Disaster Risk Reduction Programming in Ethiopia's Somali Region
Project Effectiveness Review

Full Technical Report

Oxfam GB
Adaptation and Risk Reduction Outcome Indicator

July, 2013

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Photo: Eva-Lotta Jansso

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Executive summary

Under Oxfam Great Britain's (OGB) Global Performance Framework (GPF), samples of projects are being randomly selected each year for a rigorous evaluation of their effectiveness. Oxfam's programmatic work in supporting pastoralist households to reduce their risk from drought was one of the projects selected for an Effectiveness Review under the adaptation and risk reduction thematic area in the 2012/13 financial year. The activities of two separate projects were covered by this review: one was the third phase of the cross-border 'Regional Drought Decision' programme, which focused on building the capacity of community-based disaster risk-management committees, as well as construction of water storage facilities and setting up some pilot pastoralist field schools (PFSs). The second project, the Somali Region Drought Recovery and Preparedness Project, was launched following the severe drought of 2008/09, and involved rehabilitating communal rangeland, restocking herds for female-headed households, training of community animal-health workers, a livestock vaccination campaign, a public-health campaign, and latrine construction.

To assess the effectiveness of this programme work, a quasi-experimental impact evaluation was implemented. This involved carrying out surveys with 699 households in 22 kebeles in Awbare and Harshin woredas. Ten of these communities had seen implementation of one or both of the projects under review, while an additional 12 kebeles had not been targeted by those projects, but were included in the survey for comparison purposes. Household resilience was evaluated along five interrelated dimensions: livelihood viability, innovation potential, access to contingency resources and support, integrity of the natural and built environment, and social response capability. Thirty-seven characteristics of a resilient household were identified, and a composite index of household resilience was constructed. At the analysis stage, the statistical tools of propensity-score matching and multivariate regression were used to control for demographic and baseline differences between the intervention and comparison households in order to estimate the projects' impacts.

Comparison of the intervention and comparison households provides good evidence that the two projects had a positive effect on household resilience. Households in the communities where the two projects had been implemented scored positively on average on 44 per cent of the characteristics of resilience, compared to 40 per cent in the comparison communities. Most of the specific characteristics in which differences are found, not surprisingly, are those related to the key interventions of the projects: availability of water and grazing land, vaccination of livestock, involvement in community drought-preparedness meetings and activities, and receipt of early-warning information. The households in project communities were also found to be faring better than those in comparison communities in terms of livestock lost to disease, access to livestock markets, and to have slightly more awareness of climate change and to be slightly more positive about innovation in livelihoods activities. Probably as a consequence of some of these changes, fewer of the households in project communities experienced severe losses of livestock during the drought of 2011.

The households of members of the PFS groups were found to score more highly than comparison households in many of the characteristics of resilience. However, it was not possible to assess to what extent this represents an impact of the project because the PFS households are probably systematically different in unobservable ways (such as motivation) than the average household in the comparison group.

To take forward learning from this project, Oxfam in general and the Ethiopia country team and partners in particular are encouraged to consider the following:

- Explore how to involve community members more widely in community-level drought preparedness activities, and to ensure that training and early-warning information is fully disseminated.

1 Introduction and purpose

Oxfam GB has put in place a Global Performance Framework (GPF) as part of its effort to better understand and communicate its effectiveness, as well as enhance learning across the organisation. This framework requires project and programme teams to report output data annually across six thematic indicator areas. In addition, a sample of mature projects (e.g. those closing during a given financial year) under each thematic indicator area is being selected at random each year for a rigorous evaluation. One key focus is on the extent to which they have promoted change in relation to the relevant OGB global outcome indicators.

The global outcome indicator for the adaptation and risk reduction thematic area is defined as the percentage of households demonstrating greater ability to minimise risk from shocks and adapt to emerging trends and uncertainty, compared to a 'typical' comparison household. This indicator is explained in more detail in Section 3 below.

The Effectiveness Review covers the activities of two related projects in Ethiopia's Somali Region

One of the projects randomly selected for the Effectiveness Review under the women's empowerment thematic area in 2012/13 is the 'Somali Region Drought Recovery and Preparedness Project' (ETHB25). This project, which was funded by Oxfam's drought appeal fund and by the Canadian International Development Agency (CIDA), aimed to support pastoralist communities and households in Jijiga and Shinile zones to recover from previous droughts, and to reduce their vulnerability to future droughts. The Effectiveness Review concentrated specifically on the project as implemented in Jijiga Zone, where activities have involved rehabilitating communal rangeland, restocking herds for female-headed households, training of community animal-health workers, a livestock vaccination campaign, a public-health campaign, and latrine construction.

Implementation of this project in Jijiga Zone overlapped with phase III of the cross-border 'Regional Drought Decision' project (RDD III), which is a cross-border project funded by the European Commission Humanitarian Office, which also seeks to build the resilience of pastoralist households and protect their livelihoods against drought. The

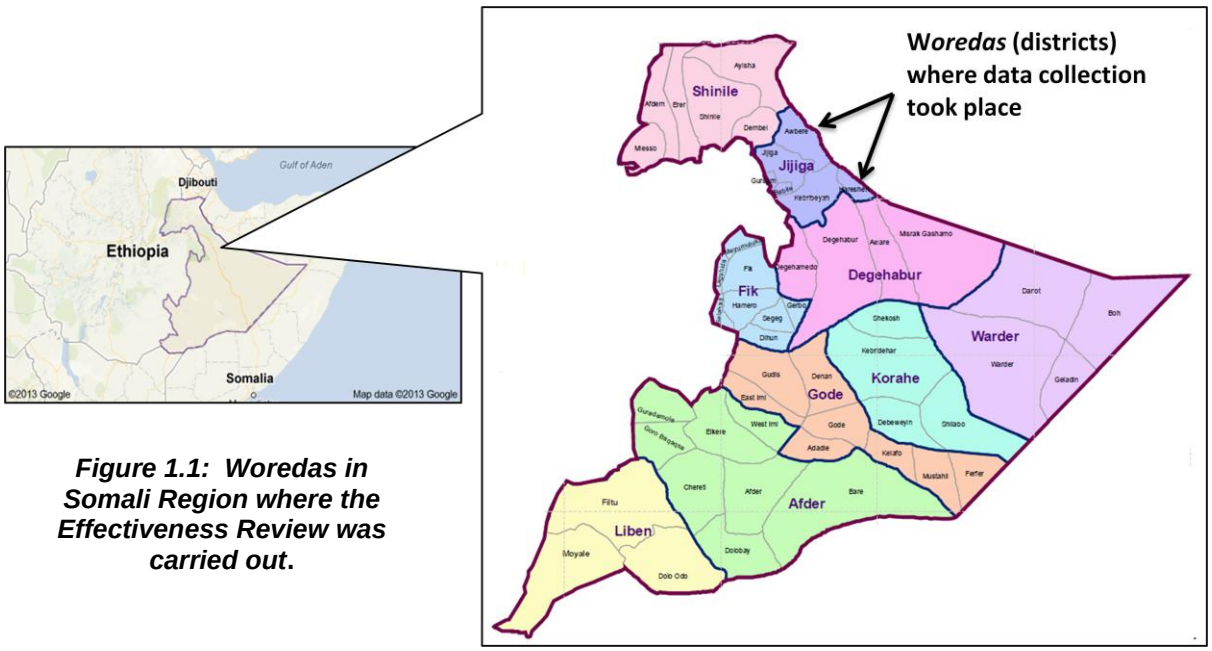


Figure 1.1: Woredas in Somali Region where the Effectiveness Review was carried out.

first two phases of this project focused on the provision of water sources for communities throughout Harshin woreda (district). In the third phase, implemented between July 2010 and December 2011, the activities have been broadened to include work on building the capacity of community-based disaster risk-management committees, including by setting up early-warning systems, giving support in contingency planning, and providing disaster risk-management committees with contingency funds. As a pilot initiative, a pastoralist field school (PFS) has been established in one community in each woreda, with the aim of promoting good practices in livestock management and risk-management practices.

Both the Appeal/CIDA project and the RDD III project have been implemented in three woredas (districts) in Jijiga Zone. Since some communities have been included in both projects, the effects of the two projects on household resilience cannot be completely separated, and so they have been considered together in this report. Of the three implementation woredas, Kabribaya was excluded from the Effectiveness Review because it was not possible to identify communities suitable for comparison. The review focused instead on the impact of the two projects in the other two woredas, Harshin and Awbare.

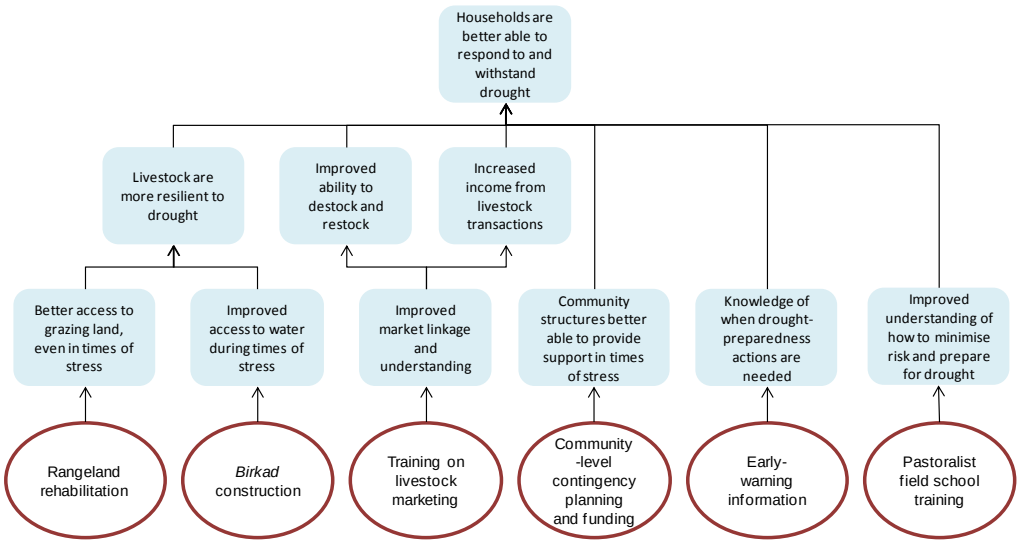
This report presents the findings of the Project Effectiveness Review. Section 2 begins by reviewing the intervention logic of the projects under review, and Section 3 follows by introducing the framework for measuring resilience that was adopted. Section 4 then goes on to describe the evaluation design, while Section 5 describes how this design was implemented. Section 6 thereafter presents the results of the data analysis, including the descriptive statistics on the population surveyed and the differences in outcome measures between the intervention and comparison groups. Section 7 concludes the document with a summary of the findings and some programme learning considerations.

2 Intervention logic of projects

Figure 2.1 shows a simple diagram of the logic model behind the various project activities that were assessed in the Effectiveness Review.

The overall aim of the two projects was to enable households to respond to and withstand future droughts. Each of the project activities shown at the bottom of the logic model was intended to contribute to this, either through providing training or information enabling households to better plan for and respond to drought, or through improving the capacity of community-level resources (including communal grazing land and water sources) to cope in times of stress. The pastoralist field schools (PFSs) provide a programme of training on livestock management and household risk-reduction to their members; at the time of the survey pilot PFS groups had been established in one community in each woreda where the RDD III project was implemented.

Figure 2.1: Intervention Logic



It should be noted that some of the activities of the two projects were not covered by this Effectiveness Review. This was either because those activities had been carried out in different communities from the rest of the activities (in the case of the latrine construction and public-health campaign) or because the activities were not focused on a particular geographical area (as was the case with the livestock vaccination campaign and the training of community animal-health workers). These activities are therefore not shown in Figure 2.1. The Appeal/CIDA-funded project (ETHB25) also included restocking herds for 55 female-headed households in Harshin woreda after the drought of 2008/09. It was originally intended to include the beneficiaries of this activity in the Effectiveness Review – but in the event this proved not to be possible for practical reasons, so this activity is also not shown in Figure 2.1.

The 'characteristic approach' assumes that households that are better able to cope with shocks and adapt to change possess particular attributes

3 The global indicator for Adaptation and Risk Reduction

3.1 Introduction to the ARR outcome indicator

As part of Oxfam GB's (OGB) Global Performance Framework, efforts are being undertaken to develop an innovative approach to measuring the resilience of households to shocks and stress and their ability to adapt to change. This approach involves capturing data on various household and community characteristics falling under the five interrelated dimensions presented in Figure 3.1. Following the Alkire-Foster method used in the measurement of multidimensional poverty,[1] a binary cut-off is defined for each characteristic. A household is considered to be faring well in relation to the characteristic if it is above this cut-off and not well if below. Weighted indices, described further in Section 6, are then developed from these binary indicators. These indices can be used as continuous outcome measures in statistical analysis. Alternatively, binary outcome variables can be created by defining cut-off points for the index, with 1 specified for households that have surpassed this threshold and 0 for those below it. For OGB's global Adaptation and Risk Reduction (ARR) outcome indicator, the binary version of this indicator is defined as follows:

[1] Alkire, S. & Foster, J. (2011) Counting and multidimensional poverty measurement. *Journal of Public Economics*. 95 pp. 476–487.

- **% of targeted households demonstrating greater ability to minimise risk from shocks and adapt to emerging trends and uncertainty**

The term *greater ability* appears in the wording of the indicator because of how it is computed in practice. Specifically, a household is coded with 1 if it is above the median of the comparison group in relation to the Alkire-Foster Resilience Index, and 0 if otherwise. Thus, households demonstrating greater ability are those that are above the typical household of the comparison group in relation to this index.

The characteristics are context-specific but are informed by a framework comprising of five distinct dimensions

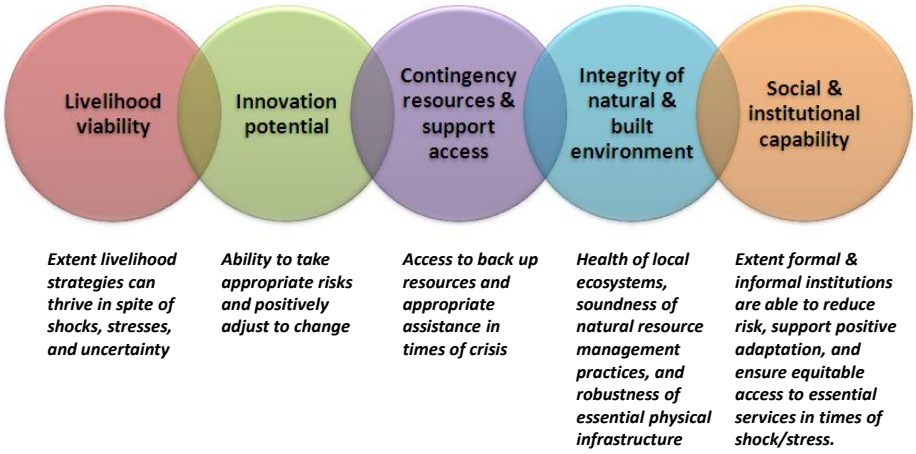
One reason why measuring concepts such as resilience and adaptive capacity is complicated is because we can only really assess whether a system has successfully coped or adapted after the fact.[2] In other words, we would have to wait until after a disaster has struck and/or climatic change has taken place in order to assess the effectiveness of the intervention in question.

The characteristic approach attempts to get around this issue by hypothesising that there are particular characteristics of households (and even communities, organisations, governments, etc.) that affect how well they are able to cope with shocks and positively adapt to change. A limitation, of course, is that we do not know for certain how relevant these characteristics actually are; rather, we assume they are important based on common sense, theory, and/or field experience. However, there is nothing preventing them from being informed by stronger empirical evidence and/or community consultation. It is further recommended that they be continuously updated, as the body of research on the determinants of resilience and adaptive capacity grows.

The characteristics that inform the ARR indicator fall under the five dimensions presented in Figure 3.1.

FIGURE 3.1:

Dimensions affecting the ability of households and communities to minimise risks from shocks and adapt to emerging trends and uncertainty



[2] Dodman, D., Ayers, J. & Huq, S. (2009) Chapter 5: Building Resilience. In: World Watch Institute (ed.). *State of the World: Into a Warming World*. Washington DC: World Watch Institute. pp. 151–168.

First, if we think about what a household would need in order to cope with current and future shocks, stresses, and uncertainly, a viable livelihood is likely to be one of them. If a shock happens, for instance, a household dependent on just one precarious livelihood activity is likely to be more negatively affected than another that has one or more less sensitive alternatives to fall back on, *all other things being equal*. In addition, households that are on the margins of survival are less likely to be resilient than their relatively more wealthy counterparts. Where longer-term climatic trend prediction information exists, it is also important to assess how viable current livelihood strategies would be given the range of likely future climatic scenarios.

Innovation potential is different and hence separate. It is focused on a household's ability to positively adjust to change, whether anticipated or not. We can hypothesise that such potential is dependent on factors such as the knowledge and attitudes of relevant household members themselves, their ability to take risks, and their access to weather prediction and market information and relevant technology and resources.

Moreover, there will likely be times when even households with the most 'resilient' and adaptive livelihood strategies will find it tough to get by. Access to contingency resources and external support – e.g. savings, food and seed reserves, social protection, kin and non-kin support networks, and emergency services, etc. – are, therefore, likely to be critical in supporting households to cope with shocks and to positively adjust to change.

It is further recognised that healthy ecosystems are better able to cope/adjust to climatic shocks/change than those that are relatively more degraded.[3] We may reasonably assume – again, with all other things being equal – that households whose livelihoods are dependent on healthier ecosystems will be in a better position to adjust to climatic shocks/change than those that are not. The presence of appropriate infrastructure (e.g. pit latrines and roads) that is resilient to shocks and stresses (e.g. flooding) is equally important; if critical infrastructure no longer functions, or collapses in times shocks and stress, the livelihoods and/or health of community members can be negatively affected.

In most – if not all – cases, it is necessary to look beyond the household level when examining resilience and adaptive capacity. Indeed, it is reasonable to assume that households are likely to be better able to successfully adjust to climatic shocks/change when they are part of larger coordinated efforts at the community level and beyond. The social and institutional capability dimension, in particular, is concerned with the effectiveness of informal and formal institutions in reducing risk, supporting positive adaptation, and ensuring equitable access to essential services in times of shock/stress. In the absence of this capability, we can assume that community-level duty bearers will be less effective in fulfilling their responsibilities in supporting community members to reduce risk and/or successfully adapt.

Specific characteristics believed to influence both resilience and adaptation fall under each of the five dimensions. However, no 'one size fits all'; that is, many of the characteristics appropriate for a particular population (e.g. slum dwellers in Mumbai, India) may not be so for

[3] Ibid

another (e.g. Bolivian shifting cultivationists). As such, each particular suite of characteristics needs to be appropriately specified given the nature of the population in question and the hazards and change processes to which it is likely to be subjected.

3.2 Particular ARR characteristics used in this Effectiveness Review

As mentioned above, there is no one generic set of 'resilience' characteristics that are applicable to all contexts. Given this, efforts were made to specify characteristics relevant to the agro-pastoral context in the project area. These characteristics are presented in Table 3.1, along with a summary rationale for including each.

Data was collected on a total of 37 characteristics under the five dimensions

As can be seen in the table, data were collected on a total of 37 characteristics. Fourteen characteristics were defined for the livelihood viability dimension. Several of these characteristics relate to the ability of households to meet their basic needs. Those on the margins of survival are assumed to be in a worse position to cope with drought than are their more wealthy counterparts. The levels of livelihood, crop and livestock diversification are also assumed important, so that that the household in question has something to fall back on in times of stress. The gender risk differential characteristic was further added to examine whether women's livelihood activities are more at risk than are those of men. A pastoral household is also assumed more likely to cope better with drought if the size of its livestock herd is sufficiently large and healthy. Finally, having access to drought warning information and taking action on the basis of this information are additionally assumed important for reducing risk.

Six characteristics were defined for the innovative potential dimension. It is assumed that households are more likely to positively adapt to change if they are open to modifying their livelihood practices, are aware that climate change is happening, and have good access to credit, innovation support, and markets. In addition, they are assumed more likely to innovate in the future if they have done something new and innovative in the past.

As implied by the resilience framework presented in Subsection 3.1, there will be times when even households with significantly viable livelihoods and internal adaptive capacity will find it difficult to cope with serious shocks (e.g. a severe drought). Consequently, having access to both local and external resources and support during such events is clearly advantageous. Eight characteristics are defined under the access to contingency resources and support dimension. Three of these relate to things directly possessed or received by the household in question: savings, remittances/formal earnings, and 'fungible' livestock.[4] Being strongly connected to social networks within the community is further assumed important, hence the group participation and social connectivity characteristics. However, there will often be times when the state (or, in its absence, other external actors) will need to intervene. Given this, household perceptions on how well they would be supported by local government in the event of a serious crisis were also solicited.

[4] Small and medium sized livestock serves as a 'household bank' in many rural contexts in the South. Fungible meaning replaceable by another item.

Only four characteristics were defined for the 'integrity of the natural and built environment' dimension. Given the context, access to water and grassing land in times of drought are clearly critically important characteristics. Vast numbers of households are also dependent on agriculture, so the extent of soil erosion and access to irrigation facilitates were also deemed important.

This brings us to the dimension of social and institutional capability, where data were collected on five characteristics. The characteristics are intended to measure the strength of community level institutions to both reduce risk and support adaptation. Hence, such capacity is assumed to be high when community members are significantly aware of and participate in relevant disaster risk reduction and adaption processes, experience minimal conflict over natural resources, and are confident in the capacity of local leaders and institutions.

As per the Alkire-Foster method, binary cut-offs were defined for each of the 37 characteristics. The specific cut-offs used for each characteristic are detailed in Appendix 2. A household was coded as being non-deprived if it can, reasonably speaking, be considered as faring well in relation to the characteristic in question. There is inevitably a degree of arbitrariness in defining such cut-offs. However, they were reviewed by programme field staff, and several were subsequently modified. The indices that were developed using the 37 binary characteristics are presented in Section 6, along with a comparison of the treatments groups in relation to both these indices and for each specific characteristic.

Table 3.1: Specific ARR characteristics examined in this Effectiveness Review

Dimension	Characteristic	Rationale for inclusion
Livelihood viability	Household asset ownership	Poor households assumed to be more at risk
	Household food security	Food-insecure households are assumed to have less viable livelihoods
	Household dietary diversity	Households with poorer nutrition assumed to be more at risk
	Livelihood diversification	Households with more diverse livelihoods assumed to be at less risk
	Gender risk differential	Differential gender impacts of shocks assumed negative
	Crop portfolio	More diversity + more drought tolerant crops = less risk
	Livestock portfolio	More diversity + more drought tolerant livestock = less risk
	Livestock herd size	The larger the herd size, the less the impact of livestock loss
	Ownership of pack animal	Means of transport to market, thereby enhancing access
	Livestock lost to disease in 2011	More experience of disease = less healthy livestock
	Livestock lost to drought in 2011	Direct indicator of susceptibility to impacts of drought
	Livestock vaccination	More healthy livestock assumed to be more tolerant
	Access to early-warning information	Enables the household to plan and reduce risk
	Drought preparedness practice	Indicates that the household is proactive in minimising risk
Innovation potential	Attitudes to new livelihood practices	Households less open to new practices are less likely to innovate
	Awareness of climate change	Households with more awareness are in better position to adapt
	Adoption of Innovative practices	Direct indicator that household is innovative
	Access to credit	Enables household to access resources to support innovation
	Access to state innovative support	Sustainable access to such support conducive for innovation
	Market access	Better access to markets = more livelihood opportunities
Access to contingency resources and support	Awareness of drought preparedness plan	Indicates planning is taking place + public participation
	Participation in drought preparedness meetings	Indicates planning is taking place + public participation
	Group participation	More opportunities for support in times of crises
	Social connectivity	More opportunities for support in times of crises
	Perceptions of local government emergency support	Level of confidence of respondents is assumed to be related to what will actually happen in times of crises
	Savings	The more savings a household has, the more it can cope in crises
	Remittances or formal earnings	Access to remittances implies potential sources of support in a crisis
	Ownership of fungible livestock	Enables households to get by in times of crisis
Integrity of the natural and built environment	Extent of soil erosion	High levels of soil erosion decreases productive
	Access to irrigation for farming	Enables yields to be maintained despite rainfall variability
	Availability of water for livestock & consumption	More difficulties in access makes it more difficult to cope
	Availability of grazing land	More difficulties in access makes it more difficult to cope
Social & institutional capability	Receipt of information or training on drought preparedness	Indicates that community institutions are fulfilling roles
	Awareness of local drought risk reduction initiatives	Indicates that community institutions are fulfilling roles
	Experience of violent disputes	Levels of conflict reflects capacity to address disputes
	Effectiveness of local leaders and institutions	Level of confidence of respondents is assumed related to the effectiveness of the actions of local leaders and institutions
	Awareness of local efforts to support adaptation	Indicates that community institutions are fulfilling roles

4 Impact assessment design

4.1 Limitations in pursuing the 'gold standard'

A social programme's net effect is typically defined as the average gain participants realise in outcome (e.g. improved household food security) from their participation. In other words:

Impact = *average post-programme outcome of participants* minus *what the average post-programme outcome of these same participants would have been had they never participated*

This formula seems straightforward enough. However, *directly* obtaining data on the latter part of the equation – commonly referred to as the counterfactual – is logically impossible. This is because a person, household, community, etc. cannot *simultaneously* both participate and not participate in a programme. The counterfactual state can therefore never be observed directly; it can only be estimated.

The randomised experiment is regarded by many as the most credible way of estimating the counterfactual, particularly when the number of units (e.g. people, households, or, in some cases, communities) that are being targeted is large. The random assignment of a sufficiently large number of such units to intervention and control groups should ensure that the statistical attributes of the two resulting groups are similar in terms of their a) pre-programmes outcomes (e.g. both groups have the same average incomes); and b) observed characteristics (e.g. education levels) and unobserved characteristics (e.g. motivation) relevant to the outcome variables of interest. In other words, randomisation works to ensure that the *potential outcomes* of both groups are the same. As a result – provided that threats such differential attrition and intervention spillover are minimal – any outcome differences observed at follow-up between the groups can be attributed to the programme.

In an attempt to mitigate bias, two statistical procedures were used – propensity score matching and multivariate regression

Villages had the project never been implemented

However, implementing an ideal impact assessment design like this is only possible if it is integrated into the programme design from the start, since it requires the introduction of some random element that influences participation. To evaluate an ongoing or completed programme – as in this Effectiveness Review – or one where randomisation is judged to be impractical, it is therefore necessary to apply alternative techniques to approximate the counterfactual as closely as possible.

4.2 Alternative evaluation design pursued

There are several evaluation designs when the comparison group is non-equivalent that can – particularly when certain assumptions are made – identify reasonably precise intervention effects. One solution is offered by matching. Find units in an external comparison group that possess the same characteristics, e.g. ethnicity, age and sex, relevant to the outcome variable, as those of the intervention group and match them on the bases of these characteristics. If matching is done properly in this way, the observed characteristics of the matched comparison group will be identical to those of the intervention group.

The problem, however, with conventional matching methods is that, with large numbers of characteristics on which to match, it is difficult to find comparators with similar combinations of characteristics for each of the units in the intervention group. Typically, the end result is that only a few units from the intervention and comparison groups get matched up. This not only significantly reduces the size of the sample, but also limits the extent the findings can be generalised to all programme participants. (This is referred to as the 'curse of dimensionality' in the literature).

Fortunately, matching on the basis of the propensity score – the conditional probability of being assigned to the programme group, given

particular background variables or observable characteristics – offers a way out. The way propensity score matching (PSM) works is a follows. Units from both the intervention and comparison groups are pooled. A statistical probability model is estimated, typically through logit or probit regression. This is used to estimate programme participation probabilities for all units in the pooled sample. Intervention and comparison units are then matched within certain ranges of their conditional probability scores. Tests are further carried out to assess whether the distributions of characteristics are similar in both groups after matching. If not, the matching bandwidth or calliper is repeatedly narrowed until the observed characteristics of the groups are statistically similar. Provided that a) the dataset in question is rich and of good quality; b) the groups possess many units with common characteristics (i.e. there is a large area of common support); and c) there are no unobserved differences relevant to the outcome lurking among the groups, PSM is capable of identifying unbiased intervention effects.

Multivariate regression is another approach that is also used to control for measured differences between intervention and comparison groups. It operates differently from PSM in that it seeks to isolate the variation in the outcome variable explained by being in the intervention group *net of other explanatory variables* (key factors that explain variability in outcome) included in the model. The validity of both PSM and multivariate regression is founded heavily on the 'selection on observables' assumption and, therefore, treatment effect estimates can be biased if unmeasured, but relevant differences exist between the groups.[5] Both PSM and multivariate regression were used to analyse the data collected for this Effectiveness Review, and efforts were made to capture key explanatory variables believed to be relevant in terms of the assessed outcomes, e.g. sex and age of household head, education levels, etc. (see Section 5).

While no baseline data were available, efforts were made, as explained later, to reconstruct it through respondent recall. This method does have limitations, e.g. memory failure, confusion between time periods, etc. However, for data that can be sensibly recalled, e.g. ownership of particular household assets, it can serve to enhance the validity of a cross-sectional impact evaluation design. The reconstructed baseline data were used in two ways. First, several of the variables included in the PSM and regression procedures were baseline variables constructed from recalled baseline data. One variable, for example, was related to the respondents' wealth status at baseline derived through the construction of a household wealth index based on asset ownership and other wealth indicators. This was done in an attempt to control for baseline wealth differences between the intervention and comparison groups.

The second way the reconstructed baseline data were used was to derive pseudo difference-in-difference (double difference) intervention effect estimates. With longitudinal or panel data, this is implemented by subtracting each unit's baseline measure of outcome from its endline measure of outcome (i.e. endline outcome status minus baseline outcome status). The intention here is to control for time invariant differences between the groups. Bearing in mind the limitations

[5] One of the MVR procedures that was used attempted to control for possible unobserved differences between the groups. This is the Heckman Selection Model or 2-step Estimator. Here, efforts are made to directly control for the part of the error term associated with the participation equation that is correlated with both participation and non-participation. The effectiveness of this method, however, depends, in part, on how well the drivers of participation are modelled.

associated with recalled baseline data, using PSM and/or regression and the double-difference approaches together is considered to be a strong quasi-experimental impact-evaluation design.

4.3 Intervention and comparison communities surveyed

A key factor in ensuring the validity of any non-randomised impact evaluation design is to use an appropriate comparison group. This is particularly true for an ex-post, cross-sectional evaluation design. Comparators that differ in relevant baseline characteristics and/or are subjected to different external events and influences are likely to result in misleading conclusions about programme impact. Identifying a plausible comparison group is therefore critically important and is, generally speaking, not an easy task in non-experimental work.

In this case, the project activities under review had been implemented in communities that were deliberately chosen for being the most vulnerable or the most in need of support in building risk-reduction capacity. This selection was made by Oxfam staff in consultation with woreda authorities. Importantly, more communities were assessed as suitable for inclusion than could, in fact, be served by the project. Field staff confirmed that communities in the implementation areas are highly homogenous in the risks they face. In most cases, field staff were therefore able to identify nearby communities that were believed to have similar characteristics to the community where the project was implemented, and so could be suitable for comparison. The exception was in Kabribaya woreda, where the team faced particular problems in identifying suitable comparison communities, since there seemed to be systematic differences between those served by the Oxfam project in terms of their proximity to the main road to Jijiga, and in terms of other disaster risk-reduction projects that have been implemented by other organisations. For this reason, Kabribaya was excluded from the Effectiveness Review. Oxfam field staff identified suitable comparison communities in Harshin and Awbare woredas: the full list of communities included is shown in Table 5.1.

The evaluation design made two sets of comparisons: a) general households in the intervention villages versus households in matched comparison villages; and b) PFS households versus households in matched comparison villages

5 Methods of data collection and analysis

5.1 Data collection

A household questionnaire was developed by Oxfam staff to capture data on various outcome and intervention exposure measures associated with the project's theory of change presented in Section 2. Data for other key characteristics of the interviewed households were also obtained to implement the evaluation design described in Section 3.

The survey was carried out by a team of 15 enumerators, who were deployed first to Harshin woreda and later to Awbare woreda

Candidates to work as enumerators were invited to a two-day training workshop in Jijiga town. The second day of the workshop included a practical exercise, carrying out the questionnaire with respondents in a nearby community. Based on their performance in this exercise, 15 candidates were selected to work as enumerators in carrying out the field work (one enumerator was subsequently disengaged due to poor performance after the first three days of field work). The practical exercise also served to pilot the questionnaire, which was subsequently revised.

Two different strategies were applied to identify respondents for

interview. Firstly, in each community, a random sample of households was required. Enumerators started from the central point in each community, and use the 'spin-the-pen' technique to randomly select a direction. They then proceeded to the first household in that direction, and carried out an interview. Following this, they continued in the same approximate direction, and sought to carry out an interview at the next household they reached. They would then continue in this manner, and in the same direction, until reaching their targeted number of interviews for the day (normally four). In most cases, they had also by this stage reached the outer limits of the community. The process of moving in a straight line was imperfect, but is not thought to have been subject to any systematic bias. In some communities in Harshin woreda where households were disbursed over a particularly wide area, some enumerators were distributed at regular points around the edge of the communities and tasked with working inwards in a straight line, to ensure that outlying households were sampled, as well as those located closer to the centre.

The survey team also intended to deliberately select for interview those households that had had direct contact or support from one of the Oxfam projects: the female-headed households who had been supported by restocking in Harshin woreda, and the members of the pastoralist field schools (PFSs) in both woredas. As already discussed in Section 4.3, no specific comparison group could be identified for these populations, so the estimates of outcome would rely on selection on observable characteristics, particularly through propensity-score matching (PSM). In the event (as discussed in Section 5.3) it was not practical to survey the households that had been supported through restocking. In the two kebeles (sub-districts) in which the PFSs were operating, the survey team approached the PFS leadership and asked for their assistance in locating the households of members. Surveys were carried out in the households of PFS members who lived within the bounds of the kebele (and, in a few cases, just outside the kebele), which accounted for the majority of the members of each PFS group. Members who lived in neighbouring kebeles were not targeted for interview. The full list of communities and the number of households interviewed are shown in Table 5.1.

The work of the enumerators was closely monitored and scrutinised by the Consultant and Oxfam staff. Oxfam's Oxford-based adviser accompanied the survey team for the first three days, monitoring the interviews, reviewing the completed questionnaires, and providing detailed feedback to the Consultant and enumerators to ensure that the appropriate quality standards were met.

Table 5.1: Numbers of households interviewed in each community

		Intervention communities		*Comparison communities*	
Woreda	**Community**	**Households interviewed in general population**	**Households of PFS members interviewed**	**Community**	**Households interviewed**
Harshin	Tagentur	10		Aladawayne 2	20
	Lafaislamod	18	18	Garabildan	28
	Madawayn	14		Megali	30
				Kurtmere 2	40
Awbare	Hindaisa	9		Lafta Kidiga	45
	Gobabley	30		Megalabote	43
	Werabe Yure	20		Ruka	42
	Wachale	8		Ayale	38
	Ruruchis	25		Shakhale/Delaa	42
	Bodley	30		Hasaadin	48
	Abay Fulan	32	30	Kaarinunu	43
				Garawadile	36
Total		**196**	**48**		**455**

5.2 Data analysis

OGB developed data-entry tools in Adobe Acrobat Pro, and the Consultant entered the data from the completed questionnaires. The data were then imported into Stata for analysis, the results of which are presented in the following sections. Most of the analyses involved group mean comparisons using *t*-tests, as well as PSM with the *psmatch2* module and various multivariate regression approaches.

Kernel and nearest-neighbour matching without replacement were used to implement PSM. Backwards stepwise regression was used to identify those covariates correlated with either being a member of the intervention population or a pastoral field school participant at *p*-values greater than 0.20 and 0.25, respectively. All the covariates presented in Table 6.1 below were used in this process.

Covariate balance was checked following the implementation of each matching procedure, and efforts were made to ensure that the covariates were balanced across groups at *p*-values greater than 0.20. Bootstrapped standard errors enabled the generation of confidence intervals for statistical hypothesis testing. (See Appendix 1 for further details.)

The same covariates noted above from Table 6.1 were included in the three regression approaches that were implemented. These approaches include: a) regression with robust standard errors (to address issues of heteroscedasticity); b) robust regression (to reduce the influence of outliers); and c) regression with control functions (to attempt to control for relevant unobserved differences between the intervention and comparison groups).

5.3 Main Problems and constraints encountered

Kam Harshin and Baligas were dropped from the survey when rainfall in the area led to problems with accessibility

- **Logistical problems in Harshin woreda**

The original plan had been to carry out the survey in all five communities in which the two projects had been implemented in Harshin woreda, and to deliberately target for interview the female-headed households who had received livestock as part of the restocking component of the Appeal/CIDA project. Unfortunately, the survey team's visit to Harshin woreda coincided with rains in the area, which severely restricted mobility. For this reason, it was seen as not practicable (within the timing and budget constraints) to visit Kam Harshin or Baligas for this survey. Those two communities accounted for two-thirds of the restocking recipients, and the remaining restocking recipients (18 households in Lafaislamod) were thought to represent too small a number to allow for statistical analysis of impact. Evaluation of the impact of the restocking activity therefore had to be excluded from the Effectiveness Review. The exclusion of Kam Harshin also means that the assessment of the impact of the activities of the RDD III project do not apply to the whole project area, but only to the other seven communities (in Harshin and Awbare) in which the survey was carried out.

- **Measurement challenges using the Likert scales**

Efforts were made to measure five of the 37 'resilience characteristics' using six-item, four point Likert scales. These characteristics include: 1) attitudes towards new livelihood practices; 2) awareness of climate change; 3) social connectivity; 4) perceived effectiveness of local government emergency support; and 5) perceived effectiveness of local leaders and institutions in supporting drought preparedness. The statements for each of the scales were mixed at random and placed in two sections of the household questionnaire. At the analysis stage, the extent to which the respondents agreed with each was analysed.

Ideally, there should be a high degree of internal consistency with respect to the level of agreement the respondents had with the six statements developed for each of the five characteristics. In other words, each respondent should have agreed with each statement associated with each characteristic-specific set in a similar way, given that these statements are intended to measure the same underlying latent construct. The degree of such internal consistency is often measured using Cronbach's alpha statistic. Unfortunately, the alpha statistics that were computed for each of the five characteristics were low, ranging from 0.51 to 0.65. This means that the respondents were not responding to the various Likert scales in a consistent manner. Consequently, there is reason to be suspicious of how accurately the five characteristics listed above were measured.

6 Results

6.1 General characteristics

Table 6.1.1 presents statistics for various household characteristics obtained through the administration of the questionnaires to the respondents of both the intervention and comparison communities. Three different comparisons were made: a) general intervention community households versus comparison community households; b) general intervention community households versus the PFS households; and c) PFS households versus the comparison households. The reason the general intervention households were compared with the PFS households was to examine how observationally different the latter is from the former, i.e. the extent to which they are a unique subset of the general intervention population.

As explained in Section 5.1, the actual PFS households that were surveyed do not represent a random sample of all the targeted PFS households. Rather, these PFS households represent the vast majority of those who participated in the pastoral field school intervention and reside in the surveyed kebeles where the members of these schools meet. Consequently, the statistics obtained for this group are not sample statistics but actual population parameters. Despite this, coupled with the fact that the statistics obtained for both the general intervention population and comparison populations are sample estimates, statistically significant tests for comparing this group with the two other groups were still implemented. This also aided in the interpretation of the size and robustness of any differences identified. It is important to bear in mind, however, that the sample of PFS households is rather small at 48, resulting in limited statistical power.

Several statistically significant differences between the various study groups were identified

As is clear from Table 6.1, there are several statistically significant differences between the three treatment groups. From an impact evaluation perspective, the less the intervention and comparison groups differ in terms of characteristics, such as those above, the better. This gives us more confidence that the comparison group is a plausible approximation of the counterfactual. When the general intervention and comparison populations are compared – while not extensive – there are several statistically significant differences. These are as follows:

- The survey respondents for the general intervention households were less likely to be household heads, but more likely to be female than those of the comparison households.
- While low for both groups, the heads of the general intervention households are less likely to have primary education than those of the comparison households.
- A greater proportion of the livelihoods of the intervention households were dependent on farming in the baseline period, while the comparison households derived more of their income from livestock.

To estimate the effects of the disaster risk reduction projects on the PFS households, these households were also compared with the comparison households. It is therefore important to assess the extent these two groups of households differ in relation to their general and baseline characteristics. It is clear from Table 6.1 that there are more significant differences between the PFS households and the comparison households than is the case between general intervention households and the latter.

Table 6.1: Descriptive statistics: covariate comparison between treatment groups

	Overall sample	**General intervention population**	**PFS members**	**Comparison population**	**General population vs. comparison population**		**General population vs. PFS members**		**PFS members vs. comparison population**	
	Mean	Mean	Mean	Mean	Difference	*t*-statistic	Difference	*t*-statistic	Difference	*t*-statistic
Distance to community centre (min)	35.99	31.15	40.00	37.65	-6.50*	-1.68	-8.85*	-1.65	2.35	0.31
Distance to livestock market (hour)	4.52	4.05	4.43	4.74	-0.69	-1.37	-0.38	-0.43	-0.31	-0.36
Respondent is head of household	0.55	0.47	0.58	0.59	-0.12***	-2.78	-0.11	-1.42	-0.0035	-0.05
Respondent female	0.51	0.57	0.71	0.47	0.11**	2.48	-0.14*	-1.74	0.24***	3.22
Household size	6.53	6.54	6.56	6.53	0.016	0.08	-0.022	-0.05	0.037	0.10
Number of adults in household	3.23	3.20	3.60	3.20	-0.0054	-0.04	-0.41	-1.50	0.40	1.58
Adults all elderly in household	0.00	0.00	0.00	0.00	-0.0044	-0.93	0	.	-0.0044	-0.46
Household has only one adult	0.02	0.02	0.06	0.01	0.0021	0.21	-0.047*	-1.90	0.049**	2.46
Female-headed household	0.13	0.12	0.29	0.12	0.0038	0.14	-0.17***	-2.94	0.17***	3.36
Senior woman in household is first wife	0.93	0.93	0.92	0.93	-0.0033	-0.15	0.012	0.28	-0.015	-0.39
Age of head of household	44.30	43.32	42.44	44.93	-1.61	-1.43	0.88	0.41	-2.49	-1.24
Household head is ethnic Somali	0.99	0.99	0.98	0.99	-0.0014	-0.17	0.011	0.60	-0.012	-0.80
Head has at least some primary education	0.16	0.10	0.29	0.17	-0.067**	-2.21	-0.19***	-3.47	0.12**	2.10
No. of adults with primary education	0.14	0.10	0.33	0.14	-0.042	-0.79	-0.24*	-1.93	0.19*	1.81
Head has at least some secondary education	0.01	0.00	0.08	0.01	-0.0088	-1.32	-0.083***	-4.20	0.075***	3.98
No. of adults with secondary education	0.03	0.03	0.06	0.03	-0.00086	-0.04	-0.037	-0.90	0.036	0.96
Head of household is literate	0.22	0.18	0.29	0.22	-0.046	-1.31	-0.11*	-1.76	0.067	1.05
Head of household is productive	0.85	0.87	0.92	0.83	0.044	1.41	-0.044	-0.85	0.088	1.57
Number of productive adults in household	2.90	2.96	3.35	2.82	0.14	1.06	-0.39	-1.45	0.53**	2.19
Number of oxen at baseline	1.67	1.24	1.75	1.84	-0.60**	-2.17	-0.51*	-1.68	-0.094	-0.17
Number of cattle at baseline	5.90	5.02	5.38	6.33	-1.31	-1.62	-0.35	-0.36	-0.96	-0.62
Number of sheep and goats at baseline	32.25	25.21	33.04	35.20	-10.00***	-2.69	-7.83	-1.14	-2.16	-0.32
Number of herd camels at baseline	2.14	2.26	2.44	2.05	0.21	0.41	-0.18	-0.17	0.39	0.45
Number of pack camels at baseline	0.48	0.44	0.85	0.46	-0.015	-0.17	-0.41*	-1.83	0.39**	2.22
Number of donkeys at baseline	0.67	0.62	0.33	0.73	-0.11	-1.00	0.29	1.26	-0.40**	-2.47
Number of poultry at baseline	0.47	0.35	0.00	0.58	-0.22	-0.93	0.35	0.96	-0.58	-1.35
Household grew crops at baseline	0.76	0.76	0.92	0.75	0.013	0.35	-0.16**	-2.41	0.17***	2.64
Land area used for crops at baseline	3.39	2.98	5.54	3.34	-0.36	-1.02	-2.56***	-3.62	2.20***	3.26
Number of crops grown at baseline	1.91	1.88	2.77	1.83	0.047	0.39	-0.89***	-3.91	0.94***	4.25
Household did agricultural labour at baseline	0.16	0.13	0.25	0.17	-0.034	-1.11	-0.12**	-2.02	0.083	1.44
Household did dry season labour at baseline	0.12	0.09	0.19	0.13	-0.041	-1.49	-0.10**	-2.04	0.060	1.16
Household provided service at baseline	0.04	0.04	0.19	0.03	0.0027	0.18	-0.15***	-3.91	0.15***	4.88
Household ran off-farm IGA at baseline	0.06	0.06	0.21	0.04	0.019	1.07	-0.15***	-3.24	0.17***	4.81
Household did formal work at baseline	0.03	0.03	0.13	0.02	0.0057	0.46	-0.099***	-3.02	0.11***	4.14
Household received remittances at baseline	0.06	0.06	0.06	0.06	0.0041	0.20	-0.0013	-0.03	0.0054	0.15
Household wealth index at baseline	-0.00	-0.08	0.58	-0.03	-0.058	-0.31	-0.66*	-1.88	0.61*	1.81
% of income from livestock at baseline	0.45	0.41	0.42	0.47	-0.052***	-2.83	-0.0074	-0.21	-0.045	-1.39
% of income from farming at baseline	0.36	0.41	0.32	0.34	0.068***	3.35	0.096**	2.43	-0.028	-0.83
% of income from labour at baseline	0.02	0.02	0.03	0.02	-0.0069	-1.31	-0.012	-1.25	0.0051	0.52
% of income from dry season at baseline	0.02	0.01	0.04	0.02	-0.010*	-1.66	-0.023**	-2.29	0.013	1.10
% of income from service at baseline	0.00	0.00	0.01	0.00	-0.0021	-1.21	-0.010***	-3.11	0.0080**	2.10
% of income from IGA at baseline	0.01	0.00	0.05	0.01	-0.0095*	-1.82	-0.042***	-4.80	0.033***	2.84
% of income from formal work at baseline	0.01	0.01	0.01	0.01	-0.0036	-0.91	-0.0063	-0.98	0.0027	0.37
% of income from community at baseline	0.03	0.02	0.04	0.03	-0.0052	-0.90	-0.019	-1.63	0.014	1.27
% of income from remittances at baseline	0.01	0.02	0.00	0.01	0.0077*	1.66	0.016	1.63	-0.0085	-1.22
% of income from aid at baseline	0.08	0.09	0.09	0.08	0.014	1.40	0.0078	0.40	0.0062	0.36
N	**699**	**196**	**48**	**455**	**651**		**244**		**503**	

* p<0.1, ** p<0.05, *** p<0.01

The PFS households are better off in relation to many of the covariates, compared with both the general intervention and comparison households

The more noteworthy of these differences include:

- As is the case for the general intervention households, the PFS household survey respondents were more likely to be female.
- The PFS households are more likely to be female-headed and only comprise of one adult, as well as being better off in terms of educational achievement.
- The number of productive adults residing in the PFS households is greater than those residing in the comparison households.
- The PFS households were more likely to own pack camels at baseline, but less likely to own donkeys.
- PFS households were more active in agriculture and possessed more asset wealth[6] during the baseline period than the comparison households, as well as being more likely to run their own businesses and engage in formal work.

While estimating the impacts of the two disaster risk-reduction projects did not involve comparing the general intervention households and the PFS households, it is of interest to understand the key differences between these two groups. How different are the PFS households from the general households in the communities in which they reside? As can be seen in Table 6.1, key relevant differences between these two groups include:

- The heads of the PFS households are more likely to possess secondary education and were more likely to be better off in livestock ownership and asset wealth at baseline.
- The PFS households reported having greater dependence on livestock in the baseline period, as opposed to farming.

Given that there are differences between the various treatment groups, directly comparing them may very well result in biased estimations of the impacts of the project. Consequently, it was important to control for these differences during the analysis of the data. This is reported on further in the following sections.

6.2 Differences between the intervention and comparison households on the resilience indices and specific resilience characteristics

6.2.1 Overall resilience indices

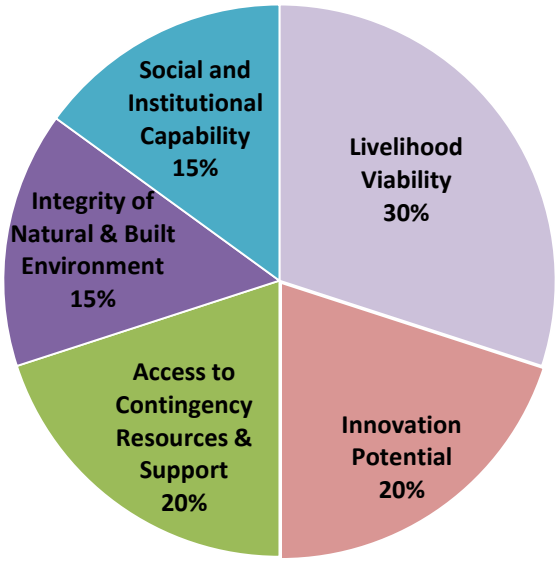
Following the Alkire-Foster method, several different composite indices were constructed using the 37 characteristics described in Appendix 2. This method permits each characteristic to be weighted, thereby affecting its contribution to the index in question. The Alkire-Foster method typically begins by assigning weights to each dimension, followed by specifying the specific weights to each characteristic (or indicator) within each dimension. Often, the various indicators within each dimension are weighted equally, but this is not necessary.

Figure 6.1 presents the higher-level dimensional weights that were used to construct the resilience indices. It is readily apparent that the dimensions are not weighted equally, something that requires justification. The context in which the two projects are being implemented in is one in which there are recurrent droughts that negatively affect the livelihoods of the targeted

[6] A baseline wealth index comprised of 27 household wealth indicators was computed with principal component analysis (PCA). See Appendix 3 for further details.

population. Consequently, developing strong livelihoods that can still thrive is such a context is absolutely critical, hence, justifying the greater weight given to the livelihood viability dimension. At the same time, climate change is a reality and there is a need for both adaptation and access to resources and support during time of intense stress. Consequently, the innovation potential and access to contingency resources and support dimensions are each weighted at 20 per cent. The integrity of the natural environment in the context is important, but directly relates to securing viable livelihoods. As such, it is strongly connected to the livelihood viability dimension, resulting in it being given less weight. Finally, the ability of the targeted households to cope effectively with stress and adapt to emerging trends and uncertainty is assumed to be more influenced by their own characteristics and efforts, rather than those of local leaders and institutions. Less weight was, therefore, also given to the social and institutional capability dimension.

FIGURE 6.1:
Dimensional Weights Used



Each characteristic under each dimension was given equal weight, as presented in Appendix 2. What is referred to in this report as the 'base resilience index' (BRI) was constructed by adding the weighted indicators together for each observation. Given the way the weights were defined, the maximum score a household could possibly obtain was one. Here, a household would have to be above the characteristic specific binary cut-offs for all the 37 characteristics. The lowest possible score obtainable on the base resilience index is zero. A household can only score zero if it is below the binary cut-offs on all the 37 characteristics. We would, of course, expect most household to score somewhere between zero and one on the index.

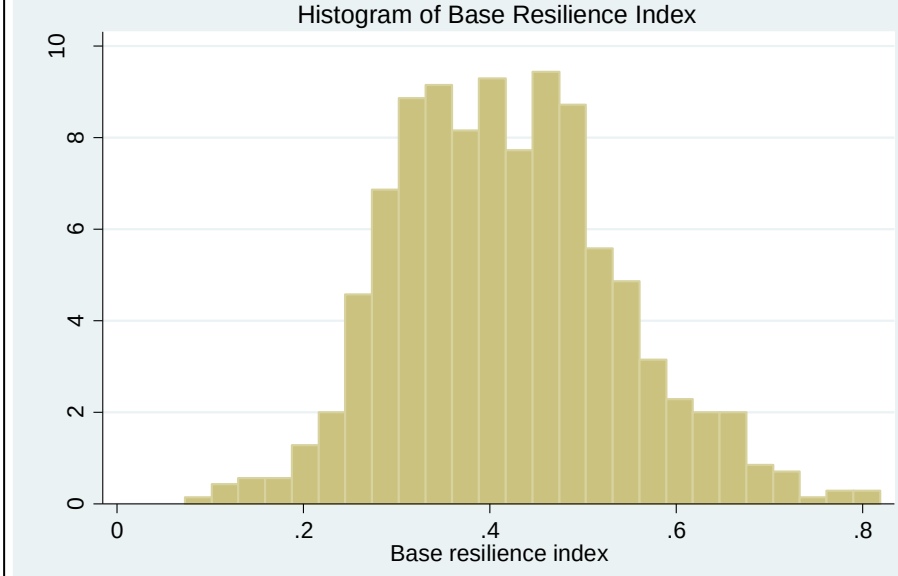
Figure 6.2 is a histogram of the BRI for the dataset used in the Effectiveness Review.[7] As can be seen, no households score positively or negatively on all the weighted indicators. It is also clear that there is considerable variation in the scores the various households obtained.

[7] Only the data from the samples of households in the project and comparison communities are included. The data relating to households of members of the PFS groups are not included in this figure.

There is considerable variation among the households interviewed in terms of the base resilience index

The next step in the Alkire-Foster method is to define an overall binary cut-off for the entire weighted index. Households above this cut-off are considered to be non-deprived in general because they are only deprived on a relatively smaller proportion of the weighted indicators. As is the case for the dimensional and indicator specific weights, it is important to provide a normative justification for the overall cut-off used. In the case of OPHI's Multi-Dimensional Poverty Index (MPI), the overall cut-off is set at two-thirds, i.e. those deprived in less than one-third of the weighted indicators are considered to be non-deprived (non-multi-dimensionally poor). The normative justification here is that one-third is equivalent to one of the three dimensions used to construct the MPI, i.e. a household needs to be deprived in the percentage of the weighted indicators that is equivalent to at least an entire dimension in order to be considered to be multi-dimensionally poor.[8]

FIGURE 6.2



The case is less straightforward for the resilience measurement framework used in this Effectiveness Review, given that there are five dimensions that are weighted differently. However, the two-thirds cut-off was maintained, given that this represents a significantly large percentage of weighted indicators a household needs to score positively on in order to be considered as 'resilient'. For the entire dataset used for the Effectiveness Review, only two per cent of households exceeded this overall cut-off on the BRI; 98 per cent under-preformed on one-third or more of the weighted indicators.

Under the Alkire-Foster method used to construct the MPI, one of the indices created is the 'average deprivation share among the poor', i.e. the average percentage of weighted indicators the poor are deprived in. As such, the greater the deprivation – i.e. the more indicators the poor are deprived in – the higher the score on this particular index. The MPI is actually a product of this index and the percentage of people who are multi-dimensionally poor. In particular, this is the percentage of weighted indicators in which the poor are deprived multiplied by the percentage of people who are multi-dimensionally poor (i.e. those at or below the overall cut-off). Consequently, this index ranges from zero to one and reflects *both* the percentage of households that

[8] Alkire, Sabina & Santos, Maria Emma (2010) *Acute Multidimensional Poverty: A New Index for Developing Countries*. United Nations Development Programme Human Development Report Office Background Paper No. 2010/11.

are multi-dimensionally poor *and* the depth of deprivation among multi-dimensionally poor households. Those households that are non-poor are effectively censored and, consequently, receive a score of 0 on the index. For the multi-dimensionally poor, however, their scores are simply left as the percentage of weighted indicators they are deprived in. Hence, if either the percentage of people who are poor drops or the percentage of weighted indicators the poor are deprived in goes down, the MPI will decrease accordingly and vice-versa.

Higher scores on the various resilience indices used in this report imply greater resilience

When applying the Alkire-Foster method to a positive construct, such as resilience, the way the various indices are defined changes. The overall cut-off is now defined positively, e.g. the percentage of households that score positively on over two-thirds of the weighted resilience characteristics. Another index is created where those above this cut-off are left out, which amounts to the percentage of weighted indicators the non-resilient are non-deprived in. When the index equivalent to the MPI is created – *referred to as the Alkire-Foster (AF) Resilience Index in this report* – all those above the overall cut-off are given a score of one (the maximum possible score on the AF Resilience Index) and the scores for those that are below this cut-off remain as the percentage of weighted characteristics they are non-deprived in. Hence, the AF Resilience Index reflects *both* the percentage of households that are resilient *and* the depth of resilience among the non-resilient. The way the AF Resilience Index is constructed is effectively the same as the MPI; it is simply that it has been defined in a positive, rather than negative, sense.

Oxfam's global outcome indicator for resilience is directly informed by the AF Resilience Index. For ease of communication, it is defined as *the percentage of households demonstrating greater ability to reduce risk and adapt to emerging trends and uncertainty*. When it is actually computed, it equates to the percentage of supported households scoring more positively on the AF Resilience Index than the typical household (as defined by the median) of the comparison population.

6.2.2 Comparing the treatment groups on the indices

If the two DRR projects implemented in Ethiopia's Somali Region were successful in supporting the targeted households to reduce risk and/or adapt to emerging trends and uncertainty, we would expect them to be better off than the comparison household in relation to the above resilience indices, all other things being equal. Table 6.2 compares the general intervention households and the comparison households in relation to these indices.

It is clear from the table that there are statistically-significant differences between general intervention population and the comparison population for the three indices and two binary variables. It is of interest to note that the size and statistical significance of these differences are larger for the estimates computed with both PSM and multivariate regression than they are for the unadjusted differences.

Table 6.2: Indices of resilience – general intervention households versus comparison households

	Base resilience index (BRI)	% of households above overall resilience cut-off	% of weighted indicators among 'non-resilient'	AF Resilience Index	Oxfam GB global resilience indicator
Unadjusted					
Sample mean	0.411	0.025	0.403	0.418	0.531
General intervention group mean:	0.436	0.046	0.421	0.448	0.612
Comparison group mean:	0.400	0.015	0.396	0.405	0.497
Unadjusted difference:	0.0356***	0.0305*	0.0258***	0.0431***	0.116***
	(3.58)	(1.90)	(2.90)	(3.40)	(2.75)
Observations:	**651**	**651**	**635**	**651**	**651**
PSM					
Post-matching difference:	0.0446***	0.0326**	0.0345***	0.0527***	0.142***
(kernel)	(4.34)	(2.29)	(3.50)	(4.19)	(3.16)
Observations:	**643**	**643**	**628**	**643**	**643**
Post-matching difference:	0.0536***	0.0412***	0.0405***	0.0644***	0.175***
(no replacement)	(4.52)	(2.64)	(3.61)	(4.74)	(3.49)
Observations:	**643**	**643**	**628**	**643**	**643**
Multivariate Regression					
MVR coefficient:	0.0467***	0.0385**	0.0373***	0.0564***	0.182***
(robust standard errors)	(5.06)	(2.38)	(4.36)	(4.80)	(3.63)
Observations:	**642**	**642**	**627**	**642**	**613**
MVR coefficient:	0.0420***		0.0380***	0.0389***	
(robust regression)	(4.65)	n/a	(4.25)	(4.38)	n/a
Observations:	**642**		**627**	**642**	
MVR coefficient:	0.0464***	0.0444***	0.0357***	0.0577***	0.182***
(with control functions)	(4.97)	(2.66)	(4.15)	(4.82)	(3.52)
Observations:	**645**	**645**	**629**	**645**	**614**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented
Probit regression used for binary outcomes

The intervention population outperformed the comparison population on all the resilience indices

Given the non-experimental nature of the data, it is of interest to explore how much unobserved bias would be needed to 'explain away' the positive effect estimates. In other words, how sensitive are the effect estimates to the possible presence of unobserved bias in favour of the intervention population?

Sensitivity analysis is an approach used for exploring this. It was implemented using Rosenbaum sensitivity analysis with Stata's *rbounds* command. Here, unobserved bias is assumed to exist in favour of the intervention population at different log odds ratios. How large can the log odds ratio be in order to render an effect estimate non-significant? Table 6.3 presents the results that were obtained from undertaking such analysis with the nearest-neighbour one-to-one matching effect estimate for the AF Resilience Index. The table reveals that the presence of unobserved bias would need to be present at a log odds ratio of 1.8 in favour of the intervention population in order for the effect estimate to be rendered statistically insignificant with a 95 per cent level of confidence. Qualitatively, we can say that the effect estimate is moderately robust to the possible existence of omitted variable bias.

Table 6.3: Results of Rosenbaum sensitivity analysis where unobserved, positive bias is assumed to exist, at various log odds ratios among the intervention population – AF Index

Log odds ratio of hidden bias	*p*-value of effect estimate with bias	Estimated effect estimate with bias	95% confidence level – two tailed	
			CI+	CI−
1	0.000000	0.055714	0.034226	0.076190
1.1	0.000006	0.049702	0.028215	0.082381
1.2	0.000057	0.043750	0.022738	0.088512
1.3	0.000343	0.038393	0.017381	0.093572
1.4	0.001488	0.033750	0.012500	0.098750
1.5	0.004967	0.029464	0.007559	0.103691
1.6	0.013409	0.025417	0.003274	0.108155
1.7	0.030438	0.021608	-0.00113	0.112620
1.8	0.059897	0.018154	-0.00548	0.116726
1.9	0.104687	0.014702	-0.00952	0.120238
2	0.165725	0.011339	-0.01304	0.124226

Since the RDD III and Appeal/CIDA projects had quite distinct activities, it is of interest to investigate whether there is any evidence that the estimated effects of the two projects on the indices are different. The number of households surveyed in the seven communities where the RDD III project was implemented (excluding the households of PFS members) was 185, while the number of interviews in the communities targeted by the Appeal/CIDA project in Awbare woreda was 59. The latter, in particular, provides too small a sample to allow for disaggregated statistical analysis. However, it is possible to test whether there is evidence supporting a differential impact by incorporating dummy variables for these two projects into the first multivariate regression model presented in Table 6.2.

The estimated impact of the projects on the Alkire-Foster Resilience Index is moderately robust to omitted variable bias

The results obtained by following this approach are presented in Table 6.4. The original regression coefficient for the intervention dummy variable is presented in the first column. The coefficient in the second column pertains to the intervention dummy variable after the dummy variable for the Appeal/CIDA project was included in the analysis. It can be seen that the coefficient on the intervention variable does not change significantly. This is complemented by the fact that the coefficient for the Appeal/CIDA project dummy variable is very small and statistically insignificant. The fourth column presents the intervention coefficient when the dummy variable for the RDD project has been included in the analysis. Again, the coefficient on the intervention variable does not change in any meaningful way. Moreover, the coefficient for the RDD dummy variable (shown in the right-hand column) is not-statistically insignificant either. There is, therefore, no evidence of differential impact among the Appeal/CIDA and RDD projects.

Table 6.4: Results of adding a project-specific dummy variable to regression models for AF Resilience Index

Original MVR Coefficient	MVR Coefficient with CIDA project dummy variable	Coefficient on CIDA project dummy variable	MVR Coefficient with RDD project dummy variable	Coefficient on RDD project dummy variable
0.055***	0.053***	-0.008	0.061***	-0.008
(4.74)	(3.96)	(-0.41)	(3.58)	(-0.41)

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Coefficients for covariates used in regression are not presented

At least in relation to the households that were interviewed, the Appeal/CIDA project was only implemented in Awbare woreda. However, the RDD project was implemented in both Awbare and Harshin woredas. It is, therefore, also of interest to investigate whether there are any differences in effects between the woredas. Again, the sample size in Harshin woreda is quite

small (42 households). Consequently, it was not possible to carry out-statistical analysis for the two woredas separately.

Nevertheless, we can formally test whether there is evidence supporting a woreda-specific effect by carrying out a simple interaction test. Here, a dummy interaction variable was generated by interacting a variable that differentiates the two districts with the intervention dummy variable. This interacted variable was then included the first MVR model that was used, i.e. the first MVR model presented in Table 6.2. The results are presented in Table 6.5. It can be seen that the coefficient for the interaction dummy variable has increased significantly with the inclusion of the Awbare dummy variable (second column). This suggests greater impact in Harshin district; after the unique effect of the projects in Abware district have been controlled for, the overall effect is larger, indicating greater impact in Harshin district. This is complemented by the fact that the coefficient for the interaction variable constructed for Awbare district is negative and statistically significant at the five per cent level.

Table 6.5: Results of Awbare woreda interaction test for AF Resilience Index regressed on intervention dummy variable

Original MVR coefficient	MVR coefficient with interaction variable	Coefficient on interaction variable	MVR coefficient for Awbare only (*n*=485)
0.055***	0.0878**	-0.050***	0.041***
(4.74)	(2.57)	(-3.23)	(3.90)

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Coefficients for covariates used in regression are not presented

There is evidence that greater impact was achieved in Harshin district

This raises the question of whether there is any evidence of impact in Awbare at all. The sample of intervention households surveyed in Awbare woreda is reasonably large (154 households), so a separate multivariate regression model was constructed for this woreda alone. The results are presented in the last column of Table 6.5, revealing that the effect estimate of the projects on the AF Resilience Index in Awbare woreda is, while smaller, still statistically significant. The results nevertheless provide evidence that there is a differential effect between the two woredas.

As described in Section 4, the participants in the pastoral field schools (PFSs) represent a specific treatment group that requires separate analysis. Table 6.6 presents results where the 48 households targeted by this intervention were compared with the general comparison population. As is clear, significant differences between these two groups were identified. The effect sizes – save for the second measure – are clearly larger than is the case for the general intervention population. Is it the case, therefore, that the PFS households have been more significantly impacted by the two projects? Unfortunately, we cannot make this conclusion with any confidence. This is because the membership of the PFS groups is self-selected, meaning that the members probably differ systematically from their neighbours who have not chosen to join the PFS group. In particular, it is very possible that the PFS households differ in unobservable ways (e.g. in motivation and attitudes) from the general comparison households that could not be controlled for in the statistical analysis.

Table 6.6: Indices of resilience – households of PFS members versus comparison households

	Base resilience index (BRI)	% of households above overall resilience cut-off	% of weighted indicators among 'non-resilient'	AF Resilience Index	Oxfam GB global resilience indicator
Unadjusted					
Sample mean	0.411	0.024	0.404	0.419	0.533
General intervention group mean:	0.516	0.104	0.495	0.548	0.875
Comparison group mean:	0.400	0.015	0.396	0.405	0.497
Unadjusted difference:	0.116***	0.0888**	0.0995***	0.143***	0.378***
	(7.08)	(1.99)	(6.73)	(5.44)	(7.10)
Observations:	**503**	**503**	**491**	**503**	**503**
PSM					
Post-matching difference:	0.0884***	0.0478	0.0822***	0.104***	0.297***
(kernel)	(4.26)	(1.02)	(3.95)	(3.25)	(3.72)
Observations:	**492**	**492**	**482**	**492**	**492**
Post-matching difference:	0.0901***	0.0732	0.0786***	0.114***	0.293***
(no replacement)	(3.59)	(1.45)	(3.40)	(3.46)	(3.17)
Observations:	**494**	**494**	**484**	**494**	**494**
Multivariate Regression					
MVR coefficient:	0.0836***	0.0492	0.0753***	0.0998***	0.884***
(with robust standard errors)	(5.03)	(1.28)	(4.56)	(4.16)	(3.25)
Observations:	**428**	**428**	**419**	**428**	**428**
MVR coefficient:	0.0871***		0.0782***	0.0780***	
(robust regression)	(4.42)	n/a	(3.89)	(3.87)	n/a
Observations:	**428**		**419**	**428**	
MVR coefficient:	0.0899***	0.0542	0.0803***	0.108***	0.991***
(with control functions)	(5.15)	(1.26)	(4.59)	(4.13)	(3.43)
Observations:	**471**	**471**	**462**	**471**	**471**

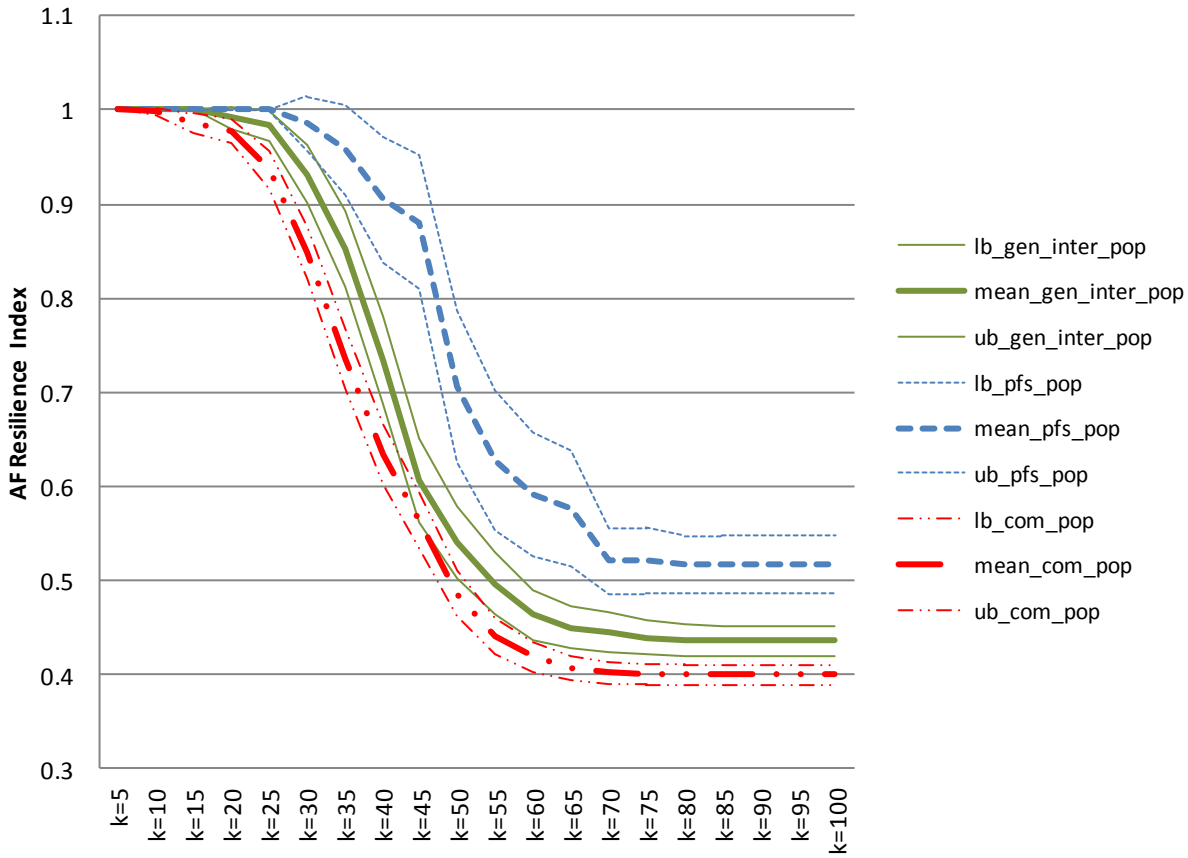
t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression not presented

One way the robustness of the results is tested in the Alkire-Foster method is to examine whether the relative differences between groups changes with different overall cut-offs used in the construction of the index. If the differences between groups change qualitatively at different cut-offs, e.g. one group is better off in relation to the index at one cut-off, but worse off at another, then the results are not robust to cut-off specification. Figure 6.3 is a graph of the AF Resilience Index at different cut-offs (*k*). As can be seen, if the overall resilience cut-off is set at between 5 to 10 per cent, all the households in the dataset would be classified as resilient. This changes, however, after the 10 per cent threshold. It is important to observe that, while the means of the three treatment groups change with different cut-offs, the lines representing their means do not intersect. More specifically, the mean of the PFS members is always dominant, while the mean of the intervention population always dominates the comparison mean. The finding that resilience is higher in project communities than in comparison communities, therefore, does not depend on the cut-off that is chosen for the AF Resilience Index.

The thinner lines both above and below the thicker lines are the upper and lower bounds of the means of the three treatment groups. Notice how the lower bound of the intervention population mean and the upper bound of the comparison mean intersect with one another (for example, at $k = 20$ and $k = 45$). This indicates that the difference in the unadjusted comparisons of the general intervention and comparison households is not consistently statistically significant at different cut-offs. This is clearly not the case for the

PFS group, where none of its lower bounds confidence intervals intersect with either of the upper bound confidence intervals of the comparison group.

FIGURE 6.3:
Changes in AF Resilience Index with Different Resilience Cutoffs



Given that there is evidence that the two projects have successfully affected at least some of the resilience characteristics, the following sections seek to indentify which ones in particular for each of the five dimensions.

There is a clear difference between the population of project and comparison communities in terms of the overall index of livelihood viability

6.2.3 Dimension 1: Livelihood viability

The first dimension included in the resilience measurement framework is that of livelihood viability: to what extent is there evidence that households in the intervention villages possess livelihoods that are more resilient to shocks than the comparison households? In other words, to what extent are they better off in relation to the characteristics assessed under the livelihood viability dimension?

To answer this question, an index specific to the livelihood viability dimension was created. This index comprises of this dimension's 14 characteristics using the binary cut-offs presented in Appendix 2. All characteristics were given equal weight. Consequently, the index simply represents the percentage of indicators in which the interviewed households scored positively. Table 6.7 presents the results of a comparison of the treatment groups in relation to this index.

Table 6.7: Comparison of intervention and comparison households in terms of the index of livelihood viability

	General intervention population	PFS households
Unadjusted		
Sample mean	0.47	0.47
General intervention group mean:	0.50	0.58
Comparison group mean:	0.46	0.46
Unadjusted difference:	0.0356***	0.117***
	(2.90)	(6.52)
Observations:	**651**	**503**
PSM		
Post-matching difference:	0.0456***	0.0814***
(kernel)	(3.77)	(3.32)
Observations:	**643**	**492**
Post-matching difference:	0.0493***	0.0540*
(no replacement)	(3.38)	(1.87)
Observations:	**643**	**494**
Multivariate Regression		
MVR coefficient:	0.0418***	0.0835***
(with robust standard errors)	(3.61)	(4.69)
Observations:	**642**	**428**
MVR coefficient:	0.0371***	0.0824***
(robust regression)	(3.14)	(3.57)
Observations:	**642**	**428**
MVR coefficient:	0.0415***	0.0886***
(with control functions)	(3.54)	(4.44)
Observations:	**645**	**471**

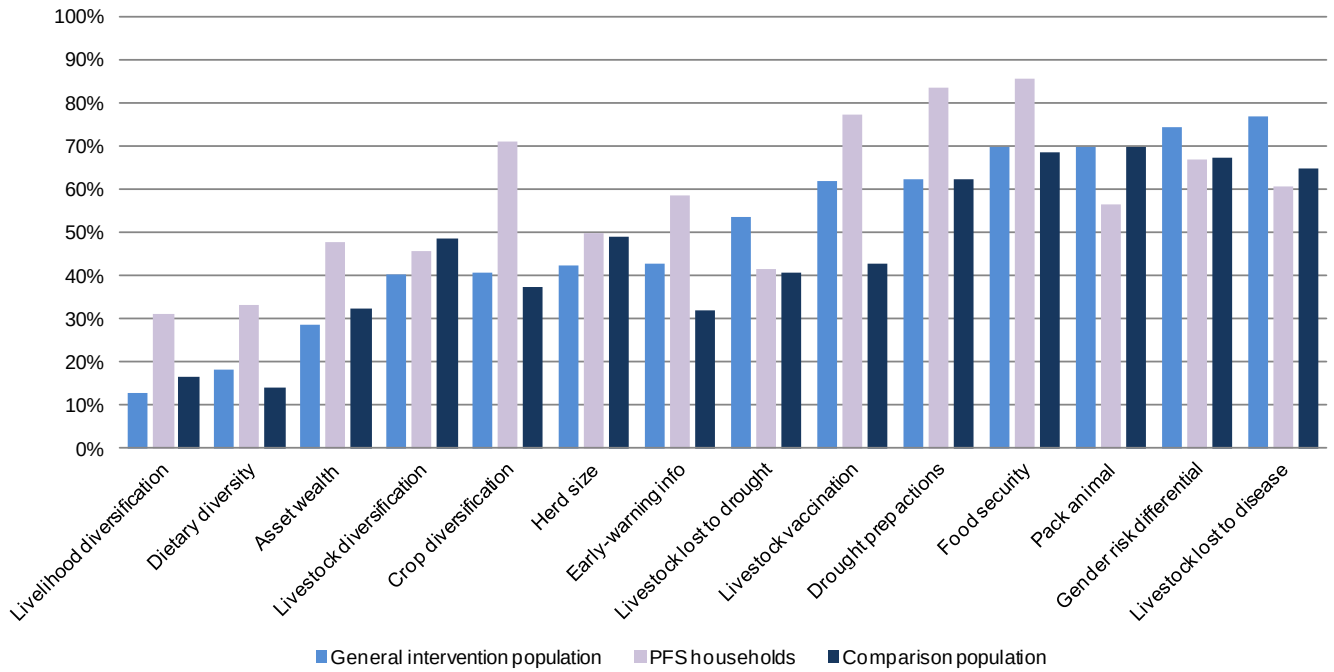
t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented

As is clear, on average, the general intervention population scored positively on half of the 14 indicators, while the PFS households performed considerably better at 58 per cent. There is a statistically significant difference of four or five percentage points between the general intervention population and the population of comparison households on this index. The differences between the households of PFS members and comparison households are clearly much larger and more statistically significant. As mentioned in Section 6.3, we unfortunately cannot conclude that this difference is due to the project activities, given that the PFS member households represent a distinct, non-random, subset of all households in the communities where the PFS groups were established.

The general intervention population is most deprived in relation to livelihood diversification, dietary diversity and asset wealth

Figure 6.4 shows the percentage of interviewed households that scored positively on each indicator, with the indicators ranked from most deprived to least deprived in relation to the general intervention population. Differences between the various treatment groups are readily apparent from the graph. The PFS households clearly perform better in relation to both the other treatment groups for many of the characteristics. However, the graph was constructed with the data before it was analysed with PSM. Table 6.8 presents the results of the PSM analysis for each characteristic. Here it can be observed that the general intervention population is clearly better off in relation to two of the 14 characteristics: livestock vaccination and receipt of early-warning information. The PSM results also provide some indication that the intervention population is better off in terms of; while the PSM estimates are not clearly statistically significant, the results are corroborated by the estimates derived from the regression models for the same characteristics, which are statistically significant at least at the 10 per cent level (the

Figure 6.4: Percentage of households scoring positively on characteristics of livelihood viability



regression results are not shown here).

Adding a dummy variable for exposure to the two different projects to the regression model for these outcomes (the results of which are shown in Table 6.10) shows that the positive results for the livestock vaccination and losses from disease appear to be particularly concentrated in the communities where the RDD III project had been implemented, rather than the communities in Awbare woreda, which were included only in the Appeal/CIDA project. For receipt of early-warning information and losses from drought, it is not clear whether that the positive effects differed according to which project was implemented in the community.

There is evidence that the RDD III project successfully affected the main characteristic under the livelihood viability dimension it was intentionally seeking to affect – access to drought early-warning information

Improving access to early-warning information has been a key activity of the RDD III project, so these results on this characteristic might imply some success from those activities. Examination of the underlying data confirms that the difference between the project and comparison communities is due to greater proportions of households receiving early-warning information from community leaders or from a community-based disaster risk-management committee, rather than from sources that were not affected by the project, such as the radio or local government officers. However, it may be a cause for concern that still less than half (48 per cent) of households in the RDD III communities reported having received any early-warning information in advance of the drought of 2011. Perhaps strangely, it is not clear that receiving early-warning information led to households taking action to protect their livestock and livelihoods. While more of those in the project communities reported storing feed or water in advance of the dry season that year (and also were slightly less likely to send family members to urban areas to look for work), there were no differences in the proportions that engaged in migration, destocking or herd splitting. However, there is evidence that drought-preparedness actions were taken at a community level: these are considered under Dimension 3.

Table 6.8: Comparison of intervention and comparison households in terms of characteristics of livelihood viability

	Asset wealth	Food security	Dietary diversity	Livelihood divers-ification	Gender risk differential	Crop divers-ification	Livestock divers-ification	Herd size	Pack animal	Livestock lost to disease in 2011	Livestock lost to drought in 2011	Livestock vaccination	Receipt of early-warning information	Drought prepared-ness actions
General intervention population														
Pre-matching														
Sample Mean	0.31	0.69	0.15	0.15	0.70	0.38	0.46	0.47	0.70	0.68	0.44	0.48	0.35	0.62
Intervention Mean	0.29	0.70	0.18	0.13	0.74	0.41	0.40	0.42	0.70	0.77	0.54	0.62	0.43	0.62
Comparison Mean	0.32	0.69	0.14	0.16	0.67	0.37	0.49	0.49	0.70	0.65	0.40	0.43	0.32	0.62
Difference	-0.037	0.013	0.045	-0.037	0.070*	0.035	-0.083*	-0.067	0.002	0.124***	0.131***	0.191***	0.110***	0.000
	(-0.96)	(0.34)	(1.41)	(-1.26)	(1.84)	(0.83)	(-1.96)	(-1.57)	(0.06)	(3.31)	(3.09)	(4.57)	(2.64)	(0.01)
Observations:	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**
PSM – kernel														
Difference:	0.00614	0.0274	0.0557	-0.00157	0.0159	0.0335	-0.00148	-0.0185	0.0342	0.0744*	0.0709	0.185***	0.111**	0.0458
	(0.15)	(0.62)	(1.61)	(-0.06)	(0.40)	(0.74)	(-0.03)	(-0.42)	(0.77)	(1.87)	(1.43)	(3.97)	(2.49)	(1.02)
Observations:	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**
PFS households														
Pre-matching														
Sample Mean	0.34	0.70	0.16	0.18	0.67	0.41	0.48	0.49	0.68	0.64	0.41	0.46	0.34	0.64
Intervention Mean	0.48	0.85	0.33	0.31	0.67	0.71	0.46	0.50	0.56	0.60	0.42	0.77	0.58	0.83
Comparison Mean	0.32	0.69	0.14	0.16	0.67	0.37	0.49	0.49	0.70	0.65	0.40	0.43	0.32	0.62
Difference	0.156**	0.168***	0.195***	0.148**	-0.008	0.335***	-0.027	0.010	-0.134*	-0.042	0.0123	0.344***	0.265***	0.211***
	(2.07)	(3.03)	(2.78)	(2.13)	(-0.11)	(4.81)	(-0.36)	(0.13)	(-1.79)	(-0.57)	(0.16)	(5.29)	(3.55)	(3.61)
Observations:	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**
PSM – kernel:														
Difference:	-0.0002	0.175**	0.188**	0.0352	0.169*	0.247***	-0.0706	-0.0375	-0.190**	-0.0685	0.0397	0.302***	0.199**	0.149*
	(-0.00)	(2.15)	(2.30)	(0.46)	(1.82)	(2.97)	(-0.69)	(-0.37)	(-2.02)	(-0.77)	(0.40)	(3.69)	(1.97)	(1.94)
Observations:	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**

t-statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
PSM estimates bootstrapped 1000 repetitions

Table 6.9: Results of adding project-specific dummy variables to multivariate regression models for characteristics of livelihood viability (general intervention population)

	Original MVR Coefficient	MVR Coefficient with CIDA project dummy variable	Coefficient on CIDA project dummy variable	MVR Coefficient with RDD project dummy variable	Coefficient on RDD project dummy variable
Receipt of early-warning information	0.148***	0.154***	-0.016	0.137*	0.016
	(3.26)	(2.94)	(-0.20)	(1.90)	(0.20)
Livestock vaccination	0.209***	0.318***	-0.323***	-0.031	0.323***
	(4.47)	(5.89)	(-4.15)	(-0.41)	(4.15)
Livestock lost to drought	0.128***	0.096*	0.102	0.197***	-0.099
	(2.63)	(1.70)	(1.17)	(2.63)	(-1.17)
Livestock lost to disease	0.094**	0.154***	-0.204**	-0.020	0.165**
	(2.20)	(3.11)	(-2.31)	(-0.30)	(2.31)

t-statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Coefficients for covariates used in regression are not presented

Livestock losses due to drought and disease in 2011 were significantly lower among the population in the project communities than in the comparison communities

In any case, it is clear that losses during the drought of 2011 were significantly lower in the communities where the two projects were being implemented. Forty-six per cent of households in those communities experienced severe losses due to drought that year (meaning that three or more large livestock or nine or more sheep and goats died or had to be sold off for a low price), compared to 60 per cent of households in the comparison communities.

The majority (62 per cent) of households in the project communities reported that at least some of their livestock were vaccinated in the 12 months prior to the survey, a considerably higher figure than the 43 per cent of households in comparison communities. Interestingly, the highest vaccination rates are reported in communities that participated in RDD III – even though the vaccination activities themselves were implemented under the Appeal/CIDA project. In addition, much larger proportions in the RDD III project communities reported having good access to veterinary services: 25 per cent reported that veterinary services were always available when required, compared to only 12 per cent in the comparison communities. Whether as a result of the vaccination campaigns or better veterinary services, households in communities where the RDD III project was implemented suffered significantly lower losses to disease than did those in comparison communities.

Table 6.8 also clearly shows that the PFS households are better off in relation to several of the livelihood viability characteristics. These include: food security; dietary diversity; gender risk differential; livestock vaccination; drought warning information; and good drought practice. Again, it is likely that some of these differences are based on the existing differences between the PFS members and non-members, so that they cannot be attributed with confidence to the project.

Results of analysis relating to several other outcome variables relevant to the livelihood viability dimension are presented in Appendix 3.

6.2.4 Dimension 2: Innovation potential

As discussed in Section 3, data were collected on six characteristics falling under the innovation potential dimension. Similar to the livelihood viability dimension, a composite index was developed, will all six characteristics being weighted equally. Table 6.10 presents the results of a comparison of the treatment groups for the resulting index. The sample mean of 0.39 means that, on average, the respondents scored positively on less than half of the six characteristics. However, statistically significant differences in favour of both the general intervention households and PFS households were identified. The remainder of this subsection will explore what particular characteristics are driving this difference.

Table 6.10: Comparison of intervention and comparison households in terms of the index of innovation potential

	General intervention population	PFS households
Unadjusted		
Sample mean	0.39	0.39
General intervention group mean:	0.42	0.51
Comparison group mean:	0.38	0.38
Unadjusted difference:	0.0367**	0.131***
	(2.18)	(4.81)
Observations:	**651**	**503**
PSM		
Post-matching difference:	0.0521***	0.114***
(kernel)	(2.83)	(3.34)
Observations:	**643**	**492**
Post-matching difference:	0.0558***	0.102**
(no replacement)	(2.77)	(2.36)
Observations:	**643**	**494**
Multivariate Regression		
MVR coefficient:	0.0550***	0.108***
(with robust standard errors)	(3.24)	(2.92)
Observations:	**642**	**428**
MVR coefficient:	0.0596***	0.113***
(robust regression)	(3.58)	(3.44)
Observations:	**642**	**428**
MVR coefficient:	0.0516***	0.114***
(with control functions)	(3.00)	(2.89)
Observations:	**645**	**471**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented

Significant differences in favour of both the general intervention and PFS households were found for the index of innovation potential

Figure 6.5 presents the percentage of households that scored positively on each of the six characteristics by treatment group. Comparing the three treatment groups reveals some interesting findings. In particular, all three groups appear to be faring well in relation to the market access, innovation practice, and, albeit to a lesser extent, access to credit characteristics. However, both the general intervention households and comparison households reported limited access to state innovation support, while the PFS households, at least on average, are better off on this characteristic. It is also of interest to note that, while all three groups performed poorly on the awareness of climate change characteristic, the PFS households performed the worst of all.

Figure 6.5: Percentage of households scoring positively on characteristics of innovation potential

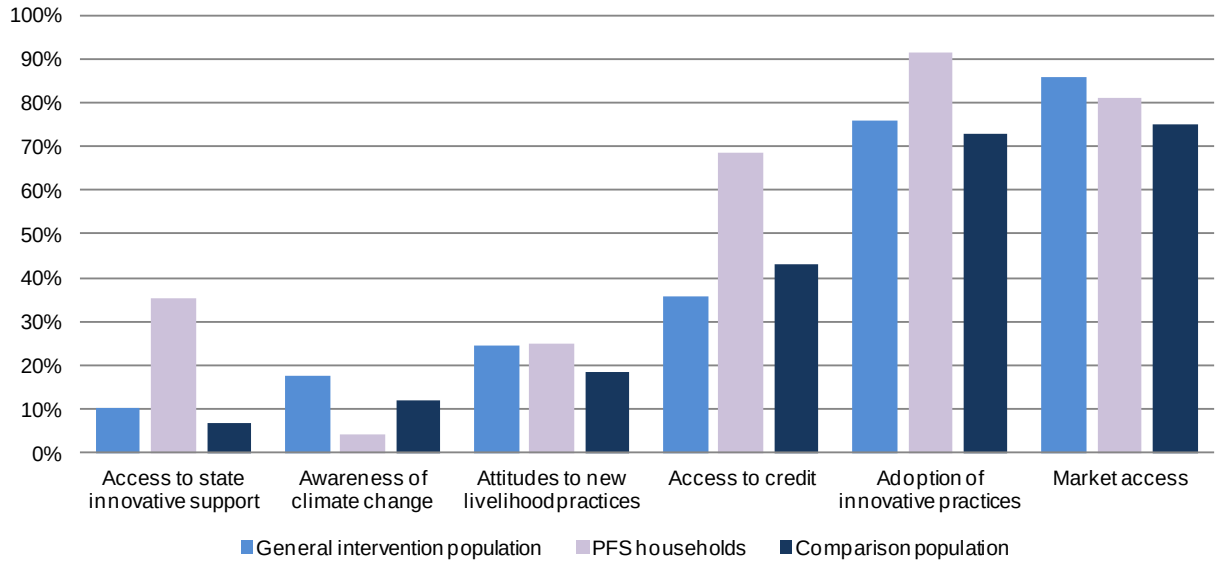


Table 6.11: Comparison of intervention and comparison households in terms of characteristics of innovation potential

	Attitudes to new livelihood practices	Awareness of climate change	Adoption of innovative practices	Access to credit	Access to state innovative support	Market access
General intervention population						
Pre-matching						
Sample Mean	0.20	0.14	0.74	0.41	0.08	0.78
Intervention Mean	0.24	0.17	0.76	0.36	0.10	0.86
Comparison Mean	0.18	0.12	0.73	0.43	0.07	0.75
Difference	0.0625*	0.0548*	0.0327	-0.0736*	0.0361	0.108***
	(1.75)	(1.76)	(0.88)	(-1.78)	(1.47)	(3.34)
Observations:	**651**	**651**	**651**	**651**	**651**	**651**
Matching – kernel						
Difference:	0.0816**	0.0607*	0.0679*	-0.00684	0.0297	0.0795**
	(2.21)	(1.80)	(1.65)	(-0.16)	(1.11)	(2.35)
Observations:	**643**	**643**	**643**	**643**	**643**	**643**
PFS households						
Pre-matching						
Sample Mean	0.19	0.11	0.75	0.46	0.09	0.76
Intervention Mean	0.25	0.04	0.92	0.69	0.35	0.81
Comparison Mean	0.18	0.12	0.73	0.43	0.07	0.75
Difference	0.0676	-0.0770**	0.189***	0.257***	0.288***	0.0630
	(1.04)	(-2.36)	(4.19)	(3.62)	(4.11)	(1.05)
Observations:	**503**	**503**	**503**	**503**	**503**	**503**
Matching – kernel						
Difference:	0.126	-0.0859*	0.151**	0.201**	0.285***	0.00955
	(1.62)	(-1.83)	(2.27)	(2.01)	(3.33)	(0.13)
Observations:	**492**	**492**	**492**	**492**	**492**	**492**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions

Table 6.11 shows the comparison of intervention and comparison households in terms of each of the characteristics of innovation potential following the application of propensity-score matching. The general intervention population, in particular, appears to be slightly better off in

relation to their attitudes towards new livelihood practices, awareness of climate change, adoption of innovative practice, and access to markets. However, only a small proportion of these households scored positively on the former two characteristics, thereby, perhaps, requiring future programmatic attention.

The PFS households are better off in relation to the innovation practice, access to credit, and access to state innovation support characteristics, but appear to be worse off in their awareness of climate change.

The characteristics in which the intervention population were found to have significantly higher results than the comparison households were again modelled through multivariate regression, and dummy variables were added to attempt to differentiate the effects of the two projects. The results of this analysis are shown in Table 6.12. There are no clear differences between the participants in the two projects in terms of their results on these measures, except that those in the communities where the Appeal/CIDA project was implemented may have scored more positively on awareness of climate change than those in communities where the RDD III project was implemented.

Table 6.12: Results of adding project-specific dummy variables to multivariate regression models for characteristics of innovation potential

	Original MVR Coefficient	MVR Coefficient with Appeal/CIDA project dummy variable	Coefficient on Appeal/CIDA project dummy variable	MVR Coefficient with RDD III project dummy variable	Coefficient on RDD III project dummy variable
Attitudes to new livelihood practices	0.084**	0.097**	-0.040	0.051	0.044
	(2.40)	(2.46)	(-0.67)	(0.87)	(0.67)
Awareness of climate change	0.067***	0.043	0.077	0.122***	-0.054
	(2.53)	(1.50)	(1.54)	(2.76)	(-1.54)
Adoption of innovative practices	0.051	0.055	-0.014	0.042	0.013
	(1.37)	(1.28)	(-0.20)	(0.72)	(0.20)
Market access	0.103***	0.097**	0.023	0.112**	-0.024
	(2.91)	(2.36)	(0.31)	(1.99)	(-0.31)

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Coefficients for covariates used in regression are not presented

6.2.5 Dimension 3: Access to contingency resources and support

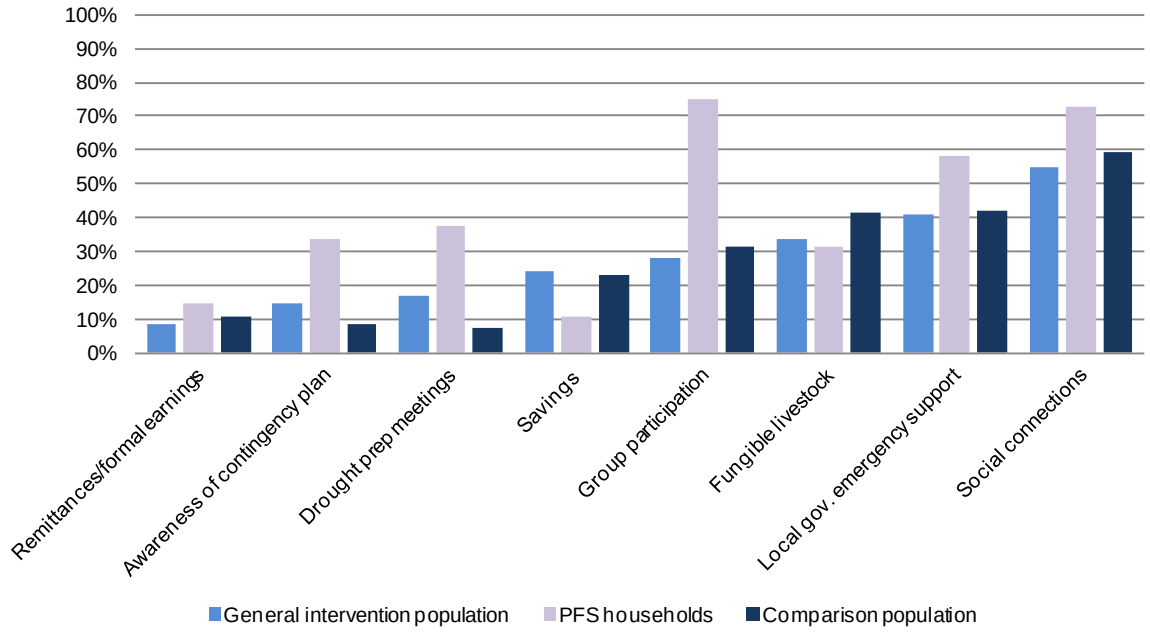
Eight characteristics were identified for the access to contingency resources and support dimension, and a composite index was also developed for them, with all the six characteristics weighted equally. Table 6.13 presents the results that compared both the general intervention population and PFS households with the comparison households. Although the value of the index is estimated to be slightly higher among households in the project communities than in the comparison communities, this difference is not statistic statistically significant – meaning that it cannot be claimed with confidence that the project activities have had an impact on this measure. The PFS households again score significantly higher on this index than the comparison households.

Table 6.13: Comparison of intervention and comparison households in terms of the index of access to contingency resources and support

	General intervention population	PFS households
Unadjusted		
Sample mean	0.28	0.29
General intervention group mean:	0.28	0.42
Comparison group mean:	0.28	0.28
Unadjusted difference :	-0.00361	0.138***
	(-0.21)	(4.42)
Observations:	**651**	**503**
PSM		
Post-matching difference:	0.0132	0.100***
(kernel)	(0.74)	(2.79)
Observations:	**643**	**492**
Post-matching difference:	0.0213	0.0884**
(no replacement)	(1.10)	(2.11)
Observations:	**643**	**494**
Multivariate Regression		
MVR coefficient :	0.0165	0.0930***
(with robust standard errors)	(1.10)	(3.23)
Observations:	**642**	**428**
MVR coefficient:	0.0103	0.0968***
(robust regression)	(0.70)	(3.46)
Observations:	**642**	**428**
MVR coefficient:	0.0230	0.0891***
(with control functions)	(1.53)	(2.91)
Observations:	**645**	**471**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented

Figure 6.6: Percentage of households scoring positively on characteristics of access to contingency resources and support



As in previous sections, Figure 6.6 visually compares the three groups in relation to the access to contingency resources and support index. It is clear that the general intervention households are, on average, less deprived in terms of awareness of the community drought-preparedness plan and participation in drought-preparedness meetings than the comparison households. It is interesting to note that the PFS households are more deprived on the savings characteristic, but much better off on the group participation characteristic.

The proportions of households aware of and engaged in community-level contingency planning are higher in project communities than in comparison communities, but are still quite low.

Table 6.14 follows by presenting the results of a comparison of both the general intervention households and PFS households with the comparison households for each of the six characteristics. There are clear differences between households in the project and comparison communities in terms of the two characteristics relating to community-level contingency planning: households in the project communities reported more awareness of whether the community had a drought contingency plan (and if so, of its contents), and were more likely to have participated in community meetings on drought preparedness. The results of the regression models shown in Table 6.16 broadly confirm that these differences are concentrated among the communities where the RDD III project was implemented, rather than in the communities included in the Appeal/CIDA project. However, it should be noted that the proportions of households scoring positively on these characteristics are low, even in the RDD III project communities. More than three-quarters of respondents in those communities said their household members were either not aware of whether the community had a drought contingency plan, or were not aware of its contents. Similarly, only 24 per cent of households reported having attended a community meeting on drought preparedness during the 12 months prior to the survey. Male respondents were more likely to respond positively to these questions than female respondents – but even among male respondents, fewer than a third reported that they had attended meetings or were aware of the contents of the contingency plan.

Of the other six characteristics considered under this dimension, one relates to the capacity of local government structures to provide support in times of crisis. The other five are concerned with contingency resources at the household level, such as access to savings or outside earnings, or the strength of their social connections. There is little or no evidence of a difference between the project and comparison communities in any of these characteristics. However, this should not be surprising, since the two projects being considered did not seek to have an impact on these household-level characteristics.

Among households of PFS members, it can be seen that most reported being involved in community groups – clearly, participation in the PFS group itself accounts for a large part of this effect. Again, the other apparent differences between the PFS members and comparison households may not be attributable to Oxfam's work.

Table 6.14: Comparison of intervention and comparison households in terms of characteristics of access to contingency resources and support

	Awareness of drought prepared-ness plan	Participation in drought prepared-ness meetings	Group partici-pation	Social connect-ivity	Local government emergency support	Savings	Remittances or formal earnings	Ownership of fungible livestock
General intervention population								
Pre-matching								
Sample Mean	0.10	0.10	0.30	0.58	0.41	0.23	0.10	0.39
Intervention Mean	0.14	0.17	0.28	0.55	0.41	0.24	0.08	0.34
Comparison Mean	0.08	0.07	0.31	0.60	0.42	0.23	0.11	0.42
Difference	0.0593**	0.0958***	-0.0315	-0.0497	-0.00942	0.00903	-0.0239	-0.0786*
	(2.10)	(3.26)	(-0.81)	(-1.17)	(-0.22)	(0.25)	(-0.98)	(-1.92)
Observations:	**651**	**651**	**651**	**651**	**651**	**651**	**651**	**651**
Matching – kernel								
Difference:	0.0665**	0.0936***	0.0279	-0.0453	-0.0203	0.0140	-0.0179	-0.0132
	(2.40)	(3.04)	(0.70)	(-0.97)	(-0.43)	(0.35)	(-0.67)	(-0.33)
Observations:	**643**	**643**	**643**	**643**	**643**	**643**	**643**	**643**
PFS households								
Pre-matching								
Sample Mean	0.11	0.10	0.35	0.61	0.43	0.22	0.11	0.41
Intervention Mean	0.33	0.38	0.75	0.73	0.58	0.10	0.15	0.31
Comparison Mean	0.08	0.07	0.31	0.60	0.42	0.23	0.11	0.42
Difference	0.250***	0.302***	0.438***	0.134*	0.166**	-0.127***	0.0403	-0.103
	(3.60)	(4.26)	(6.61)	(1.96)	(2.21)	(-2.62)	(0.76)	(-1.45)
Observations:	**503**	**503**	**503**	**503**	**503**	**503**	**503**	**503**
Matching – kernel								
Difference:	0.207***	0.305***	0.423***	0.0998	0.165*	-0.145**	-0.114*	-0.137
	(2.60)	(3.49)	(4.70)	(1.11)	(1.78)	(-2.33)	(-1.67)	(-1.40)
Observations:	**492**	**492**	**492**	**492**	**492**	**492**	**492**	**492**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions

Table 6.15: Results of adding a project-specific dummy variable to multivariate regression models for characteristics of access to contingency resources and support

	Original MVR Coefficient	MVR Coefficient with CIDA project dummy variable	Coefficient on CIDA project dummy variable	MVR Coefficient with RDD project dummy variable	Coefficient on RDD project dummy variable
Awareness of drought-preparedness plan	0.083***	0.098***	-0.029	0.042	0.045
	(3.66)	(4.06)	(-1.21)	(1.20)	(1.21)
Participation in drought-preparedness meetings	0.105***	0.124***	-0.027**	0.059*	0.046**
	(4.56)	(4.99)	(-1.49)	(1.91)	(1.49)

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Coefficients for covariates used in regression are not presented

6.2.6 Dimension 4: Integrity of the natural and built environment

As discussed in Section 3, only four characteristics were identified for the integrity of the natural and built environment dimension. Nevertheless, a composite index was developed. Again, each characteristic was weighted equally. Table 6.16 compares the general intervention and PFS households with the comparison population against this index. As is evident, statistically significant differences were identified in favour of the general intervention population. However, the PFS households were found to be at the same level as the comparison households.

Table 6.16: Comparison of intervention and comparison households in terms of the index of integrity of the natural and built environment

	General intervention population	PFS households
Unadjusted		
Sample mean	0.52	0.49
General intervention group mean:	0.59	0.47
Comparison group mean:	0.50	0.50
Unadjusted difference:	0.0911***	-0.0269
	(3.85)	(-0.67)
Observations:	**651**	**503**
PSM		
Post-matching difference:	0.0786***	-0.0523
(kernel)	(2.93)	(-1.02)
Observations:	**643**	**492**
Post-matching difference:	0.0941***	0.0244
(no replacement)	(3.19)	(0.38)
Observations:	**643**	**494**
Multivariate Regression		
MVR coefficient:	0.0811***	-0.0341
(with robust standard errors)	(3.28)	(-0.69)
Observations:	**642**	**428**
MVR coefficient:	0.0851***	-0.0341
(robust regression)	(3.26)	(-0.65)
Observations:	**642**	**428**
MVR coefficient:	0.0737***	-0.0342
(with control functions)	(2.95)	(-0.66)
Observations:	**645**	**471**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented

A larger proportion of the population in the Appeal/CIDA project communities reported having good access to grazing land than in the comparison communities

Figure 6.7 presents the absolute contribution of each characteristic to the index. All three groups are most deprived in terms of access to irrigation, followed by the availability of water for livestock production and domestic use. The general intervention population appears to be better off than both the PFS households and comparison households in terms of the water for livestock/consumption and soil erosion characteristic. Table 6.17 reveals that these differences still remain statistically significant following PSM. The difference in terms of access to grazing land is not statistic statistically significant overall. However, the regression models for which results are presented in Table 6.18 demonstrate that considerably more households scored positively on availability of grazing land in the three communities in Awbare woreda where rangeland rehabilitation was carried out as part of the Appeal/CIDA project. In those three communities, the proportion of households scoring positively on access to grazing land is 86 per cent – considerably higher than in nearby comparison communities.

Figure 6.7: Percentage of households scoring positively on characteristics of integrity of the natural and built environment

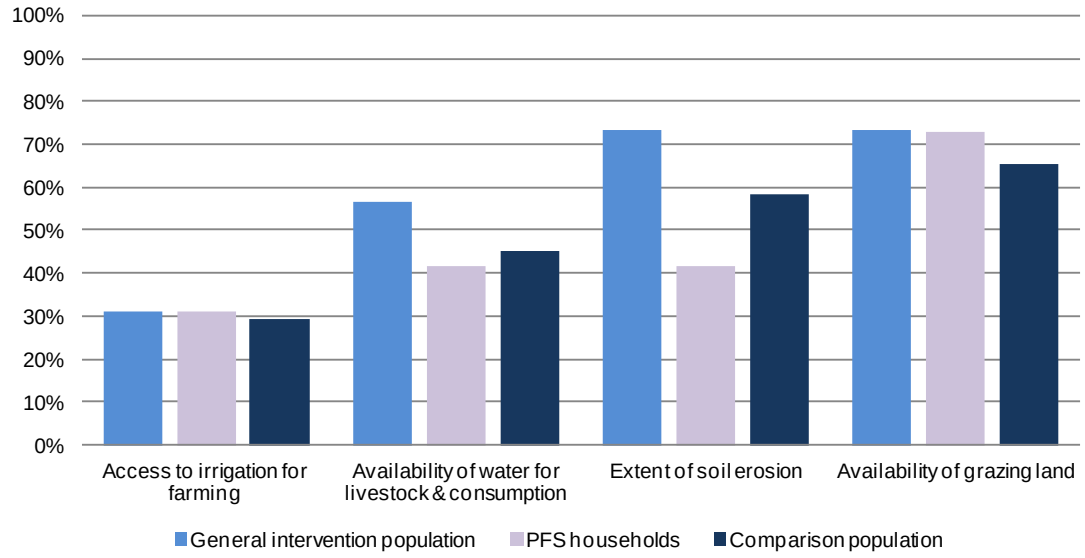


Table 6.17: Comparison of intervention and comparison households in terms of characteristics of integrity of the natural and built environment

	Extent of soil erosion	Access to irrigation for farming	Availability of water for livestock & consumption	Availability of grazing land
General intervention population				
Pre-matching				
Sample Mean	0.63	0.30	0.49	0.68
Intervention Mean	0.73	0.31	0.57	0.73
Comparison Mean	0.58	0.29	0.45	0.65
Difference	0.150***	0.0189	0.114***	0.0819**
	(3.83)	(0.48)	(2.67)	(2.12)
Observations:	**651**	**651**	**651**	**651**
Matching – kernel				
Difference:	0.140***	0.0135	0.102**	0.0593
	(3.26)	(0.31)	(2.24)	(1.45)
Observations:	**643**	**643**	**643**	**643**
PFS households				
Pre-matching				
Sample Mean	0.57	0.29	0.45	0.66
Intervention Mean	0.42	0.31	0.42	0.73
Comparison Mean	0.58	0.29	0.45	0.65
Difference	-0.168**	0.0202	-0.0361	0.0764
	(-2.24)	(0.29)	(-0.48)	(1.12)
Observations:	**503**	**503**	**503**	**503**
Matching – kernel				
Difference:	-0.223**	0.0172	-0.0118	0.00871
	(-2.30)	(0.19)	(-0.12)	(0.11)
Observations:	**492**	**492**	**492**	**492**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented

Table 6.18: Results of adding a project-specific dummy variable to a multivariate regression model for access to grazing land

	Original MVR Coefficient	MVR Coefficient with CIDA project dummy variable	Coefficient on CIDA project dummy variable	MVR Coefficient with RDD project dummy variable	Coefficient on RDD project dummy variable
Access to water for livestock & consumption	0.093** (2.00)	0.053 (0.98)	0.136 (1.59)	0.188** (2.51)	-0.135 (-1.59)
Access to grazing land	0.102** (2.46)	0.051 (1.07)	0.173** (2.31)	0.231*** (3.21)	-0.218** (-2.31)

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Coefficients for covariates used in regression are not presented

Surprisingly, a much smaller proportion of the households of PFS members scored positively on soil quality than did their neighbours in the same communities and in the comparison communities. Since this outcome measure is based on respondents' subjective judgements of the extent of erosion of their soil, it is possible that PFS members tended to have higher expectations than others, and so ranked their soil quality as lower.

Both the general intervention and PFS households outperformed the comparison households on the index of social and institutional capability

6.2.7 Dimension 5: Social and institutional capability

Another composite index was developed for the characteristics of the social and institutional capability dimension. Again, the characteristics were weighted equally. Table 6.19 presents the results of comparisons of both the general intervention population and the PFS households with the comparison households. As is clear, statistically significant differences in favour of both these groups were identified.

Table 6.19: Comparison of intervention and comparison households in terms of the index of social and institutional capability

	General intervention population	PFS households
Unadjusted		
Sample mean	0.38	0.39
General intervention group mean:	0.40	0.58
Comparison group mean:	0.37	0.37
Unadjusted difference:	0.0309*	0.210***
	(1.88)	(6.30)
Observations:	**651**	**503**
PSM		
Post-matching difference:	0.0405**	0.193***
(kernel)	(2.36)	(4.51)
Observations:	**643**	**492**
Post-matching difference:	0.0608***	0.215***
(no replacement)	(3.29)	(4.18)
Observations:	**643**	**494**
Multivariate Regression		
MVR coefficient:	0.0516***	0.180***
(with robust standard errors)	(3.20)	(5.57)
Observations:	**642**	**428**
MVR coefficient:	0.0379**	0.188***
(robust regression)	(2.48)	(6.16)
Observations:	**642**	**428**
MVR coefficient:	0.0531***	0.190***
(with control functions)	(3.28)	(5.90)
Observations:	**645**	**471**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression are not presented

Figure 6.8: Percentage of households scoring positively on characteristics of social and institutional capability

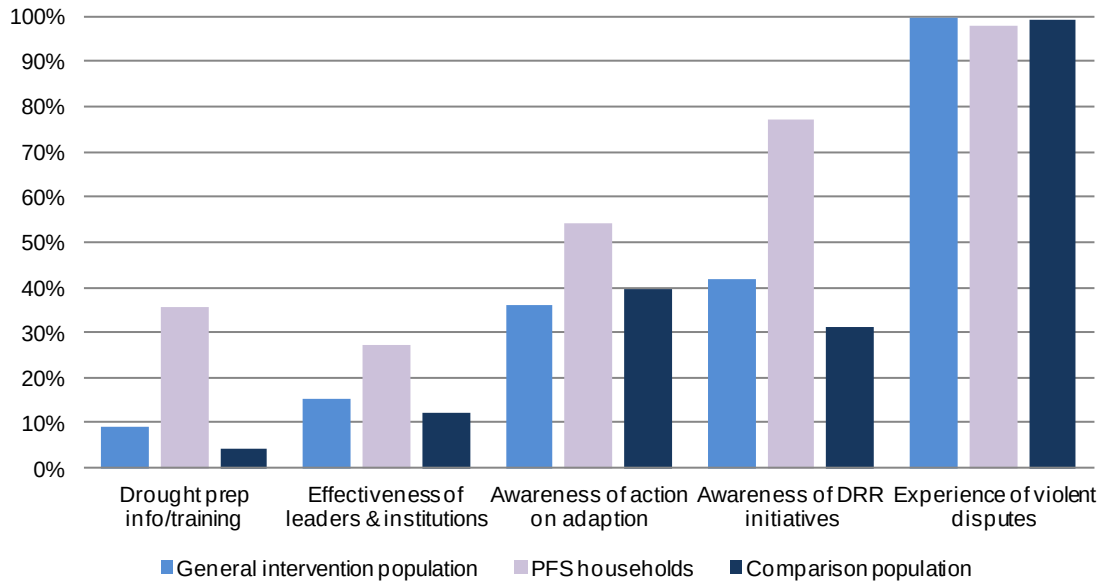


Table 6.20: Comparison of intervention and comparison households in terms of characteristics of social and institutional capability

	Receipt of info or training on drought preparedness	Awareness of local drought risk reduction initiatives	Experience of violent disputes	Effectiveness of local leaders and institutions	Awareness of local efforts to support adaptation
General intervention population					
Pre-matching					
Sample Mean	0.06	0.34	0.99	0.39	0.13
Intervention Mean	0.09	0.42	0.99	0.36	0.15
Comparison Mean	0.04	0.31	0.99	0.40	0.12
Difference	0.0479**	0.106**	0.0037	-0.036	0.032
	(2.10)	(2.56)	(0.55)	(-0.86)	(1.07)
Observations:	**651**	**651**	**651**	**651**	**651**
Matching – kernel					
Difference:	0.0580***	0.128***	0.00243	-0.0262	0.0400
	(2.61)	(2.99)	(0.37)	(-0.58)	(1.28)
Observations:	**643**	**643**	**643**	**643**	**643**
PFS households					
Pre-matching					
Sample Mean	0.07	0.36	0.99	0.41	0.14
Intervention Mean	0.35	0.77	0.98	0.54	0.27
Comparison Mean	0.04	0.31	0.99	0.40	0.12
Difference	0.310***	0.459***	-0.012	0.144*	0.150**
	(4.44)	(7.11)	(-0.57)	(1.90)	(2.27)
Observations:	**503**	**503**	**503**	**503**	**503**
Matching – kernel					
Difference:	0.306***	0.344***	-0.0220	0.228**	0.108
	(3.56)	(3.93)	(-0.80)	(2.30)	(1.16)
Observations:	**492**	**492**	**492**	**492**	**492**

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions

Figure 6.8 shows the proportions of each of the three groups scoring positively on each characteristic considered under this dimension. It is worth noting that only six of the interviewed households (less than one per cent) said that they had not been involved in a violent dispute in the previous two years, hence resulting in strong performance among all treatment groups on

this measure. Of course, to some extent this could be due to a reluctance on the part of respondents to discuss violent disputes during the survey.

Despite the fact that households in the intervention communities scored poorly on most of the characteristics of the social and institutional capability dimension, the results in Table 6.20 show that they are, nevertheless, better off than the comparison population in terms of their receipt of drought-preparedness information and awareness of local risk-reduction initiatives. There is also some evidence that there may be a difference in terms of the perceived effectiveness of local leaders and institutions to respond to crises. Table 6.21 shows that the positive result on receipt of drought-preparedness information appears to be confined to those in communities where the Appeal/CIDA project was implemented.

Table 6.21: Results of adding a project-specific dummy variable to multivariate regression models for characteristics of social and institutional capability

	Original MVR Coefficient	MVR Coefficient with CIDA project dummy variable	Coefficient on CIDA project dummy variable	MVR Coefficient with RDD project dummy variable	Coefficient on RDD project dummy variable
Receipt of drought preparedness info.	0.101***	0.053	0.167**	0.225***	-0.208**
	(2.46)	(1.11)	(2.25)	(3.19)	(-2.25)
Awareness of local DRR initiatives	0.154***	0.175***	-0.066	0.103	0.071
	(3.36)	(3.29)	(-0.87)	(1.44)	(0.87)
Awareness of local leaders supporting adaptation	0.067***	0.082***	-0.034	0.031	0.046
	(2.62)	(2.83)	(-0.96)	(0.76)	(0.96)

t-statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Coefficients for covariates used in regression are not presented

7 Conclusions and learning considerations

7.1 Conclusions

This Effectiveness Review found evidence that the two projects have resulted in positive effects on several characteristics assumed to be important for promoting resilience. In particular, even after controlling for measured differences between households located in the project communities and those in comparison communities, the former performed between three and four percentage points better than the latter on the 'base resilience index'.

The PFS households also performed better that the comparison households, scoring approximately eight percentage points higher on the base resilience index. However, this does not provide reliable evidence of impact because the PFS households are probably systematically different in unobservable ways (such as motivation) to the average household in the comparison group. It seems likely that PFS member households were already better off than the comparison households before the projects were implemented.

Data were collected on a total of 37 indicators under five dimensions. Separate indices were created for each of these dimensions, and the general intervention population was found to be better off than the comparison population on four of them. Table 7.1 summarises the Effectiveness Review's findings for each specific characteristic under each of the five dimensions.

Table 7.1 shows that out of the 37 characteristics, statistically significant differences in favour of the general intervention population were identified for 11 of them. Eight of these characteristics fall under the innovation potential and social and institutional capability dimensions. The table also shows which of the 37 characteristics were directly targeted by the two projects and those related to their intervention logic, as presented in Section 2. Out of the nine characteristics directly targeted by the project, there is evidence that the projects successfully affected seven of them. And, out of the 22 characteristics connected to the projects' intervention logic, there is evidence that 14 were positively affected.

7.2 Programme learning considerations

- ***Explore how to involve community members more widely in community-level drought preparedness activities, and to ensure that training and early-warning information is fully disseminated.***

While the RDD III project was found to have had some effect on the involvement of community members in drought preparedness activities, the fact that only a minority of households reported any involvement in these activities is a cause for concern. Less than half of households in communities where the RDD III project had been implemented reported having received any early-warning information in advance of the drought of 2011, and more than three-quarters said their household members were either not aware of whether the community had a drought contingency plan, or were not aware of its contents. This suggests that there is still scope for further embedding these activities in the life of the community, and for ensuring that all households are involved and can fully benefit.

Table 7.1: Summary of disaggregated results for general intervention population

Dimension	Index Characteristic	Evidence of impact	Directly targeted by project	Connected to project logic	Proportion of households scoring positively
Livelihood viability	**Index of livelihood viability**	**Yes**			
	Household asset ownership	No	No	Yes	29%
	Household food security	No	No	Yes	70%
	Household dietary diversity	No	No	Yes	18%
	Livelihood diversification	No	No	No	13%
	Gender risk differential	No	No	No	74%
	Crop diversification	No	No	No	41%
	Livestock diversification	No	No	Yes	40%
	Livestock herd size	No	No	Yes	42%
	Ownership of pack animal	No	No	No	70%
	Livestock lost to disease in 2011	Yes (RDD III)	No	Yes	77%
	Livestock lost to drought in 2011	Yes	No	Yes	54%
	Livestock vaccination	Yes(RDD III)	Yes	Yes	62%
	Access to early-warning information	Yes	Yes	Yes	43%
	Drought preparedness practice	No	No	Yes	62%
Innovation potential	**Index of innovation potential**	**Yes**			
	Attitudes to new livelihood practices	Yes	No	Yes	24%
	Awareness of climate change	Yes	No	Yes	17%
	Adoption of innovative practices	Yes	No	Yes	76%
	Access to credit	No	No	No	36%
	Access to state innovative support	No	No	No	10%
	Market access	Yes	No	No	86%
Access to contingency resources and support	**Index of access to contingency resources and support**	**Yes***			
	Awareness of drought preparedness plan	Yes (RDD III)	Yes	Yes	14%
	Participation in drought preparedness meetings	Yes (RDD III)	Yes	Yes	17%
	Group participation	No	No	No	28%
	Social connectivity	No	No	No	55%
	Perceptions of local government emergency support	No	No	No	41%
	Savings	No	No	No	24%
	Remittances or formal earnings	No	No	No	8%
	Ownership of fungible livestock	No	No	Yes	34%
Integrity of the natural and built environment	**Index of integrity of the natural and built environment**	**Yes**			
	Extent of soil erosion	Yes	No	No	73%
	Access to irrigation for farming	No	No	No	31%
	Availability of water for livestock & consumption	Yes	Yes	Yes	57%
	Availability of grazing land	Yes (Appeal/ CIDA)	Yes	Yes	73%
Social & institutional capability	**Index of social and institutional capability**	**Yes**			
	Receipt of information or training on drought preparedness	Yes (RDD III)	Yes	Yes	9%
	Awareness of local drought risk reduction initiatives	Yes (RDD III)	Yes	Yes	42%
	Experience of violent disputes	No	No	No	99%
	Effectiveness of local leaders and institutions	No	Yes	Yes	36%
	Awareness of local efforts to support adaptation	Yes (RDD III)	Yes	Yes	15%

* not-statistically significant

Appendix 1: Covariate balance following propensity-score matching procedures

A. General intervention population versus comparison population

Step 1: Backwards stepwise regression: covariate ( ) excluded from participation model if .

```
. stepwise, pr (.2): logit intervention $matchvars
note: hh_all_elderly dropped because of estimability
note: hhh_educ_secondary dropped because of estimability
note: o.hh_all_elderly dropped because of estimability
note: o.hhh_educ_secondary dropped because of estimability
note: 6 obs. dropped because of estimability
                    begin with full model
p = 0.8903 >= 0.2000  removing hhh_female
p = 0.8142 >= 0.2000  removing hh_size
p = 0.7698 >= 0.2000  removing hh_single_adult
p = 0.7487 >= 0.2000  removing work_labour_ag_2008
p = 0.7552 >= 0.2000  removing crops_any_2008_2
p = 0.7161 >= 0.2000  removing wife_status_first
p = 0.7065 >= 0.2000  removing hhh_educ_primary
p = 0.6436 >= 0.2000  removing hhh_somali
p = 0.5614 >= 0.2000  removing income_labour_ag_prop_2008
p = 0.5970 >= 0.2000  removing income_labour_dry_prop_2008
p = 0.5940 >= 0.2000  removing work_formal_2008
p = 0.5562 >= 0.2000  removing num_educ_secondary
p = 0.5350 >= 0.2000  removing num_educ_primary
p = 0.4501 >= 0.2000  removing distance_commcenter_now
p = 0.4412 >= 0.2000  removing crops_num_2008
p = 0.3825 >= 0.2000  removing income_commsupport_prop_2008
p = 0.3880 >= 0.2000  removing respondent_female
p = 0.2315 >= 0.2000  removing income_livestock_prop_2008
p = 0.2326 >= 0.2000  removing distance_market_now
p = 0.2438 >= 0.2000  removing hhh_productive
p = 0.2489 >= 0.2000  removing remittances_2008
p = 0.2481 >= 0.2000  removing wealth_ind_08
p = 0.3183 >= 0.2000  removing hhh_literacy

Logistic regression                             Number of obs   =        645
                                                LR chi2(13)     =      58.29
                                                Prob > chi2     =     0.0000
Log likelihood = -366.95792                     Pseudo R2       =     0.0736
```

intervention	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
work_selfemp_2008	1.257684	.6335419	1.99	0.047	.0159649	2.499404
income_selfemp_prop_2008	-11.61947	8.360823	-1.39	0.165	-28.00638	4.767446
respondent_hhh	-.4247297	.1820692	-2.33	0.020	-.7815787	-.0678807
work_labour_dry_2008	-.6186076	.3503131	-1.77	0.077	-1.305209	.0679935
income_remittances_prop_2008	4.323751	1.594911	2.71	0.007	1.197783	7.449719
num_adult	-.2281378	.1585695	-1.44	0.150	-.5389283	.0826527
income_iga_prop_2008	-7.71532	3.40039	-2.27	0.023	-14.37996	-1.050677
income_aid_prop_2008	1.941105	.8159506	2.38	0.017	.3418708	3.540339
num_prodadult	.3548748	.1516791	2.34	0.019	.0575893	.6521603
hhh_age	-.0120045	.008429	-1.42	0.154	-.0285249	.004516
income_agric_prop_2008	1.778179	.431024	4.13	0.000	.9333877	2.622971
crops_landarea_2008	-.0421752	.0241105	-1.75	0.080	-.089431	.0050806
work_iga_2008	1.501321	.4987646	3.01	0.003	.5237605	2.478882
_cons	-1.119487	.4090428	-2.74	0.006	-1.921196	-.3177776

Step 2: Run psmatch2 with short-listed covariates, followed by pstest to assess covariate balance.

pstest output – kernel (observations where hh_all_elderly=1 and hhh_educ_secondary=1 excluded):

psmatch2: Treatment assignment	psmatch2: Common support		
	Off suppo	On suppor	Total
Untreated	0	449	449
Treated	2	194	196
Total	2	643	645

```
. pstest `matchvars_gen_pop'
```

Variable	Mean		%bias	t-test	
	Treated	Control		t	p>|t|
hh_all_eld~y	0	0	.	.	.
hhh_educ_s~y	0	0	.	.	.
work_se~2008	.03093	.02596	2.7	0.29	0.769
~p_prop_2008	.00103	.00104	-0.1	-0.01	0.992
respondent~h	.46907	.46857	0.1	0.01	0.992
work_~y_2008	.08247	.09116	-2.8	-0.30	0.762
~s_prop_2008	.01846	.01449	6.7	0.60	0.546
num_adult	3.1856	3.2337	-3.0	-0.30	0.766
~a_prop_2008	.00412	.00475	-1.2	-0.23	0.820
~d_prop_2008	.09163	.08956	1.7	0.16	0.870
num_prodad~t	2.9588	2.993	-2.2	-0.21	0.832
hhh_age	43.17	43.662	-3.8	-0.38	0.702
~c_prop_2008	.41366	.41638	-1.1	-0.11	0.914
crops_1~2008	3.0103	2.9062	2.6	0.27	0.791
work_ig~2008	.05155	.06235	-4.9	-0.46	0.647

pstest output – noreplacement (observations where hh_all_elderly=1 and hhh_educ_secondary=1 excluded):

psmatch2: Treatment assignment	psmatch2: Common support		
	Off suppo	On suppor	Total
Untreated	0	449	449
Treated	2	194	196
Total	2	643	645

```
. pstest `matchvars_gen_pop'
```

Variable	Mean		%bias	t-test	
	Treated	Control		t	p>|t|
hh_all_eld~y	0	0	.	.	.
hhh_educ_s~y	0	0	.	.	.
work_se~2008	.03093	.03093	0.0	0.00	1.000
~p_prop_2008	.00103	.00155	-2.9	-0.45	0.654
respondent~h	.46907	.47938	-2.1	-0.20	0.839
work_~y_2008	.08247	.07732	1.7	0.19	0.852
~s_prop_2008	.01846	.01495	6.0	0.53	0.595
num_adult	3.1856	3.1649	1.3	0.13	0.896
~a_prop_2008	.00412	.00459	-0.9	-0.16	0.873
~d_prop_2008	.09163	.08965	1.6	0.16	0.874
num_prodad~t	2.9588	2.8969	4.0	0.40	0.692
hhh_age	43.17	43.515	-2.6	-0.27	0.788
~c_prop_2008	.41366	.41972	-2.5	-0.24	0.808
crops_1~2008	3.0103	2.9072	2.5	0.27	0.785
work_ig~2008	.05155	.05155	0.0	-0.00	1.000

B. Households of PFS members versus households in comparison villages

Step 1: Backwards stepwise regression: covariate ( ) excluded from participation model if .

```
. stepwise, pr (.25): probit intervention_pfs $matchvars
note: hh_all_elderly dropped because of estimability
note: o.hh_all_elderly dropped because of estimability
note: 2 obs. dropped because of estimability
                    begin with full model
p = 0.9847 >= 0.2500  removing hhh_female
p = 0.7752 >= 0.2500  removing income_remittances_prop_2008
p = 0.7602 >= 0.2500  removing wealth_ind_08
p = 0.7550 >= 0.2500  removing hhh_age
p = 0.7286 >= 0.2500  removing hhh_literacy
p = 0.7127 >= 0.2500  removing num_adult
p = 0.7050 >= 0.2500  removing hhh_somali
p = 0.6178 >= 0.2500  removing wife_status_first
p = 0.5925 >= 0.2500  removing distance_market_now
p = 0.5439 >= 0.2500  removing remittances_2008
p = 0.4419 >= 0.2500  removing num_educ_primary
p = 0.5441 >= 0.2500  removing num_educ_secondary
p = 0.3252 >= 0.2500  removing income_selfemp_prop_2008
p = 0.4352 >= 0.2500  removing income_iga_prop_2008
p = 0.4030 >= 0.2500  removing income_labour_ag_prop_2008
p = 0.2936 >= 0.2500  removing hhh_educ_secondary
p = 0.2914 >= 0.2500  removing crops_any_2008_2

Probit regression                               Number of obs   =        501
                                                LR chi2(20)     =      94.19
                                                Prob > chi2     =     0.0000
Log likelihood = -111.10758                     Pseudo R2       =     0.2977
```

intervention_pfs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
distance_commcenter_now	-.0026842	.0022593	-1.19	0.235	-.0071124	.001744
income_livestock_prop_2008	1.116753	.9246865	1.21	0.227	-.6955993	2.929105
respondent_hhh	.4735338	.281478	1.68	0.093	-.0781529	1.02522
respondent_female	1.126915	.2918574	3.86	0.000	.5548848	1.698945
hh_size	-.0814254	.0430472	-1.89	0.059	-.1657963	.0029455
income_labour_dry_prop_2008	4.582601	1.997205	2.29	0.022	.6681509	8.497052
hh_single_adult	.8319109	.5827484	1.43	0.153	-.3102551	1.974077
income_aid_prop_2008	3.077168	1.231756	2.50	0.012	.6629708	5.491365
income_agric_prop_2008	1.558731	.9478609	1.64	0.100	-.2990423	3.416504
work_selfemp_2008	1.259822	.3987167	3.16	0.002	.4783515	2.041292
work_labour_dry_2008	-.6543334	.3898474	-1.68	0.093	-1.41842	.1097533
hhh_educ_primary	.4474836	.2681106	1.67	0.095	-.0780035	.9729707
income_commsupport_prop_2008	2.718721	1.655544	1.64	0.101	-.5260853	5.963527
work_labour_ag_2008	.4855535	.2697893	1.80	0.072	-.0432238	1.014331
work_formal_2008	1.080219	.4643886	2.33	0.020	.170034	1.990404
work_iga_2008	.8668302	.3471813	2.50	0.013	.1863674	1.547293
hhh_productive	.5171564	.3051048	1.70	0.090	-.0808381	1.115151
num_prodadult	.173214	.0658204	2.63	0.008	.0442085	.3022196
crops_num_2008	.2426033	.0646585	3.75	0.000	.1158749	.3693316
crops_landarea_2008	.0501142	.0205919	2.43	0.015	.0097548	.0904735
_cons	-5.200664	1.064597	-4.89	0.000	-7.287236	-3.114092

Step 2: Run psmatch2 with short-listed covariates, followed by pstest to assess covariate balance.

pstest output – kernel (observations where hh_all_elderly=1 excluded):

psmatch2: Treatment assignment	psmatch2: Common support		
	Off suppo	On suppor	Total
Untreated	0	453	453
Treated	9	39	48
Total	9	492	501

```
. pstest `matchvars_pfs'
```

Variable	Mean		%bias	t-test	
	Treated	Control		t	p>|t|
hh_all_eld~y	0	0	.	.	.
distance_c~w	38.179	37.568	1.3	0.05	0.957
~k_prop_2008	.40478	.43062	-12.3	-0.56	0.575
respondent~h	.58974	.5759	2.8	0.12	0.903
respondent~e	.64103	.62474	3.4	0.15	0.883
hh_size	6.5641	6.6159	-1.8	-0.08	0.936
~y_prop_2008	.03333	.03443	-1.4	-0.06	0.956
hh_single_~t	.05128	.0324	10.0	0.41	0.682
~d_prop_2008	.08718	.08469	2.2	0.10	0.917
~c_prop_2008	.34464	.3487	-1.9	-0.09	0.932
work_se~2008	.10256	.07867	7.8	0.36	0.717
work_~y_2008	.12821	.17316	-12.3	-0.55	0.585
hhh_educ_p~y	.25641	.23575	4.9	0.21	0.835
~t_prop_2008	.04103	.03096	12.2	0.51	0.610
work_~g_2008	.20513	.19653	2.1	0.09	0.926
work_fo~2008	.07692	.07369	1.3	0.05	0.958
work_ig~2008	.12821	.12754	0.2	0.01	0.993
hhh_produc~e	.89744	.87503	6.7	0.31	0.759
num_prodad~t	3.2821	3.1731	6.0	0.25	0.803
crops_n~2008	2.6154	2.8558	-15.6	-0.51	0.615
crops_l~2008	5.1795	5.5733	-7.4	-0.32	0.753

pstest output – no replacement (observations where hh_all_elderly=1 excluded):

psmatch2: Treatment assignment	psmatch2: Common support		
	Off suppo	On suppor	Total
Untreated	0	453	453
Treated	7	41	48
Total	7	494	501

```
. pstest `matchvars_pfs'
```

Variable	Mean		%bias	t-test	
	Treated	Control		t	p>|t|
hh_all_eld~y	0	0	.	.	.
distance_c~w	37.78	28.585	18.9	1.17	0.247
~k_prop_2008	.4143	.38245	15.1	0.76	0.452
respondent~h	.58537	.53659	9.8	0.44	0.661
respondent~e	.65854	.63415	5.1	0.23	0.820
hh_size	6.3171	7.1463	-28.6	-1.24	0.218
~y_prop_2008	.03415	.02439	12.5	0.59	0.557
hh_single_~t	.07317	.04878	13.0	0.46	0.649
~d_prop_2008	.08293	.08293	0.0	0.00	1.000
~c_prop_2008	.34003	.37581	-16.6	-0.75	0.454
work_se~2008	.12195	.17073	-15.9	-0.62	0.538
work_~y_2008	.14634	.14634	0.0	0.00	1.000
hhh_educ_p~y	.26829	.2439	5.8	0.25	0.803
~t_prop_2008	.03902	.02927	11.9	0.54	0.593
work_~g_2008	.2439	.29268	-12.0	-0.49	0.623
work_fo~2008	.07317	.07317	0.0	0.00	1.000
work_ig~2008	.12195	.14634	-7.6	-0.32	0.750
hhh_produc~e	.90244	.82927	22.0	0.97	0.337
num_prodad~t	3.1951	3.5854	-21.5	-0.86	0.393
crops_n~2008	2.6341	2.6829	-3.2	-0.12	0.903
crops_l~2008	5.1463	5	2.8	0.13	0.897

```
. pstest $covariates
```

Variable	Mean Treated	Mean Control	%bias	t-test t	t-test p>|t|
min_centre~e	15.115	16.033	-7.9	-0.57	0.569
min_commun~e	35.053	37.725	-10.4	-0.86	0.390
min_sapa_mb	37.473	38.87	-6.1	-0.54	0.593
num_prod_a~t	3.3511	3.3817	-2.0	-0.16	0.876
res_head	.70229	.71756	-3.3	-0.27	0.786
head_Mong	.61069	.57252	7.8	0.63	0.532
head_farme~l	.98473	.96947	9.1	0.82	0.411
livesto~d_07	.0687	.06107	2.8	0.25	0.803
hh_size	6.1069	6.1298	-1.1	-0.09	0.931
head_chris~n	.16031	.16031	0.0	-0.00	1.000
num_adults~y	1.0763	1.0229	4.5	0.34	0.733
farming_07	.99237	.99237	0.0	0.00	1.000

Appendix 2: Cut-offs and weights used for each characteristic

Dimension	Characteristic	Threshold: a household scores positive if:	Weight
Livelihood viability (30%)	• Household asset ownership	Household owns three or more small assets, or two or more large assets, or two small assets and one large asset.[9]	0.3/14
	• Household food security	Household did not report having had to cut the size of meals, eat fewer meals, or reduce food consumed by adults in household >= 3 times in past week and reports no incidence of having to borrow food, going to sleep hungry, or going through a whole day with no food.	0.3/14
	• Household dietary diversity	In the past seven days, the household consumed a carbohydrate source every day, a protein source on at least three days, and some fruit or vegetables on at least three days.	0.3/14
	• Livelihood diversification	Household engages in two or more livelihood activities, with more than half household income deriving from activities thought to be reasonably drought tolerant.	0.3/14
	• Gender risk differential	The livelihood activities of men and women in household are at equal risk to drought.	0.3/14
	• Crop diversification	Household cultivated three or more crop types, including at least one drought-resistant crop.	0.3/14
	• Livestock diversification	Household has at least three types of animals, including some shoats or camels.	0.3/14
	• Livestock herd size	Household owns at least five large animals (cattle or herd camels) or 40 shoats.	0.3/14
	• Ownership of pack animal	Household owns at least one pack camel or donkey.	0.3/14
	• Livestock lost to disease in 2011	Household lost no large livestock (camels, oxen, cows, or donkeys) and at most two shoats and at most five poultry birds as a result of disease in the 12 months prior to the survey (where 'lost' refers to deaths of livestock only).	0.3/14
	• Livestock lost to drought in 2011	Household lost at most two large livestock (camels, oxen, cows, or donkeys) and at most 8 shoats as a result of drought in the 12 months prior to the survey (where 'lost' refers both to animals that died and those that were sold off for a low price).	0.3/14
	• Livestock vaccination	Household reported having had any of its livestock vaccinated in the 12 months prior to the survey.	0.3/14
	• Access to early-warning information	Household reported having received early-warning information from community leaders, committee, government, or radio during drought of 2011.	0.3/14
	• Drought preparedness practice	Household undertook at least two of the following practices in preparation for the 2011 drought: migrated with animals; destocked livestock; split herds; purchased feed or water to store; or gave some animals to others to care for.	0.3/14

[9] One recognised way of measuring a household's wealth status is by examining the assets it owns. The 'small assets' considered here include: plough, wheelbarrow, mattress, mobile phone, radio, solar panel, TV, cart, or iron, while 'big assets' included birkad, generator, vehicle, and mill. As presented in Appendix III, data were collected on a much larger number of assets and other household wealth indicators. However, these were selected as the focus of defining the binary wealth status indicator because these assets assumed to reasonably differentiate exceptionally poorer household from those that are better off. The binary wealth status indicator is also significantly correlated with the 2012 asset index (*t*-statistic = 22.73; R2 = 0.4256).

Dimension	Characteristic	Threshold: a household scores positive if:	Weight
Innovation potential (20%)	• Attitudes to new livelihood practices	Respondent either does not agree at all or agrees only to a small extent with 5 out of the 6 negatively phrased statements (Likert scale).[10]	0.2/6
	• Awareness of climate change	Respondent either does not agree at all or agrees only to a small extent with 5 out of the 6 negatively phrased statements (Likert scale).	0.2/6
	• Adoption of innovative practices	Household tried at least two new activities over the past two years other than what the project is promoting.[11]	0.2/6
	• Access to credit	Household reported taking out a loan in the past two years, or would be able to borrow 2,000 birr if required from a money lender, non-local family members, savings group, or bank/credit institution.	0.2/6
	• Access to state innovative support	Respondent reports having accessed state extension support in new techniques in the last two years and reports at least finding the support moderately useful.	0.2/6
	• Market access	Respondent does not report any 'severe problems' with respect to access livestock pricing information, experiencing barriers accessing markets, and selling livestock at the going market rate; they may however report experiencing small problems to two out of the three issues and still be considered as non-deprived.	0.2/6
Access to contingency resources and support (20%)	• Awareness of drought preparedness plan	Household members are aware that the community has a drought contingency plan, and are at least partly aware of the contents.	0.2/8
	• Participation in drought preparedness meetings	Some household member participated in community meetings on drought preparedness at least twice in the 12 months prior to the survey.	0.2/8
	• Group participation	Household members attend meetings of at least two different community groups, and are involved to at least a medium extent in decision-making in at least one group.	0.2/8
	• Social connectivity	Respondent agrees at least to a medium extent with 5 out of the 6 positively phrased statements.	0.2/8
	• Perceptions of local government emergency support	Respondent agrees at least to a medium extent with 5 out of the 6 positively phrased statements.	0.2/8
	• Savings	Households report that they have enough savings to enable them to support themselves for at least 14 days in an emergency.	0.2/8
	• Remittances or formal earnings	Household has received remittances during the past 12 months, or some member of the household has regular salaried employment.	0.2/8
	• Ownership of fungible livestock	Household owns at least 20 shoats or 20 poultry birds.	0.2/8

[10] One of these statements was actually positively phrased, but the scores on the four point agreement scale were reversed during data analysis.

[11] The list of innovative practices included doing any of the following for the first time: selling livestock in different markets; migrating livestock to a new area; renting grazing land; purchasing feed for storage; harvesting water; conserving feed for dry period; cultivation of new crop; tilling or ploughing soil in new way; purchasing new type of seed; or starting a new business. Other was also an option, and if something was mentioned, it was assumed to be an innovative practice.

Dimension	Characteristic	Threshold: a household scores positive if:	Weight
Integrity of the natural and built environment (15%)	• Extent of soil erosion	Respondent does not report experiencing severe erosion.	0.15/4
	• Access to irrigation for farming	Respondent reports having access to irrigation facilities or experienced only a small portion of their crops being lost during the 2011 drought.	0.15/4
	• Availability of water for livestock & consumption	Household did not experience serious difficulties accessing water for domestic or livestock using during the dry season of 2011.	0.15/4
	• Availability of grazing land	Household experienced only small problems accessing suitable grazing lands during the last dry season.	0.15/4
Social & institutional capability (15%)	• Receipt of information or training on drought preparedness	Household members have received training or information on drought preparedensss at least twice in the 12 months prior to the survey.	0.15/5
	• Awareness of local drought risk reduction initiatives	Household members are aware of at least two community-level drought-preparedness initiatives that have taken place in past two years.	0.15/5
	• Experience of violent disputes	Household members have not been involved in any violent disputes in past two years.	0.15/5
	• Effectiveness of local leaders and institutions	Respondent agrees at least to a medium extent with 5 out of the 6 statements on the effectiveness of local leaders and institutions.	0.15/5
	• Awareness of local efforts to support adaptation	Household members are at least partly aware of what actions community leaders are taking to enable the community to cope with changes in weather patterns.	0.15/5

Appendix 3: Other measures pertaining to the livelihood viability dimension

It is worth reviewing the results of analyses that were carried out on several other outcome variables that are related to the livelihood viability dimension. These include those relating to changes in household asset ownership over time, household food insecurity, reported ability to meet household needs, and reported change in income. We will start with the first outcome variable.

Data were collected on various wealth indicators to measure household wealth status and changes in wealth status over time

A reputable way of measuring household wealth status involves capturing data on various household assets, as well as other locally relevant wealth indicators, followed by the construction of a household wealth index. Depending on the context, relatively more wealthy households, in particular, may be more likely to own greater numbers and varieties of livestock, as well as have more material positions, better housing conditions, etc., than their poorer counterparts.

Data were collected on a total of 41 household assets and other wealth indicators. The respondents were first asked to provide details about various items currently owned by their household (e.g. number of radios or the material of their roof). They were further asked to recall this information for the baseline period, i.e. 2008. After examining the data pertaining to each wealth indicator and for each time period, scores between 1 and 3 were allocated. For example, for 2008, the number of jerry cans reported to be owned by the interviewed households ranged from 0 to 20. Households that owned no or just one jerry can were given a score of 1, while those that owned between two and four, and five or more were allocated scores of 2 and 3, respectively. For some items, i.e. where there was no considerable variation, it made sense to simply assign scores of 1 and 2 – 1 for being deprived in relation to the indicator, and 2 for being non-deprived.

A similar procedure was used for changes in the status of each wealth indicator over time. For example, if the household performed worse in relation to the indicator in question, it was given a score of -1. If, on the other hand, it performed better it was given a score of 1. Scores of 0 were further given when no change in relation to the indicator was observed over time.

Given that the various wealth indicators are intended to measure household wealth status, they should be significantly correlated with one another. That is, a household that scores favourably on one particular wealth indicator should be more likely to do so for other wealth indicators. In other words, these indicators should have a high degree of inter-item correlation. Cronbach's alpha is a measure of this inter-item correlation.[12] The Cronbach's alpha obtained for all 41 items for the 2008 period was

[12] When items are used in a scale or index, they should all measure the same underlying latent construct (e.g. household wealth status). The items, then, must be significantly correlated with one another. The more the variables are correlated, the greater is the sum of the common variation they share. If all items are perfectly correlated, alpha would be 1 and 0 if they all were independent from one another. For comparing groups, an alpha of 0.7 or 0.8 is considered satisfactory. See: Bland, M. J. & Altman, D. G. (1997) Statistics notes: Cronbach's alpha, *BMJ* 314 p. 572.

0.7841. This is satisfactory, but a higher alpha was obtained by removing those items with low inter-item correlated, i.e. those with factors loadings less than 0.20. This resulted in an alpha of 0.8001. The final list of 27 wealth indicators used in the analysis is presented in Table A3.1 below.

Principal component analysis (PCA) was then run on this list, both for 2008 and the difference in the indicators between 2008 and 2012. PCA is a data reduction technique that was used to narrow in on the variation in household asset ownership, which is assumed to represent wealth status. The more an asset is correlated with this variation, the more weight it is given. Hence, each household's weighted index score is determined by both a) the number of assets it owns, and b) the particular weight assigned to each asset. This enables the relative wealth status of the households to be compared. The index created for 2008 was used in the analysis of the data to control for differences in wealth status among the households of the various treatment groups.

Table A3.1: Inter-item correlations of household wealth indicators used to construct wealth index for 2008

Item	Obs	Sign	item-test correlation	item-rest correlation	average inter-item covariance	alpha
1. jerry can	699	+	0.5471	0.4692	0.036107	0.7865
2. bladder	699	+	0.2727	0.2364	0.039983	0.7981
3. milk cart	699	+	0.4168	0.3573	0.038392	0.7933
4. hoe	699	+	0.5976	0.5089	0.034713	0.7832
5. machete	699	+	0.4524	0.3525	0.036784	0.7927
6. rake	699	+	0.2466	0.1902	0.039769	0.7988
7. axe	699	+	0.3129	0.2556	0.039295	0.7968
8. wheelbarrow	699	+	0.4480	0.3988	0.038501	0.7927
9. cart	699	+	0.2385	0.1994	0.040085	0.7988
10. plough	699	+	0.5267	0.4402	0.036074	0.7877
11. birkad	699	+	0.2488	0.2000	0.039870	0.7985
12. tarp	699	+	0.3766	0.3231	0.038915	0.7949
13. box	699	+	0.2892	0.2471	0.039775	0.7976
14. watch	699	+	0.2508	0.1775	0.039529	0.7996
15. mat	699	+	0.6203	0.5299	0.034165	0.7816
16. stool	699	+	0.5137	0.4217	0.036081	0.7887
17. chair	699	+	0.2931	0.2463	0.039650	0.7974
18. table	699	+	0.2885	0.2539	0.039952	0.7979
19. mattress	699	+	0.6213	0.5454	0.034904	0.7817
20. lamp	699	+	0.5294	0.4497	0.036302	0.7875
21. pot	699	+	0.4947	0.3817	0.035762	0.7917
22. iron	699	+	0.1953	0.1707	0.040484	0.7998
23. radio	699	+	0.3382	0.2798	0.039079	0.7960
24. ox	699	+	0.3620	0.2345	0.037664	0.8014
25. sheep or goats	699	+	0.4225	0.2951	0.036787	0.7975
26. herd camel	699	+	0.3944	0.2820	0.037381	0.7972
27. pack camel	699	+	0.3937	0.2926	0.037594	0.7958
Test scale					**0.037911**	**0.8001**

Table A3.2 presents the results of the four additional outcome measures used that are associated with the livelihood viability dimension. The first outcome measure pertains to changes in household wealth status over time, as measured by changes in the status of the above 27 wealth indicators. As indicated by the sample mean, the change experienced by both the general intervention and comparison groups was positive overall, but only marginally so. Moreover, no statistically significant differences

were found between these two groups in relation to this measure. It is further interesting to note that the PFS households changed for the worse in relation to the 27 indicators over time. In fact, they appear to be worse off than the comparison population, but this is not consistently statistically significant across the various statistical procedures.

Table A3.2: Additional measures related to the livelihood viability dimension

	General intervention population				*PFS households*			
	Wealth index (double difference)	**Food insecurity score**	**Positive ability to meet household needs**	**Positive reported change in income**	**Wealth index (double difference)**	**Food insecurity score**	**Positive ability to meet household needs**	**Positive reported change in income**
Unadjusted								
Sample mean:	0.04	4.62	0.61	0.18	-0.02	4.70	0.62	0.18
General intervention mean:	0.06	3.81	0.62	0.22	-0.55	2.08	0.77	0.32
Comparison group mean:	0.03	4.97	0.61	0.17	0.03	4.97	0.61	0.17
Unadjusted difference:	0.0244	-1.168	0.0108	0.0465	-0.583	-2.890***	0.164**	0.149**
	(0.16)	(-1.62)	(0.26)	(1.35)	(-1.52)	(-2.99)	(2.53)	(2.12)
Observations:	**651**	**651**	**651**	**647**	**503**	**503**	**503**	**500**
PSM								
Post-matching difference:	0.0607	-1.520*	-0.00872	0.0523	-0.548	-2.631*	0.107	0.237***
(kernel)	(0.37)	(-1.89)	(-0.19)	(1.43)	(-1.10)	(-1.85)	(1.30)	(2.86)
Observations:	**643**	**643**	**643**	**639**	**492**	**492**	**492**	**489**
Post-matching difference:	0.193	-1.119	0.0258	0.0625	-0.972*	-1.976	0.0976	0.225**
(no replacement)	(1.04)	(-1.28)	(0.49)	(1.53)	(-1.82)	(-1.13)	(1.02)	(2.35)
Observations:	**643**	**643**	**643**	**639**	**494**	**494**	**494**	**491**
Multivariate Regression								
MVR coefficient:	0.0254	-0.917	-0.0092	0.0495	-0.543	-2.672**	0.1831*	0.2952***
(with robust standard errors)	(0.16)	(-1.30)	(-0.20)	(1.47)	(-1.37)	(-2.18)	(1.74)	(3.02)
Observations:	**651**	**651**	**647**	**632**	**503**	**503**	**495**	**486**
MVR coefficient:	0.0680				-0.458			
(robust regression)	(0.43)	n/a	n/a	n/a	(-1.42)	n/a	n/a	n/a
Observations:	**651**				**503**			
MVR coefficient:	0.0629	-0.916	-0.0178	0.05071	-0.720*	-2.502*	0.1831*	0.2952***
(with control functions)	(0.39)	(-1.30)	(-0.37)	(1.50)	(-1.70)	(-1.84)	(1.81)	(3.34)
Observations:	**645**	**645**	**645**	**628**	**471**	**471**	**463**	**456**

t statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used in regression not presented

To measure household food security, the respondents were asked whether they experienced any of the following over the past seven days:

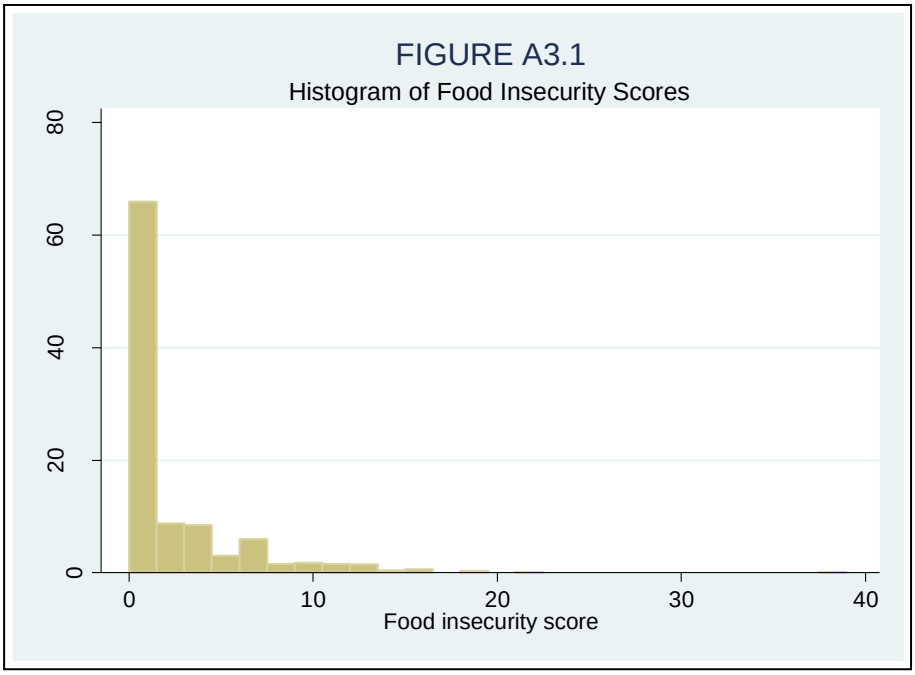
Only a small proportion of households reported having serious food security problems

- Have you or any member of your household had to ***reduce the size of meals*** because there was not enough food?
- Have you or any member of your household had to eat ***fewer meals in a day than normal*** because there was not enough food?
- Have you or any member of your household had to ***reduce the amount eaten by adults, so that children could eat***?
- Have you or any member of your household had to ***borrow food or rely on help from a friend or relative*** because there was not enough food?
- Have you or any member of your household ***gone to sleep at night hungry*** because there was not enough food?
- Have you or any member of your household ***gone for a whole day and night without eating*** because there was not enough food?

If they responded in the affirmative to any of the questions, they were then asked the number of days it happened during the past seven days. A household food insecurity score was then computed by adding together the number of times the household reported experiencing the situation. The last three items are indicative of more serious and increasingly difficult household food security problems, so they were given greater weight, with weights of 2, 3 and 4 given to the fourth, fifth and sixth items, respectively.

Figure A3.1 presents a histogram of the results. As is evident, a large number of the respondents (65 per cent) reported no household food security problems during the previous week. A smaller percentage of respondents, however, reported more serious problems. When the scores are compared between the treatment groups, both the general intervention population and the PFS households appear to be slightly less food-insecure than the comparison households. However, the differences are not consistently statistically significant.

FIGURE A3.1



Respondents were further presented with the following four descriptors about their household's ability to meet its needs, and they were asked which matched their own situation most closely:

- *Doing well*: able to meet household needs by your own efforts, and making some extra for stores, savings, and investment.
- *Breaking even*: Able to meet household needs, but with nothing extra to save or invest.
- *Struggling*: Managing to meet household needs, but depleting productive assets and/or sometimes receiving support.
- *Unable to meet household needs by your own efforts*: dependent on support from relatives living outside of your household or the community, government and/or some other organisation – could not survive without this outside support.

As presented in Table A3.2, more than 60 per cent of the respondents placed themselves in either the breaking even or doing well category. However, no statistically significant differences were consistently found in favour of either the general intervention population or the PFS households when compared with the comparison households.

The respondents were also asked to directly report whether their income levels have decreased, stayed the same, or increased in the baseline period. As indicated in Table A3.2, only 18 per cent of all households reported an improvement. Nevertheless, a slightly larger proportion of the general intervention households reported positive income gains as compared with the comparison households. However, this difference is not-statistically significant. The case is different with respect to the PFS households, where the differences are large and consistently statistically significant.