INTERNATIONAL LIVESTOCK CENTRE FOR AFRICA
AERIAL SURVEY UNIT

WET SEASON DISTRIBUTION AND ABUNDANCE OF LIVESTOCK POPULATIONS AND HUMAN HABITATION IN THE OFFICE DU NIGER REGION OF MALI

Report to CIPEA, B.P. 60, Bamako, Mali

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SUMMARY.

This report describes the results obtained from a wet season aerial survey of livestock populations and human habitation, over some 6.500 square kilometers of the Office du Niger Region of Mali, adjacent to the Canal du Sahel. The survey was carried out during September 1984, using the technique of low level systematic reconnaissance flights and oblique photography, with experienced observers who were familiar with local conditions.

Results are presented in the form of computer drawn distribution maps, accompanied by tables which provide estimates of livestock populations and human habitation for both inner and outer areas of the survey zone. The region was divided into: a core area of some 2.500 square kilometers on either side of the Canal du Sahel which was sampled at 16% sample intensity: and a peripheral area of some 4.000 square kilometers, which was sampled at 8%.

During the wet season survey livestock populations were estimated to be: 128.000 head of cattle, 121.000 sheep and goats, and 110 donkeys, equivalent to stocking rates of 5.1, 5.4, and 6.000 hectares per head, respectively. No camels were encountered during the course of the survey. These populations amounted to a combined total of some 102.000 Tropical Livestock Units, of which 88% were cattle, and 12% sheep and goats.

The 1984 wet season cattle population was substantially greater (+67%) than that estimated for the 1983 the dry season, while the sheep and goat population was somewhat lower (-10%). This was reflected in a 33% increase in TLU between dry and wet season surveys. The bulk of this increase was accounted for by a 137% increase in the cattle population of the outer zone.

Human habitation in the region, excluding the larger towns and villages, was estimated at a total of some 4.500 dwellings. Three distinct types of dwelling were recognised from the air. Those of the Peuhl (FulBe) style were by far the most abundant, representing 74% of the total: the next most common were of the Tamashek (Touareg) style, which accounted for 18%: followed by the Bella and Maure (Arab) styles, which represented 7% and 1% respectively.

PREFACE AND ACKNOWLEDGEMENTS.

Following the tragic death of Dr. Kevin Milligan in May 1984, the International Livestock Centre for Africa (ILCA) and Resource Inventory and Management Limited (RIM) entered into a collaborative agreement in order to fulfill existing aerial survey commitments in Mali and Nigeria.

The results of the wet season aerial survey of the Office du Niger region of Mali described in this report compliment those of an earlier survey carried out by the ILCA Aerial Survey Unit, previously reported by Milligan (1983). We gratefully acknowledge the assistance of the following personnel, who took part in the wet season aerial survey:

Captain Jacques Meunier	Pilot:
M. A. Alkaouri	Observer:
M. G. Sidibe	Observer.

In addition we would like to thank Dr. Diakete - Director General, Operation Developpment L'Elevage du Mopti (ODEM), and his deputy Dr. Kiata, for their help and encouragement on the ground. We would also like to express our appreciation for the support given by ILCA staff at Bamako, in particular Mr. A. Tall - Acting Team leader, and Dr. P. Hiernaux - Rangeland Ecologist. In Britain, we are indebted to Christine Windridge and Bill Campbell for their assistance in data preparation, statistical analysis and computer graphics.

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1 INTRODUCTION.

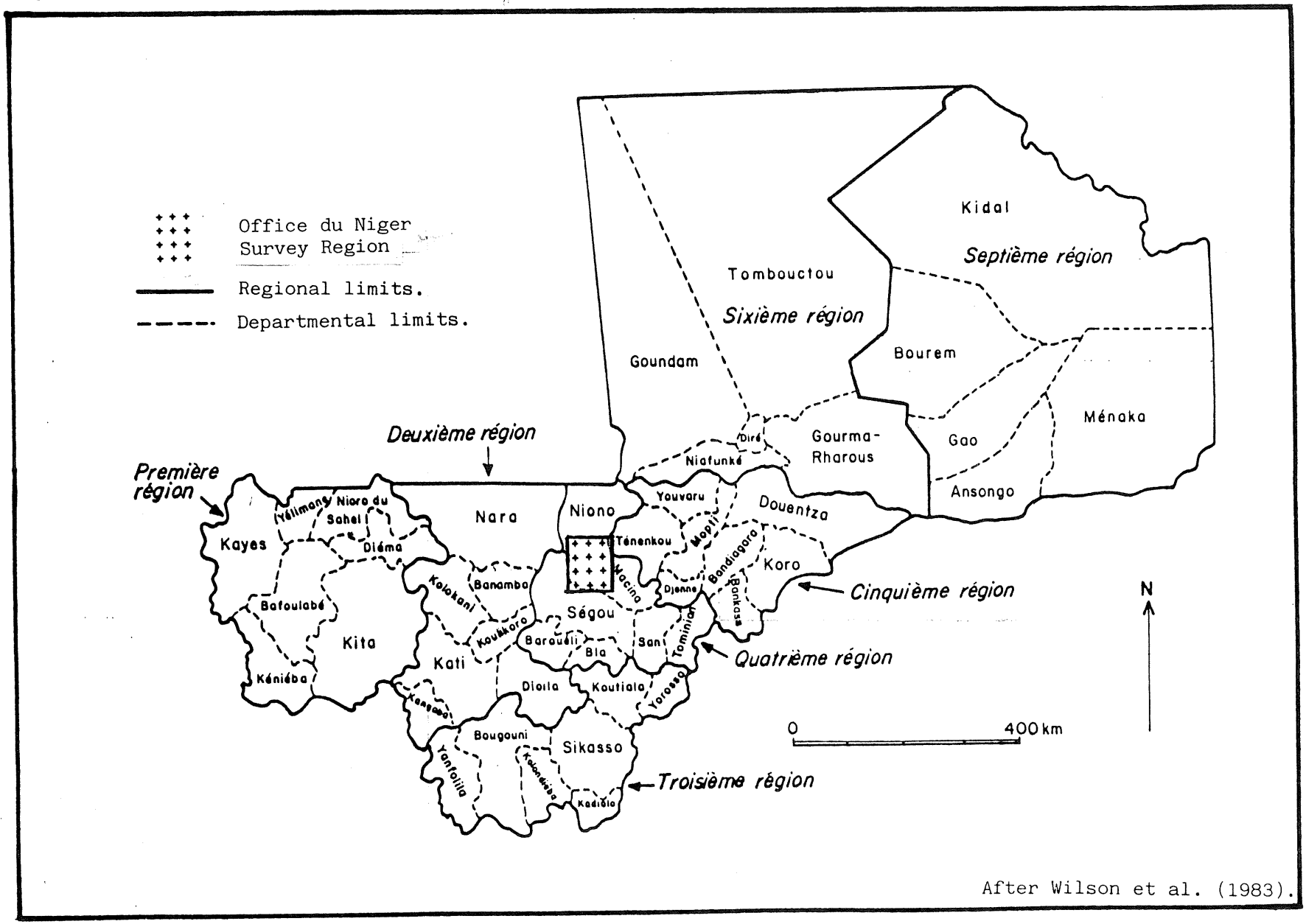
The International Livestock Centre for Africa has been studying livestock production in the arid zones of Mali since 1976 (Wilson, de Leeuw and de Haan, 1983). The Office du Niger area around the Station du Sahel at Niono in the Fourth Administrative Region (Figure 1) was selected as one of the initial focal points of investigation. Subsequently activities were extended into the Fifth Administrative Region to include livestock production in and around the inland delta of the Niger river.

In order to place the findings of such studies in the context of the overall distribution and abundance of livestock populations and human habitation, ILCA initiated a series of systematic reconnaissance flights (SRF) over areas of special interest, including: the Inland Delta; the Gourma, and Office du Niger regions of Mali. (See: Milligan and Keita, 1982; Milligan et al., 1982; Milligan, 1983; Bourn and Wint, 1985.)

The first aerial survey of the Office du Niger Region was carried out in May, towards the end of the 1983 dry season (Milligan, 1983), however because of technical problems with the aircraft the planned wet season survey had to be postponed until the following year. This report presents the results of that delayed wet season aerial survey, which took place during the first week of September 1984.

The Office du Niger survey region covers a total land area of some 6,500 square kilometers, with the Canal du Sahel providing a central north-south axis, and the town of Niono lying somewhat to the south of centre (Figure 2). The canal and the extensive irrigated lands associated with it are a dominant feature of the landscape. Approximately 100 kilometers of canal are included within the survey zone, which extends outwards some 30 kilometers to either side.

Figure 1 : Administrative Map of Mali.



After Wilson et al. (1983).

2.1 Flight and Sampling Procedure.

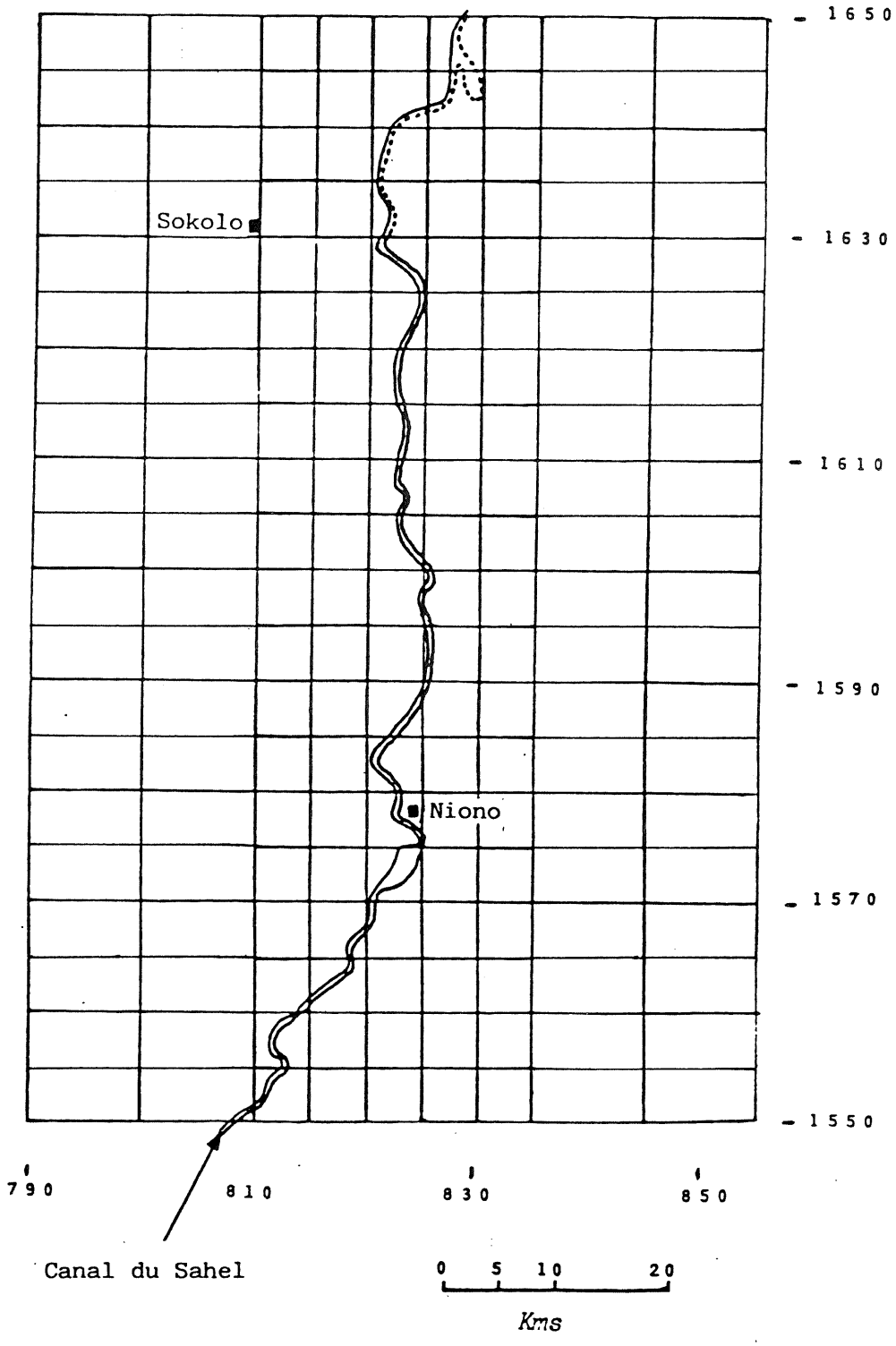
The aerial survey took place during the first week of September 1984 and was conducted from Mopti and Bamako, using the same technique of low level systematic reconnaissance flights employed in the the dry season aerial surveys (Milligan, 1983). More detailed descriptions of the methodology are given by Norton-Griffiths (1978) and Milligan and de Leeuw (1983).

As in the dry season survey, a stratified system of sampling was adopted in which an inner core area including the Canal du Sahel was sampled at double the intensity of the outer peripheral area. Flight lines were orientated in a north-south direction; in the outer zones they were spaced 10 kilometers apart, while in the inner core area they were 5 kilometers apart. Each flight line was divided into 5 kilometer sectors to create the sampling grid depicted in Figure 2.

With the aid of externally mounted viewing frames two experienced back-seat observers recorded the type, and estimated the number, of all forms of livestock and human habitation falling within defined ground strips on each side of the aircraft. Whenever possible a 35 mm colour slide photograph was taken of each herd, flock, camp or settlement, containing more than 10 components, using a hand-held camera loaded with 200 ASA film and fitted with a 200 mm telephoto lens. Subsequently, accurate photo-count values were substituted for visual estimates, and used to determine levels of observer bias, in order to correct those estimates for which no adequate photographic coverage was available.

At a designated flying altitude of 800 feet above ground level the sample strip width on each side of the aircraft was set to be 400 meters. However, as determined by regular radar altimeter measurements, the average flying altitude for the whole survey was 808 feet, which gave an overall sampling intensity of 16.2% for the inner core area, and 8.1% for the outer peripheral zone.

Figure 2: Aerial Survey Systematic Sampling Grid for the Office du Niger Region of Mali.



2.2 Information Collection.

Cattle, camels and donkeys can easily be identified from the air; however it was not always possible to distinguish sheep from goats, and these small stock were therefore combined under the single category "shoats".

Four types of human habitation were recognised from the air on the basis of their general structure, shape, colour, material and method of construction:

"Bella Style": Relatively small circular structures of grass/straw matting laid over wooden framework.

"Maure (Arab) Style": Tents usually white or gray in colour, similar in general shape to those of the Touareg, but made of cloth, with only a central supporting pole and no lateral poles.

"Peuhl (FulBe) Style": Larger circular structures of grass/straw laid over wooden framework.

"Tamashek (Touareg) Style": Tents usually red in colour, made of a patchwork of hides, with both central and lateral supporting poles.

In addition to the above information collected by the two back-seat observers, the navigating front-seat observer was responsible for assessing and recording general environmental conditions within each grid cell.

2.3 Data Analysis and Presentation.

After photo-interpretation, and correction for individual observer bias, the data collected by each observer was merged and coded for each grid cell, together with additional cartographic information extracted from published maps. This data-base was then subjected to a series of validatory statistical tests and the necessary corrections made prior to more detailed analysis and population estimation on a VAX 11-750 computer. Three closely related, but distinct, software packages were used concurrently for handling data files and analysis:

A purpose built programme for population estimation using the Ratio Method of Jolly (1969) incorporating additional statistical facilities:

The Minitab (1982) software package for statistical summaries and tabulations:

The Mapics (1984) data handling and graphics system for data manipulation, selection and mapping facilities.

Distribution maps were produced using a proportional symbolism form of point mapping on a HP 7221 flat-bed plotter.

3 RESULTS.

This report describes the results obtained from a wet season aerial survey of livestock populations and human habitation, over some 6,500 square kilometers of the Office du Niger Region of Mali, adjacent to the Canal du Sahel. The survey was carried out during September 1984, using the technique of low level systematic reconnaissance flights and oblique photography, with experienced observers who were familiar with local conditions.

Results are presented in the form of computer drawn distribution maps, accompanied by tables which provide estimates of livestock populations and human habitation for both inner and outer areas of the survey zone. The region was divided into: a core area of some 2,500 square kilometers on either side of the Canal du Sahel which was sampled at 16% sample intensity; and a peripheral area of some 4,000 square kilometers, which was sampled at 8%.

3.1 Livestock Populations.

The patterns of livestock distribution within the Office du Niger aerial survey region are illustrated in Figure 3. Wet and dry season livestock populations estimates for both inner and outer zones are summarised in Table 1.

During the 1984 wet season there were some 128,000 head of cattle, 121,000 sheep and goats, and 110 donkeys; equivalent to stocking rates of 5.1, 5.4, and 6,000 hectares per head, respectively. No camels were encountered during the course of the survey. Following Jahnke (1982) * these populations amounted to a combined total of some 102,000 Tropical Livestock Units, of which 88% were cattle, and 12% sheep and goats.

* TLU conversion factors: Camels = x1; Cattle = x0.7 Donkeys = x0.5; Sheep and Goats = x0.1.)

FIGURE 3: WET SEASON DISTRIBUTION OF LIVESTOCK.

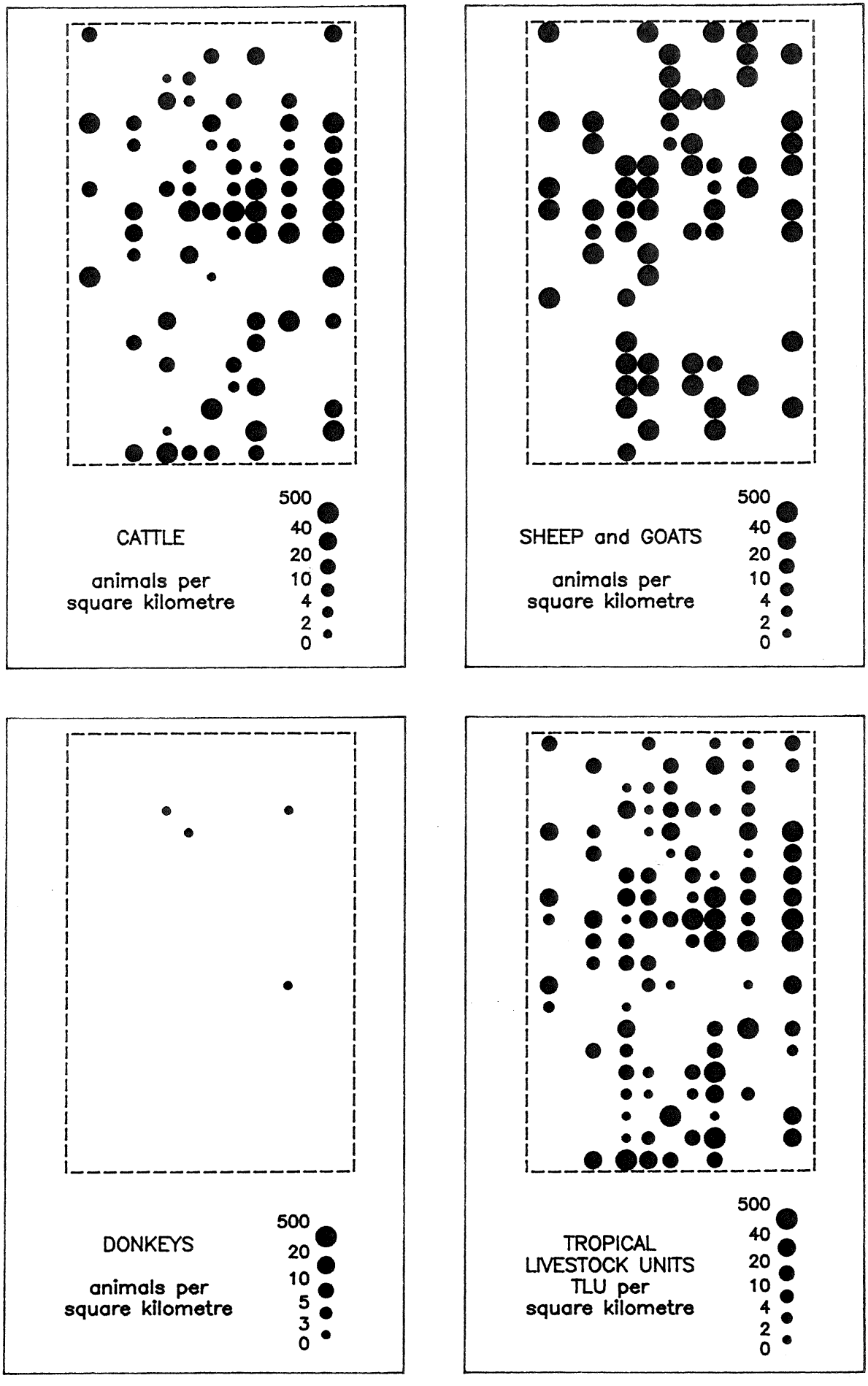


TABLE 1 : LIVESTOCK POPULATION ESTIMATES FOR THE OFFICE DU NIGER* (NIONO) REGION OF MALI.

	Dry Season (May 1983)**			Wet Season (Sept 1984)		
	Inner	Outer	Total	Inner	Outer	Total
CATTLE:						
N. Animals (% SE)	45.945(19)	30.647(15)	76.592	54.957(45)	72.715(51)	127.675
Stocking Rate ha/hd	5.4	13.1	8.5	4.5	5.5	5.1
Density / sq km	18.4	7.7	11.8	22.0	18.2	19.6
N. Group (% SE)	641(16)	522(12)	1.163	694(24)	851(33)	1.545
Mean Group Size	72	59	66	79	85	83
SHEEP AND GOATS:						
N. Animals (% SE)	71.573(12)	62.948(28)	134.521	56.959(25)	64.036 (3)	120.995
Stocking Rate ha/hd	3.5	6.4	4.8	4.4	6.2	5.4
Density / sq km	28.6	15.7	20.7	22.8	16.0	18.6
N. Flocks (% SE)	721(13)	410(23)	1.131	501(27)	568(27)	1.069
Mean Flock Size	99	154	119	114	113	113
CAMELS:						
N. Animals (% SE)	19(50)	498(96)	516	0	0	0
Stocking Rate ha/hd	13,158	803	1.260			
Density /10 sq km	0.08	1.25	0.8			
N. Groups (% SE)	19(50)	37(96)	56	0	0	0
Mean Group Size	1	13	9			
DONKEYS:						
N. Animals (% SE)	81(47)	187(60)	268	19(61)	90(96)	109
Stocking Rate ha/hd	3.086	2.139	2.425	13,158	4.444	5.963
Density /10 sq km	0.3	0.5	0.4	0.1	0.2	0.2
N. Groups (% SE)	37(39)	37(49)	74	13(56)	25(96)	38
Mean Group Size	2	5	4	1	4	3
TROPICAL LIVESTOCK UNITS*:**						
Total TLU	39.378	28.339	67.716	44.175(38)	57.350(45)	101.525
Stocking Rate ha/TLU	6.3	14.1	9.6	5.7	7.0	6.4
Density /sq km	15.8	7.1	10.4	17.7	14.3	15.6

* The Office du Niger region was divided, for the purposes of aerial survey, into an inner zone (2,500 square kilometers), and an outer zone (4,000 square kilometers). The outer zone was sampled at 8%, and the inner zone at 16% intensity.

** Milligan, 1983.

*** TLU conversion based on following factors: Camels = 1 TLU: Cattle = 0.7 TLU: Donkeys = 0.5 TLU; Sheep/Goats = 0.1 TLU (Jahnke, 1982).

The 1984 wet season cattle population was substantially greater (+67%) than that estimated for the 1983 the dry season, while the sheep and goat population was somewhat lower (-10%). This was reflected in a 33% increase in TLU between dry and wet season surveys. The bulk of this increase was accounted for by a 137% increase in the cattle population of the outer zone.

3.2 Human Habitation.

The distribution patterns of the four styles of human habitation in the Office du Niger aerials survey region are shown in Figure 4, and overall estimates of their numbers are given in Table 2.

Human habitation in the region, excluding the larger towns and villages, was estimated at a total of some 4,500 dwellings. Three distinct types of dwelling were recognised from the air. Those of the Peuhl (FulBe) style were by far the most abundant, representing 74% of the total: the next most common were of the Tamashek (Touareg) style, which accounted for 18%; followed by the Bella and Maure (Arab) styles, which represented 7% and 1% respectively.

FIGURE 3: WET SEASON DISTRIBUTION OF HUMAN HABITATION.

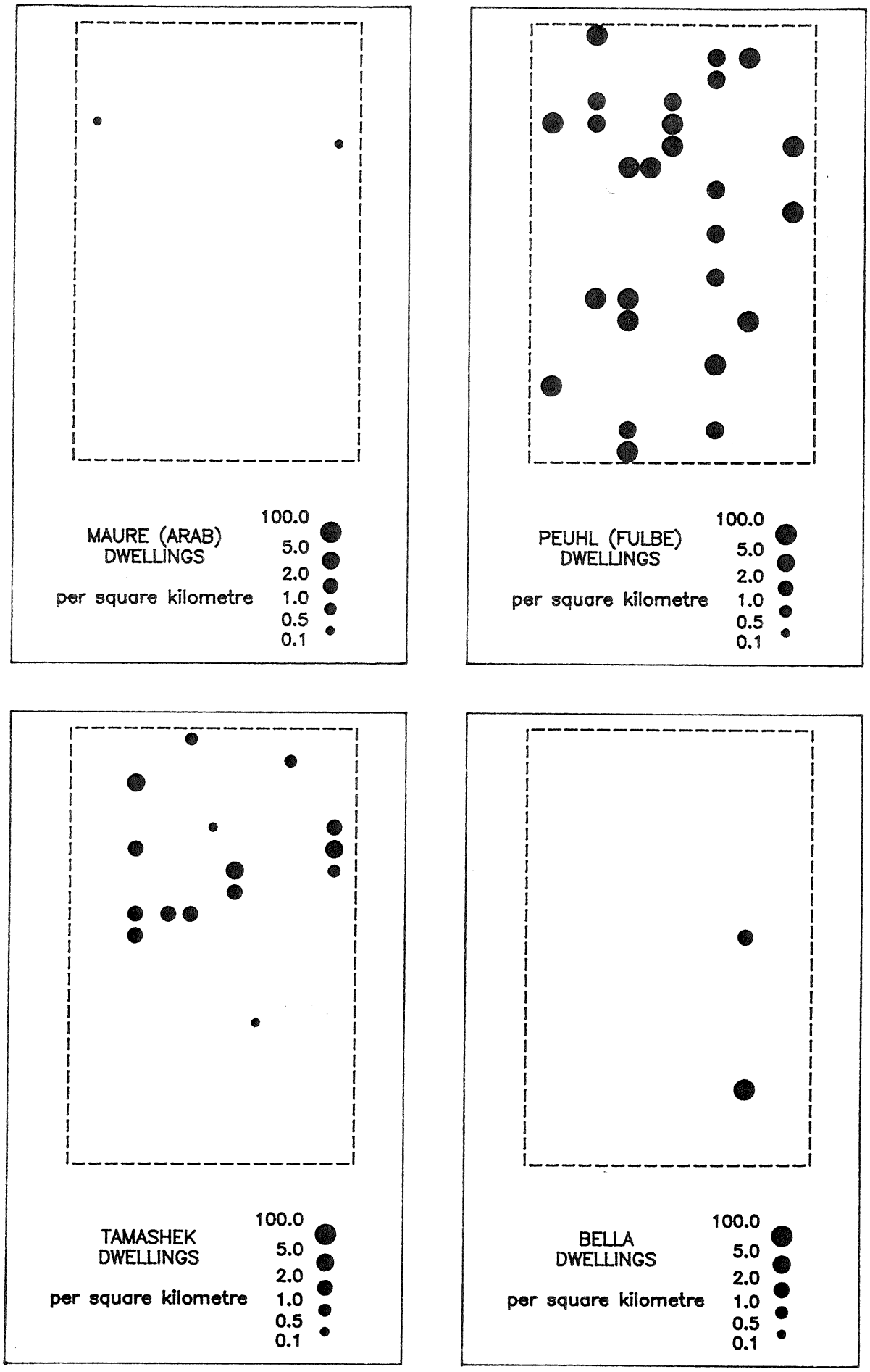


TABLE 2: HUMAN HABITATION ESTIMATES FOR THE OFFICE DU NIGER REGION* (NIONO) OF MALI.

Type of Dwelling	Inner Zone	Outer Zone	Total
Bella Style			
Number	0	300 (96)	300
Density /10 km sq		0.75	0.46
Maure (Arab) Style			
Number	0	25 (55)	25
Density /10 km sq		0.06	0.04
Peuhl (FulBe) Style			
Number	2.021 (52)	1.293 (17)	3.314
Density /10 km sq	8.1	3.2	5.1
Tamashek (Touareg) Style			
Number	194 (39)	628 (54)	822
Density /10 km sq	0.8	1.6	1.3

* The Office du Niger region was divided, for the purposes of aerial survey, into an inner zone (2,500 square kilometers), and an outer zone (4,000 square kilometers). The outer zone was sampled at 8%, and the inner zone at 16% intensity.

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