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West African Migration in the Age of Climate Change

Translocal Perspectives on Mobility from Mali and Senegal

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High mobility in West Africa, regarded as one of the world's hotspots of climate change, continues to be prominently framed by neo-Malthusian portrayals of threatened agricultural livelihoods, population pressure, and sedentarism. However, simplified notions of so-called environmental migration, especially in contexts of slow-onset environmental change, are based on fundamental conceptional flaws as well as weak, patchy empirical evidence.

This thesis contributes to the debate on climate change, environment, and migration by scrutinizing conceptual and methodological deficiencies and adopting a migration research perspective. The objective is to provide a multidimensional, translocal explanation of contemporary population movements from two rural study areas in the semi-arid Sahel of Mali (Bandiagara) and Senegal (Linguère). Assuming repetitive migration as a well-established, habitual part of people's lives and social networks spanning different places, the theoretical-conceptual framework integrates complementary approaches of translocality, migration theory, and political ecology. With this conception, circular mobility, flows of resources, knowledge, and ideas involve multidirectional, multilocal cumulative effects reshaping interconnected local contexts and environmental conditions.

Accepting the complexity, contextuality, and multicausality of migration in effect contradicts the prioritization of environmental effects on human migration in the research design. Suggestive questioning and highlighting climatic or environmental stress as drivers of migration have been identified as methodological flaws in previous empirical research as they risk biasing results and preventing new insights. Moreover, data (collection) and analytical methods that aim to causally link environmental and climatic factors with migration data while neglecting spatial and temporal scale issues are susceptible to fallacies.

Consequently, the methodology is primarily based on multi-sited ethnography, including observation, interviews, and the collection of migrant biographies at multiple places of identified migration networks. To reduce biases and allow for multidimensional explanations of migration, field research involved separating the topics of climate/environment and migration and avoiding suggestive interviewing about (climate and environment as) migration motives.

The findings show that aside from soil characteristics and significant intra- and interannual rainfall variability, human activities considerably shape prevalent vegetation and degradation patterns as well as the productivity of agricultural land. Evidently, harvests and people's ability to compensate shortfalls are temporally, locally, and socially differentiated. The availability of technical equipment, labor, know-how, pesticides, fertilizers, as well as field size and location significantly determine yields. Furthermore, rural livelihoods' reliance on mobility, pooling

multiple and multilocal income, and food sources are established strategies. Therefore, livelihoods are not only determined by subsistence agriculture, nor by external climatic and environmental factors.

Furthermore, findings on migration patterns show that historically evolved internal migration to urban centers, primarily capitals, and international migration within West Africa are most prevalent. Long-established migration networks explain why the Côte d'Ivoire continues to be major international destination for migrants from Bandiagara and the higher relevance of migration to Europe from Linguère. Moreover, the majority of population movements are circular and temporally diversified. Permanent emigration of entire communities does not take place. Instead, people's mobile life trajectories demonstrate that durable unidirectional resettlement rarely occurs or is hard to identify as such. Rather, depending on the current life phase, people circulate among different places of migration networks, discover new destinations, and sometimes return after many years of absence. The increasingly diverse and irregular timing of circular migration, previously guided by the seasonal timing of rainfall and farm work, is due to the relative decrease in economic, social, and cultural significance of traditional rainfed cultivation. This, in turn, is interlinked with translocal, diversified, and temporally flexible income generation.

Instead of initial migration triggers, multidimensional, translocal, and hence relational space represents both the result of migration and the precondition of contemporary mobility. It means that cumulative and reinforcing effects of people's socio-historical backgrounds and already existing migration strongly shape differentiated and multidirectional manifestations of contemporary migration. The findings show that the characteristics and perpetuation of people's translocality, circular migration, and resource flows are determined by intensely interdepending dimensions of necessity, maintaining common identity, and development. These aspects can hardly be separated from each other. The established reliance on translocal livelihoods and social structures (necessity), peer pressure, continual shared translocal aspirations, social bonds, beliefs, and solidarity (identity) as well as the desire for well-being, increasing living standards, participation, self-determination, and progress (development) are major explanations of contemporary population movements.

Die hohe Mobilität in Westafrika, eine ausgewiesene Hotspot-Region des globalen Klimawandels, wird weiterhin auffällig gerahmt durch neo-malthusianische Darstellungen bedrohter landwirtschaftlicher Lebenshaltungssysteme, Bevölkerungsdruck und Sedentarismus. Insbesondere in Kontexten langsam voranschreitenden Umweltwandels sind jedoch simplifizierte Vorstellungen sogenannter Umweltmigration mit fundamentalen konzeptionellen Defiziten und mangelhafter empirischer Evidenz verknüpft.

Diese Dissertation trägt zur Debatte über Klimawandel, Umwelt und Migration bei, nähert sich dem Thema aus der Perspektive der Migrationsforschung und geht dabei konzeptionellen und methodologischen Schwächen auf den Grund. Ziel ist es, multidimensionale, translokale Darstellungen und Erklärungen aktueller Bevölkerungsbewegungen aus zwei ländlichen Forschungsgebieten des semi-ariden Sahel in Mali (Bandiagara) und Senegal (Linguère) zu liefern. Unter der Annahme von sozialen Netzwerken, die sich über mehrere Orte erstrecken, und wiederholter Migration als fest etablierter, gewöhnlicher Bestandteil des Lebens integriert der theoretisch-konzeptionelle Rahmen dieser Arbeit komplementäre Ansätze von Translokalität, Migrationstheorien und politischer Ökologie. Diese Konzeption impliziert, dass sowohl zirkuläre Mobilität als auch Flüsse von Ressourcen, Wissen und Ideen multidirektionale, multilokale und kumulative Auswirkungen haben und somit die miteinander verbundenen lokalen Kontexte, also auch die Umweltbedingungen, beeinflussen.

Die Anerkennung von Komplexität, Kontextualität und Multikausalität von Migration widerspricht einer Priorisierung von Umwelteinflüssen auf Bevölkerungsbewegungen im Forschungsdesign. Suggestive Befragungen und die Betonung von Klima- oder Umweltstress als Treiber von Migration wurden als methodische Probleme in der bisherigen empirischen Forschung identifiziert, weil dadurch Ergebnisse verzerrt und das Erlangen neuer Erkenntnisse erschwert werden. Außerdem kann die Vernachlässigung wichtiger räumlicher und zeitlicher Skalenaspekte bei der Datensammlung, -aufbereitung und -analyse zu erheblichen Fehlschlüssen führen, wenn es darum geht, kausale Zusammenhänge zwischen Klima-/Umweltfaktoren und Migrationsdaten herzustellen.

Deshalb basiert der hier verwendete methodologische Ansatz vorrangig auf einer multilokalen ethnographischen Vorgehensweise, die Beobachtungen, qualitative Interviews und das Sammeln von Migrationsbiographien an mehreren Orten der identifizierten Migrationsnetzwerke umfasst. Um mögliche Verzerrungen zu reduzieren und multidimensionale Erklärungen von Migration zuzulassen, wurden während der Feldforschung die Themenbereiche Klima/Umwelt und Migration voneinander getrennt untersucht und suggestive Fragen zu Klima und Umwelt als Migrationsmotive vermieden.

Die Ergebnisse zeigen, dass nicht nur Bodeneigenschaften und signifikante intra- und interannuelle Regenfallvariabilität, sondern auch anthropogene Einflüsse sowohl aktuelle Vegetations- und Degradationserscheinungen als auch die Produktivität landwirtschaftlicher Flächen wesentlich bestimmen. Offensichtlich sind Ernteerträge und die Möglichkeiten, Erntedefizite zu kompensieren, zeitlich, lokal und sozial differenziert. Die Verfügbarkeit von technischer Ausstattung, Arbeitskraft, Know-how, Pestiziden, Düngemitteln oder die Größe und Lage der Felder sind entscheidend für den Ernteerfolg. Darüber hinaus muss es als etablierte Strategie betrachtet werden, dass die ländliche Lebenshaltung auf der Bündelung mehrerer, multilokaler Möglichkeiten der Einkommens- und Nahrungsmittelgenerierung und damit verbundener Mobilität beruht. Deshalb ist der Lebensunterhalt nicht mehr nur durch Subsistenzlandwirtschaft oder externe Klima- und Umweltparameter determiniert.

In Bezug auf die Migrationsmuster zeigen die Ergebnisse, dass historisch gewachsene Binnenmigration in die urbanen Zentren, vorranging die Hauptstädte, und internationale Migration innerhalb von Westafrika dominieren. Seit Langem etablierte Migrationsnetzwerke erklären, warum Côte d'Ivoire weiterhin die wichtigste internationale Destination für Migranten aus Bandiagara ist und Migration nach Europa relevanter für Linguère. Zudem ist der Großteil der Bevölkerungsbewegungen zirkulär und zeitlich diversifiziert. Die permanente Abwanderung ganzer Gemeinschaften findet nicht statt. Stattdessen verdeutlichen die mobilen Lebensläufe, dass dauerhafte, unidirektionale Umsiedlung kaum vorkommt oder schwer als solche zu identifizieren ist. Vielmehr zirkulieren die Menschen zwischen unterschiedlichen Orten der Migrationsnetzwerke in Abhängigkeit ihrer aktuellen Lebensphase, erkunden neue Migrationsziele und kehren manchmal nach vielen Jahren der Abwesenheit wieder zurück. Das zunehmend diverse und irreguläre Timing zirkulärer Migration, welches bislang vorrangig durch den saisonalen Zeitrahmen der Regenfälle und Feldarbeit bestimmt war, hängt mit der relativen Abnahme der wirtschaftlichen, sozialen und kulturellen Bedeutung traditionellen Regenfeldbaus zusammen. Dies steht wiederum in Zusammenhang mit der translokalen, diversifizierten und zeitlich flexiblen Einkommensgenerierung.

Statt grundlegender Migrationsursachen stellt heute der multidimensionale, translokale, und somit relationale Raum gleichzeitig das Ergebnis als auch die Vorrausetzungen für aktuelle Migration in den Forschungsgebieten dar. Das bedeutet, dass kumulative und (selbst)verstärkende Effekte sozio-historischer Charakteristika sowie bereits existierender Migration die differenzierten und multidirektionalen Ausprägungen heutiger Migration maßgeblich beeinflussen. Die Forschungsergebnisse belegen, dass die Eigenschaften und Aufrechterhaltung von Translokalität, zirkulärer Migration und Ressourcenflüssen durch stark miteinander verwobene

Aspekte von Notwendigkeit, Entwicklung und Aufrechterhaltung einer gemeinsamen Identität bestimmt werden, die kaum voneinander getrennt werden können. Die etablierte Abhängigkeit von translokaler Lebenshaltung und translokalen sozialen Strukturen (Notwendigkeit), beständige kollektive translokale Lebensvorstellungen, soziale Bindungen, Weltanschauungen und Solidarität (Identität) sowie der Wunsch nach Wohlergehen, wachsendem Wohlstand, Partizipation, Selbstbestimmung und Fortschritt (Entwicklung) sind die wesentlichen Erklärungen für aktuelle Bevölkerungsbewegungen.

The research in this doctoral thesis was part of the interdisciplinary research project ‘micle’– “Migration, Climate and Environmental Changes in the Sahel”, funded by the German Federal Ministry of Education and Research (BMBF). The project’s objective was to better understand the complex relationships between climate, environmental change, and migration while investigating the social-ecological conditions of population movements in Mali and Senegal. The motivation behind micle stems from estimates of considerable drought and loss of agricultural capacities in Sahel countries such as Mali and Senegal and simultaneous rising figures of internal and international migration in West Africa. The central task of the interdisciplinary research team was examining (climate-induced) environmental change and investigating its role in the complex interplay of multiple determinants of migration.

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i. RESEARCH DESIGN

The great Sahel droughts of the 1970s and 80s resulted in an enduring narrative about African population movements; one characterized by visions of forced migration resulting from overpopulation, ecological problems, and limited natural resources. To date, the West African Sahel is regarded as one of the world's hotspots of climate change and environmental degradation (Kandji, Verchot, and Mackensen 2006; Hulme 2001; Niang et al. 2014). Views and concerns of resulting potential, relevant displacements are perpetuated by politicians, international organizations, and researchers from the Global North ((Niang et al. 2014; McLeman and Gemenne 2018; Missirian and Schlenker 2017). This thesis contributes to the debate about climate change, environment, and migration by adopting a migration research perspective. The objective is to critically discuss conceptual and methodological shortcomings and provide a differentiated understanding of contemporary population movements in and from Mali and Senegal in the context of climate change.

The thesis is structured in four main sections: Research design, publications, synthesis and outlook, and appendix. The first section begins with an introduction on the debate of the topic at hand and is followed by the research questions. After presenting the theoretical-conceptual approach in chapter two, the description of the research field is provided. Next, the research design is presented with an explanation of the methodological approach and finishes with a reference list. The subsequent section first provides a list of the manuscripts forming the thesis before briefly explaining their overall contextual design by sketching their content and associations. The next eight chapters consist of the respective published or submitted scientific contributions. The section synthesis and outlook offers a summarizing overview and concluding discussion of the research results. It is structured according to four research questions, a reflection on the research approach, and lastly the synopsis and outlook. The last section of the thesis comprises relevant appendices.

1. Introduction

Scientific interest in the environmental dimension of population movements is not a recent phenomenon (É. Piguet, Pécoud, and Guchteneire 2011). The first popular use of the term "environmental refugee[1]" in 1985 in an UNEP publication and the first numerical estimates by

[1] Essam El-Hinnawi (1985, 4) defines environmental refugees as "those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environ- mental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life. By

Jacobson in 1988 can be seen as groundbreaking impulses for the academic and political debate on the environment-migration-nexus (El-Hinnawi 1985; Jacobson 1988). In the past two decades, concerns about the potential consequences of global climate change on human migration fueled the attention of policymakers, media, international organizations, and scholars. Consequently, the number of academic publications and empirical work from a variety of disciplines dealing with the relationship between climate, the environment, and migration skyrocketed accordingly (IOM and University of Neuchâtel 2012; Institute of Geography of the University of Neuchâtel 2019). Three major observations can be drawn from past research and the wide-ranging environment and migration debate: **1)** The majority of empirical case studies focus on countries and so-called hotspot regions in the Global South (E. Piguet, Kaenzig, and Guélat 2018); **2)** The debate became highly politicized (Tacoli 2009) at the very latest when worrying forecasts were published claiming up to hundreds of millions of environmental refugees in the near future would even exceed the numbers of traditional refugees (Norman; Myers and Kent 1995; Norman Myers 2001, 2005; Christian Aid 2007; Jakobeit and Methmann 2007; UNU-EHS 2005; UNFCCC 2007; Stern 2007); **3)** Natural and social science research paradigms characterize the scientific discussion on the environment and migration nexus.

In April 2011, a number of press articles concluded that the 50 million climate refugees predicted for 2010 had "failed to materialize" (Spiegel Online International 2011). Accordingly, international organizations and scholars eventually approached forecasts with much caution. Moreover, scientists clarified that respective estimates referred to people at risk of becoming displaced rather than "predicting mass flight of a 'refugee' nature" (Black 2001:8), which "does not necessarily mean that people do actually move" (E. Piguet 2010a, 76).

In order to elucidate the challenges and uncertainties of identifying, let alone predicting, people moving for climatic or environmental reasons, I will outline below the major viewpoints in the scientific discussion.

The discussion about 'environmental migration' was mainly shaped by two opposing positions reflecting the research paradigms and disciplinary divide between natural and social scientists (Castles 2002:2). The maximalist or alarmist perspective (environmental analysts like Myers or El-Hinnawi) submits, on the one hand, an outstanding and direct interrelation between environmental degradation and migration and "stress[es] the very high number of people concerned" (Piguet et al. 2011:4). On the other hand, minimalists (primarily the migration researchers) consider the environment as a contextual factor, meaning that no direct relationship

'environmental disruption' in this definition is meant any physical, chemical, and/or biological changes in the ecosystem (or resource base) that render it, temporarily or permanently, unsuitable to support human life".

exists between environmental deterioration as a separate causal variable and the decision to migrate (Suhrke 1994; Black 2001; Castles 2002). The idea of 'environmental refugees' was grounded in a neo-Malthusian perspective assuming that out-migration results from resource scarcity and population growth exceeding environmental limits (Morrissey 2009:3). Migration researchers extensively critiqued notions of this concept (Bilsborrow 1992a, 1992b; McGregor 1994; Black, Kniveton, and Schmidt-Verkerk 2011; Castles 2002) in conceptual-theoretical, legal, and political arguments (Oliver-Smith 2009; Doevenspeck 2011; Romankiewicz and Doevenspeck 2013).

The conceptualization of terms such as 'environmental migration' is misleading and implies a bias towards a monocausal, or at least direct, relationship between environmental change and population movements. Simplified explanations of (climate-induced) environmental change as a root cause of unidirectional migration within a static push-pull framework have been rejected by numerous scholars as lacking appropriate theoretical basis and empirical evidence (Haan, Brock, and Coulibaly 2002; Findley 1994; Van der Geest, Vrieling, and Dietz 2010; Castles 2011). It neglects the multitude of intertwining economic, social, and political factors in migration processes and the capacity to adapt to a changing environment (Castles 2002; Black 2001; McGregor 1994). Besides flight resulting from natural or man-made disasters, it is practically analytically impossible to identify climate and environment as the principal and direct cause of migration (Doevenspeck 2011). Even attempts for more differentiated terminology and definitions (environmentally-induced, environmentally-motivated, or environmentally-forced migration) that refer to a continuum of human agency in migration processes (Renaud et al. 2007; Hugo 1996; Bates 2002; Suhrke 1994) do not provide a convincing solution for the fundamental flaws of this concept and its analytical operationalization (Aufenvenne and Felgentreff 2013; Romankiewicz and Doevenspeck 2013).

Similar terminological and conceptual fuzziness within the discussion must be attributed to the operationalization of 'environment' and 'climate'. In effect, the debate and research consider climate change, climatic factors, environmental factors (natural and man-made), and natural hazards, each entailing varying implications. Knivton et al. (2008:11), for example, note that the abstract concept of climate (change) refers to (the comparison of) summarized statistics of atmospheric parameters over long periods of time. Droughts or heat waves are rather regional manifestations of the climate system. Consequently, they question that people's lives, and thus migration decisions, can be directly affected by climate change (ibid.). The importance of properly classifying relevant environmental factors becomes obvious: Not only does the degree of natural and anthropogenic influence vary, but also the power of shaping population

movements might differ considerably. The most relevant factors predicted to become significantly reinforced by climate change (Rebetez 2011) are rapid onset natural hazards such as earthquakes, volcanic eruptions, floods, hurricanes, tsunamis, and cumulative or slow-onset changes such sea level rise, drought, deforestation, land degradation, and desertification (É. Piguet, Pécoud, and Guchteneire 2011; Lonergan 1998). It is of little surprise that authors disagree about whether sudden onset natural hazards or slow-onset changes most affect population movements (Kniveton et al. 2008, 28; Laczko and Aghazarm 2009, 5). Moreover, it is typical that the dichotomy between natural and social sciences research paradigms manifests itself in the conceptualization of the environmental dimension. By referring to external 'natural' environmental factors, natural scientists usually avoid the complex interplay between society and environment and thus ignore the social constructedness and political ecology of environmental change (e.g. land degradation, flooding, desertification) (Jónsson 2010). In contrast, researchers investigating the multi-level contextual aspects of migration are implicitly informed by political ecology. Nevertheless, it is striking that only a few studies dealing with environment and migration explicitly apply this approach in their analysis (Hammer 2004; Greiner and Sakdapolrak 2016; Radel et al. 2018; Carr 2005).

Meanwhile there is general agreement within the scientific literature that migration is a multi-causal and complex phenomenon (Suhrke 1994; Laczko and Aghazarm 2009; Hugo 2008; Castles 2002; Black 2001). Environmental change can be one among many contributing factors while "the economic, social and political situation of the zone under threat can, depending on the case, increase or decrease the flow of migrants" (Piguet 2008:3). More recently, authors portray migration as one important adaptation and resilience strategy to climate change to secure and diversify livelihoods.

Irrespective of varying conceptual and methodological research approaches, and the general scarcity of migration data, previous empirical findings on the West African Sahel show the environmental dimension rather addresses short distance and temporary population movements and similarly hints at the multicausality and complexity of migration (Van der Land, Romankiewicz, and van der Geest 2018; Hochleithner and Exner 2018; Findley 1994). Despite accepting this extensive conceptual critique and weak and patchy empirical knowledge, influential authors and international organizations simultaneously continue to use problematic terminology (environmental migration) while emphasizing concerns of increasing relevance of future climate change driven migration (IOM 2018; Niang et al. 2014; McLeman and Gemenne 2018). Instead of dealing with the complex interacting and elusive multiple dimensions of migration – especially in contexts of slow-onset environmental change – forced migration and

displacement resulting from extreme weather events receive a stronger focus (McLeman and Gemenne 2018; IOM 2018; Goodwin-Gill and McAdam 2017). This suggests that aspects of political instrumentalization and securitization of migration essentially influence the agendas of international organizations and research funding. Such tendencies are based on the conception that uncontrolled migration in and from the Global South is considered a menace (Hochleithner and Exner 2018) or a reaction to a problem perpetuating notions of sedentarism (Verne and Doevenspeck 2012). In the case of West Africa, such assumptions neglect the historically well-established patterns and culture of migration (Adepoju 2005; Bakewell and de Haas 2007; Black, Kniveton, and Schmidt-Verkerk 2011; Klute and Hahn 2007); i.e. the already existing contexts of high mobility (Steinbrink and Niedenführ 2017; Tacoli 2009) as well as the recent new mobilities paradigm in migration research (Sheller and Urry 2006; Büscher and Urry 2009) which submits that migration has become an integral part of people's everyday lives.

2. Research Questions

In light of the conceptual critique, the controversial debate, and limited empirical research, the objective of this thesis is to contribute to the environment and migration debate by adopting the perspective of a migration researcher to describe and understand current migration phenomena in West Africa in the context of climate change and existing high mobility. Therefore, rather than problematizing environmental and migratory linkages or testing for primary (climatic and environmental parameters as) triggers of unidirectional migration, I critically discuss conceptual and methodological shortcomings of previous research and give a differentiated image of contemporary population movements from Mali and Senegal and their multi-dimensional feedback effects.

The thesis gives answers to the following research questions, which in part reflect the successive knowledge process while conducting research and data analysis:

(1) What are the spatial and temporal characteristics and trends of contemporary migration patterns?

The question aims to identify and describe present destinations and places of migration networks as well as temporal patterns of migration emanating from the rural research areas in Mali and Senegal. By taking into account West Africa's migration history, the historical migration background of communities, and individual migrant biographies, I consider the path dependency and processuality of migration at different levels of analysis.

(2) What are the central trends of agro-ecological conditions and what are their (multi)local interpretations?

In order to identify relevant climatic and environmental trends in the rural research areas of Mali and Senegal in interdisciplinary cooperation with fellow research colleagues, the aim was to gather information about local views on rainfall, temperature, soil conditions, and vegetation change. To better grasp local meanings of agro-ecological change, the objective was to contrast people's interpretations and explanations for changing environmental conditions with the findings of physical research data.

(3) Which methodological shortcomings and challenges exist in empirical research linking the environment and migration?

Based on conceptual and theoretical shortcomings within the debate on linking environment and migration, this question aims to highlight selected methodological deficits and hence challenge the reliability of conclusions drawn from respective empirical case studies. The question is motivated by the conclusion that the consensus about multi-causality, multi-directionality, and complexity of migration must be reflected by an appropriate research design. Thus, a critical review of methodology focusing on the one-sided and isolated role of climatic and/or environmental factors in explaining population movements is provided.

(4) What are the translocal and multi-dimensional aspects and feedback effects of population movements and how do they shape (circular) migration?

Guided by a selection of complementary theoretical approaches of migration theory, political ecology, translocality, and a multi-local research approach, this question aims to identify historical and socio-economic explanations of perpetuating circular migration and translocality of investigated Malian and Senegalese communities. Here, the relevance of interconnected local contexts in multiple places combined with the multidimensional interacting feedback effects of migration are taken into consideration to investigate how contemporary mobility is shaped and reinforced.

3. Theoretical-conceptual approach

This thesis's conceptual and theoretical approach builds on previous conceptual efforts and responds to identified shortcomings by developing a social science and migration research perspective. To enable better comprehension, in the following I will take up and expand on the conceptual inconsistencies described in the introduction. Subsequently, I will sketch my own approach.

Owing to the fact that scholars from many different disciplines with contrasting research interests contribute to the discussion on the environment and migration, currently no separate consistent theoretical approach exists that combines the environmental dimension with population movements. The majority of previous empirical studies are largely informed by two different theoretical-conceptual approaches (Jónsson 2010; Suhrke 1994).

(1) Analogous to the neoclassical approach in migration theory assuming powerful macro-level push-pull forces due to economic spatial differences (D. S. Massey et al. 1993; Lee 1966), unidirectional population movements are considered to be driven by individual rational motivation to migrate from areas of deteriorating environment to those with better environmental conditions (Doevenspeck 2011).
(2) Migration is considered complex, multicausal, and multidimensional. Instead of focusing on external structural forces, the environment is regarded as one among several multi-level contextual factors of analysis. Informed by social constructionism, political ecology, and the livelihood approach, respective studies consider migration among various responses to environmental stress by taking into account people's resilience, adaptation strategies, and diversification of livelihoods. Such approaches account for the intermediating social factors and dynamic interdependence between the environment and population movements (Jónsson 2010).

As already emphasized, the complexity of migration is widely acknowledged; recent studies can hardly be assigned to the extreme maximalist category. However, as the debate itself implies, the majority of empirical research is still centered around revealing the relevance or consequences of climatic and environmental dimensions in migration processes. Thus, this necessarily and essentially shapes research questions and (unintentionally) how population movements and migrants are framed in general (cf. Jónsson 2010). The implications of the different conceptual frameworks can be characterized as follows:

(1) Scholars starting from specific areas of relevant environmental stress and natural hazards are interested in the effects (threats) they have on migration. Where do they trigger displacement? Who is moving 'victims' of climate change? From and to where are they migrating? Implicitly, any such approaches are trapped in Neomalthusian assumptions and the unidirectional push-pull framework. In doing so, they focus on migrants' regions of departure and support sedentarist and hence problematizing notions of migration. Globally, the movements referred to are numerically irrelevant.

(2) On the other hand, researchers guided by migration theories examine significant observable (multidirectional) population movements. They are interested in the following questions: What are the evident, relevant patterns and phenomena of migration, and what are the multidimensional explanations and (self)reinforcing determinants for population movements? What are the (feedback) effects of migration and how do they perpetuate and modify existing migration patterns? Moreover, by accepting existing contexts of high mobility, migration systems, circular migration, and translocality, migration research supports multiple perspectives on migration through multilocal research. This implies that the spatial categorization of origin and destination becomes increasingly redundant. Together with the new mobilities paradigm, migration is regarded as a normal part of people's lives and not a problem per se.

The research interest of this thesis is in line with the second perspective as it follows the logic that population movements influenced by environmental conditions "must remain open for embedding in migration theory instead of regarding it as a distinct phenomenon" (Doevenspeck 2011, e53). Furthermore, I argue that in accepting the complexity of migration to comprehensively explain population movements, one must inevitably account for the reciprocal interdependencies in migration characterized by multidimensional change at different places, i.e. not only environmental change at places of departure (Jónsson 2010).

The initial conceptual approach of my research was guided by the idea of ecological inference (E. Piguet 2010b) embedded within the framework of the micle research project. This approach allows for the identification of rural research areas in the semi-arid Sahel of Mali and Senegal as point of departure, two alleged 'hotspots of environmental migration'. This means area characteristics of relevant environmental change and outmigration occurring simultaneously were considered for the choice of research areas. Against the background of the conceptual critique, research then followed a multi-local perspective on migration considering multiple approaches of migration theory. To prevent the identified conceptual and methodological pitfalls of previous research projects, the investigation of local representations of climatic and environmental change was largely separated from research on migration. The apparent relevance of people's habitual circular movements along existing translocal social structures, multidimensional explanations of migration and various feedback effects resulting from findings, finally led to the adoption of a selection of different conceptual approaches. Complementary approaches and assumptions from migration theory together with the concepts of translocality and political ecology thus informed the collection and analysis of research data.

In the following, I clarify how the migration terminology is applied, sketch the applied approaches, and explain how they relate to each other.

Definitions of migration that characterize it as a specific type of movement across borders implying a change of residence for a specific period of time are useful for political and administrative purposes. However, this form of terminological determination implies conceptual and analytical deficiencies that fall short of making a scientific contribution to understanding the diversity of phenomena and the processuality involved in contemporary human mobility: "Distinctions drawn between population mobility, which encompasses all forms of geographical movement, and migration, which is supposedly restricted to longer-distance moves and 'more permanent' changes of residence, are fraught with arbitrariness and empirical complications. For that reason alone, it is surely preferable to draw no such *a priori* distinction, in effect treating migration and population mobility as synonymous. […] Erecting *a priori* descriptive barriers is a regrettable outcome of wishing to impose an artificial simplicity on an inherently complex and multidimensional process" (Standing 1984:35). Besides the figures from the quantitative survey, this thesis therefore uses migration and human mobility synonymously and follows the broad understanding of the International Organization for Migration which refers to migration as the "movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification" (IOM 2004: 41). Derived from this conception of migration, I refer to circular migration as repeated, continuing, and fluid movements of people among different places between or within countries, which can be considered as a single social and economic space (Hugo 2013; Newland 2009; Agunias and Newland 2007). This understanding of multidirectional circular movements and perpetuating translocality of mobile communities renders the distinction between origin and destination increasingly redundant.

In order to cover the complexity and multiple facets of population movements, the selection of theoretical approaches addresses social, cultural, economic, and historical dimensions as well as the reciprocity of migration and environmental change. Moreover, instead of focusing on the so-called root causes of migration, I am interested in aspects that shape, perpetuate and reinforce already existing patterns of high mobility and associated translocality.

A basic assumption is that translocality is a result of migration. Greiner (2011) defines translocality as "the emergence of multidirectional and overlapping networks created by

migration that facilitate the circulation of resources, practices and ideas and thereby transform the particular localities they connect. Translocality thus refers to the dynamics, linkages and interdependencies of the multidimensional social space connecting migrants' areas of origin and destination". With respect to translocality, Steinbrink (2009) emphasizes the distinction of movements between *sociospatial emigration* (a one-time, uni-directional move and exit from the previous social space), *expansion* (movements contributing to an extension and translocalisation of social space), and *transmigration* (movements within the existing translocal social space). Hence, migration becomes relevant for both the creation of translocal structures as well as the perpetuation and reproduction of translocal connections. Conversely, this implies that translocal social structures represent both a result of migration (*expansion*) and the context and precondition of translocal practices such as further *(trans)*migration, a duality of translocal agency and translocal social structures. These aspects thus cannot be examined separately from each other (Steinbrink 2017, 2009).

Mabogunje's migration systems theory (1970) highlights that a set of places is linked by social ties between individuals and communities through the circular flow of people, information, commodities, and their feedback processes (De Haas 2008). "Theorizing the dynamics of migration has thus moved from a consideration of movement as a linear, unidirectional, push-and-pull, cause-effect movement to notions that emphasize migration as circular, interdependent, progressively complex and self-modifying systems in which the effect of changes in one part can be traced through the entire system" (Faist 1997, 193). Approaches such as transnational social space (Pries 2001), networks (Faist 1997, 2000) and social capital in migrant networks (Portes and Sensenbrenner 1993; D. S. Massey and Espinosa 1997) focus on the connective meso-level – namely the role of social relations, their structures, contents, and characteristics in shaping migration decisions and pattern. These theories, attributed to transnationalism in migration research (De Haas 2008; Pries 2001), emphasize that migrant's identities and livelihoods become increasingly disembedded from territorial containers, hence stressing the notion of social and relational space transcending national borders (Murdoch 2006; D. Massey 2004). The theory of cumulative causation of migration (Myrdal 1957) furthermore supports the notion that networks' growth and development of migrant-supporting institutions at all places within migration systems may negatively or positively affect, perpetuate and strengthen, or impede further migration. Here, similar to translocality, a central conceptual argument is that each migration act alters the social, economic, or cultural (translocal) contexts of migration decision-making typically tending to make subsequent movements more, or indeed less, likely over time (D. S. Massey et al. 1993, 451). Moreover, conceptualizing migration as

a self-sustaining, institutionalized process implies that migration decisions become increasingly independent from individual and structural factors that might have originally caused people to migrate from their place of origin (D. S. Massey et al. 1993, 450f.). The micro-level approach of relative deprivation (Stark 1984; Stark and Taylor 1991) follows the argumentation of cumulative causation. Stark (1984) shows that improving a household's or individual's position in relation to others (e.g. within the same village) constitutes a fundamental incentive for migration. The approach premises that interpersonal or interhousehold income comparisons are internalized, and lead to psychological states of either satisfaction or relative deprivation. Further complementary conceptual frameworks taken into account are the life course approach (Elder Jr. 1994; Kulu and Milewski 2007; Wingens et al. 2011) and the biographical approach (Apitzsch and Siouti 2007; Philipper 1997; Rosenthal 1999). They explicitly consider the temporal dimension of people's migration experience such as sex-specific and age-related regularities. These migration characteristics are then related to specific stages of individuals' life cycle, thus emphasizing the processual and dynamic character of migration (Cuba and Hummon 1993; Plane and Jurjevich 2009; Raymer and Rogers 2006; Rogers and Castro 1979).

In a call for "grounded transnationalism", Brickell and Datta (2011) develop their concept of translocality from an understanding of (non)migrants' simultaneous affiliation to and embeddedness in multiple interconnected localities – a 'groundedness during movement' within or across national borders. Here, in contrast to transnationalism, social and relational space is not regarded as deterritorialized. This is because complex connections spanning spaces, places, and scales (only) become evident and corporeal when they materialize at specific localities: "To theoretically account for these [places and spaces] as constitutive of translocality means that we need to pay attention to their multiple and hybrid histories, their politics and social constructions, their material geographies, and their connections to other scales and places" (Brickell and Datta 2011, 4). On the one hand, the specificity of places, the multiple local contexts, and migrant's habitual localized experiences and constructions actively shape the dynamics of people's mobility and vice versa. Similarly, migrants' agency, the circulation of resources, practices, and ideas transform (political, social, economic, and environmental dimensions of the) connected localities (Greiner 2011; Brickell and Datta 2011; Greiner and Sakdapolrak 2013b). In view of this, the consideration of a politicized manifestation of connected places and a translocal political ecology (Greiner and Sakdapolrak 2016) become self-evident. Unlike notions of the environment as an independent external parameter and driver for migration, a political ecology approach considers environmental processes as resulting from the dynamics of broader political economy, unequal power relations, varying interests among

involved actors, as well as the social interactions across multiple scales (Blaikie and Brookfield 1987; Büttner 2001). Therefore, feedback effects of migration and (non-)material exchange between different interlinked localities within translocal networks contribute to shaping human-environment relations and, hence, environmental contexts in these connected localities (Greiner and Sakdapolrak 2013a; Bebbington and Batterbury 2001).

In brief, instead of emanating from an initial static system and isolated spatial container, in which migration results from a specific trigger or motivation deviating from the sedentarist norm, this thesis's theoretical approach conceptualizes contemporary population movements as manifestations of perpetuating multilocal social practices shaped by their feedback effects as well as interdepending, multidimensional, and constantly changing contexts at multiple connected places.

4. Research field

Research was conducted in the rural study areas of Linguère, Senegal, and Bandiagara, Mali, as well as multiple places (destinations) in the identified migration networks of selected communities (see Fig.1). The scope of the research field (and linked research findings) can be assessed according to its interpretation as geographic space and relational space. As part of the Sahel-Sudan region and geographically sharing similar historical and cultural developments, the initial study regions Linguère and Bandiagara are exemplary for the agro-ecological conditions and agricultural activities of the semi-arid Sahel in Mali, Senegal, and other parts of West Africa. Nevertheless, they differ in their rainfall regime and economic specification. Whereas the Linguère area is part of a traditionally important pastoral zone, the Bandiagara area is mainly characterized by farmland, although crop and livestock production are important in both study regions. In Linguère, many of the pastoralist families nowadays are sedentary and practice both the cultivation of land and livestock breeding[2].

Simultaneously, the investigation of people's mobility and migration networks at multiple places produced a mobile and translocal research field. Phenomena such as (internal) circular rural-urban migration and associated processes of translocality are transferable to many other contexts of high mobility in Africa and the Global South. However, the investigated communities' very specific socio-historical background, geographic manifestations, and the effects of social networks and migration are differentiated, context specific, and not easily transferable.

[2] However, this thesis focuses on general patterns of people's mobility and excludes specific seasonal movements (transhumance) of herders and their cattle.

Figure 1: Overview of study areas and study sites

4.1 Senegal and Europe

The Linguère research area is located in the predominantly rural administrative region of Louga in the central northern part of Senegal at a distance of 300 km from the capital Dakar. The city of Linguère is the administrative capital of the eponymous province. The semi-arid region is also called the Ferlo, named after a seasonal river crossing the area, and mainly inhabited by two ethno-linguistic groups, the Wolof and the Fulani (ANSD 2007). However, the region's inhabitants refer to their homeland as the Diolof, which until the late 19th century was the name of the prevailing Wolof kingdom in the area. Economic activities concentrate on livestock breeding and crop production (mainly millet and groundnut). This agro-sylvo-pastoral area is sparsely populated (14 inh./km^2) (ibid.), characterized by an average annual rainfall of about 400 mm (1950-2010) with enormous inter- and intra-annual variability, and dominated by open shrub and tree savanna and grasslands (Brandt et al. 2014). In the past 50 years, droughts have contributed to a considerable decrease in vegetation and tree cover (Tappan et al., 2004). Based

on the most recent migration data available (Ndione 2018), Louga is home to the highest negative internal migration balance in the country and origin of approximately nine percent of Senegalese international migrants (2008-2012).
Migrants from selected villages in the study region (Fig.1) were interviewed in Dakar and the cities of Touba and Saly. The investigation of the extensive international migration network of the village of Nguith included research stays and interviews with migrants in the European cities of Marbella, Spain and Nice, France.

4.2 Mali

The Malian research area is located in the center of the country in the administrative region of Mopti around the town of Bandiagara between the Niger Inner Delta to its northwest and the border to Burkina Faso to its southeast. The nearby harbor town of Mopti, the administrative and economic capital of the region, and its suburb Sévaré represent an important traffic hub between the northern and southern part of Mali and major West African destinations. In 2009, the Mopti region had a population density of 26 inh./km^2 (S. M. Traoré, Doumbia, and Traoré 2011). The study area is mainly characterized by the history, culture, and farming activities of the Dogon people and is therefore commonly known as the Dogon country. Fulani pastoralists living in the area represent a minority. Rainfed agriculture (millet, sorghum, groundnut) and irrigated vegetable gardening are the most important economic activities. The mean annual precipitation of 500 mm (1950-2010) with significant intra- and interannual variability (Brandt et al. 2014) and the availability of wells and seasonal water basins essentially influence the agricultural productivity. In the Mopti region significant soil degradation, deforestation, and decrease in biodiversity have been observed since the mid-1980s (A. Y. Maiga et al. 2009; M. A. Maiga 2013). According to migration data from previous censuses and surveys, the region has shown a considerable migration deficit since the 1990s and both internal and international migration to other African countries have existed for a long time (Bocquier and Diarra 1999; Merabet and Gendreau 2007; WFP, UNICEF, and European Commission 2006).
For the purpose of this thesis, interviews (including a quantitative survey) were conducted in several villages of the Bandiagara research area (Fig.1) and the capital Bamako at migrants' identified places of work and accommodation spread over the entire metropolitan area.

5. Methodology

In order to respond to conceptual deficits and associated potential methodological shortcomings of previous research positioned within the environment and migration discussion, the methodological design of the thesis derives from the conceptual approach described in Chapter 4 and is characterized by a multi-level and multi-sited approach integrating qualitative and quantitative research methods. Particular emphasis is put on the interpretation of extensive ethnographic research data.

First, I point out methodological implications of the quantitative research paradigm in the investigation of migration and environmental change and plead for an open qualitative methodological research approach. After elucidating my own methodological design and research process, I present in detail the applied methods of data collection and analysis.

5.1 Beyond migration motives and causality - openness in qualitative research

Generally, individual migration motives are considered to be in the best and most traceable position to logically and causally link determinants of migration (such as climate and environment) and the decision to migrate. That is, simply inquiring into and 'collecting' people's migration motives may shed light on human behavior and the root causes of migration. From a conceptual and methodological point of view, this assumption poses two major challenges.

(1) Seeking so-called causes of social phenomena must be attributed to the quantitative paradigm and its methods of data collection and analysis (Lamnek 2010, 227). This etiological, methodological orientation, or 'aetiological tendency within migration studies' as Klute & Hahn (2007, 9) call it, however, must be ascribed to the already discussed critique of a simplified push/pull and sedentary perspective on migration processes. In contrast, qualitative approaches in social science research refer to the interpretive paradigm. This means that an understanding of people's subjective meanings and interpretations of the social reality in different contexts is in the focus rather than the search for isolated causes and explanations of human behavior (Lamnek 2010, 227).

(2) There is consensus among motivational researchers that direct interviews and, above all, investigations based on standardized interview methods such as questionnaires, do not reveal actual motives, but instead, at best, give insight into rationalizations or rational justifications of respondents (Stephan 1961, 13). Rationalization can be understood as the justification of specific patterns of behavior with reasonable statements (rationale), or those that seem to be reasonable. Therefore, asking for people's motives for their behavior may result in rationalized

responses and thus in research findings that actually reflect reasonable explanations. In the particular cultural context of the Senegalese and Malian research areas, this could possibly also deliver socially desirable responses. The strengths of open, non-standardized qualitative methods address these methodical difficulties (Schwarz 2000; Stephan 1961, 42). From the perspective of qualitative motivational research, Schwarz (2000, 215ff.) emphasizes the power of the questioning technique, which can bias and manipulate people, e.g. animate interviewees to think or to make them affirm the researcher's views. He pleads for 'openness' and 'flexibility' towards the respondents, the examination situation, and methods and therefore follows Lamnek's (2010) arguments for qualitative social research, which puts explorative fieldwork in the focus. 'Openness' in the qualitative paradigm in the social sciences relates, among other things, to the following points (see Lamnek 2010, 230).

- Openness to and open-mindedness about the field, its interacting persons, and their very meanings and interpretations of the social reality.
- Questions to the subject of investigation are open and may change in the course of the research process. Technically, questions are open because hypothetical answers are not anticipated, implicit, or provided.
- The methods of qualitative research are open because they can be changed throughout the research process or even replaced by more adequate ones.
- Epistemological possibilities are open. Profound insights can only result from the subject of investigation itself and thus may not contain any predeterminations of the researcher.

Researchers' predeterminations already arise from theoretical and hypothetical assumptions about the subject of investigation and influence the applied survey techniques and questions asked. Based on my field experience and depending on the research question, I argue, any research at the interface of climate and environmental change and population movements is potentially exposed to such predeterminations because of the power-laden political, scientific discourse and interests regarding so-called 'environmental migrants'. There is a potential risk that applied qualitative research methods, and above all the questions asked, are somewhat influenced by the idea that climatic or environmental conditions must be considered as direct push (or pull) factors for migration in the investigation. Moreover, I assert that the researcher already imposes their mindset on the respondent when addressing the climatic and environmental context as part of the migration processes in the interview, let alone when directly asking if environmental stress was a possible migration motive. There is a risk that such methodical deficits imply a suggestive effect, may lead to biased and potentially no new research findings. Lamnek (2010, 231) states that the researcher must restrain themselves

theoretically and methodically and let the interviewees speak for themselves. Relevant factors, e.g. for people's migration, must be determined by the respondents themselves and can generate more realistic findings. For this purpose, the researcher must behave in a receptive-stimulating manner rather than in a suggestive-determining way. To consistently stick to such an open methodical approach at all times of the research process is challenging, if not impossible. However, in my fieldwork I sought to meet these demands by methodically focusing on natural communication and different qualitative interview techniques through which I could avoid influencing statements about individual's migration experience.

5.2 Methodological design and research process

Initial study areas in the micle research project were identified according to the concept of ecological inference (E. Piguet 2010b), i.e. selecting Sahelian[3] regions in Mali and Senegal that show noticeable below average population growth as an indicator of elevated emigration rates and considerable land cover changes or land degradation. Additionally, accessibility and security aspects needed to be considered in the selection of the research areas. Fieldwork was conducted during twelve months between 2011 and 2013 distributed over six research stays at multiple locations in the rural research areas and places (destinations) of migration networks (see Fig.2). Between 2014 and 2015, I collected additional information and conducted follow-up interviews with migrants via telephone, email, and video chat. The investigation primarily relied on ethnographic data collection, different qualitative interview techniques, and additionally involved a large-scale individual sample survey. The intention of using the selected methods mix was to impose different perspectives on the same phenomenon by necessarily integrating different theoretical-conceptual perspectives. The validation of research findings and thus effectively counteracting the potential pitfalls of misinterpretation of a single data source is the aim of method triangulation (Berg 2006).

[3] According to their latitude and rainfall regime the two study regions are located at the southern end of the West African Sahel (Brandt et al. 2014; Nicholson 2013).

	Year	Month	Place
Empirical field research	2011	Feb – Mar	Senegal
		Mar – Apr	Mali
		Nov – Dec	Mali
	2012	Jan – Feb	Senegal
		Mar – Apr	Mali
		June	Nice (France)
		Sept	Marbella (Spain)
	2013	Dec	Senegal & Mali
Follow-up interviews via telephone and Internet	2014 – 2015		Mali, Senegal, Côte d'Ivoire

Figure 2: Schedule of empirical research

The research process comprised the following stages: 1) Literature review; 2) Formulation of research interest and questions; 2) Development of methodological approach; 3) Selection of research areas/sites; 3) Fieldwork and data collection; 4) Analysis and interpretation of empirical data; 5) Preparation of publications. This interpretive research approach follows the grounded theory approach (Glaser and Strauss 1967) and is characterized by the interplay of induction and abduction (Rennie 2005). Moreover, approaches in the interpretive paradigm imply that the strategy of investigation is not fixed *a priori*; i.e. different stages of the research process are not arranged in a strict chronological sequence but follow a hermeneutic circle-spiral while constantly interacting and influencing each other (Schwartz-Shea and Yanow 2012). Therefore, this doctoral thesis's research process of continuing data analysis, literature review as well as scientific writing resulted in the consideration of additional theoretical approaches, the readjustment of research questions and the conceptual-methodological approach, as well as the integration of further research sites eventually reshaping further data collection and analysis. The knowledge and research process of this thesis is sketched in the following.

During the first explorative fieldwork phase, research was guided by the aim to investigate destinations, temporal patterns, as well as determinants of migration. This included questions about potential migration motives such as environmental and climatic factors to gain a grasp of

local views about causalities between agro-ecological conditions and migration. In response to the identified conceptual and methodological flaws in research on the environment and migration nexus, I attempted to reduce researcher and interviewee biases towards 'environmental migration' in a second step. Therefore, I chose different villages and deliberately avoided asking explicit questions linking migration decisions with the climate and environment.

Additionally, I separated the topics of migration and climate/environment and divided them into different interview situations at different times. Moreover, I did not provide interviewees with the overall context of the research project, which my own study was part of.[4] The impartiality and openness of the interviews allowed that only the respondents themselves could elaborate on environmental change as a migration motive. It was only when interviewees themselves mentioned climatic or environmental constraints in connection with (their own) migration that I addressed these aspects in more detail. One part of the field research involved interviews about environmental change in cooperation with two physical-geographical micle project researchers whose research objective was the collection and interpretation of precipitation, vegetation, soil, and land cover data. Villagers were introduced to them as working independently from me to prevent any impressions of us contributing to the same overall research objective. I additionally acted as their French-German translator. This was a fruitful approach since their current and prior field observations could be directly solicited, interpreted, and explained by the villagers. I took the information and interpretations that resulted from these joint site inspections as well as other observations made by the project colleagues into account in later interviews in the respective village. The obtained results contributed to the research findings about environmental change in the rural research areas (Brandt et al. 2014). Moreover, the local assessments and interpretations of climatic and environmental change could be contrasted with the physical data about temperature, precipitation, and vegetation change (Romankiewicz and Doevenspeck 2014). Thanks to this divided research approach, I gained deeper and more valuable multilocal insights into migration phenomena and people's explanations and interpretations, on the one hand, and climatic, environmental, and livelihood conditions, on the other hand. In the course of the research process, informed by supplementary theoretical approaches, the open and multi-sited approach revealed a more complex, differentiated, and comprehensive picture of migration phenomena.

[4] An exception were informants originating from the Senegalese village of Nguith. Despite revealing the background of the overall research project, I expected to control potential biases because direct communication in French was possible and because of their educational background and occupations farming played a minor role. Nevertheless, I divided interviews about environment and migration and avoided suggestive questions.

For that reason, the analytical focus shifted to the explanatory value of multi-dimensional aspects and implications of translocal migration networks, circular migration, and associated feedback effects. This, for example, became relevant when considering associated effects on agriculture in rural research areas (Romankiewicz et al. 2016).

5.3 Selecting research sites and approaching interviewees

The initial explorative fieldwork aimed to investigate the diversity of villages and local contexts of the study regions and resulted in a general overview of migration phenomena, livelihoods, and agro-ecological conditions. The subsequent selection of villages followed the principle of theoretical sampling, i.e. including cases of contrasting phenomena and perspectives, thereby implying a non-random sample as well as difficulties of comparability (Lamnek 2010, 236f.). Therefore, the initial choice of research sites was geared to represent the different physiographical settings of the study areas, different ethno-linguistic groups and contrasting infrastructural conditions (see Fig.3). Additionally, significant trends of environmental change or noticeable (out)migration guided the selection. The physical-geographical unit of the research project identified signs of land degradation and vegetation change. However, it was difficult to explicitly associate environmental phenomena with single villages. Observable soil erosion and loss of vegetation cover in the vicinity was the motivation in selecting the village of Diamnati in Mali. Moreover, since mobility was generally high and community level migration data were missing, I relied on information from local experts. This information led to the selection of the villages of Tiembara in Mali (alleged increased outmigration) and Nguith in Senegal with its exceptionally high proportion of international migrants. In the Malian context of the Dogon country, I additionally opted for villages that were largely untouched by touristic or NGO activities to avoid biases in interviews influenced by people's expectations regarding foreigners. The definition of communities considered for in-depth investigation aimed at including villages with contrasting socio-historical backgrounds and migration characteristics (Kowa and Diamnati). However, pragmatic aspects such the village chief's willingness to cooperate or the accessibility of settlements and migrants in the capital reinforced the choice of villages.

When selecting interviewees from different quarters of a village, the choice of respondents was arbitrary and included people with and without relevant migration experience. Nevertheless, I assumed that each person's life experience was shaped by spatial mobility to a certain degree irrespective of the distance or length of stay. The identification of migrant networks revealed information about migrating family members and their current abode. Thus, with the help of a

snowballing strategy (Noy 2008), I established migrant contacts by telephone, online (e.g. Senegalese international migrants), and conducted interviews with them at various places in Bamako, Dakar, France, and Spain (see Fig.1).

5.4 Methods of multi-sited ethnography

I have chosen mobile and multi-sited ethnography (Marcus 1995). As described above, and in contrast to many other studies in the field of environment and migration research, I applied a form of tracing starting in rural research areas by collecting migrant information, accompanied migrants while traveling, and / or finally sought to interview those migrants at different sites. The advantage of this approach is to obtain direct (instead of proxy), and independently collected information, and therefore higher quality and more comprehensive data from and about individuals, families, and communities both at origin and destination (Bilsborrow 1984, 110f.). Thus, beginning at the identified villages of the two study regions, I followed migrant networks to collect ethnographic data before, during, and after movements in the rural study regions as well as at several places of the migration networks in Mali, Senegal, and Europe. Ultimately, all observed places can no longer be clearly categorized as locations of origin or destination.

To distance oneself from deterministic and sedentarist views, it is fruitful to consider multi-local perspectives and multi-directional movements. In doing so, the applied multi-sited ethnographic research approach contributes to enhancing the picture of migration patterns, migrant networks, and the determinants of migration by three types of data triangulation: triangulation of persons (non-migrants, migrants, return migrants, experts), triangulation of space (villages, capitals, places in Europe), and triangulation of time (repeated visits and follow-up interviews with the same communities and persons) (Denzin 1989, 236ff.).

Mobile fieldwork in the narrow sense could be carried out with migrants that traveled between the capital and their home village. At the different migration stations, and in Dakar and Bamako in particular, the everyday life of migrant communities, migrant networks, and their social organization could be captured and better understood. The multi-sited research approach to investigate the current mobility disclosed perspectives and insights that would not have unfolded by an exclusive and narrow focus on the so-called areas of migrants' departure. Communication with migrants outside the social structures of their families in the home village, for example, seemed to reduce biases and provide more explicit statements regarding determinants, effects, and personal understandings of migration. Doing follow-up interviews with the same people and migrants over a period of three years, sometimes at different places,

added much understanding to the processuality of migration. In this context it became much clearer how people's personal ambitions to migrate can change over time, and how the absence of a migrated household member is a normal part of life.

The ethnographic research methods encompassed participatory observations and narrative and semi-structured guideline interviews with individuals and groups of people. In addition, I carried out expert interviews (Berg 2006) in Mali and Senegal with local authorities and individuals in governmental and non-governmental organizations as well as academic institutions working in the fields of demography and migration, agriculture, forestry, hydrology, and rural development. Participatory observations were conducted during people's everyday activities and farm work in the villages, local markets, during their work and leisure time in the cities, gatherings, traditional and religious practices and festivities, (tele)communication, and commutes between the city and the village. The interviews focused on village history, the collection of migration biographies, the identification of destinations, temporal patterns and migrant networks, multilocal determinants, meanings as well as feedback effects of migration (Collinson 2009, 27; Iosifides 2011, 30). With the same interview methods, I additionally addressed people's assessments and interpretations of both the current state and changes in environmental and climatic conditions such as temperature, rainfall, soil fertility, woody cover, tree diversity, and crop yields (Mertz et al. 2009; Roncoli 2006). In Senegal, I could conduct the majority of interviews in French. A translator aided conversations in Wolof or Fulani when needed. In the Malian research context, however, only a few of the interviewees in the villages and Bamako spoke French. Therefore, the help of a local translator (Dogon and Bamanankan) was indispensable. I familiarized translators with my research approach. Continuing feedback and exchange between us aimed to interpret findings, readjust my research focus and questions, and ensure the quality of the results.

Country	Location	Critieria of Selection	Number of Interviews	
			Author	Research assistants
Senegal	**Kadji**	Wolof village, northern part of study area	3	
	Loumbel Mbada	Sedentary Fulani settlement, southwest of study area	12	
	Nguith	High numbers of international migrants, close to main road, developed infrastructure	19	
	Khogué	Poor infrastructure, far from main road, southern part of study area	10	
	Linguère	Expert interviews, migrant contacts	4	
	Dakar	Expert interviews, migrant contacts	3	
	Dakar	Nguith migrant community	2	18
	Saly	Nguith migrant community	1	
France	**Nice**	Nguith migrant community	1	22
Spain	**Marbella**	Nguith migrant community	7	
Mali	**Doucombo**	Signs of land degradation, close to main road, central Dogon plateau	3	
	Yawakanda	Signs of land degradation, close to main road, central Dogon plateau	6	
	Balaguina Baboye	Dogon village, southern part of study area, close to main road	2	
	Nianangali	Sedentary Fulani settlement, far from main road	1	
	Tiembara	Alleged outmigration, southern Séno plain, noticable trends of woody vegetation change	4	
	Diamnati	Signs of land degradation, late comer, female migration	16	
	Kowa	First comer, prohibition of female migration	26	
	Bandiagara	Expert interviews, migrant contacts	4	
	Sévaré	Expert interviews, migrant contacts	2	
	Bamako	Expert interviews, migrant contacts	6	
	Bamako	Diamnati migrant community	2	22
	Bamako	Kowa migrant community	1	26
		Total number of interviews	135	88

Figure 3: Selection criteria of research sites and corresponding numbers of interviews

The entire empirical research at the core of the scientific framework of this doctoral thesis encompasses a total of 269 qualitative interviews. However, for the scientific contributions of the thesis, I rely on data from 223 relevant interviews, of which 88 interviews were conducted by research assistants in 2012 who interviewed selected migrant communities in Bamako (Mali), Dakar (Senegal), and Nice (France) (Fig.3). In all different research contexts, I altogether conducted 135 interview situations of significantly varying length and informative

value, due mostly to their open and narrative character and an active effort to create comfortable, natural communication environments. The interviews were either recorded and transcribed or minutes were taken instantly or subsequently from memory. The research assistants were assigned to investigate the specific migrant communities in Dakar and Nice, originating from the village of Nguith, Senegal, and in Bamako, originating from the villages of Kowa and Diamnati, Mali. Their major research objectives were to explore patterns and determinants of migration, the organizational structures and living conditions of migrants, as well as their interpretations of environmental and climatic change in the rural study regions in Senegal and Mali by conducting participatory observations and semi-structed and biographical interviews. In Dakar and Nice the interviews could be conducted in French, whereas in Bamako the assistants realized the interviews with the help of local translators. All assistants were briefed on relevant background information about the communities and I introduced them to already established migrant contacts in the cities. Moreover, research assistants and translators were required and instructed to follow my specific research approach, i.e. to avoid suggestive questioning about the environment or climate as a trigger for migration and to conduct separate interviews about migration and the assessment and interpretation of environmental change in the villages. The resulting research reports and information from Dakar and Nice showed few additional aspects and mainly underpinned my own findings about the translocal Nguith community. The assistants' field research in Bamako gave valuable complementary information together with 22 migration biographies from the Diamnati community and 12 migration biographies from the Kowa community. Apart from the methodological challenges involved in empirical investigations through an intermediary translator, I could control for the appropriate quality of interviews on the basis of the provided recordings and transcriptions.

5.5 Additional methodological aspects of fieldwork

The multi-ethno-linguistic context of the Senegalese and Malian study sites required working with translators. The Senegalese translator was Wolof and supported interviews both in Wolof and Fulani. In Mali I exclusively collaborated with Dogon translators. Owing to limited formal education among the Malian informants, independent direct communication in French was rare. Even though most people could hardly express themselves in French and translations were inevitable, many interviewees seemed to understand the content of French conversations, showed or expressed their agreement with the interpretation given by the translator and sometimes added explanations. The same interpreter assisted interviews in the Bandiagara study area during all my research stays by speaking Dogon, Bambara, and Fulani. In Bamako I

carried out interviews with two different Dogon translators who exclusively communicated with interviewees in Bambara. The Dogon language consists of five sub-groups with more than fifty different dialects. This linguistic diversity implies that not all Dogon understand one another, although most grow up speaking the main dialects.

The key role of my translators in the research process must be emphasized when taking into account several aspects. First of all, they were much more than simple translators. Instead, they must be considered research assistants acting as facilitator, guide, advisor, teacher, researcher, interpreter, and above all as informants themselves because they originated from the study regions and have migration experience. Approaching and convincing the sometimes skeptical village chiefs and elders, accessing the villages, and gaining people's willingness to be interviewed, fundamentally depended on my translators' ethnic background, communication skills, patience, behavior and (strategic) advice on how to handle particular situations. Moreover, continuous exchange with local translators about preceding interviews was a vital element of grasping the meaning and scope of culturally specific phenomena. On the other hand, the degree of kinship or family ties between the research assistants and the study villages in a way determined people's level of trust and openness and thus the profundity of research results compared to other villages. In conclusion, working with a local (research) assistants as translators was crucial and greatly facilitated the investigations within the same ethno-linguistic group.

To facilitate first encounters with migrants in the capitals and Europe, I used photographs I took of family members and places in the home village as a methodical research tool (Collier Jr. 1957). They stimulated information and kept people focused during interviews (Bernard 2013, 196). This approach, strengthened by proof that I know the family and the village, created trust and confidence and accelerated people's willingness to be interviewed. Furthermore, the photographs provided an excellent entrance to interviews and made migrants talk about their village and family members 'here' and 'there'. I also switched this approach and gave photos I took of interviewed migrants to their family back in the home village.

5.6 Qualitative data analysis

As already mentioned, my study was guided by grounded theory, which entails an inherent correlation between the methodological procedures of data analysis and the organization of the research process (Strübing 2018). The analysis of qualitative data from observations and interviews was a continuous process realized between, parallel to, and after fieldwork and continuously refined the methodology and research questions. Instead of testing pre-formulated

hypotheses or theoretical assumptions, interpretive approaches of qualitative research aim to create new scientific (theoretical) knowledge from empirical data (Strübing 2018; Strauss and Corbin 1996). However, theoretical and conceptual orientation of migration research, social constructivism, and contextuality guided qualitative data collection and analysis. Nevertheless, theoretical sensibility characterized the research process (ibid.).

During field research, I continually discussed findings and interpretations with my translators and research colleagues. After each research stay, I transcribed recorded interviews and continuously screened my field notes, minutes, and transcriptions, wrote and revised memos about contextual interrelations and theoretical-conceptual ideas. The more insight I gained into individual migrant biographies, people's livelihoods, community life, and various migration phenomena, the more precise questions I could formulate during interviews and thereby advance my analytical skills.

The analysis of interview transcripts, minutes, and observation protocols was completed with dedoose, a web application tool for qualitative data analysis, that supported the coding and categorization process by facilitating the organization, structuring, and linking of data. In doing so, I applied methodological procedures based on grounded theory explained in the following.

As suggested by Strauss and Corbin (1996), interpretive data analysis draws upon different modes of coding the empirical material: open coding, axial coding, and selective coding, as well as drafting theoretical memos (Strübing 2018) to structure and interpret the data. Similar to different stages of the research process, the different coding levels and memo writing do not necessarily follow a strict sequence. However, repeating and switching between them becomes a useful part of the knowledge process. Based on a detailed line-by-line analysis of the text, open coding involves a first division of the data by identifying similar phenomena that can be classified into and labeled by a specific concept. The continuing coding process and comparisons for similarities and differences of the identified concepts allows for specifications, selections, and finally grouping of similar concepts into (sub)categories (Strauss and Corbin 1996). The axial coding step aims to explore a central category (axis) and significant explanatory networks among the categories and subcategories. Here, a stronger selection of identified phenomena takes place that appear relevant for the research question at this stage of analysis. Implicitly, a number of assumptions or hypotheses are developed, which are reviewed as analysis continues (Strübing 2018). Eventually, a final decision on a key category is required to best answer the central research question or objective. Thus, during the process of selective coding, a reassessment and recoding of data takes place by arranging all relevant concepts and their correlations directing at this focused key category. This step additionally implies a

readjustment towards a consistent analytical perspective and structure as well as the development of a respective consistent theoretical conception (ibid.).

The generation of findings and new knowledge during data analysis for this thesis can best be described by the continuous interplay of inductive and abductive processes as an integral part of the grounded theory method (Rennie 2005). In contrast to induction, "[i]n abductive reasoning, the researcher's thinking is led, or, more actively, directed, in an inferential process, from a surprise [tension or anomaly in the data] toward potential explanations of it" (Schwartz-Shea and Yanow 2012, 28). In this process of figuring out sense-making of a 'surprising' empirical phenomenon the researcher continually reflects back and forth simultaneously considering additional empirical data and theoretical approaches (ibid., p.27). Rennie (2005, 94) explains that in the coding process of data analysis inductive and abductive procedures alternate. Following the inductive classification and grouping of concepts, abduction occurs when assigning categories, which again are tested in the subsequent inductive analysis of the text. Eventually, resulting hypotheses from abductive inferences again are tested by inductive analysis of the empirical material. Depending on the resulting interpretations, the categories, hypotheses, and abductive inferences may be rejected or modified accordingly.

Expanding on the depiction of the research process from the second section of this chapter, in the following I briefly describe the specific process of knowledge production and development during qualitative data analysis for this doctoral thesis. The initial research stage confirmed that climatic and environmental factors contribute to explaining temporary and seasonal migration, which was neither a surprising nor new finding. Moreover, the multiple determinants and destinations of migration became apparent. Against the background of conceptual and methodological deficits, the following research phase was characterized by the separated collection and analysis of data about migration as well as climatic and environmental conditions. This led to less biased and more profound insights into the multidimensional, multilocal characteristics, and determinants of migration phenomena on the one hand, and climatic, environmental, and agro-ecological conditions and implications on the other hand. The advancing collection and analysis of empirical material revealed increasing knowledge and relevance of networks, repetitive and multi-directional migration, the temporal and biographical aspects of population movements, as well as the meanings of resource flows and feedback effects. Consequently, the relevance of the environmental dimension as a potential explanatory root cause and trigger of migration, let alone an overarching migration motive, moved into the background. Instead, I refocused on existing high mobility in the research context as historically well-established and above all circular. Similarly, the research interest increasingly involved

information from migrants at several places of identified migration networks and shifted toward the translocal social structures, conditions, and organization of migration, and the perpetuating and reinforcing determinants of circular mobility together with their multilocal (feedback)effects and implications. Here, the less biased research approach and the openness of the interviews at multiple places played an essential role. Furthermore, the ongoing consideration of additional research literature together with supplementary theoretical-conceptual approaches helped to integrate and make sense of the complexity of empirical data. During the process of data analysis this approach essentially facilitated in formulating the final research question and the final key category of translocality. At this point, I recoded and rearranged the rest of the data. In doing so, I could reintegrate the environmental dimension with the help of the concept of (translocal) political ecology and even considered aspects of environmental change as potential feedback effects of migration which was not intended at the beginning of the research project. An inferential and consistent theoretical synthesis suitable to explain the empirical data has been achieved by the integration of complementary theoretical approaches of translocality, migration research, and (translocal) political ecology.

5.7 The standardized sample survey

In March 2012, and as one step of the research project micle, a large-scale individual sample survey was conducted by local teams of interviewers in Senegal (under supervision of a project team member) and Mali (under supervision of the author). The main objective of the survey was to investigate destinations and temporal patterns of migration from the rural study areas in Mali and Senegal, migration motives, the assessment of climatic and environmental change, and to describe migrants and non-migrants in terms of their social, cultural, and economic characteristics (van der Land 2018). For this thesis, only survey data from Mali were included with the aim to supplement qualitative research findings with descriptive statistics.

The questionnaire was developed on the basis of preceding qualitative research findings and migration survey questionnaires previously carried out in West African countries (CERPOD 1994; Doevenspeck 2005; EACH-FOR 2009). Migration was defined as an absence from the home village of at least three months. Survey interviews were exclusively conducted with people who were born in the respective rural study areas. Respondents were older than 18 years and included persons in the selected villages with and without migration experience, as well as migrants who were present or lived in Bamako.

The questionnaire (see annex) was structured in such a way that it could be applied to both countries and respondents in rural areas (with or without migration experience) and the capitals.

Persons without their own migration experience could still give valuable information about migration of family members. Moreover, to largely eliminate biases in responses about the determinants of individual migration decisions, questions about economic activities, livelihood, and the assessment of agricultural and climatic conditions were asked at the end of each interview. The migrant part of the questionnaire focused on the first and the last migration experience of the interviewee. On the one hand, this was motivated by the wish to limit the length of the interview to thirty minutes, which would not be sufficient to collect entire migrant biographies.

The survey was carried out in two steps. The first part of the survey was conducted in villages in the Bandiagara study area resulting in 324 valid interviews, the second part in Bamako with 121 valid questionnaires. No detailed and up-to-date census data or population register statistics on the level of the study region nor about the surveyed communities were available. The lacking information on the sampling frame in terms of population figures and composition as well as the use of a non-probability sample selection method makes it difficult to assess the extent to which the chosen sample is representative for the village communities or the entire research areas. Given the research settings, the above-mentioned limitations of information, shortage of time and financial means, the applied sample selection followed 'judgment' and 'quota'[5], which has been 'the rule' in past migration surveys (cf. R. E. Bilsborrow, 1984:92). The latter point, however, must not be a justification of a non-probability, non-random sampling procedure at all stages of the survey. The selection of 18 villages in Bandiagara (see Fig. 1) can best be described as a 'judgment sample' that aims to cover a large area of the pre-identified study region and consider a diversity of physiographical settings while providing variation in the sizes of village population. At the same time the specific choice of settlements took into account time, logistical, and infrastructural constraints and travel distances. "[A] judgment sample *by someone knowledgeable* about the vicinity is likely to be desirable to ensure that particularly unusual, atypical areas are not selected. Judgment samples are thus reasonable for preliminary or descriptive studies of migration […] or where budgetary constraints are dominant considerations" (ibid. 1984, 93). The composition of selected interviewees in the villages is a quota sample according to three predefined age groups (18-30; 30-50, and 50+ years old) that were equally distributed amongst the entire sample. In addition, the quota aimed to consider between 30 and 50 percent of women, taking into account that generally fewer women are engaged in migration compared to men (Bocquier and Diarra 1999, 64; S. Traoré 2011; DPS

[5] "Either one or a small number of areas is chosen at the first stage – perhaps because of limited survey objectives or budget constraints – or *quota samples* […] are used at the last stage in the selection of respondents (elements) for interview" (Bilsborrow 1984, 92).

2004, 250), and resulted in a share of 37% in Mali. Within villages interviewers carried out interrogations in preferably all different quarters or family compounds. The choice of respondents was arbitrary (non-random) and sought to fulfill the quota. The selection of the migrant sample in the capital followed the same specifications. Here, the identification and location of interviewees originating from the rural study areas was based on existing personal research contacts with migrants, personal contacts of interviewers, and a snowballing strategy. By using these non-random selection techniques, interviewer biases in the final choice of respondents are inherent.

Carried out in parallel with the individual survey interviews, one village questionnaire was completed in each settlement with the village elders to extract general information about the village's population, infrastructure, and migration history (see annex). This interview involved the preparation of an inventory of local tree species and their perceived increase or decrease over the past 50 years on village land (cf. Gonzalez, 2001).

After completion of the survey, the questionnaires were handed over to a private company in Germany that entered the handwritten data and transferred them into a SPSS-software data matrix. Subsequently, one project team member controlled, corrected, and processed the data matrix. Data analysis was completed using SPSS and yielded mainly descriptive statistics of nominal scale information (qualitative characteristics).

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ii. PUBLICATIONS

1. List of scientific papers and own contributions

The doctoral thesis comprises eight scientific papers; seven peer-reviewed publications and one manuscript in preparation for submission.

Manuscript 1
Authors: Martin Brandt (major), Clemens Romankiewicz (minor), Raphael Spiekermann (minor), Cyrus Samimi (minor).
Title: Environmental change in time series – an interdisciplinary study in the Sahel of Mali and Senegal
Publication: 2014. Journal of Arid Environments 105: 52–63.
Own contribution: Data acquisition and analysis (20%), writing (10%), concept and discussion (10%)

Manuscript 2
Authors: Clemens Romankiewicz (major), Martin Doevenspeck (minor)
Title: Climate and mobility in the West African Sahel: conceptualizing the local dimensions of the environment and migration nexus
Publication: 2014. Book chapter in: H. Greschke & J. Tischler (eds.): Grounding Climate Change. Contributions from the Social and Cultural Sciences, Dordrecht: Springer, 79-100.
Own contribution: data acquisition and analysis (90 %), figures (90%), writing (90%), concept and discussion (70 %)

Manuscript 3
Authors: Clemens Romankiewicz (major), Martin Doevenspeck (minor)
Title: Migration und Umwelt im westafrikanischen Sahel: methodische Überlegungen
Publication: 2013. Chapter in: Felgentreff, C. & Aufenvenne, P. (eds.): Migration und Umwelt, Osnabrück: IMIS Beiträge 44, 81-96.
Own contribution: data acquisition and analysis (70%), figures (80%), writing (60%), concept and discussion (60%)

Manuscript 4
Authors: Angelo Müller (major), Clemens Romankiewicz (major)
Title: Mobilität zwischen westafrikanischer Freizügigkeit und euroäischer Grenzziehung
Publication: 2013. Geographische Rundschau 9, 12-18.
Own contribution: data acquisition and analysis (90%), figures (95%), writing (70%), concept and discussion (70%)

Manuscript 5
Authors: Lina Eklund (major), Clemens Romankiewicz (major), Martin Brandt (minor), Martin Doevenspeck (minor), Cyrus Samimi (minor)
Title: Data and methods in the environment migration nexus: a scale perspective
Publication: 2016. DIE ERDE /147/2, 139-152.
Own contribution: data acquisition and analysis (50%), figures (30%), writing (50%), concept and discussion (50%)

Manuscript 6
Authors: Clemens Romankiewicz (major), Martin Doevenspeck (minor), Martin Brandt (minor), Cyrus Samimi (minor)
Title: Adaptation as by-product: migration and environmental change in Nguith, Senegal
Publication: 2016. DIE ERDE /147/2, 95-108
Own contribution: data acquisition and analysis (80%), figures (80%), writing (90%), concept and discussion (90 %)

Manuscript 7
Authors: Victoria van der Land (major), Clemens Romankiewicz (minor), Kees van der Geest (minor)
Title: Environmental change and migration. A review of West African case studies
Publication: 2018. In McLeman, R. & Gemenne, F. (eds.): Routledge Handbook of Environmental Displacement and Migration, 163-177.
Own contribution: data acquisition and analysis (25 %), figures (25%), writing (25%), concept and discussion (25%)

Manuscript 8
Authors: Clemens Romankiewicz
Title: Translocal implications of circular mobility among the Dogon of Mali
Publication: Preparation of submission
Own contribution: Data acquisition and analysis (100%), figures (100%), writing (100%), concept and discussion (100%)

2. Contextual design

The presented complementary publications constitute different conceptual, methodological, and empirical contributions, partially build upon each other, and similarly reflect the knowledge development of this thesis (see Fig.4). After once again posing the research questions (RQ) the following summaries of the manuscripts clarify their specific contributions and how they are connected.

RQ1: What are the spatial and temporal characteristics and trends of contemporary migration patterns?

RQ2: What are the central trends of agro-ecological conditions and what are their (multi)local interpretations?

RQ3: Which methodological shortcomings and challenges exist in empirical research linking the environment and migration?

RQ4: What are the translocal and multi-dimensional aspects and feedback effects of population movements and how do they shape (circular) migration?

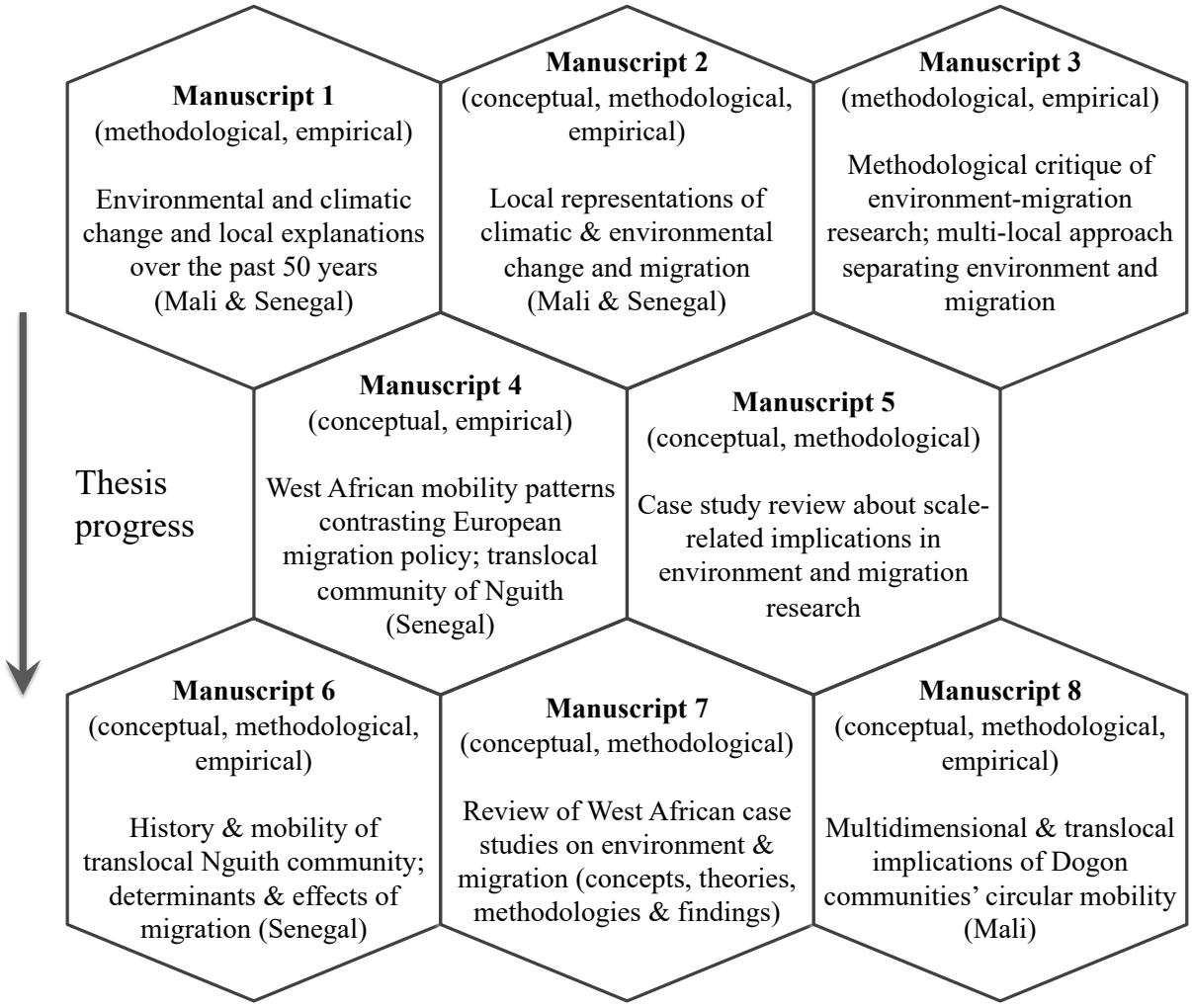


Figure 4: Overview of scientific contributions constituting the cumulative dissertation

Manuscript 1: Environmental change in time series – an interdisciplinary study in the Sahel of Mali and Senegal

This study aimed to identify and explain climatic and environmental trends in the Senegalese and Malian rural research areas based on time series, satellite imagery, and fieldwork. My specific contribution comprised collecting and interpreting people's representations and explanations of local changes in rainfall, temperature, soil fertility, woody cover, the diversity of tree population, capacities of pasture, and crop yields. The paper thus contributes to RQ2.

The study shows that drought events, less rain, and higher temperatures as well as increased demand for cropping areas and wood led to a general decrease in original forests, tree density and diversity. However, despite considerable intra- and interannual variability, a positive overall trend of annual rainfall and greening can be observed in both research areas since the mid-1980s. At the local level, degradation phenomena and vegetation cover are very heterogenous and determined by both climate and human activities. Moreover, local greening trends are increasingly shaped by anthropogenic factors such as farmer-managed agro-forestry, planting programs, and protection laws. The study contributed to better understanding the relevance of the complex interplay and meanings of climatic, geophysical, historical, social, political, and cultural factors for people's natural resource and farm management. I deepened the resulting knowledge for the case studies and drafting of the manuscripts 2, 6, and 8. Moreover, the work for this paper provided conceptual and methodological reflections for the manuscripts 3 and 5.

Manuscript 2: Climate and mobility in the West African Sahel: conceptualizing the local dimensions of the environment and migration nexus

Based on preliminary results from the Senegalese and Malian rural research areas, this paper addresses spatial and temporal patterns as well as multidimensional contexts and determinants of migration, including the potential impacts of climatic and environmental change. The paper concerns all four research questions (RQ1 to RQ4).

Against the background of conceptual and methodological shortcomings, a local research perspective aimed at a separate investigation of population movements and climate/environment considering cultural norms, migration history, and the social construction of environmental parameters as drivers for migration. Contrasting local assessments and interpretations of weather and vegetation change with physical macro data shows people's differentiated perception and concernment. They similarly stress the timing of rainfall, multidimensional factors influencing crop yields, and multiple strategies to compensate harvest

losses. Seasonal, temporary, circular migration within Mali, Senegal, and West Africa dominate. While urban centers, and especially the capitals Bamako and Dakar, represent major destinations for both research contexts, migration to Europe was only pertinent for the Senegalese study area. The study shows that seasonal and temporary migration, as a well-established adaptation to seasonality and variability of rainfall, remains relevant. Similarly, migration is essentially shaped by political, economic, social, and cultural dimensions and processes of change. This study's research approach and findings essentially inform manuscript 3 and constitute a point of departure for empirical and conceptual progress reflected in the manuscripts 4, 6, and 8.

Manuscript 3: Migration und Umwelt im westafrikanischen Sahel: methodische Überlegungen

This contribution's main objective is to illustrate the methods applied to investigate the environment and migration nexus in previous research attempts, to reveal significant shortcomings, and to present an alternative approach. The paper contributes to RQ3.

A major identified methodological flaw is that researchers often pose suggestive questions about direct linkages between environment and migration and frame migration accordingly, i.e. informants undergo problem-scanning (including potential climatic and environmental stress) with regard to their migration decision. This (biased) approach risks leading to relevant biases in answers and research results. In response, the chapter proposes the methodological approach of a multi-local and mobile ethnography separating migration and environment during field research only allowing the respondents to establish causal relationships. The sketched empirical findings from Mali and Senegal largely refer to those portrayed in the manuscript 2. The conceptual-methodological reflections of this contribution are linked to and complemented by those of the manuscripts 5 and 7.

Manuscript 4: Mobilität zwischen westafrikanischer Freizügigkeit und europäischer Grenzziehung

Illustrating and contextualizing West African population movements and contrasting them with current European migration policy is the aim of this article. It offers a case study about a Senegalese translocal community and provides answers to RQ1 and RQ4.

The majority of contemporary West African population movements is internal, intraregional, and circular, and largely shaped by historical migration patterns. Compared to Maghrebian nationals, only a fraction of West Africans are among the migrants irregularly crossing the

Mediterranean to Europe. Moreover, the majority of illegal migrants in Europe enter legally and overstay their visa. In light of this, European efforts to externalize their border and migration control (in)to transit countries such as Mali and Senegal tends to restrict and criminalize regional migration (especially toward North Africa) and thus contradicts people's long-established intraregional freedom of circularity and translocal livelihoods. The empirical example of the Senegalese community of Nguith shows how multidirectional and circular migration within international networks form and perpetuate a translocal social space. Translocal movements (within or across national borders) thus represent habitual economic and social practice. A more comprehensive analysis of the Nguith case study with regard to the discussion of migration and environmental change contains manuscript 6.

Manuscript 5: Data and methods in the environment migration nexus: a scale perspective

This case study review highlights methodological implications regarding scale as is largely neglected in environment and migration research. My contribution comprises relevant parts of the introduction, the presentation of the concept of scale, the analysis of scale issues in migration and socio-economic data and methods of analysis as well as the conclusion. This publication refers to RQ3.

The study shows that scale issues take significant effect in collecting and linking environmental and migration data. According to the extent and resolution of spatial and temporal scale dimensions, the paper identifies relevant shortcomings in (gathering) quantitative and qualitative data and different methods of analysis used in the reviewed case studies. Limitations are for example apparent in defining the time interval between residence changes for migration data or the explanatory power of vegetation data depending on the spatial resolution of satellite images. Moreover, due to scale mismatches, restructuring information that links and analyzes migration, socio-economic, and environmental data within the same time frame and spatial boundaries bears the risk of ecological fallacy. This contribution is linked to the manuscripts 3 and 7.

Manuscript 6: Adaptation as by-product: migration and environmental change in Nguith, Senegal

The objective of this case study about the Senegalese Nguith community is to challenge simplified representations of causal relationships between environment and migration by equally allowing for the multiple dimensions of population movements. It assumes that migration along social networks (within and beyond Senegal) as a well-established practice and

contextualizes interrelations between climate, migration, and land-use change with social, cultural, and historical information. The publication answers RQ1, RQ2, and RQ4.
The contribution reveals the significance of the socio-historical and religious background of the community for their high mobility and illustrates their translocal migration network across different countries and continents. Multidirectional circular movements continuously maintain and strengthen social bonds, mutual solidarity, and traditional values shaping translocal social space and a common identity. Remittances and investments essentially contribute to economic diversification and land use change in the village of Nguith reflected by a noticeable decrease of traditional rainfed-farming. The translocal community's high mobility and Nguith's associated increasing independence from local agro-ecological conditions, however, must rather be regarded as a by-product rather than an intentional adaptation. Empirically, this publication expands on manuscript 4 and stimulated the theoretical-conceptual approach of manuscript 8. Merging manuscripts 1, 2, 4, and 6 yields my empirical contribution for the Senegalese research context.

Manuscript 7: Environmental change and migration. A review of West African case studies

The chapter reviews empirical case studies about environment and migration in West African drylands with regard to their findings as well as applied theoretical concepts and methodology. My main contribution concerns the analysis of theoretical and conceptual approaches. Moreover, my own research efforts in form of manuscript 6 were considered among the reviewed studies. The systematic analysis of applied theoretical-conceptual approaches and methods contributes to RQ3.
The publication shows that apart from few exceptions most research about environment and migration in West Africa is still entrenched in the simplistic push-pull framework. Apart from the recognition that environmental change mainly concerns temporary migration, the multitude of methods, migration definitions, and environmental parameters considered makes it difficult to compare findings or get to a coherent conclusion. Merging manuscripts 3, 5, and 7 gives an overview and analysis of hitherto applied methods in environment and migration research highlighting multiple aspects of (potential) shortcomings and challenges.

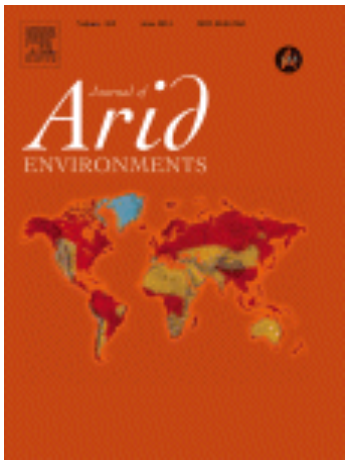
Manuscript 8: Translocal implications of circular mobility among the Dogon of Mali

The manuscript aims at explaining how multiple dimensions shape circular population movements of the Dogon people of Mali in a translocal setting. The findings contribute to RQ1, 2, and 4.

The study shows that circular migration to urban centers in Mali such as Mopti, the capital Bamako and Abidjan (Côte d'Ivoire) are historically established and form translocal networks with the rural Dogon country. The increasing importance of circularity and the diversification of its timing cannot only be explained by the variability of rainfall and uncertainty of yields. Rather, the closely intertwined social and economic feedback effects of migration are self-reinforcing, have multilocal cumulative consequences and thus perpetuate or further impede migration. Moreover, the socially differentiated assets between and within communities of the rural Dogon country strongly interdepend with migrants' social capital and economic opportunities in the cities. They essentially shape the mobility patterns and simultaneously reinforce translocal livelihoods. Conceptually, manuscript 8 progressively evolved from manuscripts 2, 4, and 6. The combined results of manuscripts 1, 2, and 8 build on the empirical contribution for the Malian research context.

3. Published Manuscripts

3.1 Environmental change in time series –an interdisciplinary study in the Sahel of Mali and Senegal



Martin Brandt, Clemens Romankiewicz, Raphael Spiekermann, Cyrus Samimi. 2014.
"Environmental change in time series – an interdisciplinary study
in the Sahel of Mali and Senegal."
Journal of Arid Environments 105: 52–63.

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Environmental change in time series – An interdisciplinary study in the Sahel of Mali and Senegal

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ABSTRACT

Climatic changes and human activities have caused major environmental change in the Sahel. Remote sensing studies detect various vegetation trends; however, explanations are rarely studied in detail. We present a methodology using time series, high-resolution imagery and fieldwork to validate trend analyses for two regions in the Sahel of Mali and Senegal. Both study areas show significant greening trends from 1982 to 2010. Reasons can be very site-specific, but several factors are valid for both research areas: (1) farmer-managed agro-forestry, (2) planting programs and protection laws, (3) widespread dispersion of robust species, which replace the former diverse woody vegetation and simulate a greening which conceals a shift in biodiversity and (4) an increase of annual rainfall. However, the situation is still far from the pre-drought conditions, which are reconstructed by Corona imagery (1965) and interviews with the local population. Rather a transformation is observed: a decrease in natural vegetation, tree density and diversity. Reasons are climatic and anthropogenic: (1) drought events, less rain and higher temperatures, (2) increased demand for cropping areas and wood, especially in times of droughts. Our example validates that climatic factors are important drivers of change, but much of today's environment and vegetation composition is controlled by humans.

1. Introduction

During the 1970s and 1980s severe droughts occurred in the West African Sahel followed by a considerable decrease of mean rainfall (e.g. Zeng, 2003). Together with financial and political instability and regional conflicts, the droughts contributed to famines and sparked not only concern at global scale by politicians and development organizations, but also an increasing scientific interest in the causation and extent of the observed environmental change in the Sahel (Hutchinson, 1996).

Initial assertions acclaimed widespread irreversible desertification (Lamprey, 1988) caused by deforestation and atmospheric reactions which led to the droughts and decline in rainfall (Charney et al., 1975). Combined with a southward encroachment of the Sahara desert much of the Sahel was expected to become degraded, unusable land (e.g. Kandji et al., 2006; Oldeman et al., 1990). The Sahel region has thus been branded as one of the "hot spots" of global environmental change (e.g. Kandji et al., 2006). Several studies have shown that primarily oceanic surface temperature controls Sahelian rainfall (e.g. Giannini et al., 2008). Land cover changes merely play a secondary role when explaining changes in rainfall patterns (Paeth et al., 2011). Moreover, further assessments did not find evidence of widespread degradation, which has led to a discussion of the term "degradation" itself and also to a questioning of the causes and existence of irreversible land degradation (e.g. Hutchinson, 1996; Tiffen and Mortimore, 2002).

Remote sensing has always been a valuable tool to assess environmental changes in the Sahel. The Global Inventory Modeling and Mapping Studies (GIMMS) dataset (Tucker et al., 2005) has been used to monitor Normalized Difference Vegetation Index (NDVI) time series since 1981. Various studies did not find evidence of widespread degradation but rather a considerable greening trend in most parts of the Sahel (e.g. Anyamba and Tucker, 2005; Olsson et al., 2005). Even if the correlation of vegetation and rainfall is high, a study by Herrmann et al. (2005) demonstrated that much of the observed greening is decoupled from rainfall. Attempts to assess land degradation with remote sensing tools are still popular (e.g. Fensholt and Rasmussen, 2011; Martinez et al., 2011), but a changing context in the desertification debate

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highlights the importance of an interdisciplinary approach which includes ecological and social aspects (Herrmann and Hutchinson, 2005; Reynolds et al., 2007).

There is no doubt that the Sahelian environment is changing. Anthropogenic disturbances and varying rainfall have massive effects on flora, fauna and soil. It is not easy to distinguish between human-induced and climate-driven dynamics, between short-term fluctuations and long-term changes (Mbow et al., 2008; Miehe et al., 2010; Wessels et al., 2007). Long-term studies indicate an overall decrease in natural vegetation and an increase in agricultural areas (e.g. Mougin et al., 2009; Tappan et al., 2004). Tree density has decreased but depending on morpho-pedological conditions, there is a moderate recovery since the droughts, which confirms the resilience of Sahelian vegetation (Hiernaux et al., 2009; Tappan et al., 2004). Detailed ground studies (e.g. Reij and Smaling, 2008; Yossi and Diakite, 2008), often supported by remote sensing tools, describe several success stories where farmer managed natural regeneration (FMNR) lead to a massive greening in several Sahelian countries but rather degradation is also detected (Miehe et al., 2010). Several investigators agree that there is a shift and decline of tree species diversity in the West African Sahel that is related to a more arid climate (Gonzalez, 2001; Gonzalez et al., 2012; Herrmann and Tappan, 2013; Hiernaux et al., 2009; Vincke et al., 2010).

Many investigators used coarse-scale time series to detect environmental trends and changes and to show the dynamic nature of the Sahelian ecosystem. However, detailed explanations for these trends remain largely unknown or speculative. Studies at tree/village level remain local and are rarely embedded into global datasets.

Our study in Mali and Senegal aims to find explanations for vegetation trends and therefore contributes to an ongoing greening vs. degradation discussion. Coarse resolution studies on the Sahel are incapable of establishing whether the "greening trend is a return to pre-drought conditions or simply a transition to a new equilibrium state with a different vegetation composition" (Herrmann et al., 2005 p. 402). In accordance with the recommendation of Herrmann et al. (2005), we use detailed fieldwork at a local scale and analyses of finer resolution spatial data. Multiple datasets and methodologies over different periods are used and their application to various spatial and temporal scales is explored. Global remote sensing techniques are broken down to a local scale and combined with high-resolution images to visually identify hot spot areas. Based on the image interpretation, explanations for a sample of both positive and negative hot spots by means of several case studies are discussed. Natural- and social scientific methods are combined to assess the current environmental setting, reconstruct pre-drought conditions and find explanations for trends and changes.

Several studies that overlap our own research areas form the basis of our work. For Senegal, these studies are manifold (CSE, 2008; CSE, 2009; Diouf and Lambin, 2001; Martinez et al., 2011; Mertz et al., 2009; ROSELT, 2005; Stancioff, 1984; Tappan et al., 2004) and contrast to Mali where only few related studies are available (e.g. Bruijn et al., 2005; IPE-Mali, 2009; Yossi and Diakite, 2008). Until now, only the Gourma region to the north of our study area has been the object of detailed environmental research (e.g. Hiernaux et al., 2009; Mougin et al., 2009).

2. Materials and methods

2.1. Study areas

The study areas are located in Senegal around Linguère and in Mali around Bandiagara (see Fig. 1a, b). The research area around Linguère is located in the semi-arid Sahel with mean annual precipitation around 400 mm (1950–2010) which mainly falls between July and September with extreme inter- and intra-annual variations (coefficient of variation is 28 mm for the period 1950–2010). Even though this research area is small (about 50 × 50 km), there is a steep north-south gradient and mean annual rainfall is 60 mm higher in the southern part compared to the northern part. The region is named after the seasonal Ferlo River, a traditionally silvo-pastoral zone, mainly inhabited by semi-nomadic Fulani pastoralists. Around Linguère cropping represents an important occupation by Wolof and also Fulani farmers. The sandy soils are suited for the cultivation of millet and groundnut, followed by fallow periods to preserve soil fertility. The woody vegetation is characterized by an open tree and shrub savanna with low vegetation diversity. Small depressions with clayey and temporarily flooded soils are widespread in this area. Droughts have caused considerable damage to the vegetation, especially in the lateritic eastern part where tree cover has decreased from 10–20% to 5–15% in the past 50 years (Tappan et al., 2004).

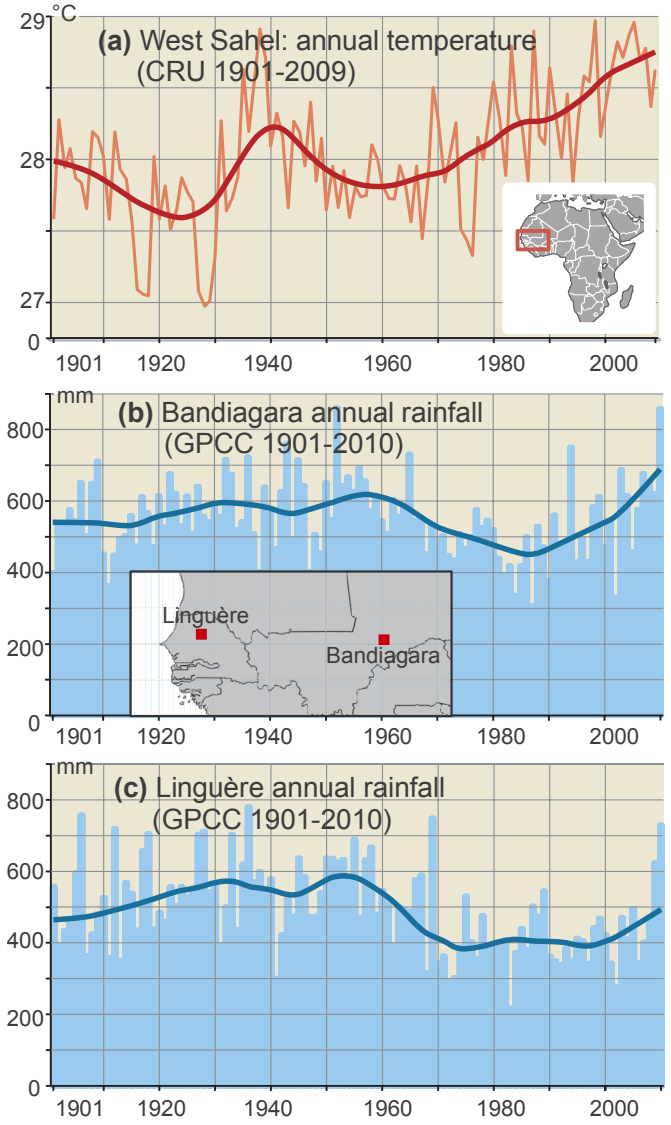

Fig. 1. Mean annual temperature 1901–2009 averaged over West Africa (a) and annual rainfall 1901–2010 averaged over the Bandiagara (b) and Linguère (c) research area. The location of the study areas can be seen in (b).

The Malian research area around the town of Bandiagara is inhabited by Dogon farmers and to a much lesser extent by Fulani pastoralists. Rainfed agriculture (millet, groundnut and sorghum) and vegetable gardening (mainly onions) are the main economic activities. Soils on the plateau between the towns Sevaré and Bandiagara are sandy, lateritic and in places with rocky sandstones, cultivation is challenging. Valleys are mainly used for cropping and onion plantations are found where irrigation is possible. The Séno Plain around Bankass stretches southwards from the Bandiagara escarpment and represents a different morphological zone. Sands are deep and infertile but more than 90% of the whole area is used for rotational cropping. Annual rainfall is around 500 mm (1950–2010), which mainly falls between June and October with a considerable inter- and intra-annual variability (coefficient of variation is 23 mm for the period 1950–2010).

In both study areas, trees and shrubs play a major role in peoples' daily life. Besides being the main source for firewood, they fulfill a variety of traditional functions related to cooking, medicine, religion and for constructions. Leaves and fruits also represent an important source of animal fodder. Selling firewood and charcoal is a common practice and constitutes a considerable income for the local population but requires purchasing an official permission from the Governmental Forest Agency. However, traditional landowner rights and control mechanisms largely determine access and exploitation of woody resources.

2.2. Data

Data of different spatial and temporal scales were used to assess and evaluate changes at different levels (Table 1). Land long Term Data Record (LTDR) and SPOT-Vegetation (VGT) coarse-scale time series provided long-term NDVI trends from 1982 to 2010 and Moderate Resolution Imaging Spectroradiometer (MODIS) moderate resolution time series contribute short-term trends at a much higher spatial resolution with more details for the period 2000–2010. Several hot spot areas were identified in which pre-drought conditions were reconstructed at tree level by high-resolution Corona-imagery (1965–67) and by information from the local population. Recent conditions were monitored at the same level by field surveys and RapidEye imagery. Climate data from different sources gave information about rainfall and temperature trends and changes.

2.2.1. LTDR–SPOT long term time series

SPOT-VGT (S) data were downloaded at a temporal scale of 10 days and a spatial resolution of 1 km. The time-frame is 1998–2010. This product consists of an unfiltered 10 day Maximum Value Composite (MVC) NDVI and a corresponding quality flag, which uses a bit pattern to rate the quality of every pixel in 5 classes. The MVC method selects the highest value within 10 days, thus excluding clouds with low values. After extracting the area of interest, a Savitzky Golay filter was applied to smooth the time series pixel-wise. For more information on the method we refer to Chen et al. (2004). The filter implements a local polynomial regression to filter out bad values mainly caused by clouds and atmospheric disturbances. According to the quality file, every pixel attained a particular weight, which was used to calculate the new time series. This is an extremely important procedure since clouds are a major problem during the rainy season and are often obstructive for more than 10 days.

LTDR is an AVHRR (Advanced Very High Resolution Radiometer) derived product, which uses new methods to obtain a daily high quality NDVI product at a spatial resolution of 0.05° (approximately 5 km). As of yet, the years from 1982 to 1999 are available in Version 3 and are distributed by the Goddard space flight center. Quality flags are processed for every pixel using methods, which are comparable with the MODIS program. After downloading daily images, 10 day MVCs were created which match the SPOT VGT periods. The quality flag points out the day used in the MVC and marks pixels of low quality. In a further step, the NDVI time series was smoothed with a Savitzky Golay filter and weighted with the respective quality flags. Due to bad quality, 1994 was completely masked as not available (NA).

Global LTDR and SPOT-VGT NDVI images were used to create a NDVI time series from 1982 until 2010 at a spatial resolution of 0.05° and a temporal resolution of 10 days. SPOT-VGT was aggregated to the spatial resolution of the LTDR images using a median filter. Then a pixel-wise regression was carried out for the two overlapping years 1998 and 1999 for the two research areas separately. R^2 is 0.94 in the Linguère- and 0.92 in the Bandiagara region. The next step was to model and adjust the LTDR time series to the SPOT-VGT series via the regression coefficients of the two overlapping years. This was necessary due to the different sensor specifications of both products. After combining the two series to the new LTDR–SPOT, comparisons were made with the often-used GIMMS showing a good agreement in our research areas. Due to the improved methods and the better temporal and spatial resolution, the new series proved to be of superior quality to GIMMS showing much more details and a more reliable time-line.

2.2.2. Terra MODIS short term time series

The product used was MOD13Q1 with a temporal resolution of 16 days and a spatial resolution of 250 m, which is available since March 2000. The individual images were delivered with a quality file, rating each pixel between 0 (highest quality) and 15 (not produced). Only pixels with values below 8 (below average) were further processed. The NDVI time series was then smoothed with a Savitzky Golay filter weighted with the corresponding quality files. Pixels were weighted by their quality to produce a smooth line and to eliminate clouds and atmospheric disturbances.

2.2.3. High resolution imagery

Corona satellite images were declassified by the U.S. Geological Survey (USGS) (McDonald, 1995) and in most cases represent the only available source that offers an impression of pre-drought conditions of the research areas in the 1960s. Images are panchromatic with a resolution of about 2 m. Available Corona Images in the Senegal are dated at December 1965 (KH-4A 1028) and in Mali December 1967 (KH-4B 1102). They were manually georeferenced using Google Earth as reference and almost 500 control points for each study area.

Twenty-two RapidEye images from December 2010 (Senegal) and 2011 (Mali) complement the high-resolution Corona images and were acquired for both research areas to monitor change at tree level. RapidEye provides multi-spectral data at spatial resolution of 6.5 m. In this paper we use a RGB composition with the bands 532 (infrared, red, green) to highlight single trees from their surrounding. Vegetation appears red in these images, whereas the

Table 1
Continuous coarse and moderate resolution data products used in this study.

Product	Spatial resolution	Time-frame	Temporal resolution	Variable
MODIS MOD13Q1 v5	250 m	2000–2010	16 days	NDVI
SPOT VGT-S	1 km	1998–2010	10 days	NDVI
LTDR v3	0.05°	1982–1999	Daily	NDVI
GPCC v6	0.5°	1901–2010	Monthly	Precipitation
CRU v3.1	0.5°	1901–2009	Monthly	Temperature

panchromatic Corona displays vegetation in dark gray and black colors. In cases where features were not detectable in RapidEye, Google Earth was additionally used for visual analysis. The Google Earth data used in our study area was delivered by DigitalGlobe and consists of Quickbird satellite imagery from the dry seasons of the years 2005–2009. A table of the Corona and RapidEye scenes used in this study is provided in Appendix 1, electronic version only.

2.2.4. Climate data

GPCC (v6) (Global Precipitation Climatology Centre, Rudolf et al., 1991) and CRU (v3.1) data (Climate Research Unit, Mitchell and Jones, 2005) interpolate monthly stationary data at 0.5° resolution and fully depend on reported station data, which can vary extremely from year to year. We compared GPCC with station data, and GPCP (Global Precipitation Climatology Project, Adler et al., 2003) in our study areas and came to the conclusion that GPCC was a good source for annual rainfall as was CRU for mean temperature if used with consideration of the limitations of these datasets. For the period 1933–2010, R^2 between yearly station data and GPCC rainfall is 0.82 over the Linguère weather station.

2.3. Methodology

This study follows a multi-level, multi-site, multi-method and interdisciplinary research design. After vegetation trends were identified by time series, we visually compared high-resolution imagery from 2010/2011 (RapidEye) respectively 2005–2009 (Google Earth) and the past (1967, Corona) in areas of interest. Based on the assessments of this comparison, specific areas were selected and visited in the field. Besides detailed vegetation measurements, interviews were conducted with local people from nearby villages. This study concentrates on the woody vegetation as trees and shrubs are an important factor in steady states of savanna ecosystems and in peoples' daily life (Croll and Parkin, 1992). Additionally trees are long-lived and therefore changes in tree populations are an indicator of long-term changes. Another reason is the fact that most of the trees remain green over the dry period and hence infrared satellite imagery can be used to detect and quantify trees over large areas. NDVI was used as an indicator for green vegetation as it is a robust and comparable index (e.g. Anyamba and Tucker, 2005). It is important to emphasize that an increase in NDVI over large areas does not necessarily mean an increase in tree density, as crown cover varies inter- and intra-annually. Therefore, positive trends are understood to mean an increase in overall biomass. What exactly causes the increase in NDVI needs to be examined.

2.3.1. Time series analysis with coarse and high resolution data

Filtered LTDR–SPOT and MODIS NDVI time series were used to perform trend analysis at different spatial scales. Regression analysis extracted significant ($p < 0.05$) slope values, which were recalculated to NDVI to express the total change over 29 years. To estimate the herbaceous and woody layer separately, a Seasonal Trend decomposition based on Loess (STL) was done (Cleveland et al., 1990). This method uses a local regression to separate the seasonal component from the yearly component in a time series. As most trees remain green during the dry season, the yearly component could be used to estimate the foliage production and therefore trends caused by the tree layer (Roderick et al., 1999). In the following, only the yearly component was used for trend analysis. We eliminated seasonal fluctuations by calculating a mean year using 11 years of MODIS images. The amplitude of the mean year was taken to quantify a pixel's productivity (Appendix 2, electronic version only). NDVI amplitudes smaller than 0.2 were allocated as degraded or unproductive land. The threshold was calibrated by test sites consisting of barren and unvegetated land.

2.3.2. High resolution satellite imagery

Areas identified by time series were compared with pre-drought Corona-imagery using RapidEye and if needed, Google Earth, for visual analyses. This offered a detailed overview of the environmental change at tree level i.e. a scale at which trees are clearly visible. Individual shrubs and small trees could not always be clearly identified on Corona and RapidEye images, however, single tree detection and quantification was not the scope of this study. Rather, tree density and land cover were observed and changes of nearly 50 years compared. After testing automated methods like object-based tree counting and supervised as well as unsupervised classifications, manual approaches i.e. visual inspection were rated more as reliable due to reasons mentioned in Tappan et al. (2004) and due to the fact that only hot spot regions and not the whole study area had to be compared. Areas with changes like loss of trees, transformation of land cover and increased woody vegetation as well as instances of no changes were identified by visual comparison of RapidEye and georeferenced Corona images. These places were then visited and validated in the field.

2.3.3. Fieldwork

Fieldwork was carried out during the dry seasons 2011 and 2012 (February and March) as well as in the rainy season 2012 (September) and provided information on land use systems, vegetation composition and the current environmental conditions. Guided by the data of the previous steps, i.e. conspicuous NDVI trends and changes in land cover and tree density, 145 transects (60 in Mali, 85 in Senegal) of approximately 200 m each were surveyed. Altogether 3301 individuals of trees and shrubs were identified after Maydell (1990) and surveyed along randomly selected line transects (see Herrick et al., 2005). Start and ending points of the transects were marked with a GPS. Further, all surveyed trees and shrubs were rated according their condition and usage (1–5) and classified in large (>4 m) and small (<4 m) to obtain comparable data to other studies (e.g. Tappan et al., 2004). These transects gave information about species distribution, abundance and their use by humans and livestock as well as trees' condition and age pattern. For several tree species, the relation between large and small trees can be taken as an indicator for the vitality of a species. Soil durability, degradation and erosion occurrence and processes were documented after Stocking and Murnaghan (2001). Additionally 5275 GPS-referenced landscape photos were taken in color with a digital camera. They documented visited areas and were the basis for ground validation of satellite imagery.

Most ethnographic fieldwork was conducted along with the ecological fieldwork. In the villages, the initial contact was carried out by a semi-structured interview with the chief or a group of elders and revealed a rough overview of the village's historical development. Apart from a few exceptions, an interpreter supported the communication. Further semi-structured individual and group interviews and key informant interviews were conducted to allow people to identify and assess changes in local climatic and environmental conditions. Questions addressed changes in rainfall, temperature, soil fertility, woody cover, the diversity of tree population, capacities of pasture, and crop yields (e.g. Mertz et al., 2009; Roncoli, 2006). Village elders gave valuable information regarding pre-drought conditions and long-term changes in natural resource and farm-management. Additionally, transect walks and site visits were conducted with villagers in the surroundings of settlements. First, observation results of the ecological fieldwork were considered in interview questions that focused on local people's interpretations and explanations of specific phenomena in

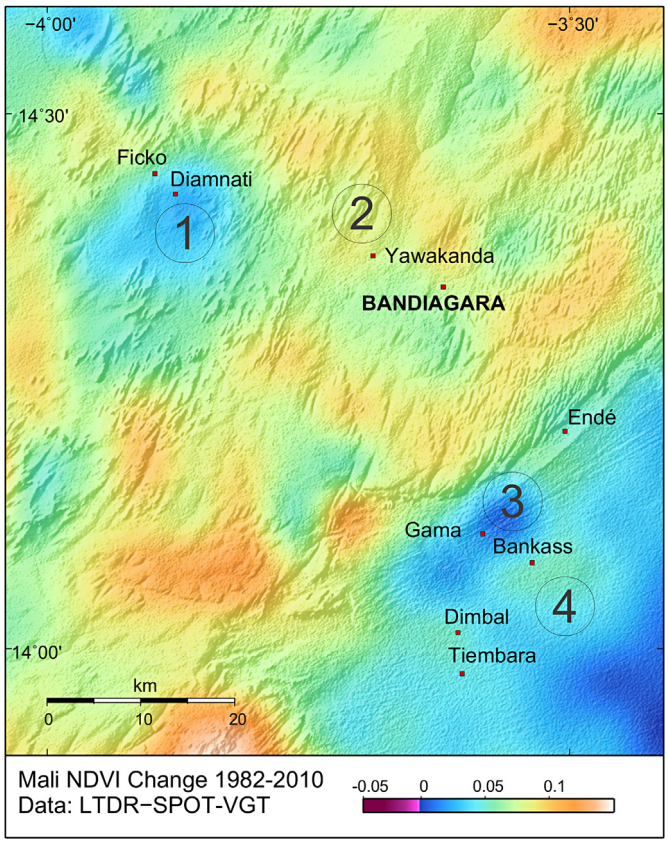

Fig. 2. LTDR−SPOT time series NDVI change from 1982 to 2010 in Mali. The numbers indicate the case study sites which are further explained within Chapter 3.2. Since the time series starts in times of droughts, no negative change can be observed. However, several areas do not follow the overall greening trend. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

the proximity of the respective villages. With the help of a village questionnaire, a local tree species inventory was developed and elders were able to identify trends in changing tree species composition of the past 50 years. For methods on local assessment of identified vegetation changes, see for example Gonzalez (2001).

3. Results and discussion

3.1. Rainfall trends

Trends of coarse-scale monthly products (GPCC and CRU) show that during the 70s and 80s of the 20th century the rainfall of our research areas dropped far below average (Fig. 1). Combined with a simultaneous increase in temperature (Fig. 1a), a shift to more arid climatic conditions was observed by Gonzalez et al. (2012) in several Sahelian regions. Annual rainfall in Linguère during 1970–2010 (390 mm) was only 75% of the 1930–1970 mean of 520 mm. In Bandiagara, the mean annual rainfall between 1970 and 2010 (501 mm) decreased by 13% compared to 1930–1970 (579 mm). According to Fig. 1, annual rainfall seems to be recovering in both research areas with extraordinary wet years in 2009 and 2010. In Mali, annual rainfall levels have almost reached pre-drought values in 2010, whereas in Senegal, the increase is much slower.

3.2. Mali case studies

Vegetation trends in the study area of Mali are positive, but major spatial discrepancies can be observed in Fig. 2. In the following, several hot-spot areas are chosen around the Dogon villages Diamnati, Yawakanda, Gama, Bankass and Tiembara.

3.2.1. Diamnati/Mali (1)

South of Ficko the large blue area stands out which is marked with 1 in Fig. 2. This seems to be an area which does not show greening trends (0.03 whereas 0.08 is the mean for the area) despite increasing rainfall. MODIS data show variations within small areas (Fig. 3) indicating that positive and negative NDVI trends are local and still active since 2000. A comparison with pre-drought Corona imagery (1967) shows major land use changes: What used to be dense bush-cover has partially been converted to farmer-managed agro-forestry and a significant proportion is now degraded land (Fig. 4). Furthermore, an increase of tree cover on the fields can be detected. Fieldwork validated suspected soil erosion and ongoing loss of trees and shrubs outside the fields used for farming purposes (Fig. 4). On the fields surrounding the village, many useful trees of all sizes were identified. Observations and interviews revealed that villagers actively protect seedlings of selected tree species (e.g. *Faidherbia albida*, *Balanites aegyptiaca*, *Borassus aethiopum*, *Adansonia digitata*) on cropland against animal grazing, trampling and cutting with the help of thorny branches. This has led to an increase of tree cover and improved soil conditions. Farmers have profound knowledge of benefits of trees on

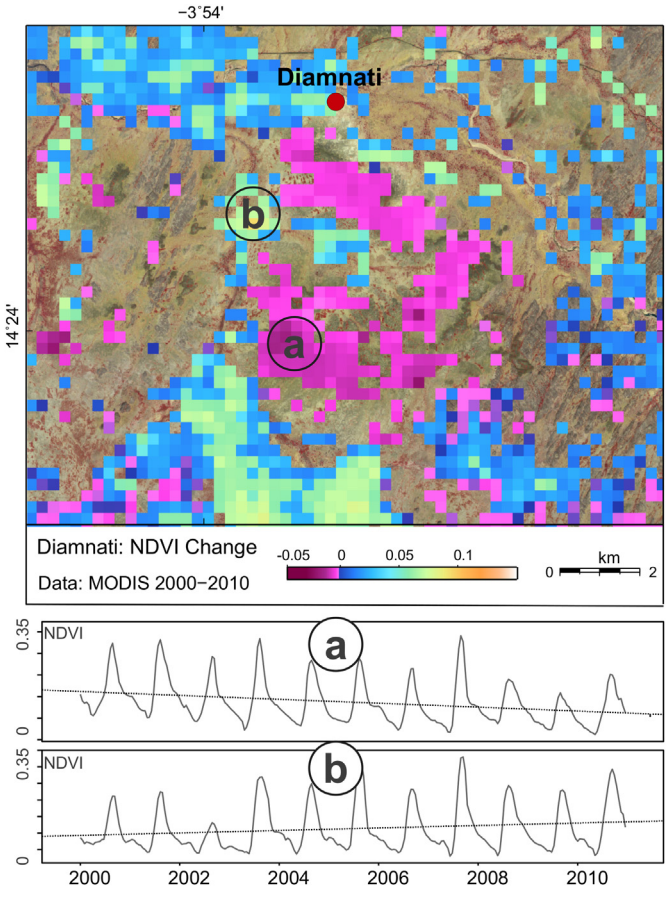

Fig. 3. The area marked with 1 in Fig. 2 appears homogeneous in the LTDR image (Fig. 2). The spatial scale of MODIS (250 m) is able to record heterogeneity within this region by identifying negative and positive vegetation trends (transparent areas stand for no significant trends). While positive NDVI change can be observed near Diamnati village, active degradation is visible in the surroundings. The temporal profiles of the pixels marked with "a" and "b" are shown below. The background map is a RapidEye 532 composite from December 2011. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

farmland. The owner of a field may pollard his trees sustainably but cutting them down is persecuted. The land outside the current farming area is highly degraded, which is explained by the following points:

1. the severe droughts in the 1970s and 1980s,
2. several years of insufficient rainfall since the droughts,
3. increased felling of trees/cutting of branches by the local population during and after the droughts to compensate for harvest losses by selling wood on markets and to feed animals respectively,
4. a lack of villagers to restrain strangers from cutting/felling due to missing ownership (latecomer) and the existence of individual cutting permits issued by the Governmental Forest Agency,
5. increased livestock numbers that put pressure on soils and vegetation.

Due to the declining vegetation cover and supported by the unfavorable morphology of the rocky plateau, the susceptibility to soil erosion by wind and water increases. Many useful trees and shrubs have become very rare or disappeared altogether (e.g. *Butyrospermum parkii*, *Crataeva adansonii*, *Combretum micranthum*, *Piliostigma reticulatum*, *Pterocarpus lucens*, *Sclerocarya birrea*, etc.).

3.2.2. Yawakanda/Mali (2)

This area is an example for a FMNR program on the Dogon Plateau (see Yossi and Diakite, 2008). Supported by dispersion of *Combretum glutinosum* and increasing rainfall, this causes a positive NDVI change, marked with 2 in Fig. 2. Elders reported that there was dense natural woody vegetation, which they started to clear for farmland and their houses at least 60 years ago when the village was founded. A comparison of Corona imagery with RapidEye and Google Earth shows that there is a significant increase of trees on the fields used for cropping. However, a major difference is that the species composition has changed. While according to the interviews several species like *F. albida*, *B. aegyptiaca*, *B. aethiopum*, *C. glutinosum* and *S. birrea* have increased, many species such as *Annona senegalensis*, *Detarium microcarpum*, *Diospyros mespiliformis*, *Khaya senegalensis*, *Lannea acida*, etc. have almost vanished during the last 30 years. Thus, the findings of Yossi and Diakite (2008) are supported.

The differences between regularly used and mostly fallow land are striking (Appendix 3, electronic version only). The active fields are covered with healthy trees and plowed soil aided by deep-rooting vegetation. The village chief mentioned the occasional unapproved cutting of branches by foreign herdsmen to make fodder available for their animals. The fallow/bush areas are exploited for firewood and the lack of regular cultivation leads to hard and crusted soils. This is a very local phenomenon, which is not visible at a scale of 5 km (Fig. 2) and sometimes not even at 250 m. High resolution at tree level imagery and fieldwork is needed to understand local land cover patterns.

The area around Yawakanda not only serves as an example for tree protection managed by farmers, trends are also influenced by small dams which are used to irrigate the vegetable cultivation in proximity to the Yame river. The dams were built by German development projects in 1996, 1999 and 2005 and represent only three of more than 80 dams on the plateau of the Cercle de Bandiagara. Areas around these dams often stay green months after the end of the rainy season.

3.2.3. Gama/Mali (3)

This area stands out with a weak positive trend because the time series starts in 1982, during the severe droughts. It would probably

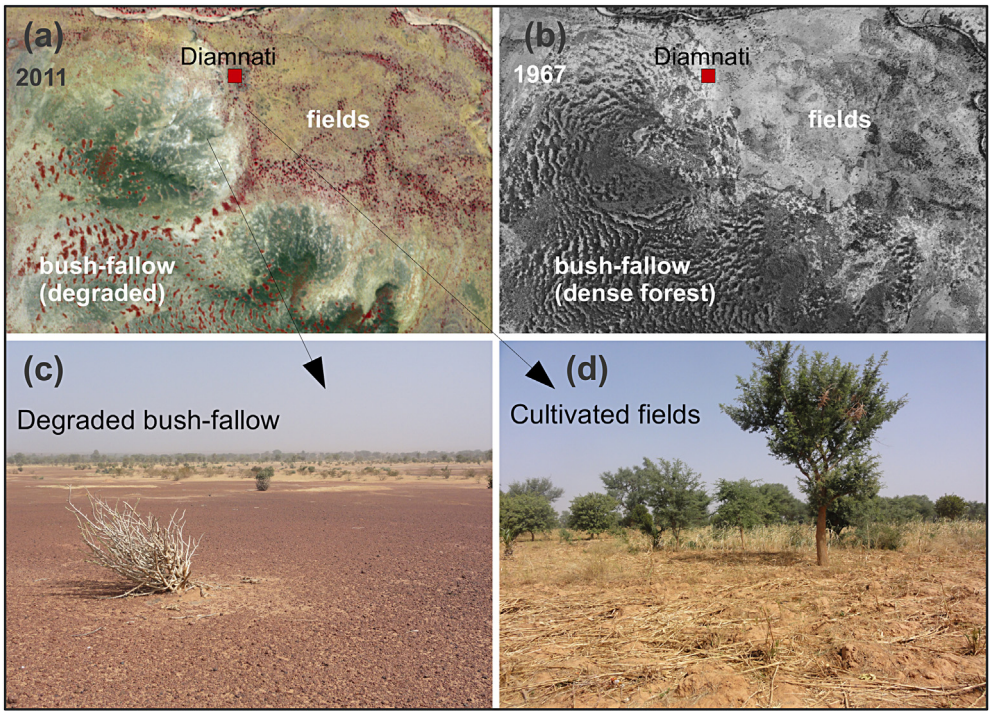

Fig. 4. The first image pair (a + b) shows exactly the same area compared over a period of 44 years. The area around Diamnati shows degradation and greening phenomena the same time. The Corona image from 1967 (b) shows formerly dense tiger-bush formations in the south-west (dark black areas), of which only small parts are left in 2011 (a, RapidEye), visible as red spots. Most parts are degraded land with exposed laterite, visible as dark areas on RapidEye. Farmers' fields around Diamnati in the north-east (bright on Corona) show a totally different development. Almost no trees (black dots) can be seen in 1967, whereas in 2011 fields are densely covered with trees (red dots). The obvious difference in vegetation cover of adjacent areas used for grazing (c) and farming (d) is illustrated by field-fotos (photos M. Brandt, Nov. 2011). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

be negative if the time series would start before the droughts. It is marked with 3 in Fig. 2. RapidEye imagery and fieldwork revealed a fossil dune area near the Bandiagara cliffs, which suffers considerably under the severe effects of soil erosion (Appendix 4, electronic version only). Compared to pre-drought conditions, most trees are lost and there is no recovery. Fieldwork showed that *D. microcarpum* often is the only species left. The sandy dunes fail to store moisture for extended periods, which is the reason why most of the trees died off during the drought periods in the 1970s and 1980s. Prior to the droughts, the trees performed soil stability functions through their deep rooting systems. Because of the lacking vegetation cover, the dunes are very susceptible to soil erosion, especially during intensive rainfall periods. This has led to the formation of extensive gully systems, which are increasing in size from year to year, as little can be done to stop the regressive erosion during the rainy season. The gullies reduce the size of cropping fields and make access to farmland more difficult. No evidence of prevention techniques to divert or reduce run-off in these areas were observed.

3.2.4. Séno Plain around Bankass, Tiembara/Mali (4)

Tree planting and protection programs have been introduced on the outskirts of Dimbal and Bankass. RapidEye imagery and fieldwork show improvements in tree density (Appendix 5, electronic version only) and a positive NDVI change can thus be observed around the villages, e.g. in the area marked with 4 in Fig. 2. Projects encouraging planting and protection of trees on fields are widespread in the Séno Plain (e.g. Allen, 2009). Higher resolution MODIS time series trends are influenced too much by cropping and fallow periods in this area. The herbaceous and shrub vegetation on fields, which lie fallow, often produce a higher NDVI than crops, especially peanuts and beans. A change from fallow to active cropping often results in a negative trend, whereas the opposite leads to greening and frequent land cover change results in no significant trends at all.

Vegetation diversity and tree density in the Séno Plain vary. Many healthy individuals of various species around the villages can be seen (e.g. *F. albida*, *Acacia nilotica*, *Acacia seyal*, *A. digitata*, *B. parkii*, *D. microcarpum*, *P. reticulatum*, *Prosopis africana*, *S. birrea*, etc.). These green tree belts also exist around smaller villages, but cannot be detected in LTDR–SPOT images. The MODIS mean seasonal amplitude exposes these green productive belts around the villages indicating active fields with a dense woody vegetation (see Fig. 5). These primary fields are kept fertile with natural and artificial fertilizers and are rarely fallow. Beyond this belt, the fields are used rotationally. Distant fallow fields serve as main source for firewood and for grazing. This is a traditional practice (Croll and Parkin, 1992), but due to lack of space for more fields, the soils on these secondary fields are overused because of shortened fallow periods. Because of the infertility of the soils around the green belt, fields are mostly used for only 3 years before being left fallow for the same period. Traditionally, at least 5 years of fallow would be needed to allow a sufficient recovery for the soils and avoid nutrient leaching. Many stumps are visible and the remaining

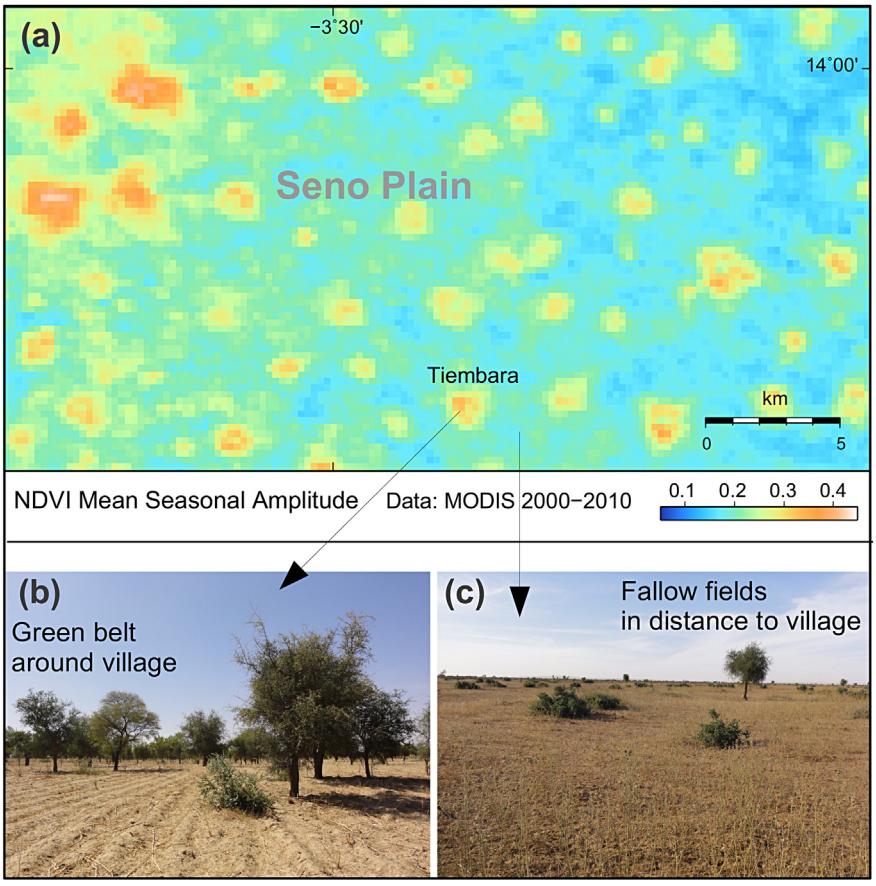

Fig. 5. MODIS mean amplitude identifies green productive belts (high values) represented by yellow and red colors around the villages in the Séno Plain (a). These fields are regularly cultivated and fertilized. Moreover, trees are protected. Photos from the Dogon village Tiembara show the difference between a regularly cultivated field near a village (b) and a mostly fallow field further away (c) (photos taken Nov. 2011). *Guiera senegalensis* is the prevalent species on the fallows. *Balanites aegyptiaca*, *Faidherbia albida* and *Sclerocarya birrea* dominate on fields. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

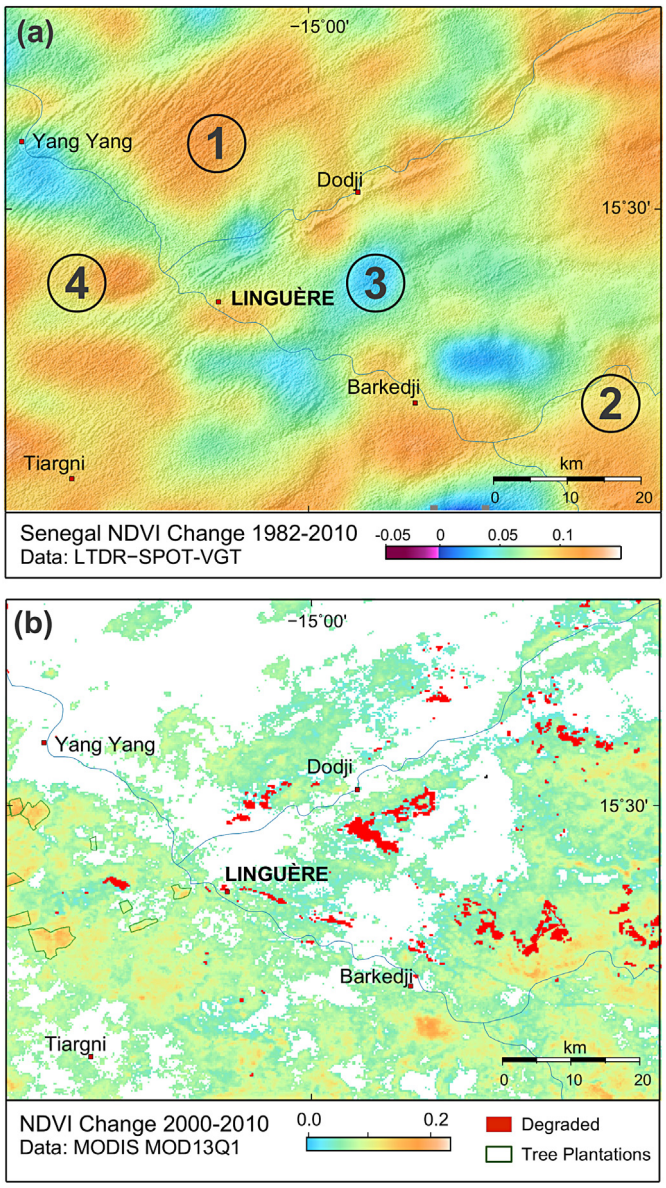

Fig. 6. LTDR−SPOT NDVI time series NDVI change from 1982 to 2010 in Senegal (a). The numbers indicate the case study sites which are further explained within Chapter 3.3. While positive MODIS trends (b) (2000–2010) in the west of Linguère are mainly caused by large tree plantations, positive changes in the east are caused by the shrubby vegetation of the lateritic Ferlo which reacts positively to increasing rainfall. Large parts of the eastern Ferlo produce insignificant trends (white) due to a huge bush-fire in 2010. Degraded areas identified by the mean seasonal NDVI amplitude (below 0.2) are marked in red, tree plantations of *Acacia senegal* are encircled in green. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

woody vegetation in these areas can be clearly recognized by severely trimmed trees and shrubs, signifying a lower prioritization or capacity for protection in these areas (see Fig. 5). The cropping period is too short for the trees to recover from the overuse during fallow periods.

Today most of the trees are small and rarely older than 20 years, indicating a good recovery since the extreme droughts. Generally, species like *B. aegyptiaca*, *C. glutinosum*, *F. albida* and *P. africana* increased while *D. microcarpum*, *Gardenia ternifolia* and *Vitellaria paradoxa* either decreased or disappeared.

3.3. Senegal case studies

Long-term time series show significant positive vegetation change in the Ferlo around Linguère. Even though the Senegal study area is smaller than the one in Mali, several zones based on ecological characteristics (see also Tappan et al., 2004) can be differentiated.

3.3.1. Northern zone (1)

In the northern zone (number 1 in Fig. 6a), dense bush formations can be observed on Corona-imagery of 1965 but current images show a complete transformation to an open tree and shrub savanna which is partly and irregularly used for cropping (Fig. 7a, b). Rainfall and drought-recovery are causative factors for prominent positive biomass trends in this area of our time-series (1982–2010). According to local people, a fire burned nearly all vegetation in this area in the times after the droughts. Although small bush fires are not an exception in this region of the Ferlo, the dimension of this event, according to the interviewees, had never been seen before or since. The drought of 1984 removed most of the animals by either migration or starvation. The following years were wet and forage accumulated in the absence of livestock. This vast fuel load caused a severe fire that burned almost all woody vegetation. Today *B. aegyptiaca*, mostly of similar age, make up more than 80% of the species.

3.3.2. Ferruginous zone (2)/(3)

This ferruginous pastoral zone forms the eastern Ferlo and has been seriously affected by severe droughts in the 1970s and 80s and by the overall drop of annual rainfall (Tappan et al., 2004). Today, considerable parts show a good recovery and react positively to increasing rainfall, as evidenced by a positive NDVI change (2 in Fig. 6a) and vegetation dominated by *P. lucens* and *Guiera senegalensis*. MODIS reveals that the recovery is widespread and that the density of the vegetation has particularly increased in the last five years (Fig. 6b). These findings coincide with local people's statements. However, other areas do not follow the strong positive trends (example areas are marked with 3 in Fig. 6a). Thus, the range of MODIS mean seasonal amplitude (see 2.3.1) was used to identify unproductive pixels, which represent degraded land. Almost 3% of the research area is degraded, barren land (red in Fig. 6b), a result similar to Budde et al. (2004). According to Tappan et al. (2004), the portion of degraded land has been spreading rapidly in this region during the last 50 years. As seen on Corona-imagery, these areas used to be covered with dense woody vegetation (Appendix 6, electronic version only). Most local inhabitants confirmed this by explaining the loss of woody vegetation by overuse of humans, but also droughts, lack of rain, and unfavorable soils were mentioned. Once vegetation is lost, soils become susceptible to erosion. Topsoils are washed away and laterite-crusts are exposed so that the remaining soil becomes impenetrable – a process very similar to certain places on the Dogon Plateau in Mali. In all visited areas many species (e.g. *Anogeissus leiocarpus*, *C. micranthum*, *D. mespiliformis*, *Grewia bicolor*, *S. birrea*, *Sterculia setigera*, *Terminalia avicennioides*) have disappeared or are only left in few numbers.

3.3.3. Cropping zone (4)

Although this area belongs to the silvo-pastoral region, large parts of this zone 4 in Fig. 6a are used for cropping. Farmers reported that when bushland was cleared during the 20th century, only trees of a particular height or certain species regardless of age were not felled (e.g. *F. albida*, *A. nilotica*, *Acacia sieberiana*, *Acacia raddiana*, *A. leiocarpus*, *Combretum nigricans*, *L. acida*, *S. setigera*, *T. avicennioides*, *Ziziphus mauritiana*). However, most of these have vanished due to lack of rain within the past 35 years. Regular

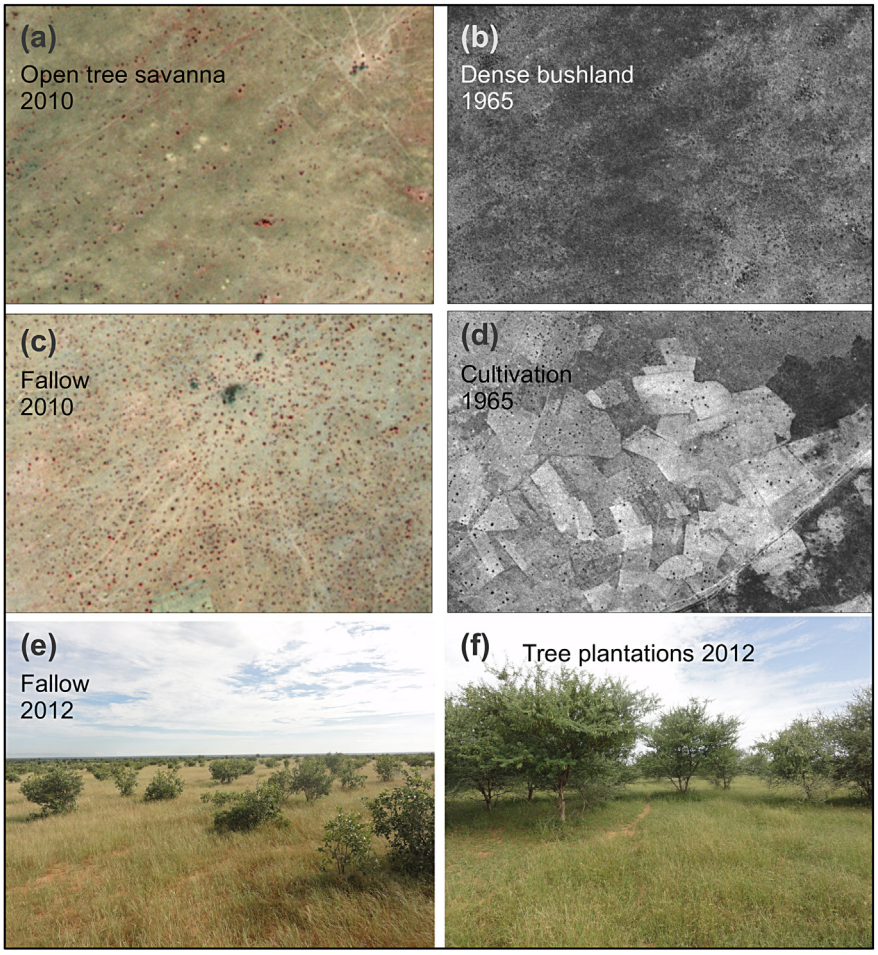

Fig. 7. The dark gray and black areas in the Corona image (b) (1965) represent dense bushland, which was common 1965 and dominated by *Guiera senegalensis*. The bushland was cleared before the beginning of our time series. Today, this area is a peanut fallow with an open *Balanites aegyptiaca* vegetation, seen as red dots on the RapidEye image (a) (2010). Formerly regularly cultivated with a sparse woody vegetation (1965 Corona), the fields near Doundodji seen in (d) are peanut fallows with a dense woody vegetation in 2010 (c) (RapidEye). *Combretum glutinosum* shrubs, dense grass on peanut fallows (e) and large reforestation areas with *Acacia senegal* trees (f) induce a positive trend west of Linguère (photos taken Sept. 2012). The trees seen in (f) were planted in 2000 and are part of a gum plantation near the villages Kamb and Ndodj. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

cultivation keeps the soil penetrable and farmers are aware of the benefits of trees in their fields. Thus, some species are regenerating by means of protection and planting but most of them are still very young and vulnerable to livestock. However, the explanations for large parts of the greening are of a different nature: (1) according to interviewees, cropping encroached rapidly since the 1960s (see also Tappan et al., 2004), while today many fields are fallow due to the lack of rain in the past decades (Fig. 7c–e). This is particularly true for the northern parts of the zone. Shrubs and trees (*C. glutinosum* on soft, and *B. aegyptiaca* on harder sand), which were usually cut down on the former active fields, are able to spread and cause a greening which is supported by herbaceous vegetation with a high NDVI. Furthermore, (2) reforestation areas maintained by farmers and supported by the Governmental Forest Agency fill up large parts of this area as can be seen by positive MODIS trends in Fig. 6b (see also CSE, 2009). Thousands of *Acacia senegal* (Fig. 7f) are planted in fenced areas which in some cases are partly used for cropping by the responsible village. Livestock is only allowed to enter in the end of the dry season for a fee, which is used to maintain the protected area. However, the purpose is not always exclusively environmental protection, as large parts of these areas serve as gum plantations for a private investor.

3.4. Overall vegetation trends

Although inter-annual variability is a common phenomenon in the Sahel, LTDR–SPOT time series reveal significant NDVI greening trends from 1982–2010 in most areas (Fig. 8). Mean changes in NDVI are 0.07 with a maximum of 0.12 in Mali and 0.08 with a maximum of 0.11 in Senegal. Our case studies have shown that reasons can be very local but several factors apply to both research areas:

1. farmer-managed agro-forestry,
2. planting programs and strict protection laws,
3. widespread dispersion of robust species, especially *B. aegyptiaca* and *C. glutinosum,* which replace the former diverse woody vegetation and simulate a greening which in fact conceals a shift in biodiversity,
4. an increase of annual rainfall and recovery from the droughts.

However, woody vegetation is far from pre-drought conditions, which have been reconstructed by Corona-imagery and information from village elders. In 1967, dense bushland covered about half of the Séno Plain (Mali) and also large areas of the Ferlo (Senegal).

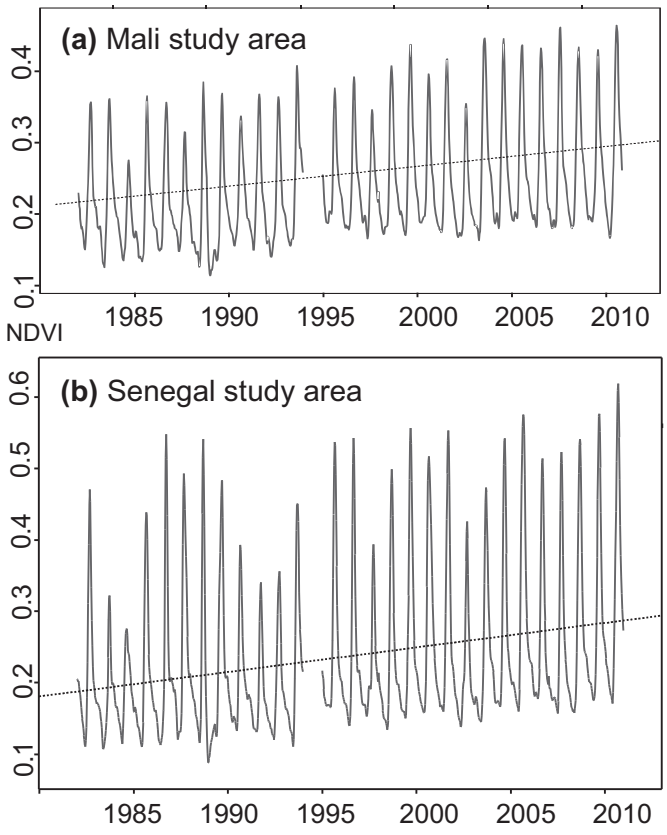

Fig. 8. LTDR–SPOT NDVI time series from 1982 to 2010 averaged for the Bandiagara (a) study area and for the Linguère (b) study area.

Since the 1960s, the natural vegetation has been completely transformed and today many trees and shrubs have become rare or disappeared (Fig. 9a) due to climatic and anthropogenic reasons: (1) the 1970s and 1980s drought events have caused the death of individuals of various tree and shrub species. During the following decades, the amount of annual rainfall remained below pre-drought levels and the mean temperature increased. These new climatic conditions largely contributed to a decrease in the diversity of woody species and at the same time, favored increasing numbers of certain robust tree varieties (Fig. 9a). (2) Initially, natural population growth and to some extent in-migration contributed to agricultural extensification and clearing of forests for farming purposes. This led to rising livestock numbers and demand for fuel-wood. Cutting living trees and selling the wood is a well-established strategy to generate income and to economically compensate harvest losses. In the pastoral regions of the Ferlo, branches are cut to feed animals with leaves. These activities increase during droughts putting pressure on the woody vegetation. In areas with a decrease of woody coverage, soil becomes more vulnerable to erosion and desertification.

Fig. 9b shows that species richness changed dramatically in Senegal after many species died due to a lack of soil moisture and increased cutting. Today *B. aegyptiaca*, *C. glutinosum* and *A. raddiana* make up 73% of all woody vegetation. Most other species are left in few numbers in clayey depressions. Considering the age structure of the trees, the dominance of these few species will even increase in the near future. The share of young trees (smaller 4 m) among the population of the three above-mentioned species is around 50% while among species like *S. birrea* or *A. nilotica* small trees barely make up 5%. Local people explained that the drought in 1973 was a starting point from which many favored species (e.g. *A. leiocarpus*, *L. acida*, *S. setigera*, *G. senegalensis*, *G. bicolor*, *T. avicennioides*) slowly vanished in some regions due to lack of water and increased cutting of living trees.

In Mali the situation is more diverse and site specific (Fig. 9a), due to morphological differences within the larger study area. While several species have disappeared in many areas (e.g. *A. leiocarpus*, *C. adansonii*, *G. bicolor*, *P. lucens*, etc.), others have taken their place (e.g. *B. aegyptiaca*, *Eucalyptus camaldulensis*). Much depends on local site conditions, management and external influence. We observed that protection and planting of trees only takes place near villages, while fields and fallows at greater distances are heavily exploited for fuel-wood. The study area has seen an increase of village numbers, particularly during the past 50 years, as seen on Corona images. New settlements caused an initial decrease of the vegetation due to land use change (bushland to fields). However, we hypothesize that the increase in village density at the same time led to a certain recovery of vegetation by the conservation of useful trees on farmland in proximity to villages resulting in a higher density, diversity and vitality of trees. Villagers encourage growth of the trees by protecting them on their actively used fields, preventing the unsustainable exploitation of the woody vegetation. Furthermore, regular treatment keeps soils penetrable and counters erosion and degradation.

4. Conclusion

Coarse-scale time series have proven to be a good indicator for long-term vegetation change. Trends were clearly positive, indicating an increase in biomass. Because this time series starts in times of droughts, degraded areas could clearly be identified because they do not follow the overall greening trend. The initiation of the degradation processes thus began prior to the period covered by the time series (1982–2010).

MODIS trend analysis revealed greening and degradation at a local level. However, fine-scale information often proved being irrelevant when trying to confirm regional patterns, i.e. trends were often caused by local irrigated plantations and fallows. The time line of MODIS often is too short to follow short-term processes. Active degradation is rarely spotted within 10 years and events such as bush-fires, floods or frequent crop rotation make trends often insignificant. The mean seasonal amplitude reliably identified productivity per pixels at a relevant scale that is valuable when identifying degraded or productive areas at field level.

The results of the time series analysis led to various hypothetical explanations of trends, which were verified by ground-truthing. Despite of their different climatic and social conditions, both research areas have many similarities when explaining environmental changes. Many of them coincide with other findings, confirming woody vegetation recovery (Hiernaux et al., 2009; Tappan et al., 2004), but also species impoverishment (Gonzalez et al., 2012; Herrmann and Tappan, 2013) and a spreading of degraded areas (Budde et al., 2004; CSE, 2009; Tappan et al., 2004) were discovered. Greening and degradation are spatially heterogeneous and caused by a combination of both anthropogenic and climatic factors. Even if droughts and a decrease of rainfall contributed to the extinction of many tree species, humans increasingly control the tree density and species composition today.

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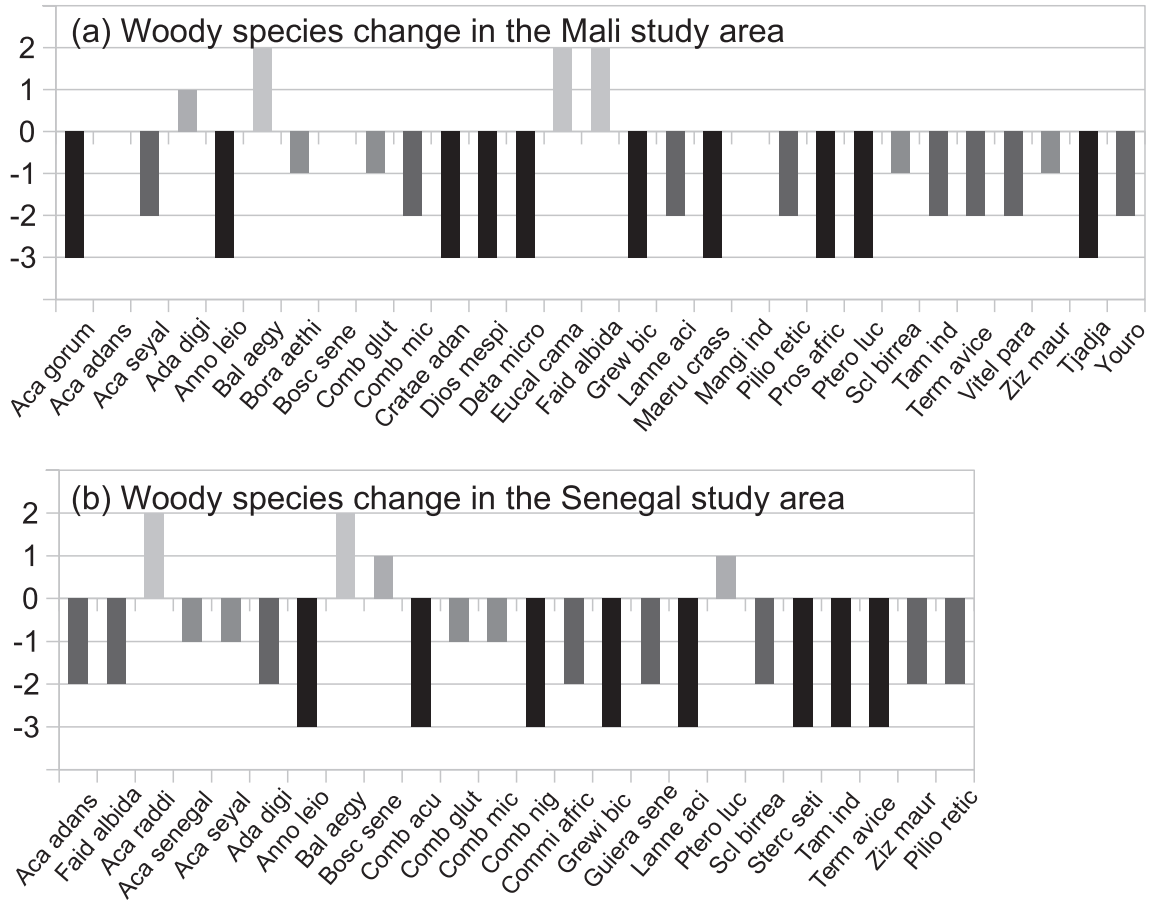

Fig. 9. Local people's perception of changes in tree species composition in the Bandiagara (a) and Linguère (b) study areas in the past 40 years. −3 very strong decline or disappeared, −2 strong decline, −1 decline, 0 stable, 1 increase, 2 strong increase. More information and complete scientific, Dogon and Wolof names can be found in Appendix 7 and 8, electronic version only.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jaridenv.2014.02.019.

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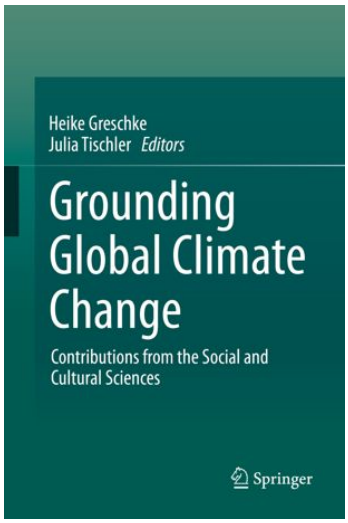
3.2 Climate and mobility in the West African Sahel: conceptualising the local dimensions of the environment and migration nexus



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Chapter 5
Climate and Mobility in the West African Sahel: Conceptualising the Local Dimensions of the Environment and Migration Nexus

Clemens Romankiewicz and Martin Doevenspeck

Abstract Despite the theoretical and methodological critique of deterministic and linear explanations of migration under changing climatic conditions, many empirical case studies in this field remain deeply entrenched in static push-pull frameworks and tend to reproduce simplistic causal relationships. Drawing on results from an interdisciplinary research project in Mali and Senegal, the chapter presents a methodological approach that emanates from past analytical shortcomings. By adopting a local perspective on migration, we consider cultural norms, the migration history and people's interpretations of weather and environmental changes. Moreover, we argue for a multilevel, multi-method research that seeks to separate the two research topics of migration and climate/environment; for example, by avoiding explicit questions about possible linkages. Contrasting results from ethnographic fieldwork concerning migration, climate and environment with 'hard' data on climate and vegetation allows us to become more susceptible for the social construction of alleged 'facts' such as droughts and land degradation as drivers for migration. We place a focus upon local meanings of weather and environment by considering how they are being assessed by the people, within a context of not only climatic but rather multiple changes.

5.1 Contextualising the Argument: Introduction

This chapter addresses the potential impacts of climate change on population movement by adopting a local perspective. Two case studies from rural Mali and Senegal serve to reveal the ambiguous relationship between climate change, environmental changes and migration. The relevance of the topic seems to be apparent in relation to the West African Sahel, given that the region's population is one of the most mobile in the world (Ammassari and Black 2001), while mean annual temperatures

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have risen since the 1960s and increased precipitation variability is predicted for the future (Boko et al. 2007). Moreover, the severe droughts of the 1970s and 1980s involved massive changes in vegetation patterns, thus rendering the African Sahel a hotspot of environmental degradation and desertification (Kandji et al. 2006). Assumptions of this kind, embedded in the highly politicised discourse on climate change, perpetuate the belief that there is a growing impact of climate factors on population movements (Piguet et al. 2011), especially in developing countries, leading to estimates of the future magnitude of climate-related population displacements. However, most scholars oppose such estimated numbers and refer to people being at risk of becoming displaced rather than depicting possible migration flows (see p. 8 in Black 2001). The *IPCC*'s 4th assessment report emphasises the importance of migration as one of the key options for adaptation to climate stress, as well as underlining that a variety of other factors may contribute to the decision to migrate (Boko et al. 2007). This complexity of migration points to fundamental shortcomings in much of the scientific and public discourse on the environment-migration nexus. This chapter contributes to the present volume's concern with context regarding the explanatory power of climate for changes within social systems. Accordingly, it seeks to re-contextualise assumed 'natural' drivers of migration processes in order to balance simplified assumptions of the relationship between climate, environment and migration.

In order to identify population movements that are affected by climate change, it is necessary to understand the linkages between environmental changes and migration, considering multiple levels of analysis and different temporal and spatial scales (Kniveton et al. 2008). Moreover, further challenges that arise in understanding the migration-environment nexus include the lack of a clear definition and use of controversially discussed terms such as 'environmental refugees'[1] or 'climate refugees,' the general scarcity of migration data, especially in developing countries (particularly longitudinal data), the lack of detailed knowledge about the impacts of climate change on environmental conditions (e.g. the evolution of local vegetation trends), and the failure to consider adaptive practices other than migration (cf. Adamo 2008; Bates 2002; Black 2001; Castles 2002; Renaud et al. 2007).

The simplified portrayal of environmental changes as root causes of migration has been contested by many scholars, both theoretically and empirically (de Haan et al. 2002; Findley 1994; Van der Geest et al. 2010; Henry et al. 2003; Piguet 2008; Doevenspeck 2011). Argumentation within the static push-pull framework has been further criticised for being too deterministic, since it suggests that migrants are being 'pushed' out of degraded areas, rather than allowing for the various other dimensions of human migration (Jónsson 2010). With the exception

[1] Essam El-Hinnawi (1985, p. 4) defines environmental refugees as "those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life. By 'environmental disruption' in this definition is meant any physical, chemical, and/or biological changes in the ecosystem (or resource base) that render it, temporarily or permanently, unsuitable to support human life."

of extreme events such as flight after natural disasters, "[it] thus seems analytically impossible to identify a migration stream as principally environmentally-induced" (see p. 51 in Doevenspeck 2011). Therefore, further research faces the challenge of balancing the multitude of factors shaping migratory patterns in the context of environmental change, in order to grasp the internal logics of migration dynamics (cf. p. 420 in Castles 2011). Similarly, changes of climatic conditions are unlikely to directly cause people to move, yet may produce environmental effects and exacerbate current vulnerabilities in a way that may render migration one possible strategy of adaptation.

Any attempt within the vast spectrum of approaches to understand the linkages between climate, environmental changes and migration also faces severe methodological challenges (cf. Piguet 2010). One major and general difficulty is to evaluate an isolated correlation between climate or environmental parameters and migration variables, considering the complexity of other contextual effects on migration processes. Ethnography applying thick description through observation, in-depth and biographical interviews with individual migrants can avoid some of the difficulties of other methods, given that it is a place-sensitive approach and provides an insight into social constructions of alleged 'facts,' such as environmental degradation and droughts, people's perceptions and experiences (see Meze-Hausken 2000; McLeman and Smit 2006; Mortreux and Barnett 2009). However, there are three essential shortcomings related to conceptual flaws in interview techniques of ethnographic and quantitative (large-scale sample surveys) approaches. First, it must be recognised that research results are shaped by the way in which questions are formulated. Interviewees often undergo an intensive 'problem-scanning' with respect to their migration motives, economic situation and environmental changes. Second, it is difficult to avoid general narratives on climate, the environment and migration issues. Third and most fundamentally, a causal linkage between environmental changes and migration is often taken for granted in research designs and reflected in questions that directly ask for these linkages, thus leading to a perpetuation and reification of this narrative. This is problematic, since it is the researcher rather than the respondent who hints at causal connections. Mertz et al. (2009) suggest how 'hinting at problems' and causal linkages can bias research results, having conducted a study in rural Senegal to analyse people's perception of climate change and their coping and adaptation strategies by applying household questionnaires and different types of interviews. To avoid biases, they only posed climate-related questions towards the end of the interviews. Indeed, none of the respondents identified climate factors among the five main positive or challenging aspects of their village life (not even within the category of agriculture). "Only when asked directly about climate issues did the group interviews largely corroborate the impacts identified in the household interviews, and they reiterated that rainfall variability during the rainy season is of major importance" (see p. 810 in Mertz et al. 2009). This example demonstrates that suggestive interviewing considerably influences responses and should thus be avoided when seeking to grasp the relevance of climatic conditions and the environment for rural households.

Given the conceptual shortcomings, this chapter will provide evidence of the complexity of the environment-migration nexus by discussing results from a research project on migration and local assessments of climatic and environmental changes in Mali and Senegal. As the Sahelian drylands are frequently presented as hotspots of climate change impacts (Hulme 2001) and the population is seen as very likely to become displaced by environmental degradation (IOM[2] 2009), two study areas in Senegal and Mali have been selected in order to understand how these assumptions translate at the local level. Macro data on climate is contrasted with findings on local people's assessments of changes in climate conditions and the environment (see also West et al. 2008) and contextualised with the identified patterns, dynamics, motives and people's notion of migration. Through this process, we are not evaluating the effects of climate trends in the study areas as outcomes of global climate change; rather, we argue in favour of assessing the relevance of various trends in climate variability and the importance of its different cultural, social and political dimensions by focusing on local people's representation, perception and interpretation of climate and environmental changes. Considering the conceptual and methodical difficulties of carving out the relevance of climate and environmental factors in migration decisions, this chapter puts forward a methodological approach that attempts to avoid suggestive causality between climate, environment and migration in the research design.

Following a presentation of the study regions and the methodological approach, we offer an analysis of current climate and vegetation trends and how people assess them locally. The second empirical part provides a historically informed analysis of the contemporary migration landscape, including patterns, motives and destinations, before the chapter concludes with some conceptual and methodological reflections on this approach to grasping the local dimensions of environment, climate and migration.

5.2 Study Regions

Research is conducted in the two study areas of Linguère, Senegal, and Bandiagara, Mali (see Fig. 5.1). Both regions belong to the semi-arid Sahel-Sudan region, yet differ in their socio-economic context as well as their cultural and historical migration background. While the Linguère area is part of a traditionally important pastoral zone, the drylands of Bandiagara are mainly farmland, although crop production is important in both study regions. In Linguère, many of the pastoralist families nowadays are sedentary and practise both the cultivation of land and livestock breeding. However, our study focuses on general patterns of people's mobility rather than the specific movements of herders with their cattle. The selection of the study regions was based on the criteria of high population mobility, peculiarity of environmental change and accessibility of the regions.

[2] *International Organization for Migration*.

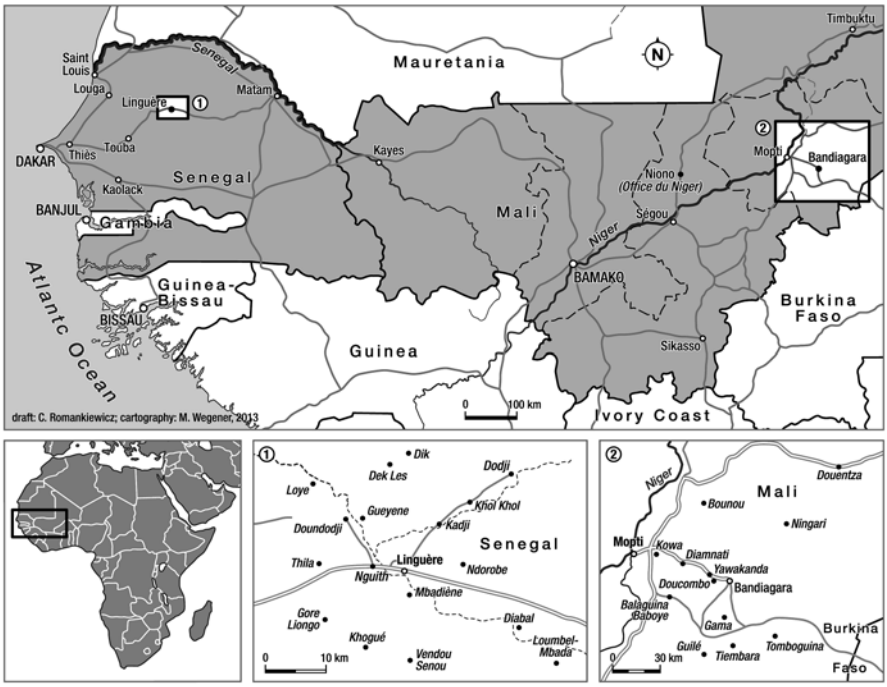

Fig. 5.1 Study regions and surveyed villages

The area around Linguère is situated in the northern part of Senegal in the region of Louga, department of Linguère (also known as the *Ferlo*) (Fig. 5.1). Around 80 % of the population lives in rural areas, with the Fulani and Wolof being the largest ethnic-linguistic groups (ANSD[3] 2007). This agro-sylvo-pastoral area is sparsely populated (14 inhabitants per km^2 [inh./km^2]), characterised by an average annual rainfall of 380 mm and dominated by open shrub and tree savanna and grasslands (Tappan et al. 2004). Economic activities concentrate on livestock breeding and crop production (mainly millet and groundnut). Relying on the most recent migration data available (ANSD 2008), Louga shows an overall migration deficit (ANSD 2007) with 18 % of Senegal's international migrants originating from this region in 2002, making it the third most important region in terms of migrant origins, after Dakar and Thiès (see p. 230 in DPS[4] 2004).

In 2009, the Mopti region in Mali had two million inhabitants and a population density of 25 inh./km^2 (INSTAT[5] 2009). Research concentrates on the Dogon plateau and the Séno plain near the town of Bandiagara, a dryland zone characterised by an annual precipitation of around 600 mm and open shrub and

[3] *Agence Nationale de la Statistique et de la Démographie*.

[4] *Direction de la Prévision et de la Statistique*.

[5] *Institut National de la Statistique*.

tree savanna. Rainfed agriculture and to a certain extent vegetable gardening are the main economic activities (MEA[6] 2009). Dogon and to a much lesser extent Fulani are the predominant ethno-linguistic groups. In the early-1990s, the region's migration deficit for both international and internal movements was among the highest in the country (Bocquier and Diarra 1999). Data from a 2005 survey reveal that 61 % of the interviewed households in the Mopti region mentioned one or more migrating members (WFP[7] 2006), thus indicating a long tradition of labour migration (Sieveking and Fauser 2009). Besides migration to Bamako (31 %) and other African countries (28 %), rural areas and villages (23 %) are also important destinations for migrants from the Mopti region (WFP 2006; Merabet and Gendreau 2007).

5.3 Methodological Approach

Given the flaws of the different approaches described above, we developed a multi-method and multi-level research design without asking respondents explicit questions about the linkages between environment, climate and migration, let alone asking directly whether climatic and environmental changes cause migration. As already pointed out, such direct questions by researchers tend to trigger answers that refer to master narratives of environmental migration and provide the respondents the opportunity to avoid elaborating on the subtle and complex social and political undercurrents that relate to migration. Moreover, we attempted to separate research on climate and vegetation trends from the migration issues by conducting the respective fieldwork at different times. During the conversations, we tried to avoid making direct causal links between environmental and climatic factors and migration motives, allowing only the people themselves to establish such potential links.

While the identification of the study areas essentially followed the idea of ecological inference (high emigration rates and noticeable trends in vegetation cover of a certain area), ethnography helped to identify migration dynamics and motives, as well as grasping assessments of climatic and environmental changes at the local level. Our fieldwork could be best described as a multi-sited ethnography (see p. 106 in Marcus 1995) following migration networks to multiple places in the area of origin and the target regions of migration, which of course have to be understood as potential places of departure for new migration. This approach is motivated by the aim to avoid the sedentary bias inherent in migration research in Africa (see also Verne and Doevenspeck 2012). We conceptualise movement "as constitutive for economic, social and political relations" (see p. 43 in Urry 2007) and mobility as an integral part of human life and not as a problem *per se*, regardless of the place where this life is lived (see also Sheller and Urry 2006; Büscher and Urry 2009).

[6] *Ministère de l'Environnement et de l'Assainissement*.

[7] *World Food Programme*.

We conducted fieldwork during 9 months in 2011 and 2012 and used semi-structured and narrative interviews to understand the village's history, directions and amplitudes of and motives for migration, as well as local meanings of these movements. Additionally, we collected biographies of migrants and identified migration networks. On this basis, contacts with migrating family members at various places were established by telephone or via the internet, leading to interviews in Bamako and Dakar, as well as France and Spain. Working with migrants from the study area at their current residence offered valuable insights into migration networks, given that speaking to migrants outside the social structure of their home village seems to produce less biased and more explicit statements regarding their migration decisions. We used also interviews for the study of the assessment of changes in climate and environmental conditions, addressing both the state of and perceived changes of temperature, rainfall and wind, soil fertility, woody cover, biodiversity, capacities of pasture and crop yields (see Mertz et al. 2010; Roncoli 2006). We conducted the respective interviews with the same people who had already provided insights into migration, or, in case we were unable to encounter them again, referred to members of the same household or family from the same village. Village elders provided valuable information regarding pre-drought conditions and long-term changes in natural resource and farm-management. Additionally, we conducted transect walks and site visits with individual villagers in the surroundings of settlements. Attention was paid to people's interpretations and explanations of already mentioned and visible changes in vegetation cover, the availability and exploitation of woody resources, soil fertility, crop yields and degradation phenomena. Accordingly, we took these impressions and information into account in later interviews in the respective villages. With the help of a village questionnaire, elders identified trends in the tree species composition of the past 50 years (see for example Gonzalez 2001).

5.4 Changes in Climate and Environment: Local Representations of "Facts"

While the Sahelian region has always been characterised by high climate variability, there is much uncertainty in climate trends and forecasts produced by the different climate models on smaller spatial levels for the West African Sahel (Boko et al. 2007; Kandji et al. 2006; Hulme 2001). When looking at environmental changes in terms of vegetation trends, it may be considered that not only climate (rainfall in particular) but also human factors contribute to long-term changes in the natural environment (Herrmann et al. 2005). Nevertheless, what is experienced, assessed and communicated by the population is the variability of weather and changes in vegetation cover at the local level. Depending on the available data, we operationalise climate as temperature and rainfall (cf. Gbetibouo 2009; Mengistu 2011) and examine the environment through the indicators of woody vegetation coverage and diversity, which can be considered as important measures of environmental

degradation (cf. p. 73 in Bilsborrow 2002; p. 113 f. in Massey et al. 2010).[8] In the following section, data on temperature, precipitation and vegetation change in the study regions are contrasted with local people's assessments and explanations. Following Hulme (2008), climate can only be understood and must be re-examined as a manifestation of both nature and culture, which implies that

> its physical dimensions are allowed to be interpreted by their cultural meanings […] [and] that discourses about global climate change have to be re-invented as discourses about local weather and about the relationships between weather and local physical objects and cultural practices (ibid. p. 6).

5.4.1 Temperature

According to data collected from meteorological stations, an increase in the mean annual temperature can be observed for the western Sahel[9] since the 1960s (see Fig. 5.2). Boko et al. (2007) state that there is a rising number of warm spells and a decrease in extremely cold days for the period 1961–2000 in West Africa. Peaks in high mean annual temperatures in the past two decades have been registered for

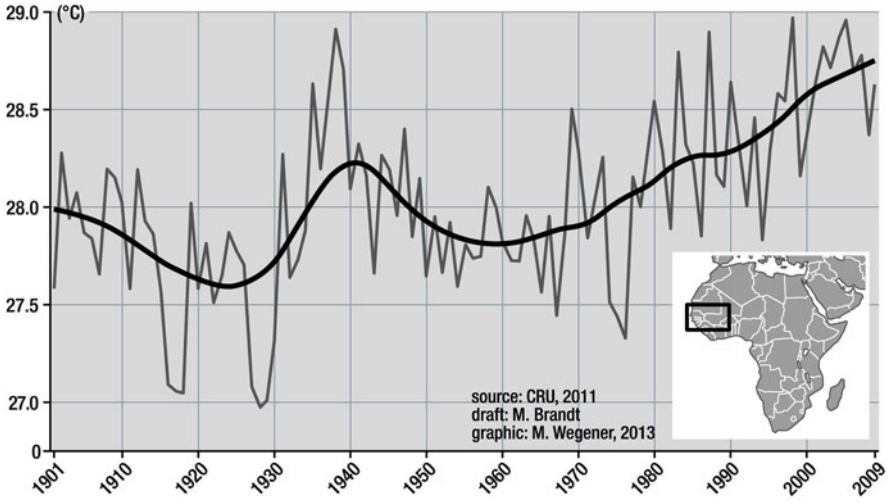

Fig. 5.2 Average annual temperature in Western Sahel (1901–2009) (*CRU* (*Climate Research Unit*), data after Mitchell and Jones (2005))

[8] The development of soil fertility has been considered in ethnographic research yet is not explicitly integrated here because there are no 'hard' data on soil quality that could be compared with people's statements.

[9] Data from *Climate Research Unit (CRU)* 2011 (see Mitchell and Jones 2005). Here, temperatures changes are considered for the Western Sahel and not on the level of the study regions, since available temperature data has been interpolated for larger areas between meteorological stations, and because temperature trends do not show significant differences within the region.

1998 and 2005. Beyond rainfall, rising average temperatures essentially account for reduced soil moisture and tree cover changes (Gonzalez et al. 2012). By determining physiological processes, changes and extremes of temperature may negatively affect crop and livestock production (Stabinsky 2011).

Villagers in both study areas expressed diverse opinions on temperature trends, providing a variety of interpretations. In contrast to the findings from five West African countries of Maddison (2007), stating that significant numbers of farmers perceived increasing temperatures, most of the elders in our study areas agreed that it used to be hotter in the past.[10] A couple of interviewees in Senegal independently recalled a phenomenon in the 1960s when birds, paralysed by the heat and unable to fly, came towards their houses and even into their rooms in search of cooling. Today, some said that suffering from the cold is worse than before, while others claimed that the 'coldness improved' and that it is getting warmer. Only a few people could not identify a general trend in temperature change, suggesting instead that hotter and colder years or periods have always alternated.[11] People's assessment of temperature change is clearly influenced by their personal experience of seasonal heat waves or cold waves; moreover, even the availability of warm clothing and a blanket can have an impact on a person's views. In general, interpretations of temperature variations were directly or indirectly related to rainfall: the more it rained in the past rainy season, the less intense the heat, people explained. Leaf growth, cloudiness, wind direction and the existence of seasonal water bodies were said to affect the intensity of the heat during the dry season. It also seems that the perceived severity of high temperatures in the past has been reduced by the increased availability of water sources such as boreholes, wells, artificial waterholes and dams, compared to the period before the 1970s drought.

Interestingly, few of the interviewees perceived the rise in temperatures that has actually been recorded for the region, with most of them reporting decreasing temperatures. Given that abundant rainfall was said to reduce the heat, one potential explanation could be that the increasing amounts of precipitation in recent years (see next section) have significantly influenced this perception. Similarly, Roncoli et al. (2003) report on the influence of the intensity and duration of rainfall on farmers' perceptions of dry season temperatures in Burkina Faso. Accordingly, narrations of rising temperatures evidently coincide with perceived decreasing precipitation (cf. Maddison 2007).

5.4.2 Precipitation

The Linguère region is clearly drier than Bandiagara, as reflected by a difference in annual rainfall of up to 200 mm (Fig. 5.3). While both study regions experienced several severe droughts during the twentieth century, the 1970s and 1980s droughts

[10] Various interviews in Kadji, Khogué (Senegal) and Kowa, Doucombo (Mali), February–April 2011.

[11] Interviews in Loumbel Mbada (Senegal) and Yawakanda (Mali), March–April 2011.

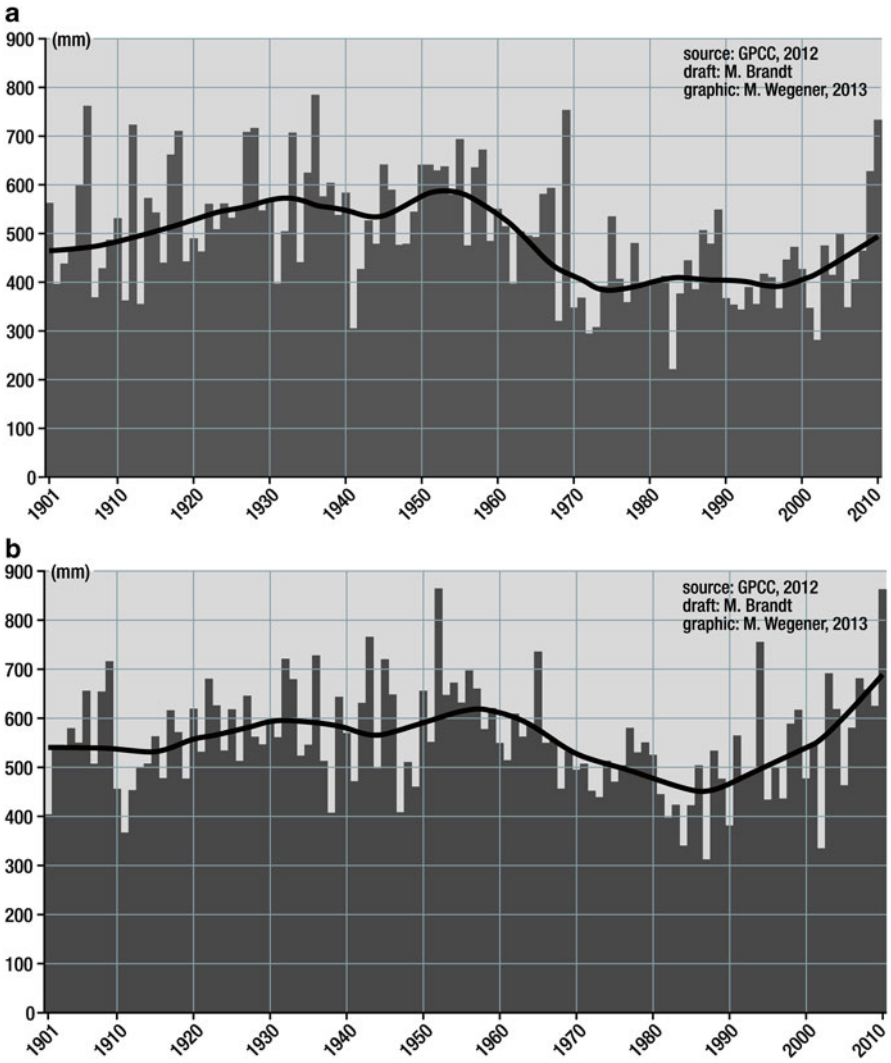

Fig. 5.3 Average annual precipitation in Linguère (**a**) and Bandiagara (**b**) (1901–2010) (*GPCC* (*Global Precipitation Climatology Centre*), data after Schneider et al. (2014)). The precipitation diagrams are given for the study areas of Linguère and Bandiagara, marked in Fig. 5.1)

coincided with a long-lasting drop in the annual precipitation level. In Linguère, for example, this rainfall decline was almost 30 %. While rising precipitation has been recorded for the past two decades in Bandiagara, almost reaching pre-drought levels, Linguère's rainfall has shown a slight increase since 1998. In 2009 and 2010, Bandiagara and Linguère had very abundant rains that locally even reached record

values.[12] Nevertheless, the apparent gain in mean values goes in hand with the increased variability and unpredictability of rainfall (cf. MEA 2009). In 2011, annual precipitation in both study areas did not exceed average amounts.[13]

The interviewed village elders confirmed that rainfall today is lower compared to the period prior to the drought in the 1970s. Generally, people seem to have a good memory of the severe droughts in the 1970s and 1980s. However, it must be noted that there are differences between villages within the same study area, and respondents did not feel equally affected. In both study regions, the informants indicated an upward trend in precipitation in the past 5 years, describing the rainfalls of 2009 and 2010 as the most abundant for a long time. Accordingly, rainfall in 2011 was clearly evaluated as being low. However, assessments of the harvests during the past years do not reveal a uniform picture. In both Linguère and Bandiagara, some villages apparently benefitted from good and very good harvests in 2009 and 2010, with people reporting increased numbers of young people reengaged in agriculture. In other places, most people stressed that the distribution of rainfall was of much greater importance[14] than its total annual amount. Missing breaks between rainfalls, floods after heavy rains, persisting moisture on the fields and delayed, altogether lacking or too little rainfall during certain periods of plant growth mean that the harvest in 2010 was even lower than in 2011 for some households.

While the remarkable increase in precipitation over the past few years was confirmed in both Bandiagara and Linguère, the local people assessed its impacts within the study areas very differently. Moreover, the interviewees also mentioned other factors determining yields, such as the access to seeds, pesticides and fertiliser, as well as their appropriate application, generally decreasing soil fertility and lack of agricultural land, equipment and labour force.[15] These first results show that the total amount of precipitation can only reflect a modest indicator of a 'good' rainy season and does not necessarily translate into better harvests and increasing food security for everyone. Moreover, it is essential to consider the cultural dimension of people's representation of climate (Hulme 2008; Peterson and Broad 2009). Therefore, Roncoli argues "an inquiry into the cultural meaning that underlies farmers' understandings of climate, both its ordinary and abnormal manifestations, is a necessary first step in climate application studies" (2006, p. 84). Important aspects that can deepen insights into assessments of climate include examining local terminologies and calendars for the different seasons (Orlove et al. 2004), or the exploration of local classifications and types of rainfall (Roncoli et al. 2002). Our respondents in both countries highlighted the impact of the timing and distribution of rainfall, which shows that "unlike scientists, these farmers think about rainfall as a process rather than as a quantity" (see p. 84 in

[12] For example, more than 720 mm for Linguère in 2010 (interview at meteorological station in Linguère, March 2011).

[13] Satellite data from *Tropical Rainfall Measuring Mission (TRMM)* (see Huffman et al. 2007).

[14] Interviews in e.g. Kadji in Senegal, Yawakanda and Kowa in Mali, 2011 and 2012.

[15] Various interviews in Kadji, Khogué (Senegal) and Doucombo, Yawakanda, Tiembara, Bamako (Mali), 2011 and 2012.

Roncoli 2006). Given that a multitude of factors besides rainfall have an effect on yields, it is clear that climate can only be of limited explanatory power with respect to people's vulnerability (Mertz et al. 2009).

5.4.3 Vegetation

Since the mid-1980s, remote sensing has detected a greening trend in large parts of the African Sahel, contesting the notion of widespread degradation (Anyamba and Tucker 2005; Olsson et al. 2005). Moreover, rainfall seems to be only one of the important causative factors for this recovery from the great droughts (Herrmann et al. 2005). While the data on local vegetation changes available for our two study sites does not provide conclusive explanations regarding the contribution of climate factors, it does provide an idea of general regional vegetation and land use trends over the past 50 years.

Linguère is located in the transitional zone of three ecological regions with different soil and vegetation characteristics (see Tappan et al. 2004). Depending on the soil type (e.g. deep sandy soils or shallow loamy and gravelly soils over laterite), there are considerable local differences in the agricultural potential as well as the mortality of woody plants (ibid.; see also Vincke et al. 2010). Generally, the trends indicate a significant expansion of cropping land and a moderate loss of woody cover since 1965, but a relative stability since 1983. In Bandiagara, two major zones can be distinguished, with the Dogon plateau characterised by rocky soils and the Séno plain by deep sandy soils. Significant losses of tree cover have been detected in the region during the past 40 years, albeit with considerable divergence in different areas (MEA 2009). Another study focusing particularly on Bandiagara describes the enormous encroachment of rain-fed agriculture and associated disappearance of natural woodlands for the same period, yet highlighting the recent success of governmental and villagers' efforts to preserve woody plants within agricultural lands (Yossi and Diakité 2008).

Regarding long-term changes in vegetation cover, local populations in both study areas report a tremendous decrease of woodlands since the beginning of the 1970s. For example, elders in Mali told us about dense forests during the time of their childhood. The interviewees related the disappearance of tree cover to the persistent water scarcity during the great droughts on the one hand, and extensive deforestation during that period to compensate for harvest losses by selling wood on the other.[16] A major change observed by the people is a decrease in the diversity of tree species: "Today you have to walk long distances to find certain medical plants and trees, some of them have completely disappeared."[17] Trees within agricultural fields are preserved by the villagers themselves and appear to be crucial for them: "Where there are more trees, there is also more rainfall. Everyone wants to have trees on his

[16] Various interviews in Khogué, Loumbel Mbada (Senegal) and Kowa, Yawakanda, Doucombo, Diamnati, Tiembara (Mali), 2011 and 2012.

[17] Informants in Kowa, Tiembara (Mali), 2011 and 2012.

fields, because it increases soil fertility and one gets a better harvest."[18] In both countries, people evaluated soil fertility as having decreased during the past 50 years, which they do not associate with a deficiency of trees but rather with shortened or even no fallow periods as a result of insufficient cultivable land.

These local assessments of vegetation change in the study areas reveal that, despite the enormous decline of woodlands since the great droughts and increasing preservation efforts being confirmed by the local populations, there seems to be a discrepancy in the evaluation of recent vegetation trends, attesting a general greening and relative stability of woody plants. Interestingly, none of the interviewees highlighted a stability or increase of trees in the study regions; rather, they emphasised the lack of trees, high population pressure on woody plants, as well as official restrictions and penalties related to woodcutting. This is in line with the findings of Mertz et al. (2009, p. 810) in Senegal, where people perceive a degradation of vegetation and do not relate it to climate but mainly to abusive use and population growth. Even if the woody vegetation is recovering in our study regions, cutting firewood is restricted to certain areas, requires a costly official permission and therefore remains a source of conflict and concern to many people, which thus might influence their personal assessment of vegetation trends.

In this section we have discussed contemporary tendencies regarding climate conditions and vegetation trends in the two study areas, providing interpretations of these trends by the local population. Even though detailed information on smaller spatial scales is not available yet, data from meteorological observation[19] and field research in the region generally point to positive trends towards more precipitation and a relative stability of vegetation cover (Tappan et al. 2004; Yossi and Diakité 2008). While people's observations of the past profound changes in rainfall and vegetation correspond to recorded data, their assessments of current trends do not draw a uniform picture and seem to be influenced by the diverse impacts these trends may have. People interpret and feel affected by the changes very differently, and name a variety of non-climate factors on which their food security and livelihoods depend. Harvest output is a result of an interplay of parameters that goes beyond rainfall and the diversification of income generating activities essentially contributes to people's livelihoods. It is clear that annual temperature, annual rainfall or overall vegetation cover are not adequate and sufficient parameters for making judgments with regard to the impact of climate on people's lives on a local level.

5.5 Hoe and Mobile Phone: Local Migration Dynamics

The high mobility of people in the study areas has a long tradition and must be regarded in the historical context of West African migration dynamics (see de Haas 2007; Merabet and Gendreau 2007). Contemporary migration patterns in West

[18] Interviews in Kowa, Diamnati (Mali), 2011 and 2012.

[19] Data from *Global Precipitation Climatology Centre (GPCC).*

Africa are shaped by colonial influence. The introduction of taxes and the high labour demand in coffee, cacao and groundnut plantations, mines or for large infrastructural projects have led to the development of a rural-rural and rural-urban circular labour migration pattern that is mainly directed from landlocked countries such as Niger, Burkina Faso and Mali towards the coastal regions of Senegal, Ivory Coast, Ghana and Nigeria (Bakewell and de Haas 2007). Fast-growing urban centres and especially harbour towns such as Accra, Lagos, Abidjan, Lomé, Dakar and Cotonou have emerged as important economic points of attraction for job-seeking migrants. Environmental and climatic conditions have always contributed to shaping the causal, temporal and spatial dimensions of human migration in the region. For example, a north-south rainfall gradient implies that regions in the south generally have more favourable conditions for crop production, thus supporting a north-south-directed agricultural and labour migration. Moreover, annual transhumant movements performed by Fulani pastoralists or the dry-season migration practised by sedentary, agriculturalist rural households are well-known migration strategies of adaptation to the effects of seasonality of rainfall and periodic droughts characteristic to the West African Sahel (see p. 451 in McLeman and Hunter 2010).

5.5.1 Migration in Bandiagara

Our results confirm that Bamako and the Ivory Coast are primary destinations for migrants from Bandiagara; moreover, apart from a few exceptions, international migration beyond Africa seems to be of lesser importance. Bamako has become an increasingly important destination thanks to rising job opportunities,[20] particularly in the informal sector.[21] Much migration from Bandiagara appears to be temporary and circular, both within Mali and abroad. In most of the villages, a tendency towards the longer absence (temporary) or intensified emigration (permanent) of young people, especially to Bamako, is associated with an increasing literacy rate and the lack of institutions of higher education or relevant employment opportunities.[22] As with many other ethnic groups in West Africa, migration as a "rite de passage" to adulthood is also an integral part of the Dogon people's culture in Bandiagara, whereby virtually all young men temporarily leave their village to "go on adventure" (Dougnon 2007; see p. 62 in Doevenspeck 2005): "It's the chat. If you didn't travel, you have nothing to tell. […] Besides, you feel less annoyed because you have experienced many things."[23] Usually, who is allowed to migrate and for how long is negotiated within the household, in order to keep at least a mini-

[20] Especially due to the growth of the construction, telecommunications, service and petty trade sectors (Kilroy 2008; OECD 2008).

[21] Various interviews with migrants in Bamako in 2011 and 2012 showed that they are self-employed or engaged in informal economic activities.

[22] Various Interviews in Doucombo, Yawakanda, Kowa and Bamako in 2011 and 2012.

[23] Interview in Kowa, April 2011.

mum of manpower at home. Young people repeatedly mentioned the lack of income opportunities in their rural home as a migration motive. For many interviewees, paying taxes, purchasing animals or farming equipment, a mobile phone or a motorbike are important objectives that can be realised through migration.[24]

The only connection between environmental and climatic factors and migration that the people established themselves was through describing an increase of seasonal labour migrants as one of their strategies to compensate for insufficient harvests caused by 'bad' rainfall (see Sect. 5.4.2). However, as Findley (1994) has shown for the drought from 1983 to 1985, short-distance, temporary migration as a response to variations in the rainfall regime of the region is not new. Even though dry-season migration is still more important, the seasonal circular movements seem to take on increasingly heterogeneous temporary patterns, with people commuting at all times of the year.[25] Depending on the individual situation, they may return to the home village for less than 3 months per year, or stay away for several years and only pay short visits to the village for family events or whenever important community affairs have to be settled.[26] Interviewees reported that migrants' remittances play an important role regarding food security, especially for poorer households, since yields are insufficient to supply the families throughout the year. However, interviews in Bandiagara revealed that harvests crucially depend on a multitude of other factors in addition to rain, including the specific location of fields, crop diversification and the degree of mechanisation. At this point, it is important to note that temporary migration is only one of various income generating activities mentioned, along with petty trade, vegetable gardening, selling animals, wild fruits and plant leaves as animal feed, or selling wood and charcoal. In a sense, all these activities can be regarded as adaptation strategies both to climate variability and economic hardship.

5.5.2 Migration in Linguère

Results show that mobility patterns in the area of Linguère are principally characterised by internal migration towards the cities and international migration towards Europe. By far the most prominent destination among the urban centres is Dakar. Even though repetitive temporary movements persist at present, young people nowadays seek to settle down permanently in the city. The most frequently cited motives for migrating to the urban centre were the same as in Bandiagara, namely education and proper employment and income opportunities.[27] One interviewee explained that

[24] Various interviews in Nianangali, Kowa, Yawakanda, Doucombo, Balaguina Baboye, Bamako, 2011 and 2012.

[25] One reason is that there is less competition between migrants for work in Bamako during the rainy season (interviews in Bamako in 2012).

[26] Interviews in Kowa, Diamnati, Tiembara and Bamako in 2011 and 2012.

[27] Interviews in Khogué, Kadji, Linguère town, Nguith, March 2011 and Dakar, February 2012.

anyone who finds a permanent job in town does not return to the village easily. A further reason is surely that movements from Linguère to the cities have persisted since colonial times, thus strengthening migration networks over a long period, which again perpetuates migration to this day.[28] Elders with their own migration experience emphasised the 'bright-light effect' of the big city: "Those people who are doing agriculture and think that agriculture is good and sufficient don't know anything and haven't seen the big cities. […] They haven't seen much in their life."[29] Although people in Linguère critically evaluate the emigration of young people by hinting at the subsequent increased workload on the farms for their elders, they also appreciate the importance of education and the positive effects of young people's migrations, as well as the importance of remittances, with typical statements including: "If you abandon school, you abandon your family"[30] or "Someone who lives in the city and sends money is closer to the family than someone who stays at home without means."[31]

Interviewees also made statements concerning environmental and climatic aspects in connection with migration. For instance, one migrant from Nguith in Dakar said that the formerly seasonal migration from his village to Dakar began to take on a permanent character following the onset of the droughts at the beginning of the 1970s, owing to decreasing yields. The community's specialisation in basket making in Dakar permitted them to become increasingly independent from harvest output in the village. The chiefs of the villages of Kadji and Khogué specified that some young people were returning to their villages and becoming reengaged in farming at the time of the investigation, due to the particularly abundant rainfalls in 2009 and 2010.[32] Even though the detailed circumstances remain unknown, it can certainly be assumed that they did not have a permanent and rewarding income in Dakar and might have returned to the capital in 2011. Another farmer from Linguère, when first interviewed in 2011, emphasised his profitable engagement in agriculture. In 2012, he was encountered in Dakar, explaining that he had decided to abandon the last cropping period following a bad onset of rainfall in 2011. Thanks to family contacts and his migration experience in Dakar, he had secured work assisting a cousin in his mobile phone shop. Such examples highlight that fluctuations in the amount and timing of rainfall are contributing factors in decisions for temporary internal movements, which are less regarded as a problem but rather a usual mode of living in a very mobile and multi-local social environment under variable climatic conditions. However, our data indicate that migration to Europe does not seem to have a causal relation to climate or environmental factors (cf. Jónsson 2010).

[28] This became evident by considering the large and still increasing community of migrants from Nguith in Dakar, April 2011, February 2012.

[29] Chef de village in Khogué and Kadji, March 2011.

[30] Interview with wife of chef de village in Khogué, March 2011.

[31] Informant in Khogué, March 2011.

[32] Interview with chef de village in Khogué, March 2011.

The contemporary migration landscape is still largely shaped by historically established patterns, with most population movements taking place within the country or region. A common, albeit not new phenomenon in both societies is the trend towards increasing emigration to the cities, and capitals in particular, which people do not primarily associate with climate and environmental factors. Dry-season migration is a well-known and important strategy of adaptation to the annual variability of climatic conditions of the region. However, there are also increasingly complex and ambiguous temporal patterns of circular migration. As shown by the remarks made in some of the interviews, the variability of precipitation (for instance, the drought of the 1970s or the varying patterns of rainfall in recent years) affects migration dynamics to a certain extent. Moreover, it also became evident that in this case migration is not the only adaptation strategy and that there can be enormous differences in the migration dynamics of different villages. The motives behind migration decisions are very complex and multi-layered, even if some respondents directly mentioned aspects of rainfall trends when explaining migration decisions.

5.6 Bringing People and Places Back in: Local Insights in Climate, Environment and Migration

In this chapter, we have adopted a local perspective to explore the relationship between climate, environment and migration in two regions of Mali and Senegal where population mobility is high and processes of environmental degradation are said to increase people's vulnerability. We have shown that seasonal and temporary migration patterns in Bandiagara and Linguère have been traditionally adapted to climatic conditions, long before the international debate on the consequences of global climate change started. Migration in this sense is a well-established strategy to adapt to seasonality and variability of rainfall (Findley 1994; de Haan et al. 2002), but likewise must be regarded as an adaptation to processes of economic, social and cultural change. This places the focus of this volume's discussion on the multiple dimensions of local contexts in which climatic and environmental change and population movements occur. Empirically, two preliminary conclusions can be drawn from our results. Local climate variability continues to impact migration, especially the magnitude of seasonal movements, although it seems that the same climate trends do not result in the same migration responses. For example, increased rainfall in 2009 and 2010 contributed to the return of migrants to Linguère, whereas by contrast, negative impacts of the higher rainfall on harvests have played a part in increased numbers of seasonal migrants in Bandiagara. However, it is evident that the contemporary migration landscape is very much shaped by historically established mobility patterns and networks. In this respect, education and income opportunities in urban centres, 'going on an adventure' and returning to the village with a mobile phone or a motorbike for prestige reasons reflect widespread migration motives. The destination and length of migration heavily depend on the migrant's assets, thus rendering migration a

socially differentiated and selective process that does not provide a homogeneous image of patterns, destinations, objectives and motives.

Complex migration patterns are embedded in an environment that, when looking at quantitative representations of rainfall and vegetation trends on a larger scale, seems to be undergoing continuous recovery from the effects of the great Sahelian droughts of the past century. However, by considering the cultural dimension of climate, people's assessments show that the timing and distribution of rainfall, or even the number of trees in the field, may be more essential than increasing mean annual precipitation. People in different places feel differently affected by recent changes in climate conditions, further stating that climate is only one of many factors that affect their livelihoods.

It must be recalled that the conceptual constraints in approaching the complexity of the environment-migration nexus imply methodological difficulties. During research, it became evident that a clear distinction between cognitive perception and people's own assessment of climate and environmental parameters is hardly possible. The answers provided by the respondents are highly biased by the impacts of climate and vegetation changes on their individual situation. Cultural aspects, experiences and concernments all impact local assessments of climate and environment (see also Roncoli 2006). Therefore, this chapter proposes an approach that conceptually and methodically separates the two research topics of migration and climate/environment. Separate research on local interpretations of climate and environmental changes allows us to deepen our comprehension of their cultural meanings and relevance for people's daily lives, rather than targeting climate variability and environmental degradation as a problem *per se* that requires migration as an answer. This approach is complemented by the inclusion of migrants at their current place of residence abroad, in an attempt to grasp mobility as a normality, a routinised practice of everyday life, as opposed to considering it as a mere coping strategy, a reaction to a concrete threat in the area of origin.

In this respect, the present study contributes to the current debate on climate and environment as drivers of migration in the West African Sahel by presenting both a local representation of migration and a local assessment of climate and environment. Considering the local level empirically and contrasting climate trends and environmental changes in the study regions with assessments by local people allows comparison with similar approaches (see Mertz et al. 2009; West et al. 2008; Maddison 2007). The multi-sited approach of presenting local people's views on migration from the study areas can provide information concerning migration motives and helps to show that contemporary mobility must not be regarded predominantly as an adaptation strategy in the face of environmental or climate stress. Given this complex framework of mobility and local assessment of climate and vegetation trends in the study areas, it becomes evident that, as discussed above, concepts adopting a disentangled view on climate as the main driver of population movements are misleading. Rather, it is important to develop a deeper understanding of local meanings of environmental change and migration in the context of multiple social, political and economic processes of change in order to understand if, how and to what extent certain climate and vegetation trends play a role for what kind of migration.

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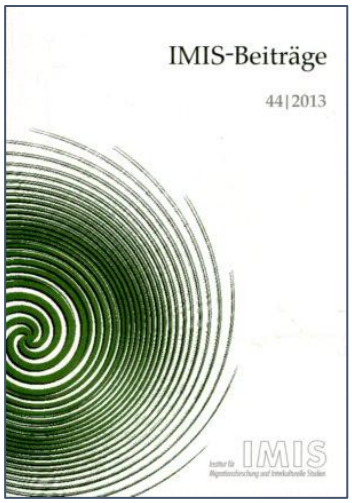
3.3 Migration und Umwelt im westafrikanischen Sahel: methodische Überlegungen



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und Martin Doevenspeck

Migration und Umwelt im westafrikanischen Sahel: methodische Überlegungen

Wie für viele andere Weltregionen wird auch für den als globaler Brennpunkt von Umweltdegradation und Desertifikation wahrgenommenen westafrikanischen Sahel[1] vor massiven Migrationsbewegungen aufgrund klimabedingter Umweltveränderungen gewarnt.[2] Diese Befürchtungen basieren auf dem seit den 1980er Jahren etablierten Narrativ umweltbedingter Zwangsmigration, ein für Migrationsbewegungen in Afrika wirkmächtiges Interpretationsschema. »Das Migrationspotenzial Afrikas dürfte aus ökologischer Sicht steigen, weil durch voranschreitenden Klimawandel, wachsenden Bevölkerungsdruck auf natürliche Ressourcen (Wasser, Boden) und fehlende ökologische Nachhaltigkeitspolitik extreme Wetterphänomene und Wassermangel sowie die Degradation der Böden zunehmen werden. Das Schwinden der Existenzgrundlage wiederum zwingt die Betroffenen zum Verlassen der angestammten Region.«[3] Mit dieser Hervorhebung des umweltbedingten Zwangscharakters von Wanderungen reproduziert auch das deutsche Bundesamt für Migration und Flüchtlinge (BAMF) Bilder von ›Überbevölkerung‹ und sedentaristische Vorstellungen von Migration.[4] Das Amt übergeht so-

1 Serigne Tacko Kandji/Louis Verchot/Jens Mackensen, Climate Change and Variability in the Sahel Region: Impacts and Adaptation Strategies in the Agricultural Sector, Nairobi 2006.

2 Thomas Hammer, Desertification and Migration. A Political Ecology of Environmental Migration in West Africa, in: Jon D. Unruh/Maarten S. Krol/Nurit Kliot (Hg.), Environmental Change and Its Implications for Population Migration, Dordrecht 2004, S. 231–246; Michel Boko u.a., Africa, in: Martin L. Parry u.a. (Hg.), Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Cambridge 2007, S. 433–467.

3 Bundesamt für Migration und Flüchtlinge, Vor den Toren Europas? Das Potenzial der Migration aus Afrika, Nürnberg 2010, S. 10.

4 Julia Verne/Martin Doevenspeck, Bitte dableiben! Sedentarismus als Konstante in der Migrationsforschung in Afrika, in: Martin Geiger/Malte Steinbrink (Hg.), Migration und Entwicklung aus geographischer Perspektive (IMIS-Beiträge, H. 42), Osnabrück 2012, S. 61–94.

wohl abweichende Interpretationen von Auswirkungen des Klimawandels auf Umweltbedingungen[5] und Migration in Afrika[6] als auch differenzierte Analysen des Wanderungsgeschehens auf dem Kontinent.[7]

Einem statischen Push-Pull-Schema verhaftete vereinfachende Annahmen von (klimabedingten) Umweltveränderungen als Ursache für Migration wurden von zahlreichen Autoren als theoretisch nicht fundiert und empirisch nicht evident kritisiert.[8] Abgesehen von Fluchtbewegungen infolge von natürlichen oder anthropogen bedingten Extremereignissen scheint es analytisch kaum möglich, eine Migrationsbewegung als hauptsächlich umweltbedingt zu bezeichnen. »There is agreement today that natural factors are not the sole cause of migration in themselves and that the economic, social and political situation of the zone under threat can, depending on the case, increase or decrease the flow of migrants.«[9] In der Debatte lassen sich drei wesentliche Linien der Kritik identifizieren:

1. Terminologische Unklarheiten: Trotz unterschiedlicher Definitionsversuche sind die verwendeten Begriffe sehr vage, wodurch eine analytische Operationalisierung schwierig bleibt (siehe auch den Beitrag von Aufenvenne und Felgentreff in diesem Band). Ob ›ökologische Migration‹, ›Umweltmigration‹, ›umweltbedingt motivierte‹ oder ›umweltinduzierte Migration‹ – Versuche, eine weniger differenzierte Terminologie zu nutzen, stellen angesichts der in der empirischen Beobachtung fließenden

5 Lennart Olsson/Lars Eklundh/Jonas Ardö, A Recent Greening of the Sahel – Trends, Patterns and Potential Causes, in: Journal of Arid Environment, 63. 2005, S. 556–566.

6 Gunvor Jónsson, The Environmental Factor in Migration Dynamics – A Review of African Case Studies (International Migration Institute Working Papers 21), Oxford 2010.

7 Oliver Bakewell/Hein de Haas, African Migrations: Continuities, Discontinuities and Recent Transformations, in: Patrick Chabal/Ulf Engel/Leo de Haan (Hg.), African Alternatives, Leiden 2007, S. 95–118.

8 Arjan de Haan/Karen Brock/Ngolo Coulibaly, Migration, Livelihoods and Institutions: Contrasting Patterns of Migration in Mali, in: Journal of Development Studies, 38. 2002, S. 37–58; Sally E. Findley, Does Drought Increase Migration? A Study of Migration from Rural Mali during the 1983–85 Drought, in: International Migration Review, 28. 1994, S. 539–553; Kees van der Geest/Anton Vrieling/Ton Dietz, Migration and Environment in Ghana: A Cross-District Analysis of Human Mobility and Vegetation Dynamics, in: Environment and Urbanization, 22. 2010, S. 107–124; Stephen Castles, Concluding Remarks on the Climate Change-Migration Nexus, in: Étienne Piguet/Antoine Pécoud/Paul de Guchteneire (Hg.), Migration and Climate Change, Cambridge 2011, S. 415–427; Martin Doevenspeck, The Thin Line Between Choice and Flight: Environment and Migration in Rural Benin, in: International Migration, 49. 2011, S. 50–68.

9 Etienne Piguet, Climate Change and Forced Migration. New Issues in Refugee Research, Research Paper No. 153, Genf 2008, S. 3.

Übergänge zwischen Unterscheidungsmerkmalen wie Motivation und Zwang keine überzeugende Lösung für konzeptionelle Probleme dar.

2. Analytische Defizite: Aufbruchsentscheidungen liegen immer vielfältige, komplex miteinander verwobene Motivlagen zugrunde. Es mag banal erscheinen, auf diese Motivbündel hinzuweisen, aber die Debatte um Klima und Migration zeigt eindrücklich, dass in diesem stark politisierten Themenfeld grundlegende Erkenntnisse der Migrationsforschung schlichtweg ausgeblendet werden. Auch von der in ihrer Gesamtheit überschaubaren Migrationstheorie scheint die Debatte schon lange abgekoppelt zu sein.
3. Politische Instrumentalisierung: Es ist erstaunlich, dass ein analytisch so wenig tragfähiges Konzept wie das der Umwelt- bzw. Klimamigration in den Agenden einflussreicher und diskursbestimmender internationaler Organisationen wie z.B. UNEP, IPCC, UNU und IOM[10] so prominent vertreten ist. Für zukünftige Migrationsforschung im Rahmen der Forschung zum Klimawandel wäre es daher interessant, den Aspekt der Versicherheitlichung von Migration stärker zu beachten und diesen Diskurs selbst zum Gegenstand der Forschung zu machen, um die interne Logik des Agenda-Settings in internationalen Organisationen, aber auch in NGOs und der Forschungsförderung zu rekonstruieren.

Der vorliegende Beitrag möchte in der hier kurz skizzierten Debatte einen bislang kaum beachteten, aber mit den offenen konzeptionellen Fragen untrennbar verbundenen Aspekt ansprechen und methodische Überlegungen in den Mittelpunkt rücken. Wie lassen sich die komplexen Beziehungen zwischen Umwelt, Klima und Migration erforschen? Welche Fragen können wem, wo, wann, warum und wie gestellt werden, um der Differenziertheit des Phänomens gerecht zu werden? Was sind Stärken und Schwächen des von multivariater Statistik bis ethnographischen Ansätzen reichenden methodischen Spektrums? Wie könnte ein synthetisierender methodischer Ansatz in der konkreten empirischen Forschung aussehen? Diese Fragen sind angesichts der allseits bemängelten empirischen Evidenz des Schlagwortes von der Umweltmigration in mindestens zweifacher Hinsicht relevant. Erstens gibt es im Verhältnis zu den zahlreichen akademischen Einlassungen zum Thema relativ wenige konkrete empirische Studien und zweitens bleibt das methodische Vorgehen in diesen Studien meist weitgehend unreflektiert. Der Beitrag gibt daher zunächst einen Überblick über bestehende methodische Ausrichtungen im Forschungsfeld Klima, Umwelt und Migration, leitet daraus einen eigenen Ansatz ab und skizziert erste Ergebnisse dieses in einem Forschungsprojekt in Mali und Senegal verfolgten Ansatzes.

10 United Nations Environment Programme (UNEP); Intergovernmental Panel on Climate Change (IPCC); United Nations University (UNU); International Organization for Migration (IOM)

1 Methodische Ansätze in der Forschung zu Migration, Umwelt und Klima

Trotz der offensichtlichen inhaltlichen, terminologischen und theoretischen Unzulänglichkeiten des Konzeptes der klima- bzw. umweltbedingten Migration bleibt es politisch weiter relevant und ausgesprochen nützlich für die Einwerbung von Mitteln zur Forschungsförderung. In ihrem Beitrag für den vorliegenden Band haben Philipp Aufenvenne und Carsten Felgentreff in diesem Zusammenhang auf einen »postnormalen Charakter« des Forschungsthemas hingewiesen. Hinsichtlich der empirischen Operationalisierung der mittlerweile zahlreichen Forschungsvorhaben stellt sich die Frage, inwiefern der kurz skizzierten konzeptionellen Kritik sowie den damit verknüpften methodischen Problemen in der Forschungspraxis Rechnung getragen wird. Die grundsätzliche methodische Schwierigkeit besteht darin, direkte oder indirekte kausale Beziehungen zwischen Veränderungen von Umwelt- und/oder Klimafaktoren sowie Migrationsdynamiken und -entscheidungen nachvollziehbar zu erfassen und dafür ein Forschungsdesign zu entwickeln, welches der Vielschichtigkeit von Migration gerecht wird und die Reifikation des Konstrukts Umweltmigration vermeidet.

Betrachtet man die internationale Forschungslandschaft zu ›Umweltmigration‹, so finden sich immer häufiger Projekte, die auf Extremereignisse und Naturkatastrophen fokussieren und daher auch nicht mit den gerade umrissenen methodischen Problemen konfrontiert sind. Ein aktuelles Beispiel ist DEVAST[11] (Disaster Evacuation and Risk Perception in Democracies), ein japanisch-französisches Forschungsprojekt, das sich vor allem mit der Evakuierung der Bevölkerung infolge der drei aufeinanderfolgenden Katastrophen (Erdbeben, Tsunami und Fukushima) in Japan vom März 2011 beschäftigt. Auch das Forschungsprogramm EXCLIM[12] (Exil Climatique – Gérer les déplacements des populations dus aux phénomènes climatiques extrêmes) kann genannt werden. Hier konzentrieren sich Wissenschaftlerinnen und Wissenschaftler auf Zwangsmigrationen nach meteorologischen Extremereignissen. Fallstudien behandeln unter anderem Überschwemmungen in Burkina Faso oder den Hurrikan Katrina in den USA. Es ist schwerlich zu bestreiten, dass bei diesen Evakuierungen und Fluchtbewegungen der Tsunami, der Hurrikan oder das Hochwasser als direkte und unmittelbare Auslöser von Bevölkerungsbewegungen angesehen werden können. Dieser spezielle und auf internationalen Konferenzen zu der Debatte immer häufiger vorgestellte Fokus lässt sich dadurch verstehen, dass so scheinbar direkte und sichtbare Folgen eines globalen Klimawandels erfahr- und vermittelbar gemacht werden kön-

11 http://www.devast-project.org/ (17.10.2013)

12 http://www.reseau-terra.eu/spip.php?rubrique180 (17.10.2013)

nen. Außerdem kann, anders als bei langsam ablaufenden Umweltdegradationen, den methodischen Herausforderungen der Erfassung kumulativer Verursachung von Migration ausgewichen werden.

Grundsätzlich sollten die verschiedenen Formen von Bevölkerungsbewegungen im Kontext von Klima- und Umwelteinflüssen wie Evakuierung, Umsiedlung und Flucht vor den Folgen von Extremereignissen sowohl voneinander, als auch von Migration als bereits etablierter Form des Lebenshaltungssystems, konzeptionell immer klar unterschieden werden. Untersuchungen von erzwungenen Wanderungen nach Extremereignissen sind notwendig, berücksichtigen aber eben nur die eindeutigste und empirisch relativ einfach zu fassende Dimension sogenannter Umweltmigration. Daher tragen diese Studien nur relativ wenig zu der eigentlichen Debatte bei und es ist zu bezweifeln, dass gerade diese Bevölkerungsbewegungen vor dem Hintergrund eines globalen Klimawandels Einfluss auf das Ausmaß und die Muster großmaßstäblicher Wanderungsmuster haben werden. Nachfolgend wird daher der Blick auf jene aktuelle Forschung erweitert, die sich stärker der Komplexität von Klima, Umwelt und Migration widmet und mit den skizzierten methodischen Herausforderungen umgehen muss.

Das Spektrum der angewandten Methoden lässt sich grob mit der Unterscheidung von quantitativen, qualitativen und modellbasierten Herangehensweisen umreißen, deren jeweilige Stärken und Schwächen nachfolgend kurz diskutiert werden. Der Ansatz der ökologischen Inferenz zielt darauf ab, eine spezifische Region auf Korrelationen zwischen Umweltparametern und Migrationscharakteristika zu testen. Mithilfe von multivariaten Methoden werden dabei Klima- und Umweltvariablen (z.B. Regenfälle, Dürren, Überflutungen, tropische Stürme) von anderen Parametern isoliert. Meist können in solchen Studien zwar messbare Einflüsse der Umwelt auf die Emigrationsraten abgeleitet werden, doch die Erklärungskraft dieser Korrelationen variiert je nach Fallstudie zum Teil erheblich.[13] Zwei wichtige Kritikpunkte sind hier zu nennen: Die bislang berücksichtigten Klima- und Umweltvariablen beschränken sich auf wenig detaillierte Indikatoren wie beispielsweise Naturkatastrophen und kumulierte Trends von Niederschlag oder Vegetationsbedeckung. Darüber hinaus lassen auch räumlich kumulierte demographische Daten keine Rückschlüsse auf die Migrationsentscheidung von Individuen zu. »In other words, nothing guarantees that the very people who emigrated and contributed to a negative migration balance in an

13 Sabine Henry/Paul Boyle/Eric F. Lambin, Modelling Inter-Provincial Migration in Burkina Faso, West Africa: The Role of Socio-Demographic and Environmental Factors, in: Applied Geography, 23. 2003, S. 115–136; Rafael Reuveny/Will H. Moore, Does Environmental Degradation Influence Migration? Emigration to Developed Countries in the Late 1980s and 1990s, in: Social Science Quarterly, 90. 2009, S. 461–479; van der Geest/Vrieling/Dietz, Migration and Environment in Ghana.

area under environmental stress, for example, are the same individuals who experienced that environmental stress and took a decision to migrate accordingly.«[14] Kurzum, Koinzidenzen dieser Art lassen sich für die Herstellung von Kausalzusammenhängen nicht heranziehen.

Ein geläufiger Ansatz, um Informationen zu sozialen und ökonomischen Bedingungen sowie Migrations- und Umweltdaten zu erhalten, ist der Einsatz standardisierter Fragebögen im Rahmen sogenannter *large-n surveys*, also umfassender vollstrukturierter Erhebungen.[15] Zwar lassen sich so zu einem gewissen Maße fallspezifische Korrelationen zwischen Umweltfaktoren und Bevölkerungsbewegungen identifizieren, doch offenbart ein solches Vorgehen gleichzeitig auch die Schwierigkeiten einer gemeinsamen und deutenden Betrachtung von Umwelt- und Migrationsvariablen. Ein Problem besteht darin, dass Umweltindikatoren über einen längeren Zeitraum nur unzureichend erfasst werden können und damit deren isolierte Deutung für Migrationsprozesse angesichts weiterer kontextueller Effekte einschränkt ist.[16] Wie immer bei vollstrukturierten Befragungen, hängt die Qualität der Forschungsergebnisse auch entscheidend vom Aufbau des Fragebogens und der Qualität der Fragen ab. Oft werden die Befragten hinsichtlich ihrer Migrationsmotive, ihrer wirtschaftlichen Situation und bezüglich potentieller Umweltveränderungen einem regelrechten *problem-scanning* unterzogen. Entweder aktiviert ein solches Vorgehen im Antwortverhalten bereits ins Alltagswissen eingesickerte Narrative zu Klima, Umweltveränderungen und Migrationsentscheidungen, wie beispielsweise die saisonale Arbeitsmigration aufgrund von Ernteausfällen, oder es lässt den Befragten gar keine andere Möglichkeit, als Wanderungen entsprechend zu rahmen. Dies gilt insbesondere für Fragen, die direkt auf eine Verbindung zwischen Umweltveränderungen und Migrationsverhalten abzielen, damit bereits im Forschungsdesign kausale Zusammenhänge voraussetzen und so weniger zu neuen Erkenntnissen als zur Perpetuierung bekannter Erzählungen führen.

Ethnographien, die mit (teilnehmender) Beobachtung, narrativen und biographischen Interviews mit einzelnen Migranten und Nicht-(mehr)-

14 Etienne Piguet, Linking Climate Change, Environmental Degradation, and Migration: A Methodological Overview, in: Wiley Interdisciplinary Reviews: Climate Change, 1. 2010, S. 517–524, hier S. 518.

15 Findley, Does Drought Increase Migration?; Sabine Henry u.a., Descriptive Analysis of the Individual Migratory Pathways According to Environmental Typologies, in: Population and Environment, 25. 2004, S. 397–422; Douglas S. Massey/William G. Axinn/Dirgha J. Ghimire, Environmental Change and Out-Migration: Evidence from Nepal. Population Studies Center Research Report 07-615, Ann Arbor 2007; Sundar S. Shresta/Prem Bhandari, Environmental Security and Labor Migration in Nepal, in: Population and Environment, 29. 2007, S. 25–38.

16 Piguet, Linking Climate Change, Environmental Degradation, and Migration, S. 519.

Migranten dichte Beschreibungen erarbeiten, können einige Mängel quantitativer, standarisierter Methoden umgehen.[17] Ein solcher orts- und kontextsensitiver Ansatz liefert einen besseren Einblick in die sozialen Konstruktionen vermeintlicher Fakten wie Umweltdegradation und Dürren und kann Wahrnehmungen und Erfahrungen stärker mit einbeziehen. Eine grundsätzliche Schwäche besteht hier in der begrenzten Vergleichbarkeit dieser oft detaillierten und sehr kontextspezifischen Fallstudien untereinander. Genau wie bei der Erhebung mit Fragebögen ist es auch hier problematisch, wenn in einer Interviewsituation eine direkte Verbindung zwischen Umweltfaktoren und Migration hergestellt wird. Es muss zu einer Verzerrung von Forschungsergebnissen kommen, wenn der Forscher (und nicht der Befragte selbst) hier auf einen Zusammenhang verweist.[18]

Die Methodik zweier prominenter Forschungsprojekte soll im Folgenden genauer betrachtet werden. EACH-FOR (Environmental Change and Forced Migration Scenarios) ist ein 2009 ausgelaufenes Forschungsprogramm der Europäischen Union, das Zwangsmigration durch den Einfluss von Umweltdegradation und Umweltwandel in Verbindung mit weiteren wirtschaftlichen, sozialen und politischen Phänomenen auf mehreren Kontinenten untersucht hat.[19] Die empirischen Ergebnisse basieren vorwiegend auf der Auswertung von Fragebögen und Experteninterviews. Das laufende »Where the Rain falls«-Projekt der United Nations University – Institute for Environment and Human Security und Care International führt Fallstudien in acht verschiedenen Ländern durch und vereint Wissenschaftler unterschiedlicher Disziplinen und Institutionen. Ziel des Vorhabens ist es, herauszufinden, inwiefern Migration für Haushalte eine Reaktion auf Regenvariabilität und Nahrungsmittelunsicherheit ist, um aus diesen Erkenntnissen Szenarien abzuleiten. Das für dieses Projekt entwickelte Forschungsdesign ist eine Weiterentwicklung aus den konzeptionell-methodischen Erfahrungen von EACH-FOR.

Eine der offensichtlichen Schwächen des EACH-FOR-Projekts bezieht sich auf den inhaltlichen Aufbau des angewandten Fragebogens. Die bereits

17 Elizabeth Meze-Hausken, Migration Caused by Climate Change: How Vulnerable are People in Dryland Areas? A Case Study in Northern Ethiopia, in: Mitigation and Adaptation Strategies for Global Change, 5. 2000, S. 379–406; Robert McLeman/Barry Smit, Migration as an Adaptation to Climate Change, in: Climatic Change, 76. 2006, S. 31–53; Colette Mortreux/Jon Barnett, Climate Change, Migration and Adaptation in Funafuti, Tuvalu, in: Global Environmental Change, 19. 2009, S. 105–112.

18 Vgl. Ole Mertz u.a., Farmers' Perceptions of Climate Change and Agricultural Adaptation Strategies in Rural Sahel, in: Environmental Management, 43. 2009, S. 804–816, hier S. 810.

19 Koko Warner u.a., Climate Change, Environmental Degradation and Migration, in: Natural Hazards, 55. 2010, S. 689–715.

beschriebene Kritik am suggestiven Abfragen von Migrationsentscheidungen lässt sich hier verdeutlichen. Bereits die Einstiegsfrage der Erhebung impliziert einfache kausale Zusammenhänge, kann zu einem *Bias* im Antwortverhalten führen und kann auch durch den Fokus auf Extremereignisse dem konzeptionellen Anspruch des Projekts eigentlich nicht gerecht werden: »At any time in your own life, did any environmental problem (like floods or pollution) affect your decision to move?«[20] Die methodischen Instrumente des RAINFALLS-Projekts[21] umfassen neben Haushaltserhebungen mit über 1.300 Fragenbögen eine Vielzahl qualitativer Methoden (PRA-tools) und Experteninterviews. Diese Kombination quantitativer und qualitativer Ansätze erlaubt eine differenziertere Interpretation der Forschungsergebnisse. Dennoch wird bei der Betrachtung der im Fragebogen und in den partizipativen Interviewmethoden thematisierten Punkte deutlich, dass nach wie vor Umwelteinflüsse wie z.B. klimatische Extremereignisse in Verbindung mit der Migrationsentscheidung abgefragt werden. Abgesehen von der Fragwürdigkeit, eine solche Forschung in Kooperation mit einer Entwicklungshilfeorganisation durchzuführen, bleibt darüber hinaus auch unverständlich, warum im Fragebogen zuerst die Bewertung von Niederschlägen und deren Auswirkungen auf die Ernährungssicherung und daran anschließend die Migrationserfahrungen und -entscheidungen abgefragt und Migration damit direkt entsprechend gerahmt wurden.

2 Multilokal und mobil: ein alternativer methodischer Ansatz

Im Folgenden wird ein Ansatz vorgestellt, der im Rahmen eines laufenden Forschungsprojektes verfolgt wird und eine lokale Perspektive auf Migration, Klima und Umwelt in zwei Untersuchungsregionen in Mali und im Senegal einnimmt. Dabei werden einerseits Klimadaten und lokale Vegetationstrends mit deren Bewertungen durch die lokale Bevölkerung kontrastiert[22] und andererseits Muster, Dynamiken und Motive von sowie Ansichten über Migration identifiziert. Klimatische Trends in den Untersuchungsgebieten werden nicht in erster Linie als Folgen globalen Klimawandels bewertet und thematisiert. Mit einer Fokussierung auf Wahrnehmungen, Repräsentationen und Interpretationen an ganz konkreten Orten richtet sich das Erkenntnisinteresse vielmehr auf die kulturellen, sozialen und politi-

20 http://www.each-for.eu/documents/Each-For_Questionnaire_Migrants.pdf (17.10.2013)

21 http://www.ehs.unu.edu/file/get/9921.pdf (17.10.2013)

22 Colin T. West/Carla Roncoli/Frederic Ouattara, Local Perceptions and Regional Climate Trends on the Central Plateau of Burkina Faso, in: Land Degradation and Development, 19. 2008, S. 289–304.

schen Dimensionen von Klimavariabilität und Umweltveränderungen. Das Vorgehen lässt sich darüber hinaus als Multimethoden- und Mehrebenen-Ansatz beschreiben. Die Identifizierung der Untersuchungsregionen in Afrika folgte mit den zwei wichtigsten Kriterien »hohe negative Wanderungssalden« und »auffällige Entwicklung der Vegetations- und Klimabedingungen« dem Prinzip der ökologischen Inferenz. In den Jahren 2011 und 2012 wurden insgesamt elf Monate Feldforschung durchgeführt. Für das Erfassen von Migrationsmustern und -dynamiken sowie für die Bewertung von Klima- und Umweltveränderungen auf lokaler Ebene wurden meist narrative, aber auch halbstrukturierte Einzel- und Gruppeninterviews durchgeführt und Migrantenbiographien erstellt. Geforscht wurde und wird an mehreren Orten im Herkunftsgebiet sowie an den Aufenthaltsorten der Migranten in Mali, Senegal und Europa (s. Karte). Zusätzlich wurde eine rund 900 Personen umfassende standardisierte Erhebung mit Fragebögen in den Untersuchungsgebieten und den Hauptstädten Bamako und Dakar durchgeführt, um flankierende analytische Statistiken vor allem zu Migrationsmustern und Destinationen zu erhalten.[23]

Das Forschungsdesign sah vor, in einem ersten Schritt Zusammenhänge von Klima- oder Umweltveränderungen und Migrationsverhalten direkt und gezielt abzufragen, um potentielle lokale Narrative von Umweltmigration zu erfassen. Im Anschluss daran wurde darauf verzichtet, den Interviewpartnern explizite Fragen über die Verbindung zwischen Klima, Umwelt und Migration zu stellen, um die bereits erwähnten standardisierten Erzählweisen über Umweltmigration zu vermeiden und differenziertere Ausführungen über Migrationsmuster zu ermöglichen.[24] Dafür wurden die Themenbereiche Klima/Umwelt und Migration während der Feldforschung räumlich und zeitlich getrennt voneinander untersucht. Auch während der Gespräche wurde vermieden, direkte kausale Zusammenhänge zwischen Klima- oder Umweltfaktoren und Migrationsmotiven herzustellen. Vielmehr wurden die Gespräche so gestaltet, dass nur die Gesprächspartner selbst potentielle Zusammenhänge thematisieren konnten, um so lokale Deutungen von Migration einerseits und Klima und Umwelt andererseits zu erhalten.

Sedentaristischen Repräsentationen von Migration, die Afrikanerinnen und Afrikaner als natürlicherweise immer fest mit ihrer Heimat verwurzelt denken und Wanderungen daher als ein Problem an sich und als Reaktion auf ein Problem bzw. auf eine konkrete Bedrohung wie etwa Umwelt- oder Klimastress repräsentieren[25], wurde methodisch durch eine mobile, multilo-

23 Auf die mit dieser Erhebung gewonnenen Daten kann aufgrund der noch nicht abgeschlossenen Auswertung in diesem Beitrag nicht rekurriert werden.

24 Für diesen zweiten Forschungsschritt wurden andere Untersuchungsdörfer ausgewählt.

25 Verne/Doevenspeck, Bitte dableiben!

kale Ethnographie[26] begegnet. Ausgehend von den Untersuchungsgebieten wurde den Migrationsnetzwerken gefolgt, um Ethnographien vor, während und nach der Migration und an unterschiedlichen Wanderungsstationen zu sammeln.[27] Diese Methodik wird gerahmt durch ein konzeptionelles Ausgangsverständnis, in welchem wir Mobilität als den Normalfall betrachten, als routinierte Praxis und integralen Bestandteil des alltäglichen Lebens und als grundlegend für sämtliche wirtschaftlichen, sozialen und politischen Beziehungen[28] und nicht als Problem *per se*.

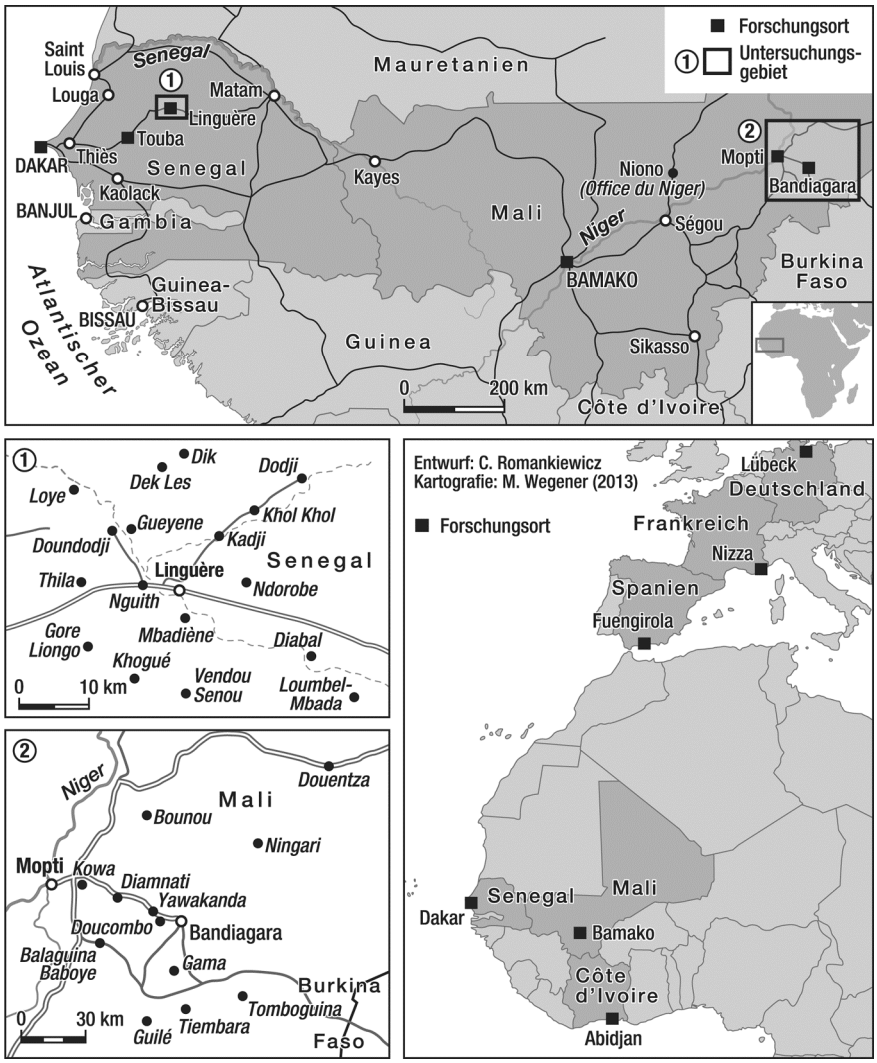
Aus der Arbeit in den Dörfern der Untersuchungsregionen resultierten nicht nur dichte Beschreibungen der Migrationsgeschichte von Familien und Orten, sondern auch über die von dort ausgehenden Migrationsnetzwerke. Mit dem Verweis auf Bekannte und Verwandte in den Dörfern konnten über Telefon oder Internet Kontakte mit migrierten Dorfbewohnern an den unterschiedlichsten Orten im In- und Ausland hergestellt werden. Neben den in beiden Ländern meist in die Hauptstädte Bamako und Dakar führenden Verbindungen wurde eine Reihe von aus den Untersuchungsgebieten stammenden Personen in westafrikanischen Nachbarländern und in Europa kontaktiert. Mobile Feldforschung im engeren Sinne konnte mit jenen Migranten durchgeführt werden, die beispielsweise zwischen der Hauptstadt und ihrem Herkunftsort in der jeweiligen Untersuchungsregion reisten. An den unterschiedlichen Stationen, insbesondere aber in Dakar und Bamako, konnten daher Migrantennetzwerke und deren soziale Organisation erfasst und besser verstanden werden. Ein Beispiel für dieses Vorgehen ist das Dorf Nguith im Senegal, das eine auffällig hohe Zahl von internationalen Migranten in verschiedenen europäischen Ländern aufweist. Die von diesem Dorf aus etablierten familiären Kontakte führten zu einer umfassenderen Feldforschung zunächst innerhalb von Dakar, später innerhalb der in Nizza (Frankreich) und Fuengirola (Spanien) lebenden Migrantengemeinschaften. Der multilokale, von den Untersuchungsgebieten ausgehende Forschungsansatz zur aktuellen Mobilität offenbarte Perspektiven und Erkenntnisse, die sich bei einem alleinigen Fokus auf die Herkunftsregion der Migranten nicht ergeben hätten. Die empirischen Ergebnisse – und welchen Mehrgewinn die erläuterte Vorgehensweise erbrachte – sollen im folgenden Kapitel kurz umrissen werden.

26 George E. Marcus, Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography, in: Annual Review of Anthropology, 24. 1995, S. 95–117, hier S. 106.

27 Mimi Sheller/John Urry, The New Mobilities Paradigm, in: Environment and Planning A, 38. 2006, S. 207–226.

28 John Urry, Mobilities, Cambridge 2007, S. 43.

Karte: Untersuchungsgebiet und Forschungsorte



3 Eine empirische Skizze

Erste Forschungsergebnisse zur Migration in den beiden Untersuchungsgebieten in Mali und Senegal zeigen, dass es sich vor allem um Binnenwanderungen handelt. Ein seit der Unabhängigkeit Anfang der 1960er Jahre bestehendes Migrationsmerkmal beider Länder sind Wanderungen in die Städte und hier vor allem nach Bamako und Dakar.[29] Die Muster internationaler Migration unterscheiden sich dagegen deutlich. Während für Linguère (Senegal) Europa als Ziel von großer Bedeutung ist, bleibt die Elfenbeinküste die wichtigste internationale Destination für Migranten aus Bandiagara (Mali).[30] Insgesamt ist das rezente Wanderungsgeschehen durch persistente, wenn auch durch die vielfältigen bewaffneten Konflikte in Westafrika gestört, historisch gewachsene Migrationsmuster charakterisiert, die durch lang etablierte Netzwerke perpetuiert werden. Die in den beiden ländlichen Untersuchungsregionen verbreitete saisonale, zirkuläre Migration zeigt zeitlich differenziertere Muster, denn in Abhängigkeit von der individuellen Situation kehren viele der befragten Migranten nur noch für weniger als drei Monate im Jahr in ihr Heimatdorf zurück oder kommen sogar erst nach mehreren Jahren für kurze Besuche zu Familienfesten oder wichtigen gemeinschaftlichen Angelegenheiten in ihre Dörfer zurück.[31] Die Motive für die individuellen Migrationsentscheidungen sind sehr komplex. Die am häufigsten genannten Motive für Land-Stadt-Wanderungen sind Bildung und Arbeitsuche.[32] Viele junge Migrantinnen und Migranten erfüllen sich mit ihrer Migration Konsumwünsche und kehren mit einem Mobiltelefon oder einem Motorrad zurück. Arbeitsmigration führt zu einer ungleichen innerdörflichen Verteilung von Kaufkraft und Ausstattung mit Konsum- und Bedarfsgütern. Die Schwierigkeiten, einen vergleichbaren Wohlstand unter den Bedingungen vor Ort zu erreichen, scheinen bei Nicht-Migranten ein Gefühl relativer

29 Papa Demba Fall/María Hernández Carretero/Mame Yassine Sarr, Senegal Country and Research Areas Report. EUMAGINE Project Paper 2, Dakar/Oslo 2010; Moïse Ballo, Migration au Mali. Profil National 2009. Genève. Organisation internationale pour les migrations (OIM), Genf 2009.

30 ANSD (Agence Nationale de la Statistique et de la Demographie), Situation Economique et Sociale de la Région de Louga – Année 2006. Dakar 2007; WFP (World Food Programme), Mali. Analyse de la Sécurité Alimentaire et de la Vulnérabilité, Bamako 2006.

31 Interviews in Bamako, Tiembara, Kowa, Bandiagara (Mali), Dakar, Nguith, Khogué (Senegal) 2011 und 2012. Siehe auch Nadine Sieveking/Margit Fauser, Migrationsdynamiken und Entwicklung in Westafrika: Untersuchungen zur entwicklungspolitischen Bedeutung von Migration in und aus Ghana und Mali. Bericht für das BMZ UNDP: Barrieren überwinden: Migration und menschliche Entwicklung (Bericht über die menschliche Entwicklung 2009, hg.v. UNDP), Berlin 2009.

32 Interviews in Nizza (Frankreich), Khogué, Kadji, Dakar (Senegal), Tiembara, Doucombo, Bamako (Mali) 2011 und 2012.

Deprivation auszulösen und die eigene Migrationsentscheidung zu beeinflussen.[33] In diesem Zusammenhang ist zu berücksichtigen, dass eine temporäre Migration auch als Abenteuer und Bestandteil des Erwachsenwerdens gilt.[34]

Hinsichtlich der Umwelt- und Klimaaspekte lässt sich zunächst festhalten, dass für den westafrikanischen Sahel seit den 1960er Jahren ein messbarer Anstieg der mittleren Jahrestemperaturen zu beobachten ist.[35] Dagegen haben die Befragten ein sehr heterogenes Bild von Temperaturtrends, und nur wenige Personen nahmen einen Anstieg wahr. Deutungen von Temperaturschwankungen bezogen sich allesamt direkt oder indirekt auf den Einfluss von Niederschlägen während der vorangegangenen Regenzeit.[36] Wie Temperaturveränderungen bewertet werden, scheint stark von persönlichen Erfahrungen saisonaler Hitze- oder Kältewellen gelenkt zu sein, und auch die Verfügbarkeit von z.B. warmer Kleidung beeinflusst die individuelle Sichtweise.[37] Für die jährlichen Niederschläge der vergangenen Jahrzehnte in den beiden Untersuchungsregionen lässt sich sagen, dass hier wie im gesamten Sahel die großen Dürreperioden der 1970er und 80er Jahre zu verzeichnen waren.[38] Erst seit den letzten zehn Jahren ist ein deutlicher Anstieg der Durchschnittswerte zu verzeichnen, wobei die Jahre 2009 und 2010 besonders ergiebige Regenfälle brachten. Diese Beobachtungen werden von der lokalen Bevölkerung weitgehend bestätigt. Die jeweiligen Bewertungen aktueller Trends ließen allerdings kein einheitliches Bild erkennen. Während manche Dörfer 2010 von sehr guten Ernten profitierten, klagten andere über fehlende Pausen zwischen den Regenfällen, über Überschwemmungen nach Starkniederschlägen und Ernteeinbußen durch zu hohe Feuchtigkeit in den

33 Interviews in Fuengirola (Spanien), Bamako (Mali), Linguère (Senegal) 2012.

34 Martin Doevenspeck, Migration im ländlichen Benin – Sozialgeographische Untersuchungen an einer afrikanischen Frontier, Saarbrücken 2005; Isaïe Dougnon, Travail de Blanc, travail de Noir – La migration des paysans dogon vers l'Office du Niger et au Ghana (1910–1980), Paris 2007; Georg Klute/Hans Peter Hahn, Cultures of Migration: Introduction, in: Hans Peter Hahn/Georg Klute (Hg.), Cultures of Migration. African Perspectives, Berlin 2007, S. 9–27.

35 Climate Research Unit 2011, Timothy D. Mitchell/Philip D. Jones, An Improved Method of Constructing a Database of Monthly Climate Observations and Associated High Resolution Grids, in: International Journal of Climatology, 25. 2005, S. 693–712.

36 Siehe auch Carla Roncoli u.a., Meteorological Meanings: Understandings of Seasonal Rainfall Forecasts by Farmers of Burkina Faso, in: Sarah Strauss/Benjamin S. Orlove (Hg.), Weather, Climate and Culture, New York 2003, S. 181–202.

37 Interviews in Khogué, Loumbel Mbada (Senegal), Yawakanda, Kowa (Mali) 2011 und 2012.

38 Global Precipitation Climatology Centre 2012; Bruno Rudolf, The Global Precipitation Climatology Centre, in: WMO Bulletin, 44. 1995, S. 77f.

Feldern.[39] In beiden Ländern wurde die Bedeutung der zeitlichen Verteilung der Niederschläge betont: »unlike scientists, these farmers think about rainfall as a process rather than as a quantity.«[40] Zudem wurde herausgestellt, dass weitere Faktoren wie z.B. der Zugang zu Saatgut, Pestiziden und Düngern, abnehmende Bodenfruchtbarkeit sowie der Mangel an Anbauflächen oder Arbeitskräften den Ernteerfolg entscheidend mitbestimmen. Durch diese Darstellungen wird klar, dass klimatische Bedingungen, und insbesondere Trends gemittelter Jahreswerte, nur begrenzt für Bewertungen landwirtschaftlicher Erträge oder Verwundbarkeit herangezogen werden können.

Der Zusammenhang zwischen Umweltfaktoren und Migration, den die Menschen selbst herstellten, war die Praxis, geringe Ernteerträge infolge »schlechten Regens«[41] durch eine Erhöhung der Zahl der saisonalen Arbeitsmigranten innerhalb des Haushaltes zu kompensieren.[42] Saisonalität von Wanderungen ist eine altbewährte und bekannte Strategie der Anpassung an die klimatischen Bedingungen der Region.[43] Dabei ist diese temporäre Migration aber nur eine von mehreren erwähnten Anpassungsstrategien, die auch Aktivitäten wie den Gemüseanbau oder den Verkauf von Tieren beinhalten. Es zeigte sich auch, dass Ernteerträge nicht nur von Niederschlägen abhängen, sondern unter anderem auch entscheidend durch die spezifische Lage der Felder, die Diversifizierung der Anbaufrüchte, den Grad der Mechanisierung und die Anbaumethoden bestimmt werden. Die Option Migration als Antwort auf klimatische Bedingungen ist sozial differenziert und in vielschichtiger Weise von unterschiedlichen verfügbaren Aktiva abhängig. Menschen selbst innerhalb eines Dorfes bewerten ein und denselben aktuellen klimatischen Trend sehr unterschiedlich. Insofern ist es zumindest fraglich, ob aktuelle Klimatrends einen entscheidenden Einfluss auf die Größenordnung oder räumliche Muster aktueller Mobilität aus den Untersuchungsgebieten haben oder haben werden.

Der im Rahmen der Studie verfolgte Ansatz einer konzeptionellen und methodischen Trennung der Themenbereiche Umwelt/Klima und Migration

39 Interviews in Kadji, Loumbel Mbada, Khogué (Senegal) und Nianangali, Tiembara, Diamnati (Mali) 2011 und 2012.

40 Carla Roncoli, Ethnographic and Participatory Approaches to Research on Farmers' Responses to Climate Predictions, in: Climate Research, 33. 2006, S. 81–99, hier S. 84.

41 Wie bereits beschrieben, ist nicht die Regenmenge allein, sondern insbesondere auch die zeitliche Verteilung ausschlaggebend. Dass die Ernteerträge aber nicht nur entscheidend vom Niederschlag abhängen, sondern, wie oben erläutert, unter anderem auch von einer ganzen Reihe nicht-klimatischer Faktoren beeinflusst wird, wurde in zahlreichen Interviews von den Befragten herausgestellt.

42 Interviews in Linguère, Khogué (Senegal) und Balaguina Baboye, Bandiagara (Mali) 2011.

43 Findley, Does Drought Increase Migration?

ermöglicht vertiefte kultur- und ortssensitive Einblicke und empirische Zugriffe auf emische Bewertungen von Umweltveränderungen und Migration. Entscheidend dafür ist die Berücksichtigung lokaler Erzählungen über Klima und Umwelt und ein Verständnis von den Bedeutungen, die Menschen dem Wandel ihrer natürlichen Umwelt und den damit verbundenen Auswirkungen auf ihre Lebenshaltung zuschreiben. Überdies hilft die separierte Analyse lokaler Wanderungsmuster, -dynamiken und -motive, Migration als einen sozial differenzierten Prozess im Kontext multipler wirtschaftlicher, sozialer und politischer Veränderungen zu verstehen. Die multilokale Organisation der Forschung ermöglichte empirische Zugriffe an verschiedenen Stationen der Wanderungen, wodurch eine gewisse zeitliche Spanne bei den Bewertungen berücksichtigt und es Migranten ermöglicht wurde, ohne die soziale Kontrolle des familiären Umfeldes im Heimatdorf zu antworten.

4 Fazit und Ausblick

Ausgehend von dem Befund eines empirisch-methodischen Vakuums in der Debatte zu ›Umwelt-/Klimamigration‹ wurde in diesem Beitrag ein Überblick über bestehende methodische Ausrichtungen in diesem Forschungsfeld gegeben. Nach der Vorstellung des eigenen Ansatzes wurden erste Ergebnisse aus einem eigenen Forschungsprojekt zu der Frage nach Migration im Rahmen sogenannter *slow-onset changes*, also langsam ablaufender Veränderungen ökologischer und klimatischer Bedingungen, skizziert. Es wurde festgehalten, dass die zahlreichen Forschungen zu Fluchtbewegungen nach plötzlichen Extremereignissen wie dem Hurrikan Katrina die konzeptionellen, theoretischen und methodischen Fallstricke der Debatte vermeiden können.

Angesichts der konzeptionell-methodischen Schwierigkeiten ist das Ziel des vorgestellten eigenen triangulierenden Ansatzes, mit der Identifikation der Untersuchungsregionen nach dem Prinzip der ökologischen Inferenz, mit multivariater Statistik sowie ortssensitiver und mobiler Ethnographie, die Validität der empirischen Ergebnisse zu maximieren. Trotz des empirischen Gewinns durch ein multimethodisches Vorgehen sind die eingesetzten Arbeitsweisen vor allem hinsichtlich des großen Zeit- und Kostenaufwands[44] jedoch nicht beliebig auf Forschungssituationen übertragbar.

Die empirischen Ergebnisse zeigen, dass ökonomische, soziale und kulturelle Faktoren sowie die Einbindung von Migranten in Netzwerke, die auch hinsichtlich der Destinationen mobilitätserhaltend und -reproduzierend wirken, großen Einfluss auf die untersuchten Wanderungsprozesse haben.

44 Die Forschung wird im Rahmen des Projektes MICLE (www.micle-project.net) vom Bundesministerium für Bildung und Forschung (BMBF) finanziert.

Mit einer Fokussierung auf einen Push-Faktor ›Umwelt/Klima‹ lassen sich weder freiwillige Immobilität noch die Ausdifferenzierung von Migrationsmustern verstehen. Wanderungsmotive ändern sich im Zeitverlauf, können aber auch reproduziert werden. Massey griff zur Verdeutlichung dieser Aspekte auf das Konzept einer »zirkulären und kumulativen Verursachung« der Migration von Myrdal zurück.[45] Demnach verursacht bzw. verstärkt Migration den Wandel sozialer und ökonomischer Strukturen und bewirkt damit Folgemigrationen. Migration kann durch strukturelle Einflussfaktoren in den Herkunfts- und Zielgebieten verursacht werden, aber in der Folge unabhängig davon erhalten bleiben. Durch die Ausbildung sozialer Infrastrukturen verlieren diese Einflüsse an Bedeutung oder werden durch neue, auch zielraumspezifische Faktoren abgelöst.

Daher lässt sich für diese Fallstudie zusammenfassen, dass unterschiedlichste strukturelle Bedingungen in den Herkunftskontexten Migrationen begünstigen können, die im Rahmen klassisch-theoretischer Ansätze verstehbar sind. Diese Bedingungen, zu denen auch ökologische und klimatische gehören, werden von den Menschen jedoch sehr unterschiedlich bewertet und bewältigt, womit Migration zum selektiven Prozess wird. Hat der Migrationsprozess einmal begonnen, führen Mechanismen sozialer Strukturbildung zu einer Selbstverstärkung, während die Kumulierung von Migrationsursachen und ihre zeit- und raumabhängige Variation zur Selbsterhaltung beitragen. Im Vergleich zu den in der Debatte zum Klimawandel weit verbreiteten alarmistischen Behauptungen bezüglich globaler ›Umwelt-/Klimamigration‹ ist dies ein eher unaufgeregter Befund. Überträgt man die Ergebnisse einer solchen orts- und kultursensitiven Studie auf einen anderen Maßstab und nimmt die bekannten globalen Migrationssysteme in den Blick, dann muss eine bei aller politischer und akademischer Aufgeregtheit in den Hintergrund gedrängte Frage weiterhin erlaubt sein: Können Umwelt(-) und Klima (-wandel) überhaupt einen bedeutsamen Einfluss auf das Ausmaß und die Muster großmaßstäblicher Wanderungsmuster haben? Dieser angesichts der Wirkmächtigkeit des Konstrukts Umweltmigration beinahe schon heikle Zweifel zieht letztlich einen zweiten, noch grundlegenderen mit sich: Brauchen wir überhaupt Antworten auf die auch in dem hier vorgestellten Ansatz zwangsläufig offengebliebene Frage nach dem genauen Anteil von langsam voranschreitenden Umwelt (-veränderungen) und Klima (-wandel) an Migrationsbewegungen?

45 Vgl. Douglas S. Massey, Social Structure, Household Strategies, and the Cumulative Causation of Migration, in: Population Index, 56. 1990, S. 3–26; Gunnar Myrdal, Rich Lands and Poor, New York 1957.

3.4 Mobilität zwischen westafrikanischer Freizügigkeit und europäischer Grenzziehung

Angelo Müller and Clemens Romankiewicz. 2013.
"Mobilität zwischen westafrikanischer Freizügigkeit und europäischer Grenzziehung."
Geographische Rundschau 65 (9): 12–18.

Mobilität zwischen westafrikanischer Freizügigkeit und europäischer Grenzziehung

Binnenwanderungen bestimmen das Migrationsgeschehen in Westafrika und gehören seit langem zu den etablierten (Über)Lebensstrategien. Angesichts eines hohen Bevölkerungswachstums in Westafrika dienen sie auch als politisches und soziales Sicherheitsventil der jeweiligen Regierungen. Die EU möchte mit ihrem Konzept der gesteuerten Migration irreguläre Einreisen nach Europa unterbinden und setzt verstärkt auf die Regulierung von Wanderungen bereits in den Herkunftsregionen. Dass dies nicht nur den Interessen westafrikanischer Staaten, sondern auch den hochmobilen Lebensweisen widerspricht, wird im vorliegenden Beitrag verdeutlicht.

Bevölkerungsbewegungen von Westafrika nach Europa gewinnen insbesondere durch die Berichterstattung über Bootsflüchtlinge und die politischen Umbrüche in Nordafrika zunehmend Aufmerksamkeit. Dabei wird suggeriert, dass Europa einem andauernden Massenansturm von Migranten aus Subsahara-Afrika ausgesetzt ist, dem mit „geeigneten politischen Maßnahmen" begegnet werden soll. Dieser Mythos einer „Invasion" wird zusätzlich durch jene Migrationsforschung aufrechterhalten, die von den europäischen Ländern und internationalen Organisationen finanziert und von deren sicherheitspolitischen Interessen geleitet wird. So rückten bislang vor allem Themen wie Menschenhandel oder „illegale" Einwanderung in den Fokus, anstatt ein tieferes Verständnis von Formen, Dynamiken, Ursachen und Konsequenzen westafrikanischer Mobilität zu erlangen.

Tatsächlich hat die Zahl derjenigen Afrikaner, die regulär wie irregulär den Weg nach Europa einschlagen, im letzten Jahrzehnt zugenommen (*de Haas* 2008, S. 15). Wenn man also durchaus von einem generellen Anstieg sprechen kann, so zeigen Studien aber auch, dass nur ein geringer Teil der Migranten aus Subsahara-Afrika und insbesondere aus Westafrika Europa zum Ziel hat. Vielmehr findet grenzüberschreitende Migration überwiegend intraregional statt, was bedeutet, dass die überwiegende Mehrheit der westafrikanischen Migranten in Afrika bleibt. Vor diesem Hintergrund erscheint die europäische Migrationspolitik mit ihrem Fokus auf Eindämmung von als irregulär verstandener Migration und ihrer Vorstellung einer ausschließlich Süd-Nord gerichteten Mobilität afrikanischer Migranten fragwürdig.

Der vorliegende Artikel liefert einen Überblick über westafrikanische Mobilitätsmuster und zeichnet an einem Beispiel ein differenziertes Bild von Wanderungsformen, -zielen und mobilen Lebenspraxen. Dem gegenüber wird das Konzept der europäischen Migrationspolitik gestellt, welches in seiner derzeitigen Ausprägung mit den Mobilitätsmustern Westafrikas im Widerspruch steht.

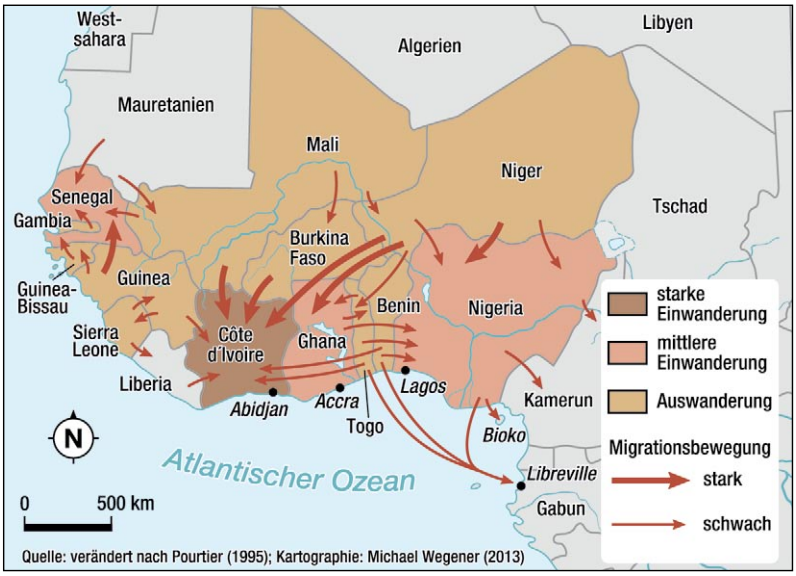


Abb. 1: Intraregionale Migrationsmuster in Westafrika bis ca. 1990

Migration in Westafrika – früher und heute

Die hohe Mobilität in Westafrika hat eine lange Tradition und muss im Kontext historischer Migrationsdynamiken betrachtet werden. Bereits weit vor Beginn der Kolonialzeit gehörten saisonale Weidewanderungen, der trans-saharische Handel oder Pilgerreisen nach Mekka zu wichtigen Mobilitätsmustern westafrikanischer Gesellschaften (vgl. *Merabet* und *Gendreau* 2007). Die Migrationsdynamik des 20. Jhs. hingegen ist durch koloniale Transformationen der Mobilitätsmuster geprägt. Vor allem der enorme Bedarf an Lohnarbeitern für die Kaffee-, Kakao- und Erdnussplantagen, für Goldminen und große Infrastrukturprojekte führte zu einem Nord-Süd-Wanderungsmuster, das aus den Binnenstaaten Niger, Burkina Faso und Mali auf die Küstenländer Senegal, Elfenbeinküste, Ghana und Nigeria gerichtet war (vgl. *Abb. 1*). Dies beschleunigte das Wachstum von neuen Hafenstädten wie Accra, Abidjan, Lagos und Dakar, die damit zu bedeutenden wirtschaftlichen Zentren und Migrationspolen

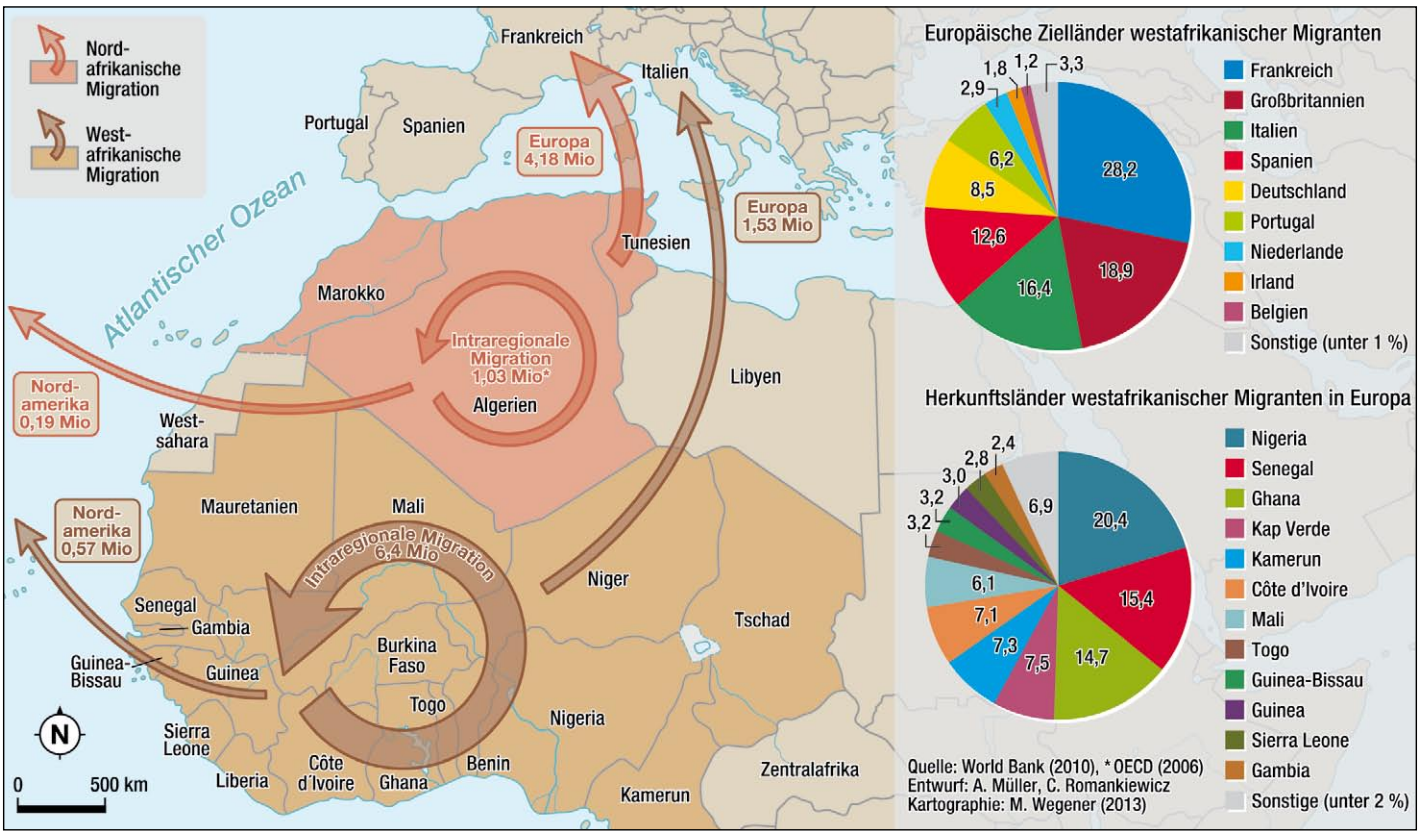


Abb. 2: Migration in und aus West- und Nordafrika in 2010

Kartengrundlage: OECD 2009, S. 82

avancierten. Innerhalb der Region bildete sich eine vorwiegend zirkuläre Arbeitsmigration heraus, die sowohl wirtschaftlich attraktive ländliche Regionen als auch die Küstenstädte zum Ziel hatte (vgl. *Bakewell* und *de Haas* 2007). Das nach Süden gerichtete Migrationsmuster kennzeichnete zusammen mit den Prozessen der Agrarkolonisation im westafrikanischen *middle belt* (*Manshard* 1986) auch die Binnenmigration.

Aufgrund wirtschaftlicher und politischer Krisen büßten Ghana (ab 1966), Senegal (Anfang 1970er) und Nigeria (ab 1983) ihre große Bedeutung innerhalb dieser westafrikanischen Migrationsmuster ein, und die Elfenbeinküste blieb der einzig wichtige Anziehungspunkt in der Region. Ab den 1990er Jahren veränderte sich das regionale Migrationsmuster grundlegend. Die Elfenbeinküste verlor aufgrund von wirtschaftlichem Niedergang, wachsendem Nationalismus und bewaffneter Konflikte seit 1999 ihre herausragende Stellung. Zudem kam es zu einer Zunahme und Diversifizierung der Migration nach Europa und Nordamerika. Darüber hinaus etablierten sich Südafrika als wirtschaftlicher Motor des Kontinents sowie Libyen mit der hohen Nachfrage an Arbeitskraft im Zuge seiner panafrikanisch gerahmten Öffnung nach Süden als neue Migrationspole. Das Anwachsen der trans-saharischen Wanderungen in Richtung Libyen, der anderen Maghreb-Länder sowie nach Europa führte dazu, dass sich Sahelstaaten wie Mali, Niger, Mauretanien und Senegal zu Transitländern entwickelten (vgl. *Bakewell* und *de Haas* 2007). Mit der politischen und wirtschaftlichen Unsicherheit nach dem Sturz des *Gaddafi*-Regimes 2011 fiel dann auch Libyen als Migrationsziel weg.

Das aktuelle westafrikanische Migrationsmuster lässt sich wie folgt charakterisieren: Der größte Teil der Wanderungen vollzieht sich intraregional. Allein 69 % aller internationalen Migranten aus Westafrika verbleiben innerhalb der Region, während lediglich 15 % in Europa und 5 % in den USA leben (vgl. *Abb. 2* sowie World Bank 2010). Etablierte, verwandtschaftliche Migrantennetzwerke bilden die Basis für die Aufrechterhaltung dieser intraregionalen Migration wie etwa der aus Mali in Richtung Elfenbeinküste (vgl. *Romankiewicz* und *Doevenspeck* 2013). Darüber hinaus sind die Städte Westafrikas weiterhin bedeutend für Binnenmigrationen sowie als Zwischenstation für grenzüberschreitende Wanderungen Richtung Europa.

Als etablierte wirtschaftliche und soziale Praxis der (Über)Lebensstrategie verstanden, kann die westafrikanische intraregionale Migration mit dem Begriff der zirkulären Migration beschrieben werden. Gemeint ist hier eine Daseinsform und „Migrationskultur" (*Klute* und *Hahn* 2007), die sich nicht zwangsläufig an Staatsgrenzen, sondern vielmehr an etablierten Migrationskorridoren und -netzwerken sowie saisonalen und regionalen Arbeitsmarktlagen orientiert und auch völlig neue Zielregionen mit einschließt (vgl. *Bensaâd* 2008). Dabei impliziert die zirkuläre Migration „eine Vorstellung des Hin- und Her-Wanderns, wobei auch Zwischenstationen auf dem Weg zu einem Zielort zu Ankunfts-, Wohn- und Aufenthaltsorten werden können. Eine gelegentliche Rückkehr ins Herkunftsland wird ebenfalls vorgesehen" (*Marfaing* 2011, S. 71).

Die politischen und wirtschaftlichen Strukturen Westafrikas sind zudem diesen zirkulären Migrations-

formen angepasst. So wird von staatlicher Seite die intraregionale Mobilität im Angesicht eines generell hohen Bevölkerungswachstums in den westafrikanischen Ländern einerseits als politisches und soziales Sicherheitsventil angesehen; andererseits werden den innerhalb der Migrationsnetzwerke getätigten Rücküberweisungen ein beträchtliches Entwicklungspotential zugeschrieben (vgl. *Faist* 2008). Zudem befördern zahlreiche Abkommen im Rahmen diverser Institutionen wie ECOWAS (westafrikanische Wirtschaftsgemeinschaft) und UEMOA (westafrikanische Wirtschafts- und Währungsunion) die freie Zirkulation von Mensch und Ware in den Staaten Westafrikas.

Migration nach Europa

Zunehmende Migration aus Westafrika nach Europa wird bereits seit den späten 1980er Jahren beobachtet und ist somit bedeutender Bestandteil westafrikanischer Mobilität. *De Haas* (2008, S. 42) schätzt, dass die Anzahl der in der EU registrierten westafrikanischen Migranten seit 2000 pro Jahr um rund 100 000 Personen zunimmt. Im Vergleich mit der Immigration aus den Maghrebstaaten (ca. 4,2 Mio.) ist jene aus Westafrika weiterhin eher gering (vgl. World Bank 2010 sowie *Abb. 2*). Von den derzeit mehr als 1,5 Mio. in der EU registrierten Westafrikanern lebt fast ein Drittel in Frankreich, was auf die historisch gewachsenen Verflechtungen zwischen der ehemaligen Kolonialmacht und den frankophonen Staaten zurückzuführen ist (vgl. *Sieveking* und *Fauser* 2009). England, Italien, Spanien, Deutschland und Portugal sind weitere wichtige Zielländer (vgl. *Abb. 2*), wobei Spanien und Italien als Destinationen im letzten Jahrzehnt erheblich an Bedeutung zugenommen haben (vgl. *de Haas* 2008).

Für die irreguläre Migration aus Westafrika lässt sich seit einigen Jahren ebenfalls ein Anstieg beobachten (*de Haas* 2008, S. 31 ff.). Bedingt durch den Ausfall der Elfenbeinküste als Anziehungspunkt innerhalb Westafrikas, aber auch durch die zunehmend restriktive Einwanderungspolitik Libyens gegenüber Arbeitsmigranten aus Subsahara, stiegen seit 2000 die Versuche, irregulär aus Marokko in die spanischen Enklaven Ceuta und Mellila und dann über die Straße von Gibraltar auf das spanische Festland oder von Tunesien nach Italien zu gelangen. Auch Libyen entwickelte sich von einem Einwanderungs- zu einem Transitland transmediterraner Migration. Geschätzt reisen jährlich rund 200 000 Menschen aus ganz Afrika irregulär nach Europa ein, wobei die Mittelmeerrouten zu den Haupteintrittspforten zählen (UNODC 2011, S. 11 sowie *Abb. 3*); weitere rund 100 000 Personen werden auf

Abb. 3: Migrationsrouten westafrikanischer Migranten

ihrem Weg dorthin abgefangen. Die Zahl irregulärer Migranten aus Westafrika, die über den Seeweg Europa erreichen, wird auf 25 000 bis 84 000 Personen pro Jahr geschätzt (UNODC 2011, S. 12). Allerdings darf der mediale Fokus auf diese sogenannten boatpeople nicht überwertet werden, da die Mehrheit aller irregulär in Europa lebender Migranten aus Subsahara-Afrika legal in die EU einreist und nach Ablauf ihres Visums dort verbleibt (vgl. *de Haas* 2008).

Niger, Mali, Mauretanien und Senegal sowie die Maghrebstaaten fungieren bei dieser Migration nach Europa als sogenannte Transitländer. Der Begriff reduziert jedoch die komplexen Migrationsprozesse auf eine unidirektionale Form, die weder den bestehenden westafrikanischen Mobilitätsformen, noch den Vorstellungen der Migranten selbst gerecht wird. So verstehen Migranten unter Transit einen Raum, „in welchem man herumkommt", nach Lebensperspektiven sucht und eine Weiterreise nicht ausschließt, wobei Europa nicht unbedingt das Ziel der Reise ist (*Marfaing* 2011, S. 71).

Skizze europäischer Migrationspolitik

Entgegen der Praxis und Vielfalt der zirkulären Mobilitätsformen, wird der Begriff der zirkulären Migration seitens der EU nur sehr eingeschränkt als Nord-Süd-Kooperationsmodell konzipiert (*Marfaing* 2011, S. 71), bei dem die EU-Mitgliedsstaaten je nach Bedarf kontingentierte, befristete Aufenthaltsgenehmigungen an Drittstaatangehörige kooperierender afrikanischer Länder erteilen (vgl. KOM 2010). Diese so genannten Mobilitätspartnerschaften, die dem Gastarbeitermodell der 1950er und 1970er Jahre gleichen, sollen das Angebot und die Nachfrage nach Arbeitskräften steuern und „dadurch zu einer effizienten Verteilung der verfügbaren Ressourcen und zum Wirtschaftswachstum [der EU] beitragen" (KOM 2010, S. 9). Die Implementierung sogenannter Arbeitsvermittlungsbüros in den jeweiligen Drittländern, wie etwa in der Hauptstadt Malis Bamako, soll zudem die Rekrutierung qualifizierter Migranten unterstützen sowie die Integration der Migranten nach der Rückkehr bzw. Abschiebung aus Europa begleiten. Kritische Stimmen vermuten jedoch, dass eine generelle Unterbindung jeglicher Migrationsbewegungen Richtung Europa sowie ein Fokus auf die Abschiebe- und Rückkehrpolitik die eigentliche Zielvorgabe sei (vgl. *Sieveking* und *Fauser* 2009).

Dieses Konzept der gesteuerten Migration mag auf den ersten Blick durchaus seine funktionelle Berechtigung aus europäischer Sicht haben. Auf den zweiten Blick widerspricht es jedoch den intraregionalen Mobilitätsmustern, indem sämtliche grenzüberschreitende Wanderungen Richtung Maghreb zu Transitmigrationen deklariert und die Arbeitsmigranten und Händler als potentiell illegale Migranten stigmatisiert werden, deren Mobilität es zu unterbinden gilt. Dieser Vorstellung folgend etablierte die EU im letzten Jahrzehnt ein Grenzkontrollsystem, das irreguläre Migration durch Maßnahmen der extraterritorialen Kontrolle unterbinden soll (*Caillault* 2012, S. 138), wobei die so genannten Transitländer hier eine Schlüsselfunktion einnehmen. Mauretanien, Marokko, Tunesien, Senegal und Mali verpflichteten sich 2006, später auch Algerien und Libyen zu einer engen Zusammenarbeit mit der EU beim Schutz der europäischen Außengrenzen. Neben Maßnahmen zur Eindämmung irregulärer Migration wurden Rückübernahmeabkommen vereinbart, die dazu verpflichten, irreguläre Migranten aus Europa wieder aufzunehmen. Im Gegenzug wurde den Transitländern finanzielle und logistische Hilfe zum Aufbau eines Grenzkontrollsystems und zur Umsetzung von Entwicklungsprogrammen zugesichert sowie eine begrenzte Anzahl temporärer Arbeitsgenehmigungen in Aussicht gestellt. Die europäische Grenzschutzagentur FRONTEX leistet Unterstützung bei der Überwachung der Land-, See- und Luftwege und beteiligt sich an der Ausbildung von Polizei- und Grenzschutzbeamten. Die Kooperationsbereitschaft der westafrikanischen Staaten bei der Unterbindung der Migration steht jedoch nicht nur im Widerspruch zu den im vorherigen Kapitel erwähnten innerafrikanischen Interessen. Sie ist auch mit der seit langem existierenden mobilen und translokalen Lebenspraxis westafrikanischer Gesellschaften nicht vereinbar, wie im Folgenden an einem Fallbeispiel aus dem Senegal dargestellt wird.

Mobil und translokal – der Senegal und das Dorf Nguith

Bereits seit Anfang der 1970er Jahre entwickelte sich der Senegal zum Emigrationsland. Bis 2010 zählten afrikanische Staaten (63 %), allen voran Gambia, Mauretanien, die Elfenbeinküste und Gabun, Europa (36 %) und Nordamerika (3 %) zu den wichtigsten Migrationszielen für Senegalesen (vgl. World Bank 2010). Innerhalb Europas war zunächst Frankreich die wichtigste Destination. Für viele Senegalesen entwickelte sich der Emigrant in Frankreich zum Symbol von Erfolg und zum Sinnbild sozialen Aufstiegs. Nach Europa zu gelangen ist bis heute ein begehrtes Ziel, das soziale Anerkennung und finanzielle Absicherung der Familie verspricht. Rücküberweisungen und Investitionen senegalesischer Migranten in ihre Heimat übersteigen zusammengenommen mittlerweile die Höhe der gesamten öffentlichen Entwicklungszusammenarbeit (vgl. *Diané* 2009). Auch wenn Frankreich bis heute eine stetige Zuwanderung aus dem Senegal verzeichnet, hat das Land durch seine zunehmend restriktive Einwanderungspolitik seit den 1980er Jahren seine herausragende Stellung als Migrationsziel verloren.

Heute gelten insbesondere Spanien und Italien als die wichtigeren Zielländer senegalesischer Arbeitsmigranten (vgl. *Fall* et al. 2010), obwohl deren Attraktivität seit 2008 durch die Finanz- und Schuldenkrise in Europa zurückging. Von hoher Bedeutung sind dabei bereits etablierte Migrationsnetzwerke, die zur Selbstverstärkung von Migration beitragen. Bei genauerer Betrachtung dieser multilokalen Netzwerke wird deutlich, dass die senegalesische Migration nicht ausschließlich als unidirektionaler und permanenter

Wohnortwechsel betrachtet werden kann. Etwa 2 Mio. senegalesische Migranten befinden sich heute an den unterschiedlichsten Orten der Welt, bewahren Verbindungen zu ihrer Heimat und halten Kontakt mit Familienmitgliedern. Durch diese Verflechtungen entstanden translokale soziale Räume, innerhalb derer soziale Beziehungen durch eine Vielfalt an Mobilitätsformen, so z. B. zirkuläre Wanderungen, über nationalstaatliche Grenzen hinweg aufrechterhalten werden.

Diese translokalen Lebenswelten lassen sich anhand der Migranten aus dem Dorf Nguith verdeutlichen. Nguith befindet sich etwa 300 km von Dakar entfernt in der ländlichen Region Louga und zeigt im Vergleich mit den umliegenden Dörfern einen hohen Anteil an internationalen Migranten (vgl. *Foto 1*). Die Migrationsgeschichte dieses Ortes lässt sich durch drei Wanderungsphasen charakterisieren: Seit den 1940er Jahren saisonale, zirkuläre Migration in die Städte v. a. nach Dakar, wo während der Trockenzeit mit der Korbmacherei Geld verdient wurde (vgl. *Foto 2*); seit den 1970er Jahren verstärkte Emigration in die Hauptstadt und Orientierung auf andere westafrikanische Länder; seit den 1980er Jahren zunehmende Migration nach Europa. Von Dakar aus, heute wohnen die meisten *Nguithois* im Stadtteil Guediawaye, reisten 1969 die ersten Migranten nach Frankreich. Aus den Ketten-

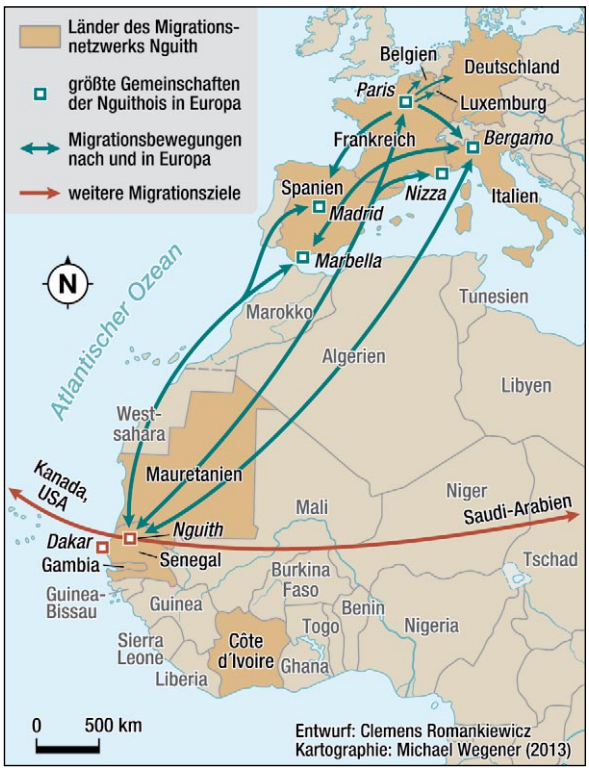


Abb. 4: Migrationssystem und Verteilung der translokalen Gemeinschaft von Migranten aus Nguith, Senegal

Foto 1: Ein von Migranten finanzierter Gemüsegarten in Nguith

Fotos: *C. Romankiewicz*

Foto 2: *Nguithios* auf einem Markt in Dakar beim Korbflechten, das seit Generationen eine wichtige Einnahmequelle ist

Foto 3: Migranten in Marbella (Spanien) vor Beginn des alljährlichen Maouloud, dem muslimischen Fest der Geburt des Propheten Mohammed

migrationen der folgenden Jahrzehnte entwickelten sich große Gemeinschaften in Frankreich (Nizza und Paris), Spanien (Madrid, Marbella) und Italien (Bergamo; vgl. *Abb. 4*).

Das von Nguith ausgehende Migrationsnetzwerk ist durch besonderen Zusammenhalt und gegenseitige Solidarität gekennzeichnet, was entscheidend zu seiner stetigen Ausbreitung beigetragen hat. Dies erklärt sich einerseits durch die direkten verwandtschaftlichen Beziehungen aufgrund kontinuierlicher innerfamiliärer Heiraten und andererseits durch die Zugehörigkeit zur und Identifikation mit der Tidjaniya-Bruderschaft, eines Sufi-Ordens innerhalb des sunnitischen Islams. Darüber hinaus förderte die Dorfgemeinschaft bereits seit den 1960er Jahren Schul- und Hochschulbildung. Die aktuelle Migrationsdynamik nach und innerhalb Europas ist sehr vielschichtig. Längerfristige Aufenthalte in Frankreich werden vor allem von Studenten angestrebt, die sich um eine Zulassung an einer Universität bemühen. Arbeitssuchende konzentrieren sich mittlerweile eher auf Spanien und Italien.

Die Wahl des Migrationsziels sowie die Dauer des Aufenthaltes hängen von einer Vielzahl von Faktoren wie beispielsweise der Präsenz von Verwandten, dem Status der Aufenthaltsgenehmigung, der beruflichen Qualifikation und Art der Tätigkeit und des Arbeitsvertrags, oder dem Wohnsitz des Ehepartners und der Kinder ab. So ist es nicht unüblich, dass man z. B. nach Ablauf der Touristensaison in Südspanien im Winter eine befristete Arbeit in der Industrie in Italien annimmt oder für einige Zeit in den Senegal zurückkehrt und anderen Aktivitäten z. B. in Dakar nachgeht. Regelmäßige Besuche der Verwandtschaft im oder aus dem Senegal sind also gängige Praxis, v. a. wenn die translokale Gemeinschaft der Nguithois einmal im Jahr sowohl in Nguith als auch in einem europäischen Land zum sogenannten Maouloud, dem religiösen Fest der Geburt des Propheten Mohammed, zusammenkommt (vgl. *Foto 3*). Diese Zusammenkünfte festigen einerseits die Gemeinschaft und dienen andererseits der Erörterung der zukünftigen Entwicklung des Dorfes.

Über die Jahre tätigten die Migranten enorme Investitionen in Nguith und finanzierten neben dem eigenen Hausbau u.a. den Bau einer Moschee, eines Gesundheitszentrums und eines Schulgebäudes. Dies soll nicht nur die Lebensbedingungen der Bevölkerung im Dorf verbessern, sondern v. a. Anreiz für eine potenzielle Rückkehr sein, was von einigen Migranten im Ruhestand auch praktiziert wird. Inzwischen absolvieren sogar viele Kinder der in Dakar lebenden Familien ihre Schulausbildung in Nguith, bevor sie zur weiteren Ausbildung wieder in die Hauptstadt oder nach Europa gehen.

Das Beispiel dieses Dorfes verdeutlicht, wie eine translokale Gemeinschaft durch ihre seit langem bestehende hohe Mobilität an den unterschiedlichsten Orten auf mehreren Kontinenten reproduziert wird. Die Aufrechterhaltung und Ausweitung multidirektionaler Mobilität ist damit zu einem wesentlichen und notwendigen Bestandteil sozialer Praxis geworden. Aus dieser Perspektive erscheinen die Anstrengungen, europäische Grenzen gegenüber westafrikanischen Migranten zu sichern bzw. deren Wanderungen im Sinne nationalstaatlicher Interessen steuern zu wollen nahezu absurd.

Fazit

Die Mobilität westafrikanischer Gesellschaften weist vielfältige persistente Formen und Muster auf, die heute eine hohe Dynamik zeigen. Fortschritte in Kommunikationstechnologie und Transportwesen beschleunigen und erleichtern die Mobilität sowie die Aufrechterhaltung grenzüberschreitender Beziehungen. Angesichts einer jungen und mobilen Gesellschaft und eines hohen Bevölkerungswachstums, werden die

Wanderungen innerhalb Westafrikas und in Richtung anderer Kontinente weiter zunehmen.

Trotz eines generellen Anstiegs der westafrikanischen Migration in die EU kann von einem „Massenansturm" auf die Festung Europa nicht die Rede sein. Dennoch scheint die europäische Union eben jener Vorstellung in Bezug auf ihre afrikaspezifische Migrationspolitik zu folgen. Das EU-Konzept der gesteuerten Migration führte jedoch nicht zur Eindämmung der Zuwanderung, sondern vielmehr zu einer generellen Illegalisierung westafrikanischer Migranten und daraus folgend zu einem verstärkten Sicherheitsbedürfnis in der europäischen Öffentlichkeit gegenüber jeglicher Form der Zuwanderung.

Diese Sichtweise steht im Widerspruch zur gleichzeitigen Betonung der Rolle der Migranten, die durch ihre Rücküberweisungen als Agenten der Entwicklung in ihren Heimatländern fungieren sollen. Impliziert dies eigentlich die Anerkennung und Förderung von Migration auch in Westafrika, so dominieren innerhalb der entwicklungspolitischen Debatte nach wie vor sedentaristische Ansätze, die der Idee von Mobilität als Entwicklungspotential entgegenstehen: Wanderungen werden hier zuvorderst als Reaktion auf Probleme und Abweichung von der Norm angesehen, als Bedrohung, die es zu bekämpfen gilt (vgl. *Verne* und *Doevenspeck* 2012). Dass westafrikanische Mobilität nicht darauf reduziert werden darf, ergibt sich aus der differenzierten kulturellen, historischen und gesellschaftlichen Verankerung westafrikanischer Migration, die durch Netzwerke und translokale Gemeinschaften aufrecht erhalten wird. III

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SUMMARY

Mobility between West African freedom of movement and European boundary-making

by Angelo Müller, Clemens Romankiewicz

West Africa's population belongs to the most mobile ones in the world. Fears of mass migration towards Europe are fuelled by media representations of boat refugees and the security concerns of European governments. This article offers a historically informed reading of prevailing West African migration patterns and dynamics. This is contrasted with the EU migration policy that seeks to contain and regulate population movements from and within the region. A case study of a translocal community from Senegal illustrates the various dimensions and meanings of contemporary population movement, thus challenging European notions of West African migration.

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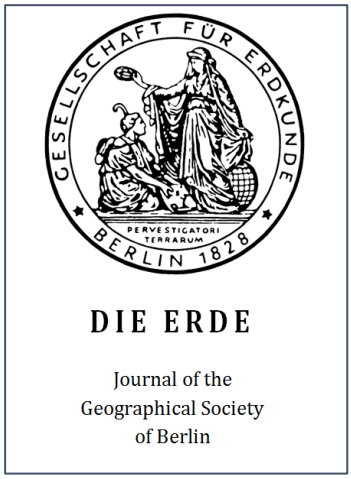
3.5 Data and methods in the environment-migration nexus: a scale perspective



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Data and methods in the environment-migration nexus: a scale perspective

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Abstract

The relationship between environment and migration has gained increased attention since the 1990s when the Intergovernmental Panel on Climate Change projected climate change to become a major driver of human migration. Evaluations of this relationship include both quantitative and qualitative assessments. This review article introduces the concept of scale to environment-migration research as an important methodological issue for the reliability of conclusions drawn. The review of case studies shows that scale issues are highly present in environment-migration research but rarely discussed. Several case studies base their results on data at very coarse resolutions that have undergone strong modifications and generalizations. We argue that scale-related shortcomings must be considered in all stages of environment-migration research.

Zusammenfassung

Seit das Intergovernmental Panel on Climate Change in den 1990er Jahren prognostizierte, dass der Klimawandel ein bedeutender Grund für Wanderungen wird, erfährt der Zusammenhang zwischen Umwelt und Migration zunehmend Aufmerksamkeit. Studien zu diesem Zusammenhang sind quantitativ und qualitativ. Dieser Beitrag diskutiert Skalen als wichtigen methodischen Aspekt für die Verlässlichkeit von Schlussfolgerungen der Umwelt-Migrations-Forschung. Bei den ausgewerteten Studien zeigt sich, dass der Maßstab von großer Bedeutung ist, aber kaum diskutiert wird. Zahlreiche Fallstudien basieren auf sehr kleinen Maßstäben, für die stark modifiziert und generalisiert wurde. Wir folgern daraus, dass maßstabsbedingte Unzulänglichkeiten in allen Bereichen der Umwelt-Migrations-Forschung bedacht werden müssen.

Keywords Environment-migration nexus, spatial & temporal extent, spatial & temporal resolution, scale

1. Introduction

Intensively discussed since the early 1990s, the climate change debate has increased the attention to the relationship between environment and migration, leading to an upsurge in empirical studies (*Laczko* and *Aghazarm* 2009, *Warner* et al. 2010, *Black* et al. 2011, *McLeman* 2013, *Fussell* et al. 2014).

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In the course of climate change, livelihoods and habitats are expected to be compromised by both long-term changes and increased frequency of extreme weather events, such as droughts, storms and floods. Yet, there is still little agreement about the relevance of the environmental dimension in population movements and its potential to shape future migration (*McLeman* and *Smit* 2006, *Afifi* 2011).

Guided by different research paradigms and resulting in ambiguous conclusions, this disagreement is reflected by a multitude of applied methodological approaches. Whereas some researchers seek to understand the environment-migration nexus through qualitative methods, others use environmental data merged with socio-economic and migration data for statistical analyses of the relationship (*Piguet* 2010, *Bilsborrow* and *Henry* 2012, *McLeman* 2013, *Fussell* et al. 2014). A major challenge in this research is the acquisition of appropriate data, which has resulted in a lack of generalizable empirical studies of how environmental change affects migration (*Bilsborrow* and *Henry* 2012).

While *Laczko* and *Aghazarm* (2009) sweepingly call for 'better' data to analyze the environment-migration nexus, we argue that this can only be achieved through an awareness of limitations in the data and methods applied in empirical research thus far. We also argue for a recognition of complications related to scale, in particular.

Several recent methodological reviews of data collection and methods in the field of environment and migration offer a discussion of censuses, surveys, and ethnographies for the representation of migration, and satellite data, surveys and meteorological data for the representation of the environment (*Piguet* 2010, *Bilsborrow* and *Henry* 2012, *McLeman* 2013, *Fussell* et al. 2014). However, scale issues have only cursorily been acknowledged as important for the integration of these data.

The neglect of scale is all the more striking if one considers its relevance with a simple example: The West African Sahel is described as affected by desertification, water shortage and hunger, particularly since the great droughts of the 1970s and 1980s. Furthermore, the region's population is particularly mobile, and migration beyond Sub-Saharan Africa continues to be of increasing importance. At this scale, it seems reasonable to associate increasing migration with deteriorating climatic and environmental conditions (see, e.g., *Boko* et al. 2007, *Hammer* 2004). On the other hand, investigations in the same region at the local level illustrate the complex, cumulative and dynamic character of population movements. A micro-level perspective shows that local environmental conditions vary significantly and are shaped by human activities. Furthermore, people perceive and assess environmental change very differently, potentially shaping migration responses and/or leading to a variety of strategies other than migration (*Brandt* et al. 2014, *Romankiewicz* and *Doevenspeck* 2015). These contrasting images of the environment-migration association are due, in part, to scale.

The aim of this paper is therefore to introduce scale as an important issue to be considered in environment-migration research and to show the potential associated shortcomings inherent in the data and chosen analytical dimensions. We do this by examining the most common data and methods used in case studies concerned with the environment-migration nexus, and by providing examples of scale issues. We analyzed a selection of 27 English-language, peer-reviewed empirical case studies focused on the nexus between migration and the slow onset of climatic and environmental change found among the country reports and case studies listed in the bibliography "People on the move in a changing climate" (International Organization for Migration (IOM) 2012). The choice of articles was guided by our aim to cover a variety of methods as identified by *Piguet* (2010), *Bilsborrow* and *Henry* (2012), *McLeman* (2013) and *Fussell* et al. (2014). A number of articles published after 2012 were added to the review by searching for the key words "environment" and "migration" in academic databases.

This paper starts by introducing the scale concept and the related scale issues in geographical research. Then we review the dimensions of different data types used in studies of the environment-migration nexus and discuss related issues. After that, we review the scales at which the analyses are carried out and identify and discuss the main scale issues in environment-migration research.

2. Scale in geographical research

Gibson et al. (2000: 219) define scale as the "spatial, temporal, quantitative, or analytical dimensions used to measure and study any phenomenon". The essential scale parameters are extent (boundaries) and resolution (detail). Scale levels share similar extents and resolutions and refer to locations along a scale, for example micro, meso and macro levels on the spatial scale, or

Table 1 A conceptual framework of scale based on *Keshkamat* et al. (2012), showing the temporal and spatial dimensions of model and data scale and respective examples from environment-migration research

Model Scale			
Spatial dimension		Temporal dimension	
Extent and resolution of space and time in models are human constructs.			
Extent	Resolution	Extent	Resolution
The area of interest covered in the analysis	The smallest spatial unit of analysis	The time period of interest covered in the analysis	The smallest temporal unit of analysis
Examples of modeling environment-migration linkage			
Quantitative: Environmental degradation contributes to emigration and should be reflected in a measurable correlation between outmigration and vegetation change for the same district, during the same decade, in a given country.			
Qualitative: A peasant expresses his concern about the late onset of the rainy season and decides to work temporarily in the capital, because his family's income largely depends on harvest output. Another family member sends extra money from abroad.			
Data Scale			
Spatial dimension		Temporal dimension	
Extent	Resolution	Extent	Resolution
The area covered or spanned in data collection	The smallest spatial unit of data collection	The time period covered in the data collection	The smallest temporal unit of data collection
Example of quantitative data sources used to assess the link between migration and environmental change: here, outmigration rate and change of NDVI (Normalized Difference Vegetation Index)			
Census data of a country	Individual residence change crossing an administrative boundary	Census round every 10 years	Residence change 5 years ago
A satellite image scene (200 x 200 km)	A pixel of 250 m^2	14 years of recording	One image every 16 days
Example of qualitative data to assess the link between migration and environmental change: here, migrants' biographies and perceived environmental change as potential migration motives			
Transnational migrant network	A village	Migration history of a village/family	Seasonal moves of individual family members
Interpretation of environmental change at multiple places in the country of origin	Interpretation of environmental change around the village of origin	Age of an individual	A season

long-term versus short-term on a temporal scale. The extent and resolution chosen for a case study are crucial because they affect the ability to identify and explain patterns of various phenomena (*Gibson* et al. 2000).

According to different research paradigms there exist varying perspectives and approaches to scale. Physical geographers mostly rely on mathematically measurable, deterministic representations of space and time in their investigations of natural phenomena, which they consider to be hierarchically nested at different levels along the spatial and temporal scale (*Sheppard* and *McMaster* 2008). This means that biophysical processes operate at distinct levels of time and space (operational scale). On the other hand, human geographers doubt the relevance of predefined geographic scales for (analyzing) social processes and emphasize that space, and therefore scale, are social, political or economic constructs (*Sheppard* and *McMaster* 2004). The distance between two places for example appears more significant in terms of social proximity and quality of social interactions rather than to be measured in kilometers or hours to travel. The individual's identity, location and perception shape the relative importance of scale over space and time.

Keshkamat et al. (2012) illustrate how different perspectives of scale are manifest by describing a conceptual framework which is set up by three "axes": reality scale, model scale and data scale (*Table 1*). These three scale types are divided into spatial and temporal dimensions, which are explained by extent (area or period covered) and resolution (level of detail). Several interconnected phenomena and processes in a space-time continuum, at different extents and resolutions, make up the reality scale. The model scale represents intangible realities in a practicable way depending on political or scientific objectives, which also determine the extent and resolution at which the analysis takes place. In doing so, models translate subjective realities and the complexity of interwoven processes at multiple scales into simplified causal relationships through the use of the data scale (see example in *Table 1*). The data's extent and resolution are influenced by analytical needs, but are also determined by the nature of observable attributes and the methods used to measure them. Here, a major problem is the mismatch of the operational scales of ecological processes (e.g. catchment level) and social phenomena, such as migration networks stretching across regions and nations (*Bruyninckx* 2009).

Nevertheless, data are often processed to fit the chosen model scale and adjusted to the desired resolution (rescaling) to yield comparability across different data types. Down- and upscaling techniques include averaging, smoothing, extrapolating and interpolating, but can have severe consequences on the data accuracy, especially when data are missing (*Atkinson* and *Tate* 2000).

The Modifiable Area Unit Problem (MAUP) refers to how the units used in spatial analyses can take many different shapes and sizes, which in turn affects the outcomes of statistical analyses and thus the reliability of results (*Dark* and *Bram* 2007, *Sheppard* and *McMaster* 2004). The first sub-problem of the MAUP, the zonation effect, refers to how data are grouped into arbitrary (spatial or temporal) units that could easily be changed, yielding different analysis results (*Openshaw* and *Taylor* 1979). The second sub-problem, the scale effect, refers to the number and size of units into which the data are divided. Coarser units decrease the variance in the data and hence neglect that the socio-economic properties of individuals, or their spatial distribution, might not be homogeneous within area boundaries chosen for analysis (*Dark* and *Bram* 2007). This means that inferences about relationships between aggregated data do not necessarily hold true for non-aggregated data in the area of analysis, which is the geographical version of "ecological fallacy".

The MAUP highlights that scale is a construction and not ontologically pre-given. Therefore the choice of analytical dimensions has political aspects (*Delaney* and *Leitner* 1997, *Brown* and *Purcell* 2005, *Moore* 2008, *Rangan* and *Kull* 2009). *Brown* and *Purcell* (2005) describe a "scalar trap" as a problem where researchers assume that e.g. the link between policies or actions, and the social and environmental effects of these actions, are stronger at local levels, while this may not necessarily be the case. The chosen analytical dimensions in environment-migration nexus studies may therefore also be determined by assumptions of the spatial and temporal nature of these processes.

3. Review of case studies

3.1 Data scale

3.1.1 Environmental data

Quantitative environmental data are included in many of the case studies that seek to determine the relevance of environmental factors in migration patterns. In these studies, environmental and climate conditions are principally represented by ground-measured climate data, global climatological datasets and/or satellite based vegetation data.

Station-measured climate data represent the meteorology of a point location, and therefore have limited spatial extent. The locations and density of stations are crucial for their ability to represent general meteorology, and all upscaling efforts are subject to the MAUP. Measured climate data can be limited in availability and quality (*Bilsborrow* and *Henry* 2012). In some countries, there is a long record of climate data and a high density of stations, like in the U.S., Burkina Faso and Mexico (*Mitchell* and *Jones* 2005, *Méndez González* et al. 2008, *Lodoun* et al. 2013). For case studies using station data from these countries see *Henry* et al. (2003), *McLeman* and *Smit* (2006), *Feng* et al. (2010) and *Nawrotzki* et al. (2013). In other countries, stations are sparse and data quality is not sufficient for spatial or temporal analyses.

Here, global gridded climatological datasets can serve as alternatives or complements. Many case studies use data originating from the Climate Research Unit (CRU) at the University of East Anglia (among them the stud-

Table 2 Global continuous environmental data used in the reviewed studies and their spatial and temporal characteristics

Dataset	Variable	Temporal extent (version)	Spatial resolution	Reference
Climate Research Unit Time Series (CRU TS) Version 1.0 – 3.2	Precipitation, temperature	1901-1995 (1.0) 1901-2000 (2.0) 1901-2002 (2.1) 1901-2012 (3.21)	0.5°	*New* et al. 2000 *Mitchell* et al. 2004 *Mitchell* and *Jones* 2005 *Harris* et al. 2014
Worldclim	Precipitation	1950-2000	1 km	*Hijmans* et al. 2005
IPCC	Precipitation	1961-1990	Country	*Mitchell* et al. 2002
Global Precipitation and Climatology Project (GPCP)	Precipitation	1979-present	2.5°	*Adler* et al. 2003
Global Inventory Modeling and Mapping Studies (GIMMS)	NDVI	1981-2006	8 km	*Tucker* et al. 2004
Moderate Resolution Imaging Spectroradiometer (MODIS)	NDVI	2000-present	250 m	*Solano* et al. 2010
Advanced Very High Resolution Radiometer (AVHRR) Pathfinder	NDVI	1982-1995	8 km	*James* and *Kalluri* 1994

ies by *Henry* et al. 2004a, *Henry* et al. 2004b, *Barrios* et al. 2006, v*an der Geest* et al. 2010, v*an der Geest* 2011, *Marchiori* et al. 2012). These data are available as grids with different temporal extents depending on version (*Table 2*). The grids are based on the upscaling of climate point data from different sources stored in a ground stations database and the interpolation of missing values based on anomalies (*Mitchell* and *Jones* 2005).

One of the main problems with constructing a global reference database of climate data is the spatially and temporally varying quality and availability of reference data. As an example, the number of precipitation stations included in the global database increased from approximately 3,000 to nearly 10,000 between 1901 and 1970, but decreased to less than 2,000 in the year 2000 (*Mitchell* and *Jones* 2005). *Figure 1* illustrates the uneven distribution of the stations and the fact that their number has decreased further. In the CRU version 3.21, less than 100 stations report rainfall data for Sub-Saharan Africa in January 2008. Data gaps are interpolated in the preparation of the dataset, but might not reflect the actual climatological situation in the region.

The spatial dimensions of the CRU dataset is another limitation that affects its usability in analyses at finer resolutions. A cell size of 0.5° (approximately 50 km) neglects spatial variations and is much coarser than the satellite-based vegetation data available. An alternative to CRU is the Worldclim dataset (used by *Gray* 2009) that has a spatial resolution of 1 km and has also been interpolated based on a global database of climate stations (*Hijmans* et al. 2005). However, the data sources are similar to CRU and thus a finer spatial resolution does not necessarily mean an improved quality. The issue of heterogeneous station data is addressed in the Global Precipitation and Climatology Project (GPCP) dataset, available globally since 1979 and used in *Gray* and *Mueller* (2012a), and *Gray* and *Mueller* (2012b). Here, rain gauges are blended with satellite-based precipitation estimates (*Adler* et al. 2003). However, despite its high reliability, the extremely coarse resolution of 2.5° (approximately 250 km) makes GPCP data inappropriate for detailed analyses.

The Inter-Governmental Panel on Climate Change (IPCC) dataset, used by *Barrios* et al. (2006) and *Marchiori* et al. (2012), is a rescaled version of the CRU dataset, where country level data have been calculated from grid cells, using weighted averages (*Mitchell* et al. 2002). *Mitchell* et al. (2002) stress that these data are not intended to be used at subnational level, and

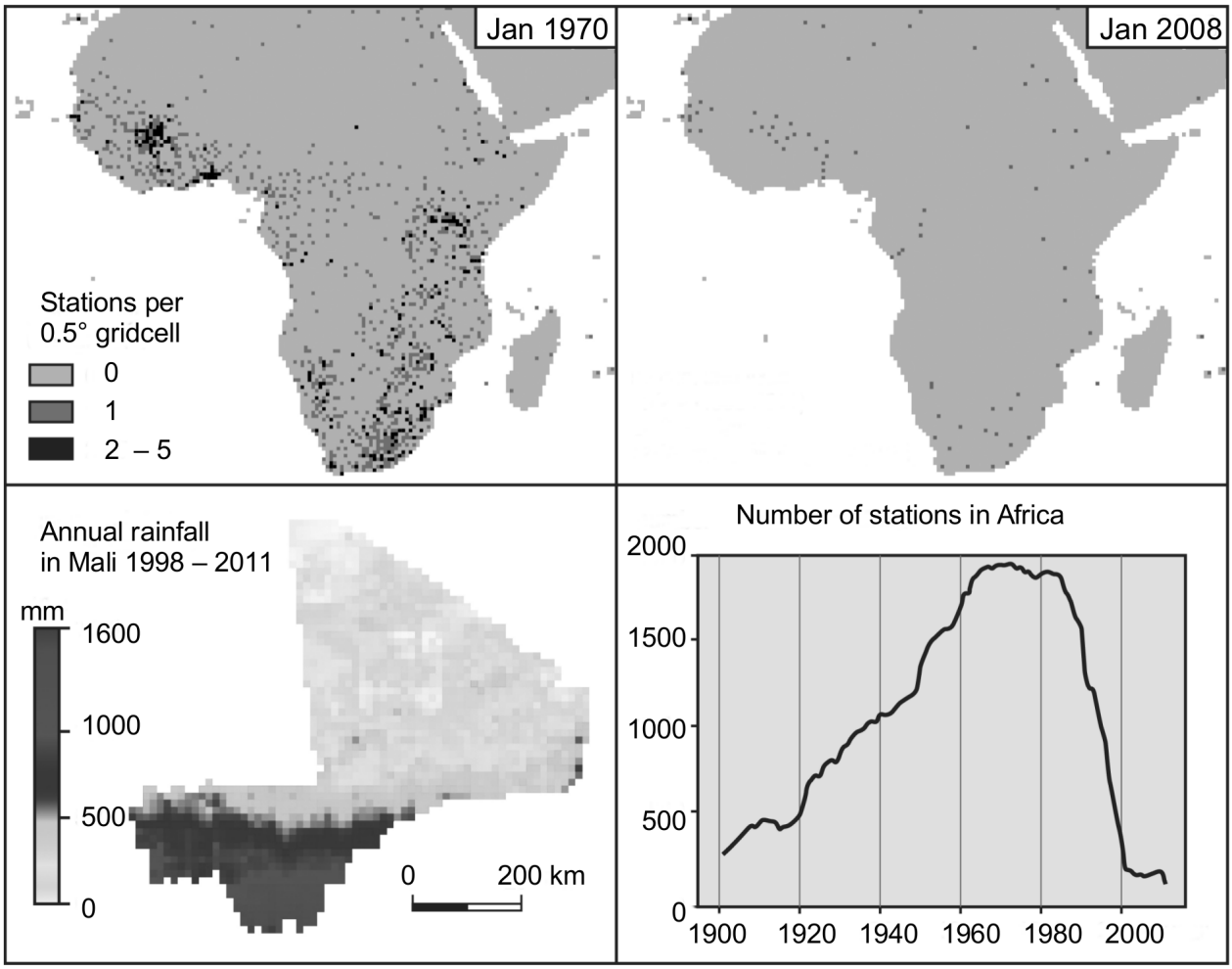

Fig. 1 Massive decline of stations in Africa in CRU data (v. 3.2) and strong regional differences in average annual rainfall in Mali, based on Tropical Rainfall Measuring Mission (TRMM, 0.25° spatial resolution)

cannot represent conditions at a certain point. While aggregating data over political areas (as opposed to grids or climate zones) may seem desirable for global or regional comparisons, the data are generalized and thereby so limited that the added value of using the IPCC dataset rather than a grid-based dataset appears questionable. Needless to say climate is not spatially homogeneous within a country, and neither are climate anomalies (see the example of Mali in *Figure 1*).

Vegetation data from satellites are a common alternative to directly measured or interpolated climate data, as recommended by *Bilsborrow* and *Henry* (2012). With data over time, these sources can reflect vegetation response to climate and other factors. A decreasing vegetation cover might thus be interpreted as a sign of land degradation and a reduction of ecosystem services (*Henry* et al. 2004a, *Van der Geest* et al. 2010). Continuous satellite data provide global images and are available from e.g. the Moderate Resolution Imaging Spectroradiometer (MODIS) (used in *Leyk* et al. 2012), Pathfinder or Global Inventory Modeling and Mapping Studies (GIMMS) datasets (used in *Henry* et al. 2004a, v*an der Geest* et al. (2010) and v*an der Geest* 2011). These datasets include Normalized Different Vegetation Index (NDVI) data that represent the greenness of the earth surface.

For all satellite data there is a tradeoff between temporal and spatial resolutions. Large extent and coarse resolution satellites have a high frequency of data collection, while the fine resolution satellites cover smaller areas, and less frequently. Pathfinder and GIMMS have a resolution of 8 km and cover the periods 1982-1995 (Pathfinder) and 1981-2006 (GIMMS) (*James* and *Kalluri* 1994, *Tucker* et al. 2004). For each grid cell, a 1.1 km sample of AVHRR (Advanced Very High Resolution Radiometer) satel-

lite data has been selected and up-scaled to 8 km, while the other samples were omitted. The quality of this rescaling depends on the location of the sample within the respective grid cell. MODIS offers a higher and unmodified resolution of 250 m but the temporal scale is shorter than Pathfinder or AVHRR (*Solano* et al. 2010). Moreover, the temporal consistency of satellite data is largely biased by orbital drifts, having severe impacts on trend analysis (*Tian* et al. 2015).

Still, coarse vegetation data offer a unique assessment on long-term trends: human activities and environmental processes, however, are rarely uniform, shaping a heterogeneous landscape. Hence, the visibility of changes in vegetation cover is scale-dependent and often obscured or neutralized by adjacent areas and merged into single mixed pixels (*Brandt* et al. 2014).

Despite these drawbacks in spatial (GIMMS) and temporal (MODIS) aspects, satellite data are considered the most accurate assessment of land degradation (*Bai* et al. 2008, *Nachtergaele* et al. 2011). An older approach by *Oldeman* et al. (1990) produced a global map based on regional expert judgments, the GLASOD (GLobal Assessment of human-induced SOil Degradation) map. Although this rather qualitative approach has been severely criticized (*Sonneveld* and *Dent* 2009, *Nachtergaele* et al. 2011) and found unreliable even at a national scale, it has been used as data input in environment-migration models (*Henry* et al. 2003).

3.1.2 Migration and socio-economic data

Relying on most definitions, the phenomenon of migration as a particular form of population movement is a human construct and itself subject to scale issues. Both the crossing of an administrative boundary and the shift of the usual residence for a given period of time (*Standing* 1984) are politically constructed dimensions of temporal and spatial scale and define which movements become relevant for investigation. To reliably capture the multitude and diversity of migratory movements is an unfeasible attempt. The scope of migration and socio-economic information considered in case studies is therefore restricted by the respective method(s) and focus of data collection. Quantitative data about socio-economic characteristics and migration patterns commonly used in regression analyses are generated by censuses, population registers or (large n) sample surveys (*Fussell* et al. 2014). Qualitative data are collected through ethnographic research methods and intensive fieldwork or come from historical records and archives.

A national population and housing census provides universal demographic, economic and social information of an entire country at a specific time based on individual enumeration, and censuses have been used in many of the reviewed case studies (*Amacher* et al. 1998, *Barrios* et al. 2006, *Feng* et al. 2010, *Graves* 1980, *Henry* et al. 2003, *Marchiori* et al. 2012, *Nawrotzki* et al. 2013, *Pedersen* 1995, *Reuveny* and *Moore* 2009, v*an der Geest* 2011, v*an der Geest* et al. 2010).

However, censuses do not capture detailed information on population mobility, and few of these studies reflect upon the methods and quality of the data used. This is particularly important because many of the reviewed empirical investigations are set in developing countries where the reliability of census information is uncertain (*Pedersen* 1995).

Examining how census data are produced reveals several scale-related limitations. Generally, migration information is obtained by looking at an individual's place of birth and/or place of usual residence at a specific date in the past (e.g. one or five years ago), and the current place of usual residence. Moreover, census surveys usually take place every ten years (*Chudinovskikh* et al. 2008). Thereby, census data cannot specify the exact timing of a migration and do not allow the identification of movements and residence changes that took place "in-between". This particularly applies to birthplace-related migration data (v*an der Geest* et al. 2010), i.e. solely comparing place of birth and current residence and reducing all potential migration steps of a lifetime to only one of unknown timing. It is therefore not possible to identify specific forms of movements such as seasonal migration (*Henry* et al. 2003) or return and circular migration. *Fussell* et al. (2014) stress that the time lags between migration information from censuses and environmental events pose the greatest difficulties to comprehensibly associate environmental parameters and migration from a specific area, let alone derive causal linkages for households or individuals.

Another scale-related problem is the fact that census reports generally aggregate the given information to larger administrative levels. *Van der Geest* et al. (2010), for example, had to downscale regional census migration data to enable an analysis with district level NDVI data. Moreover, a longitudinal analysis is difficult when, due to a previous restructuring of

administrative boundaries or bad census quality, long-term data are not comparable over time (cf. *Pedersen* 1995, *van der Geest* et al. 2010). Administrative units and, above all, national borders, i.e. politically constructed spatial scales, set the respective frame for data collection and analysis of national census information. Even though the majority of migration flows typically takes place within countries, non-negligible numbers of migrants cross international borders and are missed by census surveys and respective analyses. While censuses are able to grasp the immigrant population of a country, to reliably register emigration and nationals residing abroad is hardly possible and international migration cannot be derived from census data alone (*Chudinovskikh* et al. 2008, United Nations Department of Economic and Social Affairs 2008).

The use of standardized questionnaires at the individual or household level is a common approach to collect socio-economic and migration data, or perceptions and interpretations of environmental change (*Graves* 1980, *Findley* 1994, *Meze-Hausken* 2000, *Ezra* and *Kiros* 2001, *Carr* 2005, *Henry* et al. 2004b, *Gray* 2009, *Massey* et al. 2010, *Gray* and *Mueller* 2012a, *Gray* and *Mueller* 2012b, *Leyk* et al. 2012). Some studies do not rely solely on single survey results but analyze data from more than one survey or combine data sources, e.g. sample survey and census data (*Amacher* et al. 1998, *Pedersen* 1995, v*an der Geest* 2011), or sample survey and qualitative data (*Afifi* 2011, *Carr* 2005, *Doevenspeck* 2011).

Scale issues of sample surveys already take effect during data collection. Cross-sectional surveys are typically carried out once and gather information about past migration retrospectively. A panel survey is a costly and more reliable approach to conduct repeated interviews over a period of time to disclose individual courses of migration, as *Massey* et al. (2010) did during 36 months in Nepal. Asking individuals retrospective and time-specific questions about the temporal order of environmental and migration events, and/or migration motives (*Doevenspeck* 2011, *Findley* 1994) may give indications of causality in migration decisions at the individual or household level (*Fussell* et al. 2014). However, the comparability and representativeness of survey results are limited, considering the varying size of samples and the fact that not only the time span defining a migration event but also the types of movements applied in data collection and analysis vary. *Massey* et al. (2010), for example, defined an absence of at least one month as migration, for others it is three months (*Henry* et al. 2004b) or six months (*Gray* 2009). In this regard, survey results demand a careful case-specific interpretation and cannot be simply aggregated and compared at the regional or national level (*Meze-Hausken* 2000). The empirical work of *Massey* et al. (2010) demonstrates that analyses of data from a larger, longitudinal sample yielded, in part, contradictory results to a study conducted earlier in the same area using the same questionnaire and survey method but using cross-sectional data (*Shrestha* and *Bhandari* 2007).

Contrary to ecological fallacy, missing context information in analyzing individual migration data may result in atomistic fallacy, i.e. mistakenly inferring that a correlation between two variables at the individual level holds true at aggregated levels too. Instead, recording socio-economic and migration data together with survey questions on perceptions of (changing) environmental conditions (e.g. rainfall, crop yields or the availability of natural resources) for the same household may contribute to more harmonized data (*Bilsborrow* 2009, *Massey* et al. 2010). Moreover, such perceptions refer to relevant scales of environmental change that have material impacts on households (*Manson* 2008). As such, perception data may be more relevant when drawing conclusions about causal linkages to migration decisions.

Qualitative methods, in particular participatory observations, in-depth and biographical interviews with migrants and migrant households, can reduce shortcomings of quantitative methods. Such a context-sensitive approach provides better insights into social constructions of temporal and spatial scales of alleged "facts", such as environmental degradation and droughts as well as migration decision-making (*Meze-Hausken* 2000, *McLeman* and *Smit* 2006, *Carr* 2005, *Gilbert* and *McLeman* 2010). Scale aspects are identifiable at the point of data collection since data are often collected among fewer respondents and in fewer places. These detailed data, often collected over longer periods of time, represent a prerequisite for yielding qualitative knowledge of complex social processes and the interplay between environment and migration. *Carr* (2005), for example, conducted qualitative interviews with 30 individuals during 13 months of ethnographic fieldwork over three years. Other scholars relied on historical records from national archives (*Pedersen* 1995, *McLeman* and *Smit* 2006). *McLeman* and *Smit* (2006), for example, used reports and administrative records of migrant camps, oral histories and autobiographies from the 1930s and 1940s to investigate

historical migration patterns in Oklahoma. These historical and ethnographic data offer a more nuanced view on the complexity and multi-causal character of population movements in general, and on how different people assess and give meaning to both environmental change and migration in particular (*Afifi* 2011, *Carr* 2005, *Doevenspeck* 2011). A basic scale-related weakness of qualitative approaches is the limited comparability and generalizability in space and time.

3.2 Model scale

Scale issues related to data and to methodological approaches are closely connected. In this section, we discuss examples of scale issues as related to analytical approaches.

3.2.1 Rescaling

Data on migration, environment and socio-economic factors are of different spatial and temporal resolutions. Therefore, some data are often rescaled to a certain model scale, typically human-created administrative boundaries, to facilitate the analysis. In *Henry* et al. (2003) and *Henry* et al. (2004b) for example, CRU data were aggregated from grid cells of 0.5° to department boundaries (*Bilsborrow* and *Henry* 2012). *Van der Geest* et al. (2010) up-scaled GIMMS NDVI data to district level by a weighted-average approach and downscaled migration data from regional to district level using a regression model. Weighting the data according to the share of pixels within district boundaries allows for a more realistic aggregation. Instead of using administrative boundaries as model resolution, *Leyk* et al. (2012) focused on household level data and aggregated NDVI data into two-kilometer buffer zones surrounding the household residence, based on the distance commonly traveled for the collection of natural resources. This approach takes into account the location of settlements and its proximate vegetative resources instead of aggregating into administrative units.

3.2.2 Modifiable area unit problem and ecological fallacy

The chosen model resolution is often an administrative unit that does not necessarily reflect the spatial distribution, or socioeconomic characteristics, of the population, nor local environmental features. Alternative zonation approaches could be based on catchment areas, buffer zones around settlement areas or grids. The size of the units in which the data are aggregated has a major influence on the results of the analysis, as the variance decreases with increased unit size. *Piguet* exemplifies this issue of ecological fallacy when he states that "[N]othing guarantees that the very people who emigrated and contributed to a negative migration balance in an area under environmental stress, for example, are the same individuals who experienced that environmental stress and took a decision to migrate accordingly" (*Piguet* 2010: 518). Therefore, the choice of analytical scale should be based upon an understanding of the scale at which migration and the environmental parameters of interest operate, rather than the scale of data available.

We identified several coarse-scale case studies, of which three engaged data at the national level (*Barrios* et al. 2006, *Reuveny* and *Moore* 2009, *Marchiori* et al. 2012). *Barrios* et al. (2006) compared Sub-Saharan Africa (SSA) with non-SSA countries with regard to correlations between precipitation and urbanization rates. The authors acknowledged that there might be variations in rainfall within countries, but refer to lack of data to explain the neglect of sub-national variation. The different spatial extents between SSA and non-SSA group could explain the varying strengths of the rainfall-urbanization relationship, which are expected to increase with increasing extent. Using the same spatial dimensions and geographical focus, *Marchiori* et al. (2012) used regression models to assess the number of people, who had been "displaced" by weather anomalies between 1960 and 2000, and to estimate future displacement due to climate change, based on population and climate projections. Such estimates, based on coarse and limited data, resemble the (in)famous projections made by *Myers* (2002), which have been widely cited and later harshly criticized (*Brown* 2008).

In a study of environment and migration in South Africa, *Maclaurin* et al. (2015) examined the implications of scale effects, focusing on aggregation. They use NDVI data from the MODIS instrument to represent greenness/natural capital, and migration and socio-economic data from a rural household survey. Migration and socio-economic data, originally collected at household level, were aggregated and summarized into nine levels, where level 1 included 2-4 households and level 9 included 10-20 households. Using both global and local regression models to investigate the relationship

to migration data, the findings revealed that whereas the greenness measure was a rather stable predictor of out-migration at all aggregation levels, the socio-economic variables' ability to explain out-migration was reduced with increasing levels of aggregation. *Maclaurin* et al. (2015) conclude that empirical research on the migration-environment nexus is best studied at the household level where decisions are made, and that higher levels of aggregation may miss important associations. It should be noted that the coarsest aggregation level of 10-20 households in this study is still far from the coarseness of studies that conduct analyses at the district, province, or even country level.

3.2.3 Temporal scale

The temporal dimensions of an analysis are just as important as the spatial dimensions for the ability to identify and explain patterns. A temporal dimension is necessary to denote environmental change or stress, but some studies focus solely on the spatial differences in environmental characteristics (e.g. *Amacher* et al. 1998).

Studies using a time series or event history approach (e.g. *Gray* and *Mueller* 2012a) assume that patterns of migration should partly follow the evolution of e.g. rainfall patterns or vegetation density over the period of time under review (*Piguet* 2010). If a migration event is temporally associated with an environmental change, it is important to study the different parameters at an appropriate temporal resolution, for example to make sure that the strong increase in migration during a certain year of drought actually happened after the onset of the drought. Furthermore, many natural disasters happen over long time periods, such as land degradation and drought, which calls for a wide temporal extent of analyses. Several of the studies have a rather narrow temporal extent and focus only on a single period of environmental stress (e.g. *Findley* 1994, *Ezra* and *Kiros* 2001, *Henry* et al. 2003, *Leyk* et al. 2012). This highlights the challenges of designing spatiotemporal analyses based on data with limiting spatial and temporal dimensions.

3.2.4 Multilevel or multi-scale approaches

Some case studies have adopted a multilevel approach, where the data on migration and environment are analyzed at different resolutions or extents (*Ezra* and *Kiros* 2001, *Henry* et al. 2004b, *Gray* and *Mueller* 2012a, 2012b, *Leyk* et al. 2012). This method gives more precise results by disentangling the complexity of scale effects and has the potential to provide insights about the reliability of the results, by showing how statistical relationships vary across analysis levels. At the same time the approach requires, besides detailed environmental data, a costly and extensive collection of data through individual (longitudinal) and community surveys. In *Henry* et al. (2004b)'s analysis, multilevel models use socio-economic data collected at two or more levels, although the environmental data were collected at a single administrative level. The statistical analysis was then conducted at the individual level, with community variables assigned from community level data, and rainfall variables assigned from department level data. Thus, multi-level analysis did in this case not mean multiple analytical levels, but rather multi-level data downscaled to one analysis level. *Leyk* et al. (2012) instead attempted to overcome some scale issues associated with regression models by conducting the analysis at three "nested spatial scales" (extents), while retaining the analysis resolution. They found that the strength of the relationship varied with the analysis extent, and a stronger relationship between migration and natural resources was found when focusing on a smaller area. The results show the effects of variation within samples on statistical relationships between variables, as explained by *Wiens* (1989).

4. Conclusion

This review of scale in the environment-migration nexus highlights the need for understanding the complexity of the processes that shape migration patterns in order to translate them into a comprehensive model. Given that socio-economic, migration and environmental data are very different in measurability and quality, scale mismatches and inadequately detailed data complicate the analysis and inevitably demand the use of various re-scaling techniques to facilitate comparability of the data. The paper furthermore shows that many studies include spatial analyses, but the temporal dimension of the environment-migration nexus is more often neglected. The lack of discussion of scale in the majority of the literature indicates that the choice of model scale is based on preconceived ideas of what scales the environment-migration nexus operates at and on the spatial and temporal dimensions of the available data.

This is a call for awareness of scale implications specific to both quantitative and qualitative research approaches in data collection and analysis for establishing environment-migration linkages. We recommend combining multiple data sources and qualitative and quantitative approaches to reduce the effects of data errors and generalizations, and to allow for multiple perspectives. We emphasize that field experience and contextual knowledge is essential to interpret statistics in a nuanced way. Considering scale aspects in the investigation of environment-migration linkages throughout the research process may help to reflect on the pertinence of research questions and the reliability of research results. It can also motivate scholars and policy-makers to facilitate the production, collection and analysis of relevant qualitative and quantitative data across multiple scales.

The theoretical and terminological complexity of the scale concept admittedly offers further promising fields of studying the importance of scale as an epistemological and ontological category for environment-migration research beside the emphasis on observational scale defined by extent and resolution. On the one hand, it is unavoidable for environment-migration research, as for any other scientific endeavour, to define a model scale as an epistemological reference in order to identify and understand certain structures. On the other hand, this definition is always a conscious act with material and political effects. Being aware of this double structure of related model and reality scale involves a next step of exploring the importance of scale for environment-migration research, putting emphasis on the social and political importance of scale. Questions of how political agendas and targets of science policy effect scales of analysis and how the making of scales of analysis, operation and intervention are mutually linked are only two aspects of the research gap that must be approached in this field of environment-migration linkages.

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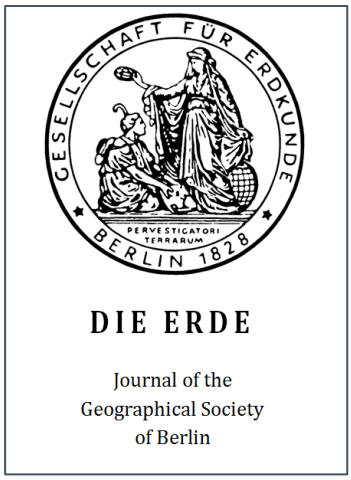
3.6 Adaptation as by-product: migration and environmental change in Nguith, Senegal



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Adaptation as by-product: migration and environmental change in Nguith, Senegal

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Abstract

In the debate about the nexus between environmental change, climate and migration much attention has been given to a changing climate as a push factor for migration. A more recent strand of academic work focuses on migration as a means to enhance adaptation capacities and resilience. This article questions these intentional attributions and starts from the observation that migration is occurring regardless of environmental or climatic change and connects people and places through shared social and cultural identities and the flow of ideas and resources. Drawing on a case study of Nguith, a village in the Senegalese Sahel with a long and complex migration history, it is shown how migration and material and non-material remittances have led (in a way accidentally) to an increased independence from local agro-ecological conditions. Therefore, we investigate the social, cultural and historical background of the people of Nguith with regard to their mobility and trace the continents-traversing migration network and connected translocal spaces. Finally, we explain the cohesive forces of this community that perpetuate and reinforce migration and show the effects of migration on everyday life, economic development in the village and resulting land-use change.

Zusammenfassung

In der Debatte über den Zusammenhang zwischen Umweltveränderungen, Klima und Migration haben bisher Klimaveränderungen als sogenannte Pushfaktoren für Migration besondere Aufmerksamkeit erhalten. Aktuellere akademische Auseinandersetzungen mit dem Thema betrachten Migration vornehmlich als ein Mittel zur Verstärkung von Anpassung und Resilienz. Dieser Artikel hinterfragt verallgemeinernde Annahmen solcher Intentionen und geht von der Beobachtung aus, dass Wanderungen auch ungeachtet von Klima- und Umweltveränderungen in Erscheinung treten und Menschen und Orte durch gemeinsame soziale und kulturelle Identitäten sowie durch den Austausch von Vorstellungen und Ressourcen miteinander verbinden. Anhand der Fallstudie von Nguith, einem Dorf im senegalesischen Sahel mit einer langen und komplexen Migrationsgeschichte, wird gezeigt, wie der Austausch materieller und nicht-materieller Ressourcen (in gewisser Weise unbeabsichtigt) zu einer erhöhten Unabhängigkeit von lokalen agro-ökologischen Bedingungen führte. Deshalb untersuchen wir den sozialen, kulturellen und historischen Hintergrund der Gemeinschaft von Nguith hinsichtlich ihrer Mobilität und verfolgen das über mehrere Kontinente gespannte Migrationsnetzwerk und die dadurch verbundenen translokalen Räume. Schließlich erläutern wir die zusammenhaltenden Kräfte dieser Gemeinschaft, welche Migration aufrechterhalten und verstärken und zeigen die Auswirkungen der Migration auf das alltägliche Leben, die wirtschaftliche Entwicklung im Dorf und den damit einhergehenden Landnutzungswandel.

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1. Introduction

When we discussed the future of Nguith with *Ibrahima*, the imam of this small village in the Senegalese Sahel, he told us: "You know, if a village has everything I mentioned, that is, electricity, running water, communications, a primary school, a college and, above all, organised people, it can usually go nowhere other than forward. We have a bright future if we are united as we always were."

Is a bright future possible for one of those countless villages in a region that is usually associated with droughts, desertification and resulting rural exodus? Nguith differs from other villages in the sense that livelihoods seem to be somewhat independent of the unfavourable agro-ecological conditions in this part of the Senegalese Sahel. And migration is the key to understand this difference. The case of Nguith may let others conclude that migration is a promising way of adapting to climate and environmental risks (*McLeman* and *Smit* 2006) or may hint at migration-based social resilience (*Sakdapolrak* 2014). Such views are quite progressive and much more nuanced than much of the simplistic representations of environment and migration linkages in the literature that was reviewed and challenged by several authors (*Black* 2001; *Castles* 2002; *Jónsson* 2010; *Lonergan* 1998; *Morrissey* 2009, 2012). Nevertheless, we argue that a focus on adaptation and resilience to environmental and climate stress still clings to a simplified causal understanding that perhaps hides more than it can reveal.

From an uncompromising stance and a refreshing perspective, *Colum Nicholson* (2014) identified banality, arbitrariness, ontological contradiction, equivocation, the laundering of categories and tautology as pervasive tendencies within the debate. He stated that the research on the relationship between environmental/climate change and migration "is a field that has political currency despite the absence of coherence, and in which a lot is being written without anything definitive being said. As a consequence, while often well-meaning, the discussion remains largely meaningless" (*Nicholson* 2014: 152).

The objective of this paper therefore is not to add another post-structuralist or post-positivist argument to the convoluted debate but to challenge the simplified representation of causal relationships. This is done by taking a step back and looking at what is really going on at one of the places that are represented as hot spots of climate and environmental change-induced migration in the West African Sahel. Moreover, we argue for an understanding of contemporary migration in the case of Nguith by placing it in the historical context of Senegalese population movements that is briefly sketched in the following.

Until the early 1970s, Senegal, with its political stability and its enormous demand for labour for groundnut production, represented an attractive migration pole within West Africa. However, affected by the economic downturn, aggravated by the great Sahel droughts of the 1970s and 1980s, Senegal gradually turned into a country of net emigration (*Bakewell* and *de Haas* 2007). For a long time most international migration from Senegal was directed towards West African destinations and neighbouring countries in particular. Census information show that in terms of migrants stocks, about 51 % of Senegalese migrants live in West African countries, such as Gambia and Côte d'Ivoire, and 40 % in Europe (World Bank 2010). Owing to colonial dominance and respective historical linkages, France developed early into the most important European destination for Senegalese migrants. Within Senegal, the Senegalese migrant in France became a distinctive symbol of success and social advancement for a society characterized by a predominantly young population with limited income perspectives. Senegalese migrants' investments and remittances exceed the country's entire Official Development Assistance (ODA) (*Diané* 2009). When immigration policies became increasingly restrictive from the 1980s onwards, historically established migration patterns were re-structured. France became less attractive, whereas Italy and Spain, as well as the US and Canada, have recorded an important gain in immigrants from Senegal since the 2000s (DPS 2004; *Fall* et al. 2010). Since the international financial crisis which started in 2008, even though Italy and Spain have become less lucrative, almost 50 % of all Senegalese emigrants are to be found in these two countries, whereas merely 12 % chose France as their destination[1] (World Bank 2011). Population movements within Senegal are still mainly directed towards the urban centres along the coast and the former groundnut basin, resulting in a negative migration balance in the interior regions. The densely populated capital Dakar and nearby re-

gions of Thiés and Diourbel hence represent both the major destinations and also the origins of internal migration (ANSD 2008), hinting at a considerable degree of circular movements within Senegal, and among these latter regions in particular.

In view of this background information, contemporary migration within and from Senegal must be regarded a historically well-established economic and social practice along existing migration networks. Therefore, in our case study we analyse migration not as something overcharged with intentional attributions in regard to environmental and climatic changes but equally allow for its multiple dimensions. We document one development path shaped by migration that we consider an ordinary phenomenon and that connects people and places through shared social and cultural bonds, and the flow of knowledge and resources. Thus, we are not primarily interested in another case study of the potential effects of a changing environment or a changing climate on the mobility of people. Instead, we contextualize interrelations between agro-ecological conditions, migration and land-use change by providing vital social, cultural and historical information about a concrete place and, finally, draw out some conceptual conclusions.

The paper therefore has the following structure: It starts with an introduction to our theoretical approach. The chapter 'study area and research design' presents our methodological approach and briefly describes the research context of the village of Nguith. Afterwards, we present the results structured according to the social and cultural background of the investigated community, their migration history and contemporary migration network describing directions of movements and the choice of destinations, before we analyse the effects of the flow of ideas and resources between the interlinked translocal spaces and Nguith and how they contribute to the economic and infrastructural development in the village and to the specific land-use change in its proximity. The paper then discusses and positions interrelations between agro-ecological conditions and the mobility of the translocal community with regard to the historical context and the cohesive forces of this community. We conclude by speculating about the importance attributed to hot spots of environmental change for contemporary migration in the light of the complexity of this social phenomenon as presented. Finally, we carefully position these findings within the erratic debate about the nexus between environmental change, climate and migration.

2. Theoretical approach

To date no separate theoretical approach exists that combines the environmental dimension and human migration. Theoretical-conceptual approaches applied in most empirical studies concerned with climate, environment and migration can basically be classified into two types (*Jónsson* 2010; *Suhrke* 1994): 1) a simplistic push-pull framework (maximalist view) analogous to neoclassical assumptions in migration theory with regard to economic-spatial differences, i.e. population movements are unidirectional and driven by individual rational thinking to migrate from a deteriorating environment to an area where better environmental conditions prevail; 2) the environment is regarded as a contextual factor and the complexity, multicausality and multidimensionality of migration is highlighted (minimalist view). Even though most recent studies can hardly be assigned to the extreme maximalist category, and multicausality and complexity of migration is widely acknowledged by the authors (*Jónsson* 2010), the respective investigations are still centred around causal linkages between climatic and environmental conditions and population movements in the first place. However, this effort becomes useless without explaining the characteristics of such a causal relationship and distinguishing it from the various other aspects of contemporary migration (*Nicholson* 2014). In order to meet the complexity and multifacetedness of this phenomenon we address the social, cultural and historical dimensions as well as the reciprocity of migration and environmental change. Moreover, instead of focusing on so-called root causes of migration we are interested in those aspects that shape, perpetuate and reinforce migration.

It is thus useful that researchers concerned with population movements in contexts of challenging climatic and environmental conditions also make use of the diverse approaches that migration theory offers (*Doevenspeck* 2011). In this case study, a number of selected theoretical-conceptual approaches such as 'cumulative causation theory' (*Massey* 1990; *Massey* et al. 1993; *Myrdal* 1957), 'migration system theory' (*de Haas* 2008; *Mabogunje* 1970), 'transnationalism' (*Pries* 2001), 'network approaches' (*Faist* 1997, 2000), the 'concept of social capital' (*Massey* and *Espinosa* 1997; *Portes* and *Sensenbrenner* 1993), the 'life course approach' (*Elder Jr.* 1994; *Kulu* and *Milewski* 2007; *Wingens* et al. 2011) and the 'biographical approach' (*Apitzsch* and *Siouti* 2007; *Philipper* 1997; *Rosenthal* 1999) mainly informed the research perspective and methodology applied.

Definitions of migration that characterize it as a specific type of movement across borders implying a change of residence for a specific period of time are useful for political and administrative purposes. However, such a terminological determination implies conceptual and analytical shortcomings and may not make a scientific contribution to understanding the diversity of phenomena and the processuality involved in contemporary human mobility (*Standing* 1984). Therefore, in the present case study we do not draw a distinction between migration and human mobility and follow the broad understanding of the International Organization for Migration who refers to migration as the "movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification" (IOM 2004: 41). Nevertheless, where it is appropriate we present an additional classification of migration.

3. Study area and research design

The selection of the study area and the village of Nguith was guided by the idea of ecological inference (*Piguet* 2010). We aimed at selecting places that show both noticeable trends of vegetation and land-use change, and of outmigration. The semi-arid Sahel-Sudan region is characterized by remarkable rainfall variability and phenomena of land degradation commonly assumed to significantly trigger migration. Moreover, migration figures depict West Africa as the continent's region with the most mobile population (*Bakewell* and *de Haas* 2007).

This high mobility can be exemplified by the people originating from the village of Nguith. The community of the Nguithois (as the people identify themselves) comprises those born in the village as well as people who were born elsewhere but refer to Nguith as their origin. According to interview statements, the Nguith community shows a distinctly higher proportion of international migrants compared to surrounding villages. Interviewed Nguithois affirmed that each village household has at least one member abroad.

Nguith is located in the predominantly rural region of Louga at a distance of 300 km from Dakar. The city of Linguère, four kilometres west of the village, is the administrative capital of the same-named province. The semi-arid region is also called the Ferlo and is mainly inhabited by two ethno-linguistic groups, the Wolof and the Fulani. However, even until today, the region's inhabitants refer to their homeland as the Diolof. Until the late 19th century this was the name of one of the Wolof kingdoms whose royal residence used to be situated close to the town of Linguère.

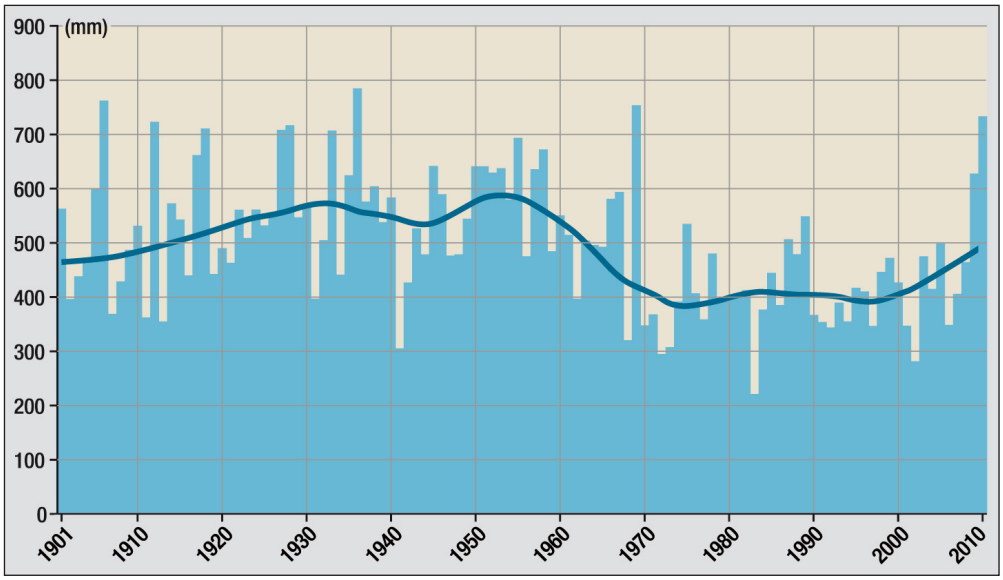

Fig. 1 Mean annual precipitation in Linguère (1901-2010). Source: GPCC (Global Precipitation Climatology Centre) 2012, data after Schneider et al. 2014. Draft: M. Brandt, graphics: M. Wegener, 2016

The agro-silvo-pastoral region constitutes a vast grazing land and Fulani pastoralists control important livestock herds. The region is characterized by an open tree and shrub savannah, annual herbaceous vegetation and the abundance of spiny trees. The predominantly sandy soils are suitable for rain-fed agriculture when regular crop rotation is applied. During the rain-laden 1950s and 1960s the area around Linguère made groundnut cultivation a very profitable business. During this period, original bush and woody vegetation was cleared to expand cropping areas, particularly in the proximity of Linguère. However, the severe droughts in the 1970s and '80s, and the subsequent dry period, made the cultivation of demanding crops such as groundnut extremely risky and resulted in a significant drop in production. Nevertheless, until today the overall area in the wider region used for rain-fed agriculture has still increased compared to the 1960s (*Tappan* et al. 2004). Nowadays, fields are sparsely scattered over the study region but concentrate around Linguère. Although annual rainfall increased again in the 2000s, the intra- and interannual variability remains considerable (*Fig. 1*) and only modest crops such as millet can be cultivated without high risk (*Brandt* et al. 2014b).

Our methodological approach was mainly based on ethnographic research which encompassed participatory observations as well as narrative and semi-structured interviews with individuals and groups of people (*Collinson* 2009; *Iosifides* 2011) and focussed on village history, migration patterns, migrant biographies and migrant networks. In a multi-sited approach, altogether 60 qualitative interviews were conducted between 2011 and 2015 among members of the community in the village of Nguith and in multiple places constituting its migration network such as Dakar and Saly (Senegal), Marbella (Spain) and Nice (France). The choice of informants in Nguith was arbitrary (non-random) and mainly targeted persons with migration experience, village elders and farmers. Snowballing enabled to establish contacts with community members outside of Nguith by telephone and via the internet.

Based on interview and remote sensing data, we analysed land-use change, phenomena of vegetation change and degradation as indicators of the interaction between prevailing agro-ecological conditions and the economic activities of the local population. The latter, again, are very much influenced by the engagement of migrants and their contributions of financial means, experience and expertise. We take the changing area of land occupied for rain-fed agriculture as a measure of people's engagement in farming and thus as one measure of their direct economic (in)dependence regarding local agro-ecological conditions and the amount and timing of rainfall, in particular.

To assess land-use and vegetation change, two satellite images were compared. A RapidEye scene from December 2010 represents the current time period, whereas a Corona scene from December 1965 stands for the pre-drought period, a time of expansion of settlements and cultivated land in the Sahel. Cultivated fields were mapped by a manual land-use classification with the help of photographs and knowledge of the terrain. Only currently cultivated and harvested land in 1965 and 2010 was mapped, and fallow fields were excluded. Fully harvested fields, leaving only bare sand in December, appear as a much brighter colour in both Corona and RapidEye imageries than surrounding grassland and fallow land covered by decaying herbaceous vegetation (see *Fig. 3*).

4. Results

4.1. Social and cultural foundations of contemporary mobility

Particular cohesion and solidarity characterize the migration network originating from the village of Nguith and constantly contribute to its perpetuation and expansion. This solidarity is mainly based on direct family relations and consecutive intra-family marriages on the one hand, and their affiliation to and identification with the Tijaniyyah brotherhood, a Sufi Order within Sunni Islam, on the other hand.

The Nguithois trace back their village history to two brothers originating from the Fouta Tooro region in Senegal who founded the village; one was a craftsman, the other a scholar of the Koran. In line with the foundation history, today the Coundoul family appoints the village chief whereas the marabout, the local Islamic leader and teacher, is always a member of the Gadji family.

Considering the division of the traditional Wolof society into different endogamous groups (cf. *O'Brien* 1971), the ancestors of the village community of Nguith used to belong to the distinct occupational group of artisans (*ñeeño* in Wolof) such as blacksmiths or leather and wood workers. The affiliation to this endogamous group determined people's social rank and their inher-

ited professional metier of craftwork. For generations, the craftsmen of Nguith specialized in basket making, which enabled them to generate additional income in Senegal's cities during the dry season, independent of prevailing climatic conditions (*Photo 1*). However, the Nguithois always pursued agricultural activities in the rainy season such as the rain-fed cultivation of millet. Even though their handicrafts, knowledge and skills were highly appreciated, the Wolof society had an ambivalent relationship with the *ñeeño*. Owing to their specific occupations and social functions in the Wolof society they were associated with impurity, which entailed specific taboos. The Wolof strictly avoided mixed marriages with, or residence among, them (*Boulègue* 1987), a fact that contributed to a certain isolation of the village community in the past and the development of a stronger solidarity among its members. In the Wolof society, the practice of identifying and differentiating people along endogamous groups resisted the impacts of Islam, independence and modernization and is preserved to a certain extent by myths and legends until today (*Diouf* 2001). The valuation of inherited affiliation and kinship continues to influence a great part of social life. Even though the former hereditary group-specific occupational specialization no longer necessarily determines people's economic activities or social reputation, respective endogamy, as indicated above in the case of Nguith, is still widely practised (*O'Brien* 1971).

Today, the Nguithois have a particular reputation among the Senegalese Tijaniyyah. This is due to the fact that Sheikh *Ibrahim Baye Niass*, the founder of the largest Tijaniyyah branch in the world (Tijaniyyah Ibrahimiyyah), in the 1950s appointed a marabout from Nguith (*El Hadji Momar Rokhy Gadji*) as the representative of this Tijaniyyah movement in the Diolof. The importance of the family history of successive marabouts in Nguith, and people's associated strong commitment to Islamic belief and the Tijaniyyah brotherhood, were factors of crucial importance for current migration for several reasons. As teachers of the Koran, the local Islamic scholars were literate and undertook regular travels within and beyond Senegal in order to study and to teach. This helped the village community to recognize early the importance of literacy and formal education so that since the 1960s all children have attended school. The consistent promotion of school and university education proved to be advantageous with regard to professional careers, income and successful integration into national and international job markets. Nowadays, highly-skilled and well-educated individuals from Nguith have found well-qualified jobs abroad, are entrepreneurs or occupy executive positions in the Senegalese public service. Until today the village marabout can be regarded as the spiritual guide in maintaining and strengthening the communal spirit of togetherness and solidarity, which became even more significant with the in-

Photos 1 and 2 *Left: Dakar-based migrants from Nguith making and selling baskets at a market in Dakar: an important source of income for generations; right: migrants from Nguith in Spain praying during the Gamou (Mawlid), the annual celebration of the prophet Mohammed's birthday*

creasing dispersion of the community. During joint religious ceremonies of the Nguithois (*Photo 2*), in his sermons the marabout emphasizes the significance of origin and identification and conveys the norms and values of co-existence, in particular with respect to mutual solidarity among Muslims, the Tijaniyyah and the Nguithois. Part of these guiding principles was and is to repeatedly stress the meaning of Nguith as the place of the (entombed) ancestors, and the prediction of the village's bright future.

As in other Sufi brotherhoods in Senegal, in the course of time the Tijaniyyah evolved into an influential institution with political and economic power (*Diouf* 2001), even, crucially, determining the organizational structures of Senegalese migrant networks abroad. The Nguithois in Europe are organized in so-called dairas, local religious and social associations of the Tijaniyyah, which not only provide the place and opportunity to practise religion, but also play a crucial role in, for example, facilitating entry to Europe, providing accommodation and finding jobs for newly arriving migrants (*Molins Lliteras* 2009: 221).

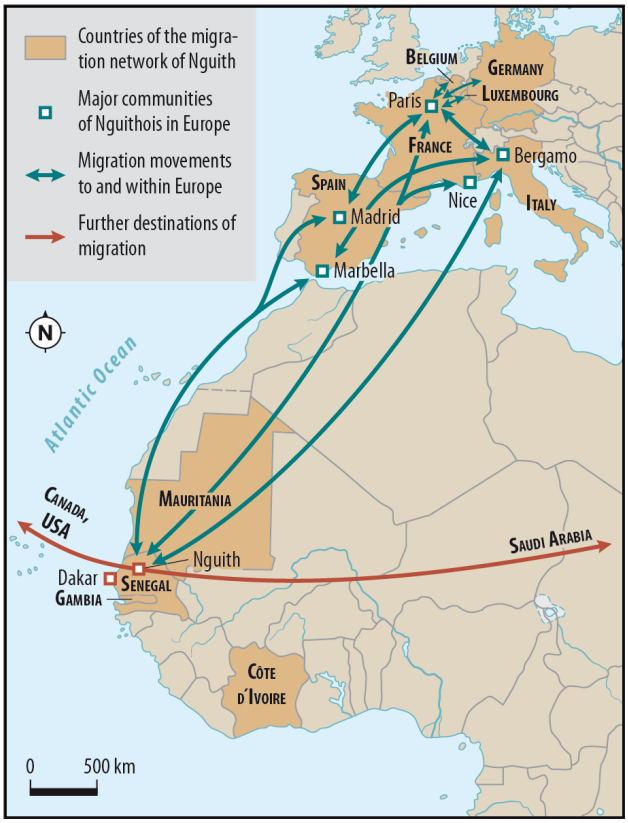

Fig. 2 Migration system and distribution of the translocal migrant community from Nguith, Senegal. Draft: C. Romankiewicz; cartography: M. Wegener, 2016

4.2 The evolving migrant community and its movements

As elaborated above, the mobility of the Nguithois can be traced back to perennial journeys of the local marabouts, as well as to people's handicrafts, which required them to move where their craftsmanship was demanded. "The profession is a know-how. We transport the know-how. And this necessarily requires mobility. One needs to find a market" (*Samba*, migrant in Spain 2012).

Embedded in Senegal's history of population movements described in the introduction, the migration history of Nguith is characterized by three major stages: 1) since the 1940s, seasonal, circular migration to the cities, and above all to Dakar, where people from Nguith generated income primarily because of their specialization in basket making; 2) since the 1970s, attracted by favourable income opportunities, increasing emigration to Dakar and other urban centres in Senegal as well as a stronger orientation towards other West African countries with the onset of Senegal's economic crisis; 3) since the 1980s, increasing migration towards Europe and North America.

Interviewees stated that the period of reduced rainfall, beginning with the great Sahel drought of 1972/73 (*Fig. 1*), and associated diminishing harvests, contributed to extended stays and permanent settling of hitherto seasonal migrants in Dakar and other urban centres. The extreme climatic conditions during that period thus did indeed shape and reinforce patterns of existing migration from Nguith.

Nowadays, the migrant network of Nguith comprises communities in several Senegalese cities such as Dakar, Kaolack, St. Louis, Touba, Thiés and Louga, and the West African countries Mauretania, Gambia and Côte d'Ivoire (*Fig. 2*). Starting from Dakar, where today the majority of Nguithois reside in the quarter of Guediawaye, the first migrants had already arrived in France by 1969. Subsequent chain migrations during the following decades led to the development of large communities in Europe, especially in France (Nice, Paris), Spain (Madrid, Marbella) and Italy (Bergamo). Other important groups live in Saudi Arabia, Canada and the US.

The contemporary national and international migration dynamics among the people of Nguith are

complex. The choice of destination and the duration of stay depend on a multitude of factors such as a person's life phase, the presence of relatives, the kind of residence permit, the professional qualifications, type of job activity and labour contract, or the residence of the spouse(s) and children. Whereas, for example, students mainly aim at admission to a university in France, labour migrants rather focus on Spain and Italy. After the end of the tourist season in southern Spain, it is not uncommon to work in industry in Italy during the winter, or to temporarily return to Dakar for other income-generating activities. Regular visits to family members and attending meetings in Senegal and Europe are common practice. Once a year, the community members from different countries get together, whether in a European country or in Nguith, to celebrate the so-called Gamou, the birthday of the Islamic prophet Muhammad (*Photo 2*). These religious events serve to strengthen the sense of community and to provide the opportunity to discuss the future development of the village and the diaspora, which in numbers exceeds by far the current population of Nguith.

4.3 Migrant money, diversification and land-use change in Nguith

In spite of continuous outmigration from the village in the past decades, the population of Nguith rose slightly from about 1,400 in 1960 to 1,800 in 2015. The strong identification with the village of origin is very much driven by people's attachment to their religious authority, the local marabout, his prophecy of Nguith's prosperous future and the associated advice to purchase plots of land. The sending of money by migrants to support family members in the village of origin is a common practice in Senegalese contexts. Over the years, emigrants have made enormous investments in Nguith. Purchasing plots of land and constructing houses are dominant private investments. With an annual financial contribution, most of the Nguithois overseas are members of the "Comité de développement du village de Nguith" (CDV), which manages the infrastructural development of the village. With these remittances, the CDV financed the construction of the mosque, a school building, a health station and a nursery school. Other migrants constructed a bakery and grocery stores in order to

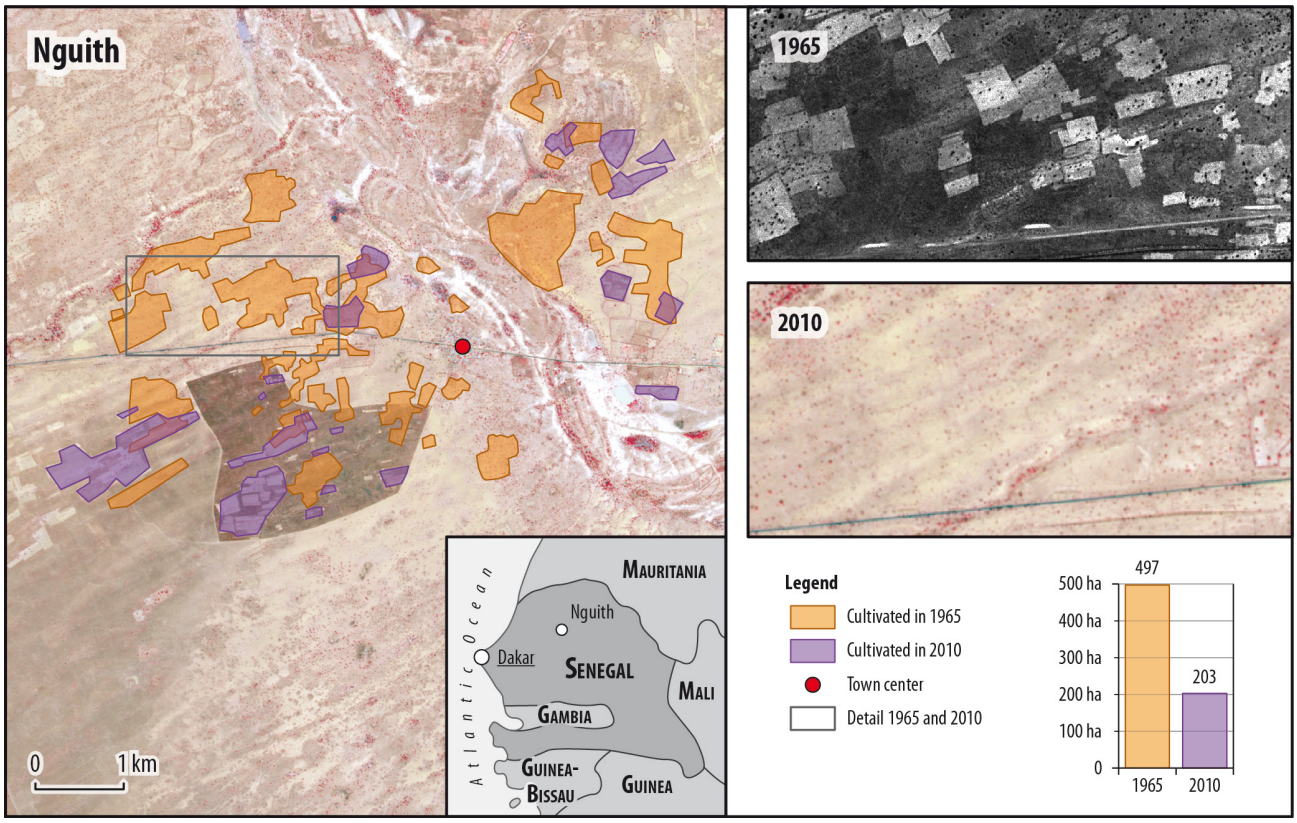

Fig. 3 Left: cultivated areas in 1965 and 2010 are illustrated for Nguith; right: zoom to the box west of Nguith; whilst in 1965 huge areas were under cultivation, in 2010 this entire area is no longer cultivated. Draft: M. Brandt, cartography: Julia Blauhut, 2016

create additional sources of income for the remaining family members. Such investments not only aim at improving the living conditions and increasing the diversification of economic activities, but also offer an incentive for people to move or return to Nguith, as some in fact have done following their working life in Europe. Moreover, many children of Dakar-based families, and even some born in other West African countries, attend school in Nguith before they pursue higher education and a career in the capital, in other Senegalese cities or overseas. One can thus state that owing to the community's translocal organisation, the village of Nguith has developed into a lively place of passage or residence (depending on a person's stage of life) for its migrant community, hence providing an additional incentive to invest in its development.

Linked to increasing mobility and migrants' support, the growing financial security of the villagers also essentially contributed to a change of land use and the diversification of agricultural activities in Nguith. Agriculture in Nguith serves two purposes: food self-sufficiency of the village and selling the surplus production. Even though the amount of annual rainfall has increased since the 2000s (*Fig. 1*), compared to the dry period of the 1970s, its intra- and interannual variability remains significant, as does the variability of annual crop yields from rain-fed agriculture. Permanent employment and regular income opportunities in the cities and abroad have had a clear advantage on the route to prosperity compared with a focus on seasonal labour and uncertain harvest outputs. This is the reason why most of Nguith's migrants never considered reengaging in rain-fed farming back home. Today, merely a quarter of the households in Nguith continue to carry out rain-fed cultivation of millet, groundnuts and, to a much lesser extent, sorghum and beans. This development can be seen by observing the enormous decrease of cultivated land around the village (*Fig. 3*). In 2010, spiny trees cover formerly intensively cultivated areas (*Brandt* et al. 2014b). Whilst nearby villages still cultivate vast millet fields, the areas under cultivation around Nguith decreased between 1965 and 2010 by 59 %. Only 203 ha were cultivated in 2010, whereas the rest of the land is classified as fallow or grazing land. This is a considerable change from 1965, when 497 ha were under cultivation. However, the remaining farmers are motivated to maintain rain-fed cropping. "You can have a good production this year. Next year, one never knows. You may have more, or less, or even nothing. But that does not mean anything. It does not prevent us from preparing everything we need to prepare every year. And the rest we leave to the good god" (Modou, farmer in Nguith, 2012). Despite high rainfall variability a good harvest still gives a non-negligible revenue and enables the villagers to achieve food self-sufficiency. Nevertheless, due to migrants' financial assistance, today's crop yields can no longer be regarded as the sole or major economic security of Nguith's house-

Photos 3 and 4 Left: a passing camel herd from Mauretania gathers around the deep well in Nguith contributing to visible soil degradation; right: returned migrants inspect a vegetable garden.

holds. Even a complete harvest loss, as in 2011, due to an invasion of birds into the fields, did not threaten people's livelihoods; this is a clear indication of a weak dependence on the returns from agriculture.

The augmentation of livestock that is given to and managed by the local Fulani is a typical example of financial investment of migrant remittances in the study area. Fulani families reside at the outskirts of Nguith in order to herd the villagers' goats, sheep and cattle, mainly purchased with money earned by migrants. These days, a network of deep wells and water holes in the region ensures the provision of drinking water for the herds – conditions not existing during the 1970s, when large numbers of animals died of thirst. Today a deep well and a water tower enable water provision within the village, which at the same time attracts passing herds. Both the augmentation of the local animal stock and the inviting watering place, however, brought about the increasing frequency of animal movements that compact the soil through trampling (*Photo 3*). Thus, soil degradation around the village, close to the deep well in particular, can be observed but is not of alarming extent. This effect is reinforced by the higher clay content of the soils around Nguith (*Brandt* et al. 2014a). What is more, the growing number of animals increased the grazing pressure on the woody and herbaceous vegetation in the vicinity with the effect that only robust woody sprouts survive(d). In combination with the recurring droughts of the past decades, a shift to a grazing and drought resistant woody vegetation could be observed in the area (*Brandt* et al. 2014a).

Nguith's deep well and water supply system has also enabled individuals to initiate the installation of irrigated vegetable gardens (*Photo 4*). Such gardening projects are very attractive since continual harvesting is possible over the whole year and thus these projects represent a steady and more reliable source of income compared to rain-fed farming. However, these gardens require very high initial investment for fencing and the construction of the irrigation system. Additionally, garden maintenance is extremely costly, especially considering the high water prices, fertilizer input, pest control and the workforce necessary for the intensive care of the plants and beds. In Nguith, migrants partly subsidized the erection of vegetable gardens; one is even managed by returned migrants. To co-finance the latter, migrants contributed with their know-how and contacts with NGOs or European sponsors. Today, fruits and vegetables are sold along the main road by women and are mainly consumed in the village. Thus, these irrigated gardens do not only create additional incomes but also increasingly contribute to a year-round food supply in contrast to the varying outputs of rain-fed agriculture. Nevertheless, because of the expensive garden infrastructure and the more convenient and traditional alternative to invest in livestock breeding, very few people are able or want to engage in gardening. To date only three such irrigated gardens have been realised in the village. In 2015, the entire area of irrigated horticulture in Nguith already covered approximately 15 ha.

5. Discussion

The beginning and perpetuation of the mobility of the Nguithois was significantly shaped by the community's socio-historical background. However, a period of unfavourable rainfall conditions since the onset of the 1972/73 drought progressively motivated many of Nguith's migrants to settle permanently in Senegalese urban centres and to abandon seasonal agricultural activities in the village. The great Sahel droughts thus reinforced the departure from this village. However, the manual skills in basket-making, and advanced formal education among the community members, gave them the advantage of economic success in the cities – a circumstance they benefitted from already, long before the beginning of the Sahel droughts. Additionally, this put them in the position to remit sufficient means in times of exceptional harvest shortfalls to support the family members remaining in the village. The end of the 1960s already marked the beginning of Dakar-based Nguithois migrating to France. The increasing numbers of migrants outside of Nguith, and growing communities overseas, must be regarded as a result of chain migration and the desire for progress and prosperity among well-educated people. Today, people do not only live to earn food, not only to practise farming. At this point it becomes obvious that the adaptive capacities of the Nguithois cannot be regarded as a strategic answer to extreme climatic events in the first place, but, in the context of their migration history, must rather be considered as a by-product.

The subsequent development of Nguith, village life, economic and agricultural diversification and related processes of land use and vegetation change in and around the village were very much informed by migrants' initiatives and particularly by the considerable financial support of the diaspora overseas. Nevertheless, traditional forms of agriculture such as livestock breeding and rainfed farming

continue to play an important role regarding food self-sufficiency and the generation of income in the village or as an investment option of migrant money especially in the former case. Thus, the development and economic security of the village, and therefore also the increasing independence from local agro-ecological conditions, are based on decentralised (translocal) income generation.

However, the particular way and extent of people's engagement and solidarity is not a matter of course in the context of the study area and particularly when compared to other villages. Important aspects of mediation and motivation need to be considered in understanding the relevance that the village itself retained for the entire community. Today, only a small fraction of the entire translocal community resides and was born in the village of Nguith. However, as the place of the ancestors and origin it gained and retained paramount symbolic importance for the community's identity. Crucial mediating factors of identity and cohesion form the particular socio-historical background; these factors are their religious belief and, above all, the commitment to their marabout as their (translocal) religious authority, who lives in the village but frequently travels within Senegal and to Europe in order to meet the dispersed Nguithois and to promote unity and solidarity. It is these cohesive forces that give meaning to the village and consequently form the basis of the development towards a more sustainable and adapted life in Nguith today. However, it must be noted that the Nguithois overseas face the particular difficulty of a balancing act between simultaneously maintaining the traditional norms and making the expected financial contributions that ensure their affiliation to the community on the one hand, and the challenges that involve adapting to and making a living in the Western World on the other hand. Additionally, taking into account the extent of the widespread community it is therefore comprehensible that also temporary (depending on the phase of life) or permanent avoidance behaviour or escape from the constraints of traditional values of the Nguith community occurs among individuals or families.

6. Conclusion

The example of Nguith indicates that, within the debate of the nexus between environmental change, climate and migration, questions relating to specific causal links are raised that are probably irrelevant, following paradigms and setting priorities that blur more than they reveal. We have shown the importance of historical, sensitive and contextualized studies of migration as a social process. Although the Sahel is represented as a hot spot for environmental degradation, the realities of Nguith do not fit that paradigm. Therefore it can be concluded that the climate, environment and migration debate should be reconnected to migration theory to avoid simplistic frameworks and flawed concepts instead of approaching the issue as an isolated phenomenon. Employing theoretical-conceptual approaches that emphasize the role of social capital and bonds, migration networks as well as the temporal dimension and cumulative effects of migration allows for a perspective that helps to make more sense of the observed patterns and phenomena of contemporary movements. Therefore, we should focus less on proper migration causes than on the interplay between migration and processes of formation and maintenance of social structures and thus on the perpetuation of human mobility. Migration, as shown in the case of Nguith, must be understood as a social process that contributes to the formation of delocalized social phenomena, in our case the "Nguith identity", and not as a response to particular stimuli only.

We demonstrated that established migrant networks essentially shape the choice of destination and perpetuate and reinforce migration towards and between specific internal and international destinations. Circular movements not only contribute to continuously create, maintain and strengthen intertwining social bonds between people and to promote traditional values at multiple places, even across national borders, and shape translocal social spaces. Multidirectional movements, as shown for the case of Nguith, have become a substantial and necessary social practice and prerequisite for translocal livelihoods and development for a long time. The recognition of today's role and importance of migration and remittances in West African contexts, however, contradicts the sedentary bias inherent in the debate about climate, environment and migration that continues to frame migration first and foremost as an answer to a problem (or even a problem itself) rather than an ordinary element of people's lives. This does not mean that the fact that people in Africa do have to tackle serious problems can be ignored or negated but it reminds us not to conceptualize mobility differently 'here' and 'there' and to accept that migration must not always and necessarily be regarded as an adaptation strategy.

Note

[1] In contrast to the common UN migration definition (absence of at least one year) this World Bank survey defines a migrant as any person who used to live in the surveyed household and is absent for at least six months. More information on the survey methodology can be found in *Plaza* et al. (2011).

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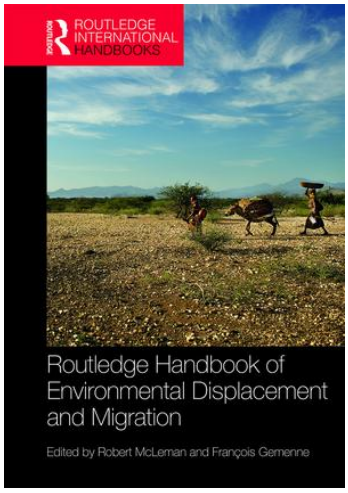
3.7 Environmental change and migration: A review of West African case studies



Victoria van der Land, Clemens Romankiewicz, and Kees van der Geest. 2018. "Environmental change and migration: A review of West African case studies." In *Routledge Handbook of Environmental Displacement and Migration*, edited by Robert McLeman and François Gemenne, 163–77. Cambridge: Routledge.

13

Environmental change and migration

A review of West African case studies

Victoria van der Land, Clemens Romankiewicz and Kees van der Geest

Introduction

West Africa is considered one of the world's regions that is presumed to be highly affected by climate and environmental changes in the future (IPCC 2007). The majority of the rural population in the region depends on small-scale agriculture, crop production and livestock farming, and therefore on the natural environment. Environmental changes can thus constitute a severe threat to people's livelihoods. Mobility in West Africa has a long tradition and the seasonality of rainfall influences mobility patterns. Agricultural activities depend on only one rainy season, during which the workload in agriculture is high. The seasonal movements of pastoralists with their animals to pasture grounds or the labour migration of farmers during the dry season are well-established patterns of migration (Davies 1996; Ellis 1998; Rain 1999). Main destinations are urban areas or more productive rural areas, either within the country or in neighbouring countries. The most established inter-regional mobility pattern in West Africa was and still is the north-south movement from the Sahelian landlocked countries of Burkina Faso, Mali and Niger to coastal states, particularly to the economically strong Côte d'Ivoire. These patterns date back at least to the colonial area in the 19th century, when plantation economies (e.g. cocoa, coffee, cotton, groundnut) attracted labour migrants from neighbouring countries and cities as Dakar, Abidjan, Lome and Accra benefited from investments for the export of goods to Europe (Hummel et al. 2012; Bakewell and de Haas 2007). Dryland West Africa has harsh environmental conditions and long established mobility patterns, but that does not necessarily mean that the two are related.

This review analyses 15 empirical case studies that focus explicitly on the complex linkages between environmental factors and human mobility in West African drylands – in the semi-arid Sahel zone and the savannah (Table 13.1). This includes studies conducted in Senegal, Mali, Burkina Faso, Niger and (Northern) Nigeria, Ghana and Benin. In contrast to existing reviews on African case studies (e.g. Jónsson 2010; Morrissey 2014), the present chapter focuses specifically on West African drylands with relatively homogenous climatic and cultural conditions compared to other regions. Environmental parameters investigated in the case studies comprise slow-onset changes such as rising temperature, increasing rainfall variability and land degradation, as well as the severe droughts of the 1970s and 1980s. In addition, the review provides a systematic analysis

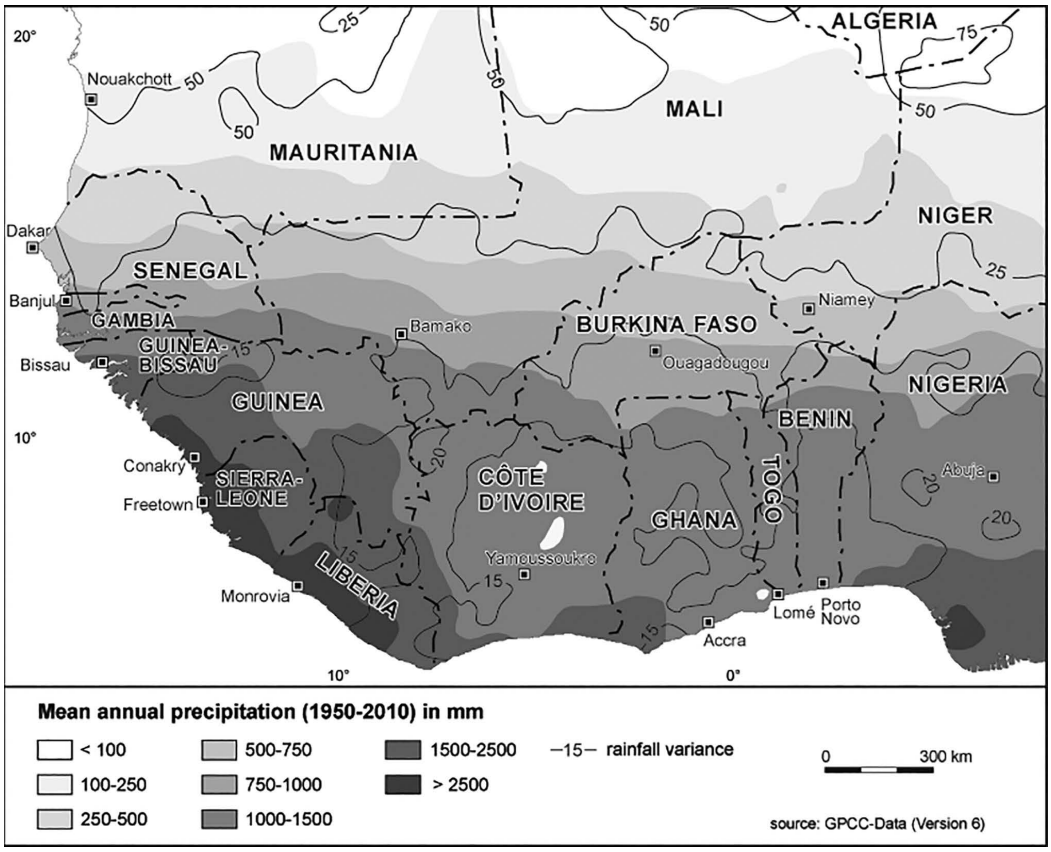


Figure 13.1 Map of West Africa with mean annual precipitation

Source: Modified by authors based on: Martin Brandt, Heiko Paeth, Cyrus Samimi (2013): Vegetationsveränderungen in Westafrika – Spiegel von Klimawandel und Landnutzung. Georaphische Rundschau 9: 36

on the similarities and differences of concepts, methods and results of the most relevant case studies on the environment-migration nexus, aiming at drawing conclusions and identifying future directions for research on the environment-migration nexus in the region.

Approaching the environment and migration nexus in West African drylands – concepts and theories

The great Sahel droughts of the 1970s and 1980s and the assumed direct effects of climate and environmental change on human migration have shaped the image of the entire Sahel region as being a serious hotspot of environmental displacement. Contemporary political concerns of (uncontrollable) large-scale population movements as a consequence of unbearable environmental conditions in dryland West Africa influence and dominate the focus in research, as well as conceptual approaches applied in empirical investigations on the linkages between migration and environmental change. Empirical studies can basically be classified into two conceptual categories (Suhrke 1994; Jónsson 2010): a) a push-pull framework (maximalist view) derived from the approach of neoclassical economics in migration theory that assumes (unidirectional) migration to be a result of economic-spatial differences, or analogously here, driven by spatial differences in environmental conditions; and (b) approaches that regard the environment as a contextual component and emphasize and elucidate the multiple dimensions and levels, complexity and multicausality of population movements (minimalist view). Even though authors of

Table 13.1 Overview of the reviewed case studies

Author(s)	*Title*	*Publication year*	*Study country*
Henry, S., Boyle, P. and Lambin, E.F.	Modelling inter-provincial migration in Burkina Faso, West Africa: the role of socio-demographic and environmental factors	2003	Burkina Faso
Henry, S., Piché, V., Ouédraogo, D. and Lambin, E.F.	Descriptive analysis of the individual migratory pathways according to environmental typologies	2004	Burkina Faso
Henry, S.; Schoumaker, B. and Beauchemin, C.	The importance of rainfall on the first out-migration: a multi-level event-history analysis in Burkina Faso	2004	Burkina Faso
Kniveton, D.; Smith, C. and Wood, S.	Agent-based model simulations of future changes in migration flows for Burkina Faso	2011	Burkina Faso
Findley, S.E.	Does drought increase migration? A study of migration from rural Mali during the 1983–1985 drought	1994	Mali
Pederson, J.	Drought, migration and population growth in the Sahel: The case of the Malian Gourma: 1900–1991	1995	Mali
van der Land, V.	The environment-migration nexus reconsidered: Why capabilities and aspirations matter	2015	Mali, Senegal
Romankiewicz, C.; Doevenspeck, M.; Brandt, M. and Samimi, C.	Adaptation as by-product: migration and environmental change in Nguith, Senegal	2016	Mali, Senegal
Bleibaum, F.	Senegal. Case study report	2009	Senegal
Afifi, T.	Economic or environmental migration? The push factors in Niger	2011	Niger

(*Continued*)

Table 13.1 (Continued)

Author(s)	*Title*	*Publication year*	*Study country*
Mounkaïla, H.	De la migration circulaire à l'abandon du territoire local dans le Zarmaganda (Niger)	2002	Niger
van der Geest, K.	North-South migration in Ghana: What role for the environment?	2011	Ghana
Rademacher-Schulz, C.; Mahama, S.	"Where the rain falls" project. Case study: Ghana. Results from Nadowli District, Upper West Region	2012	Ghana
Doevenspeck, M.	The thin line between choice and flight: environment and migration in rural Benin	2011	Benin
Dillon, A.; Mueller, V. and Salau, S.	Migratory responses to agricultural risk in Northern Nigeria	2011	Nigeria

recent empirical investigations widely acknowledge the complexity and mulicausality of migration, this classification can be useful "to illustrate how conceptual frameworks shape the kinds of data and analyses researchers produce" (Jónsson 2010: 8). The theoretical-conceptual approaches and research designs applied in most of the reviewed West African case studies are framed to a greater or lesser extent by plausible basic assumptions of environmental push and pull factors of migration. The following exemplary quote illustrates the underlying premises in the investigations: "Since rain-fed agriculture is the main source of livelihood in rural Burkina Faso, intuitively it makes sense that environmental factors (e.g. rainfall and land degradation) will influence socio-economic conditions and may lead people to emigrate" (Henry et al. 2004b: 424).

Several studies do not specify the theoretical-conceptual approach that guided their research (e.g. Mounkaïla 2002; Bleibaum 2009; Afifi 2011), however, implicitly they mainly follow the push-pull idea. In the case studies of Henry et al. (2003, 2004a, 2004b) and van der Geest (2011), even though considering a variety of demographic, socio-economic and environmental parameters in their statistical model/analysis, the respective approaches basically involve testing the explanatory power of environmental and socio-economic area characteristics as push or pull factors for migration. Whereas Pedersen (1995) looked at the demographic effects of exceptional droughts in Mali, of which migration is only one parameter, Findley's (1994) analysis frames migrants as social and economic members of a larger household, and presents socially and spatially differentiated movements as drought coping strategies. In contrast, both Doevenspeck (2011) and Romankiewicz et al. (2016) stress the importance of making use of the multiple approaches contemporary migration theory offers, and put the environmental dimension in the context of migration shaped by social capital and migration networks. Three case studies (Dillon et al. 2011; Rademacher-Schulz and Salifu Mahama 2012; van der Land 2015) use the

Sustainable Livelihood Approach (SLA) to analyse the importance of migration as a household's survival, risk reducing, or adaptation strategy in the face of climatic or environmental stress. Van der Land (2015) combines the SLA and a capability approach and thus, in contrast to other studies, not only considers the household level, but also highlights individual aspirations and preferences in migration decisions. Kniveton et al.'s (2011) Agent Migration Adaptation to Rainfall Change model, which incorporates the theory of planned behaviour, involves multiple sets of migration drivers and the assumption that migration away from affected areas is an adaptation strategy.

Apart from the variety of theoretical-conceptual approaches applied in the reviewed papers, the empirical studies rely on different definitions and classifications of human mobility. They depend on the type of analysis (quantitative/qualitative) or the availability and quality of data sources. Studies referring to migration information from censuses usually use a migration definition of an absence of at least 12 months (Pedersen 1995; Henry et al. 2003; van der Geest 2011). Other studies that use survey data differentiate for instance between seasonal/circular (less than 6 months) and temporary/permanent migration (more than 6 months) (Findley 1994; Rademacher-Schulz and Salifu Mahama 2012), or short-term (3–10 months), temporary (10 months–5 years), and permanent migration (more than 5 years) (van der Land 2015). Henry et al. (2004) exclusively look at the first out-migration from the village after age 15. Romankiewicz et al. (2016) follow the IOM definition of migration (IOM 2004) that encompasses any kind of population movement irrespective of length, boundaries crossed or causes. Moreover, the environmental parameters considered vary among the case studies. Almost all studies refer to respective rainfall variability in time and space. Rademacher-Schulz and Mahama (2012) and Dillon et al. (2011) also include temperature as a variable. Authors who go beyond a general description of so-called environmental stressors, and thus quantify environmental parameters in their study, include a combination of explanatory factors. Such factors are rainfall, land degradation (soil fertility) and crop yields (Henry et al. 2003; Henry and Schoumaker et al. 2004), annual rainfall and land use change (Romankiewicz et al. 2016), and vegetation cover (NDVI), crop yields and rainfall (van der Geest 2011).

The analysis of theoretical-conceptual approaches shows that most empirical case studies on West African drylands are still guided and entrenched in traditional push-pull frameworks. Only a few authors point out and apply alternative approaches in order to make sense of observed contemporary migration phenomena in West Africa beyond an interpretation of environmental displacement. Moreover, the variety of migration definitions and combination of environmental parameters applied in the studies make it difficult to compare the results.

Methods: Diversity, trends, challenges and opportunities

The studies use an impressive variety of methods to analyse the relation between environmental change and migration in dryland West Africa. All six types of research methods that Piguet (2010) distinguishes have been applied in the region: a) ecological inference based on area characteristics; b) sample surveys; c) time series; d) multilevel analysis; e) agent-based modelling (ABM); and f) qualitative and ethnographic work. Some of Piguet's categories include several different research tools. For example, qualitative research methods might include individual interviews, focus groups, expert interviews and participatory research approaches.

Table 13.2 indicates the methodological approach and the spatial and temporal dimensions applied in the reviewed case studies. The table shows that most studies combined two or more methods that complement each other, helping to validate or triangulate findings. A particularly

Table 13.2 Overview of methods and spatio-temporal dimensions

Author(s)	*Publication year*	*Study country*	*1 Ecological inference*	*2 Surveys*	*3 Time series*	*4 Multi-level*	*5 ABM*	*6 Qualitative research*	*Source area*	*Destination area*	*Past or present*	*Future*
Henry et al.	2003/2004a/2004b	Burkina Faso	X	X	X	X			X	X	X	
Kniveton et al.	2011	Burkina Faso					X		X			X
Findley	1994	Mali		X					X		X	
Pederson	1995	Mali		X				X	X		X	
van der Land	2015	Mali, Senegal		X				X	X	X	X	
Romankiewicz et al.	2016	Mali, Senegal	X					X	X	X	X	
Bleibaum	2009	Senegal		X				X	X	X	X	
Afifi	2011	Niger		X				X	X	X	X	
Mounkaïla	2002	Niger		X				X	X		X	
van der Geest	2011	Ghana	X	X	X	X			X	X	X	
Rademacher-Schulz & Mahama	2012	Ghana		X				X	X		X	
Doevenspeck	2011	Benin		X				X		X	X	
Dillon et al.	2011	Nigeria		X	X	X			X		X	
Total			**3**	**12**	**3**	**3**	**1**	**9**	**13**	**7**	**13**	**1**

Notes:

- Kniveton et al. (2011) use survey and time series data from Henry et al. (2003, 2004) to construct their agent based model.
- Pederson's (1995) work is based on a literature review and statistical data from demographic and nutrition surveys. These were not designed to study migration-environment linkages specifically.
- The surveys in the EACH-FOR studies (Bleibaum 2009; Afifi 2011) had a low sample size (N = approximately 30) and contained several open-ended questions yielding qualitative data. The other qualitative work in these two studies consisted of expert interviews.
- The study by Mounkaïla (2002) has no methods section. Most of the findings seem to be based on a desk study and, following Piguet's (2010) description of research approaches, are categorized under qualitative research. Mounkaila has also conducted a survey in two 'source area' villages.
- In the work by Rademacher & Salifu Mahama (2012), PRA tools play a central role. These are classified under qualitative methods here.

common mix has been the combination of a sample survey and qualitative research tools. Table 13.1 also shows that the focus is mostly on past and current population movements; few studies have extrapolated into the future, which is a challenging exercise (Brown 2008; Gemenne 2011; McLeman 2013). With regards to the spatial dimension, the table shows that almost all studies are based on data from migrant source areas, where the environmental push factors were at play. About half the studies under review also included data from migrants' destination areas.

Jónsson's (2010) review of African case studies on environmental migration identifies several methodological challenges. The scholarly work reviewed in this chapter also faces these challenges to varying degrees. First, many studies are too narrowly focused on environmental drivers. This is especially the case for studies that use a macro-level push-pull framework that fails to take into account micro- and meso-level contextual factors that were highlighted in the previous section of this review. Several studies (e.g. Bleibaum 2009; Afifi 2011) asked directly for the impact of environmental drivers on migration while others (e.g. van der Geest 2011; Rademacher-Schulz and Salifu Mahama 2012; van der Land 2015; Romankiewicz et al. 2016) followed a broader approach by inquiring a wide variety of potential reasons for people to migrate, including environmental factors. A second challenge or weakness is that many studies lack a longitudinal perspective: they provide snapshots that fail to grasp the historical context of migration and longer-term dynamics of the environment. Third, there is an issue with the reliability and validity of data. This is particularly the case for interview data about migration reasons. It also applies, however, to secondary data about mobility (e.g. population census data and people's recall of migration years) and the environment (e.g. rainfall data). There is a general paucity of reliable migration data in West Africa, especially at sub-national level. National census data often includes – if at all – only limited information about migration. In addition to the challenges Jónsson identified, several reviewed studies chose to interview the head of the households (e.g. Bleibaum 2009; Doevenspeck 2011; van der Geest 2011). Most of the household heads, however are men, which can cause gender imbalances in the results, especially with regard to questions about perceptions and migration reasons. Rademacher-Schulz & Mahama (2012) address this challenge by interviewing wives of male household heads in approximately half the sample. The seemingly simple, but potentially complicated question 'who to interview?' is crucial in migration research. Household heads may not know or want to reveal the migration motives of the different household members. It often depends on the research focus whether the choice should fall on individual migrants, their household heads or others. Another challenge is that the results of case studies are hard to compare due to the different research approaches, including methods used, scale levels, sample sizes and amount of time spent in the field. Therefore, a systematic analysis of research findings on the environment-migration nexus, as is attempted in this chapter, has its limitations.

Besides challenges, there are also opportunities that have not yet been fully exploited. For example, increasingly granular datasets depicting environmental change have become freely available in the past years. For dryland West Africa, where drought and desertification are key issues, a more thorough analysis of these datasets can help to better understand the environmental drivers of migration. Moreover, methods for studying migration-environment linkages in dryland West Africa have improved considerably since the first studies on this topic appeared in the 1990s. Particularly there is a move towards more mixed-method research that produces more robust findings. Several challenges remain, and new opportunities for analysis arise.

Ambiguous findings on the impact of environmental factors on migration behaviour

The agreed aspects on the linkages between the environment and migration

The reviewed case studies focus on different aspects of the relationship between the environment and migration and apply different concepts, data and methods. This makes it difficult to compare and to draw consistent conclusions even from case studies that focus on the same region. Nevertheless, all studies agree at least on three relevant aspects for the research on environment and migration in the region: a) environmental conditions and changes favour temporary migration; b) migration is a well-established activity to diversify income; and c) migration is multi-causal.

Climatic conditions in the region, such as the long dry season and highly variable inter- and intra-annual rainfalls, favour temporary migration from the rural areas. For many people in the region, seasonal or temporary labour migration from rural areas is a common activity and well-established strategy to diversify income. Particularly, migration during the dry season is often an economic activity complemental to agriculture and crucial to ensure the household's food security, as has been widely acknowledged in literature on West African drylands (e.g. Mortimore 1989; Davies 1996; Ellis 1998; de Haan 1999; Breusers 1999; Mortimore and Adams 1999; Rain 1999; de Haan et al. 2002; Ellis 2003; McLeman 2014). Nevertheless, the studies agree that migration in the region is multi-causal. Environmental factors are usually not the only driver of migration, but cultural, economic, environmental, political and social aspects also influence the migration decision. While the studies agree on these basic aspects, there is little consensus on the role and weight of environmental change and stress as a driver of migration compared to other aspects, on the necessity or the degree of urgency to migrate and on the impact of environmental factors on the duration and destination of migration.

The multi-causality of migration as a major challenge

Economic and environmental factors as main reasons for migration

The studies on the environment-migration nexus in West Africa acknowledge that a variety of variables influences the migration decision and that migration is complex and context-dependent. However, this complexity of migration seems to be a major conceptual and methodological obstacle to research on the environment-migration nexus. Afifi, for instance, recognises that "it is hard to link migration to the environment" (Afifi 2009: 17), and Doevenspeck notes that it is very difficult to achieve a clear differentiation between the different impact factors (Doevenspeck 2011: e61). Concluding that migration is complex and context-dependent is a very unsatisfying result (Nicholson 2014; van der Land 2015, 2018; Romankiewicz et al. 2016). The relationship between environmental and economic drivers of migration seems to be particularly complex. This is because environmental stress may be an indirect driver of migration through economic needs. Often it is not environmental factors themselves which influence the migration decision but rather their consequences or related structural constraints, such as reduced productivity or food insecurity (Mounkaïla 2002; Afifi 2011; Rademacher-Schulz and Salifu Mahama 2012). At the same time, labour migration in West African drylands not only ensures food security but is also a means to increase assets and improve economic wellbeing and livelihoods (Ellis 2003). Nevertheless, some of the reviewed studies assume environmental problems as a driver of economic motivated migration, while the migrants themselves do not relate

their migration to environmental problems. Interviewees in Afifi's EACH-FOR study on Niger state economic factors, such as poverty and unemployment, as main causes of migration. Afifi reckons that the underlying causes of the economic motives were declining crop yield or death of animals due to the droughts and water shortage. He even suggests the term "environmentally induced economic migration" (Afifi 2011: e116). In Findley's (1994) study on the effect of the 1980s drought in Mali, surprisingly few of the household heads explicitly reported drought or famine as the reason for migration. Instead, economic reasons, marriage or other family reasons were the main migration motives. Other studies show that better economic prospects in other regions influence the migration decision and patterns. In the EACH-FOR study on Northern Ghana, people mentioned better agro-ecological conditions in the destination area more often as reasons for migration than the unfavourable conditions for farming at home (van der Geest 2011: e85). Henry and colleagues relativize the role of the environmental conditions by stating that "Burkinabe migrants are not likely pulled by rainfall conditions in Cote d'Ivoire but are rather attracted by job opportunities in plantations of cafe and cacao" (Henry et al. 2004a: 414). The research project "MICLE: migration, climate change and environment" (http://www.micle-project.net/) finds that economic motives are the main migration motives for both Senegalese and Malian migrants. Environmental reasons played a role as underlying causes for 71% of the Senegalese, while this applies only to 13% of the Malians. Malians relate their economic motivated migration rather to consumption, like buying clothes or dowry (Hummel 2015; van der Land 2015). The "Where the rain falls" project (https://wheretherainfalls.org/) finds for Ghana that people migrated mainly for economic and food security reasons. The most common reasons for migration were the decline in crop production for own consumption, shifts in the rainy season, unemployment, longer drought periods followed by unreliable harvest and increase in drought frequency (Rademacher-Schulz and Salifu Mahama 2012). With respect to gender, earlier studies showed that male migration was dominated by economic motives and women rather migrated for marriage and family reasons (Findley 1994; Petit 1997). While this tendency is still valid, women also seem to migrate increasingly for economic reasons (de Haan et al. 2002; Sieveking and Fauser 2009; van der Land 2015). It is, however, not clear if this is due to deteriorating environmental conditions or due to an increasing acceptance of women migrating for economic reasons.

Economic motives for migration include different levels of voluntariness or necessity. Rademacher-Schulz and Mahama show in their Ghana study that 75% of their survey participants perceive migration as a normal income-generating strategy, whereas 36% perceive and use it as a strategy only in times of crisis (Rademacher-Schulz and Salifu Mahama 2012). Van der Geest (2011) suggests for Northern Ghana that only 24% of the migrants in his sample moved for reasons that indicate a high level of urgency and distress, citing "food insecurity" or "hunger" as migration reasons. For most migrants, the level of urgency was lower and their migration rather attempts to improve their livelihoods (van der Geest 2011). He concludes that "[t]he picture that emerges for northern Ghana is not one of distress migration in the face of environmental disaster but rather of migration as a way of dealing with structural environmental scarcity" (van der Geest 2011: e69). The reviewed studies suggest that this conclusion applies for the whole region. The underlying motives for people's economic migration are manifold and migration is often a voluntary decision, which goes beyond risk prevention and adaptation to environmental stress. Better income opportunities and the desire for progress and prosperity – inspired by the prestige and economic achievements of previous migrants – as well as the aspirations for a better life and a different lifestyle are important motives for economic migration (van der Land 2015, 2018; Romankiewicz et al. 2016).

The importance of individual characteristics, structural conditions and social determinants for migration in environmentally fragile areas

Studies that consider multiple variables as drivers of migration find that environmental factors are often not the main driver of migration in the region. Instead, they show that individual characteristics (e.g. level of education, religion, ethnicity and the economic activity), structural conditions (e.g. infrastructure and lacking [non-farm] income opportunities on site, and better income opportunities elsewhere) or social determinants (e.g. conflict, envy, migration tradition and relative deprivation) strongly influence migration.

For Burkina Faso, Henry et al. (2004b) find no evidence of a general effect of rainfall conditions on people's first out-migration from rural areas. Instead, they find that migration mostly depends on individual characteristics such as the educational level, the type of economic activity or the ethnic group to which the individual belongs (Henry et al. 2004b: 454). In an earlier study on inter-provincial migration in Burkina Faso in the 1980s, Henry et al. (2003) also show that socio-demographic variables, such as literacy and economic activity, have more power to explain migration than environmental factors, such as rainfall variability, drought frequency and soil degradation (Henry et al. 2003: 134). Individual characteristics not only determine the migration propensity, but also the migration motives. The MICLE project, for instance, shows that individual characteristics, such as gender, age, economic activity and educational level, strongly influence people's reasons to migrate (van der Land and Hummel 2013; Hummel 2015; van der Land 2015). Environmental factors predominantly influence the migration of middle-aged male farmers with no or a low formal education (van der Land 2015).

Van der Geest and colleagues (2009; 2010; 2011) find in their studies on Ghana that migration propensities tend to be higher in districts that experience more resource scarcity – depending on annual rainfall, vegetation cover, crop yields and, to a lesser extent, rural population density. However, van der Geest (2011: e80) suggests that religion and a higher level of education, migration tradition and poorly developed infrastructure could be important influencing variables to explain the higher out-migration from the Upper West region compared to the Upper East, two regions with similar resource scarcity. Similarly, Doevenspeck (2011) finds for the northwest of Benin that environmental problems, such as soil degradation, poor harvests and food security, are not necessarily the main migration determinants, but that economic reasons, envy, and conflicts influence migration (Doevenspeck 2011: e63).

Moreover, several studies on migration in West Africa show that social networks, social capital and identity play a role in the migration decision (Hampshire 2002; de Haan et al. 2002; Doevenspeck 2011; van der Land 2015; Romankiewicz et al. 2016). Particularly, recent studies suggest that environmental stress might have been the principal cause for migration during the 1970s and 1980s, and that these migrations still influence current migration behaviour (Gonin and Lassailly-Jacob 2002; Doevenspeck 2011; van der Land 2015; Romankiewicz and Doevenspeck 2015; Romankiewicz et al. 2016). Established networks facilitate migration and lead to social prestige and relative wealth of the migrants and their families. This in turn encourages other member to migrate and leads to a perpetuating effect, even if the initial causes of migration do not remain (Massey et al. 1993; de Haas 2010). Some studies even suggest that men and women use unfavourable environmental conditions as excuses for other more delicate or less accepted migration reasons, such as sorcery or to escape traditional norms in the village, to be economically independent and to postpone or avoid arranged marriages (Gonin and Lassailly-Jacob 2002; Doevenspeck 2011; van der Land 2015, 2018).

The impact of environmental factors on spatial and temporal migration patterns

Only a few studies consider the impact of environmental stress on migration patterns. The use of different definitions with respect to duration and destination of migrations makes it difficult to compare the findings. The impact of environmental factors on migration patterns is controversial. Several studies suggest that factors such as economic opportunities, social networks or the person's life phase, education and professional prospects, and the type of residence permits and/or labour contract influence the duration and destination of migrations (Henry et al. 2004a; Doevenspeck 2011; van der Geest 2011; van der Land 2015; Romankiewicz et al. 2016). In general, migration in the region is mainly temporary, often seasonal, and takes mainly place within the country or to neighbouring countries (Adepoju 2005, 2008; Bakewell and de Haas 2007; Afifi 2011; van der Geest 2011; Rademacher-Schulz and Salifu Mahama 2012; Mueller and Romankiewicz 2013; van der Land 2015).

Studies which investigated the changes in migration flows during the severe droughts in the beginning of the 1970s and 1980s found that droughts tended to limit migration flows. Studies on northern Ghana and Mali found, for instance, that migration flows had been lower during the severe droughts during in the 1970s and 1980s compared to the years before 1970 and after 1984 (Gonin and Lassailly-Jacob 2002; van der Geest 2011). Two further studies on Mali show that migration at least did not increase during the drought period in the 1980s (Findley 1994; Pedersen 1995). Particularly, these earlier studies tended to find that environmental stress favours short-term and short-distance migration. Findley finds for the region of Kayes in Mali that short-cycle migrations more than doubled during the droughts in the 1980s. Migration during that time shifted from permanent (more than 6 months absent) to short-term migration (less than 6 months absent) and destinations shifted from intercontinental destinations to destinations in Mali and other African countries (Findley 1994: 544). In contrast, Henry et al. (2004b) find for migration during the 1970–1998 period that short-term migration did not rise following a severe rainfall deficit. They, however, define short-term migration as up to two years. Recent studies find that acute or anticipated stress changes the usual temporal migration patterns. Studies in Ghana (Rademacher-Schulz and Salifu Mahama 2012; Rademacher-Schulz et al. 2014) observe an accelerated migrant departure rate during the rainy season in 2011, and not during the dry season as is usually the case for short-term seasonal migration. The assumption is that people leave earlier due to acute food shortages and/or in anticipation of a poor harvest. Similarly, interviewees in van der Land's study on Mali and Senegal indicate they leave earlier and stay longer in migration in years with (expected) poor yields (van der Land 2015). With respect to gender, Dillon and colleagues find in their model for northern Nigeria that households are more inclined to send men out of the village to reduce the risk and retain women in the household in response to ex post covariate shocks, thus as risk management (Dillon et al. 2011). Similarly, Henry and colleagues find that women are less likely to move after bad rainfall conditions (Henry et al. 2004b). The short-term increase of numbers of migrating male household members seems to be a common strategy to respond to environmental stressors.

Today, studies on the region agree that rural households generally consists of two groups: members who stay and members who migrate (de Haan et al. 2002; Mounkaïla 2002; van der Land 2015). They often take turns of migrating and staying with other family members. The long-term migration of some members to urban areas and neighbouring countries seems to become increasingly common (e.g. Rademacher-Schulz et al. 2014; van der Land 2015). Several studies suggest that temporary long-term migration may become the main livelihood

activity and end up marginalising agricultural activity (Hampshire 2002; Mounkaïla 2002; Afifi 2011; van der Land 2015; Romankiewicz et al. 2016). Studies, however, disagree on whether a change from seasonal to long-term migration is a consequence of more and more deteriorating environmental conditions (Mounkaïla 2002; Afifi 2011; Rademacher-Schulz et al. 2014) or a consequence of economic development, social transformation processes and changes in lifestyle (van der Land 2015, 2018; Romankiewicz et al. 2016). Permanent out-migration of entire households seems to be rare in the region (Mortimore 1989; Hampshire 2002; van der Land 2015).

Migration usually moves from the north to the south or to coastal and urban areas, and thus to areas with higher soil fertility and rainfall as well as better economic prospects. Many studies find that the economically attractive Cote d'Ivoire is often a main destination for people from Mali, Burkina Faso and Ghana (Hampshire 2002; Henry et al. 2004a; Afifi 2011; Rademacher-Schulz and Salifu Mahama 2012; van der Land 2015). International migration to destinations beyond the African continent is less common and considered as prestige migration rather than a consequence of deteriorating environmental conditions (Afifi 2011; Tacoli 2011; van der Land 2015). The entry costs for international migration to Europe or North America are high, and therefore it seems unlikely that people would migrate to non-African destinations because of worsening climate conditions (Henry et al. 2003; Afifi 2011; van der Geest 2011; van der Land 2015; Romankiewicz et al. 2016). With respect to migration within the country and to neighbouring countries, the impact of environmental factors is less clear. Afifi suggests that migration within the country and to neighbouring countries is "a matter of survival" and determined by the search for better livelihoods, (Afifi 2011: e111). With respect to the migration destination, Henry et al. (2004b) show for Burkina Faso, in line with Findley's findings on drought in Mali (Findley 1994), that temporary migration to other countries was less common among males after periods with low rainfall levels. In contrast, other studies (including those that use model simulations) suggest that migration during times of stress is directed to neighbouring countries, particularly when considering migration from urban centres and the South of the Sahel (Pedersen 1995; Kniveton et al. 2011). Overall, most studies suggest that people choose their destination for factors other than environmental ones, such as social networks, employment options, better educational or economic prospects, etc. (e.g. Henry et al. 2004b; Doevenspeck 2011; van der Geest 2011; van der Land 2015; Romankiewicz et al. 2016).

Conclusion

Our review of case studies on the linkages of the environment and migration in West African drylands shows that these studies use different concepts of mobility and environmental factors, and apply a broad variety of different methods. This influences the results and makes it difficult to compare the findings, even when focussing on a region with relatively similar climatic and environmental conditions. Population mobility has a long tradition in the region, and the seasonality of rainfall has been shaping the mobility patterns for generations. Temporary migration is a well-established activity to diversify income and to cope with the harsh environmental conditions in the region. Permanent out-migration of entire households, however, seems to be rare. Although the financial support of the migrants is crucial for most households in rural areas, people have many different reasons to migrate. These reasons often go beyond risk prevention and adaptation to environmental stress. Several studies suggest that environmental factors are often not the main driver of migration in the region. Instead, individual characteristics (e.g. level of education, religion, ethnicity and the economic activity), structural conditions (e.g. infrastructure and lacking [non-farm] income opportunities on site, and better income opportunities elsewhere), social determinants (e.g. conflict, envy, migration tradition and relative deprivation)

or individual aspirations (e.g. for progress, prosperity and a different lifestyle) strongly influence the migration decision.

Despite these findings, many studies on the environment-migration nexus still use simplistic push/pull frameworks assuming that environmental stressors are the main determinants of migration. Future research on the environment-migration nexus will have to pursue a broader approach, which considers the variety of people's migration motives and drivers of migration in environmental fragile environments. This is important in order to assess the role of environmental factors in the migration decision as well as the level of urgency, necessity, usefulness and/or normality of human mobility in West African contexts.

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3.8 Translocal implications of circular mobility among the Dogon of Mali

Clemens Romankiewicz. 2019

Translocal implications of circular mobility among the Dogon of Mali

Translocal implications of circular mobility among the Dogon of Mali

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Despite widespread agreement on the multicausality and complexity of migration, a geodeterministic and sedentarist perspective still dominates influential scholarly work in the environment and migration debate. Displacement resulting from extreme weather events and migration as an adaptive strategy to climate change guide research on the Global South. This study on Dogon communities from the West African Sahel of Mali takes a translocal perspective and accepts existing circular mobility as a habitual element of people's livelihoods. Based on complementary research approaches of translocality, migration theory, and political ecology, the findings demonstrate the relevance of interdependent translocal contexts and interconnected social and economic feedback-effects for contemporary migration, which reinforce and reshape migration patterns. The multi-dimensional implications of mobility challenge previous simplified representations of population movements in the context of climate change.

Keywords: West Africa, Mali, mobility, circular migration, translocality, climate change, environment

Introduction

Concerns about population movements and displacement as potential consequences of climate change and environmental stress continue to receive political and scientific attention. Similarly, the extensive debate about the environment-migration nexus and critiques of concepts such as 'environmental refugees' and related theoretical, methodological shortcomings (Morrissey 2012; Doevenspeck 2011; Black 2001; Castles 2002; Jónsson 2010) led to consensus that population movements are shaped by an entanglement of political, economic, social, and environmental dimensions (IOM 2018; IPCC 2014).

However, despite widespread agreement on the complexity, multicausality, and multidirectionality of migration, a geodeterministic, sedentarist view of population movements shapes assessments of migration processes, especially concerning the Global South (Piguet, Kaenzig, and Guélat 2018). Analyses thereby focus on displacement as resulting from extreme weather events and highlights migration as an adaptation strategy to climate change (IOM 2018; Niang et al. 2014; Afifi et al. 2015; McLeman and Gemenne 2018). A recent case study review about migration and environmental change in West African drylands (Van der Land, Romankiewicz, and van der Geest 2018) submits that interest in environmentally-induced population movements largely relates to sedentarist notions of self-subsistent agrarian populations. It demonstrates that the power, reproduction, and control over the dominant narrative of 'environmental migration' still prevails against differentiated interpretations of contemporary population movements.

To generate better understandings of current migration dynamics, it is essential to acknowledge that mobility in African contexts, particularly in West Africa, is already high and historically well-established (Bakewell and de Haas 2007; Adepoju 2005; Tacoli 2009). Furthermore, research should recognize that climate variability and (changing) agro-ecological conditions in the Sahel region contribute to shaping current migration patterns and have done so for many generations (Morrissey 2014; Findley 1994; Pedersen 1995; Carr 2005; Doevenspeck 2011).

Therefore, this study examines two translocal communities from the so-called Dogon country in Mali that exemplify mobile populations characteristic of the West African Sahel. There is early evidence of translocalization processes and repetitive migration along kinship networks within the Dogon country and beyond since the first half of the 20th century. People migrated seasonally over short distances to cultivation sites (Bouju 1984) and resettled within the sparsely populated region, usually establishing new settlements at already familiar sites (Marti 1957; Gallais 1975). This period was also marked by the beginning of annual circular movements between cities, where money to pay taxes was generated during dry season, and the villages of the Dogon country, where fields were cultivated during rainy season. Moreover, the Dogon found work on rice plantations within the Niger River delta. Migration to the Gold Coast between 1910 and 1940 and other West African harbor towns became increasingly crucial (Bouju 1984). Discovering another world while presenting new knowledge, working skills, as well as prestigious Western clothes and accessories eventually became an initiation ritual in villages, a so-called 'migration ritualisée' that gave returning young migrants a superior social status for a certain period of time (Dougnon 2003). In the early 1960s Côte d'Ivoire evolved into the most popular international destination for the Dogon (Petit 1998). During the 1970s and 1980s migration to agriculturally more attractive regions in southern Mali and urban centers, such as the capital Bamako, reached sizable numbers boosted by the great Sahel droughts of that period and shaped by family networks and chain migration (Nijenhuis 2005; Dougnon 2007).

Brand et al.'s (2014) investigation of environmental change in the Dogon country revealed that despite considerable intra- and interannual variability, a positive overall trend of annual rainfall and greening can be observed since the 1980s. Moreover, local changes of soil conditions and vegetation cover are very heterogenous and increasingly shaped by anthropogenic factors. In this vein, recent migration studies from this region (Barros 2010; Sauvain-Dugerdil 2013; van der Land 2018) suggest the majority of movements are primarily circular and temporary, thereby constituting a habitual part of people's attempt to diversify and generate additional income.

Through the circular movements of people, the flow of goods, information, and knowledge within social networks spanning different places, the translocality of people's lives and livelihoods receive particular importance (Lohnert and Steinbrink 2005; Verne 2012; Peth, Sterly, and Sakdapolrak 2018) and started to gain more attention within the environment-migration debate (Greiner, Peth, and Sakdapolrak 2015; Sakdapolrak et al. 2016).

Thus, rather than testing for primary (climatic and environmental) triggers of migration, the objective of this contribution is to answer how multiple dimensions shape contemporary circular population movements in a translocal setting. The paper answers the following questions: (1) What are the spatial and temporal characteristics of contemporary mobility from the Malian research area? (2) What are the multi-local effects of circular mobility in terms of economic and social change and how do they reinforce translocality while perpetuating and reshaping migration?

The paper is structured as follows. After presenting conceptual-theoretical approaches in chapter two, an overview of methodological design and research stays is provided. Chapter four outlines the characteristics and trends of contemporary migration. Next, the effects of circular mobility with regard to the growing role of monetary income are discussed in chapter five. Chapter six describes the relevance and interdependence of multiple local contexts for circular mobility. Selected aspects of social change in relation to reinforced migration lie at the core of chapter seven. Chapter eight discusses the findings. The paper concludes by critically reflecting the applied conceptual approaches with regard to the research results and providing respective implications for future research.

Conceptual framework of migration and translocality

To understand circular movements along translocal social structures and their effects, the approach combines migration theory, translocality, and political ecology. Their relation to one another will be sketched in the following.

Greiner (2011, 610) defines translocality as "the emergence of multidirectional and overlapping networks created by migration that facilitate the circulation of resources, practices and ideas and thereby transform the particular localities they connect. Translocality thus refers to the dynamics, linkages and interdependencies of the multidimensional social space connecting migrants' areas of origin and destination". Thus, translocal social structures represent both a result of migration and the context and preconditions of further migration; i.e. the duality of translocal agency and social structures cannot be examined separately from each other (Steinbrink 2009).

Mabogunje's (1970) migration systems theory highlights that a set of places is linked by social ties between individuals and communities through the circular flow of people, information, commodities, and their feedback processes (De Haas 2008). "Theorizing the dynamics of migration has thus moved from a consideration of movement as a linear, unidirectional, push-and-pull, cause-effect movement to notions that emphasize migration as circular, interdependent, progressively complex and self-modifying systems in which the effect of changes in one part can be traced through the entire system" (Faist 1997, 193).

The approaches of transnational social space (Pries 2001), networks (Faist 1997, 2000) and social capital in migrant networks (Portes and Sensenbrenner 1993; D. S. Massey and Espinosa 1997) focus the connective meso-level – namely the role of social relations, their structures, contents, and characteristics in shaping migration decisions and pattern. The theories attributed to transnationalism in migration research (De Haas 2008; Pries 2001) emphasize that migrant's identities and livelihoods become increasingly disembedded from territorial containers, hence stressing the notion of social and relational space transcending national borders (Murdoch 2006; D. Massey 2004). The theory of cumulative causation of migration subsumes the growth of networks and the development of migrant-supporting institutions that may perpetuate, strengthen, or impede further migration (Myrdal 1957). Here, similar to translocality, it is argued that each migration act alters the social, economic, or cultural (translocal) contexts of migration decision-making, typically making subsequent movements more or less likely over time (D. S. Massey et al. 1993, 451). Moreover, conceptualizing migration as a self-sustaining, institutionalized process implies that migration decisions become increasingly independent from individual or structural factors, which might have originally caused people to migrate (D. S. Massey et al. 1993, 450f.). In line with cumulative causation is the micro-level approach of relative deprivation (Stark 1984; Stark and Taylor 1991). Stark (1984) shows that improving a household or individual's position vis-à-vis others constitutes a fundamental incentive for migration. The approach premises that income comparisons are internalized, and lead to psychological states of either satisfaction or relative deprivation. Further complementary conceptual frameworks are the life course approach (Kulu and Milewski 2007) and the biographical approach (Apitzsch and Siouti 2007). They explicitly consider the temporal dimension of people's migration experience such as sex and age-related regularities in migration characteristics such as specific stages in people's life cycle, thus emphasizing the processual, dynamic character of migration (Cuba and Hummon 1993).

Calling for 'grounded transnationalism', Brickell and Datta (2011) develop their concept of translocality from an understanding of (non)migrants' simultaneous affiliation to and

embeddedness in multiple interconnected localities – a 'groundedness during movement' within or across national borders. Here, in contrast to transnationalism, social and relational space is not regarded as deterritorialized, because the complex connections spanning spaces, places, and scales (only) become evident when they materialize at specific localities: "To theoretically account for these [places and spaces] as constitutive of translocality means that we need to pay attention to their multiple and hybrid histories, their politics and social constructions, their material geographies, and their connections to other scales and places" (Brickell and Datta 2011, 4). On the one hand, the specificity of places, the multiple local contexts, and migrants' habitual localized experiences and constructions actively shape the dynamics of people's mobility and vice versa. Similarly, migrants' agency, the circulation of resources, practices, and ideas transform the multiple dimensions of the connected localities (Greiner 2011; Brickell and Datta 2011). Against this background, the consideration of a politicized manifestation of connected places and a translocal political ecology (Greiner and Sakdapolrak 2016) become self-evident. Unlike notions of the environment as an independent external parameter and driver of migration, a political ecology approach considers environmental processes as mainly resulting from the dynamics of a broader political economy, unequal power relations, varying interests among involved actors, and the social interactions across multiple scales (Blaikie and Brookfield 1987). Therefore, the material and non-material feedback effects of migration contribute to shaping human-environment relations, and hence environmental contexts, in connected localities (Greiner and Sakdapolrak 2013; Bebbington and Batterbury 2001).

Research design and the field

In line with the translocal perspective, the methodological research design follows the precepts of multi-sited ethnography (Marcus 1995; Greiner 2008). Empirical research is thus not restricted to the geographical area of migrants' origin. Instead, to trace people's mobility networks and identify interconnected localities, 'following the people' (Marcus 1995) is central to the investigation (Steinbrink and Peth 2014). By referring to the International Organisation for Migration's definition of migration (IOM 2004, 41) this paper takes into account population movement irrespective of its length, distance, causes, or borders crossed and interchangeably uses the terms migration and human mobility. Furthermore, mobility is conceptualized as a routine practice in people's lives and not a representation of a problem or vulnerability *per se*, regardless of where lives are lived (Urry 2007; Sheller and Urry 2006; Büscher and Urry 2009).

The starting point was identifying a rural area in the semi-arid Sahel of Mali based on the idea of ecological inference, i.e. elevated rates of emigration together with signs of environmental change (see Piguet 2010). This rural research context is located in the Mopti region, in the cercles[1] of Bandiagara, Bankass, and Koro in central Mali, east of the Niger River and the harbor town of Mopti. Mopti's suburb Sévaré represents an important traffic hub between northern and southern Mali and Burkina Faso in the southeast. This area is particularly characterized by the history, culture, and agricultural activities of a distinct ethno-linguistic group, the Dogon, and thus known as the Dogon country (Fig.1).

Figure 1. The Dogon country and research sites; (Cartography: M. Wegener)

Rainfed agriculture (millet, sorghum, groundnut) and irrigated vegetable gardening are the most important economic activities. Animal husbandry and selling charcoal and firewood are important additional revenues. With a rainy season between June and October and mean annual precipitation of 500 mm with significant intra- and interannual variability (Brandt et al. 2014) the amount and timing of rainfall as well as the availability of wells and water holes fundamentally determine agricultural activities.

The Dogon villages of Kowa and Diamnati, which belong to the same commune of Pignari Bana, were selected for investigation because they were not affected by touristic or NGO activities and exhibit differences in terms of socio-historical background and female migration. Kowa is located 12 km from Sévaré and has about 900 inhabitants. The village was founded hundreds of years ago and belongs to the oldest settlements in the area. According to customary tenure and traditional practice of the first comer, Kowa claims access to considerable land in

[1] The hierarchical order of administrative units in Mali is region, cercle, commune, and village.

the nearby surrounding. The primary school in the village was erected in 2001. However, there is no modern infrastructure such as tarred roads or electricity. Labor migration started to become a usual practice before Mali's independence in 1961. The migration of unmarried women (separately from their family) is forbidden and punishable since the 1970s. Since 2010, the migration of children enrolled in school is also prohibited. At a distance of 30 km from Sévaré, Diamnati is located close to the national road between Sévaré and Bandiagara at the banks of the Yamé River and has about 400 inhabitants. The village was founded in 1953 on the territory of a neighboring village and has use rights to limited agriculturally productive land mainly used for growing millet. During rainy season, Diamnati is difficult to access due to a lack of safe crossings across the Yamé River. Apart from one deep well, there is no modern infrastructure. Since the 1960s, migration became a regular occurrence. In contrast to Kowa, female migration is frequent and has existed since the 1990s.

During four research stays between 2011 and 2013, semi-structured and narrative individual and group interviews (Collinson 2009; Iosifides 2011), in addition to participatory observation, were conducted to extract information about village histories, mobility patterns, migrant networks and biographies. Through telephone contacts and a snowballing approach (Noy 2008) migrants at multiple localities were contacted. They were interviewed in Bamako at multiple work places and accommodation throughout the metropolitan area. This paper relies on 93 interviews, of which 40 were in the Diamnati and 53 in the Kowa community.

Moreover, in 2012 a standardized sample survey (n=445) was carried out both among individuals in eighteen villages (n=324) of the Dogon country (see Fig.1) and migrants in Bamako (n=121) born in the Dogon country. Surveyed villages were chosen to represent different physiographical settings of the study area. The choice of respondents was arbitrary (non-random) and quota-oriented. The survey aimed at complementing qualitative findings with descriptive statistics about migration patterns and motives.

Characteristics and trends of contemporary translocal mobility

This chapter presents spatial and temporal characteristics of migration based on the analysis of quantitative survey data, qualitative interviews, and migration biographies.

Consolidation of destinations and translocal networks

There are indications of a concentration and consolidation of a specific spatial network of destinations. The majority (96%) of contemporary migration[2] is directed to places within Mali

[2] In the survey, migration was defined as absence from the village of at least three months.

and Côte d'Ivoire (Fig.2). Here, the Malian capital Bamako (47,4%) and the Ivorian economic center Abidjan (20,7%) represent the most important destinations and point to a considerable perpetuation of the historically established circular migration patterns and networks (Fig.3). Migration to Europe is the exception and only few migrants in Spain and Italy were mentioned. Informants cite a lack of financial means as a primary reason. Qualitative findings from the communities of Kowa and Diamnati confirm that Bamako is the most preferred destination surpassing Abidjan, thereby demonstrating the path dependency and perpetuation of migration resulting from relational and professional contacts that have existed for generations. However, fewer people sought to migrate to Abidjan during the post-election crisis of 2010/11 as a result of xenophobic violence, political and economic insecurity, and increasing costs of the bus fares.

Furthermore, circular mobility to short-distance destinations within the Mopti region, such as weekly markets, are essential in people's everyday life. Due to their proximity, the cities of Mopti and Sévaré are major points of attraction for commerce, (high) school education, medical treatment, and family visits. People also use long-distance buses to major national and regional destinations from Sévaré's bus station. Moreover, like their ancestors, both communities are involved in the rice harvest on plantations close to Mopti, which is rewarded with a tenth of the harvested yield and contributes to secure and diversify food consumption in the village.

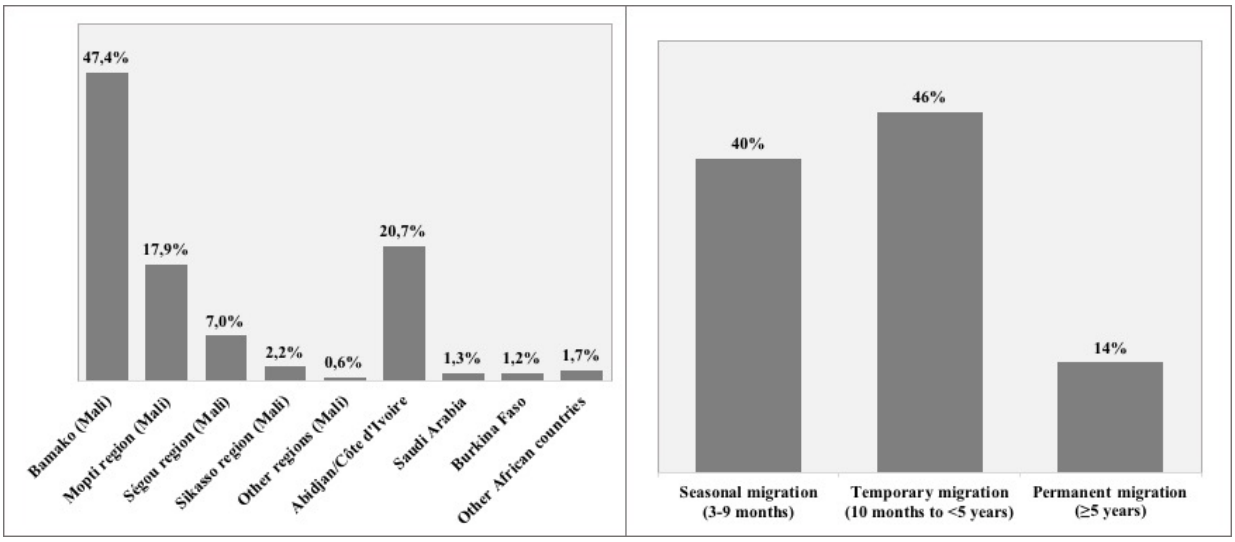

Figure 2. Destinations and temporal patterns of migration from the Dogon country

Changing temporal dimensions of migration

Survey results demonstrate the dominance of temporary migration patterns (Fig.2). About 86% of respondents reported absences from the village ranging between three months and five years,

reflecting a significant proportion of circular movements. In fact, some migrants return after many years abroad, and even a very long absence may not necessarily be interpreted by the family as definitive emigration (Barros 2010). Migrants from Kowa and Diamnati stated that the choice of destination in terms of distance and expenses influences the duration of the stay. Generally, migrants in Abidjan stay longer before returning to the village. Moreover, it is common to work in Bamako to earn money for transport before moving on to Abidjan. There were some reports about permanent emigration. Only those who can rely on steady employment with sufficient revenue settle permanently in Abidjan or Bamako and choose to bring their family. Today, several individuals and families from Kowa reside in Saudi Arabia. Mostly, they remain in the country after completing the hadj. Working as grocery store owners and contractors in the building sector, some migrants from Kowa and Diamnati permanently live in Bamako with their families.

Results show three striking tendencies of temporal migration patterns: (1) The frequency of circular migration has increased; (2) the duration of stay in the village between the migrations has shortened, i.e. the length of stay in the cities has extended; and (3) the timing of circular movements has become more diverse and irregular. In contrast to the older generation's rarer and irregular migrations in the past, today unmarried men (and women from Diamnati) continuously travel each year between the village and Bamako, only provided that a sufficient workforce stays with the elders in the village[3]. This coincides with informants' perception of a noticeable increase in migration (rural exodus) in all villages of the quantitative survey. Thanks to established employer contacts and the solid relational networks at multiple places, the majority of young migrants spends the largest part of the year outside of the village. Returns to the village during rainy season and period of rainfed farm work are still widespread. However, migrants increasingly stay less than three months and return to the capital even before the beginning of the harvest (cf. Barros 2010). This indicates that young people tend to fully exploit their opportunities of mobility to pursue paid work in Bamako or Abidjan. It is no longer valid that the calendar of rainfed cultivation of millet in the village, from sowing in May/June to harvesting in September/October, strictly defines the timing of seasonal circular migration as before.

> Nowadays, people come back home and return when they desire. During rainy season, some leave the village to Bamako whereas others simultaneously leave Bamako for the

[3] It is common practice here to maintain a rotation principle among brothers; i.e. they take turns migrating and staying in the village.

village […] Even right now while we are talking. (Amadou, Migrant from Diamnati, March 2012, Bamako)

Migrants may extend their stay in Bamako (even for more than one year) when they could not earn sufficient money or in order to strategically keep at least one family member in the city. Fewer competition for jobs is one additional motivation to sojourn in Bamako during rainy season. Furthermore, improved infrastructure and fast, reliable, and affordable bus connections between Bamako and the Dogon country substantially facilitate short and irregular sojourns in the village. Here, additional circumstances both in the village and Bamako influence the timing of movements. In addition to illness or struggling to find regular income, Muslim holidays, ceremonies (marriage, baptism, funeral), and settling family affairs are among reasons to visit the village. Instead of remaining inactive and forced to spend the hard-earned money in Bamako, migrants prefer returning to the village.

Multidirectional and translocal life trajectories

Besides temporal migration patterns, the biographical and life course approach (Kulu and Milewski 2007; Apitzsch and Siouti 2007) also revealed the manifestation of translocal networks and life trajectories (Fig.3). Findings underline the strong interrelation between people's specific life course, mobility, spatial patterns, and timing of migration.

The predominant translocal life course and mobility regime of those born in the village and staying closely attached to it can be sketched as follows. During childhood, mobility depends on the proximity of the rural home and the nearby city of Mopti. As soon as youngsters are old enough to work and are still unmarried, they migrate frequently to Bamako or Abdidjan and can also stay away from the village for longer periods. During this stage of life, the desire and search for income-generating opportunities in new destinations is common. Apart from a few villages where female migration is forbidden, young women's circular migration, beginning at the age of 13 to 14, to Bamako during five to six consecutive years is widespread (cf. Barros 2010) and serves to gain the bride price before getting married and moving to the husband's residence. Once married and having established a family in the village, men's periodic presence in the village is required. Alternatively, the wife and children join the father during a longer absence. Regular circular migration for men is just as prevalent as focusing on and investing in economic activities in the village. As soon as children (normally sons) are old enough and start migrating themselves, migration frequency and duration of the male household head decreases. Elderly people prefer to spend their old age in the village without moving long distances.

Migrating and earning money in the cities has thus become a standardized and inclusive part of life.

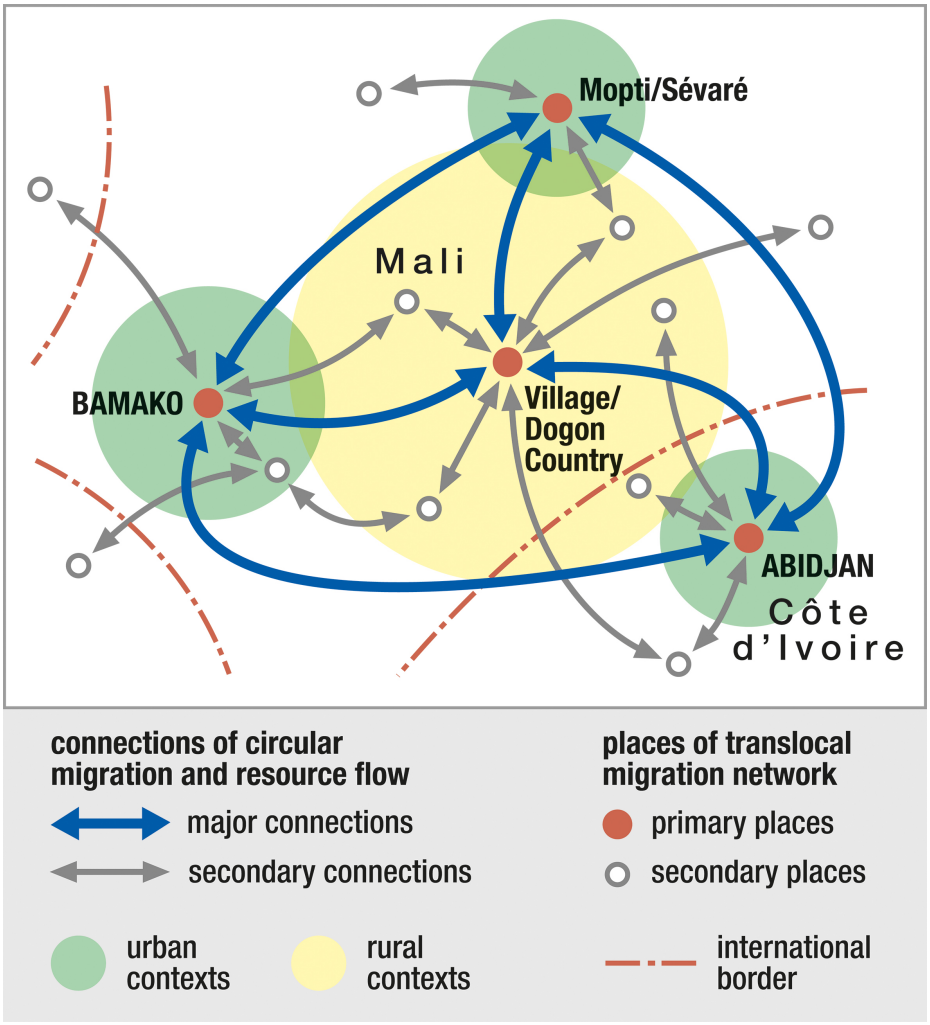

Figure 3. Dogon network of translocal circular mobility and resource flow; (Cartography: M. Wegener)

However, the following two cases exemplify that life trajectories and repetitive mobility within the community's translocal migration network are multi-directional and can take on diverse forms.

(1) Aly, whose parents migrated from Kowa to Côte d'Ivoire, was born in Abidjan. When he was seven years old his father decided to take his family back to the village and migrated to Saudi Arabia. From the age of ten Aly attended different Koran schools in the region before returning to Kowa. In 1995, at the age of twenty, he started to regularly migrate and work in Bamako, chopping wood, loading sand, and later engaged in trading. At one point, he decided to stay in Bamako and then also reunited with his wife and children. Since that time, he and his family visit Kowa occasionally for Muslim festivities and to see the

relatives. In the future, he would prefer to stay in Bamako and keep visiting his village due to traditions.

(2) Sidi came to Bamako for temporary work for the first time in 1986. Between 1993 and 1995 he worked in Abidjan where his uncle and sister also lived. After spending the next two consecutive years in Kowa, he continually migrated annually to Bamako. During that time, Sidi invested a part of his earnings to purchase a plot of land in Sévaré. In 2006, he settled in Bamako indefinitely. Due to financial limits, each of his two wives and accompanying children alternately spends one year with him in Bamako since 2007 while the other one stays in Kowa. Since then, he returns once or twice every year to the village for a maximum of three weeks. If his earnings are sufficient, Sidi would like to permanently live in Kowa in the future and help develop his village.

People's translocal life courses thus maintain and strengthen the cohesion of the community over spatial distances and seem to have become a necessary part of their identity and future aspirations. Under the premise that they will manage to earn sufficient money, other informants expressed a desire to settle in Mopti to be closer to the village, or construct houses in both Bamako and the village to commute between the two. As a result, life courses and translocal mobility are socially differentiated, manifest in diverse ways and can follow different directions along the established communities' migration network.

The cumulative effects of migration between necessity, prestige, and prosperity

Explanations for the perpetuation and reinforcement of circular mobility are multifaceted and socially differentiated.

Money rules

The quantitative illustration of individual migration motives shows a variety of interrelated answers (Fig.4). Earning money is the most prominent response (71%) and reflects the continuous reliance on a regular monetary income, which people said cannot be achieved with traditional farming alone.

> In the village we are farmers and there is no work to have enough money. That's why we are leaving, to have money and to send money to the family. (Daouda, Migrant from Diamnati, Bamako, March 2012)

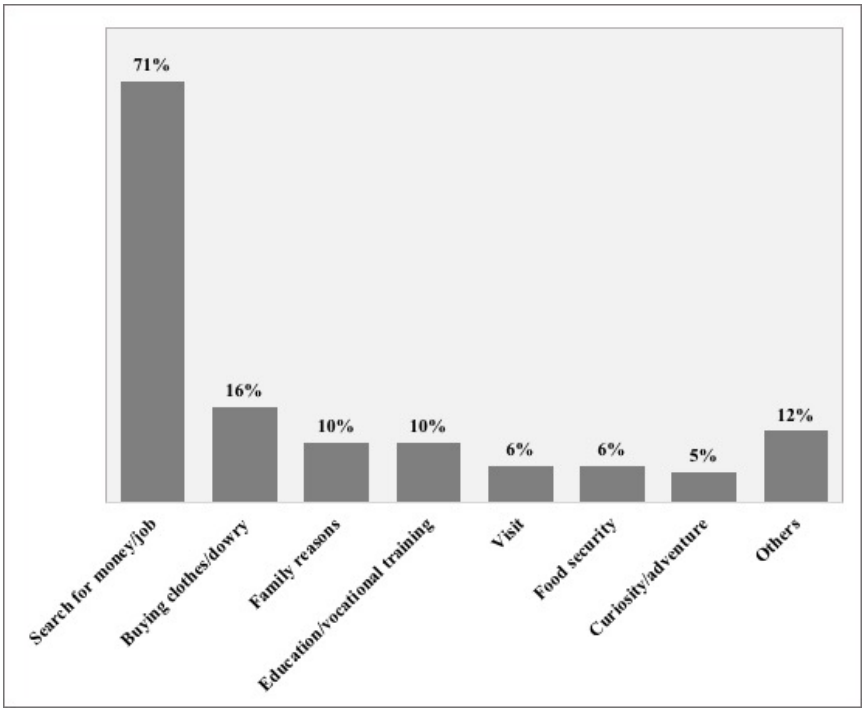

Figure 4. Migration motives (multiple answers possible)

Temporary migration with the initial intention of earning money to pay taxes, compensate for harvest losses, or embark on the ritualized 'aller en aventure' with the acquisition of Western souvenirs has contributed to an increasing integration of the Dogon country into the general monetary economy (Sauvain-Dugerdil 2013). The cumulative effects of continuous circular migration thus unavoidably lead to a growing demand for prosperity and diversification of monetary needs, which again reinforces the need for the stable, permanent availability of cash. The following statement illustrates the manifestation of such effects and self-reinforcing character of migration as described by the theory of cumulative causation of migration (Myrdal 1957).

> Now, there are too many expenses. In the past we would spend the year with a few articles of clothing. Nowadays you must own many of them. Besides, there is much more money involved than before. One cannot simply stay in the bush. There is pressure to attain money. In the past you went on foot to a wedding […], today you must arrive with big motorbikes. (Ousmane, migrant from Diamnati, March 2012, Bamako)

The indicated increasing demand for money is reflected by the diversity of investments in the villages and multidirectional resource flows aiming to secure and improve the family's living standards as well as maintain the communities' required translocal social and economic structures. The most common goods migrants purchase in Bamako and Abidjan and bring or send to Kowa and Diamnati are clothes, radios, bicycles, motorbikes, cell phones, kitchen

utensils as well as fertilizers, vegetable gardening equipment, pesticides, and herbicides. Money is invested in cereals for food shortages. Cattle and ploughs are also purchased to facilitate cultivating the fields, as well as sheep and goats that can be resold if money runs out.
Indeed, it is noticeable that livelihood costs have diversified and risen enormously according to the living standard and requirements increasing with the availability of translocal income opportunities. Additional expenditures in Kowa and Diamnati arise for mobile communication, fuel for motorbikes, transportation, traveling, school education, healthcare, and medication in the city. Few family joint investments such as a television, solar panel, or acquiring a threshing machine for the millet harvest were observed in Kowa. Furthermore, Kowa's migrant association annually collects money, which financed the building of the school and the reconstruction of the village mosque. Material resource flows, however, also go in the opposite direction. Informants mentioned that villagers also send items to the migrants in Bamako such as traditional medicinal products, groundnuts, and different kinds of wild fruits.

However, it is important to note that there are differences between and within the investigated communities. Families do not benefit from migration and remittances in the same way. In Kowa it was reported that, depending on the year, some migrants need to invest the largest part of their earnings to buy millet because the family harvested insufficiently, whereas at the same time other migrants can use their income for supplementary acquisitions. Research findings also show that, in contrast to Kowa, additional collective financial efforts of migrants from Diamnati cannot considerably improve infrastructure in the village. In fact, such circumstances contribute to the diverging cumulative consequences of circular migration in the village and thus can exacerbate economic disparities (Steinbrink and Niedenführ 2017; Sauvain-Dugerdil 2013). This is all the more relevant because the institutionalized circular migration never serves the sole purpose of food security. One migrant summarizes it succinctly.

> Well, the harvests serve something, but they are not sufficient. Moreover, human beings are never satisfied. That's why no matter how rich man may be, he will always want to have more. Therefore, even if our granary is bursting at the seams, we never cease to look for more […] Even if this house is full of money, you wish for more. That's why man, from the young age until the grave, is on eternal quest for richness in any métier. (Aly, migrant from Diamnati, March 2012, Bamako)

Prestige and psychological pressure

A cumulative effect becomes even more apparent when interpreting adolescents' mobility experiences, which are largely independent from agricultural production (Sauvain-Dugerdil

2013). Prestige aspirations and psychological peer pressure among youths and their associated cumulative manifestations are explained below.
When describing his return from Abidjan to Kowa a migrant explained:

> We bought motorbikes to impress the girls [...] When you return from the city with money and a motorbike, they will admire you […] I was famous in the area. The young people were disappointed if I did not attend a celebration. (Boureima, migrant from Kowa, March 2012, Bamako)

His statement reflects a phenomenon that has existed since migrants first returned with modern products from the gold coast and hitherto continues to affect the aspirations of the youth. Acquiring prestige and satisfying social status in the village is fundamental in the interpretation of adolescents' migratory movements (Barros 2010; Dougnon 2003). A significant relevant aspect is described by the approach of relative deprivation (Stark 1984). People are motivated to achieve the same socioeconomic well-being as other community members. During their first migration experiences, men aim to return to the village with a bicycle, a radio, or a motorbike, while women seek household objects as dowry. This is because others do they very same (Castle and Diarra 2003).

> Comrades of my age went to Bamako before me to earn money and they brought these beautiful things […] That's pushed me to leave. I wanted to follow my friends. (Issa, migrant from Kowa, March 2012, Bamako)

Barros (2010) emphasizes that male adolescents' orientation in their first migration experiences is essentially shaped by the same age group traditionally undergoing collective initiation rituals such as circumcision. The same motivation applies to young women's first mobility aspirations (Sauvain-Dugerdil 2013).

> Because when a young woman leaves, she will return with something valuable. Meanwhile her friend in the village has nothing. Therefore, it is inevitable the friend will also move […] The parents don't have a choice. She will cry the whole night because her friend's gone, and she couldn't go. (Ibrahim, farmer, December 2011, Diamnati)

The psychological pressure on young people to not fall behind their peers becomes particularly relevant for those still attending school, especially considering that even younger teenagers are beginning to migrate. Dropping out of school, against one's parents' wishes, to follow the peers to Bamako or Abidjan is not an exception.

> I've seen the other youths abandon school to go to Bamako and bring back a radio. Therefore, […] I went to school for one week, and then also fled to Bamako. (Abdramane, migrant from Kowa, March 2012, Bamako)

Teenagers are increasingly incentivized to adopt established successful migration objectives of their own and the older age groups. A comparison of migrant biographies in the Diamnati community shows that first migrants are younger today than those in their parents' generation. While young men previously migrated to Bamako for the first time at the age of 18 to 21, today first-time migrants are merely between 15 and 17 years old. A few cases of even younger migrants were reported as being seriously challenged by physical labor in the city.

This investigation shows that the feedback effects of money flows and increasingly individualized consumption and investments are socially differentiated but at the same time self-reinforcing and necessarily lead to rising consumer demands and better quality of life. This again requires higher revenues. Consequently, the distinction between the necessity to assure the status quo of the family's livelihood and striving for greater prosperity and social well-being becomes hardly possible.

The simultaneous relevance of (trans)localities

The findings suggest that the prevailing circumstances of connected locations mutually depend on and interact with each other, thereby reinforcing the translocality of the communities. This chapter describes the specific local opportunities and constraints both in Bamako and the villages of Kowa and Diamnati. It highlights their interdependent relevance for shaping and perpetuating circular mobility.

Bamako's informal labor market matches migrants' capabilities; temporal flexibility and low technical requirements. Chopping wood, producing bricks, and loading sand extracted from the Niger River bed for the building sector are the most widespread occupations. Furthermore, this labor is strongly determined by relying on the communities' networks. Only few of the interviewed migrants received formal education. With few exceptions, widespread illiteracy prevents them from obtaining better qualified or well-paid jobs (van der Land and Hummel 2013) that would eventually improve their living standard in Bamako.

Informants from Kowa acknowledged that their village experiences slow development because they long hesitated to put their children into the 'school of the whites'. Today, the Kowa community is convinced that the primary school in the village is important and will realize positive developments. Accordingly, they strictly condemn the act of children dropping out of school and migrating. Catching runaways (both school children and unmarried girls) and bring

them back to the village is even supported financially by community associations that collect funds annually both in Bamako and in the village. In Diamnati, however, villagers are unable to make significant efforts to prevent and control teenagers school dropouts and migration. Therefore, without sufficient formal education and qualification, the majority of migrants end up trapped in low-skilled and poorly paid jobs.

Relatedly, migrants consistently reported increasing costs of living in Bamako, thereby preventing them from keeping living expenses as low as possible to save money. Lower costs in the village additionally explain why people temporarily migrate without bringing their family.

> If you have sufficient money, you can live comfortably in Bamako. But since we don't have enough, I prefer to live in the village. We have enough to cultivate and eat. Life in Bamako is too complicated without money. Everything is linked to money. (Daouda, Migrant from Diamnati, Bamako, March 2012)

Moreover, secure and affordable housing in the capital is an increasing challenge, which heavily depends on each community's social network. Some migrants spend the night in a small barber shop or restaurant in exchange for cleaning services. Other interviewed migrants share the expensive rent of a single room while others both work and sleep on a building site. A landlord's property, who has accommodated generations of migrants from Diamnati free of charge, risks being turned into a source of profit that becomes unaffordable for those depending on it.

Another fundamental change in Bamako concerns the increasing numbers of migrants competing on the low-skilled labor market.

> It has changed from before when we earned a lot […] The numbers of workers have increased […] Therefore, working opportunities have decreased, and we don't earn even half of what we used to. (Issa, migrant from Kowa, March 2012, Bamako)

This has led to extended stays in Bamako to earn the desired amount of income. Simultaneously, these changes contribute both to the increasing regularity of circular migration and the growing importance of social networks. Otherwise, migrants risk losing their clients and work places to newcomers. To guarantee the maintenance of business contacts, migrants defer their customers to trusted colleagues or family members when absent.

Agricultural productive capacities and opportunities in villages become relevant and simultaneously demonstrate the pertinence of a translocal political ecology approach (Greiner and Sakdapolrak 2016). In both villages, traditional means to enhance soil quality are lacking (land available for rotation of fallow fields) or insufficient (deficiency of animal dung).

Therefore, chemical fertilizers and technical equipment, mainly provided by migrants' revenues since the 1980s, have become increasingly necessary resources to assure cereal yields. Moreover, a complex interplay of further aspects contributes to the differentiation of the families' harvest outcome. Apart from varying yearly amounts and quality of rainfall (Brandt et al. 2014), the size and location of fields are determined by the rules of hereditary succession, the availability of labor (i.e. often the number and availability of able-bodied family members), and even the know-how and motivation for cultivation.

Moreover, there are natural resource differences between Kowa and Diamnati, which can be exploited as additional income sources. This traces back to variation in size, location, quality, and access rights to the land occupied by the two villages. Benefitting from the status of firstcomers, the population of Kowa, as opposed to the Diamnati community, draws on a greater variety of marketable natural products, such as tree fruits, animal fodder, as well as fire and construction wood. In Kowa, commercial vegetable gardening intensifies and some migrants fund fencing and motor pump irrigation. Due to the lack of means and significant soil erosion (Brandt et al. 2014), the Diamnati community has been unable to cultivate vegetables and is therefore more dependent on migrant income to satisfy basic needs than Kowa.

The presented results demonstrate how the interconnected localities' distinct historical, social, economic, and environmental contexts interdepend, mutually and constantly reshaping the translocal space and preconditions of people's circular mobility. The interdependence and cumulative effects of the specific translocal contexts become clear in the depiction of the different consequences between the two village communities.

Challenging traditions and power relations

The transformation of traditional Dogon society is key to understanding the effects and interdependencies of today's translocal organization of people's lives and circular migration (Barros 2010; Sauvain-Dugerdil 2013; Petit 1997). In what follows, I will focus on selected aspects associated with the aspiration of economic self-determination and increasing youth autonomy.

Individual income generation in Bamako strongly contrasts with traditional collective farm work in the village, which formerly made up an integral part of the construction of Dogon communities' common identity (Barros 2010). The joint cultivation of millet strictly regulated locally has given way to the increasingly individual and diversified translocal economic projects of mobile youth (e.g. by accepting that migrants do not assist with the harvest any longer). Similarly, migrants' increasingly individualized consumption of revenues together

with the diversity of expenses and investments question the traditional patriarchal decision-making power over the distribution and use of the family's revenues (previously only the yields). Previously, young migrants usually delivered their entire earnings to their fathers. Today, they choose to keep and control part of it. These two statements demonstrate intergenerational disagreements and lack of trust.

> The children there only work for their own clothes, that's all. They give nothing to their parents […] They buy a motorbike for 350 000 francs[4] even though the family doesn't even have many things to eat […] Today, the young don't listen to elders anymore. That's why there are disputes and people don't understand each other. (Moussa, elder in Kowa, November 2011)
>
> In the village, I hand over the money to my father. I don't give him everything and keep some of it for myself […] When there is a wedding, I refuel my motorbike and go there […] I don't show my parents the rest of the money […] We have understood that when you give them all the money, they will waste it all at once. Therefore, we decided to divide the money we earn in two parts. (Seydou, migrant from Diamnati, March 2012, Bamako)

Accordingly, village elders in Kowa blamed spreading egoism on the dwindling established solidarity within extended families and among village inhabitants. Moreover, the financial empowerment of the youth and individual families also contributes to claims to greater monetary autonomy and self-determination (Petit 1997).

Intergenerational and gender-related tensions particularly manifest around preventing unmarried young women from migrating. In Kowa, groups of young girls continue to escape the village to Bamako every year, despite financial sanctions for their families and search and retrieval missions. Here, male villagers' major concern is the growing phenomenon of women rejecting pre-arranged marriages with a village male.

> Their migration is rejected because girls are already promised to a man. When they arrive in Bamako and boys here give them a little bit of money, they are going to tear up the arrangement in the village. And this will destroy the ties of our kinship. (Issa, migrant from Kowa, March 2012, Bamako)

Sauvain-Dugerdil (2013) and Barros (2010) show that the mobility of young women (and similarly men) and the open selection of a spouse has a significant societal dimension. From the elders' point of view, matrimony with outsiders, let alone a different ethnic group, represents a fundamental challenge for power structures and family alliances. This thus affects

[4] 655.957 West African CFA francs = 1 €

social cohesion and collective identity, which constitute a pillar of the traditional Dogon society (Barros 2010). In contrast, findings show that collective youth migration aspirations, the mutual dependence and support of migrants in the capital, and joint investments of migrant associations simultaneously reinforce social cohesion over distances and contribute to economic security and rising desire for village development.

Challenged traditional family alliances, power relations, and control of youth migration, similar to resulting social tensions, must be considered as relevant feedback effects of increasing circular mobility modifying the respective translocal contexts of further migration. As the examples of Kowa and Diamnati show, this manifests in noticeable differences between the two communities. Economic and social change in the given translocal context thus must not be examined separately. Their effects are interconnected and reinforce each other, thereby constantly redefining and transforming the social and economic institutions of the translocal communities.

Self-reinforcing translocal mobilities

Besides the obvious stability of circular population movements to historically established destinations such as Bamako, Mopti, and Abidjan, resulting in translocal networks with the rural Dogon country, there is evidence of a significant increase and timing diversification of circularity to urban centers. Even though its relevance remains decisive for people's lives until today, the declining economic and social importance of the traditional millet cultivation in the villages of Kowa and Diamnati has led to a decreasing interrelation between growing season and migration. The variability of rainfall and related uncertainty of yields contribute to this tendency. Clearly, the historically determined and diverging local agroecological preconditions, as in Kowa and Diamnati, additionally influence crop yields. Similarly, the socially differentiated assets and migrant inputs within each community define agricultural opportunities and success.

However, the conditions for youth mobility and frequency of circular movements between the villages and Bamako are far more complex, multi-dimensional, and above all translocal. It is well known that differences in cash income opportunities and living costs between rural and urban places perpetuate the circularity and translocality of communities. Yet, there is strong evidence that both the economic and social feedbacks of migration in the villages are closely intertwined and similarly perpetuate or impede further migration. This is evident when considering key actors of change, namely young migrants that are initially driven by peer pressure to keep up with others' individual economic accomplishments and thus achieve

psychological and social well-being. Consequently, the limits between the necessity to supply money for the mere survival of the rural household and the desire for a more prosperous life while developing the village become blurred. For the village household, pooling translocal income (and food) sources must be considered a habitual routine. Furthermore, it is apparent how specific rural and urban contexts interdepend and shape people's mobility. The differentiated social, economic, educational, and (infra)structural opportunities and constraints in the villages strongly interact with those of migrants' mobility, as well as work and income in the cities.

Economic disparities between families in Kowa and Diamnati as well as increasing competition for jobs in Bamako are simultaneously cumulative effects and reinforcing factors of circular migration. Securing and maintaining job opportunities and accommodation in the increasingly expensive city requires an even stronger reliance on trusted social networks, thereby cementing mutual dependency and solidarity. The older generation, however, is torn between the benefits and control of youth migration. The flows of resources, ideas, and innovations, and young migrants' longer stays outside of the village, necessarily lead to an ongoing transformation of social values challenging traditional patriarchal power structures. Aspirations for economic independence to enhance personal and family livelihood security and prosperity as well as simultaneous integration into and dependence on traditional institutions creates a constant tension and need for negotiation. However, this does not result in a loss of solidarity and social cohesion, as feared by elders, but rather a reorganization and redefinition of social control and decision-making that is shaped by and adapted to the consolidating translocal and mobile reality of the communities.

Conclusion

These findings show that assumptions of migration as a mere adaptation strategy to climate change and investigations of root causes for population movements must be overcome. The study confirms that circular mobility and translocal social and economic structures of Dogon communities in Mali are long-established and habitual phenomena. Thus, discussions on migration and environment in the West African Sahel must discard sedentarist notions of autarchic and self-sufficient local agrarian communities.

The theoretical-conceptual synthesis for a multilocal and multi-level research approach sensitive to the historical, social, cultural, economic, political, and environmental aspects enriched the identification and interpretation of multiple cumulative, reinforcing, and interfering effects of circular mobility interacting between multiple places of translocal

networks. The biographical approach revealed the manifestation of multidirectional life trajectories along well-established places of Dogon migration networks. Moreover, the detection of ever-younger migrants, higher frequency, and temporally diversified circular migration patterns can hardly be associated with the agro-ecological conditions in the Dogon country alone. Rather, these phenomena relate to the self-reinforcing and multilocal cumulative consequences of already existing effects of circular migration such as the youths' increasing (desire for) individualization and material consumption. Here, the concepts of cumulative causation of migration and relative deprivation are valuable explanatory approaches. Moreover, the analytical aspects of the concepts of translocality and translocal political ecology illustrated the (experienced) multidimensional specificities and relevance of multiple interconnected rural and urban contexts. People's differentiated social and physical assets in the villages of the Dogon country strongly interdepend with migrants' social capital and economic opportunities in the cities. This essentially shapes both spatial and temporal mobility patterns and simultaneously reinforces their translocal livelihoods. Furthermore, conceptually framing population movements within a single economic and social relational space revealed that contemporary circular migration and its differentiated control and economic manifestations significantly interact with changing traditional power relations in Dogon society. This implies the inseparability of migration and economic and social transformations.

The translocal perspective elucidated the intertwining multiple dimensions of Dogon communities' circular mobility. In order to improve the comprehension of present population movements, further investigations would benefit from a more sustained engagement with issues of social change in contexts of high mobility and climate change. Conclusively, future research efforts must reconnect to contemporary mobile perspectives in migration theory and larger societal change processes.

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iii. SYNTHESIS AND OUTLOOK

The objective of this doctoral thesis was to describe and understand current migration phenomena in West Africa in the context of climate change and existing high mobility. To respond to the identified conceptual and methodological deficits of past empirical research within the environment and migration debate, I provide a differentiated multilocal representation and explanation of contemporary population movements from Mali and Senegal along with their multidimensional (feedback)effects. This study shows the prevalence of a complex, multidirectional, and circular character of population movements. Multidimensional intertwined constraints and opportunities at multiple connected places are relevant for present migration. The translocalilty of livelihoods and population movements in the research contexts both theoretically and empirically refutes notions of so-called environmental migration.
The following sections summarize the findings according to the research questions of this thesis before reflecting the applied research design and providing a synoptic conclusion and outlook.

What are the central trends of agro-ecological conditions and what are their (multi)local interpretations?

The applied research approach revealed the following insights. The semi-arid Sahel of the two rural research areas usually regarded as a hotspot of climate and environmental change essentially threatening agricultural livelihoods, shows an overall greening trend, rising temperature as well as increasing annual rainfall in the past 30 years. However, the detailed analysis reveals significant intra- and interannual rainfall variability and, at the local level, noticeable heterogeneity of both vegetation recovery and degradation phenomena. Even though the influence of rainfall and soil characteristics is uncontested, an important result is that anthropogenic activities considerably shape present vegetation and degradation patterns as well as the productivity of agricultural land. Moreover, human efforts prove that degradation is a reversible process.
For this study considering people's assessments, interpretations, and explanations of climatic and environmental change, however, was more relevant. Informants emphasized declining biodiversity and increasing scarcity of woody vegetation. The latter point can be interpreted as a result of the increasing commercialization of wood resources and governmental forestry authorities' intensified control and sanctions of illegal woodcutting. Annual rainfall yields directly and indirectly influence people's perception and interpretation of temperature trends and intensity of seasonal heat waves. Moreover, farmers highlighted the importance of the timing of rainfall over its annual amount for harvest outcomes. Evidently, within and between

communities, people assessed the impact of past Sahel droughts and recent annual rainfall for their harvests and livelihoods very differently.

Apart from rainfall, the social differentiation of successful farming is comprehensible because the availability of technical equipment, labor, know-how, pesticides, fertilizers, or the size and location of fields additionally significantly determine harvest yields. People are able to compensate for harvest shortfalls in socially differentiated ways. Besides migrants' direct financial contributions, economic diversification through cash-cropping, running small-scale commerce, and the returns from rice harvesting (in Mali) contribute to rural livelihoods just as selling wood, charcoal, animals, and wild fruits. Therefore, variable rainfall and uncertain harvests from rainfed farming as well as pooling multiple (and multilocal) income sources must be regarded as established normality. Furthermore, the findings demonstrate that the differentiated accessibility to physical, social, political, and economic resources (education, fertile land, wild plants, mobility, income opportunities, social networks, solidarity, decision-making power) is very much shaped by the families' and communities' socio-historical background.

These illustrations challenge the simplified understanding that livelihoods are only determined by subsistence agriculture principally controlled by external climatic and environmental factors. Thus, to reduce deterministic and sedentarist biases toward migration as an adaptation strategy to threatened rural livelihoods, reflecting and interpreting the empirical reality of contemporary population movements required to expand the researchers view and took into account approaches of migration theory, translocality, and political ecology.

What are the spatial and temporal characteristics and trends of contemporary migration patterns?

The findings show that for both the Senegalese and Malian research contexts, historically evolved migration destinations continue to be prominent. This points to path dependency, chain migration, and the significant role of already existing social networks for present migration patterns. Considering West Africa's general migration history as well as communities' specific historical background was therefore indispensable to interpret contemporary population movements. Internal migration to urban centers, primarily the capitals, and international migration to West African States dominate. Despite recurrent political and economic instability and the xenophobic tendencies of the past twenty-five years, until today the Côte d'Ivoire represents one of the most important regional destinations. Its economic capital Abidjan remains a paramount international point of attraction, especially for the Dogon people in Mali. This perpetuation can be explained by the long-established migration networks and relational

professional contacts. For the same reason, present migration to Europe is more relevant for the investigated communities from Linguère in Senegal than for the Dogon in Mali.

It is empirically evident for both research contexts that the majority of population movements are multidirectional, temporary, circular, and temporally diversified. Even though particularly young men often try and prefer to gain an economic foothold in the cities, an omnipresent phenomenon often described as rural exodus, the permanent emigration of entire communities from the rural areas, does not take place. Instead, the analysis of migrant biographies and apparent mobile life trajectories shows that a durable unidirectional resettlement rarely occurs or is hard to define and identify as such. Rather, depending on the current life phase, people circulate among the different places of their migration networks, discover new destinations, sometimes return even after many years of absence or choose spending their old age in the village of origin. The traditional seasonal migration between the period of cultivation in the village during rainy season and paid work in the cities during the dry season is still a relevant migration pattern in both study regions. However, it very much depends on the economic, cultural, and social importance of rainfed farming as well as on the diversification of alternative income opportunities at the different places of the migration network. The Nguith example in Senegal shows that the marginal millet cultivation no longer determines the timing of migration. Even for the traditional Dogon farmers in Mali the timing of circular movements has become more diverse and irregular. Young men's stays in the village have become shorter as they return to the cities more frequently before the harvest or are deliberately absent for longer periods, including the rainy season.

What are the translocal and multi-dimensional aspects and feedback effects of population movements and how do they shape (circular) migration?

The observed phenomena and patterns of mobility suggest people's translocal organization and strengthen a translocal research perspective. Multilocal social networks are created, linked, and perpetuated by people's multidirectional circular mobility and the circulation of resources and information. The interdepending multidimensional relational space hence connects several places and implies that any local changes and dynamics can exert multidirectional and multilocal effects. Hence, not all migration from the research contexts is strictly circular. Discovering and opening up new destinations is an important part of the mobility spectrum, but quantitatively minor and more difficult to grasp. If not in the extreme case of escaping social network/control, such moves belong to the translocalization process, i.e. expanding the migration network and integrating new places into the translocal flow of resources, information, and ideas and for further circular migration.

Initial determinants of (temporary) migration and resulting translocalization involved aspects such as the exploitation of new agricultural land, earning money to pay taxes, the seasonality of climatic conditions, the great Sahel droughts, the compensation of harvest losses, the ritualization of migration, and religious reasons. Today, circular mobility, translocality, and their effects themselves constitute the determining multi-dimensional and multilocal context that perpetuate, shape, and reinforce circular migration.

Rising needs, expenses, and aspiration for economic independence among the youth together with investments and economic diversification in the rural areas must be regarded as self-reinforcing cumulative consequences of already existing effects of migration: the growing importance of monetary income, and relative deprivation and peer pressure; i.e. the motivation to achieve the same socioeconomic well-being as other community members resulting in the increasing desire for prestige and development. For that reason, the necessity to ensure basic livelihood (and food) security for the family can hardly be separated from the increasing wish for individual material consumption and a more prosperous life. However, because of families' and communities' socially differentiated livelihood assets to cover essential needs such as food, the cumulative effects of migration similarly lead to exacerbating economic disparities and diverging benefits.

Additionally, the multidimensional local contexts within migration networks and their interdependence are pertinent for shaping and perpetuating circular mobility and communities' translocality. The educational and professional capacities of migrants largely determined by the historical, social, cultural, and infrastructural characteristics of the communities in the rural research areas play a decisive role for their present opportunities in urban and international job markets. This explains why, on the one hand, many well-educated migrants from Nguith (Senegal) early on followed permanent formal employment in the cities and abroad. On the other hand, due to insufficient formal education, the Dogon (Mali) hitherto generally pursue temporary, poorly paid, informal, and low-skilled jobs in Bamako or Abidjan. The similar manifestations of rapid urbanization in the capitals such as increasing competition on the labor market and resulting decreasing revenues, and above all the sharp increase of living costs and particularly finding affordable housing, represent enormous challenges. This contributes to the ever-increasing importance of education and social networks to access employment and accommodation. Earning the desired amount of money and maintaining business contacts to not lose employment to newcomers requires extended stays or more regular circular moves. Moreover, for low-paid migrants improving living standard in the capitals is hardly possible

and the lower costs in the village explain why they temporarily migrate without bringing their family and have a stronger incentive to stay anchored and invest in the village.

People's socio-historical background as well as migrants' differentiated material and non-material input significantly influence the rural environmental context, the quality of physical cultivation conditions and harvest outcomes, and the role and management of vegetational and agricultural resources. It suggests that grasping the environmental context and relationships between the environment and migration necessarily must take into account an understanding of (translocal) political ecology.

Local agricultural production in the rural research areas remains relevant, both for food production and increasingly for monetary revenues. Fundamentally facilitated by migrants, the diversification of economic income opportunities, particularly animal husbandry and irrigated vegetable gardening, are on the rise. Here, the possibility of year-round monetary income generation is the desired advantage. Consequently, in relative terms the significance of traditional seasonal rainfed cereal cultivation is decreasing in favor of translocalized, diversified, and temporally flexible monetary income generation. Against the background of preceding illustrations about the complex determinants of translocality, mobility, and environmental context, the resulting further increasing independence from the local rainfall regime must rather be interpreted as a side-effect.

Furthermore, mobility and people's continuing integration into the monetary economy promote phenomena of interdepending social, economic, and cultural change in the villages. The individual and diversified translocal income of the mobile youth contrasts, and progressively replaces or supplements traditional modes of collective farm work, which formerly constituted an integral part of traditional agricultural societies' common identity and associated system of patriarchal power and resource distribution. As particularly evident for the Malian context, young people's increasing (desire for) economic independence similarly triggers the wish for self-determination challenging traditional power structures and decision-making. Resulting intergenerational and gender-related tensions manifest around the use and distribution of revenues, the control of migration of unmarried girls and school children as well as the choice of spouse leading to differentiated outcomes for families' and communities' translocal social structures and mobility. Hence, the effects of economic and social change are interconnected and reinforce each other, thereby constantly redefining and transforming the social and economic institutions of the translocal communities.

Even though increasing economic individualization suggests dwindling solidarity, it becomes apparent that the perpetuation of circular migration and a common identity among different

places over large distances similarly requires mutual support and reliance on social networks and social capital. Thus, we observe a reorganization and redefinition of social control and decision-making that is shaped by and adapted to the consolidating translocal and mobile reality of the communities. Apart from the strong symbolic, social, and cultural value of the village of origin and family bonds, religion as well as (translocal) migrant associations pursuing mutual support and joint investments serve as essential institutions to maintain a common identity, cohesion, security, orientation, solidarity, and thus circular mobility and flows of resources across space and time. Migrants' reliance on and integration into these institutions, however, vary according to their motivation, economic opportunities and dependency. The similar embeddedness into traditional collective structures and associated obligations on the one hand and the liberty and constraints of a modern, urban individualist lifestyle on the other hand creates tension and represents a balancing act requiring great efforts that some people (temporally) seek to escape.

Which methodological shortcomings and challenges exist in empirical research linking the environment and migration?

Against the background of theoretical-conceptual shortcomings around environmental migration and associated attempts to prioritize and investigate linkages between climate, environment, and migration essential methodological deficits could be carved out. These mainly concern suggestive causal linking and hence highlighting climatic or environmental stress as drivers of migration in the methodological design as well as neglecting (or insufficiently reflecting) spatial and temporal scale issues in data (collection) and methods of analysis. The former relates to focusing and directly asking for environmental factors as migration motives, both in quantitative and qualitative approaches. Framing and methodically investigating people's mobility in such a way must be regarded as problematic as it leads to a bias in research results impeding new insights and contributing to a perpetuation of the questionable narrative of environmental migration. Moreover, causally linking environmental and climatic factors with migration data is subject to relevant aspects of scale. This is particularly apparent when macro data on environment and migration are involved. Significant limitations of spatial and temporal extent and resolution in data (collection) together with the non-uniformity of information about population movements and climatic and environmental phenomena makes it difficult combine them. Restructuring and up and downscaling of environmental and migration data, thus harmonizing different information to fit the same spatial and temporal framework of analysis, involves fundamental scale issues through modifying the informational value of research data. Hence, resulting correlations between environment and

migration can hardly indicate traceable isolated causal linkages and for example risks leading to what is generally known as ecological fallacy.

Reflection of research design

Disengaging from initially framing and centering empirical investigation around environment and migration does justice to the conceptual understanding of migration as a complex and multicausal phenomenon. The research design of this doctoral thesis aimed to overcome this challenge by largely separating the topics of climate/environment and migration during field research and avoiding suggestive interviewing about (climate and environment as) migration motives. To reduce biases in investigating patterns and explanations of migration, this study greatly benefitted from equally allowing for the multiple dimensions of population movements. Consequently, this involved considering additional theoretical concepts and adjusting the research questions and methodological approach to explore and make sense of the empirical reality, i.e. multidirectionality and circularity of migration together with translocality of people's lives as established and habitual routine. Based on a multi-sited ethnographic approach, interviewing people at different places of identified migration networks, considering migration history, and revealing translocal life courses from migrant biographies not only enabled differentiated, valuable perspectives on mobility. Similarly, this approach comprises and integrates spatial and temporal dimensions of scale, usually masked out by sedentarist and deterministic explanatory approaches, and thus allows contemporary mobility to appear in a different light.

The applied research design involved certain conceptional, methodological, and analytical implications, limitations, and challenges. The initial study area and overall research objective were given by the research project and provided a conceptional framework implying to a certain extent a sedentarist and deterministic bias towards the environmental context in the approach and data collection. For this thesis, a more consequent detachment from the environment focus and a translocal perspective resulted only from progressing interpretation of empirical data and more differentiated knowledge of migration phenomena.

Consistency in the translocal approach was difficult and due to the fact that the focus of most field research, including the investigation of environmental change, referred to the initial rural study areas and consequently in a way controlled the emphasis toward these 'areas of origin'. Widening the analytical view and escaping a sedentarist bias was challenging. However, the division of climate/environment and migration into different interview situations together with multilocal fieldwork formed the basis allowing for differentiated views about the same migration phenomena. Additionally, ethnographic field research into migration networks and

phenomena results in certain limitations. While the snowballing method favors the detection of social and migration networks at multiple places, pioneer migration remains rather difficult to grasp. The latter holds true for tracking migrants exiting social networks. Moreover, it proved difficult to receive deeper insights into socially undesirable aspects and negative effects of migration such as social conflicts and thus for essential dimensions of social change. Cultural and social norms additionally complicated gaining access to female informants and restricted their willingness and freedom of expression towards me as a male researcher and my male translators. Supposable limitations and biases must be considered in the interpretation of findings.

Synopsis and Outlook

The findings demonstrate how distinct and interdepending historical, cultural, social, economic, political, and environmental contexts constitute the translocal space that is a precondition for consolidating people's circular mobility. Here, multidimensional cumulative and reinforcing effects of already existing migration resulting in differentiated and multidirectional manifestations of people's mobility play a particular role. Translocality and circular migration are perpetuated and shaped by strongly interdepending implications of necessity (established reliance on multilocal livelihoods and translocal social structures), maintaining identity (relative deprivation and peer pressure; continual shared translocal experiences, aspirations, social bonds, beliefs, and solidarity defining and transforming communities' common identity), and development (desire for well-being and increasing living standard, participation, self-determination, and progress).

In view of these findings, discussions about migration and environment in contexts of established high mobility, considerable climatic variability, and slow-onset environmental change such as the West African Sahel require a change of perspective. Sedentarist notions of autarchic and self-sufficient local agrarian communities must be overcome. Conceptual implications of translocality fundamentally contradict static notions of strictly local explanations or external factors for migration. This means that research efforts must disengage from a deterministic and simplistic push-pull framework consequently developing a conceptual and methodological research design that allows for an open and less biased approach to contemporary migration, environmental change, and their multiple, multilocal, and interdepending dimensions taking multidirectional and varying effects.

The attempt of this thesis to conceptually frame population movements within a single social relational space under a longitudinal perspective does justice to the empirical manifestations and relevant theoretical conceptions of contemporary population movements. A benefit is

integrating and connecting micro, meso, and macro levels of analysis. This allows for a consideration of individual, collective/social, and structural aspects of the local and translocal for migration. Moreover, expanding the temporal dimension of analysis from snapshots of migration to individual migration biographies and communities' migration pathways shows the processuality of migration and contributes to less deterministic explanations of human mobility.

Thus, the theoretical-conceptual synthesis for a multilocal and multi-level research approach must be equally sensitive to the historical, social, cultural, economic, political, and environmental aspects. By doing so, it allows for the identification and interpretation of multiple cumulative, self-reinforcing, and interfering effects of circular mobility and resource flows interacting between multiple places of translocal networks. Such a conceptualization should not belie the fact that global trends of climatic change and variability continue to affect livelihoods and migration. Rather, it should be maintained that the locally, socially, and temporally differentiated environmental effects cannot be isolated from the complexity and capabilities of human agency. Similarly, the multidimensional determinants and effects of migration cannot be examined separately from one another. In addition, considering translocality, i.e. recognizing the existence of multilocal social networks, associated multidirectional mobility and/or resource flows as well as the similarity of their multidimensional and multilocal effects, means that it is unreasonable and analytically effectively impossible to identify initial causes to explain contemporary migration.

In that sense, the new mobilities paradigm's claims of viewing migration not necessarily as an exception and (reaction to a) problem but as an integral part and need of people's everyday life should be given more attention. This is particularly relevant for contexts of the Global South where mobility should not be conceptualized differently from the more favorable notions of mobile societies in the Global North.

In this doctoral thesis some manifestations of migration remain open for further research. However, the study was able to point out useful approaches for a more appropriate research design and raise awareness for the multiple implications of contemporary migration with regard to the environment and migration debate in particular, and population movements in West Africa in general. Further investigations would benefit from a more sustained theoretical and empirical engagement with the interaction of broader processes of societal and economic change and migration to better grasp the meanings of contemporary mobility in contexts of not only climate but also multidimensional changes.

Finally, the perpetuating prominence and potential instrumentalization of climate change in discussing population movements, particularly in the Global South, both in politics and science

should be a stronger focus in future research. One cannot overlook that political concerns about climate change-related migration have long merged with environmental and immigration security issues. They have thus become a persistent focal point in the general perception of potential mass migration as a threat to European (welfare) states and societies. Evidently, efforts leading to increasing securitization and control of migration in countries of the West African Sahel receive more consideration than mitigation attempts for vulnerable people or accepting the role migration plays in people's lives. Despite inconsistent scientific conceptual and methodological approaches and empirical evidence, scholars' motivation to repeatedly hint at the continuous high relevance of climate change for future population movements and displacements can hardly be separated from primary political and research funding interests. Therefore, with relevant input from science and technology studies (STS) a critical reflection on the mechanisms and outcomes of the science-policy complex in the field of climate, environment, and migration should be given more attention.

iv. ANNEX

1. Questionnaire

Questionnaire – micle

Identification

Nom de l'enquêteur	
Date	___ / ___ / 2012
Numéro (ne pas remplir)	

Introduction

Bonjours. Je m'appelle _____.

Nom d'interviewée (volontaire)	

Je fais une recherche pour une Université Allemande en collaboration avec _____. La recherche s'intéresse sur la mobilité des personnes et des conditions de vie. Pourriez-vous nous consacrer environ 30 minutes pour répondre à nos questions ? Vos réponses seront traitées de manière confidentielle.

➔ **Demandez le lieu d'origine de la personne enquêtée!**

1 Lieu de l'interview

1.	Pays	1 ☐ Sénégal 2 ☐ Mali
2.	Région	Sénégal : 1 ☐ Dakar 2 ☐ Louga Mali : 3 ☐ Bamako 4 ☐ Mopti
3.	Département/Cercle	Sénégal : 1 ☐ Dakar 2 ☐ Guédiawaye 3 ☐ Pikine 4 ☐ Rufisque 5 ☐ Linguère

		Mali : 3 ☐ Bandiagara 4 ☐ Bankass
4.	Arrondissement/Commune	Sénégal : 1 ☐ Barkedji 2 ☐ Dodji 3 ☐ Ouakhokh 4 ☐ Yang-Yang Mali : _____
5.	Ville/Village	_____
6.	Quartier/Hameau	_____

2 Coordonnées

7.	Sexe	1 ☐ Masculin 2 ☐ Féminin
8.	Vous-avez quel âge ? En quelle année êtes-vous nés ?	_____ ans ; 19___ (année) ***Si inconnu, faites une estimation.***
9.	Quelle est votre situation matrimoniale ?	1 ☐ Célibataire 2 ☐ Monogame 3 ☐ Polygame 4 ☐ Veuf/veuve, divorcé(e), en séparation
10.	Quel est votre niveau d'instruction le plus élevé ?	1 ☐ Analphabète 2 ☐ Sait lire et écrire une langue nationale (Bambara, Wolof, Peul, Dogon, …) 3 ☐ Sait lire et écrire français 4 ☐ Ecole primaire 5 ☐ Secondaire Générale Premier Cycle 6 ☐ Secondaire Générale Second Cycle 7 ☐ Secondaire Technique ou Professionnel 8 ☐ Supérieur
11.	Avez-vous une autre éducation scolaire ?	1 ☐ Non 2 ☐ Ecole Coranique 3 ☐ Ecole Arabe 4 ☐ Ecole Franco-arabe 5 ☐ Autre à préciser _____

12.	De quel group ethnique faites-vous partie ?	1 ☐ Bambara 2 ☐ Dogon 3 ☐ Peulh 4 ☐ Wolof 5 ☐ Autre à préciser _____
13.	Quelle est votre religion ?	1 ☐ Musulman(e) 2 ☐ Chrétien(ne) 3 ☐ Animist(e) 4 ☐ Aucun
14.	Quelle est votre nationalité ?	1 ☐ Sénégalais(e) 2 ☐ Malien/ne 3 ☐ Autre à préciser _____ 4 ☐ Aucune
15.	Occupez-vous un des titres/fonctions suivantes ? ***(lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Chef de village 2 ☐ Marabout 3 ☐ Iman 4 ☐ Conseiller à la communauté rurale 5 ☐ Enseignant 6 ☐ une autre fonction : _____ 7 ☐ aucune fonction particulière

3 Informations sur la migration

16.	Quel est votre lieu d'origine ?	_____ (village/ville) _____ (arrondissem./commune) _____ (département/cercle) ***Abandonnez l'interview si la réponse n'est pas département de Linguère (Sénégal) ou région de Mopti (Mali) !!!***
17.	Ou habitez-vous ? (domicile principale)	À _____ (ville/village) Si, c'est un village diffèrent a lieu d'origine complétez aussi : _____ (arrondissem./commune) _____ (département/cercle) _____ (pays, si n'est pas pays d'enquête)

18.	Actuellement, ou êtes-vous basé ? (travail)	À _____ (ville/village) Si, c'est un village diffèrent a lieu d'origine complétez aussi : _____ (arrondissem./commune) _____ (département/cercle) _____ (pays, si n'est pas pays d'enquête)
19.	Ou habite(nt) votre mari/épouse(s) et enfants ? *Si l'homme a plusieurs épouses notez aussi le nombre à cote de la réponse.* ➔ ***Plusieurs réponses possibles***	1 ☐ je ne suis pas marié/ je n'ai pas d'enfants 2 ☐ Lieu d'origine ___ 3 ☐ Lieu, où vous habitez ___ 4 ☐ Lieu, où vous êtes actuellement basé ___ 5 ☐ Autres, à préciser _____
20.	Etes-vous déjà partis de votre lieu d'origine plus de 3 mois ?	1 ☐ Oui 2 ☐ Non ➔ ***Passez à la catégorie 5 (Question 31)***

4 Expérience migratoire individuelle

21.	Quand êtes-vous partis de votre lieu d'origine la *première* fois pour plus que 3 mois ?	_____ (année) _____ (mois) Si inconnu, notez l'âge de la personne ____ ans
22.	Où êtes-vous allé ?	À _____ Si, c'est un village complétez aussi : _____ (arrondissem./commune) _____ (département/cercle) _____ (pays, si n'est pas pays d'enquête)
23.	Pour combien de temps y êtes-vous resté ?	____ ans et ___ mois
24.	Quelles étaient vos motivations/raisons pour partir de votre lieu d'origine pour la *première* fois ? ➔ ***Réponse spontanée*** *(L'enquêteur ne fait que noter la réponse de son interlocuteur/interlocutrice.)* ➔ ***Plusieurs réponses possibles***	1 ☐ Aller en aventure/curiosité 2 ☐ Aller chercher de l'argent/travail 3 ☐ On fait ça depuis des générations (tradition), on a l'habitude de partir 4 ☐ Rendre visite à qqn 5 ☐ Acheter des vêtements 6 ☐ Gagner le trousseau 7 ☐ Faire l'études/apprentissage/formation (pour aller s'instruire) 8 ☐ Pour des raisons religieuses/mystiques

		9 ☐ Aller se soigner (Santé) 10☐ Pour des raisons familiales 1 ☐ Mariage/Divorce/Veuvage 2 ☐ Pour être plus indépendant de la famille 3 ☐ Conflit au sein de la famille 4 ☐ Pour retarder/éviter le mariage 5 ☐ Autres raisons familiales 11☐ Conflit dans le village 12☐ Conflit entre éleveurs et cultivateur 13☐ Payer les impôts 14☐ Manque d'eau (approvisionnement) 15☐ Nourrir la famille/alimentation 1 ☐ La récolte ne suffisait pas pour toute la famille 2 ☐ La terre était/est fatiguée 3 ☐ La pluie était insuffisante 4 ☐ Le(s) champ(s) était/étaient trop petit 5 ☐ Manque d'accès et disponibilité de terre 6 ☐ Inondation 16☐ Pas suffisant pâture pour le bétail 17☐ Autre à préciser _____
25.	En plus, y avait-il d'autres raisons qui ont joué un rôle dans votre décision de partir de votre lieu d'origine pour la première fois ? Je vais vous donner une liste de motifs/raisons. Merci de me dire si ces motifs étaient valables pour votre voyage. ➔ ***Rotation importante!*** ➔ ***Plusieurs réponses possibles***	1 ☐ Aller en aventure/curiosité 2 ☐ Aller chercher de l'argent/travail 3 ☐ On fait ça depuis des générations (tradition), on a l'habitude de partir 4 ☐ Rendre visite à qqn 5 ☐ Acheter des vêtements 6 ☐ Gagner le trousseau 7 ☐ Faire les études/apprentissage/formation (pour aller s'instruire) 8 ☐ Pour des raisons religieuses/mystiques 9 ☐ Aller se soigner (Santé) 10☐ Pour des raisons familiales 1 ☐ Mariage/Divorce/Veuvage 2 ☐ Pour être plus indépendant de la famille 3 ☐ Conflit au sein de la famille 4 ☐ Pour retarder/éviter le mariage 5 ☐ Autres raisons familiales 11☐ Conflit dans le village 12☐ Conflit entre éleveurs et cultivateur

		13☐ Payer les impôts 14☐ Manque d'eau (approvisionnement) 15☐ Nourrir la famille/alimentation 1 ☐ La récolte ne suffisait pas pour toute la famille 2 ☐ La terre était/est fatiguée 3 ☐ La pluie était insuffisante 4 ☐ Le(s) champ(s) était/étaient trop petit 5 ☐ Manque d'accès et disponibilité de terre 6 ☐ Inondation 16☐ Pas suffisant pâture pour le bétail
26.	Quelle personne a été la plus impliquée dans votre décision de partir de votre lieu d'origine pour la première fois ?	1 ☐ Personne 2 ☐ Conjoint 3 ☐ Père et/ou Mère 4 ☐ Ami(e)s 5 ☐ Employeur 6 ☐ Marabout 7 ☐ Autre à préciser _____
27.	Pourquoi avez-vous choisi ce lieu (destination du premier voyage; voir question 22) comme destination ? ***(lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Par hasard 2 ☐ J'ai déjà connu l'endroit 3 ☐ J'avais de la famille/des amis ici/là-bas 4 ☐ Des amis/des membres de ma famille, qui sont déjà allés là-bas et sont revenus m'ont donné des informations 5 ☐ Je voulais connaître la ville/la région 6 ☐ J'ai des meilleures perspectives professionnelles ici/là-bas 7 ☐ J'ai une meilleure possibilité de recevoir une bonne formation ici/là-bas 8 ☐ Je voulais aller autre part, à _____ 9 ☐ Il y a des conditions meilleures pour l'agriculture/l'élevage ici/là-bas 10☐ Autre à préciser _____
28.	Quand êtes-vous partis de votre lieu d'origine la *dernière* fois plus de 3 mois ?	1 ☐ je suis partis qu'une seul fois ➔ ***Passez à la question 32*** _____ (année) _____ (mois) Si inconnu, notez l'âge de la personne _____ ans

29.	Quelles étaient vos motivations/raisons pour partir de votre lieu d'origine pour la *dernière* fois ?
	➔ ***Réponse spontanée*** *(L'enquêteur ne fait que noter la réponse de son interlocuteur/interlocutrice.)*
	➔ ***Plusieurs réponses possibles***
		1 ☐ Aller en aventure/curiosité
		2 ☐ Aller chercher de l'argent/travail
		3 ☐ On fait ça depuis des générations (tradition), on a l'habitude de partir
		4 ☐ Rendre visite à qqn
		5 ☐ Acheter des vêtements
		6 ☐ Gagner le trousseau
		7 ☐ Faire les études/apprentissage/formation
		8 ☐ Pour des raisons religieuses/mystiques
		9 ☐ Aller se soigner (Santé)
		10☐ Pour des raisons familiales
		  1 ☐ Mariage/Divorce/Veuvage
		  2 ☐ Pour être plus indépendant de la famille
		  3 ☐ Conflit au sein de la famille
		  4 ☐ Pour retarder/éviter le mariage
		  5 ☐ Autres raisons familiales
		11☐ Conflit dans le village
		12☐ Conflit entre éleveurs et cultivateur
		13☐ Payer les impôts
		14☐ Manque d'eau (pas pluie)
		15☐ Nourrir la famille/alimentation
		  1 ☐ La récolte ne suffisait pas pour toute la famille
		  2 ☐ La terre était/est fatiguée
		  3 ☐ La pluie était insuffisante
		  4 ☐ Le(s) champ(s) était/étaient trop petit
		  5 ☐ Manque d'accès et disponibilité de terre
		  6 ☐ Inondation
		16☐ Pas suffisant pâture pour le bétail
		17☐ Mon travail est là-bas
		18☐ C'est chez moi/j'ai ma maison là-bas
		19☐ Autre à préciser _____

30.	En plus, y avait-il d'autres raisons qui ont joué un rôle dans votre décision de partir de votre lieu d'origine la dernière fois ? Je vais vous donner une liste de motifs/raisons. Merci de me dire si ces motifs étaient valables pour votre voyage.	1 ☐ Aller en aventure/curiosité 2 ☐ Aller chercher de l'argent/travail 3 ☐ On fait ça depuis des générations (tradition), on a l'habitude de partir 4 ☐ Rendre visite à qqn 5 ☐ Acheter des vêtements 6 ☐ Gagner le trousseau 7 ☐ Faire les études/apprentissage/formation 8 ☐ Pour des raisons religieuses/mystiques

	➔ ***Rotation importante!*** ➔ ***Plusieurs réponses possibles***	9 ☐ Aller se soigner (Santé) 10☐ Pour des raisons familiales 1 ☐ Mariage/Divorce/Veuvage 2 ☐ Pour être plus indépendant de la famille 3 ☐ Conflit au sein de la famille 4 ☐ Pour retarder/éviter le mariage 5 ☐ Autres raisons familiales 11☐ Conflit dans le village 12☐ Conflit entre éleveurs et cultivateur 13☐ Payer les impôts 14☐ Manque d'eau (pas pluie) 15☐ Nourrir la famille/alimentation 1 ☐ La récolte ne suffisait pas pour toute la famille 2 ☐ La terre était/est fatiguée 3 ☐ La pluie était insuffisante 4 ☐ Le(s) champ(s) était/étaient trop petit 5 ☐ Manque d'accès et disponibilité de terre 6 ☐ Inondation 16☐ Pas suffisant pâture pour le bétail 17☐ Mon travail est là-bas 18☐ C'est chez moi/j'ai ma maison là-bas

5 Questions sur la migration dans la famille

31.	***Seulement pour des personnes sans expérience migratoire !!! (voir question 20)*** Pourquoi n'êtes-vous jamais partis de votre lieu d'origine pour plus que 3 mois ? ***(lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Je suis le seul garçon/fille 2 ☐ Je me suis occupé de mes parents 3 ☐ J'ai une fonction au village que ne me permet pas de partir 4 ☐ Nous n'avons pas (eu) des moyens pour partir 5 ☐ Je n'en avais pas envie 6 ☐ Je n'ai y jamais pensé 7 ☐ J'ai des frères/sœurs qui sont partis 8 ☐ Nous avons (eu) suffisamment des moyens pour rester 9 ☐ Nous avons (eu) beaucoup de travail ici 10☐ On n'a pas l'habitude de partir dans ma famille 11☐ Les parents/le village n'est pas d'accord 12☐ Autre à préciser _____

A partir d'ici pour tout les interviewés !

32.	Combien des (autres) membres de votre famille se trouvent actuellement hors du village pour une durée d'au moins 3 mois ?	_____ Nombre des femmes _____ Nombre des hommes ☐ Aucun membre de ma famille se trouve actuellement hors du village ➔ ***Passez à la question 35***
33.	Où ces membres de votre famille sont-ils actuellement basés ? *Commencez par la destination la plus fréquentée !* *Si, c'est un village, complétez aussi arrondissement/ commune ; département/ cercle ; pays, si n'est pas pays d'enquête.*	À _____ À _____ À _____ À _____ À _____
34.	**Personnes *avec* expérience migratoire :** De quelle façon soutenez-vous votre famille au village ? **Personnes *sans* expérience migratoire :** De quelle façon les autres membres qui sont partis soutiennent-ils la famille au village ? ***(lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Malheureusement, il ne reste rien pour soutenir la famille Avec … 2 ☐ de l'argent 3 ☐ de la nourriture 4 ☐ des vêtements 5 ☐ des aliments de bétail 6 ☐ des semences 7 ☐ de matériel agricole 8 ☐ Autre à préciser _____
35.	Quels sont les avantages/ conséquences positives des départs ? ***(lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Il n'y a pas d'avantage 2 ☐ Envoyer d'argent à la famille 3 ☐ Ils/on apportent des vêtements 4 ☐ Il y a moins de gens à nourrir 5 ☐ la solidarité de la famille devient plus forte 6 ☐ Changement de look, coiffure 7 ☐ Changement de langage 8 ☐ On apprend des nouvelles langues 9 ☐ On revient avec des nouvelles (bonnes) idées et expérience au village 10☐ On apprend beaucoup de choses/la migration c'est une école de vie 11☐ Plus d'émancipation des jeunes/femmes 12☐ Etre plus indépendant de la famille

		13☐ Plus de liberté en cas d'absence du conjoint 14☐ Autre à préciser _____
36.	Quels sont les problèmes/ conséquences négatives que posent des départs ? ***(lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Il n'y a pas de problème 2 ☐ Ceux qui sont d'ailleurs n'envoient pas (assez) d'argent 3 ☐ Il manque de main-d'œuvre 4 ☐ La solidarité de la famille souffre 5 ☐ Les enfants ne voient pas leur père/mère 6 ☐ Manque du respect de la coutume/des mœurs 7 ☐ Changement de langage 8 ☐ Changement de look, coiffure 9 ☐ Les migrants reviennent avec des mauvaises idées/comportements 10☐ L'entente de village baisse 11☐ Grossesse (involontaire) des jeunes filles migrantes 12☐ Manque de fidélité des migrants 13☐ Autre à préciser _____
37.	Conseilleriez-vous à d'autres membres de votre famille d'aller autre part (temporaire ou permanent) ? ***(lire les réponses)***	1 ☐ Non 2 ☐ Oui, mais seulement dans le pays 3 ☐ Oui, mais seulement en Afrique 4 ☐ Oui, n'importe où
38.	Souhaitez-vous que le gouvernement fasse quelque chose pour influencer la migration ? ***(lire les réponses)***	1 ☐ Non 2 ☐ Oui, il devrait encourager/faciliter la migration 3 ☐ Oui, il devrait réduire la migration 4 ☐ Oui, il devrait empêcher la migration 5 ☐ Je ne sais pas
39.	Pensez au développement du village dans les dernières 5 années. Quelle projection faites-vous concernant les conditions de vie au village dans les 5 prochaines années ? ***(lire les réponses)***	1 ☐ Ca va s'améliorer 2 ☐ Ca va rester inchangés 3 ☐ Ca va s'aggraver 4 ☐ Je ne sais pas

6 Questions sur les conditions de la vie et l'environnement

40.	Quelle est actuellement votre activité économique principale/ occupation ? ***(lire les réponses si nécessaire)***	1 ☐ Agriculture (cultures de l'hivernage) 2 ☐ Jardinage 3 ☐ Élevage 4 ☐ Commerce 5 ☐ Artisanat 6 ☐ Gardiennage 7 ☐ Tourisme 8 ☐ Femme de ménage 9 ☐ Manœuvre 10☐ Études 11☐ Retraite 12☐ Autres à préciser _____
41.	Ou est-ce que vous menez cette activité si ce n'est pas au lieu où vous êtes actuellement basé (*voir question 18)*? ***Si, c'est un village, complétez aussi arrondissement/commune ; département/cercle ; pays, si n'est pas pays d'enquête***	1 ☐ Je fais l'activité là où je suis basé À _____ À _____ À _____
42.	Quelles sont vos autres activités économiques ? ***(lire les réponses si nécessaire)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Agriculture (cultures de l'hivernage) 2 ☐ Jardinage 3 ☐ Élevage 4 ☐ Commerce 5 ☐ Artisanat 6 ☐ Gardiennage 7 ☐ Tourisme 8 ☐ Femme de ménage 9 ☐ Manœuvre 10☐ Études 11☐ Retraite 12☐ Autres à préciser _____ 13☐ aucune autre activité
43.	Quelle est l'activité économique principale de votre famille au village ?	1 ☐ Agriculture 2 ☐ Jardinage 3 ☐ Élevage 4 ☐ Autre à préciser _____

44.	Votre famille possède-elle suffisamment de terres pour satisfaire à ses besoins ?	1 ☐ Oui, c'est suffisant 2 ☐ Non, ce n'est pas suffisant 3 ☐ Non, je n'ai pas de terre
45.	Votre famille au village possède t-elle ? *Inscrire le nombre à cote de la réponse*. ***(Lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Cheval ____ (nombre) 2 ☐ Charrue ____ 3 ☐ Charrette ____ 4 ☐ Moto ____ 5 ☐ Voiture ____ 6 ☐ Téléphone portable ____ 7 ☐ Radio _____ 8 ☐ Télévision _____ 9 ☐ Ordinateur _____ 10☐ Panneau solaire _____ 11☐ Bâtiment _____ 12☐ Bétail (types de bétail à préciser) _____
46.	Les deux dernières récoltes (et jardinage) ont-elles suffit aux besoins alimentaires de votre famille (au village) pour toute l'année ? ***(Lire les réponses)***	En 2010 1 ☐ Oui 2 ☐ Non 3 ☐ Ne sais pas En 2011 1 ☐ Oui 2 ☐ Non 3 ☐ Ne sais pas 4 ☐ On ne fait pas l'agriculture
47.	Les activités de l'élevage (vente des animaux) ont-elles suffit aux besoins alimentaires de votre famille (au village) pour toute l'année ? ***(Lire les réponses)***	En 2010 1 ☐ Oui 2 ☐ Non 3 ☐ Ne sais pas En 2011 1 ☐ Oui 2 ☐ Non 3 ☐ Ne sais pas 4 ☐ On ne fait pas l'élevage
48.	Les activités agricoles (aussi jardinage) et de l'élevage ensemble ont-elles suffit aux besoins alimentaires de votre famille (au village) pour toute l'année ? ***(Lire les réponses)***	En 2010 1 ☐ Oui 2 ☐ Non 3 ☐ Ne sais pas En 2011 1 ☐ Oui 2 ☐ Non 3 ☐ Ne sais pas 4 ☐ On ne fait qu' une seule activité 5 ☐ On ne fait pas ni l'agriculture ni l'élevage

49.	Quels sont les facteurs qui ont *limité* la dernière récolte (2011) de votre famille au village ? ***(Lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Main d'œuvre 2 ☐ La fertilité du sol 3 ☐ L'engrais 4 ☐ La fumée 5 ☐ Les semences 6 ☐ Matériel agricole 7 ☐ Quantité de la pluie 8 ☐ Répartition de la pluie 9 ☐ Durée de la jachère 10☐ Les animaux nuisibles (oiseaux, criquet migrateurs, scarabées ou autres) 11☐ Autre à préciser _____ 12☐ On ne fait pas l'agriculture
50.	Quelles sont les activités de votre famille pour compenser une mauvaise récolte/ou de mauvaises conditions pour l'élevage du bétail ? ***(Lire les réponses)*** ➔ ***Plusieurs réponses possibles***	1 ☐ Augmentation des transferts d'argent des membres de la famille en migrations 2 ☐ Augmentation du nombre de migrants 3 ☐ Vente d'animaux 4 ☐ (Coupure) et vente de bois/charbon 5 ☐ Manger des feuilles et fruits sauvages 6 ☐ Vente des fruits sauvages 7 ☐ Vente de l'herbe/paille d'arachide 8 ☐ Envoyer un enfant à une école coranique (mendiant) 9 ☐ Jardinage 10☐ Rationner/diminution de la quantité des repas 11☐ Aide alimentaire de l'état, ONG 12☐ Nous nous soutenons les uns et les autres au village avec de la nourriture et des céréales 13☐ Prendre crédit avec qqn. ou à la banque 14☐ On ne peut rien faire 15☐ Autres à préciser _____ 16☐ On ne fait pas ni l'agriculture ni l'élevage
51.	Est-ce que la famille a bénéficié d'un appui venant de l'Etat ou d'une ONG ou autre organisation dans le domaine de l'agriculture ou de l'élevage les 5 dernières années ?	1 ☐ Non 2 ☐ Oui Lequel ? _____

52.	Comment la situation/la disponibilité de pâturage (aux alentours du village d'origine) a changé il y a 20–30 ans ? *Il faut parler des grandes tendances et changements intervenus depuis 20–30 ans !* ***(Lire les réponses)***	1 ☐ Amélioré 2 ☐ Constant 3 ☐ Dégradé 4 ☐ Je ne sais pas
53.	Comment ont changé les pluies au village d'origine par rapport à il y a 20–30 ans ? *Il faut parler des grandes tendances et changements intervenus depuis 20–30 ans !* ***(Lire les réponses)***	
	Quantité totale de pluie par an	Augmenté 1 ☐ Stable 2 ☐ Diminué 3 ☐ Alternation 4 ☐ ne sais pas 5 ☐
	Coupure de la pluie pendant l'hivernage	Augmenté 1 ☐ Stable 2 ☐ Diminué 3 ☐ Alternation 4 ☐ ne sais pas 5 ☐
	L'intensité des pluies (la quantité de l'eau par pluie)	Augmenté 1 ☐ Stable 2 ☐ Diminué 3 ☐ Alternation 4 ☐ ne sais pas 5 ☐
	Inondations des champs et villages pendant l'hivernage	Augmenté 1 ☐ Stable 2 ☐ Diminué 3 ☐ Alternation 4 ☐ ne sais pas 5 ☐
54.	Selon votre avis personnel, quels sont les principaux facteurs qui influencent la pluie aujourd'hui ? ***(Lire les réponses)*** ➔ ***Plusieurs réponses***	1 ☐ C'est la variabilité naturelle 2 ☐ Le climat et aussi la pluie changent maintenant partout dans le monde 3 ☐ La présence des arbres 4 ☐ La prière, sacrifice (Allah) 5 ☐ L'entente des personnes (au sein du village) influence Allah et donc la pluie 6 ☐ Le programme pluie provoquée 1 ☐ Augmente la pluie 2 ☐ Diminue la pluie 7 ☐ Personne/rien ne peut l'influencer 8 ☐ Autre à préciser _____

2. Village Questionnaire

Questionnaire village

1.	Nom du village	_____
2.	Nom du chef de village	_____
3.	Date ou période de création du village	_____ (année)
4.	Accessibilité : Comment est la voie principale d'accès au village ?	1 ☐ Route bitume / goudron 2 ☐ Route latéritique / terre rouge 3 ☐ Piste 4 ☐ Autre à préciser _____
5.	Caractère d'accessibilité	1 ☐ Permanente 2 ☐ Temporaire
6.	Fréquence des véhicules de transport desservant le village	1 ☐ Quotidien 2 ☐ Quelquefois/par semaine 3 ☐ Hebdomadaire 4 ☐ Rarement/pas souvent
7.	Ethnie fondatrice du village	1 ☐ Wolof 2 ☐ Peulh 3 ☐ Bambara 4 ☐ Dogon 5 ☐ Autre
8.	Principale langue parlée dans le village	1 ☐ Wolof 2 ☐ Peulh 3 ☐ Bambara 4 ☐ Dogon 5 ☐ Autre
9.	Existe-t-il une école (fonctionnelle) dans le village ?	1 ☐ Non ➔ **Passez à la question 12** Distance à laquelle se trouve l'école la plus proche _____ (en km) 2 ☐ Oui

10.	Il s'agit de quelle(s) école(s) ?	1 ☐ École coranique 2 ☐ École arabe 3 ☐ École publique 1 ☐ École primaire 2 ☐ Collège Distance à laquelle se trouve le *collège* _____ (en km) Distance à laquelle se trouve le *lycée*_____ (en km) 4 ☐ Autre, _____
11.	***S'il existe une école au village :*** Depuis quand existe l'école (niveau plus élevé) ?	Depuis _____ (année)
12.	Existe-t-il un centre de santé dans le village ?	1 ☐ Aucun 2 ☐ Case de santé 3 ☐ Poste de santé 4 ☐ Centre de santé Distance du centre de santé le plus fréquenté par les habitants village _____ (en km)
13.	Existe-t-il un marché (hebdomadaire) dans le village ?	1 ☐ Oui 2 ☐ Non, Où et à quelle distance se trouve le marché le plus fréquenté par les habitants village? à _____ (ville/village) _____(en km)
14.	Quelle est la source principale d'approvisionnement en eau potable au village?	1 ☐ Marigot, rivières, fleuves 2 ☐ Puits traditionnel 3 ☐ Puits moderne 4 ☐ Forage/pompe villageoise 5 ☐ Forage/robinet public 6 ☐ Eau courante (robinet) privé 7 ☐ Autre à préciser : _____
15.	Est-ce que le village est électrifié ?	1 ☐ Oui 2 ☐ Non
16.	Est-ce qu'il y avait des projets de développement dans le village dans les dernières 5 années ? (ONG, gouvernement, privé, etc.)	1 ☐ Non 2 ☐ Oui

17.	Si Oui : Lesquels ? (notez nom, secteur, bailleur de fonds, initiateur(s))	1) Nom : _____ Secteur/description :_____ Bailleur de fonds/Initiateur(s) :_____ 2) Nom : _____ Secteur/description :_____ Bailleur de fonds/Initiateur(s) :_____ 3) Nom : _____ Secteur/description :_____ Bailleur de fonds/Initiateur(s) :_____
18.	Quand est-ce que la première personne du village est partie pour travailler ailleurs ?	_____ (année) Si réponse exact n'est pas possible : 1 ☐ Avant de l'indépendance 2 ☐ Pendant les années 1960 3 ☐ Pendant les années 1970 4 ☐ Pendant les années 1980 5 ☐ Pendant les années 1990 6 ☐ Il y a environ dix ans 7 ☐ Ca ne date même pas 5 ans
19.	Le nombre des personnes qui sont partis du village (perma-nemment/temporairement) dans les 5 dernières années a-t-il …	1 ☐ Augmenté 2 ☐ Stable 3 ☐ Diminué 4 ☐ Je ne sais pas
20.	Y a-t-il des femmes qui quittent votre village pour aller ailleurs (pas mariage)? *Demandez s'il est interdit !*	1 ☐ Oui, quelques-uns (rare) 2 ☐ Oui, c'est fréquent 3 ☐ C'est interdit au village 4 ☐ Non
21.	Si oui : Quand est la première femme (non mariée) du village partie pour travailler d'ailleurs ?	_____ (année) Si réponse exact n'est pas possible : 1 ☐ Avant de l'indépendance 2 ☐ Pendant les années 1960 3 ☐ Pendant les années 1970 4 ☐ Pendant les années 1980 5 ☐ Pendant les années 1990 6 ☐ Il y a environ 10 ans 7 ☐ Ca ne date même pas 5 ans
22.	Y a-t-il des familles entières qui ont quitté votre village dans les 5 dernières années pour aller s'installer ailleurs définitivement?	1 ☐ Oui 2 ☐ Non

3. List of Publications

The publications five, six, ten, eleven, and twelve are not part of this dissertation.

(1) Van der Land, Victoria, Clemens Romankiewicz, and Kees van der Geest. 2018. "Environmental Change and Migration: A Review of West African Case Studies." In *Routledge Handbook of Environmental Displacement and Migration*, edited by Robert McLeman and François Gemenne, 163–77. Cambridge: Routledge.

(2) Eklund, L., C. Romankiewicz, M. Brandt, M. Doevenspeck, and C. Samimi. 2016. "Data and Methods in the Environment-Migration Nexus: A Scale Perspective." *Die Erde* 147 (2): 139–52. doi:10.12854/erde-147-10.

(3) Romankiewicz, Clemens, Martin Doevenspeck, Martin Brandt, and Cyrus Samimi. 2016. "Adaptation as By-Product: Migration and Environmental Change in Nguith, Senegal." *Die Erde* 147 (2): 95–108. doi:10.12854/erde-147-7.

(4) Romankiewicz, Clemens, and Martin Doevenspeck. 2014. "Climate and Mobility in the West African Sahel: Conceptualising the Local Dimension of the Environment and Migration Nexus". In *Grounding Global Climate Change*, edited by Heike Greschke and Julia Tischler, 79–100. Dordrecht: Springer. doi:10.1007/978-94-017-9322-3.

(5) Romankiewicz, Clemens; Doevenspeck, Martin (2014) Klima, Umwelt und Migration im westafrikanischen Sahel. In: G. Obermaier (Hrsg.) *Folgen des Klimawandels*. Bayreuther Kontaktstudium Geographie, Band 8, 15-34.

(6) Romankiewicz, Clemens; Hummel, Diana; Liehr, Stefan; Van der Land, Victoria; Doevenspeck, Martin; Samimi, Cyrus; Brandt, Martin (2014) Klimawandel, Umweltveränderungen und Migration im Sahel: Sozial-ökologische Bedingungen von Bevölkerungsbewegungen am Beispiel der Sahelländer Mali und Senegal (micle). BMBF, Schlussbericht. Frankfurt am Main

(7) Brandt, Martin, Clemens Romankiewicz, Raphael Spiekermann, and Cyrus Samimi. 2014. "Environmental Change in Time Series – An Interdisciplinary Study in the Sahel of Mali and Senegal." *Journal of Arid Environments* 105: 52–63. doi:10.1016/j.jaridenv.2014.02.019.

(8) Romankiewicz, Clemens, and Martin Doevenspeck. 2013. "Migration und Umwelt im westafrikanischen Sahel: Methodische Überlegungen." In *Migration und Umwelt*, edited by C. Felgentreff and P. Aufenvenne, IMIS, 81–96. Osnabrück.

(9) Müller, Angelo, and Clemens Romankiewicz. 2013. "Mobilität zwischen westafrikanischer Freizügigkeit und europäischer Grenzziehung." *Geographische Rundschau* 65 (9): 12–18.

(10) Doevenspeck, M., and C. Romankiewicz. 2013. "Book Review 'Migration and Climate Change.'" *Geographica Helvetica* 67 (4): 233–34. doi:10.5194/gh-67-233-2012.

(11) Brandt, M., Samimi, C., Romankiewicz, C. & R. Spiekermann (2012): Detecting environmental change using time series, high resolution imagery and field work – a case study in the Sahel of Mali. Geophysical Research Abstracts, Vol. 14, EGU2012-10583, EGU General Assembly 2012.

(12) Romankiewicz, Clemens (2012) Focus Mali. In: Hummel, Diana, Doevenspeck, Martin, Samimi, Cyrus (Eds.) *Climate Change, Environment and Migration in the Sahel. Selected Issues with a Focus on Senegal and Mali*. micle working paper no. 1, Frankfurt am Main.

(§8 Satz 2 Nr.3 PromO Fakultät)
Hiermit versichere ich eidesstattlich, dass ich die Arbeit selbstständig verfasst und keine anderen als die von mir angegebenen Quellen und Hilfsmittel benutzt habe (vgl. Art.64 Abs.1 Satz 6 BayHSchG).

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Hiermit erkläre ich, dass ich die Dissertation nicht bereits zur Erlangung eines akademischen Grades eingereicht habe und dass ich nicht bereits diese oder eine gleichartige Doktorprüfung endgültig nicht bestanden habe.

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Ort, Datum, Unterschrift