The relation between the coping strategies and the state of food insecurity in the Republic of Niger

Authors:

Andres Ludovic[1], Philippe Lebailly[2]

[1] ULg-Gembloux Agro Bio Tech, economic and rural development unit passage des déportés no.2, 5030 Gembloux

[2] ULg-Gembloux Agro Bio Tech, economic and rural development unit passage des déportés no.2, 5030 Gembloux

Abstract:

The Niger's rural population represents 80 percent of the total population. This very high percentage creates an important pressure over the environment because of the high density of population. Indeed, the agricultural favorable area is equivalent to a third of the total area of Niger. This area is located in the South of Niger over a strip 300 kilometers of broad. Furthermore, the rural population is subjected to the temporal and structural disruptions. The temporal shocks are defined by the "natural" disruptions such as the hydrometeorological disruption, etc. The structural disruptions are caused by the chronicle difficulties (low income, etc.). The capacity to struggle against the disruptions is defined by the resilience (Lhomme et al., 2010). The resilience is illustrated and assessed by the different coping strategies practiced by the Niger's rural population. The target of the paper is to demonstrate the state of food insecurity and the coping strategies developed in the departments of Niger. The state of food insecurity and the coping strategy index are calculated as from the data of an annual survey realized by the Early Alert System (EAS) and the Statistical National Institute of Niger (INS). This survey investigates around 10.000 households in December 2009 and April 2010. The sample is extrapolated to estimate the number of people suffering from food insecurity per department. The paper illustrates the state of food insecurity of each department and coping strategy index of the departments. The results will demonstrate the differences between departments. The answers of the paper at the following question: Which are the most vulnerable departments and what is the situation of the coping strategies index in each department? This paper creates also a typology bringing together the same departments in comparison with the coping strategies and the state of food insecurity.

Key words: coping strategy, food insecurity, Niger, risk

1   Introduction

Since 2000, the concept of food security has introduced the notion of risk through the concept of food vulnerability. Currently, "the food insecurity occurs when an individual has limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Anderson S., 1990). The paradigm of the food security has evolved and present many forms because the causes and consequences of the food insecurity are varied. The notion of risk is integrated in the

food security paradigm on account of a dynamic overview of the food security. This dynamic appearance is characterized by the possibility that an individual can fall quickly in the food insecurity state. This dynamic aspect is defined through the food vulnerability that is characterized by "the analysis of adaptation mechanisms and reaction faced with a difficult situation. The household is in a temporal or structural vulnerability situation, if the mechanisms aren't effective" (EAS and INS, 2010a; EAS and INS, 2010b). The identification of the coping strategies is used to calculate the capacity to fight against one or several disruptions. It exist two types of disruption: temporary and structural. The temporary disruptions assemble the short-term disasters such as the hydrometeorological disaster; demographic crisis (exodus, etc.); cultural enemies (locust, caterpillar, etc). The structural disruptions can be linked the unfavorable environment, non-efficient food system; the chronicle poverty (Gado A. and Yayé A.D., 2006). This paper is focused on the resilience defined as the capacity to struggle against the disruptions (Lhomme et al., 2010).

The target of this paper is to demonstrate the state of food insecurity and the coping strategies developed in the departments of Niger. Since 2006, the state of food insecurity is estimated from an annual survey. The population is classified on four groups: strict food insecurity; moderate food insecurity; at risk; food security. The paper considers the population in a state of several and moderate food insecurity. This state of food insecurity is illustrated by geographical zoning (department of Niger). Furthermore, the coping strategies show the capacity to struggle against the disruptions in a mapping. The database enables to calculate to do the coping strategy index. The coping strategy index evolves this capacity of the population of Niger per department.

2   Material and method

The result and analysis of this paper come from an annual survey based on an assessment of the state of food insecurity. The state of food insecurity is calculated from variable based on household food economy: income, food consumption and coping strategy. The investigations of the household are based on the database of the population census of 2001. This population census has determined the "enumeration areas". These "enumeration areas" are defined as a "geographical area of 200 households on average" (INS, 2007). The sample of this investigation is established from a significant sample a point of view of the departments of Niger. This sample is extrapolated to estimate the number of people suffering from food insecurity per department. The database is used to calculate a state of food insecurity. This state is obtained from calculating a principal component analysis (PCA) of several variables. The several variables are the food consumption score; the proportion of food expenditure in total expenditure; the duration of stocks; the livestock ownership expressed in tropical livestock unit; the index survival strategy (Andres L., and Lebailly Ph., 2011a; EAS and INS, 2010).

In 2010, the survey on the state of food insecurity investigates the household chief. Indeed, the number of sample is 9.195 households in April 2010 and 17.653 in December 2010. The analysis indicates the state of food insecurity for April and December 2010. Indeed, in April is a difficult period to nourish the households (lean period). While, December is the post-harvesting period while the households have a better food situation. In this paper, the data concerns two types of mixed index: the state of food insecurity and the coping strategy index. The coping strategy index is determined by eight variables: decreasing the daily ration; consumption of cheaper food; consumption of wild plants; one or several day without eating; global sale of animals; sale of

productive goods; sale of non-productive goods; sale of land. These eight variables are described through how often are used those coping strategies. A graduation have been defined as: 0 equal never; 1 equal one at two time per week; 2 equal three at four times per week; 3 equal four at five times per week; 4 equal six at seven time per week. In order to estimate the strategies in a long term period, INS and EAS have introduced a weighting coefficient to evolve the index survival strategy. The coefficient is subdivided on four classes: the strategy is used only during the lean period (1); the strategy is used only before the lean season (2); the strategy is used before and during the welding (3); the strategy has been used since the 2005 food crisis (4).

The analysis of the result has been calculated with the software SPSS and the map of this paper have been created with the software ARCGIS 9.3. The methodology of this paper uses a descriptive statistic and with a correlation of Pearson between the coping strategy index and the state of food insecurity. Furthermore, the most vulnerable departments will be described to illustrate the coping strategies that are used by the population of this area. Finally, this paper demonstrates an organization into a hierarchy cluster to realize a typology of the different department.

3   Result and discussion

3.1   Several and moderate food insecurity in the Republic of Niger

Since 2005, the Republic of Niger has introduced a new survey to characterize the food insecurity of household. This survey is based on the "entitlement" defined by Amartya Sen as "The entitlement approach concentrates on each person's entitlements to commodity bundles including food, and views starvation as resulting from a failure to be entitled to any bundle with enough food" (Sen A., 1981, p 434). In this survey, the entitlement is evolved from the food economic variables: food consumption score; the proportion of food expenditure in total expenditure; the duration of stocks; the livestock ownership expressed in tropical livestock unit; the index survival strategy. The paper illustrates the food insecurity for each department and the index survival strategy because the state of food insecurity shows the food situation at a period of time. While, the index survival strategy is used to identify the answers capacity of the Niger average household.

In 2010, the government of the Republic of Niger has announced an important food crisis. The analysis indicates the state of food insecurity for April and December 2010. April is difficult period to nourish the households (lean period). While, December is the post-harvesting period and the households have a better food situation.
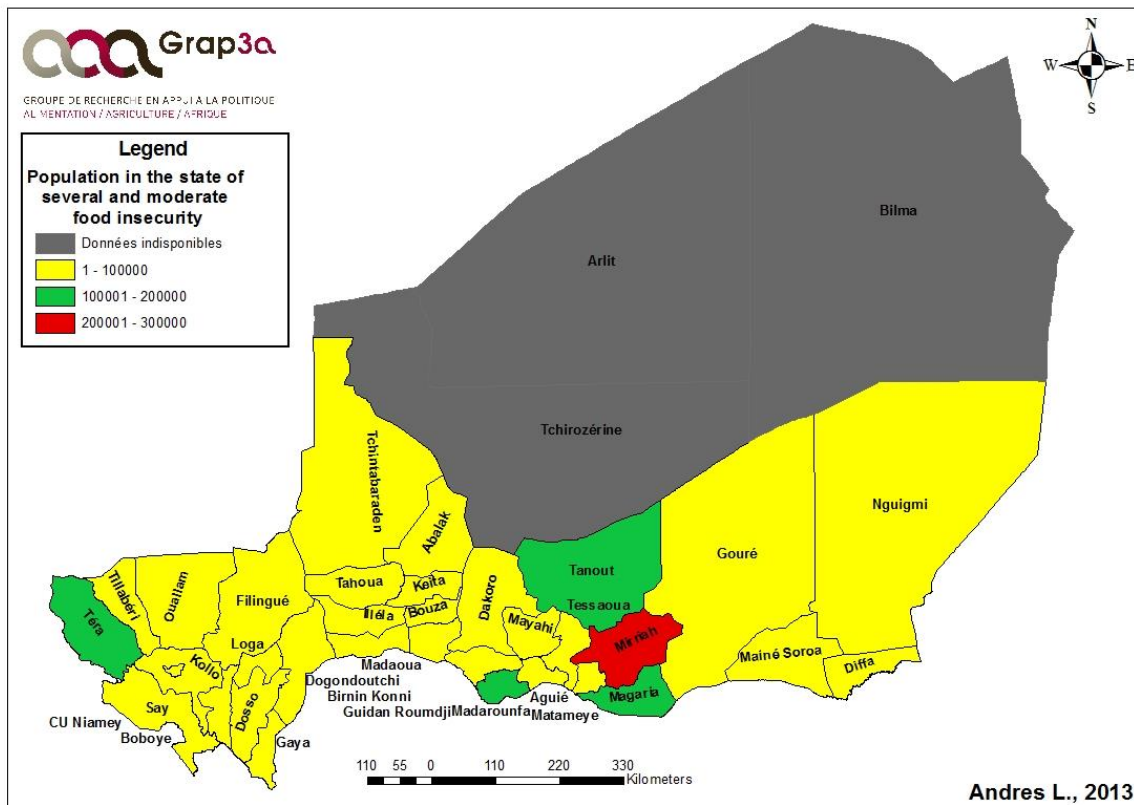
In April 2010, the state of food insecurity is high in the departments of Ouallam, Mirriah and Tessaoua. The most vulnerable department is localized around Niamey (Kollo, Filingué, Tera) and the storehouse of Niger (the department of Maradi and Zinder) (Figure 1).
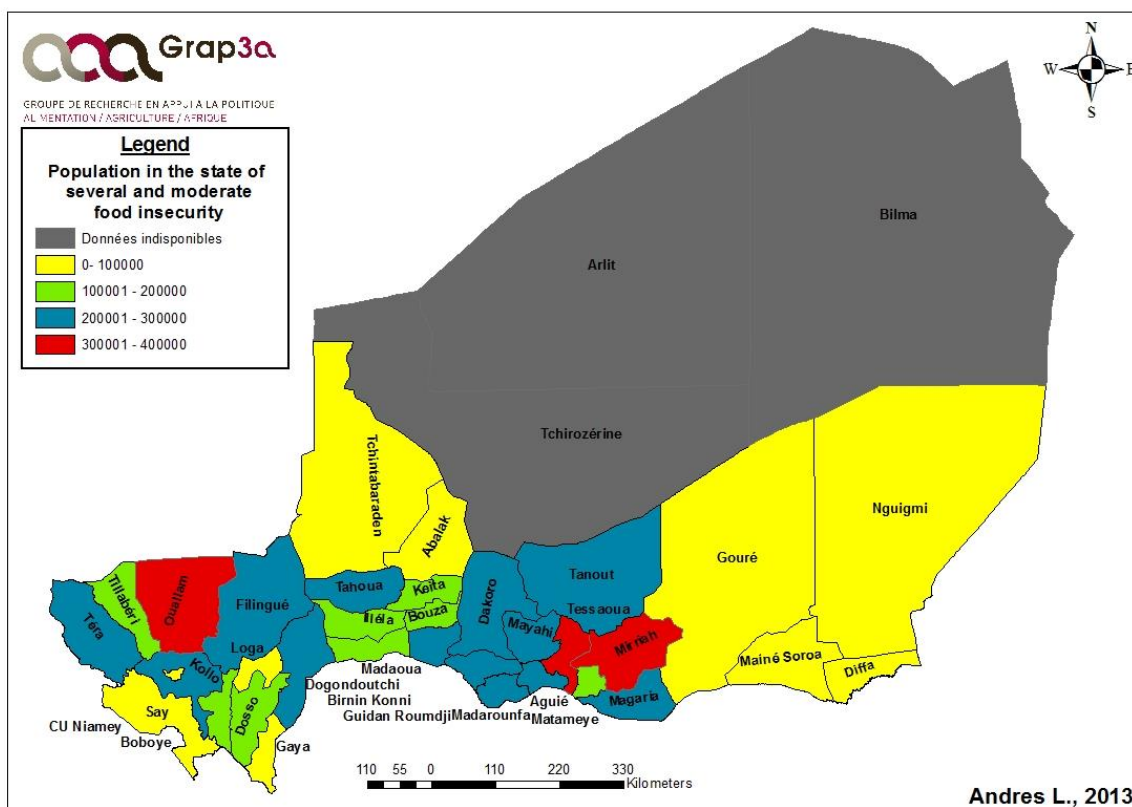
Figure 1 : Population in the state of severe and moderate food insecurity in April 2010 (EAS and INS, 2010a; EAS and INS, 2010b)

On the other hand, In December 2010, the vulnerability is lower than the April results because the rainfed agriculture produces an income to fight better the structural and temporal food insecurity. In December 2010, the most vulnerable department is Mirriah. In 2010, Mirriah presents a high rate of vulnerability. Mirriah is structurally vulnerable and it is very important to examine specifically this department. Furthermore, the population in strict and moderate food insecurity of many departments is lower 100.000 people except Téra, Tanout, Magaria and Madarounfa which have a population in severe and moderate food insecurity located between 100.000 and 200.000 people (Figure 2).

The strict and moderate food insecurity in each department of Niger is characterized by a structural insecurity but each year, a temporary cause can create an increase of the food vulnerability of the population. This structural and temporal food insecurity degrades the well-being and decreases the resilience to struggle against the structural and temporal disruptions.

Figure 2 : Population in the state of severe and moderate food insecurity in December (EAS and INS, 2010a; EAS and INS, 2010b)

But the correlation between the state of food insecurity in April and December is highly significant estimated at 0,514. The results show that the vulnerability of each department evolves in a similar way even if the vulnerability is higher in April than in December. But the result of the correlation is not very high and this result does not prove totally a link between the data of April and December. This weak correlation confirms a seasonal variation between the post-harvesting period (December) and the dry period (April).

The Figure 3 shows a cluster hierarchization of the severe and moderate food insecurity in April and December 2010. The hierarchization proves the specificity of the department of Mirriah. It brings together the similar department point of view of the severe and moderate food insecurity. Another group is characterized by a high vulnerability in April or/and in December: Ouallam, Magaria and Guidan Roumdji (Figure 3).

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Dendrogram using Average Linkage (Between Groups)

                        Rescaled Distance Cluster Combine

        C A S E             0         5        10        15        20        25
     Label        Num     +---------+---------+---------+---------+---------+

     Dogondoutchi    10     ─┐
     Mayahi          25     ─┤
     Téra            35     ─┤
     Tanout          32     ─┼─┐
     Dakoro           8     ─┘ │
     Tahoua          31     ───┤
     Aguié            2     ───┤
     Madarounfa      21     ─┐ │
     Filingué        12     ─┤ │
     Madaoua         20     ─┤ ├─┐
     Kollo           18     ─┤ │ │
     Magaria         22     ─┤ │ │
     Ouallam         29     ─┼─┘ │
     Guidan-Roumdji  15     ─┤   │
     Tessaoua        36     ─┘   ├─────────────────────────┐
     Birnin Konni     5     ─┐   │                         │
     Tillabéri       37     ─┤   │                         │
     Boboye           6     ─┼─┐ │                         │
     Bouza            7     ─┤ │ │                         │
     Dosso           11     ─┤ ├─┘                         │
     Illéla          16     ─┤ │                           │
     Keita           17     ─┘ │                           │
     Gaya            13     ───┘                           │
     Matameye        24     ─┐                             │
     Gouré           14     ─┤                             │
     Mainé-Soroa     23     ─┼─┐                           │
     Loga            19     ─┤ │                           │
     Say             30     ─┘ │                           │
     N'Guigmi        27     ─┐ ├───────────────────────────┘
     Niamey          28     ─┤ │
     Diffa            9     ─┼─┘
     Tchintabaraden  33     ─┤
     Abalak           1     ─┤
     Mirriah         26     ─┘
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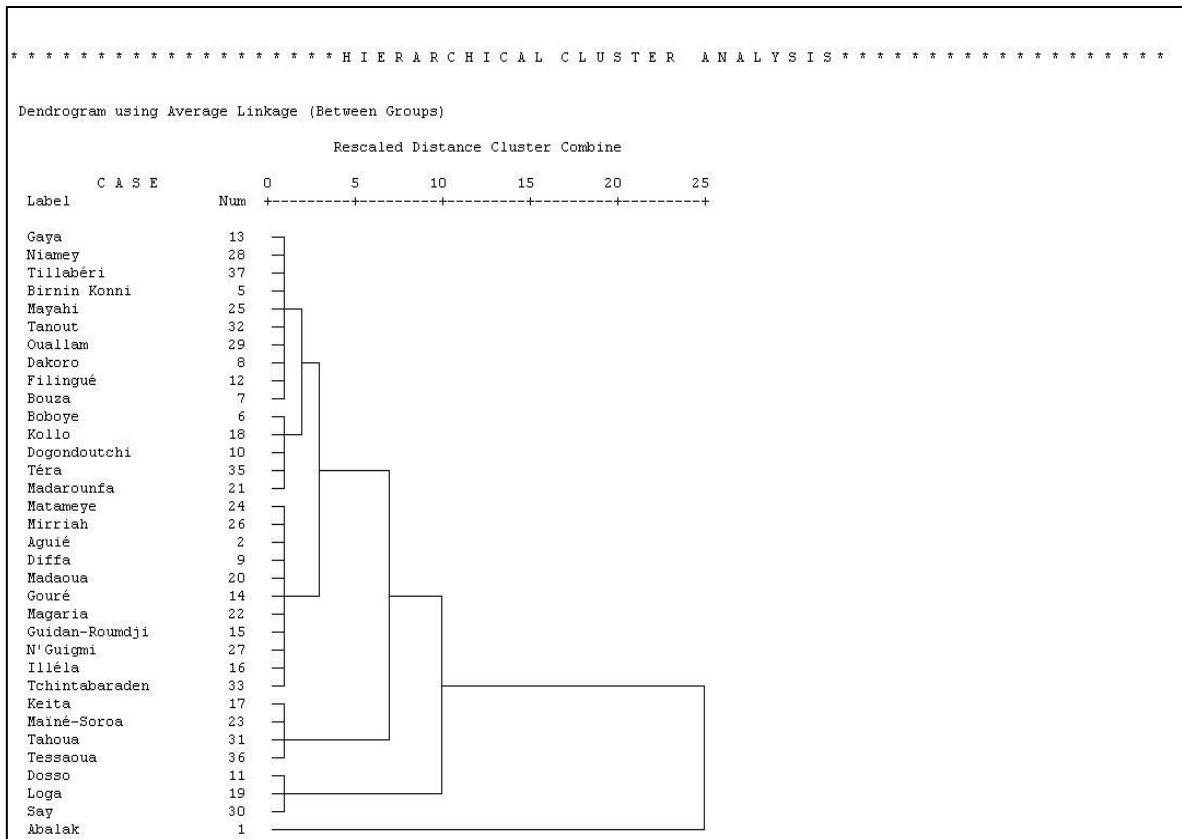
Figure 3: Cluster hierarchization of the strict and moderate food insecurity

3.2   The coping strategy index in each department of Niger

The coping strategy index is used to prove the resilience of the population in each department. The geographical zoning of the coping strategy illustrates the capacity of the population to fight the disruptions in each department. If the index is high, the population develops many strategies and the frequency of the strategies used is important.

The departments of the southeast of Niger have a low coping strategy index in comparison with the departments of Tahoua and the east of Niger (Diffa, N'Guigmi, Mainé Soroa, Gouré, Mirriah, Magaria, and Matameye). In 2010, the population of Abalak has created many strategies to fight against the structural and temporal disruptions. Furthermore, two departments have developed several strategies in relation to other department characterized by an agro-pastoral system: the department of Tillabéri; Bouza and Birnin Konni; someone department of Maradi (Dakoro, Mayahi, Aguié, and Madarounfa); and Tanout (Figure 4).
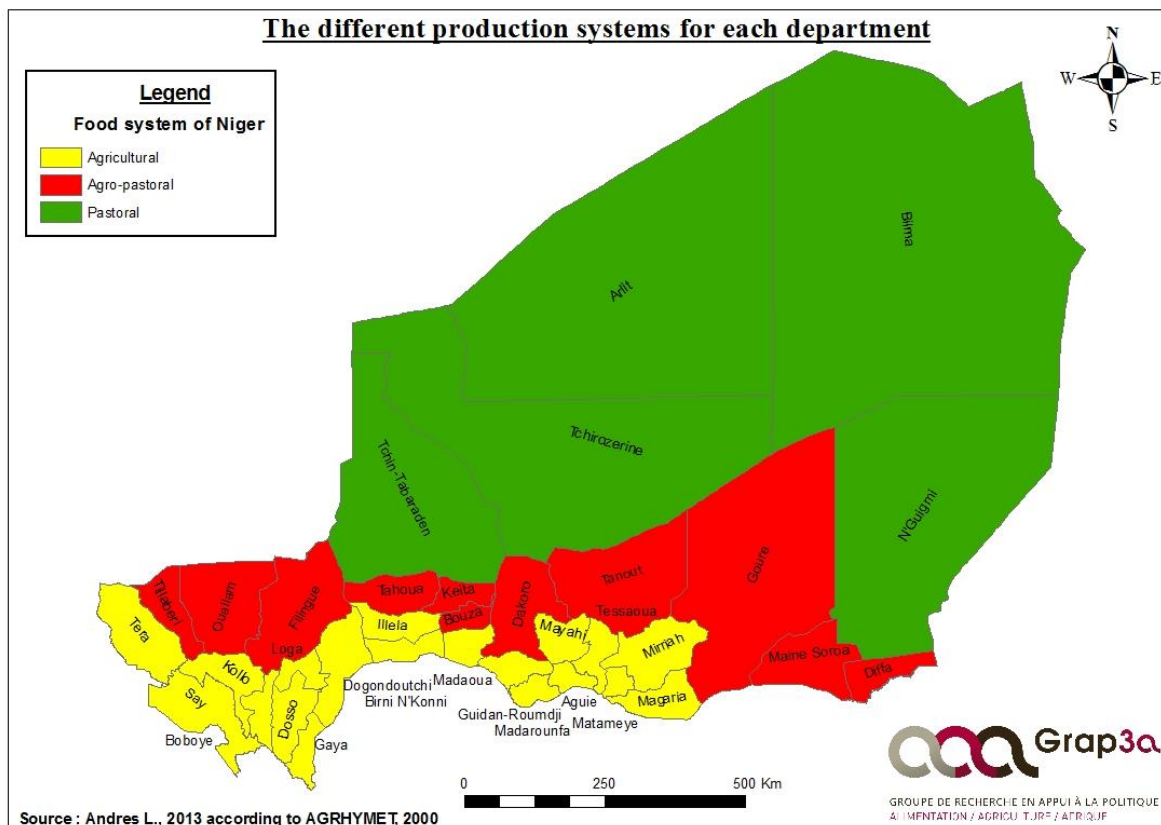
Figure 4: Coping strategy index in each department of Niger (EAS and INS, 2010a; EAS and INS, 2010b)

The coping strategy index isn't correlated with the state of strict and moderate food insecurity in April and December 2010. The test of Pearson isn't significant because the impact of the coping strategy is weak in comparison with the other indicators: food economic variables: food consumption score; the proportion of food expenditure in total expenditure; the duration of stocks; the livestock ownership expressed in tropical livestock unit. But the cluster hierarchization proves another view of the food vulnerability and resilience of the population of each department. Abalak has developed and used many strategies because the environment situation is very difficult. The cluster hierarchization confirms the specific case of Abalak and it identifies another group who has a high coping strategy index: Keita, Mainé-Soroa, Tahoua and Tessaoua. The index of this group vary between 29 and 31. In the other hand, three departments present a weak index: Say, Loga, Dosso. This department s most resilient in the comparison with the other department (Figure 5)

Figure 5: Cluster hierarchization of the Coping Strategy Index per department

3.3 The relation and the link with the variables studied and the food system

The environment of each department is decisive to determine the structural and temporal food insecurity. The researches of an agrohydrometeorological center AGRHYMET have shown the different food system present in the department of Republic of Niger. AGRHYMET have identified three food systems: agricultural system; agro-pastoral system and pastoral system. The food system has been calculated in function of the production per department. If the agricultural production (cereal, bean, peanut, etc.) exceeds the seventy percent, the department is classified as an agricultural food system. But if the department is located above the pastoral limit and has a level of cereal needs coverage is inferior of 30 percent. The intermediate (agro-pastoral) shows the characteristics of the other two systems described above (Figure 6) (Di Vecchia A. et al., 2000)

In the Republic of Niger, the southeast and southwest departments are agricultural. The North and the East departments (Tchintarabaden, Abalak, Tchirozérine, Arlit, Bilma, and N'Guigmi) are characterized by a pastoral food system. The departments located between the agricultural system and pastoral limit is defined as agro-pastoral food system (Figure 6).

Figure 6: The food system for each department of Niger

In the Table 1, we have introduced the result in function of the food system. The results show that the coping strategy index are different in function of the food system. Indeed, the coping strategy index in the agricultural system is lower than the agro-pastoral and pastoral system. Concerning the state of food insecurity in April and in December, the most vulnerable populations are located in the agricultural system and the result decrease if the population is located in the agro-pastoral and pastoral systems. These results depend on the density of population. Indeed, the density in the pastoral departments is very weak and the population is concentrated in the agricultural area and most weakly in the agro-pastoral system (Table 1). But the maximum and minimum demonstrate the importance of the variation per department. The analysis of the food insecurity should be study per department and per system if we could integrate an overview of the vulnerable population.

Table 1: the variables in function of the food system (EAS and INS, 2010a; EAS and INS, 2010b)

Food system	Variables	Mean	Median	Max	Min	Standard Deviation
Agricultural	**Coping Strategy Index**	16	15	33	2	8
	Food insecurity in April	202048	227149	359824	31033	88968
	Food insecurity in December	93546	88695	267581	5924	56059
Agro-pastoral	**Coping Strategy Index**	21	19	31	13	6
	Food insecurity in April	183914	198731	316203	51046	86189
	Food insecurity in December	80532	76681	151408	34370	40070
Pastoral	**Coping Strategy Index**	31	27	45	21	12
	Food insecurity in April	31351	30187	50709	13157	18803
	Food insecurity in December	37347	36360	59416	16264	21593

4   Conclusion

In conclusion, the example of the crisis of 2010 illustrates the evolution of the state of severe and moderate food insecurity between December (post harvesting period) and April (difficult food period). In the future, the intra-annual periodicity should be considered in the food security program in order to appreciate a dynamic modification. The appreciation of this dynamic will allow approaching the entirety of the dimension of food security. The analysis also identifies the department of Mirriah as the most vulnerable department in December 2009 and April 2010. Furthermore, the relation between the food insecurity and food systems is inversely proportional. Indeed, the population of the agricultural and agro-pastoral systems is most vulnerable than the pastoral systems. Despite the intra-annual variability, the analysis of the coping strategy index has showed that the departments with the most of strategies are located in the region of Tahoua. The departments with fewer coping strategies are located in the most vulnerable departments. The relation and the study of the different coping strategies are fundamental to analyze the food security. In the future, the research about the vulnerability and the resilience with the coping strategy index should be integrated in the evaluation of food insecurity.

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