

Case Studies for Terrace Rehabilitation in Yemen:

Report produced as consultant to the Social Fund for Development (SFD), in support of the collaborative World Bank-SFD project, "Assessing local communities and household resilience to adapt to climate change in rain-fed areas of Yemen"

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There is a lot of interest among donor organizations in funding programs to rehabilitate abandoned terraces in Yemen's mountainous regions. However, if terraces are to be rehabilitated, it is not clear how to guarantee that the rehabilitated terraces remain maintained and employed after the completion of the program. The purpose of this study is to perform a detailed case study analysis of communities that expressed interest in terrace rehabilitation to determine factors that contributed to the abandonment of terraces, the characteristics of the communities contributing to variations in these factors, and what has changed or could change within the community to make maintenance of rehabilitated terraces possible and desirable in the future.

Over the course of the study 11 villages in three governorates, (Al-Hodayda, Al-Mahweet and Lahaj) in Yemen were visited and in-depth interviews were conducted between July 20th and August 12th, 2009 to explore the issues surrounding terrace abandonment and maintenance. Eight of the communities are currently included in the Rain-fed Agriculture and Livestock Project (RALP) conducted by The Social Fund for Development (SFD). These communities will be receiving some form of terrace rehabilitation aid over the next year or two. Two of the villages, Bait Al-Maghuri and Al-Ghariba, are not a part of the RALP program, but were locations where the CARE organization conducted terrace rehabilitation projects in the past. Another village, Rahabaat, is not a part of the RALP program, but is a community that has expressed interest in terrace rehabilitation aid.

The methodology used for the case studies was onsite interviews guided by questionnaires (see Appendix B). Upon arrival to the villages we gathered anywhere from 3 to 15 farmers together and went through a guided discussion. The questionnaires acted as a guideline to the interviews, but the survey was not formal in that additional follow-up questions and side discussions were embarked upon when appropriate. The focus was to obtain the required information while letting the villagers themselves have the freedom to emphasize their own needs and opinions. There are two questionnaires, one is used for all the villages, and the other is specifically designed to find out information about the villages who participated in the CARE terrace rehabilitation program.

The following report discusses several of the more relevant and interesting observations obtained over the course of the study. In addition to this, detailed case studies of each community are presented.

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Section 1: Terrace Abandonment

The primary purpose of this study is to understand factors contributing to terrace abandonment. Most of the communities visited through the course of this study had extensive amounts of terraced land that had been abandoned. The factors contributing to this abandonment varied widely, although there were some factors that seemed to be shared by most of the communities.

Table 1: Terrace Maintenance and Abandonment

Governorate	District	Village	CARE	Community Cooperation in Terrace Maintenance: Jaysh or 'Aana	Percent of Terraces Currently Abandoned Overall	Percent of Terraces Abandoned in Past 5 Years	Currently Employed Terrace have Problems
Al-Hodayda	Bura'	Bani Batal		'Aana	70%	15%	No
Al-Hodayda	Bura'	Rahabaat		None	33%	-	Yes
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	√	-	-	-	-
Al-Mahweet	Ar-Rujum	Al-Hajaar		Jaysh	-	30%	No
Al-Mahweet	Ar-Rujum	Al-Hazza		None	33%	15%	Yes
Al-Mahweet	Ar-Rujum	At-Taraaif		Jaysh	0%	0%	No
Al-Mahweet	Ar-Rujum	Shansub		Jaysh	-	0%	No
Al-Mahweet	At-Toweela	Al-Ghariba	√	Jaysh	25%	0%	No
Lahaj	Al-Maqatira	Zaqiha		None	12% (non-qat)	8% (non-qat)	Yes
Lahaj	Al-Qabaita	Ar-Rima		None	50%	50%	No
Lahaj	Al-Qabaita	Farisat Al-Jabal		None	20%	20%	No

As can be seen in Table 1, the amount of terraces abandoned and the timing of this abandonment varies widely. This is closely related to the causes of terrace degradation and abandonment in these communities. The communities farther north, such as those in Al-Mahweet and Al-Hodayda, in general experienced more terrace abandonment farther in the past, while the communities farther south in Lahaj experienced the majority of their terrace abandonment, if not all of it, within the past five years. One explanation for this is that during the 1970s and 1980s the mass exodus of migrants to Saudi Arabia seemed to impact the North more than the South. In addition, the amount of road construction currently taking place in the South is much more extensive than in the northern areas visited, and because of this, two of the three villages from Lahaj have experienced all of their terrace abandonment in the past five years, largely due to damage from road construction.

When the large influx of migrants returned from Saudi Arabia in the early 90s many found their terraces degraded and unusable. This raises the question of why they did not reconstruct their terraces at that time, given that many had few other options for employment. A likely explanation for this is the difficulty of coordinating this effort within the community. If all or most of the terraces on a given mountain slope had been abandoned and were degrading, it is difficult for one farmer to rehabilitate his terraces on that slope without everyone else with land on that slope also rehabilitating their terraces. This is because all the terraces on a shared slope affect each other, and having unmaintained terraces above you makes it very difficult to protect your terraces from landslides and water damage. Therefore, it is likely that a contributing factor was this issue of coordination when migrants returned.

Coordination may also have been a hinderance to rehabilitation in the case of water infrastructure. If any shared water infrastructure existed to feed the terraces and it had degraded along with the terrace walls themselves, then the additional coordination and commitment within the community needed to rehabilitate this infrastructure as well could have prohibited progress.

As can be seen in Table 2, besides the issue of the anomalous shocks of mass migration and road construction, the most salient ongoing factors contributing to terrace abandonment are increasing water scarcity and increasing opportunity cost of labor. Many of the villages reported not only that there is a current drought that has been severe for the past two years or so, but there has also been a reduction in rainfall over the long-term. This has made returns from terrace farming (all of which is exclusively rain-fed) dramatically reduced over time, and has contributed to abandonment of marginal terraces and those farther from water tributaries. Additionally, while the level of migration to Saudi Arabia is less than it was in the 70s and 80s, there is still substantial migration (see details in the following section) both within Yemen and to Saudi Arabia. This has reduced the number of farmers in the villages and increased the expected wage as employment opportunities elsewhere become more accessible. All of this has led to an increase in the opportunity cost of the time of the farmers themselves, and an increase in the cost of hired labor for major work on the terraces.

Table 2: Reported Factors Contributing to Terrace Abandonment

Governorate	District	Village	CARE	Reasons for Terrace Abandonment
Al-Hodayda	Bura'	Bani Batal		Water scarcity, long-term decrease in rain, cost of labor
Al-Hodayda	Bura'	Rahabaat		Water scarcity, long-term decrease in rain, cost
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	✓	Large amount of migration to Saudi Arabia in 80s/90s
Al-Mahweet	Ar-Rujum	Al-Hajaar		Water scarcity
Al-Mahweet	Ar-Rujum	Al-Hazza		Water scarcity, cost of labor, migration to Saudi Arabia in the 80s/90s
Al-Mahweet	Ar-Rujum	At-Taraaif		Cost of labor, distance to village
Al-Mahweet	Ar-Rujum	Shansub		N/A
Al-Mahweet	At-Toweela	Al-Ghariba	✓	Damage from road construction, migration
Lahaj	Al-Maqatira	Zaqiha		Water scarcity, long-term decrease in rain, cost of labor
Lahaj	Al-Qabaita	Ar-Rima		Water scarcity, damage from road construction, cost of labor
Lahaj	Al-Qabaita	Farisat Al-Jabal		Damage from road construction, migration

Section 2: Migration

As mentioned above, migration has been an important issue in terrace abandonment, but it is much more complex than one might initially think. While migration is present in all of the communities, the extent to which migration has impacted terrace abandonment has not been uniform across the country. Some villages experienced more migration to Saudi Arabia in the 70s and 80s than others, some have more migrants now than others, and some communities have more people who have migrated permanently than others. All of these factors have impacted terrace abandonment in the past and would impact the community's ability to utilize and maintain terraces in the future if they were rehabilitated.

The case of Al-Ghariba provides some insight into how the complexity of the migration situation can impact terrace maintenance and utilization. It was reported there that in the past when people migrated, they migrated for extended periods of time, sometimes several years, and their land would be abandoned or out of their control while they were gone. Now however, even though there is still a substantial amount of migration from Al-Ghariba, people leave for much shorter periods of time, sometimes only a few months during the non-agricultural season, and then return to work on their land. Questions delving into this particular issue were not asked in all of the villages, but some measure of

the permanence of the migration in the villages can be seen in the responses to the question about whether or not those who are currently migrated would return if they could. In many cases they say they would, or even that they do return frequently already, while in some cases they said only some might return, or that likely none would return even if conditions improved. The closeness of the ties of farmers to their village is likely to affect the extent to which rehabilitated terraces can be expected to be maintained in the future. Therefore, just because a village has a large amount of migration may not mean that those people are permanently gone and the land will not be maintained, while a village with fewer migrants, but migrants permanently gone, may face a different set of constraints to ongoing terrace maintenance.

As can be seen in Table 3, there is a large amount of variation in the prevalence of migration across the villages included in this study. Why there has been less migration in some areas than others is unclear. It could be geographical; Al-Mahweet and Al-Hodayda are closer to both Saudi Arabia and Sana'a. It could be infrastructural; road construction is much more actively present in Lahaj in recent years than farther north where there are more areas that have had roads for longer. Perhaps people did not migrate as much from Lahaj in the 80s because it was more difficult without quality roads, or perhaps the areas visited for this study in Lahaj are experiencing the same process now that may have already happened in areas farther North. This is unknown at this point.

Table 3: Migration

Governorate	District	Village	CARE	Approximate Number of Households	Percent of Households with at least one migrant	Number of Full Families Migrated	Migrants in Saudi Arabia	Migrants Would Come Back
Al-Hodayda	Bura'	Bani Batal		200 (?)	60%	2 (past 5 years)	Many	No
Al-Hodayda	Bura'	Rahabaat		100	60%	-	Many	Yes
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	√	25	-	-	-	-
Al-Mahweet	Ar-Rujum	Al-Hajaar		70	60%	0 (past 5 years)	Few	-
Al-Mahweet	Ar-Rujum	Al-Hazza		37	100%	35 (overall)	Many	Yes
Al-Mahweet	Ar-Rujum	At-Taraaif		205 (?)	70%	20 (overall) – 0 (past 5 years)	Many	Yes
Al-Mahweet	Ar-Rujum	Shansub		76	100%	5 (overall)	Many	Some
Al-Mahweet	At-Toweela	Al-Ghariba	√	50	100%	0 (past 5 years)	Some	-
Lahaj	Al-Maqatira	Zaqiha		110	30%	11 (past 5 years)	Few	Yes
Lahaj	Al-Qabaita	Ar-Rima		680 (?)	100%	20 (past 5 years)	Few	Yes
Lahaj	Al-Qabaita	Farisat Al-Jabal		120	50%	7 (past 5 years)	Many	Yes

Section 3: Sharecropping

Characteristics of sharecropping agreements are also important for patterns of terrace maintenance and abandonment. The nature of the sharecropping arrangements and the extent of sharecropping varies widely among the communities in this study. Table 4 shows percents of the types of sharecropping arrangements reported in these communities.

In many cases, sharecropping is a pseudo-permanent arrangement whereby a farmer may work the land under a sharecropping contract his entire life, and potentially pass the contract on to his descendants for generations. In most cases the owner does not live in the village and the contract is for an open period of time (see Table 5). Therefore, in many cases the farmer has a very high incentive to maintain the land, even though he does not own it, because he has long-term interest in the land.

Table 4: Types of Sharecropping

Governorate	District	Village	CARE	Percent of Terraces Owner-Operated	Percent of Terraces Sharecropping with Private Owner	Percent of Terraces Sharecropping on State Land	Percent of Terraces Sharecropping on Religious Endowment Land
Al-Hodayda	Bura'	Bani Batal		77%	20%	0%	3%
Al-Hodayda	Bura'	Rahabaat		98.50%	1%	0%	0.50%
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	√	-	-	-	-
Al-Mahweet	Ar-Rujum	Al-Hajaar		30%	60%	0%	0%
Al-Mahweet	Ar-Rujum	Al-Hazza		30%	20%	40%	10%
Al-Mahweet	Ar-Rujum	At-Taraaif		70%	29%	0%	1%
Al-Mahweet	Ar-Rujum	Shansub		60%	30%	0%	10%
Al-Mahweet	At-Toweela	Al-Ghariba	√	10%	80%	3%	7%
Lahaj	Al-Maqatira	Zaqiha		90%	10%	0%	0%
Lahaj	Al-Qabaita	Ar-Rima		99%	1%	0%	0%
Lahaj	Al-Qabaita	Farisat Al-Jabal		90%	10%	0%	0%
Average:				65%	26%	4%	3%

It is interesting to note that the prevalence of the different types of land management seems to follow a geographical pattern. There is less land under sharecropping contracts in the villages visited in Lahaj than in some other areas. This could be related to patterns in migration discussed in the previous section; the communities from Lahaj had less migration to Saudi Arabia in the past, and to a certain extent in the present as well, and there is more variation in the amount of migration overall in Lahaj than in the other areas (see Table 3). Because in many cases sharecropping exists solely as a mechanism to keep the land employed and maintained when someone migrates (see Table 5), the fact that there is less sharecropping in areas that have experienced somewhat less migration seems logical.

Table 5: Aspects of Sharecropping Arrangements

Governorate	District	Village	CARE	Contract Written/Verbal	Period of Contract	Owner Lives in Village	Share of Crops to Owner	Who Pays for Terrace Maintenance if General	Who Pays for Terrace Maintenance if Serious Problem
Al-Hodayda	Bura'	Bani Batal		Written	2-10 Years	No	Maintain Terraces	Farmer	Both
Al-Hodayda	Bura'	Rahabaat		Written	Open	No	25%, 50%, Maintain Terraces	Farmer	Both
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	√	-	-	-	-	-	-
Al-Mahweet	Ar-Rujum	Al-Hajaar		Written	Open	Some	33%	Farmer	Both
Al-Mahweet	Ar-Rujum	Al-Hazza		Written	Open	Some	Varying Yearly 5-15%	Farmer	Farmer
Al-Mahweet	Ar-Rujum	At-Taraaif		Both	3 Years	Yes	33%	Farmer	Both
Al-Mahweet	Ar-Rujum	Shansub		Most Verbal	Open	No	33%	Farmer	Farmer
Al-Mahweet	At-Toweela	Al-Ghariba	√	Written	Open	No	33% (10% in CARE area)	Farmer	Farmer
Lahaj	Al-Maqatira	Zaqiha		Both	Open	No	50%, Maintain Terraces	Farmer	Both
Lahaj	Al-Qabaita	Ar-Rima		Both	Open	No	Maintain Terraces	Farmer	Farmer
Lahaj	Al-Qabaita	Farisat Al-Jabal		Both	Open	No	Maintain Terraces	Farmer	Owner

It is clear that the degree to which incentives are affected by the different types of sharecropping varies widely between communities and, because of this, sharecropping must not be approached as simply a rental agreement. In many places the relationship of the sharecropper to the land worked is much closer

than one might initially expect in a sharecropping arrangement. Because of this it must be noted that 1) in many cases it is the sharecropper that is the appropriate individual to deal with to coordinate terrace rehabilitation efforts, and 2) even if terraces are rehabilitated on land where there is a large land owner and many sharecroppers, this does not necessarily mean that the landowner is the only individual receiving benefit from the rehabilitation. The sharecroppers will often have a long-term stake in the rehabilitated terraces, and receive long-term benefits from the rehabilitation as well.

Section 4: The Importance of Farming

For the most part all of the communities included in this study are subsistence farming communities. A few of the communities sell a small amount of coffee or qat (see Appendix C) sometimes, but the majority never sell their agricultural production unless they have an emergency and need cash quickly. Oftentimes if this is the case they will sell livestock before they will sell agricultural output. The degree to which agriculture is considered to be a significant component of the livelihood of these communities varies from place to place, but it is generally important. The estimates provided by the community of what percent of their livelihood comes from various sources are presented in Table 6. These estimates should not be taken literally. In many cases the concept of what we meant by percents was difficult to communicate and/or the community would provide percentage estimates that did not add up to 100%. Rather than literal percentages, these estimates should be seen as some measure of the extent to which the communities considered these sources of livelihood important.

Table 6: Approximate Percentages of Sources of Livelihood

Governorate	District	Village	CARE	Agriculture (including livestock)	Remittances (from Yemen and abroad)	Hourly Labor	Professional/ Government Employment
Al-Hodayda	Bura'	Bani Batal		15%	50%	35%	0%
Al-Hodayda	Bura'	Rahabaat		20%	80%	0%	0%
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	√	-	-	-	-
Al-Mahweet	Ar-Rujum	Al-Hajaar		20%	80%	0%	0%
Al-Mahweet	Ar-Rujum	Al-Hazza		20%	70%	10%	0%
Al-Mahweet	Ar-Rujum	At-Taraaif		60%	15%	0%	25%
Al-Mahweet	Ar-Rujum	Shansub		30%	70%	0%	0%
Al-Mahweet	At-Toweela	Al-Ghariba	√	25%	75%	0%	0%
Lahaj	Al-Maqatira	Zaqiha		25%	10%	65%	0%
Lahaj	Al-Qabaita	Ar-Rima		10%	70%	0%	20%
Lahaj	Al-Qabaita	Farisat Al-Jabal		30%	10%	30%	30%
Average:				26%	53%	14%	8%

What Table 6 also demonstrates is that in all of these cases there are alternative sources of income for these communities besides agriculture. Indeed, villagers in Bani Batal described wealthy households as those who had one or two members of the family working in Saudi Arabia. Therefore, particularly in cases where the estimated percent of livelihood coming from agriculture is relatively low compared to other sources, the question of why these communities continue to farm is raised. Terrace farming requires a lot of ongoing investment in the maintenance and care of the terraces and other infrastructure as well as planting, caring for, and harvesting the crops themselves. While we see the amount of terrace farming decreasing (indicated by the level of abandonment) a large amount still persists. I asked several communities why this was. The following insight was provided: while they trust the market for

supplying their food needs, it must be recognized that they trust it to function in the way they currently use it, which is to *supplement* their agricultural production. The prices in the market do fluctuate a lot and they don't always have easy access to funds and credit. They therefore farm in order to ensure their access to food for the year.

In Rahabaat in particular they reported that they store up food for the winter specifically because if they set aside enough food for their families, they can leave the village during the winter in order to find work. This speaks to the fact that there are different degrees of migration, and many are migrating during short stretches in non-agricultural seasons. They therefore farm in order to guarantee food for their families while they leave to face the often unpredictable labor market outside the village.

In addition, there is the issue of animal fodder. The cost of animal fodder in the market is quite high (see Table 9 in Appendix A). Because of this, villages grow animal fodder or use crop waste for this purpose. Additionally, many expressed that if they were to receive the benefits of a terrace rehabilitation program they would like to grow more food for their animals. Indeed in Al-Ghariba they explained that one of the primary reasons they farmed was to grow food for their animals. Therefore, farming is also important for the sustenance of livestock within the communities, and livestock provide extensive benefits to the villagers including cash, food, fuel, fertilizer, and physical work on the farm. There was even a case in Al-Hazza where the farmers claimed that their livestock was even more important for their livelihood than their crops.

Table 7: Agricultural Production

Governorate	District	Village	CARE	Agricultural Output	Agricultural Output Generally Sold
Al-Hodayda	Bura'	Bani Batal		Corn, Qat, Coffee, Bananas	Qat, Coffee
Al-Hodayda	Bura'	Rahabaat		Corn, Sorghum, Cow Peas, Qat	None
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	√	Corn, Sorghum, Sesame, Vegetables, Fruits	None
Al-Mahweet	Ar-Rujum	Al-Hajaar		Corn, Wheat, Sorghum, Qat	None
Al-Mahweet	Ar-Rujum	Al-Hazza		Corn, Sorghum, Qat	None
Al-Mahweet	Ar-Rujum	At-Taraaif		Corn, Sorghum, Qat	Qat (Sometimes)
Al-Mahweet	Ar-Rujum	Shansub		Corn, Sorghum, Qat	Qat (Sometimes)
Al-Mahweet	At-Toweela	Al-Ghariba	√	Corn, wheat, Sorghum, Lentils, Qat	None
Lahaj	Al-Maqatira	Zaqiha		Corn, Wheat, Sorghum, Qat	Qat (Sometimes)
Lahaj	Al-Qabaita	Ar-Rima		Corn, Wheat, Sorghum	None
Lahaj	Al-Qabaita	Farisat Al-Jabal		Corn, Sorghum	None

Table 7 demonstrates the types of crops grown in each community and whether or not they sell any of their production. As can be seen by this table, many of the communities grow qat, though it should be noted that many do not grow large quantities of qat. One interesting observation about the role of qat in agricultural production has to do with the reduction in water availability reported by many of these communities. In several cases, when asked how the community adjusts to times of water scarcity it was reported that they stop caring for their qat or irrigating their qat terraces. This was a surprising finding because in one case in particular where this was reported (Bani Batal) qat contributed relatively extensively to their income. However, they explained that qat can survive extended periods of water scarcity and recover, so in times of scarcity they would prioritize the water for other uses because the

qat would survive on its own. In particular in Bani Batal where a large amount of coffee and qat are both grown and sold, they explained that they focused their limited water on coffee terraces because the coffee was much more sensitive to water scarcity. This is an important issue because both coffee and qat are long-term investments. One coffee plant produces for 30 years if in good conditions and qat can last for hundreds of years. It may be that because of the long-term investment nature of coffee and its sensitivity to surrounding conditions, farmers without many options for sources of income are reluctant to invest in coffee and prefer qat because there is a strong market in Yemen, but also because it is a more secure long-term investment.

Section 5: Water Infrastructure

By far the strongest finding in this study is the extent to which water scarcity is important for the agricultural activities in these communities, including terrace maintenance and utilization. As can be seen in Table 8, most of the villages expressed specific needs for improved or new water infrastructure for agricultural purposes. Many villages had dams that needed to be rehabilitated, water infrastructure that was badly designed, or no water infrastructure at all for agricultural applications.

While water infrastructure is important, I think it is worth noting that what is more important is *effective* water infrastructure. The problem with water is that it is costly to move, particularly if gravity is not in your favor. The location and careful design of water infrastructure in these poor, mountainous areas are essential for the communities to be able to gain any benefit from the water resources. I observed several situations where water infrastructure such as cisterns or dams were present, but they were not able to be used because of their location or because there was no irrigation infrastructure such as trenches, canals, or pipes. In particular, in Bait Al-Maghuri there were two very large cisterns built for the community to use for agricultural purposes, but neither was in use for anything other than household uses or animal drinking water because they said they couldn't afford to buy pumps for the water to get it out of the cistern and to the terraces. In another case, in Al-Hazza they had 10 water cisterns that had previously been used for drinking water. A water project was brought into the community for drinking water, so they have since abandoned these cisterns and allowed them to be filled with soil. Initially I thought they were being careless to let those water resources degrade and yet still to complain of water scarcity in their agricultural terraces, but then I realized that catching and holding water is not enough, the infrastructure must be put into place to get the water where it is needed after it is contained. On the flip side, many of these communities explain that while they don't have enough water for agriculture, at the same time they must invest in building canals to divert water that is flowing off of the slopes to avoid damage to the terraces caused by the floods.

It appears that a different kind of water system must be emphasized, one that captures the flood water, and then allows it to be easily spread onto the terraces as desired. In many cases it appears that the communities are requesting things like dams. It is my opinion that they request dams because dams are large, and it is imagined that if they have a large dam, they will have a large amount of water. Alternatively they are requesting dams because they have observed such large scale water projects, and they seek to cater to the preferences of the organizations conducting the projects. Unfortunately, this does not seem to be the optimal approach for the way the water system works in the mountainous areas of Yemen. Rather than constructing large water containment infrastructure such as dams and large cisterns, water diversion and smaller containment infrastructure should be constructed on the slopes above and among the terraces themselves. This would have the double benefit of capturing the water during rainfalls, and protecting the terraces themselves from the floods. Indeed in many places in

Yemen, this type of water infrastructure existed in the past and has since degraded. In the SFD evaluation report by Nassr Mansoor this traditional system of birak (cisterns) and a'abbar (canals) is mentioned as being an efficient irrigation mechanism in these mountainous areas. It may be that farmers, if approached about this issue, would have valuable insight into how best to design more effective and useful irrigation infrastructure.

Additionally, water infrastructure should be designed in a way that will be easy for the villagers to maintain and use. Dependence on electric pumps when there are options to design the infrastructure in a way that utilizes gravity seems overly costly for the farmers. Also, while metal pipes may be better in some ways, they are also more difficult to clear out if they get clogged with soil, so open canals may be easier to maintain. These are issues that should be discussed in detail with the villagers to design a more efficient and effective water system for agriculture. This system may end up being the previously employed traditional system of canals and small birak cisterns among the terraces, or perhaps a new innovation may be determined to be better. Either way, large-scale containment infrastructure does not seem to be the optimal solution in almost any of the villages observed for this study.

Table 8: Needs of the Community

Governorate	District	Village	CARE	Primary Needs for Agriculture
Al-Hodayda	Bura'	Bani Batal		Dam/irrigation infrastructure, terrace rehabilitation
Al-Hodayda	Bura'	Rahabaat		Dam/irrigation infrastructure, terrace rehabilitation
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	✓	N/A
Al-Mahweet	Ar-Rujum	Al-Hajaar		Irrigation infrastructure, terrace rehabilitation
Al-Mahweet	Ar-Rujum	Al-Hazza		Terrace rehabilitation
Al-Mahweet	Ar-Rujum	At-Taraaif		Dam/irrigation infrastructure, terrace rehabilitation
Al-Mahweet	Ar-Rujum	Shansub		Dam rehabilitation, protection from stone slides
Al-Mahweet	At-Toweela	Al-Ghariba	✓	N/A
Lahaj	Al-Maqatira	Zaqiha		Dam/irrigation infrastructure, terrace rehabilitation
Lahaj	Al-Qabaita	Ar-Rima		Terrace rehabilitation
Lahaj	Al-Qabaita	Farisat Al-Jabal		Terrace rehabilitation

Section 6: Sustainability of Terrace Maintenance

In many cases there have been shocks that have resulted in the abandonment of terraces. In the cases where these shocks have persisted it may be that if terraces were rehabilitated they would not continue to be maintained. An example of this are areas where many people have permanently migrated or areas where terrace abandonment has been influenced by increased water shortage and long-term decreases in rainfall, and where additional water infrastructure is not feasible or effective. However, there are cases where the opportunity for future sustainability of the maintenance of rehabilitated terraces is likely possible. There are four main areas where this is likely the case:

1. Places where terraces have been abandoned due to damage from road construction. This is an example of an isolated shock to these communities that, once the road construction is completed, would not be expected to persist indefinitely. In many of these places the community did not willingly abandon their terraces and would eagerly put them back into use if they had the resources necessary to repair the damage.
2. Places where terraces were initially abandoned due to large amounts of migration to Saudi

Arabia in the 80s and 90s. This is another example of an isolated shock that has not persisted. When there was a restriction of migration in the 90s most of the migrants returned to their villages to find the terraces they had left untended for the year or years they were gone damaged and unusable, and they were not able to make the investment or coordination necessary to rehabilitate them. In many of these cases people would be willing to employ and maintain them if they had help with the upfront cost of rehabilitation.

3. Places where water infrastructure programs could be implemented alongside terrace rehabilitation. In most of these communities water scarcity is a major issue for agriculture and in some of these places it could be feasible to provide water infrastructure for rainwater harvesting and irrigation along with the terrace rehabilitation. This would relax the constraint of water shortage enough that more terraces could profitably be employed and terraces would be maintained.
4. Places where migration is not permanent. There are places where many farmers have migrated, and would likely not return, even if a terrace rehabilitation program were implemented. However, there are places where many farmers have migrated but they frequently return and maintain close ties to the communities. In these cases it is likely that many would return to work their land and maintain the terraces if the rehabilitation were implemented. Indeed in the CARE final progress report it is mentioned that in many cases families that had migrated returned to the villages due to the terrace rehabilitation and livestock project interventions.

Section 7: CARE Programs

In visiting two of the villages that had received programs of terrace rehabilitation from CARE in 2002, it was possible to observe how successful these programs were in the longer term. In both the villages visited, the terrace aspects of the CARE programs were considered a success. We were informed of two other villages where the program was less successful and we were provided with some anecdotal information about why this was the case.

Section 7.1: Description of the CARE Program

In general it appears that CARE's approach was not to rehabilitate terraces in the entire community but rather to select a particular location of terraces among those within the community and focus rehabilitation in that specific area. This was likely due to a limited budget combined with the need to coordinate terrace rehabilitation over a particular mountain slope or sub-catchment. However, this meant that not all farmers in the community benefited from the terrace rehabilitation. The CARE program of terrace rehabilitation was also coupled with additional programs for livestock, seeds, and water projects. The CARE program involved community contributions of 20% paid by the villagers, mostly in-kind through labor and materials. An engineer determined the cost of the rehabilitation. The villagers were paid incrementally, conditional on the progress of the rehabilitation. The monetary aid from CARE was used to compensate the farmers themselves for their labor, to hire additional labor, and to rent heavy machinery such as jackhammers to cut appropriate stones to construct the terrace walls. CARE worked with the farmers, which meant the sharecroppers in the case of sharecropping, not the owners of the land.

Section 7.2: Reasons for Success of CARE

Because the two villages that were visited were both examples of successful programs, we tried to determine the reasons for the success of the program. In the case of Al-Ghariba the villagers reported that the main reason the terraces were abandoned in the first place was because of migration to Saudi

Arabia, as well as the reduction in water availability. They explained that they have been able to continue to employ and maintain the rehabilitated terraces over the past six years since the program was completed because of the following reason: while it's true that there is still a substantial amount of migration from Al-Ghariba, those that are leaving to work are not going as far or for as long a period of time as they did in the past. They still return to work on the land. Because of this, the pressure towards terrace abandonment is reduced from the levels of the past. Additionally, they report that they feel like they have invested a lot of effort and money into the rehabilitation, and because of this they are motivated to maintain the terraces. Because the farmers themselves made the investment in the rehabilitation and not the land owners in the case of sharecropping, the share to the owner in the area rehabilitated by CARE is lower than in other areas (10% as opposed to 33%). This also provides incentive for farmers to continue to employ those terraces. Lastly, in CARE's external evaluation report it is mentioned that because the abandoned lands had not been cultivated for many years, the soil was healthier and more fertile than the soil of the terraces that had been continuously used in recent years. Despite these last two points, there did not appear to be any slippage where farmers abandoned other terraces even as they continued to maintain the CARE terraces; they reported that no other terraces were abandoned since the CARE program was implemented.

In the case of Bait Al-Maghuri the primary reason they cite for terrace abandonment in the past was because of a large amount of migration to Saudi Arabia. They explained that people have returned and that they have no other options besides farming. Because of this, they are able to continue to employ and maintain their terraces. They do report that there is one beneficiary of the rehabilitation who is currently migrating out of the village and they say that his terraces are being abandoned, so the problem of abandonment is not entirely eliminated, even if it is reduced.

Section 7.3: Reasons for Failure of CARE

In the cases where the CARE programs were not successful we heard reports that there were three reasons for the failure of the program: migration, suboptimal location of the rehabilitated terraces, and conflict within the community. In one case the beneficiaries consisted of eight brothers and two other neighbors and at some point after completion of the rehabilitation all eight brothers decided to migrate to Saudi Arabia, so the bulk of the terraces that had been rehabilitated were abandoned. In the other case the location of the terraces that were rehabilitated were reportedly too far from the village, and additionally, because the benefits to each farmer were not equal, this caused conflict within the community reducing the effectiveness of the program. This problem of social conflict inhibiting development projects is something we heard of happening in two other communities as well. In Al-Hajaar there was a drinking water project in the process of being established in the community, however the project had been halted because of conflict within the community. Also, in Al-Ghariba CARE had intended to implement a water harvesting project in addition to the terrace rehabilitation project, however this project was canceled because of disagreement between the villagers. In this case the disagreement was because of the cost of the project. CARE was requiring that the villagers contribute 30% of the cost of the water project and there were villagers who felt this was too much.

Section 7.4: Lessons Learned from CARE

The primary lessons learned from our observations in the CARE villages were the following:

1. Emphasize community involvement in determination of which terraces are to be rehabilitated. If the community itself has an involved roll in this determination it is likely to minimize both conflict between beneficiaries, and between beneficiaries and non-beneficiaries. It is also likely to minimize abandonment of the rehabilitated terraces due to suboptimal location of the project;

- if the community members determine the terraces to be rehabilitated, they will likely emphasize those they are most likely to be able to employ and maintain.
2. In the case of Al-Ghariba the community contribution appears to have been both a positive aspect of the program and a negative aspect. In the case of the terrace rehabilitation they expressed that it made them feel invested in maintaining the terraces after the rehabilitation, while in the case of the water project it was the source of conflict leading to the abandonment of the project. This implies that the role of community contributions in these projects must be carefully designed to maximize the benefits they provide, while minimizing the negative aspects.
 3. CARE formed groups of a small number of farmers from each village consisting of those who would be beneficiaries of the terrace rehabilitation program, and they implemented rehabilitation in a limited area. If a broader project were to be implemented where all or most of the abandoned terraces in a community were rehabilitated, another way of potentially reducing the problems due to conflict would be in how the groups are formed. Rather than having one group for the entire community, it might be more effective to have groups consisting of farmers whose actions affect each other. This means forming groups of farmers whose terraces share a particular slope or sub-catchment. This idea was proposed to villagers of Rahabaat and they expressed that this seemed to be a logical idea and they were interested.

Section 8: Primary Recommendations

1. While some factors that have contributed to terrace abandonment such as water scarcity and the increased cost of labor can be expected to continue, much of the terrace abandonment that has taken place has been due to isolated shocks such as large amounts of migration to Saudi Arabia and road construction. Because of this, it is likely that terrace rehabilitation programs could be expected to have long-term success in many areas where the primary reason for the abandonment has been these particular events. Additionally, coupling terrace rehabilitation programs with improved and/or increased irrigation infrastructure will mitigate the effects of water scarcity and improve the likelihood of the success of terrace rehabilitation programs as well.
2. In general the farmers/sharecroppers have the greatest interest in terrace rehabilitation. It is recommended that programs for rehabilitation work closely with the sharecroppers and not only with the land owners. In many cases the sharecroppers have a long-term stake in the performance of the land and would be willing to make the necessary investments and commitment to rehabilitate the terraces. As occurred in the CARE site in Al-Ghariba, it is also possible to persuade the owners of the land to reduce the share they take from the harvest to reward or encourage the rehabilitation efforts.
3. Qat is a complicated issue. While SFD does not want to encourage the production of qat on terraces rehabilitated by them, it must be recognized that the decision to grow qat for many of these farmers is not only a short term profit-driven decision, but also a long-term insurance mechanism because of the fact that qat can survive extended periods of water scarcity while coffee, for example, cannot. Both of these plants are long-term investments for the farmers, but there is much less risk associated with qat. Therefore, any efforts to reduce qat production must be coupled with some other form of long-term insurance of crop survival, such as extensive new irrigation infrastructure.
4. Water infrastructure for rain harvesting and agricultural applications is of paramount importance

in many of these communities. However, it must be emphasized that large scale dam and cistern projects seem to be of limited value in some locations. Rather, more systemic water capture and transportation infrastructure should be emphasized, and extensive cooperation with the communities to design this infrastructure would likely be beneficial. In particular, canal infrastructure for the transport of captured water to the terraces is essential for the value of rainwater harvesting to be realized.

5. Also with regard to water, infrastructure should be designed in such a way that it will be easy and cheap for the villagers to maintain and utilize going forward. Open canals may be better than pipes in some instances because they are easier to clean. Cisterns should be built in such a way that the transportation of the water to the terraces can depend on gravity more than pumps.
6. One of the primary barriers to the success of the CARE program has been conflict within the communities. For this reason, group formation, community participation and community contributions should be carefully designed to limit the likelihood of conflicts. One option, which also helps address the fact that terrace rehabilitation must be coordinated along a shared mountain slope and/or sub-catchment, is to form groups of farmers whose terraces share a given slope. With this model it may be that some farmers will be in more than one group if his terraces are in more than one location.
7. The other problem reported in the CARE communities has been abandonment of rehabilitated terraces because of their suboptimal location. For this reason, extensive community participation should be included in the determination of the terraces to be rehabilitated in order to maximize the likelihood that the terraces will be maintained after the completion of the program.
8. The community should be involved in determining not only the terraces to be rehabilitated, but also the order in which they should be rehabilitated. This will increase the cooperation within the community as they have to coordinate this process along the mountain slopes. In addition, there were communities (Rahabaat and Zaqiha) that expressed that it would be more important to them to have aid in rehabilitated currently employed terraces that had maintenance problems rather than moving on to abandoned terraces. Additionally in Rahabaat they expressed that it would be most important to start with the poorest and most needy individuals. Therefore, allowing the community to determine which terraces to prioritize is important to stimulate cooperation in the community and to address the specific needs of each community, which seem to vary.
9. It appears from the CARE experience that community contribution of a portion of the cost of rehabilitation is likely a useful tool to increase the likelihood that terraces will be maintained in the future. However, this tool should be carefully applied as it can also be a barrier to participation in areas where there is conflict within the community and/or there is not enough income within the community that would allow them to contribute the required share.

The purpose of this study was to perform a detailed case study analysis to determine factors contributing to terrace abandonment, and to identify the characteristics of communities that influence these factors. Several important factors were identified and recommendations have been made that may improve the likelihood of successful formulation and implementation of any terrace rehabilitation projects. The next step is to identify mechanisms to successfully encourage community coordination in watershed management, terrace rehabilitation and/or maintenance, to determine the role that any external organization such as SFD should take, and to establish what form any aid to encourage terrace rehabilitation and/or maintenance should take. One option is to establish social structures similar to Water User Associations to manage the watershed, irrigation infrastructure, and terraces. Another

option is to implement a Payment for Environmental Services scheme to incentivize terrace maintenance. More work is needed to determine the right approach to this issue, but this report provides a valuable overview of some of the relevant issues for developing such an approach.

Section 9: Detailed Case Studies

Section 9.1: Bani Batal

Governorate:	Al-Hodayda	الحديدة
District:	Bura'	براع
Village:	Bani Batal	بني بطل

Location and Accessibility:

Bani Batal is very remote. It took a long time (maybe 45 minutes) to get there from باجل. However, the road quality was quite good. They are high up on steep mountain slopes with terraces extending all the way down to the wadi. They are the only village among those that I visited who grow coffee in any large amount. They have a lot of terraces that have been abandoned.

- Approximate Location: N 14°54'55.3"
E 43°29'24.5"
- Approximate Elevation: 1049 meters
- Nearest major town: باجل (Bajil) – Approximately 40 km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejrán as translator and facilitator. The interview took place on July 22nd, 2009. There were approximately 5-6 farmers present during the interview, many very young.

Socioeconomic Information:

- **Population**
 - Approximately 1200 people live in the village (200 households). However, according to the 2001 Agricultural Census there were 95 households at that time. It is unclear the source of such an extreme discrepancy unless they were exaggerating the size of their community. They report that the size of the population currently living in the village has been increasing.
- **Migration**
 - Approximately 60% of their households have at least one person migrated for work, many to Saudi Arabia and primarily young men. Two full families have migrated in the past five years.
 - **Migration Pressure:** When asked if people would come back if they could, they said that people would likely not return. There are also many people who would like to migrate but can't because of the cost of a visa to Saudi Arabia or because their families can't leave and they don't want to leave their families. When asked what would need to change in order to make people willing to stay in the village and not migrate they said that they needed higher incomes. They also request financial support for rehabilitating their terraces and they want a dam built.
- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 15%
 - Percent of livelihood from remittances: 50%
 - Percent of livelihood from hourly labor 35%

Agriculture:

- **Water**

- **Drinking Water:** They have three غيول (ghuyul) that are used for drinking water. Additionally they have approximately 100 بركة (barika) that are private. There is approximately one per household (another corroboration that the 2001 Census number of households is likely more accurate than the number they reported). They use the برك (birak) during drought for drinking water.
- **Agricultural Water:** In addition to the three غيول (ghuyul) that are used for drinking water, there is another large غيل (ghiel) that is used to irrigate the agricultural terraces. They have canals and water diversion routes used to get water from the غيل (ghiel) to the terraces in order to cultivate their coffee trees. They want to put in a dam in order to more efficiently use the rainwater they get for this type of irrigation.
- **Equity:** There is equal access to the three غيول (ghuyul) for drinking water. However, for the غيل (ghiel) used for irrigation, while everyone has access, there is a system for rotating the irrigation among farmers. The system is based on the area of land the farmer has cultivated. A farmer who has a large amount of terraces may get to irrigate for two-three days while someone with less would get to irrigate for one day. However, there is also an issue of distance to the water source. Terraces closer to the غيل (ghiel) can easily be irrigated while terraces farther away have to depend exclusively on rainfall, which makes them much more affected during drought times. This is why they wanted the dam, so that more of their terraces can be irrigated.
- **Drought and Adjustment to Scarcity:** There is currently no drought. However, when asked how they adapt to periods of water scarcity they said that they drink from their برك (birak) rather than from the three غيول (ghuyul). Additionally some terraces are not irrigated during water shortage, primarily qat terraces are left to survive as they will without irrigation since qat can survive extended periods of water scarcity. After qat it is areas that are generally planted with corn that are not irrigated or planted. In general they focus on their coffee trees during times of water scarcity and on irrigating areas that they need most first.

- **Livestock**

- **Animals:** They have cows, goats and sheep.
- **Grazing:** They do not have any open grazing land that they use for grazing the animals. They graze the animals on their own private unmaintained terraces and on special private land in the valleys. They only buy animal fodder during times of water scarcity. In order to buy animal fodder they have to go to باجل (Bajil).
- **Terrace Damage:** The animals do graze on unmaintained terraces, but not on terraces used for cultivation.
- **Benefit from Animals:** The animals provide direct income, particularly for poor families who sell goats and sheep especially. More wealthy people (they described wealthy households to be those with two or three members working in Saudi Arabia) will use their animals for meat for the household. Poor households use the manure for fuel and the village as a whole uses the manure for fertilizer. Carrying the manure to the terraces and fertilizing the land is a job that women do.

- **Farm Output**

- **Production:** They grow yellow corn (when there's rain), qat, coffee, and bananas.

- **Selling:** They sell qat (making up about 30% of their agricultural income) and coffee (making up about 70% of their agricultural income). These percents vary depending on the prices of qat and coffee. They sell their products in باجل (Bajil) and they say that now that the road is constructed this is much easier.
- **Inputs**
 - The only material constraint to agricultural production is water. They need financial support to rehabilitate their terraces because there is plenty of labor available, they just can't pay for it.

Terraces:

- **Current State of Maintenance:** Overall 70% of their terraces have been abandoned. Approximately 15% have been abandoned in the past five years. The terraces they currently use are relatively well maintained.
- **Cause of Abandonment:** The main reason that terraces have been abandoned is water scarcity. About 20 years ago there was much more rain and after that time it has been decreasing. The primary reason one terrace is abandoned as opposed to another is because it is farther from the water source. There are even lands that have been abandoned that are more fertile than those that have been kept because they are too far away from water. In general they focus on the terraces on which they grow coffee. Because water is such an issue they want a dam constructed, as well as the terraces rehabilitated. If this were to happen they would hope to see higher incomes from expanded coffee production since they say that coffee has a good price these days. They would also hope that this would provide more work opportunities closer to home.
- **Terrace Maintenance:** The terraces on which coffee grows are maintained yearly while all others are just repaired when damaged. In general they spend more energy and care in maintaining terraces that grow coffee and terraces that are lower down on the slopes rather than those that are farther up on the slopes and far from water. Terrace maintenance is conducted only by men. The primary constraints to terrace maintenance are the cost of labor (it costs approximately 1500YR to hire someone for one day), and availability of appropriate stones. They say that rebuilding terraces is expensive because appropriate stones have to be carried long distances.
- **Cooperation in Maintenance:** This village does not have جایش (jaysh), but has a system they call عانة ('Aana) which is a similar system. With this system the community provides help to someone who needs it, but it's generally only for one day and then the person is on their own. Additionally it primarily happens in particular emergency situations, especially if there is damage to a بركة (barika) or house. In this system repayment is considered traditional as well.
- **Optimality of Current Terraces:** They do not think that any other method of terrace construction would be better.
- **Soil:** If the soil from the collapsed terrace has not been carried far they just replace it. If not, they have to carry it approximately 100 meters.
- **When the Farmer Migrates:** Generally when someone migrates they give their land over to a relative to be maintain. In some cases they will even pay them to maintain it for them.
- **Repercussions of Terrace Erosion:** Repercussions of terrace degradation are landslides and stone slides, particularly in cases of heavy rain. There can be damage to terraces below the damaged terrace and there can be damage to crops. It is particularly a problem when coffee trees are damaged since they are an investment that lasts longer than annual crops. A coffee tree can live for about 30 years while qat can live for hundreds of years if in good conditions. There

are no other villages below them on the slopes. A landslide that affects a terrace will generally affect all the terraces along the whole slope all the way to the valley bottom. If there is this severe of an event generally they will wait for two or three days for the slopes to stabilize as the land dries and then they all go out to repair the damage.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 77%
 - Percent of terraces operated through sharecropping with a private land owner: 20%
 - Percent of terraces operated through sharecropping on state land: 0%
 - Percent of terraces operated through sharecropping on religious endowment land: 3%
- **Sharecropping Structure:** The contracts are written contracts. The period of the contract varies from 2-10 years or more. A condition of the contracts is that if a farmer wants to stop the sharecropping arrangement he needs to return the land to the owner with the terrace well-maintained. These contracts are all in cases where the owner has migrated, so the owner is never living in the village. Additionally, it is the case that the farmer is allotted all of the profit from the production of the sharecropped land but that he is simply asked to keep the terraces maintained.
- **Sharecropping and Terrace Maintenance:** The farmer is responsible for paying for and carrying out the terrace maintenance, but if there is very severe damage the owner may contribute money and/or participate in the repair.

Other Questions:

- **Fuel:** They use gas in the house and additionally gather wood. Approximately five hours is spent gathering wood per day. The wood is gathered from their private terraces.
- **Forestation:** They would not be interested in reforestation.

Section 9.2: Rahabaat

Governorate:	Al-Hodayda	الحديدة
District:	Bura'	برع
Village:	Rahabaat	رحبات

Location and Accessibility:

Rahabaat is in a relatively steep mountainous area. It is not particularly difficult to access, although the road gets washed out at one point as it goes through the wadi, so it can be difficult. Rahabaat is not one of the 16 villages from the initial RALP survey who expressed interest in terrace rehabilitation, but they are interested in terrace rehabilitation and have problems with their terraces.

- Nearest major town: باجل (Bajil) – Approximately 30-40km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on August 12th, 2009. There were approximately 15-20 farmers present during the interview. The same questionnaire was used for this village as for the others from the RALP communities, but some different strategies were used for community participation and some different questions were asked.

Socioeconomic Information:

- **Population**
 - Approximately 1000 people live in the village (90-100 households). According to the 2001 Agricultural Census there were 124 households at that time. They report that the size of the

population currently living in the village has been increasing.

- **Migration**

- Approximately one-third of their members are currently in Saudi Arabia, one-third are migrated to other areas inside Yemen, and one-third are still in the village. Approximately 20 years ago there was a time of very extensive migration.
- **Migration Pressure:** People would come back if they could. As it is, people frequently come back and forth. The longest anyone stays away is generally about a year. There are people who want to migrate, especially to Saudi Arabia, but they can't because they can't leave their families without taking care of them and most who go to Saudi Arabia do so illegally because the visa is so expensive, so they often are caught and sent back home. The main things they need that will make it possible for people to stay in the village are a dam and water infrastructure for irrigation, and rehabilitation of their damaged terraces.

- **Approximate Percents of Sources of Income**

- During drought periods:
 - Percent of livelihood from agriculture: 20%
 - Percent of livelihood from remittances: 80%
- During non-drought periods:
 - Percent of livelihood from agriculture: 80%
 - Percent of livelihood from remittances: 20%
- There are a few people (approximately 8) who have permanent employment in the village, and there is one person who is in the army.

Agriculture:

- **Water**

- **Drinking Water:** Some people have private برك (birak) used for drinking water and household use. There used to be 10 springs a long time ago, but they are more or less dry now. Two of these springs used to be used for drinking water, but now only one is, and it's approximately five hours away for women to travel to get water. They purchase drinking water from Bajil which costs approximately 100YR for 20 liters.
- **Agricultural Water:** Agriculture is entirely rain-fed and there is currently no water infrastructure for agriculture.
- **Drought and Adjustment to Scarcity:** There is currently a drought and it has been severe for about three years. Rainfall has been decreasing over time. There was a very severe drought about 10 years ago, but their springs were flowing at that time so they didn't feel the scarcity as acutely. They adjust to water scarcity by stopping agricultural production entirely and they have to buy their drinking water from Bajil.

- **Livestock**

- **Animals:** They have cows, goats, sheep and oxen. They no longer have donkeys now that the road is completed.
- **Grazing:** The animals graze on open grazing land and on privately owned land on abandoned or damaged terraces. During drought times they have to purchase food for the animals.
- **Benefit from Animals:** The animals provide direct income, as they are sold when they need money. They provide food for the household in the form of meat and milk. They use their manure for fertilizer. The oxen are also used for work on the terraces.

- **Farm Output**

- **Production:** They grow corn, sorghum, cow peas and qat.
- **Selling:** They do not generally sell their agricultural production.
- **Inputs**
 - A participatory exercise was used to determine the most severe constraints to agricultural production. The outcome is that the largest problems faced in agricultural production are the following four in order of importance from most important to least: water scarcity, lack of income/funds, lack of knowledge/training, crop disease.
- **Farming as a Strategy**
 - **Why they continue to farm:** Besides a strategy to save money, they farm because they want to be able to have enough food. Additionally by growing their food they can store up a large amount of food for their families to subsist on so that they can travel to other places to work in the winter season.
 - **Relationship to and Attitudes about the Market for Food:** They do purchase food from Bajil. They purchase primarily wheat, rice and sugar. They have a small shop nearby but food there is more expensive.
 - Wheat: 50kg sack costs 4000YR and lasts approximately 60 person-days.
 - Rice: 10kg sack costs 1800YR and lasts approximately 1 month (not used as frequently)

Terraces:

- **Current State of Maintenance:** Approximately one-third of their terraces are currently abandoned. A participatory exercise was done to determine the primary causes of terrace degradation. The results were as follows, from the most important to the least. First was lack of income/funds to be used for maintenance, second was general neglect, tied for third were floods and damage from grazing.
- **Cause of Abandonment:** When asked what is different now that would make it so they would not abandon their terraces in the future if they were rehabilitated they explained that the primary need in order to continue using their terraces is water infrastructure for irrigating the terraces. The amount of rainfall has been decreasing which has contributed to their inability to employ their terraces.
- **Cooperation in Maintenance:** They do not have any form of community participation in terrace maintenance.
- **Attitudes about Rehabilitation:** They are very interested in terrace rehabilitation. They would be interested in the terraces that are currently in use, but in bad condition, to be rehabilitated first, then the abandoned terraces. They would want the rehabilitation to begin with more needy people, prioritizing those who are very poor and have lands with lots of problems.
- **Repercussions of Terrace Erosion:** When a terrace has problems, those downslope from them are affected. When asked what they thought about the idea of forming groups to prioritize rehabilitation and manage maintenance that were comprised of all of the farmers on a shared slope they expressed that this sounded like a reasonable and logical idea and would be willing to work in that way.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 98.5%

- Percent of terraces operated through sharecropping with a private land owner: 1%
- Percent of terraces operated through sharecropping on state land: 0%
- Percent of terraces operated through sharecropping on religious endowment land: 0.5% (the religious endowment land is very degraded)
- **Sharecropping Structure:** The sharecropping contracts are written contracts for open periods of time. The share to the owner is sometimes 25%, sometimes 50%, and sometimes the agreement is just that the farmer maintain the terraces. The owner is never living in the village.
- **Sharecropping and Terrace Maintenance:** The farmer pays for the maintenance of the terraces. If there is very severe damage the owner may contribute.

Primary Needs of the Community:

- A participatory exercise was done to determine the primary needs of the community. The resulting ranking (with a measure of the comparative degree of importance) are listed below in order of importance, most important to least.
 - 10 – Need for water infrastructure for irrigation and agriculture
 - 8 – Terrace Rehabilitation
 - 6 – Aid with livestock
 - 4 – Aid with bees/honey production
 - 1 – Need for more hourly labor job opportunities
 - 1 – Desire for more migration opportunities

Section 9.3: Bait Al-Maghuri (CARE)

Governorate:	Al-Mahweet	المحويت
District:	Al-Khabt	الخبث
Village:	Bait Al-Maghuri	بيت المغوري

Location and Accessibility:

Al-Maghuri is relatively accessible. It took approximately 20 minutes to reach it from the main road. The access road was moderately rough, but the quality was not too bad. The village is located in a relatively low area and the slopes surrounding the village are not extremely steep. There is some natural vegetation in the surrounding area, but it is not particularly pervasive.

- Nearest major town: المرواح (Al-Marwah) – Approximately 5 km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 26th, 2009. There were approximately 5-6 farmers present during the interview. I did not have time to go through both the full CARE questionnaire and the full general questionnaire in this village, so I focussed on the CARE program and asked a few additional follow-up questions reported below.

CARE Questionnaire:

CARE initiated their program in Bait Al-Maghuri in 2002 and worked with the community for approximately one year. Before CARE came to the village approximately 30% of their terraces were abandoned. Of those that had been abandoned, 25% were rehabilitated through the CARE program. There were not really any terraces in use prior to the program that were rehabilitated through the program.

When asked why CARE rehabilitated their terraces they said that they were targeted because they were poor and needed help, but also because they were highly motivated; they don't have a lot of

people who want to migrate and they want to focus on agriculture.

Aspects of CARE program:

As well as rehabilitating the terraces, CARE also conducted several other projects in the community. The CARE program included the following projects:

1. Groups were formed of people who were not getting terrace rehabilitation help and they were given goats.
2. Vegetable seeds were provided by CARE in encourage production of salable crops.
3. A cistern was constructed in 2003 by CARE and they tried to facilitate the use of drip irrigation.
4. The terraces in one area were rehabilitated.

It appears that some of these projects were more successful than others. The terrace aspect of the project seems to be very successful. The farmers report that the terraces were rehabilitated successfully and all that were rehabilitated are still being used and maintained. There is some small problem because there is someone who has migrated out of the village and it is likely that his terraces will be abandoned, but they say it is a small amount. Less successful were the vegetable seed and irrigation projects. The farmers used the vegetable seeds and grew vegetables during one season, but CARE didn't provide any training for them on how to continue cultivation of the vegetables, so they stopped after one year. Also, the cistern that CARE built is maintained and in good condition, but the farmers have no way of getting water out of the cistern and onto their terraces. They say they need pumps and canals and pipes in order to make the cistern usable for agricultural. As of now it's just being used for animals and household uses.

Implementation:

A group was formed of the approximately 13 families (approximately 50% of all families in the village) who were to be beneficiaries of the terrace rehabilitation. The program worked with the sharecroppers rather than the land owners in sharecropping situations. There was one person selected from the group to represent them all and he signed the contract. An engineer visited the village and determined which area to rehabilitate and determined the amount of money for the project based on the number of terraces and their state of repair. The engineer determined how much money each family would get based on their terraces, so not all the beneficiaries benefited equally. Money was given to the group members and the farmers themselves decided how to rehabilitate the terraces and which ones to start with. The money was given to the farmers in stages based on their progress in the rehabilitation.

Contract:

There was a contract required by CARE between the organization and the farmers. The contract was for two years, for approximately 170,000YR. The contract was that the farmers would rebuild their own terraces and CARE would come and inspect the work and pay the farmers based on how the rehabilitation was progressing. If farmers were not rehabilitating the terraces as was required they would have had to pay 10,000YR as a penalty, however everyone kept up with the requirements of the program so this didn't have to happen. The contract stipulated that during the two years covered therein the farmers had to maintain their terraces. Someone from CARE came back once after the two year period to check on how things were going.

Why the Problem was there in the first place:

The reason their terraces were abandoned in the first place was not because of drought, but rather because approximately 20 years ago there was a very large wave of migration to Saudi Arabia, so many of the terraces were abandoned and had been in use as grazing land since then. When asked what is different now that has allowed them to maintain and use the rehabilitated terraces they say that people came back from Saudi Arabia, and they don't have any other option besides agriculture.

Outcome of the program:

The farmers feel good about the program. They say that there are a few terraces owned by someone

who has now migrated that are being abandoned, but other than that the program was a success. They have another area of terraces that have been abandoned for approximately 20 years that they really want to be rehabilitated but that was not included in the CARE program. The one thing they think is more important than the terraces that they did not receive was a pump for the cistern. They cannot currently use their water effectively. The main benefits they saw from the program were high yields and incomes, the ability to plant more animal fodder, and the protection of all the terraces in the area from mudslides and rainfall. They notices benefit to the terraces lower on the slope because they are more protected now that the slope is fully terraced, however, they did not notice any particular impact farther downstream outside the immediate terraced area.

General Questionnaire:

Socioeconomic Information:

- **Population**

- The population is made up of approximately 25 households.

Agriculture:

- **Water**

- The primary water infrastructure they have are two large cisterns. One was built by the Agricultural and Fishery Fund in 2004 and one was built by CARE in 2003. The one built by the Agricultural and Fishery Fund leaks and is in somewhat bad condition. The one built by CARE is in good condition, but they don't have an efficient way to access the water in either. They all participate in the annual maintenance of these shared water resources.

- **Farm Output**

- **Production:** They grow yellow corn, sorghum, sesame, a few vegetables, mango, papaya, kharbash (custard apple), and a small amount of coffee as a recent experiment.
- **Selling:** They sold the vegetables when they grew them using the seeds from CARE, but currently they don't sell anything.

- **Farming as a Strategy**

- **Why they continue to farm:** They report that besides a strategy to save money, they farm because they have no other option and because it's traditional, it's what there fathers did.
- **Relationship to and Attitudes about the Market for Food:** They do purchase food from Al-Marwah. They purchase primarily wheat and rice.
 - Wheat: 50kg sack costs 3500YR and lasts approximately 150 person-days.
 - Rice: 10kg sack costs 1800YR and lasts approximately one month (not used as frequently)

They do trust that they can depend on the market to provide food for their needs; the main problem they face is lack of money, but if they need money to buy food they will sell a goat or something of that sort. Prices of food in the markets do change a lot, and frequently.

Section 9.4: Al-Hajaar

Governorate:	Al-Mahweet	المحويت
District:	Ar-Rujum	الرجم
Village:	Al-Hajaar	الحجار

Location and Accessibility:

Al-Hajaar is located in a dry high altitude location, at an elevation of approximately 2040 meters. There is not a large amount of natural vegetation surrounding the village, though some bushes

and low vegetation are present. The quality of the access road is relative good, though still rough. It took about a half an hour to access the village from the main road, and four wheel drive was required at some points.

- Approximate Location: N 15°23'45.1"
E 043°41'59.1"
- Approximate Elevation: 2040 meters
- Nearest major town: الرجم (Ar-Rujum) - Approximately 10-15km away

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 20th, 2009. There were approximately 12-14 farmers present during the interview.

Socioeconomic Information:

- **Population**
 - The village is made up of approximately 600 people (approximately 70 households). According to the Agricultural Census of 2001 the number of households at that time was 55. The population of the community is increasing over time despite the presence of migration.
- **Migration**
 - The villagers reported a very small amount of migration to Saudi Arabia (only five men) but Sultan said that he overheard them whispering and suspects that this number is much larger, but that they were reluctant to say so because the migration is illegal. There are other people in the the community that want to migrate but couldn't because of the cost of the visa, which is very expensive. Approximately two-thirds of the population (all men) are currently working outside the village, either in Sana'a or other places. In general migration is only young men, not full families.
- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 20%
 - Percent of livelihood from remittances: 80%
 - Many of the men from the village are employed in the army and send back some of their income to the village.

Agriculture:

- **Water**
 - **Drinking Water:** There is a water project in the process of development and implementation but it is failing because of administrative and social problems. They do get drinking water from a nearby lake, as well as from five برك (birak, singular: بركة barika) in the community. One is old and not in good condition, a second one is new and modern; it was constructed by the Social Fund for Development and is in good condition. There are also three private برك (birak) that were constructed by individuals for their own personal use and are not open to public use. There is a well that is used by poorer people for drinking water, and those with more money do buy drinking water from trucks.
 - **Agricultural Water:** Agriculture is entirely rain-fed. For the most part they depend only on water that falls or runs directly onto terraces during rains. There are some water diversion canals that divert water from bare slopes onto the terraces, but most of these are destroyed and are too expensive to maintain.
 - **Equity:** All public water resources are open to anyone, and everyone has equal access. The only inequality comes from those who can afford to buy drinking water verses those who

must depend on the well or other sources, and of course the private برك (birak) are not for public use. However, in times of water shortage, the people who own the برك (birak) will distribute water to their neighbors too.

- **Drought and Adjustment to Scarcity:** There is currently a drought and it has lasted for approximately two years. During times of water scarcity they still plant the terraces, and there is no change in their cropping patterns, but often the crops fail. One of the major ways that people must adjust to water scarcity is in the care of their animals. Animal fodder is very expensive (approximately 500YR for a dried feed bundle and 200-300YR for a fresh feed bundle and they must travel far to get it). Many people must sell their animals when there is not enough water because they are very expensive to feed.
- **Livestock**
 - **Animals:** The villagers keep cows, goats, sheep and donkeys.
 - **Grazing:** The animals graze on open grazing land and on uncultivated terraces. They also bring food to the animals that is purchased when there is a problem of food scarcity from water shortage.
 - **Terrace Damage:** The animals do damage the terraces when they graze on them, but it is very minor compared to other causes of damage.
 - **Benefit from Animals:** The animals provide a large benefit to the villagers; they are sold when people need direct income, their milk and meat is also consumed by the household, and their manure is used for fertilizer on the terraces and for some fuel in the household. The animals also work on the farm and are used in carrying water and in tilling.
- **Farm Output**
 - **Production:** They grow three kinds of corn: white corn, red corn and yellow corn. They grow wheat and sorghum as well. They do have some qat, but it is not a lot and not really on the bulk of the terraces. (I didn't necessarily see all of the terraces, but the only qat I saw was planted near the houses on a smallish plot).
 - **Selling:** Nothing is sold.
- **Inputs**
 - The only input that they report as being a binding constraint is water. Even with migration there are people willing and able to work so labor is not a problem.

Terraces:

- **Current State of Maintenance:** The terraces that are currently in use are well-maintained. More than 30% of the terraces have been abandoned in the past five years. They do not need help maintaining the terraces that are currently employed but they would need help to rehabilitate abandoned terraces.
- **Cause of Abandonment:** Terraces are abandoned slowly and gradually. They are abandoned first due to reduced water availability, then allowed to degrade. In determining whether to abandon one terrace and not another the factors entering the decision are 1) they keep terraces with more fertile soil for longer, 2) they keep terraces that are closest to canals and water tributaries longer and tend to abandon those that are farther away first. They would be able to put their abandoned terraces back into use if they were rehabilitated as long as there was enough water.
- **Terrace Maintenance:** Maintenance is done by the men. Sometimes women contribute, but it is primarily work done by the men. Regular maintenance has to happen after every major rain and this is done primarily by the individual farmers on their own terraces.

- **Cooperation in Terrace Maintenance:** If there is major damage caused by the rain they will work together and help the farmer who is responsible for the damaged terrace repair the damage. This system is called جایش (jaysh) and it is still practiced in this village. There is no inequality with this system, if someone asked for help they will get it every time.
- **Optimality of Current Terraces:** When asked whether or not they would choose to construct the terraces with different materials or using a different method if they were able, they insisted that they would like to construct the terraces better. If they had the opportunity and/or money they would choose to use bigger stones and cement in some cases and they would want to rehabilitate and improve the construction of the water runoff diversion canals.
- **Soil:** Soil must be transported to fill the terraces if a new terrace is being constructed, a terrace is being rehabilitated, or there is a major collapse in a large rain storm. This soil must be carried approximately 300-400 meters, and this severe of a collapse happens approximately once every two years.
- **When the Farmer Migrates:** When a farmer migrates his terraces will likely be taken over by another member of the family. It used to be (two years ago) that the terraces of someone who migrates would be rented out, but now this is not common because there are less terraces so it is not as difficult for another member of the family to absorb the additional terraces. Still, if someone leaves who has a very large amount of land, the other members of their family may rent some of the terraces out even today and then take care of the rest.
- **Repercussions of Terrace Erosion:** The repercussions of major terrace erosion or collapse are landslides, wasted water, damage to other terraces, sometimes damage to other structures, crop damage and loss of soil. The communities that exist below them on the slope are not directly affected by these terrace erosion incidences because they are very far away. The primary negative external impact of a terrace collapse is on the terraces directly below the failed terrace. In this case the community works together and quickly and, in order to avoid further collapse and damage, they repair the damaged terrace.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 30%
 - Percent of terraces operated through sharecropping with a private land owner: 60%
 - Percent of terraces operated through sharecropping on state land: 0%
 - Percent of terraces operated through sharecropping on religious endowment land: 10%
- **Sharecropping Structure:** Sometimes the land owner lives in the village and sometimes not. The contracts are written contracts and are for an open period. However, they say that if the owner wanted the land back he can take it at any time. In the sharecropping arrangement the owner gets one-third and the farmer gets two-thirds of the returns from the terraces.
- **Sharecropping and Terrace Maintenance:** The terrace maintenance is paid for and carried out by the farmer. Sometimes if there is a very serious problem the land owner may contribute a little bit.

Other Questions:

- **Fuel:** The households use gas as well as some manure and some wood that is gathered as fuel. The women spend approximately three hours per day gathering wood. Wood gathering is only allowed in specific areas. When asked whether or not planting trees nearby would be seen as a potential source of benefit either for fuel wood or animal food they were very enthusiastic about the idea.

Section 9.5: Al-Hazza

Governorate:	Al-Mahweet	المحويت
District:	Ar-Rujum	الرجم
Village:	Al-Hazza	الحزة

Location and Accessibility:

Al-Hazza is located in a low valley area. The ecosystem is quite wet and there is a lot of wild plant growth. An indication of the extent of this can be seen in how the terraces are constructed in this area. They told us that they place one or two layers of stones and then wait for grasses and weeds to grow up into them to help stabilize them before building them higher. This is the only place I've seen to this point that uses this method. It appears to be a function of the fact that weeds and grasses will grow abundantly there, as well as the fact that the force of runoff water there is quite high due to how far down the steep slopes they are. The road to access the community is currently under construction and is extremely rough and treacherous at some points. While it wasn't too far from the main road, it still took us about 45 minutes to an hour to traverse the access road. While we were interested in getting information about Al-Hazza itself, the villagers identified themselves as part of a larger group of villages the collection of which is referred to as الروحاني (Ar-Rawhani) including the following:

الحزة	اللج
المخساعي	الجرين
الظهرة	رياد
حماس	سيال الذنبة
بيت ثابت	

- Approximate Location: N 15°32'24.6"
E 043°35'09.4"
- Approximate Elevation: 1104 meters
- Nearest major town: الرجم (Ar-Rujum) - Approximately 15-20km away

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 20th, 2009. There were approximately 3-4 farmers present during the interview, though all of the information came primarily from one individual.

Socioeconomic Information:

- **Population**
 - The village of Al-Hazza is made up of approximately 250 people (37 households) while if all of Ar-Rawhani is included the number is approximately 700 people (130 households). The 2001 Agricultural Census indicated that the number of households was 135 at that time.
- **Migration**
 - One or two members of every family (only men) are currently migrated to Saudi Arabia. Approximately 35 full families (consisting of approximately 70-80 people) are currently migrated to other areas of Yemen for work such as Sana'a or other large cities.
 - **Migration Pressure:** If conditions allowed, people who had migrated would come back and, there are not currently any additional people living in the village who desire to or intend to migrate. When asked what people felt they would need in order to remain in the village rather than migrate the primary things listed were improved services such as electricity and water service, and completion and improvement of the road. They also indicated that better work opportunities were desired.

- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 20%
 - Percent of livelihood from remittances: 70%
 - Percent of livelihood from hourly labor: 10%
 - After the fact they said that livestock brought in 20% of their income. It is unclear where this 20% fits into the rest of the percentage breakdown, but most of the time these percents are extremely rough and just used as a way of indicating what the villagers feel are the more important source of their income, so should not be taken literally in any of the case studies.

Agriculture:

- **Water**
 - **Drinking Water:** They used to use برك (birak) for drinking water, but a water project was recently put into operation so they said they have abandoned all of their برك (birak), they had 10 of them, and they are now all filled with soil.
 - **Agricultural Water:** They have no infrastructure for capturing or diverting rainwater for agriculture. They depend on rain falling directly on the terraces exclusively.
 - **Equity:** There is no shared water infrastructure in use now like wells or برك (birak), and the water project was for the whole community, so everyone has equal access to that. However, they say that poor people tend to be more affected by shortage than others because they have fewer options for adjustment.
 - **Drought and Adjustment to Scarcity:** There is currently a drought, though they are better-off than some other places. The drought has lasted for the past two years. In order to adjust to water shortage in terms of agriculture and terraces, they tend to abandon terraces that are farther away, and those that have collapses.
- **Livestock**
 - **Animals:** They have cows, goats, sheep, donkeys and oxen. Their animals are very important to their well-being and they support them more than agricultural output does. Indeed when asked what they would see as a potential benefit to rehabilitating terraces they expressed that they would like to grow more animal food, since their animals are important.
 - **Grazing:** During the agricultural season they graze the animals on open grazing land on the uncultivated slopes surrounding the village. After the agricultural season they graze the animals all over, including on the terraces.
 - **Terrace Damage:** The animals do cause some damage to the terraces, but they say that it is very small.
 - **Benefit from Animals:** The animals provide direct income; they sell them at the market if need be. The animals also provide food for the family in the form of meat and milk and their manure is used as a fertilizer and as a fuel in the household.
- **Farm Output**
 - **Production:** They grow corn and sorghum and a small amount of qat. Their qat is of low quality because it is so hot where they are.
 - **Selling:** They do not regularly sell any of their output. They will very rarely sell agricultural production, but in general when there is surplus they store it.
- **Inputs**
 - The primary constraint they face is water. While labor is somewhat short because of the amount of migration, they insist that if there were work available here, for example if there were money to hire the workers to rehabilitate the terraces, then the workers would quickly

return and gladly work in the village so they don't consider availability of labor to be a problem.

Terraces:

- **Current State of Maintenance:** Approximately 15% of their terraces have been abandoned in the past five years and that if you look farther into the past then overall about one-third of their terraces have been abandoned. They continue to use damaged terraces if the problems are minor but they abandon them as soon as they collapse. Many farmers have a large amount of currently damaged terraces and this depends on where they are located. If they are far away on steeper slopes they have more problems. Terrace maintenance has been below optimum since about the 1980s because it was easy to get to Saudi Arabia at that time. A lot of people left at that point and then when they came back many of the terraces had degraded. They are very interested in getting help rehabilitating both their abandoned and currently used but damaged terraces and they say that if their abandoned terraces were repaired they would be able to put them back into use and they would be able to maintain them.
- **Cause of Abandonment:** They generally will keep using the terraces until they collapse and then will abandon them. Therefore they let them degrade first and then abandon them once they get too bad. They also indicated that water shortage will contribute to the decision to abandon terraces as well.
- **Terrace Maintenance:** When they rebuild terraces they must do it slowly. Because of the steepness of the slopes around them, and how far they are down the slopes (which causes the volume and velocity of the water flowing down the slopes to be quite high), they have to rebuild a small amount at a time. They build a layer or two of the wall, then allow weeds and grasses to grow up into the stones to stabilize them before they build the walls higher. Terrace maintenance is conducted only by men while women participate in agriculture in other ways. The maintenance is done sometimes three or four times per growing season, depending on the severity of the rainfalls. They then also do another round of maintenance after harvest season. The main constraints to terrace maintenance are the cost of labor and the availability of quality stones. Most workers go outside the village for work because they are paid more elsewhere. It costs the villagers 800YR to hire a worker to work from eight o'clock in the morning to noon.
- **Cooperation in Maintenance:** There is currently no form of community cooperation in terrace maintenance in this village. They do not practice جایش (jaysh), so everyone must maintain their own terraces.
- **Optimality of Current Terraces:** If they had the option they would use the same method of building terraces but they would prefer to use larger stones so the walls are stronger, but they can't afford to bring them in.
- **Soil:** When a terrace is being reconstructed the soil does not have to be brought from too far away. They often will move soil from one terrace to another, or will replenish soil slowly over time.
- **When the Farmer Migrates:** When someone migrates they say that sometimes the terraces are abandoned, though often the terraces are taken over by another family member, or taken over by another family member or neighbor under sort of a sharecropping situation but in this case the owner won't take a share but will just ask that the terraces be maintained.
- **Repercussions of Terrace Erosion:** When terraces collapse there is damage to the terraces below the collapsed terrace. There used to be more severe repercussions such as larger landslides (about 10 years ago and prior to that), but now there is less rain so this is not as much of a problem. There used to be more trees growing on the slopes surrounding the terraces,

which had a positive impact in preventing landslides, but now there are much fewer trees. Crops can be damaged when terraces collapse, as well as terraces themselves that are downslope, but no other property damage such as damage to houses or anything else happens because the buildings are all built strategically on higher ground and ridges. They do say there is a small village that is downstream that sometimes gets affected. When terraces get damaged everyone must repair their own terrace.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 30%
 - Percent of terraces operated through sharecropping with a private land owner: 20%
 - Percent of terraces operated through sharecropping on state land: 40%
 - Percent of terraces operated through sharecropping on religious endowment land: 10%
 - Sometimes one terrace might be divided between all of these types of ownership. They used to own all their own land, but their grandfathers sold it.
- **Sharecropping Structure:** The contracts are written contracts. The time period of the contracts are open, and many have been in place for generations. However, there are conditions; if the terraces are not well maintained the owner can take back the land at any time. If the owner wanted to take back the land or rent it to a different sharecropper he must compensate the original sharecropper. The shares are determined on an annual basis. In cases of sharecropping with a private owner the owner will come and see the crops, then decide the share for that year. It's usually around 10% to the owner. In the case of sharecropping on state land a similar system is in place. Someone comes and observes the yield during the harvest and then determines the share. It can change from year to year. Finally, on religious endowment land the share is usually around 5%-10% for the owner.
- **Sharecropping and Terrace Maintenance:** The terrace maintenance is paid for by the farmer and carried out by the farmer. In some rare cases the owner will reduce the amount of the share they take if they see that the terraces are well-maintained.

Other Questions:

- **Fuel:** The villagers use some gas as well as wood and manure for fuel. Approximately two hours is spent gathering fuel each day. Wood is gathered from common areas, and if there is fuel available on terraces then the owner of that terrace has a right to the wood, but it's private.
- **Animal Fodder:** During agricultural season about three hours per day is spent gathering animal fodder, and during non-growing season the animals roam free to eat.
- **Forestation:** They would be interested in reforestation but they say that it would have to be done slowly and in stages so that the new seedlings could be protected from the animals.

Section 9.6: At-Taraaif

Governorate:	Al-Mahweet	المحويت
District:	Ar-Rujum	الرجم
Village:	At-Taraaif	الطرائف

Location and Accessibility:

At-Taraaif is located in a relatively high, dry environment. The road is in good condition and they are not far from the main road. It took us approximately five minutes to get there from the main road. This is a relatively large and well developed community. They have a large school with computer facilities (we met in the computer room at the school).

- Approximate Location: N 15°26'21.9"
E 43°36'41.5"
- Approximate Elevation: 2006 meters
- Nearest major town: الرجم (Ar-Rujum) - Approximately 3km away

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 21st, 2009. There were approximately 13 farmers present during the interview.

Socioeconomic Information:

- **Population**
 - The villagers of At-Taraaif reported that their village is made up of approximately 2800 people (205 households). However, Sultan said that he heard some discussion between them that lead him to believe that it is likely closer to 1700 people and that they inflated the number to make their village appear to be of more consequence. The 2001 Agricultural Census indicated that the number of households was 118 at that time so Sultan was likely correct. They indicate that the population currently living in the village is increasing.
- **Migration**
 - There are currently 80-90 people working in Saudi Arabia or elsewhere in Yemen, all men. Approximately 20 full families migrated out of the village for work all together, but there have been none that have left in the past five years.
 - **Migration Pressure:** People would return if they could. They have kept their houses here and still have a stake in the community. However, there are other people who would migrate if they could but can't because the cost of a visa to Saudi Arabia is too expensive and the procedures are too difficult. The things that are needed in order to make people willing to stay and not migrate are better services (they want a dam and water projects), expanded agriculture and increased work opportunities.
- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 60%
 - Percent of livelihood from remittances: 15%
 - Percent of livelihood from government employment: 5%
 - Percent of livelihood from professional labor: 20%

Agriculture:

- **Water**
 - **Drinking Water:** There is a water project for drinking water.
 - **Agricultural Water:** There are four برك (birak) used for animal drinking water. There are two large abandoned dams and one big dam that is currently in use for animals and for household tasks, but is in need of reconstruction. There are also canals that lead water into the dam.
 - **Equity:** There is equal access. Other villages share the water resources as well.
 - **Drought and Adjustment to Scarcity:** There is currently a drought. The drought has lasted for the past two years. They do nothing different to adjust to water scarcity, they keep all the terraces and plant all the same crops, however during water shortage many people have to sell their animals.
- **Livestock**
 - **Animals:** They have cows, goats, sheep, and donkeys.

- **Grazing:** During the agricultural season they graze the animals on open grazing land and on uncultivated terraces. After the agricultural season they graze the animals all over, including on the terraces. Generally they don't buy animal food, but this year they have to because of the water shortage.
- **Terrace Damage:** The animals do cause some damage to the terraces, but it is very small compared to the damage from other sources.
- **Benefit from Animals:** The animals provide direct income. They sell their animals when there is drought or if they need the money. The animals also provide food for the family in the form of meat and milk, and their manure is used as a fertilizer and as a fuel in the household. The donkeys are also used to carry water or other things and work on the terraces for tilling.
- **Farm Output**
 - **Production:** They grow three types of corn: red, white and yellow; sorghum, and qat.
 - **Selling:** The only thing they sell is qat but they do sometimes trade or barter food crops.
- **Inputs**
 - The only real constraint to agricultural production is water. Labor is available. They did mention that they are having a large problem with a particular type of weeds in their fields, called وابل (wabil) in Arabic.

Terraces:

- **Current State of Maintenance:** The terraces are relatively well maintained. They do face problems from heavy rains, landslides and stone slides, but they repair the damage. Approximately 5% of their terraces have been abandoned in the past five years. They express interest in rehabilitation of their currently abandoned terraces, and they say that if they were rehabilitated they would be put back into cultivation, however they reiterate that they want their big dam reconstructed to be used for agriculture. If terraces were reconstructed they would hope to see increased income from their use and especially they're interested in growing animal fodder.
- **Cause of Abandonment:** The pattern of terrace abandonment is both abandonment first and then degradation of the terraces, and also degradation of the terraces followed by abandonment. The primary factor in why one terrace is abandoned as apposed to another is its distance to the village. Some families have a lot of terraces and can't cultivate them all, so they abandon the ones that are far from the village.
- **Terrace Maintenance:** All of their terraces are currently well maintained. Only men conduct maintenance work on the terraces. Regular terrace maintenance is done every year and when needed throughout the rainy season. The primary constraint to terrace maintenance is the cost of labor (they expressed that there were those who would give up their abandoned terraces if someone wanted to reconstruct and use them).
- **Cooperation in Maintenance:** جایش (jaysh) is currently practiced for instances of major damage. Everyone gets help when they ask for جایش (jaysh), especially poor people.
- **Optimality of Current Terraces:** They do not think that any other method of terrace construction would be better.
- **Soil:** Their system for constructing and reconstructing terraces does not require that they transport soil. They generally construct the terrace walls and then wait for the terrace to fill with soil as the soil washes in from higher ground.
- **When the Farmer Migrates:** When someone migrates their terraces are either rented to

another farmer or taken over by another family member like a son or brother. In very rare cases the land will be sold, if it's an emergency.

- **Repercussions of Terrace Erosion:** When terraces collapse there is damage to the terrace below and to crops. The terraces below, while they can be damaged, will also get benefit if a terrace above them collapses, in the form of soil and water. Traditionally it's the farmer whose terrace failed that is responsible to clean up any damage.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 70%
 - Percent of terraces operated through sharecropping with a private land owner: 29%
 - Percent of terraces operated through sharecropping on state land: 0%
 - Percent of terraces operated through sharecropping on religious endowment land: 1%
- **Sharecropping Structure:** The contracts are sometimes verbal and sometimes written. The contracts are for a limited period, they must be renewed every 3 years. The owner in a sharecropping arrangement almost always lives in the village. There are a few cases where they live in a neighboring village. The shares are two-thirds to the farmer and one-third to the owner.
- **Sharecropping and Terrace Maintenance:** The terrace maintenance is paid for by the farmer and carried out by the farmer. If there is an instance of very serious damage, the owner may help by allowing the farmer to deduct some part of the cost of the repair from the owners share.

Other Questions:

- **Fuel:** Approximately two-three hours is spent gathering fuel each day. There is open land that is available to everyone but it's far. Most commonly people cut from trees growing on their own terraces.
- **Animal Fodder:** Approximately two-three hours is spent every day gathering animal fodder.
- **Forestation:** They would be interested in reforestation.

Section 9.7: Shansub

Governorate:	Al-Mahweet	المحويت
District:	Ar-Rujum	الرجم
Village:	Shansub	شنصب

Location and Accessibility:

Shansub is located in a relatively high, dry environment. Water does not flow very forcefully down the slopes above them, but rather large rockfalls are more of a concern. The road is in relatively good condition and they are not too far from the main road. It took us approximately 15-20 minutes to get there from the main road.

- Approximate Location: N 15°26'0.45"
E 43°36'20.43"
- Approximate Elevation: 1900 meters
- Nearest major town: الرجم (Ar-Rujum) - Approximately 5km away

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 21st, 2009. There were approximately 3-4 farmers present during the interview.

Socioeconomic Information:

- **Population**

- The village of Shansub is made up of approximately 400 people (76 households). If all of the surrounding scattered houses are included (making up the community referred to as بني المصعب (Bani Mosa'ab)), the number is approximately 800 people (180 households). The 2001 Agricultural Census indicated that the number of households was 91 at that time (likely referring only to Shansub). They indicate that currently the number of people living in the village has been decreasing due to the high amount of migration.
- **Migration**
 - Two or three members of every family (only men) are immigrated to Saudi Arabia or elsewhere for work. Approximately five full families are currently immigrated to other areas of Yemen for work such as Sana'a or other large cities.
 - **Migration Pressure:** If conditions allowed, some people who had migrated would come back and others wouldn't. There are a lot of people in the village that currently wish to migrate but can't because the visa to go to Saudi Arabia is too expensive. When asked what people felt they would need in order to remain in the village rather than migrate the primary things listed were improved services such as water service, and completion and improvement of the road. Higher incomes were also desired.
- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 30%
 - Percent of livelihood from remittances: 70%

Agriculture:

- **Water**
 - **Drinking Water:** There is a water project in place from Ar-Rujum but the pumps failed two months ago so they've be reverting to previous sources such as two غيل (Ghiel – naturally occurring water collection and storage cisterns). They had stopped maintaining the غيل (Ghiel) because of the water project, but now they're maintaining them again because of the problems with the water project. The غيل (Ghiel) aren't particularly useful right now though, because there's no rain so they're running dry.
 - **Agricultural Water:** There is one بركة (barika) outside the village that is used for animal drinking water. Currently the agriculture is entirely rain-fed and terraced, but they have drilled two wells, one for drinking water and one for agriculture, that they intend to use to cultivate the valley below them with irrigated fields. However, they can't afford the pumps for the wells so they're not being used yet. There is also an ancient dam that is currently being used but needs to be reconstructed. They maintain their water resources well. Soil is cleared out of the بركة (barika) and dam every year.
 - **Equity:** All their water resources are equally shared. They even share them with neighboring villages.
 - **Drought and Adjustment to Scarcity:** There is currently a drought. They say the drought has lasted for the past two years. They adjust to water shortage by more or less stopping all cultivation on all terraces. Sometimes they will purchase water to continue irrigating the qat in order to sell it.
- **Livestock**
 - **Animals:** They have cows, goats, sheep, and donkeys.
 - **Grazing:** During the agricultural season they graze the animals on open grazing land (they say the grazing land is approximately 4km by 4km). After the agricultural season they graze the animals all over, including on the terraces. They generally don't buy animal food, but

- this year they have to because of the water shortage.
- **Terrace Damage:** The animals do cause some damage to the terraces, but it is very small compared to the damage from other sources.
- **Benefit from Animals:** The animals provide direct income. In recent times a lot of people have been selling their animals because of the shortage of animal food. The animals also provide food for the family in the form of meat and milk and their manure is used as a fertilizer and as a fuel in the household. They scatter the manure on the terraces at the end of every growing season. The newly constructed road makes this easier, it used to be that they had to walk for almost an hour to carry the manure to the terraces.
- **Farm Output**
 - **Production:** They grow red, white and yellow corn, sorghum (they say that they have a particularly good variety of traditional sorghum), and qat. They have a crop rotation system; if a terrace is planted with sorghum one year, then it will be planted with corn the next year.
 - **Selling:** The only thing they sell is qat which they usually only sell when it fetches a high price. They do not sell any food crops generally, but rather store the surplus. However, if they really need the money they may sell their crops.
- **Inputs**
 - The only real constraint to agricultural production is water. Labor is available.

Terraces:

- **Current State of Maintenance:** None of their terraces have been abandoned in the past five years. Some farmers have even been rehabilitating previously abandoned terraces over the past five years in anticipation of the new well water resource. They intend to start growing vegetables and fruits with the new irrigated lands from the new well. Rainfall does cause damage to terraces, but they consider it minor damage compared to the stone slides that come off the mountainside. These stone slides crush both terraces and houses.
- **Cause of Abandonment:** No current abandonment.
- **Terrace Maintenance:** They report that all of their terraces are currently well maintained. The maintenance of the terraces is not a problem. Rather, the primary problems they face are the drought and the stone slides. The terrace maintenance is done only by men while women are responsible for different work. They conduct regular maintenance every year, and then when problems occur during the course of the year. When there is major damage from a stone slide they have to break up the large stones that come off the mountain with a jackhammer and they sometimes use this material to rebuild. It didn't take much effort to rehabilitate the terraces that have recently been rehabilitated. The primary constraint they face in terrace maintenance is the cost of labor.
- **Cooperation in Maintenance:** جایش (jaysh) is currently practiced for instances of major damage. They say that everyone gets help when they ask for جایش (jaysh) but that often poorer people will get more help than those who can afford to hire help.
- **Optimality of Current Terraces:** They do not think that any other method of terrace construction would be better, but they do want to build a big wall to protect them from the stone slides from the mountainside.
- **Soil:** When needed, they take soil from nearby grazing land or from uncultivated terraces. They do not have to go far for this.
- **When the Farmer Migrates:** When someone migrates their terraces are either rented to another farmer or taken over by another family member like a son or brother.

- **Repercussions of Terrace Erosion:** When terraces collapse there is damage to the terrace below and to crops. When a terrace collapses and there is a terrace below that is affected the farmer below the collapsed terrace will readily help repair the collapsed terrace in order to be able to repair their own. There are villages below them on the slope but they do not get affected by terrace damage.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 60%
 - Percent of terraces operated through sharecropping with a private land owner: 30%
 - Percent of terraces operated through sharecropping on state land: 0%
 - Percent of terraces operated through sharecropping on religious endowment land: 10%
- **Sharecropping Structure:** The contracts are primarily verbal. In some cases they are written, but this is rare. The contracts are for an open period. The owner in a sharecropping arrangement is never living in the village. The shares are two-thirds to the farmer and one-third to the owner. The farmer must pay a kind of religious tax from their share, called زكاة (zakaah).
- **Sharecropping and Terrace Maintenance:** The terrace maintenance is paid for by the farmer and carried out by the farmer.

Other Questions:

- **Fuel:** The villagers use some gas (80%) as well as wood (20%) for fuel. Approximately two hours is spent gathering fuel each day.
- **Animal Fodder:** Food is only gathered for the cows, and it's not a long or difficult process.
- **Forestation:** They would be interested in reforestation if it helped with the land and rock slides.

*In general primary needs identified by the farmers are protection from the stone slides and rehabilitation of the dam.

Section 9.8: Al-Ghariba (CARE)

Governorate:	Al-Mahweet	المحويت
District:	At-Toweela	الطويلة
Village:	Al-Ghariba	الغربة

Location and Accessibility:

Al-Ghariba is relatively accessible. The access road is still being constructed, but it is passable without four wheel drive. I could not observe the ecosystem or nature of the surrounding area very well because of a heavy fog that was present at the time of my visit.

- Nearest major town: الطويلة (At-Taweela) – Approximately 6km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 27th, 2009. There were approximately 10 farmers present during the interview. I had time to do both the full CARE questionnaire and the full general questionnaire in this village, but I still prioritized some of the questions over others in the general questionnaire in the interest of time.

CARE Questionnaire:

CARE initiated their program in Al-Ghariba around 2002. Before CARE came to the village approximately 30% of the terraces were abandoned. Of those that had been abandoned, 5% were rehabilitated through the CARE program. The program focused on a particular area of terraces in the village called 'Adana, in this area specifically 80% of the terraces had been abandoned prior to CARE

and all of the abandoned terraces in that area were rehabilitated. There were some terraces that had been in use prior to the program that had some maintenance problems and were rehabilitated through the program. These terraces made up approximately 10% of the terraces that were rehabilitated by CARE. Approximately three hectares of terraced land were rehabilitated by CARE in total.

Aspects of CARE program:

CARE did not only rehabilitate terraces but also implemented some other programs in the village at the same time. The CARE program was comprised of the following projects:

1. Chicken farm for the women's association
2. Water harvesting project (but it was canceled and didn't end up being implemented because of conflict in the community)
3. Literacy classes
4. Terrace rehabilitation

The terrace rehabilitation aspect of the project was reported by the villagers to have been a complete success. They are proud of the project and the way it was done. They feel like the area that was selected to be rehabilitated was the best area to focus on because there were the most beneficiaries. They still maintain and employ all of the terraces that were rehabilitated by the project. They are unhappy that the water project was abandoned. The reason it was abandoned was because of conflict in the community caused by differing opinions about how much it was going to cost the villagers. Because they had to contribute 30% of the cost of the water project, there were those in the village that felt this was too expensive and so there was conflict and the project was cancelled.

Implementation:

An engineer from CARE did a survey and cost evaluation first. This engineer determined how much money would be allotted to each farmer based on the area of land he had that was to be rehabilitated. A group was formed of all the beneficiaries (in this case the group was comprised of 15 farmers). The group consisted of the sharecroppers in the case of sharecropping, not the land owners. The area rehabilitated by CARE consisted of 70% sharecropping land and 30% owner-operated land. The farmers picked one representative from among them who signed the contract with CARE on behalf of the whole group. CARE provided money to the farmers incrementally based on the progress they were making with the rehabilitation and the farmers contributed 50% of the cost, mostly in labor. The farmers used the money from CARE to hire labor and rent heavy machinery such as jackhammers that they could use to cut the large boulders in the terraces into good quality appropriately sized rocks for rebuilding the walls of the terraces. While CARE determined the amount of money each farmer would get, the farmers determined where to start rehabilitating first and how to progress.

Contract:

A contract was signed but it was a representative from among them who went to sign the contract and none of them knew what was in it.

Why the Problem was there in the first place:

The reason the terraces were initially abandoned was because of migration primarily, and because of a reduction in rainfall and water shortage. When I asked what was different now that has allowed them to continue to maintain their terraces and not abandon them, they explained that while there is still a lot of migration, the villagers are not going as far (not as many are going to Saudi Arabia) and they are not gone as long. Most of them only leave for shorter periods of time and then return and work on their land, whereas in the past they would go to Saudi Arabia for one or two years and their land would be abandoned for that time. They are motivated to maintain the rehabilitated terraces also because they contributed 50% (mostly in-kind in the form of labor) to the reconstruction of the terraces, and because they made such a large investment, they have a strong incentive to keep them well-maintained. In addition to this, the share provided to the owner in the case of sharecropping in the areas rehabilitated

by CARE are now only 10% as apposed to 33% because of the investment made by the sharecropper, so the farmers are also seeing an increased direct benefit from these lands compared to others.

Outcome of the program:

The main benefits observed from the program are increased yields and higher income from those terraces, as well as the fact that they are able to grow more animal fodder, which has been a good benefit.

General Questionnaire:

Socioeconomic Information:

- **Population**
 - There are approximately 50 households in the village.
- **Migration**
 - All of the households have at least one person migrated. As of right now most have migrated to other areas within Yemen. No full families have left in the past five years. There was a time in the past when there was a very large amount of migration. This was in the 1990s or so, and many people migrated to Saudi Arabia at this time.
- **Sources of Income**
 - Percent of livelihood from agriculture: 15%
 - Percent of livelihood from livestock: 10%
 - Percent of livelihood from remittances: 75%

Agriculture:

- **Water**
 - **Drinking Water:** There is a water project (a large cistern) that was put in place to be used for drinking water. However, they have to share it with another village and it is not sufficient for their needs. Additionally the quality of the water is very low. They are reportedly having a drinking water crisis right now. It costs them 100YR for 20 liters to buy water for drinking, and they have to bring it 6km from At-Toweela. There are three small برك (birak) that are old, but are still used somewhat. There used to be a spring but it has dried up. There is one additional بركة (barika) that is used for household tasks and for animals.
 - **Agricultural Water:** Agriculture is entirely rain-fed and there is currently no water infrastructure for agriculture. They express that this is a problem and that they feel they need resources for irrigation.
 - **Drought and Adjustment to Scarcity:** There is currently a drought, but they say it's just starting to get better; the rain started falling about two weeks prior to the interview. The drought has been severe for the past two years, and rainfall in general has been decreasing over the past 15 years.
- **Farm Output**
 - **Production:** They grow wheat, corn, sorghum, lentils and qat.
 - **Selling:** They do not generally sell their agricultural production.
- **Inputs**
 - The only agricultural input that is a binding constraint is water. Labor is available although it's expensive, they have no problem saving seeds from previous harvests, and they use animal manure and sometimes purchase fertilizer, but this is not a problem.
- **Farming as a Strategy:**
 - **Why they continue to farm:** They farm in order to have food for their family, and also

food for their animals, which is expensive.

- **Relationship to and Attitudes about the Market for Food:** They do purchase food from At-Toweela. They purchase primarily wheat, rice, sugar, and oil.
 - Wheat: 50kg sack costs 3500YR in addition to approximately 100YR for the cost of bringing it to the village, and this lasts approximately 110 person-days.
 - Rice: 10kg sack costs 1800YR and lasts approximately one month (not used as frequently)

They do trust that they can depend on the market to provide food for their needs, the main problem they face is lack of money but if they don't have enough they can sometimes get credit from the shop. Prices of food in the markets do change a lot, and frequently. In particular they say that the prices of rice and sugar are rising a lot in recent days.

Terraces:

- **Current State of Maintenance:** Overall approximately 30% of their terraces were abandoned over the past 30 years, however none have been abandoned over the past five years.
- **Cause of Abandonment:** The primary reasons for terrace abandonment are damage from road construction, low return from the land, migration, reduced water availability, and damage from floods.
- **Terrace Maintenance:** Maintenance is done only by the men. They conduct regular maintenance yearly, and additionally when needed during heavy rains. They spend around a month's worth of time spread out over the whole year doing maintenance work on the terraces. If there is major damage caused by flooding it can take around a week to repair the damage. They worked for a year to rehabilitate the terraces rehabilitated by CARE. The main constraint facing terrace maintenance is the cost of labor. Additionally the road construction is still going on so they can't decide whether to start repairing damage from the roads, or wait until the work is done to repair the damage.
- **Cooperation in Maintenance:** They do have a system of جایش (Jaysh) for cooperation in terrace maintenance. If someone needs help, generally people help for one day. This cooperation extends beyond the community alone. They said that during the rehabilitation work done during the CARE project, people from neighboring villages even came to help.
- **Optimality of Current Terraces:** They believe the way that their terraces are constructed is the best way. The only thing they did differently in the case of the terraces they reconstructed during the CARE project was to use heavy machinery to break up and shape the large boulders found in the middle of their terraces in order to use the stones created in this way to construct the terrace walls.
- **Repercussions of Terrace Erosion:** When a terrace has problems, those downslope from them are affected. When this happens, the farmer whose terrace had the problem is expected to clear the debris and repair the damage as soon as possible. They say that another repercussion of terrace abandonment is that animals grazing on abandoned terraces nearby to employed terraces can sometimes easily sneak onto the agricultural terraces and damage the crops.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 10%
 - Percent of terraces operated through sharecropping with a private land owner: 80%
 - Percent of terraces operated through sharecropping on state land: 3%
 - Percent of terraces operated through sharecropping on religious endowment land: 7%
- **Sharecropping Structure:** The sharecropping contracts are written contracts for open periods

of time. The share to the owner is one-third. However, in the areas rehabilitated by CARE the share to the owner is generally only 10% because the farmers invested so much in the rehabilitation. The land owners do not live in the village in the case of sharecropping.

- **Sharecropping and Terrace Maintenance:** The farmer pays for the maintenance of the terraces.

Section 9.9: Zaqiha

Governorate:	Lahaj	لحج
District:	Al-Maqatira	المقاطرة
Village:	Zaqiha	زقيحة

Location and Accessibility:

Zaqiha is very remote with a difficult road that doesn't reach the village. We had to walk 1.9km on rough trail to get from the road to the village. Indeed, the inaccessibility is an issue for the people there as well. They showed me the stretcher they use to carry sick or injured people out of the village. They say they have to carry them out to the main road and then try and find a car to take them to التربة (At-Turba). The community is in a high steep area. Above them on the mountain is a large plateau which used to be rented from them as a military training area. After the military finished with it, they tried to start cultivating it as it's a large flat area capable of growing crops. However, the lack of rain in recent times has made this untenable.

- Approximate Location: N 13°10'49.9"
E 44°11'11.5"
- Approximate Elevation: 1834 meters
- Nearest major town: التربة (At-Turba) – Approximately 15 km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 28th, 2009. There were approximately 5-6 farmers present during the interview.

Socioeconomic Information:

- **Population**
 - Approximately 700 people live in the village (110 households). According to the 2001 Agricultural Census there were 93 households at that time. They report that the size of the population currently living in the village has been increasing.
- **Migration**
 - Approximately 30 families have someone (young men mostly) who has migrated. Only about 3-5 of these people are in Saudi Arabia. Approximately 11 full families have migrated in the past five years.
 - **Migration Pressure:** Four years ago there used to be a more substantial amount of migration out of the village because there weren't any services such as roads and schools. Now the road is being constructed and there is a school so things are improving a bit. Therefore, when asked whether people would return if they could they said that many are returning now so yes, there are those who would return. However some would not return because now they have permanent jobs outside the village. Many study or work in التربة (At-Turba), so these people only come back for holidays. When asked what was needed in order to keep people in the village they listed services such as completion of the road (most

important), a hospital, water project, electricity and school resources.

- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 25%
 - Percent of livelihood from remittances: 10%
 - Percent of livelihood from hourly labor: 65%

Agriculture:

- **Water**
 - **Drinking Water:** They have a spring nearby which they depend on completely for all drinking and household water.
 - **Agricultural Water:** Agricultural is more or less exclusively rain-fed. They do have a tank to collect rainwater that the Social Fund constructed and all farmers get a benefit form it. They have two very old برك (birak), one was destroyed by a stone slide and one is filled with soil. They used to use them for drinking water for their animals. They were destroyed about 10-15 years ago and they haven't been able to repair them because it's too expensive.
 - **Equity:** Everyone has equal access to shared water resources and during drought times they take turns.
 - **Drought and Adjustment to Scarcity:** There was a drought two years ago, but now it's not a problem. However, 10 or 20 years ago there was more rain overall then there is now and it has been decreasing over time. In adjusting to water scarcity they do the following. During droughts they don't cultivate any food crops. They leave their qat trees to fend for themselves and they often get very dry. They say, however, that they keep their terraces maintained during drought years even if they're not growing anything on them. During the drought they dig pits in the soil to create small برك (birak) but they didn't have the right materials so they stopped. These برك (birak) would have been used for household use and for animals. Additionally they will often sell their animals during drought seasons.
- **Livestock**
 - **Animals:** They have cows, goats, sheep and donkeys. They do not have a large amount of animals; every household has two or three goats or sheep, that's all.
 - **Grazing:** During drought the animals graze on open grazing land. During the agricultural season they gather food for the animals so that they do not walk on the terraces and damage the crops. After harvest everyone's animals graze on their own terraces.
 - **Terrace Damage:** The animals do cause problems to the terraces when they graze on them, but they are simple problems.
 - **Benefit from Animals:** The animals provide direct income as they are sold when they need money. They also provide food for the household in the form of meat and milk. They use their manure for fertilizer.
- **Farm Output**
 - **Production:** They grow corn, sorghum, wheat (sometimes, especially in winter), and qat.
 - **Selling:** The only agricultural product they sell is qat, and they only sell it when there is no drought.
- **Inputs**
 - The only constraining input in agricultural production is water, but it is not a large problem right now because there is rain. There is plenty of labor available, just no money to pay for it.

Terraces:

- **Current State of Maintenance:** Approximately 8% of their non-qat terraces have been abandoned in the past five years and overall 12% have been abandoned in the past 30 years. In addition to the 8% of terraces that were abandoned in the past five years, 50% of the fields they cultivate on the plateau above them (which are non-terraced fields) have been abandoned in the past five years. In addition to the abandoned terraces there are maintenance problems with the currently utilized terraces. Approximately 50% of the non-qat terraces need to be rebuilt. The damaged terraces are relatively evenly distributed across farmers. In general the qat terraces are maintained the best, and all farmers have some qat terraces. They are interested in help with their terraces and say that their first priority is rebuilding the currently degraded terraces that they are using, and then after that, rehabilitating ones that have been abandoned.
- **Cause of Abandonment:** The main cause of abandonment is that yields are not enough to make it worthwhile to maintain them. In general the terraces will start to degrade first, and then when they get too bad they are abandoned. When asked whether they would be able to put the terraces back into use if they were rehabilitated they said yes, but that they need a dam so that they can irrigate the terraces. When asked what is different now compared to when all the terrace that are currently abandoned were employed they explain that there use to be less farmers and that they depended mainly on agriculture but nowadays they don't have enough crops to subsist so they go outside for better options and this lowers the relative importance of the terraces. When I asked why they have less crops now than they used to they explained that the rain has been decreasing over time, so the crops are getting worse.
- **Terrace Maintenance:** The terrace maintenance is conducted only by men. Regular maintenance is done during rainfalls when the rainfall causes damage. In general if there is simple damage they can rebuild the terrace but if there is major damage due to stone slides or landslides they can't afford to rebuild. The largest constraining factor in terrace rehabilitation and major maintenance is the cost of labor. In particular it is very expensive to hire enough labor to transport appropriate stones to the village, since the road does not reach them.
- **Cooperation in Maintenance:** There is not really a system for community cooperation in maintenance. Generally the one whose terrace is damaged has to repair it himself. On rare occasions people will provide help for one day.
- **Optimality of Current Terraces:** They believe that the method of terrace construction that they currently use is the best method, but they are interested in cement to construct water diversion canals to irrigate the terraces.
- **Soil:** They generally move soil from abandoned terraces to ones that need it. The distance is approximately 100 meters.
- **When the Farmer Migrates:** A long time ago when a farmer migrated their terraces might have been abandoned. Usually now the terraces are taken over by another family member or taken over through a sharecropping arrangement where the owner takes no share but just asks that the land be maintained.
- **Repercussions of Terrace Erosion:** When a terrace collapses or degrades the repercussions are damage to other terraces and crops, and loss of soil. When a terrace collapses, that farmer is expected to repair both their own terrace and the terrace below that is damaged. Generally the farmer below him will help him though. When asked what happens when they abandon terraces that are directly above terraces that they are continuing to use they explain that in order to avoid damage to the downstream terraces they must build canals to divert water to keep the lower terraces safe and they explain that the community cooperates to do this.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 90%
 - Percent of terraces operated through sharecropping with a private land owner: 10%
 - Percent of terraces operated through sharecropping on state land: 0%
 - Percent of terraces operated through sharecropping on religious endowment land: 0%
- **Sharecropping Structure:** The sharecropping contracts are written contracts if they are between non-relative and verbal if they are between relatives. The period of the contracts are open-ended and generally end when the owner asks for the land back. The owner generally does not live in the village but rather is someone who has migrated to Ta'iz or elsewhere. The shares are 50% for the farmer and 50% for the owner, although there are cases where the deal is to maintain the terraces only and the owner does not take any additional share. The terraces that are under sharecropping arrangements are a mix of both qat and other crops.
- **Sharecropping and Terrace Maintenance:** If the damage is simple damage, the farmer pays for the maintenance. If the damage is major damage the owner and the farmer will split the cost evenly.

Other Questions:

- **Fuel:** They use primarily wood as fuel in the household and they spend five hours to gather a bundle of wood that lasts for approximately three days. There are both open lands and private lands where they gather fuel.
- **Animal Fodder:** They spend three hours per day gathering animal fodder when it is agricultural season.
- **Forestation:** They would not be interested in reforestation.

*The primary need of this community is help rebuilding terraces, but also they really want to construct a dam. They want a dam but they can't afford to bring in the appropriate materials such as iron and cement. They say that if they had help they would be more than willing to walk the materials in to the village themselves, but they just can't afford them. They also want to construct additional irrigation infrastructure such as water diversion canals among the terraces.

Section 9.10: Ar-Rima

Governorate:	Lahaj	لحج
District:	Al-Qabaita	القبطة
Village:	Ar-Rima	الرما

Location and Accessibility:

Ar-Rima is a relatively large community with a large school and several mosques. The village is quite far away from Ar-Rahida, particularly because the road is still being constructed that leads there. Because of the difficulty of the road it took us approximately two hours to drive there from near Ar-Rahida.

- Approximate Location: N 13°15'30.4"
E 44°25'59.3"
- Approximate Elevation: 1430 meters
- Nearest major town: الراهدة (Ar-Rahida) – Approximately 100 km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 29th, 2009. There were approximately 10 farmers present during the interview.

Socioeconomic Information:

- **Population**

- Approximately 4000 people live in the village (680 households). According to the 2001 Agricultural Census there were 455 households at that time which makes it appear that the estimation of 680 villages currently is somewhat inflated. They report that the size of the population currently living in the village has been increasing.

- **Migration**

- All of families have at least one or two members (young men) who have migrated to areas in Yemen, not many have migrated to Saudi Arabia. Approximately 20 full families have migrated in the past five years. There was not a time in the past when there was a particularly substantial amount of migration, but rather it was about two years ago, when the drought really started, that the amount of people migrating increased a lot.
- **Migration Pressure:** People would come back if they could, but the reason they can't is because of a lack of water. Many migrated because of scarcity of drinking water. There are a few who would migrate if they could but can't because of financial reasons: it's too expensive to obtain housing and a job in larger towns. In order to make it possible for people to stay in the village the main things they need are water (the most important), as well as completion of the road and service infrastructure, such as electricity.

- **Approximate Percents of Sources of Income**

- Percent of livelihood from agriculture: 10%
- Percent of livelihood from remittances: 70%
- Percent of livelihood from government employment in the village: 20%

Agriculture:

- **Water**

- **Drinking Water:** Every house has a stone, covered tank that is used to collect drinking water from the roof. There are 10 dry wells and 20 wells that are in use but the water in them is very low. In 1989 the government conducted a water project. They manually dug a well and installed piping but there isn't any water so the infrastructure provided by this project is not in use anymore. In addition to all this, the water that is available from the wells is sometimes not suitable for drinking and has a strong bad smell. Many people also get kidney stones because of the amount of minerals in the water.
- **Agricultural Water:** Agriculture is more or less exclusively rain-fed. There are two dams nearby but both are currently dry because of the drought. There is also one canal that guides water from the mountainside to the dam. The dam, when there is rain, is a success. Once the dam was constructed they even saw an improvement in the level of their wells, indicating that the dam was helping in replenishing groundwater.
- **Equity:** Everyone has equal access to common water resources.
- **Drought and Adjustment to Scarcity:** There is currently a drought and it has been severe for about a year. There have been five months with no rain at all. Several years before, when the most recent dam had not been constructed, they had a very hard time with water scarcity, but then when the dam was constructed and the groundwater started to be replenished, things became easier. However, now with the current drought the situation is very severe. Rainfall has been decreasing over the long-term as well. They adjust to water scarcity by not planting any crops at all during droughts, and they divide wells between families depending on how many members are in the families.

- **Livestock**

- **Animals:** They have cows, goats, sheep and donkeys.
- **Grazing:** The animals graze on their own private terraces and land during non-agricultural seasons. During drought and agricultural seasons they purchase food for the animals.
- **Terrace Damage:** Only goats and sheep graze on the terraces and they cause only simple problems.
- **Benefit from Animals:** The animals provide direct income, as they are sold when they need money. They provide food for the household in the form of meat and milk. They use their manure for fertilizer. They use their hides to make leather for water carrying containers.
- **Farm Output**
 - **Production:** They grow a traditional type of wheat in the winter, and corn and sorghum in the summer.
 - **Selling:** They do not generally sell their agricultural production.
- **Inputs**
 - The only constraining input in agricultural production is water. They also report that many of their animals get diseases and that there is no vet.

Terraces:

- **Current State of Maintenance:** Ar-Rima faces severe damage to their terraces due to road construction. They used to grow in terraces along the wadi bottom but they were all destroyed because of severe floods made worse by the road construction and those terraces were all covered in sand. They have abandoned approximately 50% of their terraces in the past five years, mostly because of damage from the roads both directly, from terraces being crushed and covered by rocks and sand from the road construction itself, and indirectly from the increased flood damage due to the road construction. Those terraces that are currently being maintained have no serious problems at this time.
- **Cause of Abandonment:** The main problem is damage from the road construction. This can be seen in the fact that many of the terraces on the side of the valley that is under the new road are damaged and/or abandoned while the terraces on the side of the valley without the road have no problems. They are eager for help in rehabilitating their terraces. They are expecting to do the work of carrying away all of the sandy soil and rocks from the road damage and reconstructing the walls of the terraces, but they need financial support because the scale of the problem is so large.
- **Terrace Maintenance:** Terrace maintenance is conducted by both men and women, though the men do most of the more difficult physical labor. Generally speaking, setting aside the issue of the road, regular maintenance to terraces higher up on the slopes happens before every agricultural season and when needed and those down close to the wadi bottom are repaired as needed. If there is damage from rains they repair them right away. The main constraint to terrace maintenance is the cost of labor. It costs 1500YR to hire someone for a day's work, and a lot of labor is required for repairing the terraces damaged from the road construction because it takes a lot of work to remove the sandy soil. Additionally, appropriate stones of the right size and consistency are not readily available. The stones that are easily available are sandstone and terrace walls constructed with this material collapse easily. They have to cut rock in order to get stones that are better for constructing the terraces walls and this requires labor and machinery.
- **Cooperation in Maintenance:** There is no social system in place for cooperation in terrace maintenance. It is more or less every man for himself.
- **Optimality of Current Terraces:** They say that the way that they currently construct terraces is the best way, however they want to be able to build water diversion canals to protect terraces

- from floods.
- **Soil:** Generally they do not have to transport soil from far away, if a terrace collapses they just replace the soil from where it fell.
- **When the Farmer Migrates:** When a farmer migrates they generally rent the terrace to a family member or neighbor but they don't ask for a share of the crops, they just require that the terraces be well-maintained.
- **Repercussions of Terrace Erosion:** When a terrace collapses and affects a terrace below, the traditional system is that the farmer whose terrace collapsed has to rebuild his own terrace quickly, so the one below him doesn't get severely damaged. The farmer below will not help other than to provide land for the farmer to pile soil and stones, but the farmer below must repair his own terrace.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 99%
 - Percent of terraces operated through sharecropping with a private land owner: 1%
 - Percent of terraces operated through sharecropping on state land: 0%
 - Percent of terraces operated through sharecropping on religious endowment land: 0%
- **Sharecropping Structure:** The sharecropping contracts are written contracts and signed with a witness if they are between non-relative and verbal if they are between relatives. The period of the contracts are open-ended and generally end when the owner returns to the village, although the farmer can give the land back and end the contract themselves at any time as well. The owner never lives in the village, but rather sharecropping exists only because of migration. The conditions of the contract are only to maintain the terraces. The owner does not take a share of the crops.
- **Sharecropping and Terrace Maintenance:** The farmer pays for the maintenance of the terraces.

Other Questions:

- **Fuel:** They spend two hours gathering wood per day. They gather the wood each from his own private lands.
- **Animal Fodder:** They spend three hours per day gathering animal fodder when it is agricultural season.
- **Forestation:** The number of trees are decreasing because of the drought and they are very interested in programs for reforestation.

Section 9.11: Farisat Al-Jabal

Governorate:	Lahaj	لحج
District:	Al-Qabaita	القبطة
Village:	Farisat Al-Jabal	فريسة الجبل

Location and Accessibility:

Farisat Al-Jabal is relatively easily accessible. The road is rough and we did have to walk a short distance to get to the village itself, but the walk was easy and along the wadi. The village is situated in a small wadi with terraces and houses constructed up the lower slopes of the mountainside above the valley bottom. The community members, or at least some individuals, appear to be somewhat more wealthy than some of the places I've visited. They have a new school, some more modern houses and they've been able to afford extensive work to avoid damage from wadi floods now made more

severe by the road construction in the mountains above them. The main issue faced by this community is the extensive damage to their terraces caused by the road construction. The damage is both direct: sandy soil and rocks are piled onto the terraces or flow down the hill onto them from the road itself, and also indirect: the sandy rocky soil displaced by the road construction is filling the valley floor. They say that the valley floor has risen seven meters in the past four years and that because of this and because of the water washing off of the roads, the floods are much more severe than they ever used to be, so they have lost an extensive amount of terrace towards the bottom of the slopes due to flood damage.

- Nearest major town: الراهدة (Ar-Rahida) – Approximately 40 km away.

Interview:

The interview was conducted by Anna Spurlock along with Sultan Dejran as translator and facilitator. The interview took place on July 29th, 2009. There were approximately four farmers present during the interview.

Socioeconomic Information:

- **Population**
 - Approximately 500 people live in the village (120 households). According to the 2001 Agricultural Census there were 105 households at that time. They report that the size of the population currently living in the village has been increasing.
- **Migration**
 - Approximately 50% of families have at least one person (young men) who have migrated to Saudi Arabia and elsewhere. Seven full families have migrated in the past five years. There was not a particular time in the past when there was a substantial amount of migration, but rather it has been relatively steady over recent years.
 - **Migration Pressure:** People would come back if they could. They explained that their houses are here and that they are still tied to the community. There is not currently anyone in the community who wants to migrate, those who wanted to have already done so.
- **Approximate Percents of Sources of Income**
 - Percent of livelihood from agriculture: 25%
 - Percent of livelihood from livestock: 5%
 - Percent of livelihood from remittances: 10%
 - Percent of livelihood from hourly labor: 30%
 - Percent of livelihood from those who are permanently employed in the village: 30%
 - As can be seen by the fact that the percentages don't add up to 100%, it was difficult to get across the concept of the percentages we were interested in, I therefore chose to ask this question in a couple of different ways in this community. After asking about the percent I asked them to rank the sources of their income in order of importance. Interestingly, when asked in this way they indicated that the most important was agriculture, then selling animals, then hourly labor, then remittances, then permanent employment. This ranking does not exactly match the percents given, and highlights how these estimates must not be taken literally, however it does indicate that agricultural is considered a major source of livelihood in the community and is considered to be very important by the villagers.

Agriculture:

- **Water**
 - **Drinking Water:** Approximately 60 households have private covered tanks to hold water that is for household use. There are three wells, one is still in use and two have been severely damaged by floods. All have less water than they used to. There used to be springs

but they have all been covered with sand and rocks because of the landslides from the roads so they are gone now.

- **Agricultural Water:** There is a new dam constructed by the Ministry of Agricultural two years ago that is in the next valley over. This dam is used for irrigation and for animals, but it was very recently constructed so there is not a lot of water in it yet. The Ministry of Agriculture was going to construct a dam in their valley two years ago but then engineers determined that it wasn't suitable, so this was not done. They also have narrow canals used to divert water to avoid damage to terraces. As a side note there is an additional problem recently of an increase in malaria and mosquitos because of the dam and other open water resources.
- **Equity:** Everyone has equal access. However, those that are farther away from the common water resources have a harder time using them, so they tend to depend more on their private tanks.
- **Drought and Adjustment to Scarcity:** There is currently no drought, but last year there was severe water scarcity and they had to purchase water. A 20 liter container of drinking water cost 130YR at that time. They do not think there has been a reduction in rainfall over the long-term. In order to adjust to water scarcity they often have to purchase water for drinking. This is much easier now because of the new road. Because their agriculture is rain-fed only, they don't grow anything during drought seasons. They intend to use water from the dam to irrigate the terraces if there is a drought, but they are currently only able to do this a little because there is not much water in the dam yet.
- **Livestock**
 - **Animals:** They have cows, goats, sheep and oxen.
 - **Grazing:** The animals graze in open grazing land and on the terraces after the harvest. Sometimes food is gathered for them as well. Generally if there is enough rain they can feed them from their own terraces and they are able to grow enough that is sufficient for the whole year, however in drought years, such as last year, they have to purchase food for the animals which is a great hardship.
 - **Terrace Damage:** The animals do cause problems to the terraces when they graze on them, but they are simple problems.
 - **Benefit from Animals:** The animals provide direct income, as they are sold when they need money. They provide food for the household in the form of meat and milk. They use their manure for fertilizer.
- **Farm Output**
 - **Production:** They grow corn and sorghum.
 - **Selling:** They sell their agricultural output very rarely. Sometimes they trade for other goods. Generally they store surplus in containers called برميل (barmeel).
- **Inputs**
 - The only constraining input in agricultural production is water. There is plenty of labor available, just no money to pay for it. Some farmers use industrial fertilizer because the manure isn't enough, but some don't. In general they express that a major difficulty is the low level of income. This makes it difficult to pay for necessary aspects of their agricultural production.

Terraces:

- **Current State of Maintenance:** Other than the damage from the roads described above they did not have any problems with abandoned terraces. Other than those damaged by the roads

they kept their terraces well-maintained and did not abandon any really at all in the past 30 years and they had even been trying to increase the number of terraces they had. However, now there are about 20% of their terraces that are severely damaged or destroyed due to problems from the road construction, many of them damaged to an extent that they can't be rebuilt. The damage is relatively evenly distributed among farmers who farm at the bottom of the slopes close to the wadi, however there are only about three or four farmers effected by the damage at the top of the slopes closer to the roads, so they are facing an unequal distribution of problems.

- **Cause of Abandonment:** The main problem with these terraces is damage from the road construction. There are two types of damage currently. First, the terraces higher up on the slopes closer to the roads get covered with sandy soil and rocks which reduces the fertility of the soil (when the sandy soil is mixed in with the good soil) and damages the terraces themselves. Second, the rising level of the wadi due to the increased deposits of sandy soil and rocks from the roads are making the floods much more severe. This is damaging large, wide terraces down at the bottom of the slopes washing away the soil and destroying the terrace walls and in many ways damaging them irretrievably. In addition to this, because there is much more loose soil on the slopes from the road, the damage from rainfalls are much more severe since the road has been under construction. While they insisted that they do not really abandon terraces regularly, they said that in some cases when someone migrates and they have terraces that are very far away they will sometimes be abandoned.
- **Terrace Maintenance:** Terrace maintenance is conducted by both men and women. Generally speaking, setting aside the issue of the road, regular maintenance to terraces higher up on the slopes happens after every harvest season and terraces closer to the wadi bottoms get maintained only when needed. With terraces that have been damaged by the roads they generally rush to rebuild them as quickly as possible unless the damage is too severe and they can't afford to. One man said he is spending 700,000YR to rebuild his damaged terraces. There is another man who constructed a cement and stone wall in the wadi bottom at a bend in the wadi in order to protect his terraces from the rising floods. This wall cost him 300,000YR to build. The main constraining factor to terrace maintenance and rehabilitation is the cost of labor.
- **Cooperation in Maintenance:** There is not really a system for community cooperation in maintenance. It is more or less every man for himself. However, they have cooperated in the construction of a major canal to divert flood water and landslides from the road past the terraces into the wadi in order to protect the terraces that are farther up the slopes and close to the road. This project cost approximately 500,000YR.
- **Optimality of Current Terraces:** They say that given local conditions, the way that they currently construct terraces is the best way.
- **Soil:** They do not carry soil to rebuild or build terraces. Instead they construct the terrace walls and let the soil wash into and fill the terraces over time. Sometimes this takes up to three years.
- **When the Farmer Migrates:** When a farmer migrates on rare occasions some of their terraces have been abandoned because they are very far away from the village. Most usually the terraces are rented to a family member, or sometimes to a neighbor.
- **Repercussions of Terrace Erosion:** The damage from the erosion of other terraces is very small compared to the continuing damage due to the roads which is more or less affecting everyone. Generally when a terrace collapses each farmer repairs his own terrace.

Sharecropping:

- **Estimated Breakdown of Types of Ownership:**
 - Percent of terraces owned by the farmer who is cultivating them: 90%

- Percent of terraces operated through sharecropping with a private land owner: 10%
- Percent of terraces operated through sharecropping on state land: 0%
- Percent of terraces operated through sharecropping on religious endowment land: 0%
- **Sharecropping Structure:** The sharecropping contracts are written contracts if they are between non-relatives and verbal if they are between relatives. The period of the contracts are open-ended and generally end when the owner asks for the land back (though he cannot ask for it back before harvest season). The owner never lives in the village, but rather sharecropping exists only because of migration. The conditions of the contract are only to maintain the terraces. The owner does not take a share of the crops. They explain that this is still substantial because the cost of labor for maintaining the terraces is high. It cost 1500YR to hire someone for six hours. Although there are no shares that go to the owner, sometimes the farmer will give the owner a gift of crops.
- **Sharecropping and Terrace Maintenance:** The farmer pays for the maintenance of terraces if it is general maintenance. If there is a serious problem then the owner pays.

Other Questions:

- **Fuel:** They use gas and wood as fuel. There are electricity lines put in but they aren't working yet. They spend two and a half hours gathering wood that lasts for one or two days. They gather the wood each from his own private lands.
- **Animal Fodder:** They spend three hours per day gathering animal fodder when it is agricultural season.
- **Forestation:** They would not be interested in reforestation.

Reports Referenced:

CARE: Draft – Western Highland Rural Development Project: Final project progress report

CARE: Taylor-Awny, Adam. May 2002. Community management of Local Natural Resources: Al-Mahweet Governorate, Yemen.

SFD: Mansoor, Nassr. Evaluation of Rural Production Conditions for 8 Selected Communities in Agriculture Rainfed Areas and Livestock: Al-Rujum District, Al-Mahweet Governorate.

Appendix A: Costs

Table 9: Reported costs of selected needs purchased by the community and money spent on terrace issues

Governorate	District	Village	CARE	Cost of Labor	Money Spent	Cost of Drinking Water: 20 liters	Cost of Animal Feed on Market	Cost of Wheat in Market: 50kg	Cost of Rice in Market: 10kg
Al-Hodayda	Bura'	Bani Batal		1500YR per day		-	-	-	-
Al-Hodayda	Bura'	Rahabaat		-		100YR	-	4000YR	1800YR
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	✓	-	CARE contract was 170,000YR. Took 1 year to rebuild. Benefited 13 families.	-	-	3500YR	1800YR
Al-Mahweet	Ar-Rujum	Al-Hajaar		-		-	300YR fresh 500YR dry	-	-
Al-Mahweet	Ar-Rujum	Al-Hazza		800YR for 4 hours		-	-	-	-
Al-Mahweet	At-Toweela	Al-Ghariba	✓	-		100YR	-	3500YR	1800YR
Lahaj	Al-Qabaita	Ar-Rima		1500YR per day		-	-	-	-
Lahaj	Al-Qabaita	Farisat Al-Jabal		1500YR for 6 hours	300,000YR wall to protect terraces from floods. 700,000YR to rebuild damaged terraces. 500,000YR to build canal to protect terraces.	130YR last year	-	-	-

Appendix B: Questionnaires

General Questionnaire:

QUESTIONS FOR TARGET COMMUNITY:

Village: _____ District: _____ Governorate: _____

Socioeconomic:

- Approximately how many people live in this village?
- Approximately how many households are in this village?

MIGRATION

- Percent of households with at least one migrant?
 - Where did they migrate?
 - When have they been migrating?
- Number of families that have left in the past five years?
 - Where did they migrate?
- Was there a time in the past with much more migration? Yes ___ No ___
- Would people who have migrated come back if they could? Yes ___ No ___
 - Why or why not?

- Are there others in the community who would migrate if they could but can't for some reason? Yes ___ No ___
 - If yes, why can't they?
 - If yes, who are they? Are they farmers or others?
- What do they feel is needed in order to keep people in the village?
 - Better access to services (which services?)
 - Higher incomes
- Is the number of people living in the village full-time increasing or decreasing? Increasing ___ Decreasing ___

INCOME

- What are the sources of income in this community?
 - LIST:
- What percent of total income is made up by each form of income?
 - Agriculture ___%
 - Livestock ___%
 - Remittances from members who have migrated ___%
 - Hourly labor ___%
 - Other ___%
- Rank forms of income in order of importance to the community, most important to least:

Agriculture:

WATER

- Is there any water infrastructure? Yes ___ No ___
 - Describe in detail all of the water infrastructure currently in the community both for drinking water and irrigation/water storage.
- Is the water infrastructure well maintained? Yes ___ No ___ Explain:
- Who maintains the water infrastructure?
- Does everyone have equal access to the common water resources? Yes ___ No ___
 - If not, what is the pattern of the disparity?
- Is there currently a drought or unusual water scarcity? Yes ___ No ___
 - If so, for how long?
- Has there been a reduction in rainfall over a longer period of time (50 years or so)? Yes ___ No ___
 - How long?
- How is water scarcity dealt with?
 - Is there equal distribution of the hardship when water is scarce?
 - How do they adjust to water scarcity in agriculture?
 - Terraces in particular locations are not cultivated (i.e. higher up, farther from water source)
 - Less lucrative crops are not planted

LIVESTOCK

- What kind of large farm animals are kept?

<input type="checkbox"/> Cow	<input type="checkbox"/> Camel
<input type="checkbox"/> Goat /Sheep	<input type="checkbox"/> Oxen
<input type="checkbox"/> Donkey	<input type="checkbox"/> Other
- Where do the large animals graze?
 - On open grazing land (if so, when?)
 - On the terraces (if so, when?)
 - Food is gathered for them (if so, when or why?)
 - Food is purchased for them (if so, when or why?)
- What benefit do the animals bring?

<input type="checkbox"/> Direct income	<input type="checkbox"/> Fertilizer
<input type="checkbox"/> Food for the family	<input type="checkbox"/> Work on the farm
<input type="checkbox"/> Fuel for the household	

FARM OUTPUT

- Is the production sold? Yes ___ No ___ Sometimes ___ (why?)
 - How far are the markets?
 - What problems exist on this front?
- What is grown on the terraces
 - Wheat
 - Corn
 - Sorghum
 - Animal Fodder
 - Vegetables
 - Fruits
 - Qat
 - Coffee
 - Other:
- What is grown on the other fields
 - Wheat
 - Corn
 - Sorghum
 - Animal Fodder
 - Vegetables
 - Fruits
 - Qat
 - Coffee
 - Other:
- What is sold?
 - Wheat
 - Corn
 - Sorghum grain
 - Animal Fodder
 - Vegetables
 - Fruits
 - Qat
 - Coffee
 - Other:

RELATIONSHIP TO THE MARKET:

- What food do they purchase?
- Where do they purchase food?
- How much does this food cost?
- How do they feel about the market?
 - Do they trust the market to provide food for the family? Yes ___ No ___
 - Do the prices of the food they purchase vary a lot? Yes ___ No ___
- Why do they continue to grow their own food? Are there any other reasons besides lack of money?

ACCESS TO INPUTS FOR AGRICULTURE

- Is there a major problem with access to any of these inputs used in agriculture and if so what?
 - Water: Yes ___ No ___ Explain:
 - Labor: Yes ___ No ___ Explain:
 - Fertilizers: Yes ___ No ___ Explain:
 - Seeds: Yes ___ No ___ Explain:
 - Veterinary Medicine: Yes ___ No ___ Explain:
 - Transportation: Yes ___ No ___ Explain:
 - Other: _____ Yes ___ No ___ Explain:

Terraces:

- What percent of the area cultivated is in terraces?

SHARECROPPING/LAND TENURE:

- Percent of types of terrace ownership:
 - Percent owned by the farmer: ___%
 - Percent sharecropping with private land owner: ___%
 - Percent sharecropping on state land: ___%
 - Percent sharecropping on religious endowment land: ___%
- Of these types of land, are some types better than others in terms of quality/yield? Yes ___ No ___ Explain:
- If sharecropping, is the owner living in the village? Yes ___ No ___
- Who pays for terrace maintenance?
 - Owner
 - Farmer
 - If this varies, why?
 - If the owner pays, can the farmer deduct the cost of maintenance directly from the owner's share?
- How do the sharecropping contracts work?
 - Are they written contracts?

- Are they verbal contracts?
- How long are the contracts for?
- What percent does the farmer get and what percent does the owner get?
- If abandoned terraces were rehabilitated, how would that work if it would be a sharecropping situation?

GENERAL STATE OF TERRACES

- What is the state of terrace maintenance in the community?
 - What percent of terraces have been abandoned in the past 5 years?
 - What percent of terraces have been abandoned in the past 30 years?
 - What percent of terraces that are in use currently have major breaches or other serious problems?
 - Are the current in-use terraces that are damaged evenly distributed across farmers?
 - If not, why not?
- What are the primary causes of terrace damage?
- If animals walk on the terraces, does this cause any erosion problems?
 - Would they consider this to be a major source of terrace degradation?
- Why would a terrace be abandoned now?
- Why were terraces abandoned in the past?
- If a terrace is abandoned now, how does this usually happen?
 - It starts to degrade first and then get abandoned once it gets too bad
 - It gets abandoned first and then is allowed to degrade

TERRACE MAINTENANCE

- Who traditionally performs maintenance work on the terraces?
 - Only men
 - Men and women
- When/how is the terrace maintenance work done?
 - Regular maintenance (How frequent?)
 - How much time does it take to perform the regular maintenance?
 - Maintenance if major damage (i.e. collapse or breach)
 - How much time does it take to repair a major breach?
 - Rehabilitation if a terrace has been abandoned and is being re-employed/construction of new terrace
 - How long does it take to rehabilitate/construct a new or abandoned terrace?
- Do they believe the terraces are constructed in the best way? Yes___ No___ Explain:
- If possible, would the terraces be built with different materials or built differently? Yes___ No___ Explain:
- Where does the soil come from?
 - New terrace: Distance:
 - Repaired terrace: Distance:
- If there is a terrace that someone wants to repair or build, what would be the main reasons that it may not be possible?
 - Availability of materials
 - Availability of labor
 - Cost of materials
 - Cost of labor
- How much does it cost to do work on the terraces?
 - Cost of /time for bringing stones:
 - Cost of labor:
 - Cost of/ time for transporting soil:
- If someone migrates today what happens to their terraces?
 - The terrace land is sold
 - The terrace is abandoned
 - The terrace is rented to another farmer
 - The terrace is taken over by another family member

- If someone migrated in the past what happened to their terraces? Is this different from now?
 - The terrace land is sold
 - The terrace is abandoned
 - The terrace is rented to another farmer
 - The terrace is taken over by another family member
- What form of community cooperation exists to maintain terraces? (جايش؟)
- When people ask for help maintaining terraces from the community do they get help sometimes and not other times?
 - If yes, why?
- When terraces fails what is the usual repercussion?
 - Landslide
 - Wasted water
 - Property damage
 - Other terraces
 - Other structures
 - Crops
 - Loss of soil
 - Major landslides far downstream
 - Other problems downstream from the village
- When terraces degrade, who is affected?
 - Just owner/operator
 - Surrounding terraces (those below?)
 - If people surrounding get affected, do they do something to rectify the situation?
 - What does the downstream terrace owner do to fix the situation?
 - What is the one whose terrace collapsed expected to do?
- If they decide to abandon terraces, what do they do to protect terraces that are below the abandoned terraces from the erosion of the abandoned terrace?
- If many terraces have been abandoned, what changed that made them decide to abandon those terraces?

OPINIONS ABOUT REHABILITATION

- Do the villagers consider that the terraces are in need of rehabilitation?
 - Abandoned terraces Yes ___ No ___
 - Why?
 - Currently employed terraces Yes ___ No ___
 - Why?
- What benefits would be expected from the rehabilitation?
- If abandoned terraces were repaired would they be put back into use?
 - If that depends, what does it depend on?
 - What would be planted on the rehabilitated terrace?
- Would they want abandoned terraces or currently employed terraces to be rehabilitated first?
- If given the option would you choose to rehabilitate all of the abandoned terraces, or just some of them?

USE OF LAND IF TERRACES NOT REHABILITATED:

- How much time is spent on average gathering fuel for the household per day?
 - Are their restrictions on what material can be used for fuel?
- How much time is spent on average gathering animal fodder per day?
- If some slopes were reforested would the new wood resource be a good benefit to the people if it could be used for fuel? Yes ___ No ___
- If some slopes were reforested would it be a good benefit to people if it could be land used for grazing? Yes ___ No ___

CARE Questionnaire:

Questions for CARE villages:

Name of Village:

District:

Governorate:

- How long ago did CARE rehabilitate your terraces?
- What percent of terraces were abandoned before the program?
- What percent of abandoned terraces were rehabilitated by the program?
- Where were terraces that were still in use that were rehabilitated by the program?
 - If so, what percent of the program was this type of terrace?
- Why did CARE rehabilitate your terraces?
- What other projects did CARE or any other organization conduct as well as rehabilitate the terraces?
 - Water
 - Agricultural Productivity
 - Seed varieties
- Did CARE require any contractual agreement about the project?
 - If so, what was it?
- What percent of the rehabilitated terraces are still in use and well maintained?
- What were the reasons that your terraces were abandoned or degraded before the program?
 - Water/Rain
 - Cost of Labor
 - Immigration
- What is different now from the situation before that program that has allowed you to continue maintaining your terraces after the program?
- How were the terraces rehabilitated?
 - CARE gave money and the community did it
 - CARE hired a firm to do it
- Who decided which terraces to rehabilitate?
 - CARE
 - Whole community
 - Subset of community: Who?
- Is there anything you would have done differently now that the terraces have been rehabilitated?
 - Are there any terraces that should not have been rehabilitated but were?
 - Are there any terraces that should have been rehabilitated but weren't?
- Was there a small number of people who benefited from the program or did more or less everyone benefit?
 - If everyone benefited, did everyone benefit equally?
- How do you feel about the project, was it worth while, was it helpful?
- Is there some other project that you feel would have been more beneficial than the terrace rehabilitation?
- What benefits, if any, did you see from the rehabilitation?
 - More yields/income
 - Less soil loss
 - Less water loss
 - Less landslides
 - Less damage to other terraces

Appendix C: Glossary

A'abbar – يعبر – Traditional canals among terraces.

'Aana – عانة – A form of social structure for community participation in terrace and other maintenance.

Awqaaf – أوقاف – Religious endowment lands.

Barika (plural: birak) – بركة (plural: برك) – Traditional water cistern.

Barmeel – برمیل – Barrel used for storing grain crops.

Ghail (plural: ghuyul) – غیل (plural: غیول) – Naturally occurring water cistern.

Jaysh – جایش – Most common form of social structure for community participation in terrace and other maintenance.

Qat – قات – A plant whose leaves are chewed. This practice is widespread in Yemen. The chewing of the leaves produces a mild stimulant effect.

Zakaah – زكاة – Religious tax.

Appendix D: Codes for Case Study Villages

Table 10: Census Codes of Included Villages

Governorate	District	Village	CARE	Census Code
Al-Hodayda	Bura'	Bani Batal		181223103
Al-Hodayda	Bura'	Rahabaat		181225101
Al-Mahweet	Al-Khabt	Bait Al-Maghuri	✓	?
Al-Mahweet	Ar-Rujum	Al-Hajaar		270336103
Al-Mahweet	Ar-Rujum	Al-Hazza		270333101
Al-Mahweet	Ar-Rujum	At-Taraaif		270322108
Al-Mahweet	Ar-Rujum	Shansub		270322110
Al-Mahweet	At-Toweela	Al-Ghariba	✓	?
Lahaj	Al-Maqatira	Zaqiha		251332101
Lahaj	Al-Qabaita	Ar-Rima		251021101
Lahaj	Al-Qabaita	Farisat Al-Jabal		251022145