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Pastoral and agropastoral household economy in the region of Diffa (Niger): between poverty and vulnerability

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1. ABSTRACT

Livestock is the main economic activity in the Region of Diffa. It employs 95% of communities and contributes on an annual basis to 55% of the gross domestic product of the Region. This article analyzes the economics of pastoral and agropastoral households in the region of Diffa taking onto account environmental contingencies. A survey involving 300 households (150 households with sedentary livestock and 150 households with mobile livestock) was conducted based a pre-established agro ecological zoning (pastoral bowls zone, Komadugu zone and Lake Chad zone). Analysis of annual monetary income of households shows that 81% of the interviewed were poor and that 47% of the poor were extremely poor. This income is largely extent dominated by the agricultural sector with a significant contribution of livestock. The study also highlights the existence of a highly significant positive correlation between monetary income and herd size in sedentary breeder's households in the area of pastoral bowls and for those with mobile livestock all areas combined. By cons, no correlation for sedentary households in the Komadugou and Lake Chad zones. Furthermore, analysis of the relationship between livestock endowment and household size reveals the extreme vulnerability of pastoralist households. About 74% of the herds of sedentary households in the pastoral bowls zone are below the pastoral viability threshold. The same applies to mobile livestock with zonal disparities.

2 INTRODUCTION

Niger is a great livestock country in West Africa Whose Livestock sector represents 62% of agricultural exports, 11% of the country's gross domestic product (GDP). It is the second major export commodity (21% of export earnings) of the country after uranium (Republic of Niger, 2013). Livestock significantly contributes to household budgets (25% of budgets) and the satisfaction of the food needs of Nigerien population (Republic of Niger, 2013; Save the Children, 2009). However, over the last years, livestock activity has been impacted by various natural (rainfall deficits and fodder shortfalls) and anthropic (demographic pressure) constraints, which have affected all pastoral and agro pastoral production systems in Niger. This article analyzes the economics of pastoral and agropastoral households in the region of Diffa. It is a largely pastoral region with over three million animals heads i.e. 10% of the country's animal resources. In this Region, 95% of the population practices animal husbandry as their main or secondary economic activity after crop farming (Republic of Niger, 2008). For the realization of this study, a

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survey of 300 households was conducted. After the presentation of the region in its natural environment and the methodology used, the income sources and structures of households surveyed were analyzed. Then, an analysis of household well-being and wealth level were used to assess poverty incidence, herd viability threshold and household vulnerability. A comparative analysis between agro ecological zones will enable us to understand zonal disparities, especially among the households with sedentary livestock.

3 MATERIALS AND METHOD

3.1 Study area: The Region of Diffa is located at the far East of the Republic of Niger between 10° 30' and 15°35' East longitude, 13°04' and18°00' N Latitude and covers an area of 156,906 Km^2. It displays a relief consisting of dune plains and plateaus characterized by lacustrine and alluvial formations in the Southern part of the Region and eolian formations in the North. Thus, the majority of the population is concentrated in the Southern strip of the Region.

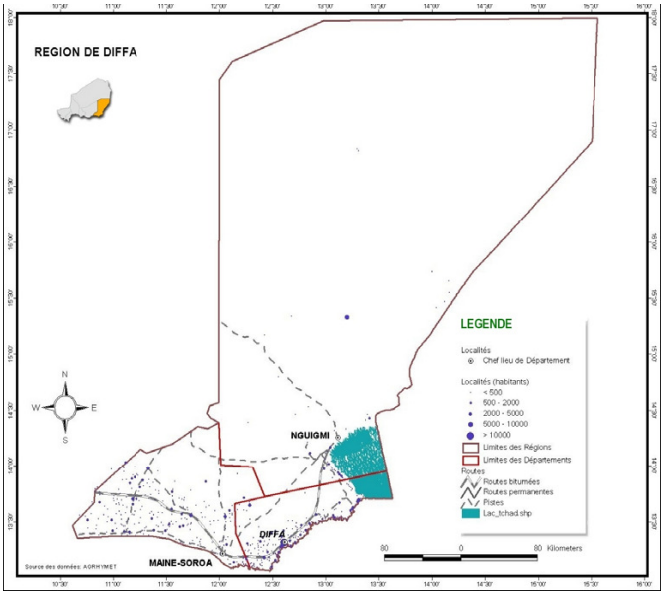

Figure 1: Spatial distribution of communities in the Region of Diffa (source: Republic of Niger, 2008).

The climate is of the Saharan-Sahelian type. Annual rainfalls extend from July to September, scarcely from June. Average annual rainfalls vary from around 340mm for 36 days of rain in the South to 78 mm in the North (INS, 2010). This makes Diffa one of the pastoral zones per excellence in Niger. The climate is characterized by an increasingly constant succession of dry spells. Such climate variability engenders recurrent shocks, especially in terms of pastoral resources, translating into significant fodder shortfalls, which are increasingly becoming structural for an extensive rearing system. Over the 2000- 2017 period, only tree were years of surplus (Laouali *et al.* 2013; Republic of Niger, 2017).

3.2 Agro ecological zoning: The study area was subdivided into three agro ecological zones (AEZ):

- Pastoral bowls Zone: located between 150mm to 250 mm isohyets per annum, it corresponds to the Saharan-Sahelian strip (Northern part of the Region of Diffa). Livestock is the main economic activity of communities in this zone.

- Komodugu Zone: Located in the South, along KomaduguYobe River, it stretches for 150 km. It receives annual rainfalls of 250mm to 300 mm. Irrigated or/and flood recession agriculture is the main economic activity of communities. This is a fallback area for pastoralists during dry seasons.
- Lake Chad Zone: Located at the Far East of the Region, in Lake Chad basin, it receives annual rainfalls of 250mm to 300 mm and agriculture (especially flood recession agriculture) is the main economic activity of communities in this area. This is a fallback area par excellence for pastoralists.

3.3 Sampling and statistical analysis: Sampling was conducted using a double spatial scale approach and household as survey unit. The first level relates to the selection of villages or encampments and the second one relates to the selection of households to be surveyed. . A total of 300 households in 30 villages and/or encampments were randomly sampled, at the rate of 10 households per village (or encampment). Households were selected in such a way that we had 150 households practices sedentary livestock and 150 households engaged in mobile livestock. The database was constructed using Excel spreadsheet. Data were processed using Minitab 16 software. Economy of households surveyed was analyzed according to HEA (*Household Economic Analysis*) approach, designed by Save The Children UK, NGO in the mid-1990s (Group URD, 2013; Oxfam, 2012). Descriptive statistics made it possible to characterize households. An ANOVA was used to compare data regarding agro ecological zones. Monetary approach by income is the most widely used method to analyze household well-being. In the microeconomic literature, monetary income very often considered as indicator to understand household poverty dynamics (Barrett, 2005; Duteurtre *et al.,* 2009). It measures household poverty by comparing their monetary income with a threshold income below which households or individuals is unable to ensure his well-being. They are thus qualified as poor. As such, the concept of poverty threshold has proven to be one of the relevant instruments (Duteurtre *et al.,* 2009) used to characterize household well-being level. To categorize households, a distribution grid was built around median (FCFA 52,336 /person and per year, or USD 91) and average (FCFA 72,763 /person and per year, or USD 126) incomes of the sample and rural poverty threshold (FCFA 110,000 / person and per year, or USD 191). This grid is as follows:

- Very poor: households with monetary income below USD 87 or F CFA 50,000 /year and per person;
- Poor: households with income ranging from F CFA 50,000 to F CFA 110,000 / year and per person (USD 87 to USD 191);
- Average: households with income ranging from F CFA 110,000 to F CFA 160,000 /year and per person (USD 191 to USD 278);
- Rich: households with income above F CFA 160,000 /year and per person, or 278 USD.

Correlation tests were conducted to determine the relationships between annual monetary income and size of household's herd at the 5% threshold. It is also easy to conduct analysis of household economy based on local criteria set by communities themselves. Household vulnerability was analysis based on the pastoral viability threshold of 3 TLUs */per capita* for mixed livestock (Thébaud, 1999) and work of Ludovic *et al.* (2014) on pastoral food security index.

4 RESULTS AND DISCUSSION

4.1 Household monetary income: Sources and structures: The average annual monetary income of the sample surveyed is around F CFA 672,000 or 1168 USD with excessive dispersion around the mean (variation coefficient is 0.86). However, an ANOVA of average incomes according to zones and livestock system using Tukey method (Table 1) reveals that these are not significantly different (p-value = 0.354).

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Table 1: Comparison of household average incomes according to agro ecological zones (AEZ) and livestock systems.

Items	AEZ	N	Group average	P value	Decision
Sedentary	Pastoral bowls zone	55	581975a	0,344	NS
	Komadugu zone	43	689556a		
	Lake Chad zone	41	722384a		
Mobile	Pastoral bowls zone	43	818467a		
	Komadugu zone	31	552467a		
	Lake Chad zone	76	666730a		

NS: Not significant

Figure 2 shows the structure and sources of annual monetary incomes of households surveyed according to AEZ and livestock system. It transpires low diversification of monetary income sources in responding households. This is largely dominated by agriculture with a significant contribution of the livestock sector. However, structure varies according to livestock system (sedentary or mobile), on the one hand and according to AEZ, on the other hand.

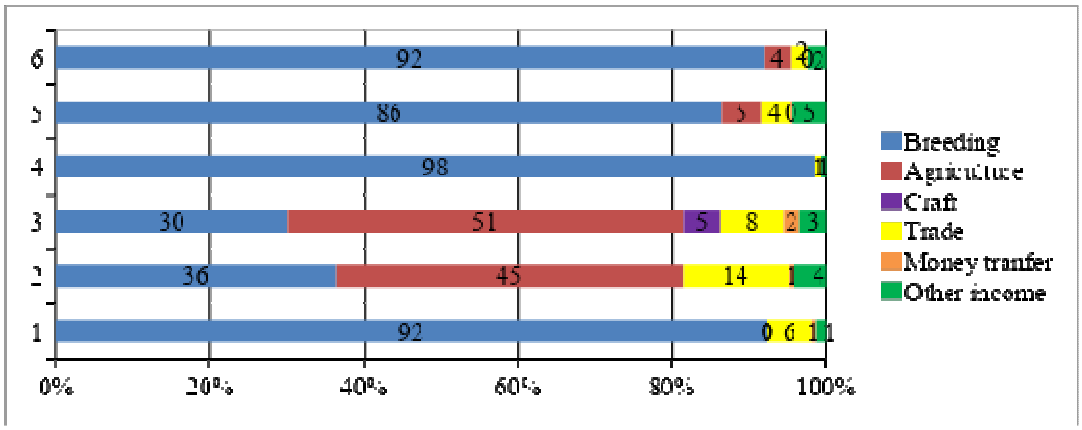

Figure 2: Structure of average household income according to zone and livestock system (%)

Thus, agriculture (irrigated or flood recession) represents a major source of monetary income in sedentary households in the Lake Chad (51% of income) and in Komadugu (45% of income) zones. Livestock share (30% and 36% of income respectively) remains however non-negligible. Trade contribution varies from 8% (Lake Chad zone) to 14% (Komadugu zone). In contrast, in the pastoral bowls zone, households earn most of their monetary income from livestock (92%). The contribution of agriculture is low, if not zero. In this zone with no irrigated agricultural potential, rainfed crop production is very often insufficient to meet the food needs of households, and beyond, accumulate tradable surpluses (Laouali and Lebailly, 2018). The structure of average monetary incomes of households with mobile herds indicates that income is largely pastoral (86% to 98%) regardless of the survey area considered. The share of agriculture in monetary

income varies from 4% in Lake Chad zone (flood recession cropping) to 5% in the Komadugu zone (irrigated agriculture). It is very insignificant or even nil in the pastoral zone. The results of correlation tests having a threshold of 5% for the entire sample show that household monetary income is positively correlated (the Pearson correlation coefficient is 0,36) with the size of herds belonging to households and that this correlation is very highly significant (p- value is 0.000). By conducting the same test according to livestock system and by AEZ, we note that monetary income is not correlated with herd size in sedentary households in the Komadugu and Lake Chad zones (Table 2). These households have a crop dominated agricultural farming system (Laouali and Lebailly, 2018). In contrast, for sedentary households in the pastoral bowls zone, the test reveals a very highly significant correlation. Similarly, for households with mobile livestock, all areas combined. These are households with a pastoral vocation (Laouali and Lebailly, 2018).

Table 2: Test of correlation between annual income and herd size of households with a threshold of 5%.

	Zone	Coefficient of correlation	P-value	Decision
Sedentary	Pastoral basins	0.463	0	VHS
	Komadugu	0.142	0.365	NS
	Lake Chad	-0.088	0.586	NS
Mobile	Pastoral basins	0.512	0	VHS
	Komadugu	0.512	0.003	HS
	Lake Chad	0.535	0	VHS

VHS: Very highly significant; HS: Highly significant; NS: Not significant.

These analyzes make it possible to argue that the disparity of sources and the structure of the average annual monetary income of households, according to the zones, can be explained by the agro-ecological potential of the latter. Rainfed agriculture remains a very random activity in the Region of Diffa. Rainfall is not only erratic, but also very often below the minimum threshold (350 mm of rainfall annually) for cereal crops (Hellal *et al.,* 2014). Selling livestock and livestock products is the main alternative for many households to access some basic goods and services (cereals, clothing, health, etc.). In contrast, in Lake Chad and Komadugu zones, communities are actively engaged, in addition to rainfed agriculture, in irrigated and/or flood recession agriculture during dry seasons around permanent watercourses. They produce cereals (rice, corn wheat) intended for their own consumption and cash vegetable crops, including pepper, tomatoes, onion, lettuce, etc. (Laouali and Lebailly, 2018).

4.2 Income and poverty: towards an analysis of household well-being: The analysis results show that around 80% of households surveyed are poor and that 47% of them are extremely poor. The situation is widely shared in the three survey areas, particularly for sedentary livestock households, with a poverty rate ranging from 80 to 83%. On the other hand, for households whom practices mobile livestock, surveyed in the Komadugu and pastoral bowls zones, the incidence of poverty appears relatively less pronounced with a rate of 74% and 78% respectively (Figure 3). This might be due to the level of the financial needs of mobile households, which is indeed lower. It mainly summarizes for the latter in financing the purchase of cereals that represent their largest item of expenditure. These rates are largely above the national average that stands at 54.6% in Nigerien rural areas (INS, 2016).

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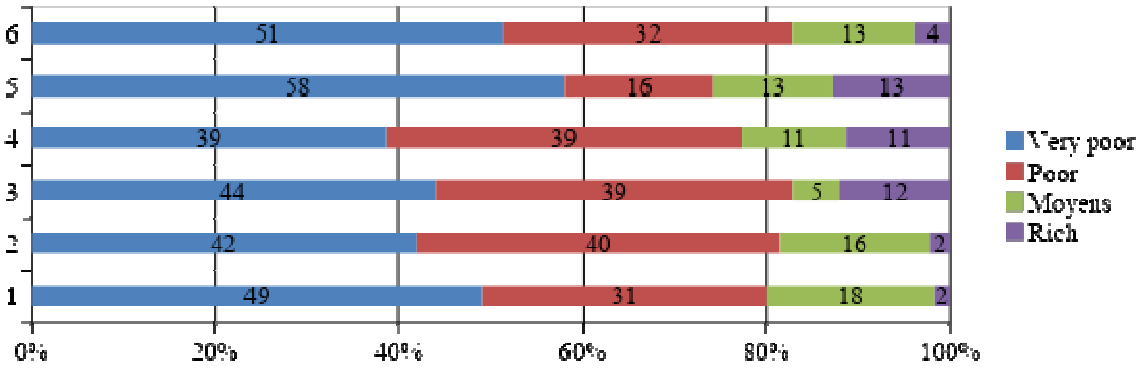

Figure3: Categorization of households based on average annual per capita monetary income according to agro ecological zones and livestock system (%)

4.3 Household wealth level: livestock endowment: The synthesis of the different declarations obtained during the fieldwork made it possible to classify households surveyed according to the level of wealth. Overall, two local criteria were put forward to classify households surveyed according to the level of wealth. It is either the possession of livestock (size of herds and animal species farmed), or agricultural production or both. All production systems and therefore household living conditions depend on these activities. Table 3 shows the average livestock endowment by asset according to agro ecological zones and livestock systems. It also shows a highly significant difference (p-value of 0.000) in terms of average livestock endowment between households engaged in sedentary livestock in the pastoral bowls zone (3.6 TLU/asset), on the one hand, and those in the Komadugu (1,7 TLU/asset) and Lake Chad (1.2 TLU/asset) zones, on the other hand. In contrast, there is no statistically significant difference, between households with mobile livestock surveyed in these three zones.

Table 3: Average ownership of TLU/household asset according to zones and livestock systems

Livestock system	Zone	N	Average TLU/asset	P value	Decision
Sedentary	Pastoral bowls	55	3.6 a	0.000	VHS
	Komadugu	51	1.7 b		
	Lake Chad	41	1.2 b		
Mobile	Pastoral bowls	45	7.2 c	0.725	NS
	Komadugu	31	6.4 c		
	Lake Chad	76	6.0 c		

An ANOVA of possession of TLU per capita according to areas and livestock systems allow to refine the analysis (Table 4). The results of this analysis confirm the differentiation in livestock endowment between, on the one hand, sedentary and mobile households and, on the other hand, sedentary households according to agro-ecological zones.

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Table 4: Average per capita ownership of TLUs, according to zones and livestock systems

Livestock system	Zone	N	Group average (*per capita TLU*)	P value	Decision
Sedentary	P bowls	55	1.6 a	0.000	HS
	Komadugu	51	0.9 b		
	Lake C	41	0.6 b		
Mobile	P bowls	45	3.9 c	0.251	NS
	Komadugu	31	4.8 c		
	Lake C	76	2.7 c		

HS: Highly significant; NS: Not significant

Based on the assessment criteria communities had to evaluate pastoralists' wealth in the past, it clearly transpires that the wealth level of pastoral households in the Region of Diffa has sharply decreased. In the 70s to 80s, wealth was estimated in hundreds of heads of large ruminants (cattle or camels according to ethnic groups) owned by breeders, so that a household with about 100 head of cattle heads, equivalent to 75 to 80 TLUs would not have been considered rich (Thebaut, 1999; Duteurtre and al., 2009). However, according to the breeders surveyed, very few households have such number of cattle and yet are considered wealthy by their peers. Like pastoral households, the success of agro-pastoral households is also reflected in its propensity to capitalize in livestock the surplus value derived from agricultural rents. Thus, herds represent one of the key assets for both pastoral and agro pastoral households. Added to this are social capital, expertise and the accessibility and availability of natural resources (water and pasture) etc. (Laouali and Philippe, 2018; Laouali *et al.,* 2014). Wiese *et al.* (2008) indeed specified that poverty in pastoral areas could not be perceived only in terms of « income », as; it is part of an impoverishment dynamics, which affects the entire economic production, social reproduction and cultural identity system (quoted by Duteurtre *et al.* (2009)).

4.4 Pastoral viability: An analysis of household vulnerability: Figure 4 shows the classification of households by tranche of TLU per capita and assesses the health status of the herd according to the area and the livestock system. A nuanced analysis of this figure reveals wide disparities in terms of the ratio of size of household –size of the herd according to agro-ecological zones, on one hand, but also according to the livestock system, on the other.

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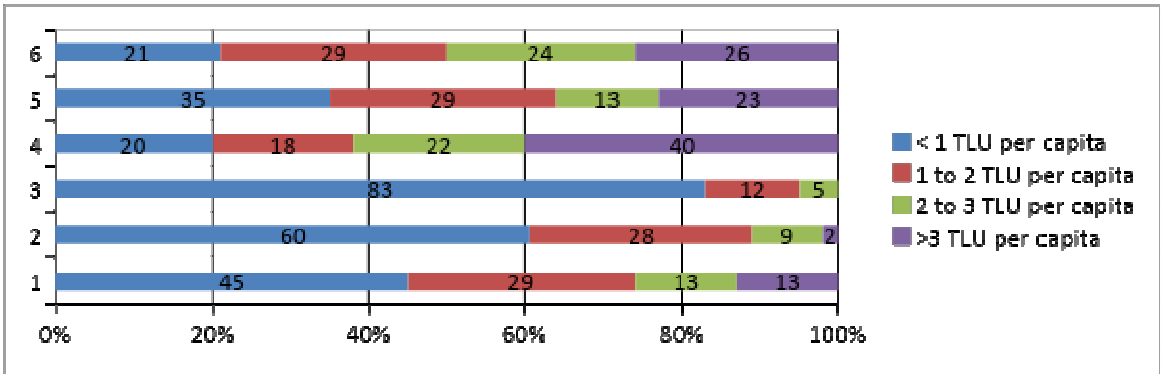

Figure 4: Distribution of households according to TLU / per capita class by zones and livestock system (%)

The ratio is lower for households with sedentary livestock. 45% to 83% of them (Lake Chad zone) have less than one TLU *per capita*. For mobile households, the ratio varies from 20% to35%. Thus, 23% to 40% of mobile households surveyed have more than 3 TLUs *per capita*. Based on the pastoral viability threshold of 3 TLUs /*per capita* for mixed livestock (Thébaud, 1999) and work of Ludovic *et al.* (2014) on pastoral food security index, it appears that:

- Mobile herds surveyed have a relatively acceptable viability in contrast to sedentary (less than 2 TLUs *per capita* (Table 4)). This is understandable given the dependency ratio (number of household members /number of household assets) of around 2.2 which impacts each asset of households surveyed.
- Sedentary households in the pastoral bowls zone lead a relatively precarious even vulnerable life (Ludovic *et al.,* 2014; Yamba, 2013), as their economy is mainly pastoral. However, they have very little livestock capital, largely dominated by small ruminants including goats (Laouali *et al.* 2013).
- Mobile herds generally have relatively better pastoral viability than sedentary herds. However, the situation must be nuanced mobile herds tend to have a better pastoral viability than sedentary herds. Yet, the situation must be nuanced. The proportion of households with mobile herds has their livestock endowment below or equal to 2 TLU *per capita* remains high (38% in pastoral bowls zone; 50% in Lake Chad zone and 64% in Komadugu zone). At the same time, occurrence of climate risks (recurrent forage deficit) and other animal diseases undermine zootechnical performance of herds, thus compromising household productive capital (Laouali *et al.,* 2014). According to Hellan (quoted by Thébaud, 1999), in the pastoral societies in the Horn of Africa, where a pastoralist derives livelihoods from a single animal species, the minimum ratio required would be 1 person for 5.71 camels or 13.06cattle or 20.4 small ruminants.

5 CONCLUSION

This study clearly shows poverty even vulnerability of pastoral households in the Region of Diffa. It raises long-term concerns about the viability of pastoral household productive potential, in view of climatic contingences, which characterize this region. Given that, the economy is essentially pastoral, herd viability, and therefore household viability depends on the capacity of herds to meet their feed requirements and/or the financial needs of households while preserving their core-breeding herds. At this level, the issue is in terms of social and economic reproduction capacity of households, especially sedentary households in the pastoral bowls zone whose herd viability is critical. By contrast, for sedentary households in the Komadugu and Lake Chad

zones, viability of herds is not a real preoccupation as the economy of such households is essentially based on crop farming. Livestock represents for them a means of capitalization and/or saving.

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