Cycles of Vulnerability and Migration: A Case Study of Migration and Climate Variability in the Niono District of Mali

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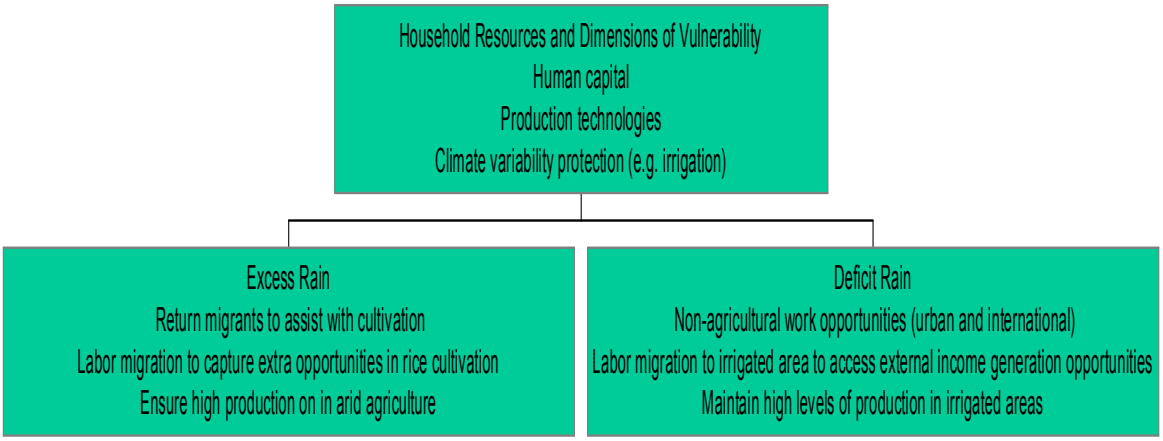
Introduction

Vulnerability to long-term economic cycles is much anticipated in the Sahel, and the region has developed adaptations to cope with these swings. A major response to this type of structural vulnerability has been livelihood diversification through international migration. [2, 4, 12, 18] In contrast, climate variability poses an unpredictable, short-term threat to livelihoods in in the Sahel. [21, 22] Unlike eastern and southern Africa, which is affected by the El Nino System (ENSO), the Sahel's climate is determined by the Atlantic dipole and the Inter-tropical Convergence Zone (ITCZ) system of storms.[10] The climate in this region varies substantially on year-to-year and multi-year timescales. The region's severe droughts of the early 1970's and 1980's attracted widespread attention and resulted in major international initiatives to mitigate their impact. Averaged over 30-year intervals, annual rainfall across the Sahel fell by between 20 and 30 per cent between the pre-independence period (1930s to 1950s) and the decades since (post-1960s). Short-term fluctuations in the rainfall produce drought and famine. Against the background of continually falling average annual precipitation, the negative precipitation anomalies have had a devastating impact on food production, as evidenced in the periods 1968-1973 and 1983-85. [23, 24] These fluctuations in annual rain are governed by the movement of the ITCZ, which moves north–south with the seasonal progression of the overhead sun and reaches its maximum northward extent in July/August and its minimum in January. The movement of the ITCZ's northern extent is not regular and short-term oscillations of as much as 500-1000 km may occur over a few days causing frequent erratic starts to the rainy season. Thus, in the Sahel, long-term, structural vulnerability is further exacerbated by the short-term variations in production related to climate variations.

Faced with both chronic and short-term fluctuations in income, families and communities throughout the Sahel have developed a wide range of coping mechanisms to offset both the gradual and persistent encroachment and the short-term variations on livelihoods. Figure 1 outlines the conceptual model for this integrated response to economic and climate swings.

Figure 1: Conceptual model for Incorporating Migration as a Response to Climate Variability in the Context of Chronic Economic Vulnerability



This paper reports on a case study of a community in Mali where the region maintains an irrigation system to enable access to alternative crops and markets (attempting to address the structural threats) as well as family-based coping strategies, including a diverse migration patterns. We show

how the presence of the irrigation system greatly alters the coping patterns, compared to similar regions in Mali and the Sahel, in particular enabling a very high level of short-term circulation, which enables families to maintain adequate resilience so that they can continue to live in the region.

Study setting: Niono, Mali

The study site is the district of Niono, in the region of Segou, Mali, located 330 km northeast of Bamako, centered at 14.15 degrees North and 6.00 degrees West and 100 km north of the Niger River. This district has been selected because of the potential for climate-related variability in rainfall and temperature. Rainfall records for Niono show significant climate variability. The last decades have seen wide fluctuations in the rainfall, with negative anomalies for 10 of the 30 years and positive anomalies in 6 of the years.

Niono affords the opportunity to study the nature of household adaptations to different livelihood threats through interactions in an irrigated zone, namely the 50,000 hectares managed by Office du Niger along the Canal du Sahel, fed by the Niger River. This irrigated area attracts migrants from the nearby Sikasso Region, as well as from Nara, Goundam and the areas to the north of Niono. In addition, many households in Niono send members to work in the irrigated areas, particularly during the planting and harvesting seasons.

Niono is also located in the region of Segou. A year-round road links Niono to Segou, the regional capital and the second largest city in Mali. There are several major agricultural development projects, including programs for irrigated rice, cotton, and sugar cane. These activities generate a strong labor demand, and the in-migration rate to the Segou region, in which Niono is located, is second only to that for Bamako. The 1998 census shows above average in-migration rates to the central, irrigated sections of Niono, while there was high out-migration from the dry northern zones. [29]

Selection of the Study Villages

We purposefully selected 11 villages that are located in three of the major ecological – production zones found in Mali: the semi-desert area (agro-pastoralism dominates), the central irrigated zone, and the savannah zone, with a mixed agricultural economy. The villages selected in the irrigated zone span the North-South gradient of the irrigated zone, located between 15° N and 13° N. In the dry, northern zone we expected to find the most common Sahelian production patterns : millet with ground nuts and legumes, small scale pastoralism. In the irrigated villages, especially those closer to the town of Niono, we expected to find rice cultivation to be dominant. In the southern dry zones, the rainfall levels were higher, generating a higher level of millet productivity than in the northern dry zone villages. The areas in which these villages are located have striking differences in their peak July-August-September 1997 and July-August-September 1999 rainfall amounts, as reported by the Famine Early Warning System for Mali (FEWS). The rains in 1997 were at least half a deviation below the decade average for August, but in 2 districts the rain deficit was one standard deviation below average. The opposite held for 1999, an exceptionally rainy year, with dry and wet years alternating for 2000-2002.

Methods

In October 2001, we initiated baseline observations in six study villages, and in January 2002 we added 5 more villages, for a total of 11. The final round of interviews was conducted October 2002. We interviewed one randomly selected household per compound in each villages, resulting in a sample size of 382 households with 4755 members. The baseline surveys obtained a listing of all family members, recent demographic events (births, deaths, migrations), the family migration history, agricultural production in the recent past, socio-economic status, and illness episodes in the past month and selected health behaviors. The baseline survey included several questions about the known deficit (1997) and excess rain (1999) years, as well as details about the 2000 and ongoing 2001 production season. We re-interviewed 75% of the household heads (n=288). At the follow-up surveys, we obtained details on changes in household composition, detailed information on migrations

in the intervening period, and details about births, deaths, and illness episodes for children under age 5. The household characteristics derive from the baseline interviews conducted in October 2001, while the migration information comes from the migration questions in all three rounds and is observed prospectively, from 2001 forward.

We used three categories of migration: in-migrant, out-migrant, and circular migrant. In-migrants were persons who were not resident in the household at the baseline survey who had become members of the household, even temporarily. Out-migrants were defined as persons who had moved out of the household and were not present at the time of the repeat visit. For each person changing residence between the visits, the household head was asked if the migration was definitive. If not, and if the person was absent (or immigrant) for a period of less than 6 months, the migration was defined as circular or temporary.

Data were linked by household and individual member to create records containing observations from all three rounds. For this paper we present a household level analysis, which associates different patterns of migration to/from each household with the household's production characteristics. All analyses were performed with SPSS 10. We used bi-variate analyses for the initial assessment of relations between household production, climate variability and migration, and then logistic regression to assess the relations controlling for relevant household characteristics. F-statistics and Odds Ratios were used as statistical tests of significance.

Results

Almost half (43%) of the households had at least one migrant, and half (46%) of the households with migrants had members who had migrated relatively short distances, to other villages in Niono. The vast majority of migrants were circular, with 87% returning or planning to return to their family in the village. The households averaged 1.0 in-migrants and 1.5 out-migrants, regardless of duration, out of an average household size of 13.

Production has varied from year to year, and the very dry year of 1997 was evidenced in production deficits for 26% of the families, with almost all of those experiencing shortages located in the villages with little or no access to controlled irrigation from the Office du Niger, where two-thirds (68-69%) of the families reported a deficit. In 1999, a rain excess year, the total grain production per household was 1270kg for families with access to irrigation, compared to 1550kg for families with no access to irrigation. In contrast, in 2000, a rain deficit year, grain production was 1470kg for households with access to irrigation and falling to 1200kg for families with only dry cultivation.

Households without access to irrigation had consistently lower standards of living than households with access to irrigation. Across the diverse measures of living standard, households with access to irrigation had a higher level of living: they are 10-15% more likely to have a radio, bicycle, motorbike, mud brick roof, private latrine, and access to a drilled deep well.

Different levels of household migration were associated with access to irrigation. Half (51%) of the households without migrants had access to irrigation, compared to 80% of the households with in-migrants and 90% of the households with circular migrants. In contrast, only 40% of the households with out-migrants had access to irrigation. ($F = 8.8$, $p.<.001$).

Migration status of household members was associated with significant differences in agricultural production. Those with the highest production levels were the households with in-migrants, followed by those with circular migrants. Two migrant groups (in-migrant and circular migrant) had higher levels of production self-sufficiency than households with no migrants or those with out-migrants. Their standard of living was significantly higher than the households with out-migrants or non-migrants.

Conclusions and Future Research

Our study illustrates a potential cascading impact of climate variability on the livelihoods of families in Niono, and the potential for irrigation to facilitates alternative adjustments to the climate

related changes in agricultural production. Households with access to irrigation had higher standards of living than those without such access to irrigation, but both households were subject to production variability associated with climate variability. The patterns of migration from these households show that migration may be a critical link allowing families without irrigation to compensate for anticipated production losses in a rainfall deficit year by moving to the irrigated zone. During an excess rainfall year, families with irrigation appear to have been less successful at buffering their losses, probably because the floods were not anticipated and there were fewer options available, but also because their usual migration adaptation is to receive circular migrants. In rain excess years, this strategy did not work and many found themselves sending out migrants instead of receiving them.