pédologique du Perimètre de Ougarou-Piega, ORD. Est-Fada N'Gourma. Ouagadougou.

Remy, Gerard. 1967. Yobri: Etude Géographique du Terroir d'un Village Gourmanché de Haute-Volta. Paris: Monton et Co.

SAED. 1979. Projet de Collecte de Statistiques Agricoles dans l'ORD de l'Est., Rapport Final.

Saunders, Robert J. and Warford, Jeremy J. 1976. Village Water Supply, Economics and Policy in the Development World. Washington, D.C.: World Bank.

Swanson, Richard Alan. 1979. Gourmanché Agriculture, Part II. Fada N'Gourma: BAEP.

Terrible, Martin. 1975. Atlas de Haute-Volta, Essai d'Evaluation de la Végetation Ligneuse. Bobo-Diolasso: CVRS.

USAID. 1976. Oncho Areas Village Development Fund. Memeo.

Urban Functions Survey. 1979. "Tally of Binary Data on Urban Functions for Selected Towns and Villages in E. ORD."

Weldring, Johan R. 1979. Aménagements Hydro-Agricoles dan l'ORD de l'Est Fada N'Gourma. Ouagadougou: Direction du Fonds de Développement Rural.

Wilcock, David. 1981. Small-Scale, Non-Farm Enterprises in Eastern Upper Volta: Survey Results. East Lansing: Department of Agricultural Economics, Michigan State University.

World Bank. 1975. Health, Sector Policy Paper. Washington, D.C.: World Bank.

_____. 1976. Village Water Supply. Washington, D.C.: World Bank.