

Drought Survival Tactics of Subsistence Farmers in Niger

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Previous research into drought-response tactics has tended to be undertaken after the fact, and hence has been forced to be impressionistic. This study quantifies the importance of farmer drought-response strategies in south-central Niger based on a survey which began during the drought of 1984. Livestock sales, food aid, temporary migration, remunerative non-agricultural activities, and loans were the principal drought-survival tactics employed

KEY WORDS: drought; Sahel; Niger; subsistence; household survey.

INTRODUCTION

Research into farmers' drought-response measures tends to be undertaken after the fact. Although retrospective studies have offered an exhaustive list of drought-response tactics employed, they fail to demonstrate the relative importance of the different measures pursued. Begun before the Sahelian drought of 1984, the purpose of this study is to identify and measure the relative impact of drought-survival tactics practiced by peasant farmers in south-central Niger.

Drought is a regular phenomenon in semi-arid climates. Not only are farmers accustomed to it, it is central to their economic planning. A peasant household in a drought-prone environment is chiefly concerned with insuring its survival. Two general strategies are followed in order to achieve this: (1) the household seeks to minimize the risk of failing to produce its means of subsistence, and (2) it seeks to limit its losses following a production failure (Binswanger, Jodha, and Barah, 1979).

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Risk-minimization strategies followed in semi-arid environments may include crop diversification, the mixing of crop and livestock enterprises, intercropping, staggered plantings, planting large land areas, and under-investment in risk-augmenting modern inputs, to name a few. Such strategies are discussed in depth elsewhere (Balcet and Candler, 1982; Binswanger *et al.*, 1979; Lynam, Sanders, and Mason, 1986; Roumasset, Boussard, and Singh, 1979; Sanders and de Hollanda, 1979; Swinton, 1985).

Loss management aims to insure the survival of the household and its productive capacity (Jodha, 1978). Jodha has pointed out that farm households in semi-arid environments habitually undergo cycles of asset depletion and replenishment. Assets accumulated when agricultural conditions are favorable may be considered equivalent to insurance. In this sense, a household successfully survives a drought if it can retain intact all its productive assets (including the family labor supply) solely by cutting back on ceremonial forms of consumption and by liquidating nonproductive assets. Since the depletion of productive assets jeopardizes the continued existence of the household, the process demands close scrutiny to see how farm households manage losses and to determine how their chances for survival could best be improved. Although the data are drawn from a fairly small geographic area, the drought-response tactics used will be shown to be typical of those employed by farmers in Sahelian Africa and share similarities with other semi-arid regions in Africa and India.

MANAGING DROUGHT-INDUCED FOOD DEFICITS

When drought reduces a harvest to below the subsistence threshold for a peasant household, a number of avenues exist for making up the deficit. Watts has characterized the measures followed by the Hausa of northern Nigeria as a continuum increasingly demanding of domestic resources and decreasingly reversible in consequences (Watts, 1983). The accounts given by him and by van Apeldoorn (1981) of the Hausa response to the 1973-1974 drought in northern Nigeria cover virtually all of the measures mentioned by other writers discussing that drought in Africa (Campbell, 1984; Campbell and Trechter, 1982; Hankins, 1974; Kgathi and Opscheer, 1981; Lallemand, 1975; Shepherd, 1984; Silberfein, 1984; Wisner and Mbithi, 1974). The initial reactions involve foregoing special kinds of consumption and intensifying habitual dry-season income-generating activities, such as: (1) suspension of unnecessary consumption, e.g., ceremonies, (2) gathering of "famine foods" from the natural environment, (3) dry-season gardening, (4) the sale of gathered hay and wood, (5) sales of handicrafts, (6) borrowing of grain from kin, and (7) temporary migration for wage labor.

The second group of response measures explicitly involve the management of asset losses. These include: (1) livestock sales, (2) borrowing from merchants (often with land serving as collateral and its usufruct serving as loan interest), (3) selling domestic assets, (4) selling land, and (5) permanent emigration.

In addition, members of many households simply eat less. Many also receive food aid; however, this does not generally require individual sacrifices beyond being present when and where the food distributions are taking place.

Although there may seem to be a wide range of alternatives, in practice, only a few have a significant impact and others are options only for specific locations. Dry-season gardening, for example, is viable only where there exist accessible reserves of irrigation water or substantial residual soil moisture. Both of these are the exception rather than the rule in the Sahel. Other options are practical only in areas of low population density; this is true of the gathering of wild vegetation and wood, as well as of hunting and fishing. However, the dramatic increases in population density since the onset of European colonization in West Africa are sharply curtailing the viability of this option (van Apeldoorn, 1981; Lallemand, 1975). In southern Maradi, population density had reached 35–100 inhabitants per square kilometer on the better agricultural soils by the early 1970s (Raynaud, 1975). Aerial photographs demonstrate that between 1957–1975, open bush land around Maradi villages in the more populous, better agricultural areas had been almost completely displaced by cultivated fields (Raynaud, 1983; Stigliano, 1980).

Many observers believe that the expansion of the capitalist economy since the nineteenth century has tended to weaken the mutual self-help and charitable measures characteristic of the traditional “moral economy” of village social structures on the Sahelian fringe (van Apeldoorn, 1981; Baier, 1980; Raynaud, 1975; Watts, 1984). While all the current options were open to the farm household in those days (except perhaps for wage labor), Watts (1983) argues that there existed stronger charitable obligations within the community, stronger patron–client ties, and a state government more sensitive to coping with drought than were the colonial governments. Because disaster-stricken households could turn to local notables and rely more strongly on communal moral obligations, they were less likely to be forced to liquidate their own productive resources to an unreplenishable level (Raynaud, 1975). Jodha (1978) has observed similar trends in Rajasthan, India.

If charity and mutual self-help are no longer significant options, then there remains little else but to migrate temporarily for wage labor, to sell assets, or to borrow (usually against a fixed asset). An overview of drought-response studies suggests that capital ownership is the key variable in determining how farmers respond to drought in semi-arid agricultural areas. But

only for India do there exist quantitative data on the liquidation of assets to meet household subsistence needs (Jodha, 1978). None of the literature consulted on drought response in Africa quantifies the contributions of different tactics to household income (and thereby nutrition). Without this information, it becomes impossible to determine the relative importance of different responses and hence the policy measures likely to have the most beneficial impact on the existing system. Fortunately, household budget studies from central Niger are available to give benchmarks on income and expenditures during less penurious years (Arnould, 1982; Nicolas, 1986; Sutter, 1982).

METHODOLOGY AND SETTING

This study examines how farmers in south-central Niger survived the 1984 drought. It draws upon panel data from a weekly survey of farm transactions carried out during the year from June 1984 to September 1985, plus farm inventories taken in June of 1984 and 1985. The 75 farms surveyed are evenly distributed among three villages in Madarounfa *arrondissement*. Of the three villages, 100% of the farm households were Hausa in two (Maugéro and Rigial Oubandawaki), while in the third (Kandamao), 83% were Fulani and 17% Hausa when a village census was taken in April 1984. The data were collected by the rural economics research department of the National Institute of Agricultural Research of Niger (INRAN; Swinton and Mamane, 1987a).

The villages are located in the Sudano–Sahelian zone, and receive a mean annual rainfall similar to that of Maradi (570 mm, 24 inches), as shown in Fig. 1. However, the mean over the last 20 years has been only 430 mm. The coefficient of variation in rainfall was 0.25 for the 53 years up to 1983 at the city of Maradi, 40 km north of the center of the study zone (Koechlin, 1980; Service Départemental de la Météorologie de Maradi, personal communication). Assuming a *t*-distribution, this means that there is one chance in 40 that rains will not attain the 300 mm generally considered to be the minimum in order to insure a good millet crop.

Because typical rainfall is higher than in most of the rest of the country, and because soils are sandy and easy to cultivate, the zone is relatively densely populated. Median farm size was 4.6 hectares, the land being farmed by families averaging seven members, including two to three children under age ten (Swinton, 1985). These figures are consistent with other descriptive statistics on rainfed farming in the vicinity (Eddy, 1979; Hill, 1972; Legal, 1985; Raynaut, 1980; Sutter, 1982), although Arnould (1982) found somewhat larger farms in Zinder.

Millet is the most important crop, present on 88% of the cultivated land in 1984 (Swinton, 1985). Sorghum and cowpeas, which are typically in-

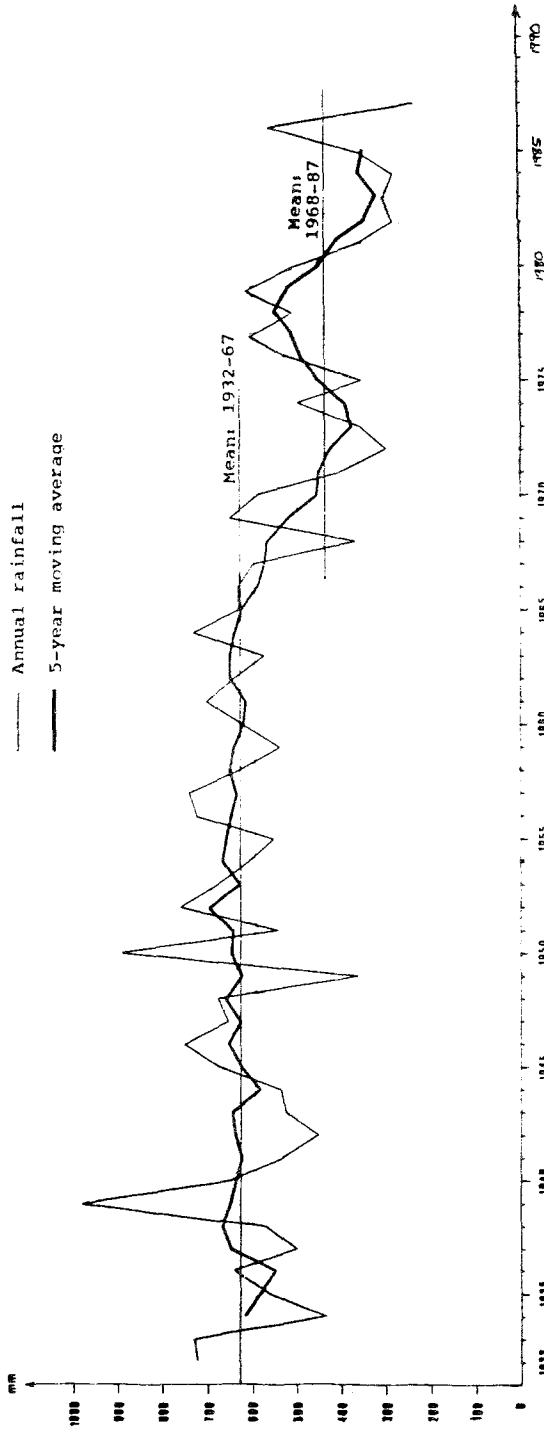


Fig. 1. Annual rainfall in Maradi, Niger, 1932-1987 (adapted from Koehnlin, 1980).

Table I. Mean and Median Livestock Holdings per Farm in Three Madarounfa Villages in Niger in 1984^a

Type of animal	Village						
	Kandamao		Maugéro		Rigial Oubandawaki		All villages Mean
	Mean	Median	Mean	Median	Mean	Median	
Cattle	3.2	1	1.0	0	1.8	1	2.0
Goats	3.1	3	3.6	3	9.2	9	5.3
Sheep	2.5	2	1.5	0	5.4	3	3.2

^aSource: Swinton (1985, p. 21).

tercropped with millet, are of secondary importance. Peanuts were an important cash crop, but have been declining in importance since the mid-1970's due to reduced rainfall and disease problems. Cowpeas have largely supplanted peanuts as the principal cash crop of the region. Certain minor crops are locally important: on valley soils with high water-retention capacity, maize and tobacco are grown; in certain villages, sesame, nutsedge, and sorrel (roselle) may also enter the cropping pattern.

Cattle, sheep, and goats are by far the most important means of wealth storage and reproduction in the surveyed villages (Swinton, 1985). Ninety percent of the households surveyed owned at least one of these. Goats appear to be the vehicle of wealth storage *par excellence*, as they are kept primarily for their meat and resale value, and only secondarily for their milk. They are the only species owned in significant numbers by women. Being browsers, they are particularly well adapted to survive drought conditions. Over three-quarters of the farms surveyed own goats, with village medians ranging from 3–9 per farm (Table I).

Ownership of sheep was slightly less widespread, median village holdings ranging from 0–3 per farm and owned by 57% of the farms sampled. Besides storing wealth, rams have an important ceremonial function as the preferred animal for ritual slaughter at the Muslim feast of Tabaski. Although sheep will browse bushes under duress, they are chiefly grazing animals, and as such less well adapted to drought conditions. Both sheep and goats reproduce frequently, twice a year under good conditions, and because of their smaller size, they are easier to sell than cattle.

Cattle are each worth 5–10 times the value of small ruminants, and so are an important form of wealth despite their smaller numbers. They are particularly important to the Fulani people, and proved the most numerous livestock in the Fulani village of Kandamao. Because Fulani culture honors cattle and places a high nutritional value on cows milk, cattle fill other more important functions than simply to store wealth. Among both the Hausa and the Fulani, cattle are also kept as a source of traction power. Because they

must graze large amounts of forage and will not browse, they are the least adapted to drought of the three livestock species. This weakness means that in time of drought their price drops more precipitously than that of sheep or goats.

It is no accident that farmers accumulate wealth mostly in the form of livestock. In a culture where peer pressure to redistribute wealth is strong, people are drawn to nonliquid assets. Land ownership and financial assets are essentially not options. Legally, all rural land belongs to the state. By custom, usufruct rights are granted to the person who clears land and makes it productive (Raynaut, 1975, 1988). These rights are subsequently controlled by the household head and passed from one generation to the next. Rights of use are occasionally used as collateral for informal loans among villagers, and outright (albeit unofficial) sales appear to be on the rise (Arnould, 1982; Raynaut, 1988; Sutter, 1982). However, land is still not widely viewed by farmers as an investment asset. A recent increase in land investment appears to come from urban civil servants and merchants (Raynaut, 1988). Financial savings are not common among farmers, as banks lack rural branches, and informal savings societies are not widespread (Cuevas, 1986).

FARMER RESPONSE TO THE DROUGHT

Nineteen-eighty-four was the kind of year farmers plan against. At less than half normal rainfall, the season was a one-in-forty disaster. Worse yet, a dry spell struck during what is normally the rainiest month, August, when millet, cowpea, and peanut flower and are at their most vulnerable. Millet, the staple crop, yielded 150 kg per hectare,² one-third of its normal yield. Instead of providing enough grain to feed two adults, a hectare yielded less than enough for one. Yet other crops yielded virtually nothing (see Table II). Low grain yields were accompanied not only by low hay production, but also by poor pasture growth generally.

Although drought is a cyclic phenomenon in the Sahel, it is becoming harder to withstand. Declining rainfall since 1970 has been undermining yields at the same time that increasing population pressure has made open land less available to increase cereal production extensively (Painter, 1985; Raynaut, 1975, 1983; Stigliano, 1980). Consequently, grain stocks have declined to the point where most households lack enough grain to survive until the next harvest without purchasing from the market (Norman, Newman Ouédraogo, 1981; Painter, 1985; Raynaut, 1983; Sutter, 1982). Arnould (1982) found that in the late 1970's, two Zinder villages had cereal deficits

²This amounts to roughly the same number of pounds per acre.

Table II. Mean Yields from 515 Madarounfa Fields in Niger in 1984*

Crop	Fields observed	Yield (kg/ha)
Millet	374	149
Sorghum	220	10
Cowpea (grain)	203	15
Peanut (unhulled)	37	33
Sesame	11	18
Cowpea hay	197	28
Peanut hay	35	86

*Source: Swinton and Mamane (1987a, p. 2).

averaging 4–6% of consumption needs, while Sutter found the mean deficit to be 25% in two different Zinder villages in 1977–1978.

Following a normal harvest, farmers typically sell no more than 10% of their grain (Berg *et al.*, 1983; Raynaut, 1975; Sutter, 1982), but virtually all of their cash crops to pay off loans and buy household necessities. Charitable and social obligations also claim a large portion of the family budget, although some of this giving is reciprocated (Arnould, 1982; Nicolas, 1986; Sutter, 1982). During a normal year, grain production at least approaches family subsistence needs for the average household, and many of the above objectives can be attained with a modest amount of off-farm work.

But in September 1984, peasant households in Madarounfa villages faced a different picture. Most lacked sufficient grain even to feed themselves until the next planting. Grain prices, which normally drop sharply at harvest, fell hardly at all from their record high levels. Cash crop prices, too, stayed high, reflecting the poor harvest. Meanwhile, meat prices plummeted in response to heavy selling by pastoralists further north who had realized by July that the rangeland had not grown enough pasture to support their herds for another year (Projet Elevage Intégré, 1985).

ASSET SALES

Examination of farm transactions over the year following the 1984 harvest shows a general tendency to sell livestock and buy cereals (Figs. 2–4). In recent “normal” years, farm households in southern Niger purchased the equivalent of 4–8% of their total production of millet and sorghum (Arnould, 1982; Berg *et al.*, 1983), although some studies have found higher levels (Sutter, 1982). But in 1984–1985, farmers in the three Madarounfa villages bought an amount of millet and sorghum equal to 35% of their production, not counting gifts and government aid received. To obtain the money they

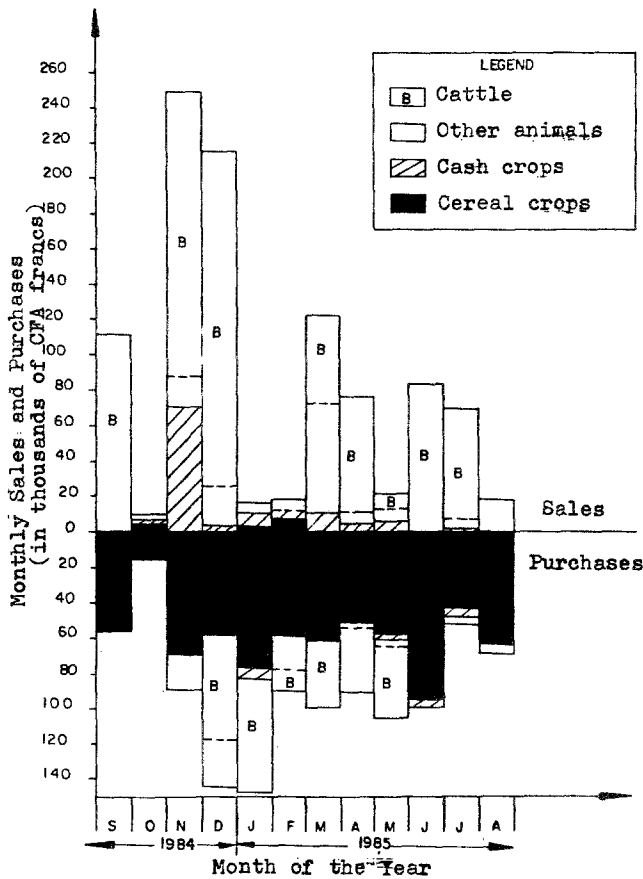


Fig. 2. Financial balance sheet for the agricultural transactions of 25 farms in Kandamao, 1984-1985.

needed to buy cereals, they sold cash crops and livestock. The chief cash crops were peanut, cowpeas, and sesame. However, low production of all three meant poor sales, income that was rapidly consumed in the months immediately after harvest. The three graphs are denominated in terms of the value of total monthly sales and purchases for the 25 households monitored in each village. Because they are measured in terms of money, they do not correspond directly to volume, since cereals prices rose and livestock prices fell during the year. They omit wage income and noncash transactions, including gifts and food aid.

Upon closer scrutiny, the transactions can be divided roughly into three phases of drought response. During the period immediately after harvest (Sep-

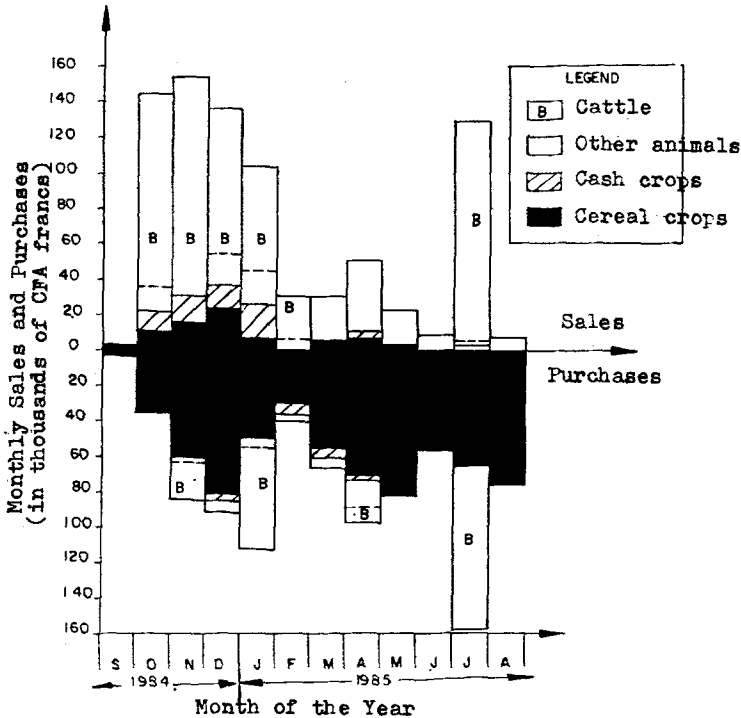


Fig. 3. Financial balance sheet for the agricultural transactions of 25 farms in Maignuéro, 1984-1985 (large livestock sales in July are due to the sale and purchase of three cattle by the same farm).

tember to December 1984), farmers prepared for the hard times ahead by selling livestock, especially cattle. In so doing, they may have sought to cut herd size to levels their resources could support without risk of loss. For decades, human population growth has been reducing the area of fallow grazing lands around villages in the agricultural zone of south-central Niger (Raynaud, 1975, 1983; Stigliano, 1980). Scanty rains left inadequate pasture and poor hay production. The high prices for peanut and cowpea hay meant that feeding was generally not a viable option.

Since destocking cattle was a virtual necessity to begin with, many farmers, particularly the Fulanis, reinvested that wealth in cereals. From a portfolio-balance standpoint, this strategy was prudent even though meat prices were already low and cereal prices relatively high (Projet Elevage Intégré, 1985). During a serious drought, the meat/cereal price ratio will only get larger until it becomes evident that the next rainy season will be a good one or else until very few animals remain alive. As a portfolio readjustment tactic, selling small ruminants made sense too. However, there is little evidence that transactions were motivated by income-maximization objectives.

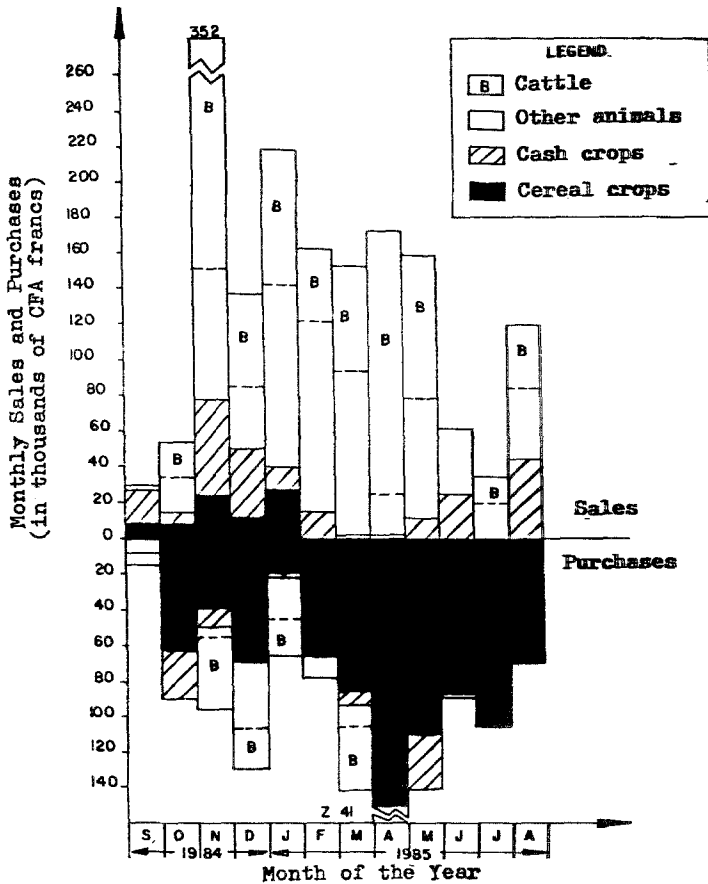


Fig. 4. Financial balance sheet for the agricultural transactions of 25 farms in Rigial Oubandawaki, 1984-1985.

The second phase of farmers' response to the drought was to wait it out. From January to March, sales, purchases or both slackened off in all three villages. Only in Rigial Oubandawaki, the village worst hit by the drought, did substantial sales of livestock continue.

A comparison of monthly livestock sales and cereal purchases suggests that the former tended to finance the latter (Table III). The table shows that with one exception, in all three villages, most farms that sold livestock purchased grain during the same month. Breaking down the figures, it would appear that farms which sold their cattle and small ruminants early (as cattle sellers did in Maignéro) were less likely to reinvest that money immediately in grains. By contrast, those who sold later tended to do so in order to get

Table III. Percentage of Those Farms that Sold Animals which Bought Cereals during the Same Month on 75 Madarounfa Farms in Niger in 1984^a

Village	Cattle		Sheep/goats	
	N ^b	Percent	N ^b	Percent
Kandamao	17	82	26	54
Maiguéro	10	0	38	66
Rigial Oubandawaki	17	53	81	58

^aSource: Swinton and Mamane (1987a, p. 7).

^bN indicates the number of months during which individual farms sold animals. Thus, a farm which sold seven goats in 1 month is counted once, whereas a farm which sold one goat per month for 7 months is counted seven times.

Table IV. Changes in Mean Level of Non-Agricultural Work and Temporary Migration from 1983–1984 and Mean Inventories of Animal Traction Tools from 1984–1985 on 25 Farms in Each of Three Madarounfa Villages in Niger^a

Village	Non-agricultural work activities by household members		Person-months on temporary migration		Inventory of animal traction tools	
	1983	1984	1983	1984	6/84	6/85
Kandamao	2.1	1.7	0.1	0.7	0.7	0.8
Maiguéro	1.7	1.6	0.6	0.9	0.9	0.5
Rigial Oubandawaki	1.4	2.9	0.8	2.5	1.8	1.9
Mean totals	1.7	2.1	0.5	1.4	1.1	1.1
Percent change		+ 24%		+ 180%		- 6%

^aSource: INRAN survey data and Krause (personal communication).

the means to buy cereals. The Fulani village, which places a very high premium on keeping cattle, sold cattle rarely, except in exchange for cereals. By contrast, in the two Hausa villages, a larger proportion of cattle were sold outright without the purchase of grain. In these villages, cash for cereals purchase was more frequently provided through sales of goats and sheep.

During this period, non-agricultural work and temporary migration reached their peak. Compared with the 1983–1984 dry season (which also followed a relatively poor harvest), the mean number of non-agricultural work activities by household members rose by 24% (Table IV). This occurred despite the weak local demand for handicrafts and prepared food typical of cash-poor villages after the drought. More dramatic was the 180% leap in time spent on temporary migration to neighboring Nigeria. Because respondents were loath to report their cash earnings, it was not possible to estimate income from these pursuits. Most immigrants returned to their home villages

by May to prepare for planting. However, six of the 75 households surveyed (all semi-nomadic Fulanis) emigrated permanently.

By April, most farms' grain stocks were running low. To meet subsistence needs during the April to August period, more farmers sold small animals and all received food aid. From January onwards, 75% of the farms which sold goats and sheep in Rigial Oubandawaki bought cereals during the same month.

Sales of assets other than livestock were much less important. Direct sales of land appear not to have taken place. However, larger loans (especially from persons outside the household) were sometimes secured by the pledging of land. This practice entitles the lender to use the pledged field(s) until the loan is paid back. Indirectly, it can lead to the permanent transfer of usufruct rights tantamount to ownership. Over 80% of the households in Cuevas' INRAN-ICRISAT subsample received loans or assistance from relatives, friends, or neighbors in 1984-1985. Most of these took the form of cereals and were worth 20,000-30,000 CFA francs, enough to buy 120-175 kg of cereals at the high prices which prevailed from February to July, 1985 (Cuevas, 1986). However, household borrowing was partially offset by the giving of loans such that the net loan amount per household for the subsample was 9500 FCFA.

Farm equipment sales were minor. Two-thirds of the farms practiced manual agriculture before the drought. The dozen hand tools owned by an average farm household (Swinton, 1985) were inexpensive when new and of very low resale value. Of the one-third of farms owning animal traction equipment none reported sales, and inventories in June 1985 were virtually unchanged (Table IV).

During the final months before the new harvest of 1985, food aid played a significant role in providing households with nutritional subsistence. Food aid began reaching the villages in significant quantities during April. Some millet, most sorghum, and all maize and wheat received after April took the form of free food aid distributed by the government. The pattern of grain flows in Rigial Oubandawaki (Fig. 5) is typical. Beginning in May, food aid provided a third to a half of mean household cereal inflows, amounting to roughly 20 kg per farm per month in the two hardest hit villages (Kandamao and Rigial Oubandawaki).

DISCUSSION OF RESULTS

Overall, it appears that livestock liquidation was the principal means by which Madarounfa farm households financed their cereal needs following the 1984 drought. Over the 12 months following the 1984 harvest, farm-

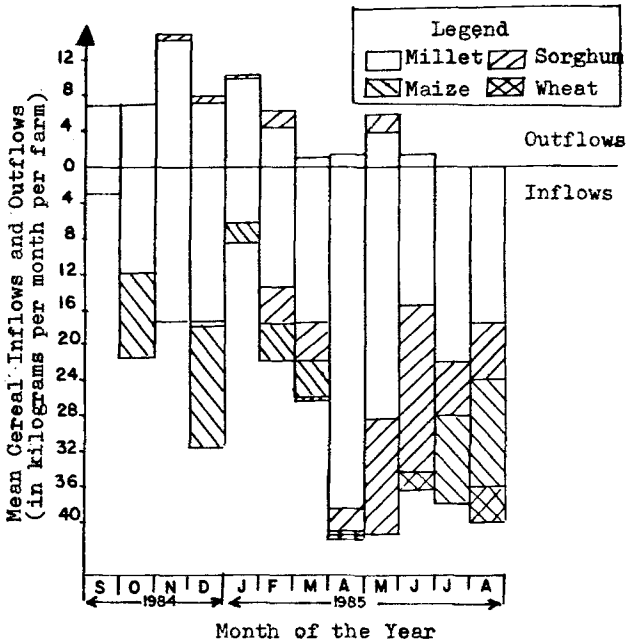


Fig. 5. Mean monthly cereal flows from 25 farms in Rigial Oubandawaki, 1984-1985 (outflow = sales + gifts given + barter given; inflow = purchases + gifts received + barter received).

ers paid out a mean of 27,300 CFA francs more for cereals than they took in from sales (Table V). Against this deficit, farmers took in a mean net revenue of 27,000 FCFA from livestock transactions and 3900 FCFA from cash crop sales. As a direct result, livestock inventories in the three surveyed villages dropped 31% for cattle, 26% for sheep, and 22% for goats between June 1984 and June 1985 (Table VI). Sales of land and farm equipment were apparently not significant. By contrast, loans from relatives, friends, and neighbors averaging 9500 FCFA made a substantial contribution. Because it arrived at the time of greatest need, food aid played a critical role in providing cereals worth a mean of 10,000 FCFA per household.

Unfortunately, net income from non-agricultural work and temporary migration is unknown. Probably the latter exceeded the former since most non-agricultural work involved the manufacture and sale of handicrafts and prepared foods (Swinton, 1985), increasing supply at a time when demand was weak. Hence, income earned was likely very modest.

Temporary migration probably made a much greater contribution, since it usually entailed wage labor in the wealthier Nigerian economy, and not only brought in some cash, but also relieved the household of responsibility

Table V. Mean Net Income from Agricultural Transactions in Three Madarounfa Villages from September 1984–August 1985^{a,b}

Item	Village mean net income (in thousands of francs C.F.A.)			
	Kandamao	Miaguéro	Rigial Oubandawaki	All villages
Household sources				
Grain and tubers	(27.7)	(23.7)	(30.6)	(27.3)
Cash crops	3.5	2.0	6.2	3.9
Livestock	21.1	18.8	41.2	27.0
Outside sources				
Food aid	14.7	6.0	9.2	10.0

^aExchange rate at U.S. \$1.00 = 400 francs C.F.A.

^bSource: Figs. 2–4.

for feeding the migrant while he was away. During the 1970–1974 drought, Faulkingham (1983) found the percent of men migrating from one Madaoua village leapt from 37% prior to the drought to 75% in 1973–1974. To assign a very rough value to income from temporary migration, it may be speculated that if a migrant was able to find “well-paid” work at 1000 FCFA/day one-third of the 1.4 months duration of the average migration, he would then earn 14,000 FCFA. Discounting this somewhat for travel costs, he might be left with an amount slightly more than those obtained from loans and food aid.

The best way to evaluate farmers’ drought survival tactics is by the twofold test proposed by Jodha: The measures taken should (1) detract as little as possible from capacity to produce in the future, and (2) permit the fastest possible recuperation of productive assets (Jodha, 1978). Of the measures for coping with drought discussed at the beginning of this paper, the first seven essentially meet both criteria in that they do not ransom the future productivity of the farm. Of these, it was not possible to estimate cash values for foregone ceremonial consumption or “famine foods” consumed at home. The feeble rains left so little moisture in the soil that in the one village where dry-season gardening is customary, it was not an option in 1984–1985. Sales of gathered hay and straw were very minor and were included in the cash crop income figures. The most important of the measures with minimal repercussions were the borrowing of grain and income from temporary labor migration.

Families appear to have obtained more emergency income from measures that undercut the future productive capacity of their farms. Foremost among these were livestock sales. Such sales occur normally and do not automatically imply a reduction in future productivity. However, when inventories decline, future production has been jeopardized. Depending on the

Table VI. Change in Livestock Inventories from June 1984-1985 on 25 Farms in Each of Three Madarounfa Villages in Niger^a

Village	Cattle			Sheep			Goats		
	1984	1985	Percent change	1984	1985	Percent change	1984	1985	Percent change
	Kandamao	58	37	-36	42	36	-14	60	113
Maiguéro	24	15	-38	42	31	-26	102	63	-38
Rigial Oubandawaki	48	37	-23	149	106	-29	249	143	-43
Total	130	89	-31	233	173	-26	411	319	-22

^aSource: Swinton and Mamane (1987a, p. 9).

age and sex of the animals lost, the 31% drop in cattle inventories could take more than one year to recover, since the animals reproduce only once a year and the single offspring mature slowly. The one-quarter decline in small ruminant populations could be overcome within the coming year, since goats and sheep can bear a litter of two young per year in dry climates.

The impact of cattle sales on animal traction agricultural production was probably minor, even though sales data did not distinguish between draft oxen and other cattle. Use of animal traction generated no significant increases in yields in the sample villages (Swinton, 1988a). Its potential to increase cultivated area was also small due to its use primarily for field preparation (when labor is not a production constraint) and the lack of open land to cultivate in two of three villages.

Repayment of loans for which land was pledged as collateral may have been more damaging to future productivity. It would depend on the borrower's subsequent income and the terms of repayment. Loans in kind can be paid back the next season if the harvest is good. Cash loans are more problematic, since good harvests, like that of 1985, cause crop prices to fall and with them expected income. Land pawning appears to have been growing more widespread even before 1984 (Arnould, 1982; Raynaut, 1988; Sutter, 1982), with frequent loss of land by the borrower. Poor subsequent harvests, such as that of 1987, tend to accentuate this tendency. As Hill (1972) and Sutter (1982) note, such asset losses are disproportionately borne by the poorest households.

Most of the farms studied had sufficient assets to subsist until the next harvest without food aid. But the cost in future productivity would have been high. Food aid played a critical role specifically because it made food available without the expenditure of cash to purchase grain from the market. Arriving when cereal prices were highest and livestock prices still very low, government grain allocations obviated the need for farmers to liquidate their assets to a level that would have made recovery extremely difficult.

The combination of livestock sales, temporary migration, non-agricultural activities, loans, and food aid allowed virtually all of the farm households studied successfully to survive the drought. They succeeded by retaining intact the productive resources most difficult to recuperate if lost: family labor, land, and farm equipment. Livestock losses were significant, but generally recoverable within 2 years.

POLICY RECOMMENDATIONS

To be effective, government policy to counter the effects of drought must address the roots of the problem in practical ways. Crop insurance pro-

grams are, in theory, the ideal solution to the problem of potential crop loss. In practice, they have proven excessively costly when administered to small-scale subsistence farmers (Binswanger, 1979). Perhaps for this reason, the impoverished governments of the Sahel have avoided such programs to date.

Since the members of individual farm households are the ones who have the greatest stake in coping with drought, policy measures should focus on this level. Asset depletion has been shown to be the tactic most valuable to farms in coping with inadequate agricultural production. Hence, government policy should seek to facilitate the accumulation of assets by farmers.

Production of surpluses is the most useful way to gird for privation. Over the long term, research and extension programs to boost crop and livestock production on small farms are to be encouraged. As the scope for extensive gains in production is narrowing, these should focus on yield improvement and drought resistance. Regeneration of soil fertility deserves special attention as demographic pressure forces farmers to cultivate more intensively. Improved annual intercropping techniques, tree intercrops, and the use of long-range weather forecasts to gauge appropriate mineral fertilizer application are three areas with potential (Swinton, 1988b).

Heretofore, livestock improvement and range management research have not received a commitment equal to that of agronomic research in Niger and other Sahelian countries. But the key role of livestock as a store of wealth for farmers (not to mention being a livelihood for pastoralists) makes it an equally important object of increased research efforts.

On-farm storage of locally-produced grain should be the focus of government programs to stock cereals. The literature points to a downward trend in on-farm grain storage as peasant farmers grow more fully integrated into the market economy (van Apeldoorn, 1981; Raynaud, 1975, 1983; Watts, 1983, 1984). Although some governments have tried to build national buffer stocks, both to moderate market price fluctuations and to insure against drought, the administrative costs are often unacceptable and stock liquidation often inequitable. One alternative is the constitution of village cereal banks to which farmers contribute each year at harvest and from which they withdraw grain during the "hungry season" preceding the next harvest. However, storage costs are higher than in farm granaries, and villagers sometimes mistrust stock managers. More beneficial might be government initiatives to reinforce traditional customs of laying away private grain reserves. In 1985, the government of Niger directed farmers to contribute 10 kg per household to a village grain reserve. This was a step in the right direction. However, storage losses are probably better controlled in private granaries.

Measures to improve market efficiency tend to be fairly simple to enact and offer benefits without substantial recurrent cost to the government. Domestic measures include the building of good roads without internal customs check-

points in order to facilitate the free flow of goods. They also encompass efforts to improve market information, such as radio news broadcasts of prices in different markets, which help to equilibrate interregional price differences.

By exposing farmers to wider markets less likely to be perturbed by crop failure, free international trade benefits subsistence farmers two ways in time of drought. First, it makes the grain they must buy available at a lower price. By May of 1985, the grain sold in two local markets in Madarounfa came almost exclusively from Nigeria (Swinton and Mamane, 1987b). Had the border been tightly closed, the supply of grain would have been much less³ and prices would have been more than proportionately higher (assuming demand for food is price inelastic). Second, free trade provides markets for the livestock that farmers are forced to sell at higher prices than those which would attain under economic autarky. In West Africa, the livestock trade has traditionally moved from the Sahel to the coastal countries where demand is higher (due to higher incomes) and relative supply lower (due to the presence of tse-tse flies which infect local herds; Baier, 1980).

The free cross-border movement of people also favors drought-stricken subsistence households. As described above, substantial numbers of Madarounfa farmers migrated temporarily to Nigeria for work. In so doing, they offered to Nigerian farms and businesses a source of inexpensive labor while obtaining for themselves work which would have been more poorly paid or wholly unavailable in a glutted domestic labor market. The income earned translated directly into improved subsistence for the households of the migrants. In effect, labor migration served the same end as the kind of public employment programs which wealthy countries sometimes implement in times of economic hardship. Diplomatic and policy initiatives to realize unimpeded cross-border flows of goods and people are legitimate policy responses to drought. That migrant workers from Niger could find employment in Nigeria in the dry season of 1984–1985 was not to be taken for granted. In January 1983, Nigeria had deported undocumented foreign workers *en masse*. However, this deportation was not repeated until May 1985, on the eve of the agricultural season in the Sahel. To the extent that this was due to Niger's diplomatic efforts, it may be considered a successful policy response to the drought.

Preparing more farm household members for non-agricultural work can reduce the extended family's financial reliance on subsistence agriculture, and hence its vulnerability to drought. This is widely recognized by many

³In fact, the border was closed from the Nigerian side, but enforcement was rather lax. Soon after the poor harvest of 1984, the government of Niger ended restrictions on cross-border grain flows from its side. However, it did not lift customs duties on livestock exports (although customs checkpoints were fairly easily circumvented by itinerant herders).

peasants wary of the fickle returns to farming (Painter, 1985). Strengthening public education further is thus another government policy that would reinforce the ability of farm families to withstand future droughts by diversifying their income sources.

The relief options open to governments after drought strikes are few. Foremost is the distribution of free food. Its effectiveness is determined by the quantity, equity, and timing of distributions. Governments can make aid effective by establishing a reliable harvest-forecasting system, by maintaining good roads to move it when it arrives, and by building efficient bureaucracies able to identify and measure needs and to deliver the goods. An early alert in Niger by September 1984 made the first food deliveries available by January 1985. The bulk of the shipments came during the months before the harvest of 1985. Besides reducing hunger, they undoubtedly contributed in two other ways: (1) they increased size of that harvest by providing the nourishment needed to do timely, good-quality farmwork, and (2) they increased future farm income (and thereby future drought preparedness) by reducing the need to liquidate productive assets to buy food.

Broad-based public works programs, although not within the normal means of Sahelian governments, can be run as food-for-work operations financed with donated emergency funds and food aid. However, administrative needs are great. Such programs should be carefully planned before disaster strikes and then shelved against time of need. As a means of distributing food relief, food-for-work has the advantage of feeding the destitute without sacrificing work habits.

Most of these policy measures are interrelated. The effective extension of productive research in plant and animal science gives farmers more wealth to cushion against privation. Better schooling allows family members improved access to urban jobs and thus diversifies the financial base of the extended family. Open borders offer larger markets for goods and labor that are less likely to be affected by drought in the Sahel. Good roads help local products circulate more freely (moderating price fluctuations) and allow food aid to be distributed more swiftly. Ultimately, the most successful policy measures will be those which complement and reinforce the individual tactics which farmers find most useful already.

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