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**Livelihood diversification and landscape
greening,
a case study from rural Niger**

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Abstract

The ability of population to deal with climate change is topical. In the case of Niger, recent research showed that the changes in agricultural practices are behind the recent increase in biomass production also called greening process in the Sahel. But other social phenomenon such as de-agrarianisation (long-term process of livelihood diversification; social identification and spatial relocation of rural dwellers away from agricultural-based livelihood, Bryceson) also plays an important role in the social structure of the rural areas. Then what are the consequences of the changes in the correlation between the agricultural production and off-farm activities for livelihood strategies? This question is investigated at the scale of rural families of the district of Mayahi, Maradi, Niger. Participatory rural appraisal and individual interviews were used to collect data on livelihood strategies, farm and off-farm activities, coping strategies at the present time and on their evolution during the past 50 years. Villagers perceive strong decrease in the yields since the 1950's. As a response to the uncertainties of their agricultural production, villagers developed a whole range of coping strategies, which allow them decreasing their dependence on degrading agricultural productivity. The off-farm coping strategies have a growing importance in the livelihood strategies of the villagers. The remittances from migration and the benefits of small business are either reinvested in agricultural intensification either in off-farm activities development. At the same time, the growing importance of off-farm activities changes the social pattern in village, affecting the traditions (solidarity and women seclusion), the social classes, and the identity of the people. Greening and development of off-farm activities are coexisting at different scales in the villages; their reciprocal impacts on livelihoods are very different in time. The diversification of activities brings immediate benefits to the households, while the increase of tress doesn't have any perceived impact on soil fertility and land degradation process. Hence, the question of re-greening should not only be studied from an agricultural perspective but it should include the whole diversity of socio-economic aspects of rural livelihoods.

Key words: Sahel, Niger, re-greening, livelihood diversification, agricultural production, coping strategies, small business, migrations.

Preface

This study is written within a project lead by the Stockholm Resilience Centre and the Department of Human Geography of Stockholm University (Sweden), and in collaboration with the “Centre Régional de l’Enseignement spécialisé en Agriculture” (CRESA) of the Abdou Moumouni University of Niamey (Niger). Five master students were selected in Stockholm, six master students were selected in the University Abdou Moumouni of Niamey. This team of students met in Niger from August to November 2009 for field research.

The aim of this project was to explore the socio-ecological dynamics behind changes in the landscape, focusing on the processes of re-greening (increase of trees) or degradation in the regions of Maradi and Zinder, in Niger. The analysis included an evaluation of the ecosystem services and natural assets as well as social, political and economic factors. The project was set as a comparison of degraded and re-greened villages.

The project was also carried out in cooperation with partners from the environmental services of Mayahi and Mirriah, who assisted in selecting one pair of villages in each district as study sites for the project. The choice of our partners relied on common wisdom and their expert knowledge. The initial requirements were that the study sites would have comparable biophysical preconditions and similar long-term historical development. For the purpose of comparison one village would be brown and the other green. In this context “green” means that the village experienced recent increase in biomass on its territory while “brown” means that it didn’t. The setting of the field work was to compare two neighbouring villages with similar settings apart for the changes in the tree cover.

The data for the thesis presented here have been collected in Mayahi district.

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I. Introduction

A. Problem formulation

African Sahel has been in the scope of the research community since the second half of 19th century. In the later periods of colonization, western colonizers discussed the questions of degradation, desertification and the role of human activities in these processes (Aubreville, 1949; Mainguet and Da Silva, 1997).

Later, the problem of desertification has also been approached by the international community. The Plan of action to Combat Desertification has been accepted by the Conference on Desertification in Nairobi in 1977. The Rio Earth Summit of 1992 led to the UN Convention to Combat Desertification (UN 1997) and was ratified by more than 150 countries. This shows the general understanding of the problem and the importance of this issue for the world community.

This formal recognition have encouraged researchers to tackle the desertification problem, and their findings have drawn a more and more gloomy picture of the desertification process (Brown and Wolf 1985, Timberlake 1985, UNEP 2003). But at the same time, in the 1980's, a new discourse has been raised in the scientific community. Researchers such as Reij et al. (2005), Anyamba and Tucker (2005), Olsson et al. (2005), Seaquist et al. (2008) documented a wide trend of re-greening in African Sahel after a period of severe drought and desertification in the 1970's and 1980's. Now, the Sahel region is presented as a rare case of human success in adaptation to environmental change (Polgreen, 2007, Lenton, 2008).

Whereas the greening pattern itself is established quite firmly across the Sahelian belt, on at least 5 million ha in Niger only (Anyamba and Tucker 2005, Olsson et al. 2005), scientists seek to understand the driving forces behind the greening. The increase of rainfall was proven not to be enough for being entirely responsible for the greening: human action is presented as another driving force for landscape change (Rasmussen et al. 2001; Herrmann et al 2005). As the re-greening has occurred mainly on-farm and in particular regions with high population densities, the work of farmers for protecting and managing spontaneous natural regeneration is generally considered as the driver for the greening (Tougiani et al 2009, Rinaudo 2007).

Researchers tried to identify this human factor on large scale studies, but no clear pattern was observed (Seaquist et al. 2008). Researchers concluded that, today, there is a necessity to conduct cross-scale studies to identify and properly understand the interaction between changing environment (i.e. greening) and humans affected by it (Seaquist et al. 2008, Fairhead and Leach 1996, Gray 1999).

The researchers who studied the human factors of the greening at a smaller scale focused primarily on the farm perspective (Reij et al 2008, Gray 1999, Mortimore 2005). They studied the work of farmers for protecting and managing spontaneous natural regeneration, also called "Farmer Managed Natural Regeneration" (FMNR), on their cultivated fields, which they interpreted as the driver for the greening (Tougiani et al 2009, Rinaudo 2007). Researcher's interest in trees comes from the assumption that the greener a field is (i.e. more big/medium/small trees on one's field), the more fertile the soil is (Manning 2006, Belsky 1994). Then, a soil with higher fertility gives a higher yield. Consequently a green village is supposed to have higher soil fertility and more

yield than a brown village. More yield gives farmers more incentives to protect trees, so the success signal is being reinforced by the villagers (Larwanou et al. 2006).

This major attention towards trees and their influence on soil fertility (and eventually on the yield) is justified by the fact that the yield is the final objective of agricultural work: it is the driver for farm work and the outcome of the interactions between villagers and their environment. But the main problem with this kind of research (Tougiani et al. 2009, Rinaudo 2007 etc) is that it perceives rural dwellers of Sub-Sahara exclusively as farmers. But life in rural Sahel is not only about farm work; it only takes place during the few months of the rainy season every year. Livelihoods are not only about cultivation of fields and securing a yield. Villagers are all sorts of petty traders, and the “Non-Agricultural Rural Employment” (NARE) is a substantial part of their income and living strategies (Bryceson 1997, p. 5). NARE increase when the population increases and the pressure on land is higher, when the land is degraded, when the political and economic changes restrain the urban employment of rural migrants (in the case of Structural Adjustment Program for instance), or when the values and standards changes towards a consumption orientated lifestyle. And these livelihood changes have impacts back on the agricultural practices. Therefore if one wants to understand the whole complexity of this Sahelian human-environment system, not only agricultural practices should be studied, but rather the whole complexity of the human society and its interactions with a changing environment.

B. Research question

As a part of this research project’s comparison of green and brown villages, I will give primary attention to the effects of greening as an increase in yield. Therefore, the research question is formulated as follows:

How do the changes in agricultural production interact with off-farm activities for livelihood strategies?

To answer this question I will investigate the off-farm activities of the households and the flows of people and money organised around the possibilities offered by the yield.

C. Site description

Niger is a country that suffered a lot from the droughts of the 1970’s and 1980’s. Back then desertification was already a landscape trend identified by scientists (A. Aubreville 1949 as in Glantz and Orlovsky 1983), and the issue of desertification in Niger still raises debate among scientists (Journal of Arid Environments Vol. 63, Issue 3). There is no consensus for explaining the reasons behind the landscape change in the form of re-greening in Niger, (Seaquist et al. 2008, Reij et al. 2005, Joet et al. 1998). As presented on the figure below, we settled in the South of Niger in the periphery of the main area where FMNR is located (Reij et al. 2005, Rinaudo 2007, Figure 1 below), in the district of Mayahi, department of Maradi.

The Figure 1 below shows the location of the study sites. Figure 1 is showing the data from 40 climate observation stations, showing change in percentage between the periods 1982–1990. In shades of yellow to green are the positive vegetation changes with an increase in vegetation. Our study area near Mayahi is on the edge of a clearly identified zone of greening. The district of Mayahi is about forty kilometres away from

the border to Nigeria. This area hadn't been studied in terms of reasons behind landscape change. The two villages selected for the study in Mayahi are Warzou and Maissakoni. The first village, Warzou was said to be greener while the village of Maissakoni was said to be degraded.

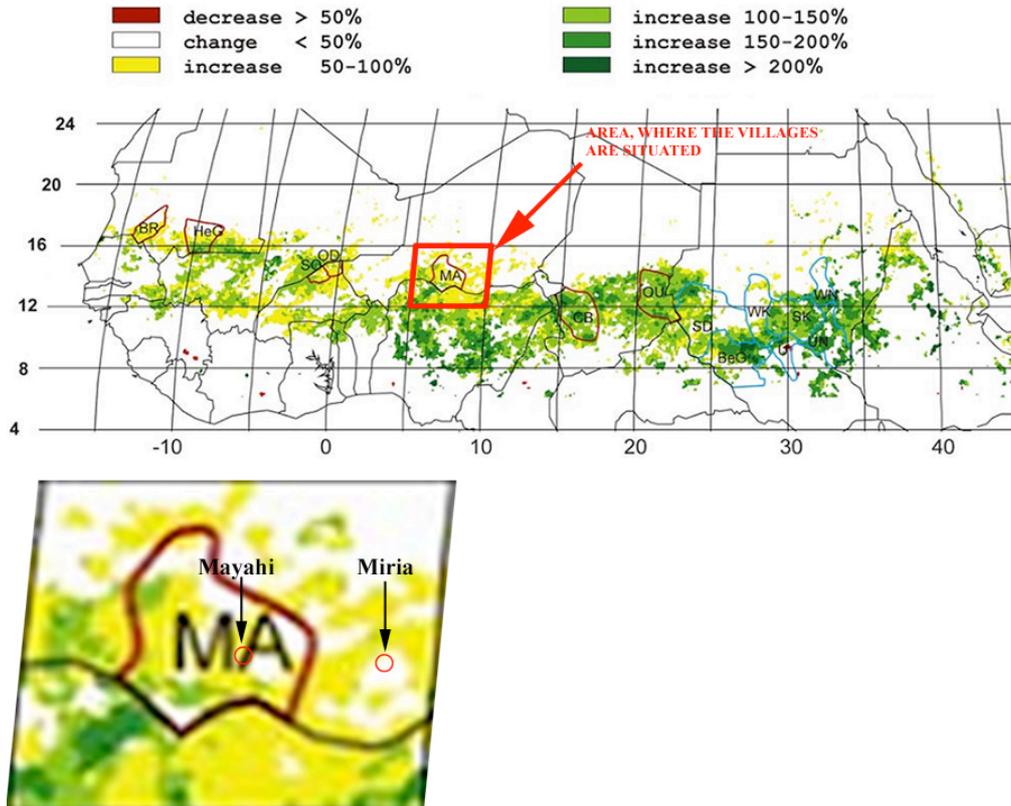


Figure 1. Location of the study sites of Mayahi and Miria at the scale of the re-greening of the Sahel-Soudanese zone (source: Olsson et al. 2005, adapted by Marat Murzabekov, 2010)

The local climate is Sahelian with a short rainy season (from June to September) and a long dry season (October to May). The rain data collection shows that the average rainfall is about 333 mm per year (from 200 mm/year in the north of the district and 450 mm in the south). There is a high variability within the rain season and between the rain seasons (start of the rain, intensity, frequency); droughts are a recurrent phenomenon. The landscape in Warzou and Maissakoni is relatively flat and the soils are sandy and poor. (Banoïn & Jouve 2000, pp. 92-93, Joët et al 1998, p. 33, Gnomou and Bloch 2003, p. 2, Lund 1998, p. 53).

In 2006, in the commune of Sherkin Hausa where Warzou and Maissakoni belong, the density of population was estimated at 83/km² (Diarra and Monimart, 2006, p.17). The villages lie on both sides of Sherkin Hausa. The distance between Warzou and Maissakoni is ten kilometres as the crow flies.

Even though the prerequisite for the study site location included a similar long-term historical development there are differences between the two villages. Warzou is inhabited by a population of settled Touareg and was founded in 1890. The houses of the village of Warzou were scattered until 1963 when a governmental decision ordered to group together the villages. The village of Maissakoni is inhabited by Hausa population and was founded in 1934 (source: Capitaine Lamine Traoré, Chief of the Environmental service of Mayahi).

Below are the main social features and infrastructures of the villages of Warzou and Maissakoni collected during the fieldwork of this research paper:

Characteristics		Warzou	Maissakoni
Demography	Population (no)	1143 (census 2006)	1269 (census 2006)
	Farms (no)	137 (census 2006)	93 (census 2006)
Income generating activities	Livelihood sources	Agriculture Breeding Small business exodus	Agriculture Breeding Small business exodus
	Number of cattle per species	Goats 460 ; sheep 354; cattle 250 ; donkey 24; horse 1; camel 21	Goat 630; sheep 362 ; cattle 96 ; donkey 24; horses 2
Infrastructures	Schools (no & type)	3 permanent coran schools 1 “regular” school	2 permanent coran school 1 “regular” school
	Type of housing	Brick houses and round houses made of wood	Brick houses and round houses made of wood
	Mosques (no)	At least one main for the Friday worship	At least one main for the Friday worship
	Cereal banks	none	1 (FAO)
	Roads and transports	on the sandy path	On the laterite road (dirt road)
	Distance to markets	Mayahi to Warzou = 12km By foot: 2h With cart: 2h Sherkin Hausa to Warzou = 5km By foot: 50mn With cart: 60mn	Mayahi to Maissakoni = 22km By foot: 4h With cart: 3h30 Sherkin Hausa to Maissakoni = 7km By foot: 1h20 With cart: 1h10
	General description of location and infrastructure	Warzou is a village located in a remote place, far from the main laterite road.	Maissakoni is located on the main laterite road that goes between Mayahi and the asphalt road to Maradi.

Table 1. Social features and infrastructures in Warzou and Maissakoni

Sources of information: Olivia Puill, Gonda Abdou (master student from Abdou Moumouni University, Niamey), **Captaine Lamine Traoré (Chief of the Environmental service of Mayahi)**

From the census of 2006 in Sherkin Hausa, the two villages have similar number of inhabitants. But there are the differences in the number of farms. As explained by the chief of village of Warzou, in each family, the power of decision belongs to the head of farms who is also the head of the family. The descendants of the head of farm/family have their own household, but are not independent in their on-farm activities. Following the census of 2006, there are 8 people per farm in Warzou and 13 people per farm in Maissakoni. In Warzou, the power of the head of farm/family has been reduced toward a redistribution of responsibilities to his sons: the number of farms which corresponds to the actual number of households in the village.

In Warzou and Maissakoni, people have the same livelihood sources of agriculture, breeding, petty trade and migration. The size of the breeding is different: if the number of sheep and donkey are equivalent, there are 2.5 times more cattle in Warzou and Maissakoni. People in Warzou have camels while none in Maissakoni. People in Maissakoni have roughly 200 more goats than in Warzou. This induces a different pressure on land by cattle (for grazing) and different needs for fodder in each farm.

The infrastructures of the two villages are similar in access to worship and education. Nevertheless, the school of Warzou opened 6 years ago while the school of Maissakoni opened 25 or 30 years ago (data from informants of Warzou and Maissakoni).

Warzou and Maissakoni differ in their accessibility: Warzou is located in a remote area with no proper path, distant from the main road, while this main road crosses Maissakoni. Thus villagers of Maissakoni have an easier access to the nearby markets (Mayahi and Sherkin Hausa).

To conclude the site description, the main differences between Warzou and Maissakoni lie in the repartition of farms, in the number of cattle, in the spread of education and in the access to markets. Otherwise, the villages have similar setting in climate, soil, livelihood sources and infrastructure

II. Literature review

In order to answer the research questions presented above, I divided my work into three major steps. After the literature review below, field work took place for data collection. Eventually, an analysis and a synthesis of the data in regards to the literature finalized this process.

The fragility of the environment in its relationship to human societies in Sub-Saharan Africa has been a scientific interest since long time. The interest of researchers was focused on rapidly increasing African population, and the consequences of this process on environment and on human societies. There have been two major theoretical movements following Malthus and Boserup, which still underpin the discussion about Africa today. Their theories are presented below.

A. Malthus in the Sahel

Even before the droughts of the 1970's and 1980's, the demographic increase of Sub-Saharan Africa raised pessimistic voices. With the rapid and steady increase of population, Sahelian countries started their demographic transition in the 1950's. In Niger, in 1950's the population was 2,9 millions inhabitants; it increased to 3.2 millions in 1960, and to 4.1 millions in 1970 (Raynault, 1997, p.61-63). In 2009, Aboubakar Namoda, special adviser of the now deposed president Mamadou Tandja, claimed that Niger reached 13 millions inhabitants¹. With regards to this rapidly increasing population, the western 'common wisdom' discourse was and is still blaming too many Africans for destroying their environment (Marchal, 1963 cited in Jouve 2004, p.102; Lericollais, 1970 cited in Jouve 2004, p.102). A good example of this 'common

¹ Namoda, A. (2009), Europe 1 radio interview from the 2009/12/02, <http://www.youtube.com/watch?v=qpSiQbSs5tE>

wisdom' is a famous French agronomist Renée Dumont, who in his book "L'Afrique noire est mal partie"² (Dumont, 1962), claimed that the limitation of the demographic expansion was a necessary condition for the development of agriculture in Africa (Dumont, 1962 as in Jouve, 2004, p.101).

The roots of this 'wisdom' are based on the theory of Malthus. As presented by Garnier (as in Malthus, 1852, p.xviii - foreword for the French translation), Malthus claimed that population increase was limited by Nature, especially in its agricultural productivity. When there were too many people on Earth. In other words, when there were too many people, food production was insufficient, then, famine or another catastrophe occurred and people died. At last, equilibrium was re-created (idem, p.xviii). As Demont et al., (2006) present it: when population growth is uncontrolled, it follows geometric growth, while the agricultural production growth follows arithmetic pattern (Demont et al, 2006, p216). The productive capacity of the environment degrades which leads to internal crisis (famine, war and/or migration) taking the role of a "natural control" of the population (Demont et al, 2006, p216).

Malthus was hardly criticized for his ideas (Garnier, as in Malthus, 1852 p.xviii). Critique was claiming that immigration, agricultural innovation (introduction of potatoes in Europe), expansion and/or intensification of cultures and social welfare could solve the issue of human societies' dependency on agricultural productivity (ibid, p.ix).

Garnier (as in Malthus 1852, p.ix,) defended Malthus by claiming that all counter-malthusian arguments - presented in the previous paragraph - would not bring any population stability in regards to food production and the number of poor would continue to increase. This Malthusian discourse was introduced as a "warning for the head of household" (Garnier, 1852, p.xv): it was presented as the responsibility of the poor not to reproduce their poverty. The Malthusian theory was thought as a warning sign to avoid impoverishment of the already poor population and of the whole society (Garnier, 1852, p.xv). This discourse was extended by neo-Malthusians who developed the idea of "starving sections": the starving section is the fragment of society that is always in surplus compared to the food availability, they are the poor condemned to starve as an inevitable and natural regulation of society by Nature (Lohez, 2002, p.1). For instance, the Irish and Indians who undergone famine in 1846-47 and 1881 were thought by neo-Malthusians as typical example of "starving sections"; there is nothing to do for them as the disaster by food shortage will otherwise occur again (Lohez, 2002, p.1 and Ambirajan, 1976, p.5).

Even during my interviews with Nigerien farmers, they stated that desertification, famines and poverty in Niger are direct outcomes of the population increase.

B. Boserup counters Malthus

Even though it is true that resources are limited in the Sahel and that many countries in Africa are still in demographic transition; many scholars have raised their voices to counter the Malthusian narrative. Already in the 18th century Sir James Steuart (as in Grigg, 1979, p.64) stated that population growth caused not only economic

² « Sub-Saharan Africa gets off to a bad start » (translation Olivia Puill)

improvement, but that it acted as a spur on human society, which would otherwise stagnate culturally and economically. Following this idea H. Settegast thought of an optimum density of population for every type of farming with threshold requiring emigration or change in intensity to cope with increase of population (Nõu 1967, p.54, as in Griggs 1979 p.64). Finally, in 1967 Colin Clark said that increase of population is a spur for economic change and agricultural change, as “population growth [...] is the only force powerful enough to make [...] communities change their (agricultural) methods, and in the long run transform them into much more advanced and productive societies” (Clark 1967, p.xi as in Griggs 1979, p.65).

Ester Boserup (1965) elaborated such ideas to a more complex level. In her theory, “population is regarded as [an] independent variable (i.e as a starting point) which in its turn is a major factor determining agricultural development” (Boserup, 1965, p.11). She gives the example of the growth of the underdeveloped world’s population between the two world wars: the growth came from changes in livelihood conditions such as medical inventions, and wasn’t related to “changes in the conditions for food production” (Boserup, 1965, p.11). Boserup’s theory proposes that, in pre-industrial agriculture of the developing world, the population pressure stimulates changes in land use, agricultural technology, land tenure system and settlement forms (Grigg, 1979, pp.66-67). Soil fertility is not an asset of a land per se: changes in soil fertility are instead considered as a variable depending on population density and changes in agricultural methods (Boserup, 1965, p.13). The output of all the changes described above is a change in agriculture and food production. These changes are based on intensification; Boserup distinguishes two types of intensification: the increase of cropping frequency and the increase of labour efforts.

The intensification of the frequency of cropping is the main idea developed by Boserup (1965, p.13). The land around a village is never free from human activity; cropping or land use can be spread over a very long period of time (Jouve, 2004, p.103). For instance, slash-and-burn practice will be followed by very long fallow period, up to the point forest will be recreated, until the land will be cleared again to start a new cycle (Jouve, 2004, p.103). In conditions of increased pressure of population, intensification of the frequency of cropping means disturbance of land-use cycles, reduction of fallow surfaces and duration of crops on the field (Demont et al, 2006, p.224).

The intensification takes also the form of increased labour efforts (weeding and manure application for instance) per cultivated field (Griggs, 1979, p.67). It is also a shift in technologies (from digging stick to hoe to plough) and a shift to permanent and individual ownerships (Griggs, 1979, p.67).

The law of diminishing returns is applied in Boserup’s theory: the increased labour effort is not proportional to the outputs, “although total output increases as the frequency of cropping rises, output per head declines” (Griggs, 1979, p.67). But even with these diminishing returns, intensification still leads to economic growth: intensified modes of agriculture require more efficiency in work, creating division of labour and economies of scale (Griggs, 1979, p.67). Due to the diminishing returns and according to the principle of the least effort developed by Spooner in 1972, pre-industrial farmers will change their way of life and give up their leisure time only when the population growth requires increase of agricultural production (Griggs, 1979, pp.67-69). This is assessed by Demont et al. (2006) who conclude that a threshold should arise for a transition to occur; they set the critical point at population density of 30/km² or a land use intensity of 30% (Demont et al 2006 p.226).

For Boserup, the evolution of a landscape, in terms of variation of land use intensity, is the result of changes in population pressure and in existing agricultural systems that are shaped by history of local demography.

C. Malthus versus Boserup in practice

Today ideas of Malthus and Boserup are fundamental for the discussion of the relationship between environment and society in Sub-Saharan Africa. It is possible to find these ideas in the current papers dedicated to the recent environmental changes in Sahel.

For example, Demont et al. (2006) discuss the perspectives of Malthus and Boserup in a case study in Côte d'Ivoire. The objective of their study is to compare villages “for a better understanding of evolution of farming systems and identifies the key factor responsible for this process” (Demont et al 2006, p.218). The four villages are diverse in demography and economic situations. The researchers quantitatively measured land use intensity of arable fields, investigated the levels and gross margins in surveyed farms. Labour is considered as the principal production factor; the real economic dimension of a farm is given by the size of the available labour force better than the cultivated area per se.

Demont et al. (2006, pp.226-7) come to the conclusion that in their study area the two theories of Malthus and Boserup co-exist in this case study. In the first stage of change, the demographic pressure causes Malthusian mechanisms, such as over-pressure on land causing degradation and eventually migration of villagers. But at the same time, there is an intensification of the cropping system with innovations and equipment (animal traction), in spatial dimension (fallow put into culture) and in temporal dimension (increase of the cropping period to the detriment of the fallow). In a second stage, as the traditional systems of cultivation are not adapted anymore, the whole socio-environment changes. The key factors are access to labour and adoption of innovations; they allow escaping from the feed-back loop of Malthusianism and are crucial for the sustainable reproduction of the transforming farming system. They conclude that the debate between Malthusianism and Boserup analysis is a “divergence of opinion concerning comparative analysis of farm performance [...] [:] the Boserupian innovations in both the scale of operation [...] and intensification [...] compensate for the Malthusian repercussions of increasing demographic pressure” (Demont et al 2006, p.226). But if population growth is not met by adequate intensification, the environment will degrade (Griggs, 1979, p.69) which leaves space for Malthusian consequences.

D. The agrarian transition theory

Philippe Jouve presents a case study in the region of Maradi: after a rapid increase of the rural population, farmers extended their farming and the availability of trees in the landscape dropped (Jouve, 2004, p.104-105). The farmers reacted with a change in agricultural practices towards trees; they protect the sprouts growing in their field, applying FMNR³. This is the origin of the re-greening of this area. It is also a transition between a Malthusian logic to a Boserupian logic that Jouve calls “transition

³ “Farmers’ Management Natural Regeneration”

agraire”⁴ (Jouve, 2004, p.105). The figure explaining this concept is presented below (Jouve 2004, p.105).

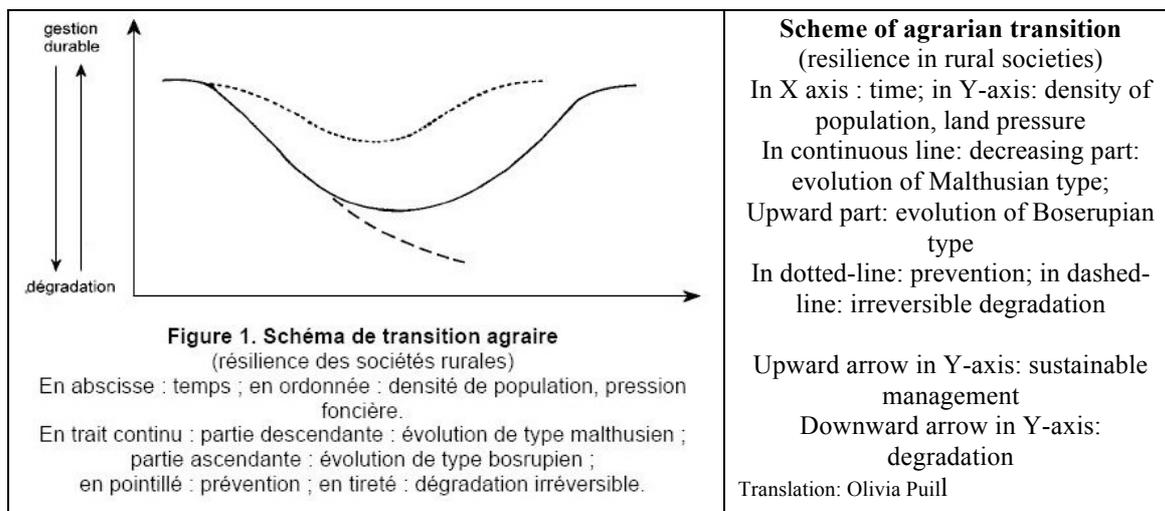


Table 2. Scheme of agrarian transition, by Jouve⁵

This figure shows that degradation from Malthusian causes is not irreversible⁶, it can be reversed into sustainable ways of agriculture of a Boserupian mode. Moreover, if a prevention for mitigation of the degradation is implemented, the degradation due to population pressure is reduced and sustainability can be increased from the beginning. According to Jouve, the agrarian transition can happen when value is given to local knowledge and savoir-faire in order to mobilize the endogenous capacities of the rural societies to fight against the degradation of their environment (Jouve, 2004, p.105).

E. Greening of Sahel (extending the ideas of Boserup)

The greening discourse was also influenced by the ideas of Malthus and Boserup. Greening of Sahel was identified and measured by researchers working with remote sensing data (Anyamba & Tucker 2005 among others). These researchers found that rainfall doesn't completely explain the greening; they suggested that there might be some other driving forces, such as human factors (Herrmann et al. 2005). These human factors of greening were investigated by a plethora of researchers, who usually worked in coherence with the ideas of Boserup.

In the region of Maradi, the vegetation status degraded for 33% of the territory but improved for 15% between 1975 and 1996 (Mahame, 2001, in Mortimore and Turner, 2005, p.573). In the 1980's and 1990's, despite the end of the agricultural expansion and the continuous increase of population, the grain yield per capita was maintained in average (Mortimore, 2001, and Hamadou, 2000, in Mortimore and Turner, 2005, p.574). The driving forces for this change are population increase associated with new market opportunities and the improvement in road infrastructure. These researchers interpreted the trends of market opportunities and infrastructure of

⁴ 'agrarian transition' in English

⁵ Jouve, P (2004) Transition agraire et résilience des sociétés rurales, la croissance démographique frein ou opportunité pour une intensification agricole durable en Afrique subsaharienne ? in *Courrier de l'environnement de l'INRA* No 52, 2004, pp.101-106, <http://granit.jouy.inra.fr/dpenv/pdf/jouvepc52.pdf>

⁶ But no threshold to assess the irreversibility is defined by Jouve

improvement as being a contributor to the greening (Mortimore and Turner, 2005, p.589-90).

Reij et al. (2005) and Tougiani et al (2009) tell the story of the greening in Burkina Faso and Niger respectively. After a period of Malthusian environmental degradation and its consequences, Soil and Water Conservation (SWC) techniques such as manure inputs, FMNR, rain water harvesting, were implemented in the degraded areas. The conventional reforestation techniques (planting young trees) have no impact on tree density in Niger, but the technique of FMNR allowed an increase in the tree population on 5 millions hectares in from 1983 to 2008. This technique is based on sprout conservation of under-valuated indigenous species; it created a first sustainable fuel-wood market for the communities (Tougiani et al, 2009). It enhanced a switch from extensive to semi intensive agriculture with better management of soil fertility. Food crop productivity increased immediately. Plus, villagers invested more in livestock (for manure). The migration out of the area dropped, and villagers said the poverty decreased as well as their vulnerability to droughts (Reij et al. 2005, Tougiani et al, 2009). Mortimore and Tiffen documented similar patterns in the region of Maradi in Niger (Mortimore and Tiffen, 2000, in Reij et al, 2005).

The greening phenomenon is well accepted by the scientific community as well as the local actors (Nigerien environmental service). However the reasons behind it are still debated.

It becomes clear from the literature presented above, that the relationship between human societies and their environment was often considered one-sidedly: population was considered as completely depended on agriculture, and on limited agricultural production which would eventually regulate population (Malthus), either the population growth was a spur for intensification and innovation (Boserup and greening discourse). But many scientists don't view African societies as being drastically and deterministically limited by population-environment relationship. Their idea is that farming is not the only occupation of people in Sub-Saharan Africa.

F. Migration

In Hausa regions, embracing the areas around Maradi, Zinder in Niger and Kano and Katsina in Nigeria (Tiffen, 2001, p.1), there is a long tradition of temporary migration during the dry season (idem, p.14). Whenever the food security is endangered, the Hausa people have always considered economic migration as a valuable strategy for lowering their vulnerability, and escaping hazard. It can be permanent or long term migration, or shorter migration but they can all be ranked as income diversification (Tiffen, 2001pp.14-17).

The link between the improved land management (through investment) and migration is also made by Adama Konseiga in the Burkinabe Sahel (2004). Her objective is "to show how non-farm income sources plays a crucial role in household's capacity to adopt farming technology, especially via migration" (idbid, p.3). Several points are supporting her theory:

- First, migrants have a specific profile. They are more educated than the non-migrant, they have more land and their soil is more sandy (better for millet cultivation). They also have a better access to the food market, but have less

livestock than a non migrant. With a less favourable climate more people will be prone to leave. (ibid, p.14)

- Migration outside the Sahel positively depends on the labour resources of household's, its human capital, the density of households in the village, the ethnic network, rainfall relative scarcity, and the income risk. (idem, p.16) Migration is not a loss of labour when it occurs in a big household (which will suffer less from the labour constraint) or during the dry season (which will not encroach on agriculture during the rain season). (ibid, p.21)
- Remittances are a secure income -even though temporary- which provides money for technology adoption and increase the production and the yield; it enhance the productivity of land use (de Janvry and Sadouet, 2001 in Konseiga, 2004, p.3).
- Migration is the best way for households to adopt innovation: they earn enough to consume (and ensure the food security) as well as to invest. As there is no land expansion possibility, farmers have to invest into intensification techniques. The adoption of technologies, such as stone-bunds, depends of the ratio between the risk involved and the certainty of the production increase as a return. If the pressure on land is high with a general need to increase the yields, the innovations will eventually trickle down to the non-migrant poor households. (Konseiga, 2004, p.6)
- Migrant household also have the advantage of being less dependent on local markets as they have more latitude to wait for the best transaction cost (grain price is low after the harvest and increases gradually to reach a pick before the harvest⁷) (idem, p.7). The purchasing power of households is then delinked with the local economy (idem, p.16)

For Adama Konseiga (2004 p.1 and p.21), “main findings show that migrant households have a significant higher average adoption rate (of innovative technologies) and therefore are better able to ensure their food security through the direct channel of food production and the indirect channel of food market participation where they have better access and purchasing power [...], while at the same time they secure a sustainable local agro-ecological risk management”

The idea of the role that migration plays in rural agrarian societies sits in between the Malthusian and the Boserupian points of view: pressure on land pushes people to migrate and they bring back new techniques and intensification. It fits in the agrarian transition theory of Jouve. At the present time, the phenomena of economic migration and income diversification are discussed to be, or not, one of the cause of the re-greening or contributing to desiccation (Batterbury S. 2007, Mortimore et al, 2005 ; Olsson et al, 2005, Warren, 2005).

G. De-agrarianization of Bryceson

The study of migrations developed the understanding of the relationship between environment and societies, making it more complex than the determinist debate of population-agricultural capacity of Malthus and Boserup and followers. In the middle of

⁷ From field data collection, Olivia Puill

1990's a group of researchers led by Deborah Bryceson made further steps in understanding the societies of Sub-Saharan Africa, considering rural dwellers as more than farmers spurred or limited by agricultural capacity. This approach has the name of De-agrarianisation theory.

The theory of de-agrarianisation developed by Bryceson (1997, p.3) and is “a long term process of: (1) occupational adjustment, (2) income earning reorientation, (3) social identification, and (4) spatial relocation of rural dwellers away from strictly peasant modes of livelihood (Bryceson 1996)” which occurs at different time span.

Since pre-colonial time, non-agricultural rural employment of trade and craft was a central component of rural livelihoods in Hausaland (Baier, 1980, Hill, 1972 and Watts, 1983, as in Meagher and Mustapha 1997, as in Bryceson, 1997, p.66). Colonization reinforced this way of life through taxation, importation of cheap goods and diversion of raw material; all of these increased the need for cash and created a new demand for labour (Mustapha, 1990, Bello, 1982, Baier, 1980, in Meagher and Mustapha 1997, as in Bryceson, 1997, p.66).

Bryceson has a Malthusian analyses of the socio-environmental trends: she states that, after decolonization, this trend of off-farm diversification of activities has been reinforced with an increase of population, which amplified constraints on land and shaped landscape changes (i.e. degradation) (1997, p.8). But the spread of non-agricultural rural employment (NARE) in Sahel is also due to the Structural Adjustment Programs (SAP) which reduced urban employment for rural migrants and due as well to a youth who is more and more attracted by urban and western ways of life lead to (idem, p.8). NARE is a number of activities with different payment schedule and varying rates of return, which lower the risk of total income failure for the household in case of shock (environmental catastrophe for instance), and which will bring income outside of the agricultural season (idem, p.8). For the rich households, NARE is a matter of “profit maximisation” while for the poor is about “risk minimization” and “income stabilisation” in an unpredictable environment (idem, p.8). The mushrooming of petty trade, the scarcity of ‘free-goods’ (firewood, water), the new needs for market-provisioned commodities and the changing demand for traditional handicraft transformed farmers into consumers (idem, p.10-11) and created the trend of de-agrarianisation.

De-agrarianisation can be seen as a pattern of economic development in unstable market conditions or as a diversification into marginal survival activities in a context of economic and environmental decline (Meagher and Mustapha, 1997, as in Bryceson, 1997, p.63-64). It is also questioned a being an engine of growth for rural societies in times of economic crisis with an increased flexibility in income generation or a response to an incapable State, or a response to economic and ecological adversity (idem, p.64-5).

By its very localized aspect, by the asynchronic development of its multiple facets, by its constant readjustment according to the evolution of the context, the de-agrarianisation process is very difficult to measure. Nevertheless, Bryceson (1997, p.244) distinguishes four trajectories of de-agrarianisation: (1) labour flight (i.e. urban migration), (2) rural non-agricultural labour diversification (i.e. small business), (3) gain or loss in rural labour autonomy (i.e. alternative forms of labour more or less close to peasant farming) and (4) labour drop-out (i.e. socially and economically marginalized

from the peasant origin, elder, handicapped or youngsters)⁸. The eventual objective of these de-agrarianisation strategies is to mitigate the economic constraint and to size new opportunities.

De-agrarianisation contributes to the change in social structure in and out of the village. Family solidarity declines and it reduces the family network to the nuclear family. It still disintegrates the traditional economics and social fallbacks (Meagher and Mustapha, in Bryceson 1997, p.248). Within the village structure, de-agrarianisation changes also the social system with stronger wealth differentiation and formation of social classes. The relationship to land changes, people are more strongly getting wealthier or poorer; it creates new economic classes and moreover a class consciousness (Bryceson 1997, p.249). Anyway the scarcity of land will change the patterns of inheritance and determine new activities and ways of life for the youth (Bryceson , p.249).

Adaptive activities such as temporary migration are adopted to enhance the plasticity of the system and to upgrade the capacity to withstand environmental stress (Meagher and Mustapha 1997, as in Bryceson, 1997, p78). As Meagher and Mustapha (in Bryceson 1997, p.78) explain it, “maximising flexibility in an environment of uncertainty may contribute to the process of environmental degradation”, “many non-agrarian activities extract too much from the local agrarian resource base, thereby accelerating environmental degradation” (Bryceson, 1997, p.238). But it is in the most degraded areas, where agriculture doesn’t bring sufficient income and thus where off-farm incomes are the most needed, that the NARE are the most difficult to generate (Livingston, in Bryceson, 1997, p.239).

But as Meagher and Mustapha (1997, as in Bryceson, 1997, p79) admit, more research is needed to determine under what conditions livelihood diversification affects the agrarian way of life and undermines environmental management practices.

H. Concluding the literature review

As seen in the previous literature, the changes in Sahelian landscape are often interpreted from Mathusian or Boserupian perspective. Bryceson brings a new standpoint with de-agrarianisation where new kinds rural livelihood are more and more disconnected from agriculture, as a response to environmental degradation among other aspects.

⁸ NB: all are mutually exclusive

III. Methods on site

To complement the de-agrarianisation/ greening debate with empirical data, I did an 8 weeks field work in the region of Mayahi - presented in a previous section.

1. Data collection

The data collection was divided in two stages. First collective approach though “Participatory Rural Appraisal” (PRA) method was adopted. Then individual interviews where conducted with members of a selection of households.

a) Access to the community through gatekeepers

We were introduced to the chief of each village by Capitaine Lamine Traoré, chief of the environmental service in Mayahi. We were already accompanied by our interpreters who are working for the service as well. The students from Stockholm didn't have any prior connection to these villages. We needed a gatekeeper to facilitate our access to the key informants, i.e. the villagers. Firstly, neither locals nor the chief of village spoke French and, least of all English. As we didn't know the language, we had no access to the way of thinking and understanding of the villagers (Cherry, 1965 as in Tushman and Katz 1980, p. 1072;). The cultural boundaries and the difficulties of communication created a need for individuals “capable of understanding and translating contrasting coding schemes” (Tushman and Katz 1980, p1072). Hence, we needed gatekeepers. By his authority, Capitaine Lamine Traoré introduced us to the village chief. Then the chief of the village addressed us to the respondents who were the most suitable to answer our questions. His authority guaranteed that people would answer our questions. In both villages, the participants were brought to us by the chief of village, presented as reliable persons.

The interpreters of the environmental service were respected by the villagers due to their status and power. The advantages were that our interpreters understood the objective of our research as well as the local culture. They were a great help in the communication between us and the villagers; they were capable to explain the culture as well as to pick up particularly relevant aspects for the study. One of the disadvantages was that the interviewees might have modified their story in order to please the interpreter: if an interviewee admitted he was illegally logging the trees of his neighbours, he would have been arrested immediately. Hence, we tried to avoid this kind of sensitive issues.

The choice was made to protect the respondent identity (Bryman, 2001). The collected data are personal and recount of the economic life of the respondent. Even if in a small rural community, many of the information collected from the respondents are well known by the other villagers, it is a duty not to disclose the personal data. To protect the anonymity, the families of respondent are divided in numbered households and no names or too obvious characteristics are mentioned. But in such communities, people are still easily identifiable by the simple features of their family (number of wives, types of businesses, number of migrants).

The purpose of the study was systematically explained to the respondents, even though they were always hoping for some kind of humanitarian aid. A small gift was

given to them, one day prior to our departure, as compensation and a thank-you for the big amount of time spent answering questions.

b) PRA method and exercises for understanding the life of villagers

(1) PRA method

A preliminary study was made in each village, using PRA method. “The term Participatory Rural Appraisal (PRA) (Mascarenhas et al., 1991 as in Chambers, 1994b, p. 1437) is used to describe several approaches and methods to enable local people to share, enhance and analyze their knowledge of life and conditions. PRA comes from the traditions and methods of participatory research applied anthropology, and field research on farming systems (Gilbert et al. 1980 as in Chambers, 1994b, p. 1437; Shaner et al., 1982 as in Chambers, 1994b, p. 1437). The objective of this method was to collect information by the community and to get a quick overview of particular interest in this context.

The results of the PRA exercises are presented in the result part of this paper

(2) Wealth ranking

The first PRA exercise was a wealth ranking. The overall objective of the wealth ranking was to have an overview of the social composition of the village. We were especially interested in the perception of the local population about what it is to be rich, middle class or poor. Wealth ranking is considered to give a good insight of the life condition on site (Chambers, 1994a). The wealth ranking was done by our colleagues Gonda Abdou and Amadou Mamane (Abdou Moumouni University, Niamey) with the “hommes de confiance” (trustworthy men) of the village. The ranking was done inside the private home of the chief as the subject of social ranking is considered as being uncomfortable by villagers. The first step of the exercise was to set the criteria of what it is to be rich, middle class or poor by the participants. Then the “matrice” was used to rank each and every household of the village. The “matrice” is a register that can be found in the town council and that registers the detail of each family of the village. Each family has a head who is traditionally the oldest man. Under his name, are his wife(s), his children who still live at home, his un-married daughters, his sons and their wife(s) and children, and even the families of the grand-sons. Thus, it is a broader registration than the households per se: several households are under the umbrella of the head of family. The chiefs of villages and his “hommes de confiance” discussed family by family, debating to which class they belong. It was a very long exercise, especially in the village of Warzou where there is more households.

According to the participants, in Warzou, a rich head of family/farm has at least 2 ox or donkeys and more than 7 ha of land, a middle class family has one ox or one donkey and less than 7 ha of land but more than 4 ha while a poor has no big cattle and less than 3 ha. In the village of Maissakoni, the rich head of family/farm is the one who produces enough food for feeding his family and helping others. The middle class family can feed his households without help but cannot help the others. The poor families “manage” to feed the household thanks to external help and working as labour; they don’t have their own seed for cultivation. One can notice that there is no mention of complementary source of income and assets like the small cattle, small business,

migration etc. On one hand, this wealth ranking shows the priorities of a group of villagers at a certain time of the year; in this case during the agricultural season before the harvest. On the other hand, another set of villagers could have proposed different characteristics according to their own priorities, and these characteristics might also vary in times depending on the present life conditions (generous or poor harvest for instance). Another reason for the criteria of the wealth ranking is that villagers define their identity as being farmers and put it first in their list of assets.