4. Adaptation and Coping Behavior of Farmers during Pre- and Post-Shock Periods

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Abstract

Farmers use both on-farm and off-farm-based coping strategies to mitigate the impact of heavy rain. The choice of coping behaviors tends to vary with access to resources. As an example of on-farm-based coping behaviors, farmers can change land use patterns by switching crops. As an example of off-farm-based coping behaviors, heavy rain affected farmers can compensate for lost income by selling livestock and fishing.

4.1. Introduction

When assessing farmers' adaptation and coping behavior as elements of household resilience, it is important to clarify how farmers actually adapt to climate variability during the pre-shock period, and how they cope during the post- shock period.

In this chapter we describe adaptation strategies in land use, and coping behavior in terms of on- and off- farm activities.

4.2. Adaptation to climate variability

Figure 4-1 illustrates the relation between maize harvest and three characteristic rainfall amounts. Figure 4-1 a), b) and c) show an adequate rainfall year, a drought year and a heavy rainfall year, respectively. Maize fields are distributed around different topographic positions including ridges, slopes and valley bottoms. In an adequate rainfall year, maize harvest is a normal harvest for each topographic position. In a drought year, we expect fields on valley and slope near the valley to retain an adequate harvest, while fields on ridges and slopes near ridges are unlikely to produce an adequate harvest because of a shortage of rainfall. In heavy rainfall years, however, we expect fields on ridges and slopes near ridges to acquire adequate harvest, but fields on valley and slope near the valley may not acquire adequate harvest because of flooding. These predictions were confirmed by field experience from 2007_08 to 2009_10.

Thus, the maize harvest varies every year depending on rainfall and topographic position. Thus, if a farmer possesses maize fields at each topographic position, they can avoid severe negative consequences of climate variability such as drought or heavy rainfall. However, not all farmers have access to fields at all topographic positions. Therefore, it is important to know where each household's fields are located when considering their adaptation to climate variability.

Table 4-1 indicates the potential risk of heavy rainfall for a rainy season maize field, for each household in 2007_08. The number in parentheses indicates the potential risk of heavy rainfall. We supposed that if a farmer has three maize plots of the same size, the potential risk can be estimated by three numbers as follows. The value is 1 for a ridge plot, 2 for a slope plot and 3

for a valley plot.

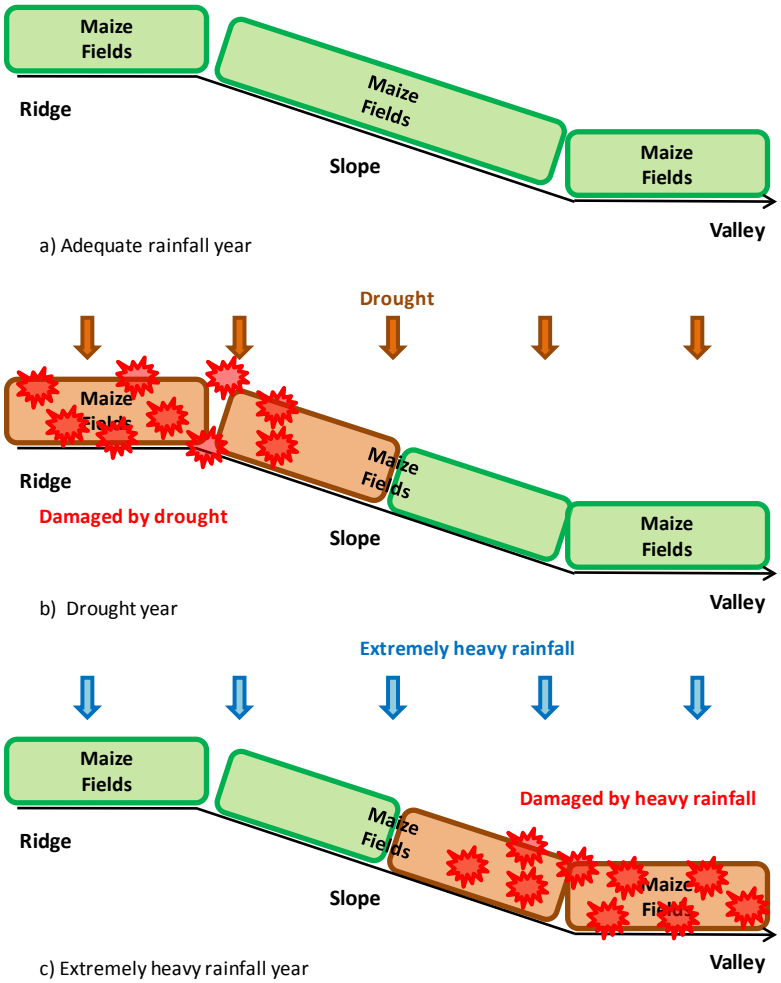


Figure 4-1 Relationship between maize harvest and three characteristic rainfall amounts, a) Adequate rainfall year, b) Drought year and c) Extremely heavy rainfall year

Table 4-1 Potential risk of heavy rain at rainy season maize fields in 2007_08

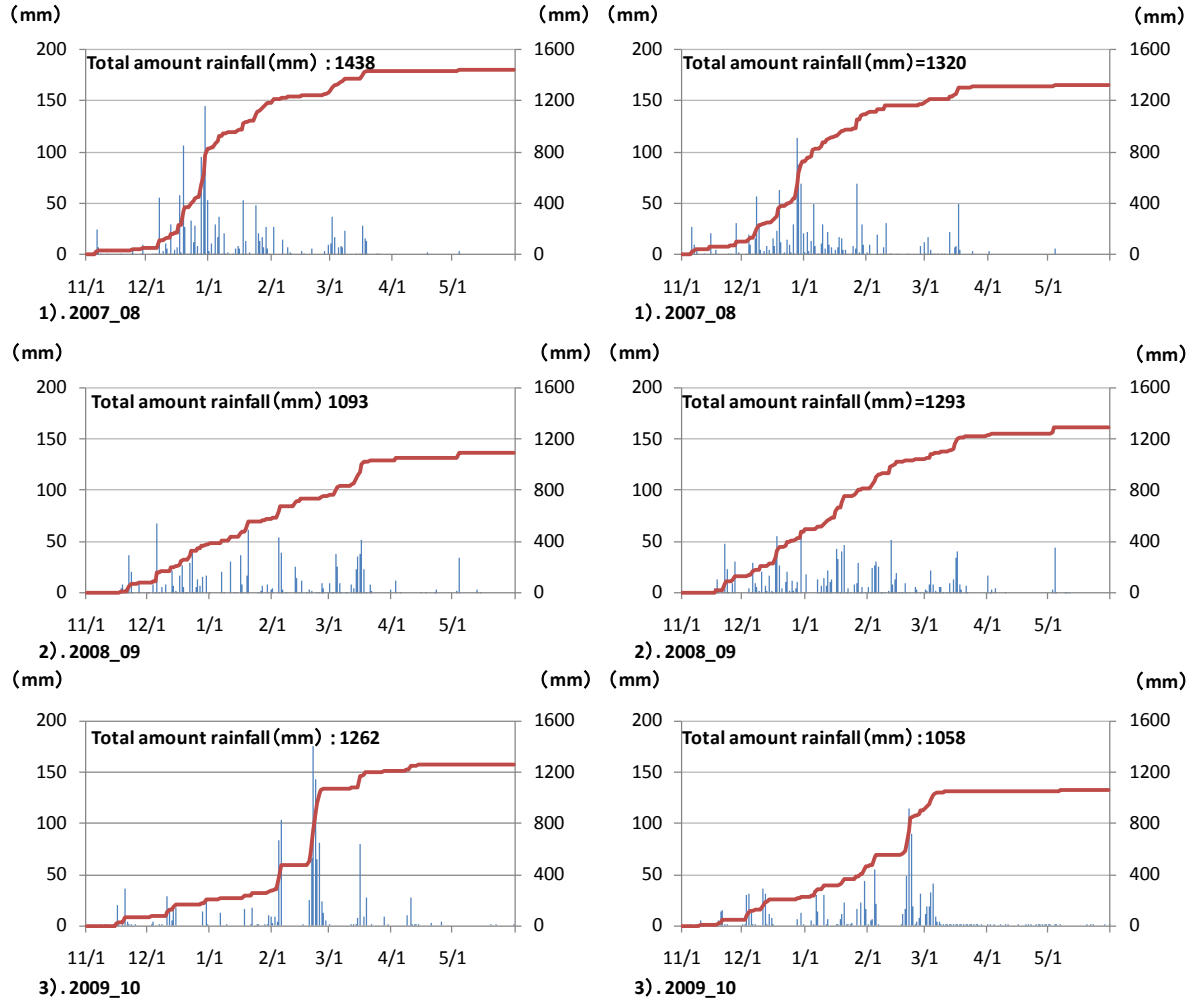
	Households Number	Valley		Slope and valley		Slope		Ridge and valley		Ridge, slope and valley		Ridge and slope		Ridge	
		(9.0)		(7.5)		(6.0)		(6.0)		(6.0)		(4.5)		(3.0)	
Site B	37	0	0%	0	0%	0	0%	0	0%	35	95%	2	5%	0	0%
Site C	81	0	0%	16	20%	29	36%	1	1%	19	23%	16	20%	0	0%

If potential risks are larger, it is more likely for a crop to be damaged by heavy rain. Conversely, smaller potential risk indicates higher resilience. At Site B, almost all households possessed maize fields at all topographic positions. However, at Site C, the location of maize fields tended to be biased to a slope. Comparison of the two sites reveals that Site B has greater resilience than Site C. However, this estimation is tentative. Future studies should make topographic maize harvest classifications on the basis of topographic features, soil nutrient content and slope angle.

4.3. Coping behaviors in terms of on-farm activities during the post shock period

4.3.1. Rainfall between 2007_08 and 2009_2010

Figure 4-2 shows the daily rainfall and daily accumulation rainfall at Site A and Site C. At Site A, total amounts of rainfall of 2007_08, 2008_09 and 2009_2010 were 1,438 mm, 1,093 mm and 1,262 mm respectively. At Site C, the amounts were 1,320 mm, 1,293 mm and 1,058 mm, respectively. As is mentioned in our previous report, many of the fields at each of our study sites were damaged by heavy rain in 2007_08. Many fields were also damaged by heavy rainfall in 2009_2010. At each site, total amount of rainfall was highest in 2007_08. However, the total amount of rainfall in 2008_09 was higher than in 2009_2010 at Site C. This means that the damage to fields caused by heavy rainfall was not determined by the total amount of rainfall alone, but rather the rainfall pattern, as can be seen at the end of December in 2007_08 and the end of February in 2009_10.



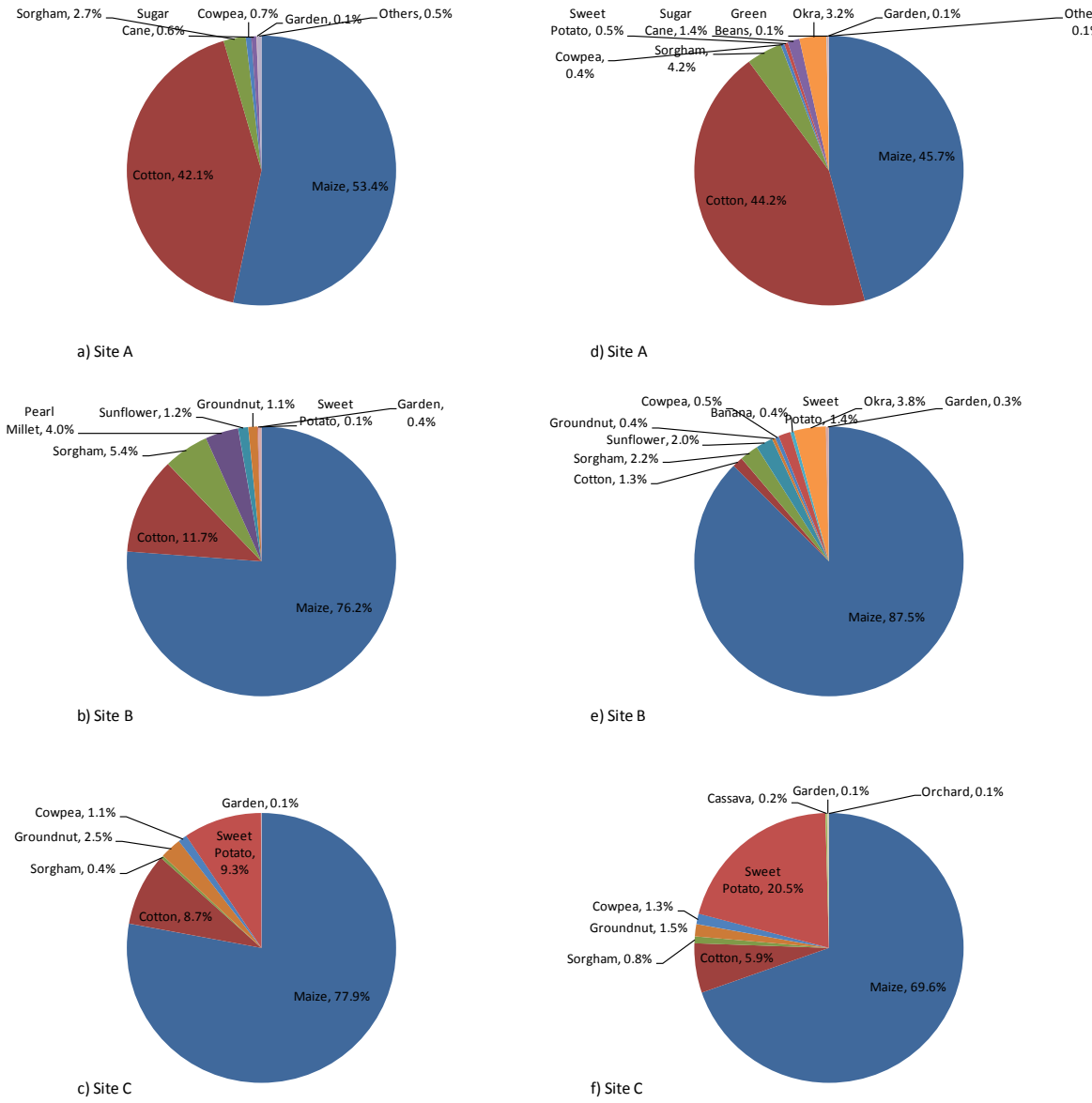
a). Site A b). Site C

Figure 4-2 Daily rainfall and daily accumulated rainfall at a) Site A, and b) Site C

4.3.2. On-farm activities at each site from 2007_08 to 2008_09

Figure 4-3 shows on-farm activities at each site from 2007_08 to 2008_09. At all sites, maize was most dominant staple food crop. At site A, cotton was the second most common crop in

both years. In 2007_08, cotton was second, but in 2008_2009 the ratio of cotton grown was decreased due to the additional labor and chemical inputs required compared to other crops, leading to a selling off of cotton crops at site B. Sweet potato is the second-most dominant crop at site C. At this site, sweet potato is a more important cash crop than cotton. These differences of on-farm activities among three sites depend on meteorological conditions, soil conditions and access to the market and the main roads.



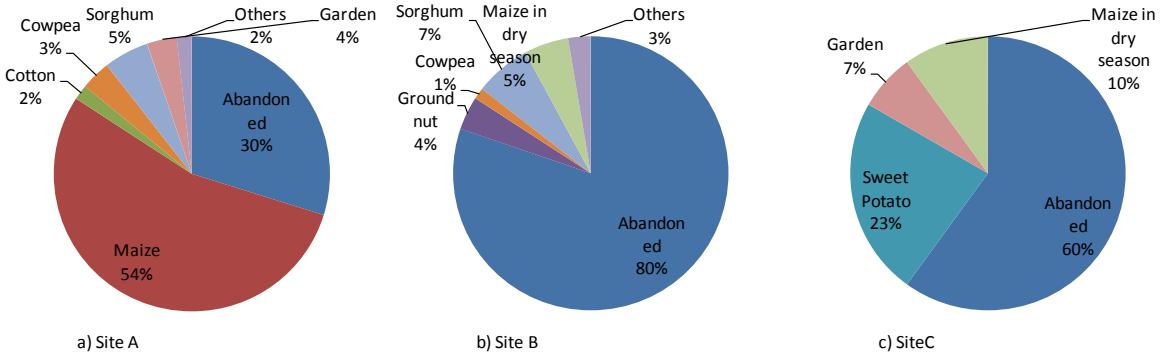
1) 2007_08 2) 2008_09

Figure 4-3 On-farm activities at each site from 2007_08 to 2008_09

4.3.3. Coping behaviors related to on-farm activities during the post shock period

Approximately 20% of maize fields were damaged by heavy rainfall in 2007_08. As a coping response to heavy rain damage, between 30% and 80% of damaged fields were abandoned. (Figure 4-4) In some fields, farmers switched or replanted crops. At site A, many farmers sowed maize seeds again. In site B, many farmers switched to planting groundnuts and maize during the

dry season. At site C, many farmers switched to sweet potato. Thus, coping behaviors in response to heavy rain damage were markedly different at each site.



a) Site A　　b) Site B　　c) SiteC

Figure 4-4 Coping behaviors related to on-farm activities following heavy rain damage

4.4. Coping behaviors in off-farm activities during the post-shock period

4.4.1. Coping behaviors in off-farm activities at the site-level

Table 4-2 shows site-level coping behaviors to damage from heavy rain through non-agricultural activities. The table shows the number of households that started new non-agricultural activities because they could not sell maize due to a shortage of maize production in 2008. 65% of households sold animals as a coping behavior. (Figure4-5) At site A, elderly households commonly asked for financial assistance from relatives. At site B, the number of households selling planks increased.

Table 4-2 New non-agricultural activities for households that were unable to sell maize due to the shortage of maize yields in 2008

	Housholds	Animal	Poultry	Fish	Local Beer	Plank	Others
SiteA (n=69)	16	10	1	1	0	0	4
SiteB (n=33)	7	6	1	0	0	5	0
SiteC (n=91)	6	2	0	1	1	0	0
Total	29	19	2	2	1	5	4

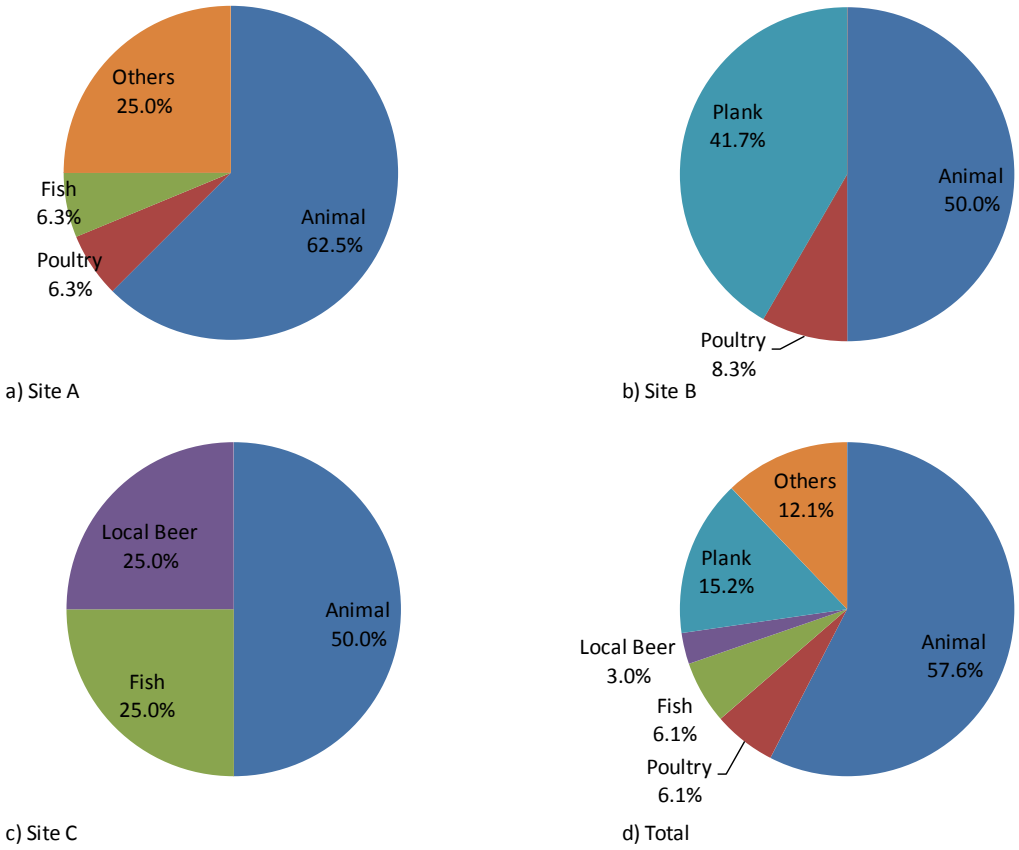


Figure 4-5 Coping behaviors in off-farm activities at the site-level for households that were unable to sell maize due to the shortage of maize yields in 2008

4.4.2. Coping behaviors related to off-farm activities by household-level

Table 4-3 shows household-level coping behaviors. Table a) shows data for 2007. Table b) shows data for 2008. The numbers in each row indicate the percentage distributions of cash income sources in each year, summing to 100%. After the fields were damaged, income was obtained by selling animals, fish, and local beer in 2008.

a) 2007

2007	Maize	Cotton	Vegetable	Animal	Poultry	Gathering	Fish	Local Beer	Carpenter	Plank	Piece Work
Csa 5	20.0	30.0	20.0		15.0						15.0
Csa 21	15.0		50.0		15.0						20.0
Csa 24	5.0	20.0	20.0		5.0						50.0
Csa 33	11.1		5.6		11.1	16.7			38.9		16.7
Csa 59	5.0		10.0	45.0	5.0					35.0	
Csa 85	10.0	30.0	15.0	20.0	10.0						15.0

b) 2008

2008	Maize	Cotton	Vegetable	Animal	Poultry	Gathering	Fish	Local Beer	Carpenter	Plank	Piece Work
Csa 5				100.0							
Csa 21			100.0								
Csa 24		10.0	10.0	70.0	5.0		5.0				
Csa 33			20.0		15.0	15.0		50.0			
Csa 59		1.0		95.0	4.0						
Csa 85		70.0	15.0	5.0	10.0						

Table 4-3 The cash income situation in 2007 and 2008 for households experiencing crop damage from heavy rain at Site C