

RESILIENCE IN ZAMBIA

Impact evaluation of the 'Citizen Participation in Adaptation to Climate Change' project

Effectiveness Review Series 2016/17



Photo: Community awareness raising meeting on climate resilience in Namwala, Southern Zambia. Credit: Oxfam Zambia.

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EXECUTIVE SUMMARY

Oxfam GB's Global Performance Framework is part of the organization's effort to better understand and communicate its effectiveness, as well as to enhance learning for staff and partners. Under this Framework, a small number of completed or mature projects are selected at random each year for an evaluation of their impact, in an exercise known as an 'Effectiveness Review'. One key focus is the extent to which the projects have promoted change in relation to relevant Oxfam GB global outcome indicators.

During the 2016/17 financial year, one of the projects that was randomly selected for an Effectiveness Review was the Citizen Participation in Adaptation to Climate Change (CPACC) project, carried out in Zambia from April 2013 to March 2015. The CPACC project was the third in a series of projects that were launched in response to flooding across southern Africa in 2008 and 2009. Oxfam implemented this sequence of projects in Zambia in partnership with three local non-governmental organizations (NGOs), the People's Participation Service (PPS), the Program for Sustainable Rural Development (PSRD) and the Southern Partners Organization (SPO).

The project was designed to increase the resilience of participants to a number of different shocks and stresses. In the project districts, households' livelihoods are based principally on agriculture, which is threatened by erratic and uncertain weather events, including floods and droughts. The project worked at a number of different levels to try to reduce households' vulnerability to these risks. At a local community level, the project aimed to help households diversify their livelihood approaches and adapt to increasingly uncertain weather patterns by providing training and inputs for producing new crops and using more sustainable agricultural practices. Training was also provided on the use of both indigenous and scientific early warning information, as well as on broader topics related to climate change. In addition, the project worked with community members, particularly the Satellite Disaster Management Committees (SDMCs), to produce and update action plans detailing how the community as a whole could develop in the long term and respond to crises such as floods and droughts. These plans were then integrated into district government structures, and community members participated in training sessions and workshops to help them access extension services and advocate for improvements to local infrastructure. To further foster information-sharing between communities, the project also broadcast training messages and interviews on local radio stations, and conducted exchange visits so that farmers could observe agricultural practices in other project communities.

EVALUATION APPROACH

The Effectiveness Review used a quasi-experimental evaluation design to assess the impact of the project activities among the households whose members directly participated in them. This involved comparing households that participated in the project with a group of comparison households who were thought to have had similar characteristics to the project participants before the project was carried out. Using this methodology, the Effectiveness Review was able to identify the household- and community-level effects of the project only. The impact of those activities that were intended to benefit people across the entire local area – including the radio broadcasts and capacity-building at the district level – could not be assessed in this evaluation.

The Effectiveness Review was carried out in Mongu District, one of the three districts in which the CPACC project was implemented. In Mongu, direct project activities (such as the provision of training and the distribution of seeds and other agricultural inputs) had been carried out in eight communities. Random samples of the direct project participants in each of these eight communities were interviewed. For comparison purposes, 12 communities were identified that were thought to have similar characteristics to the project communities, but with which neither the CPACC project nor any similar projects had been implemented. In the comparison communities, households were selected at random for interview from among the whole population of the community. A total of 282 project participants and 545 comparison respondents were interviewed.

At the analysis stage, to increase confidence when making estimates of the project's impact, the statistical tools of propensity score matching and multivariate regression were used to control for apparent baseline differences between the households in the project and comparison communities.

The results of the Effectiveness Review are discussed below and are summarized in Table 1. The primary aim of the Review was to investigate the project's impact on building resilience to shocks, stresses and uncertainty. This was assessed by identifying 28 characteristics that are thought to be associated with resilience, and which

can be measured at the household level. These characteristics were identified through discussions with project staff and focus groups conducted in local communities. The characteristics were categorized according to Oxfam's framework in which resilience is understood to be composed of absorptive capacity, adaptive capacity and transformative capacity. A full list of these resilience indicators and a breakdown of the results for each are shown in Table 2.

RESULTS

The results of the Effectiveness Review suggest that the CPACC project had a modest but significant positive impact on the resilience of participating households. The households of project participants, on average, scored positively on 47 percent of the indicators of resilience, compared with 42 percent among the matched comparison households. This positive result is driven by an improvement in several of the indicators of absorptive capacity, and there are also indications of positive impact on transformative capacity. In contrast, there is no evidence of the project having a positive impact on adaptive capacity.

On the other hand, the data do not provide any indication that the project had an impact on households' material welfare by the time the survey was conducted, as measured either by dietary diversity or by an index of wealth indicators (including housing conditions and asset ownership).

The Review investigated whether there was any evidence of greater impact on resilience among households in the four lower-land communities – where Oxfam and PPS have been implementing resilience-building projects since 2009 – than among those in the four upland communities where the CPACC project only has been implemented since 2013. The quantitative estimates of the impact on resilience were found to be similar across the two areas.

In order to understand the reasons for the project's positive effect on overall resilience, it is necessary to examine the underlying indicators in more detail. The area in which the effects of the project are clearest is in community-level disaster preparedness activities. Two-thirds of the project participants were aware of the existence of the SDMCs, a figure substantially higher than in the comparison communities, and just over a third said that they or other members of their household participated in the SDMCs directly. The project participants were also more likely to agree that the SDMC (or equivalent committee in the comparison communities) represented the community's needs effectively to the district council. On the other hand, only 23 percent of respondents in project communities were aware of whether or not the community had an action plan or disaster management plan, and only 12 percent said that members of their household had been involved in creating or updating the plan during the past year – a figure that is not clearly higher than in the comparison communities. Project participants were no more likely than comparison households to have received early warning information about flooding in the year prior to the survey. However, they were more likely to have received early warning information from SDMCs, other community-based channels or from District Council officials, rather than from the radio. There is also some evidence that the project has led to the construction of grain or seed banks in some of the project communities.

Table 1: Key findings of the Effectiveness Review

Outcome	Evidence of positive impact?	Comments
<i>Involvement in community-level disaster planning</i>	Yes	Awareness of and participation in Satellite Disaster Management Committees (SDMCs) or similar committees were substantially higher in the project communities than in the comparison communities. However, rates of participation in creating or updating community action plans were low.
<i>Link to district-level processes</i>	Yes	Respondents in project communities were more likely than those in comparison communities to agree that their community's needs are represented at the district level, and were more likely to have received early warning information from district officials. However, they were no more likely to recognize the role of district officials in providing training.
<i>Involvement in savings groups</i>	No	Only 17 percent of project participant households were participating in a savings group, compared with 36 percent of comparison households.
<i>Investment in crop production</i>	Yes	Project participant households had increased the area of land under cultivation since 2009 by more than the comparison group, and were also growing a wider range of crops.
<i>Practice of conservation farming</i>	Yes	Project participant households adopted conservation farming practices – particularly the use of organic fertilizer and cover crops – at greater rates than comparison households. There is also some evidence that they have experienced less of a decrease in yields since 2009.
<i>Improved access to markets</i>	No	There were no clear differences between the project participants and comparison respondents in the proportions who sold crops or livestock, nor in the markets in which they made sales.
<i>Increased involvement in non-agricultural income-generating activities</i>	Not clear	There was no difference between the project participants and comparison households in the numbers running household businesses. Project participants were more likely to be engaged in casual labour, but this difference does not seem likely to be a result of the project.
<i>Improved household welfare</i>	No	There was no indication of any difference between the project participants and comparison households in the diversity of their diet, nor in indicators of wealth (housing conditions and ownership of assets).
<i>Resilience</i>	Yes	Households of project participants met the threshold to score positively on 47 percent of the resilience indicators, compared with 42 percent among the comparison households. The effect of the project was concentrated in indicators of absorptive capacity and (to a lesser extent) of transformative capacity, but not in indicators of adaptive capacity.

Table 2: Characteristics of resilience examined in the Effectiveness Review

Capacity	Characteristic	Connected to project logic?	Evidence of positive impact?
<i>Absorptive capacity</i>	Livelihood diversification	Yes	Yes
	Crop diversification	Yes	Yes
	Diversity of crop-growing sites	No	Yes
	Ownership of fungible livestock	No	No
	Access to drinking water	No	Yes
	Savings	Yes	No
	Access to external early warning information	Yes	Yes
	Social support networks	Yes	No
	Access to back-up seeds	Yes	Yes
	Dietary diversity	Yes	No
<i>Adaptive capacity</i>	Remittances or formal earnings	No	No
	Access to credit	Yes	No
	Access to markets	Yes	No
	Understanding of climate change	Yes	No
	Use of indigenous early warning information	Yes	No
	Conservation farming practices	Yes	Yes
	Ownership of productive assets	No	No
	Access to irrigation	Yes	No
	Improvements in infrastructure	Yes	No
	Understanding of inflation	No	No
<i>Transformative capacity</i>	Attitude to change	No	No
	Adoption of innovative practices	No	No
	Involvement in community-level disaster or development planning	Yes	No
	Confidence in implementation of community disaster or development plans	Yes	No
	Integration of community committees or plans at the district level	Yes	Yes
	Participation in community groups	Yes	No
	Voice of women in the community	No	No
	Women's decision-making power in the household	No	No
Children's school attendance	No	No	

The Effectiveness Review also provides some evidence of positive impacts on households' farming activities. Specifically, the CPACC and predecessor projects appear to have led to an increase in the land area and the range of crop types that project participants are farming. The project participants have also applied more of the practices of conservation farming, particularly the use of organic fertilizer and cover crops. Although nearly two-thirds of them said that their crop yields had decreased since 2009, this appears to be a smaller proportion than among the comparison respondents.

There are several other outcome areas in which the project was expected to have an impact, but for which there is no evidence of such a change having occurred. For example, there was little or no difference between the project participants and comparison respondents in the proportions who were participating in a farmer or producer organization. Respondents in comparison communities received training or information on most of the same themes as those in the project communities – with the important exceptions of training on gender issues,

hazard assessment and advocacy. (It should also be noted that no data are available on whether the intensity or quality of the training or information received differed between the project and comparison communities).

One particularly unexpected finding is that the comparison respondents were twice as likely as the project participants to be members of a community savings group. This difference may be partly a result of higher pre-project rates of participation in savings groups in the comparison communities, but that does not appear to be the complete explanation. Consequently, the availability of savings was not clearly any higher among the project participants than the comparison households, and the availability of credit was significantly lower.

Approximately 45 percent of the households surveyed had sold some crops in the year prior to the survey, and 23 percent had sold some livestock. There were no clear differences between the project participants or comparison respondents in the proportions who sold crops or livestock, or in the markets in which they made sales.

Project participant households were found to be engaging in a more diverse range of off-farm livelihoods activities than comparison households. However, this difference was mainly driven by greater rates of engagement in casual labour, something that does not seem likely to be a result of the CPACC project. There is no indication of a difference between the two groups in the proportions who were running a household business.

Finally, it is interesting to note that the impacts of the Oxfam water, sanitation and hygiene (WASH) project that had also been implemented in several of the CPACC project communities are clear in the results of the Effectiveness Review. This can be seen from data on the construction and rehabilitation of wells, boreholes and toilets, as well as in households' participation in WASH committees and their access to modern sources of drinking water.

PROGRAMME LEARNING CONSIDERATIONS

Continue to experiment with the community-led approach to project design, and investigate how to learn from communities with particularly positive experiences.

A central feature of the CPACC project was that members of each community should define their priorities and the activities that would best meet their needs. Since a variety of different activities were carried out in different communities, comparing experiences between communities presents natural opportunities for learning about the effectiveness of the various interventions. A useful supplement to the quantitative results identified in this Effectiveness Review would be to explore qualitatively whether there are communities that have been particularly successful in building resilience (perhaps based on their experience during recent droughts and floods), and to identify the key processes or activities that led to those positive results.

It would also be of interest in future evaluations to assess whether the community-led approach leads to a greater sense of ownership and agency on the part of community members, both women and men. It may also be fruitful to experiment with the degree of involvement that Oxfam has in project implementation, in order to ensure that the organization's concept of resilience is fully reflected and operationalized in the project activities.

Identify opportunities to coordinate with and learn from the experience of other organizations working in the project area.

It is clear from the survey results that there are various NGOs actively implementing projects in Mongu District. Project managers should actively seek to coordinate with organizations that are working in the same local area, in order both to ensure that the activities being carried out are complementary, and to find opportunities to learn from their experiences.

In particular, the greater rates of participation in savings groups in the comparison communities are thought to reflect the activities of other organizations to promote savings groups in Mongu District. The CPACC project provided participants with training and encouraged them to form savings groups, but other organizations are known to have provided more direct support to the formation of groups, particularly in the form of an initial capital

injection. Allocating funds to make such grants may be a good method of encouraging participation in savings groups in future projects. It may also be possible to learn from others' experiences about whether supporting the development of household businesses has stimulated demand for savings and credit facilities.

Consider how best to identify participants for new projects, particularly when attempting to target more vulnerable populations.

The direct participants in the CPACC project were selected as being 'vulnerable but viable', using similar criteria to those used by Zambia's Farmer Input Support Programme (FISP). On that basis, the project participants were thought to be generally poorer than their neighbours. In contrast, survey respondents in the comparison communities represented a random sample of all households in those communities. Assuming that the wealth distribution was similar in the project and comparison communities, the project participant households would, therefore, generally be expected to have been poorer than the comparison households before the project was carried out. In fact, the Effectiveness Review data suggests the opposite: the households of project participants were, on average, significantly wealthier than the average comparison household, based on the information on housing conditions and asset ownership recalled from 2009. This suggests that those selected for the CPACC project tended to be better off than their neighbours in 2009.

Careful consideration should be given in future projects to how to identify those who will participate in or benefit directly from the activities. If the intention is to work specifically with a more vulnerable portion of the population, then making this identification through discussion with key informants in the communities may not be adequate. Involving community members as a whole in a participatory wealth ranking may be a useful approach.

Invest in improved monitoring, evaluation and learning practices – including regular tracking of progress, ideally including a comparison group.

Resilience is a complex and dynamic concept. In order to gain a deeper understanding of a project's impact in this area, it is important to invest in robust systems to monitor progress.

One important factor that would improve the ability of programme managers to learn from monitoring and evaluation activities would be to establish a comparison group at baseline. This Effectiveness Review has attempted to assess the impact of the CPACC project as rigorously as possible, within the constraint that the comparison group was identified after the project's implementation. However, confidence in the results of an evaluation such as this would be enhanced if the comparison group had been identified before the project: doing so would allow for baseline characteristics to be controlled for in making comparisons, and external influences on the project's outcomes to be tracked over the project's lifetime. Regular monitoring of the situation in both the project communities and the comparison communities would provide insight into how those within and outside the project are exposed to and respond to shocks, stresses and uncertainty.

Finally, an important component of the CPACC project was aimed at promoting wider changes, in market systems and in the policy and practice of government actors. The effectiveness of some of the local-level interventions – particularly relating to access to markets – was expected to be complemented and enhanced by these higher-level changes. Evaluating the impacts of a project at a systemic level is not possible through a quasi-experimental approach such as that used in this Effectiveness Review. However, it would be valuable to use alternative approaches to assess what systemic changes have taken place and to understand how best they can be reinforced in the future.

1 INTRODUCTION

Oxfam GB's Global Performance Framework is part of the organization's effort to better understand and communicate its effectiveness, as well as to enhance learning for staff and partners. Under this Framework, a small number of completed or mature projects are selected at random each year for an evaluation of their impact, in an exercise known as an 'Effectiveness Review'. One key focus is on the extent to which the projects have promoted change in relation to relevant Oxfam GB global outcome indicators.

During the 2016/17 financial year, one of the projects that was randomly selected for an Effectiveness Review was the Citizen Participation in Adaptation to Climate Change (CPACC) project in Zambia. The CPACC project was the third phase of a series of projects that were launched in response to the 2008–09 floods in southern Africa. The specific activities of the CPACC project were carried out from April 2013 to March 2015. Oxfam implemented this sequence of projects in partnership with three local non-governmental organizations (NGOs), namely the People's Participation Service (PPS), the Program for Sustainable Rural Development (PSRD) and the Southern Partners Organization (SPO). The projects' activities were undertaken in Mongu District in Western Province and in Namwala and Kazungula districts in Southern Province. The three districts are shown in Figure 1.1.

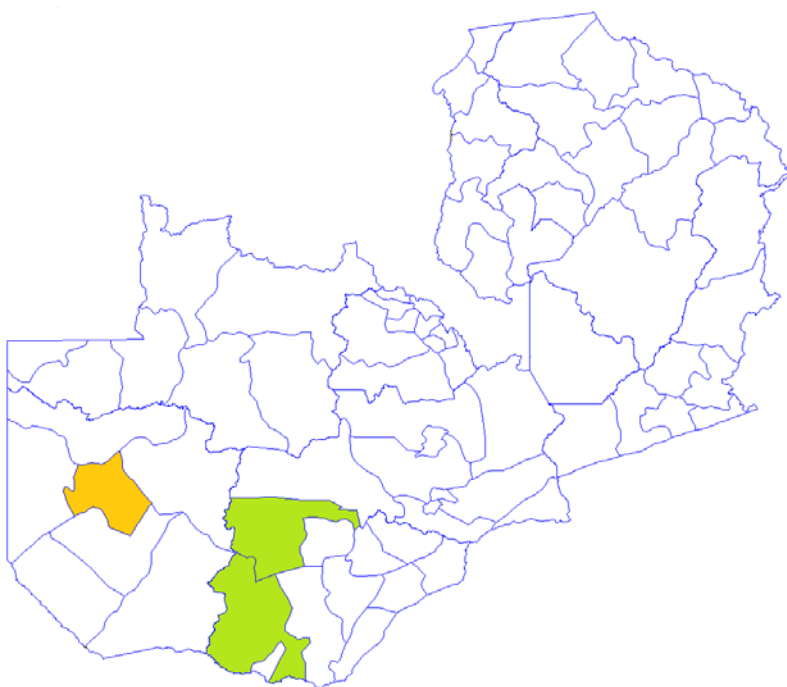
The project was designed to build the resilience of project participants to a number of different shocks and stresses. In the project districts, households' livelihoods are based principally on agriculture, which is threatened by erratic and uncertain weather events, including floods and droughts. The project worked at a number of different levels to try to reduce households' vulnerability to these risks. Within communities, the project aimed to help households diversify their livelihood approaches and adapt to increasingly uncertain weather patterns by providing training and inputs for producing new crops and using more sustainable agricultural techniques. Additional training was provided on how to use both indigenous and scientific early warning information, as well as on awareness of climate change. The project also worked with community members, especially the Satellite Disaster Management Committees (SDMCs), to produce and update action plans detailing how the community as a whole could develop in the long run and respond to crises, such as floods and droughts. These plans were then integrated into district government structures, and community members participated in trainings and workshops to help them access extension services and improvements to local infrastructure. To further foster information sharing between communities, the project broadcast training messages and interviews on local radio stations and conducted exchange visits so that farmers could observe agricultural practices in other project communities.

The Effectiveness Review, for which the fieldwork was carried out in August and September 2016, was aimed at evaluating the success of this project in enabling households to maintain and improve their well-being, in spite of shocks, stresses and uncertainty. Due to logistical constraints and to the perceived benefits in terms of learning, the survey work did not cover the entire project area, instead focusing solely on Mongu District. Within Mongu, the survey covered 20 communities, including all eight of the communities in which the CPACC project provided direct support.

This report presents the findings of the Effectiveness Review. Section 2 briefly reviews the activities and the logic of the project. Section 3 describes the evaluation design used, and section 4 describes how this design was implemented. Section 5 discusses the approach used to measure resilience. Section 6 presents the results of the data analysis, based on the comparison of outcome measures between project and non-project households. Section 7 concludes with a summary of the findings and some considerations for future learning.

Figure 1.1: Map of Zambia, showing project areas

Mongu District is highlighted in orange and Namwala and Kazungula districts in green.



Source: <https://osm.wno-edv-service.de/boundaries/>

2 PROJECT DESCRIPTION

2.1 PROJECT ACTIVITIES

The project under review focused primarily on supporting households to diversify their livelihoods and adopt new agricultural techniques, in order to adapt to increasingly erratic weather patterns. This was complemented by community- and district-level planning activities to help better manage potential risks and disasters. This section describes the project activities in more detail. Although the project operated in Namwala, Kazungula and Mongu districts, the description in this section is focused on Mongu District, where the evaluation was carried out.

Mongu District is situated in Zambia's Western Province, straddling the upper sections of the Zambezi River, and has a population of approximately 200,000 people. The population is spread across the low-lying Barotse floodplain, part of which floods annually, and a high plateau of land in the east of the district. Livelihoods are centred on cultivating maize and other crops, despite sandy soil which pervades much of the district. Given the prevalence of flooding in the 'lower lands', households living there may uproot and relocate their entire crop each year to avoid it being damaged, or even split their farming activities between the floodplain and the 'upper lands' on the plateau. Agricultural livelihoods may then be supplemented by harvesting wild produce (such as firewood, mushrooms or fruit) from nearby forests, fishing or fish farming, and various other casual labour activities (such as construction or masonry). Some households also operate small-scale businesses, such as buying and selling clothes, brewing beer or running small kiosks.

The reliance on agricultural livelihoods exposes people in Mongu District to a range of shocks and stresses. The traditional strategies for coping with flooding outlined above may be unsuitable as rainfall becomes more erratic and more intense during certain parts of the wet season. The flooding that occurred across southern Africa in 2008 and 2009 had profound effects on Mongu District, destroying household crops and assets and also damaging infrastructure, schools and clinics across the Barotse floodplain. The loss of agricultural production also threatened food security in the area, necessitating a widespread relief effort from the Zambian government and various international NGOs, including Oxfam.

Agricultural livelihoods are also vulnerable to drought, the prevalence of which has increased substantially in recent years. In the past, the wet season typically ran from roughly November to April each year, with rainfall intensifying in December and January and then starting to abate in March. Drought may occur when the rains come too late – for example, in January rather than November. 'Late rains' of this type make it very difficult or impossible to grow maize. However, since maize is so important for households in Mongu District, many endeavour to grow it anyway, with disastrous consequences for yields. Another problem is 'in-season drought', which occurs when the rains initially arrive on time, but then end earlier than normal. In-season drought is especially problematic because of uncertainty about what strategies farmers should adopt in response: it is often unclear whether the rains will return before the end of the normal wet season.

It should be noted that the survey work for this evaluation was undertaken during a period of especially severe drought in Mongu District – and indeed across southern Africa – associated with the 2015–16 El Niño phenomenon. However, floods and droughts of some kind afflict the district almost annually, so households are chronically vulnerable to shocks and stresses.¹

Apart from floods and droughts, a number of other shocks also threaten livelihoods in Mongu District. Firstly, in more densely populated areas, localized fires may damage dwellings, crops and local infrastructure during drier periods of the year. Secondly, for livestock owners, outbreaks of disease may also cause the loss of important assets, especially as the spread of such diseases is more likely during periods of severe drought or flooding. Finally, macro-economic shocks may have severe effects on people's living standards, due not only to the effects of rising food prices on the cost of living but also to the impact of inflation on monetary savings.

The Citizen Participation in Adaptation to Climate Change (CPACC) project aimed to build households' resilience to the shocks and stresses described above, mainly by working directly with households in communities in Mongu District, but also by providing support at the district level.

The CPACC project was the third phase of a series of Oxfam projects that began in response to the 2008–09 floods across southern Africa. Oxfam worked with three local NGOs to implement these projects: the People's Participation Service, the Programme for Sustainable Rural Development (PSRD) and the Southern Partners Resilience in Zambia: Impact evaluation of the 'Citizen Participation in Adaptation to Climate Change' project
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Organization (SPO). In Mongu District, PPS was the main partner organization. The specific activities of the CPACC project ran from April 2013 to March 2015. Before this, Oxfam and the partner organizations had provided emergency relief after the 2008–09 floods (the first phase), followed by a recovery phase (the second phase), in which support was given to help communities map potential hazards, diversify livelihoods and improve early warning systems. This second phase was the subject of a previous Effectiveness Review, carried out in 2013 (Bishop, 2014).

The CPACC project was designed with three specific objectives:

1. Ensure that communities are more aware and better organized in order to develop and implement their own adaptation and risk-reduction strategies.
2. Strengthen the capacity of small-scale food producer organizations and communities to network nationally and influence development partners, policy makers and politicians on the issues of climate change adaptation and early warning.
3. Improve the capacity of food producer organizations to engage in effective dialogue with policy makers and decision makers on government investment in early warning, adaptation and risk preparedness.

It should be noted that a substantial portion of the project activities focused on the first of these three objectives, as many of the activities sought to enable households to better diversify and adapt their livelihood strategies.

Many of the project activities were channelled to a sub-set of households that were identified by Oxfam and PPS – in combination with other local stakeholders – as ‘vulnerable but viable’ (see Section 3 for more details). The household-level activities were focused principally on making livelihoods more sustainable. In part, this involved improving production practices for traditional crops. In particular, the project distributed seeds for open-pollinated maize, enabling farmers to more easily recycle their seeds from one harvest to the next. However, the project primarily sought to encourage the cultivation of new crops to complement maize production among participant households. This involved the distribution of seeds for vegetables and non-standard varieties of crops, such as cassava, which could be grown in low-lying lands with an unusually short period of maturation. The project also provided training on so-called ‘conservation farming’ techniques, which were designed to improve soil fertility and boost agricultural yields. For example, households were trained on how best to intercrop (grow more than one crop in the same field), use organic fertilizer and use ploughing or tilling techniques such as ‘minimum tillage’ to preserve the sandy soil. In Namwala and Kazungula districts, the CPACC project also involved distributing goats and poultry to vulnerable households. However, little or no distribution of livestock was carried out in Mongu District.

A number of other types of training were organized in project communities, to improve the viability of agricultural livelihoods and to support non-farm income-generating activities. Training was provided on using both indigenous and modern early warning systems, as well as on the effects of climate change, to help participants make good decisions about appropriate livelihood strategies. Indigenous early warning systems may involve looking at the blooming or fruiting patterns of wild plants or observing the colour of sand in the river basin to help predict the onset of floods or droughts. Project participants were also trained on marketing practices, in order to boost profits from income-generating activities. Finally, training was provided on methods for saving money in the absence of formal financial institutions, including information about forming rotating savings and credit groups with other community members.

As well as seeds and training, the project provided some communities with larger durable agricultural inputs, including irrigation systems and water pumps, following up with demonstration sessions to show farmers how these could be used. In order to distribute these larger assets, the project supported farmers to form informal producer groups. These groups were designed to have approximately 60 percent female membership.

At the community level, the project sought to strengthen existing structures and institutions for reducing disaster risk. This was initiated by undertaking Participatory Capacity and Vulnerability Analysis (PCVA) workshops, to map out and rank risks with the Satellite Disaster Management Committees (SDMCs) in each community. The SDMCs are responsible for managing risks and disasters and are comprised of various community members, including people from churches, youth groups, teachers, health clinic staff and traditional leaders. Following the PCVA workshops, the SDMCs were supported to produce ‘action plans’ detailing strategies for long-term development and contingencies for times of crisis. The project also worked to ensure that these community action plans were updated annually and integrated into the planning activities of the District Council’s District Disaster Management Committee (DDMC), based in Mongu town.

To help implement these action plans – many of which focused on improving aspects of local infrastructure – the CPACC project distributed several types of tools and equipment for undertaking public works. For example, some project communities were provided with spades, sickles and machetes to maintain the quality of canals and other irrigation structures.

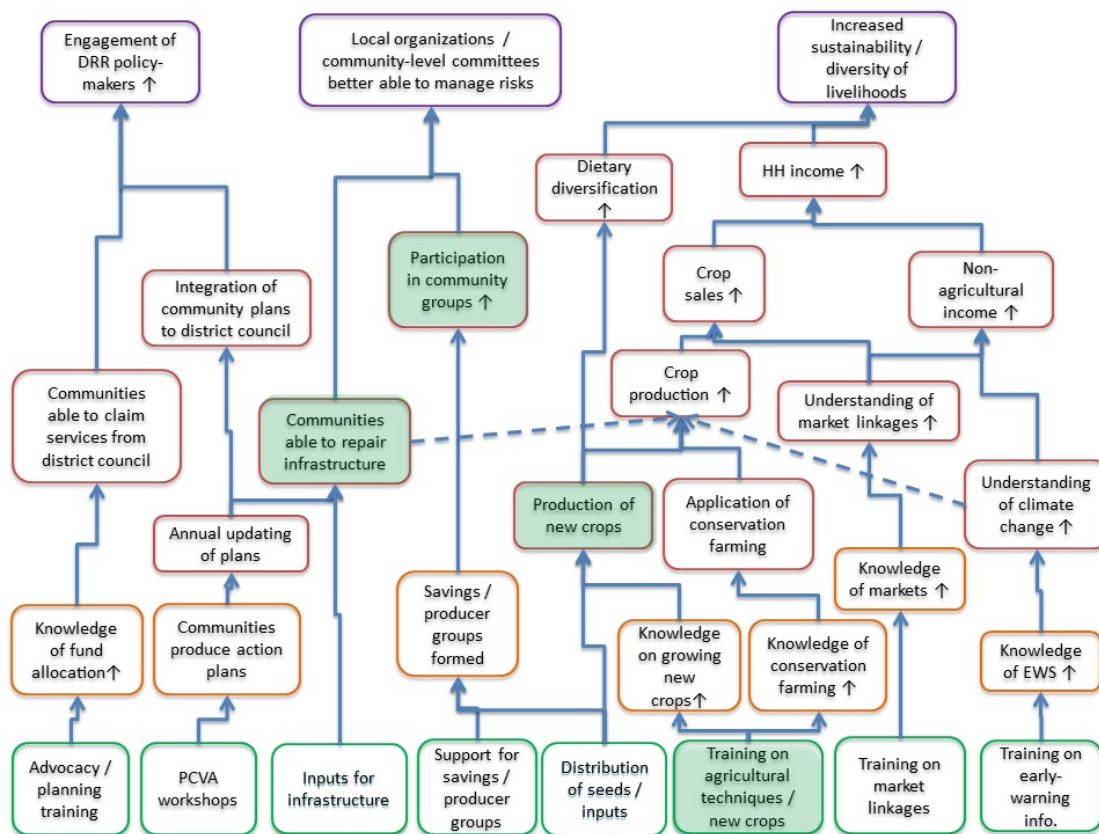
There were several aspects of the CPACC project that explicitly sought to build linkages between communities and higher-level institutions, like the District Council. Firstly, although Oxfam and PPS facilitated much of the training described above, it was often delivered by officials from Mongu District Council. This gave community members a direct channel through which they could communicate with the local government, enabling them to claim the public services they required. The CPACC project further supported local advocacy by providing community members with information about the funds that the national government had allocated to the District Council to support them. Community information was also shared at the district level by working with local radio stations to broadcast interviews and features containing information relating to weather patterns, crop cultivation techniques and other livelihood strategies.

In summary, although the CPACC project maintained the strong emphasis on sustainable livelihoods from previous phases of project work, there was also a significant focus on disaster risk reduction (DRR) at the community and district levels.

2.2 PROJECT LOGIC AND INTENDED OUTCOMES

This section describes how the CPACC project was designed to achieve its objectives. A simple logic model for the project is shown in Figure 2.1. Using existing documentation about the project, and through discussions with the team implementing it, it is possible to map out the intended causal links from project activities (green boxes), via outputs (orange) and intermediate outcomes (red), to higher-level outcomes (purple). It should be noted that this diagram stops at the factors that could be considered drivers or characteristics of resilience and does not include the final outcomes beyond resilience (such as improved well-being) that the project may have been trying to promote in the long run.

Figure 2.1: Logic model for the CPACC project



The project aimed to build the sustainability and diversity of livelihoods through several different channels. By directly providing training on growing new crops and new agricultural practices, the project sought to build households' base of knowledge on resilient farming techniques. The project then provided the seeds and inputs required to apply this knowledge, with the aim of increasing production of both new and traditional types of crops. It was hoped that this would improve households' dietary diversity as some of this extra agricultural output was consumed by the household. Additionally, training was provided to build participants' knowledge and understanding of market linkages, in order to boost crop sales. In conjunction with further training on climate change and using early warning information, this was also intended to encourage households to pursue other livelihood strategies, including non-farm household businesses.

In order to improve the capacity of local organizations and community committees to manage risk, the project focused primarily on ensuring that community action plans were well designed and up-to-date. The initial PCVA workshops were intended to promote planning activities that reflected the risks faced by particular communities, and the project also worked with the SDMCs to update plans year by year to ensure that they remain relevant. To help the community action plans come to fruition, the project provided some of the inputs needed to implement them, such as tools for clearing canals or constructing irrigation systems.

The project also sought to establish and support other groups within target communities. One approach to this was to raise awareness and knowledge about savings groups by implementing training on different options for saving. In addition, the project supported the formation of producer groups, and channelled the provision of certain farm inputs through those groups. For example, by providing water pumps to groups of farmers, the project intended to build intra-community networks. A further objective was to build inter-community links, through exchange visits and radio broadcasts (which are not shown in Figure 2.1).

To enable communities to engage with local leaders and policy makers, the project aimed to integrate the action plans described above into the activities of the District Council. This was further complemented by the training on advocacy and planning that was provided within target communities, which aimed to build households' and community leaders' knowledge of the services and funds to which they are entitled by district and national government policies. As described in Section 2.1 (but not shown in Figure 2.1 for simplicity), a space for advocacy was created by bringing district officials into target communities to deliver certain training and to undertake workshops, such as the PCVA.

3 EVALUATION DESIGN

The central problem in evaluating the impact of any project or programme is how to compare the outcomes that resulted from that project with what would have been the case had the project or programme not been carried out. In the case of this Effectiveness Review, information about the situation of households in the project communities was collected through a household questionnaire, but clearly it was not possible to know what their situation would have been had the project activities not been undertaken. In any evaluation, this 'counterfactual' situation cannot be directly observed: it can only be estimated.

In the evaluation of programmes that involve a large number of units (such as individuals, households or communities), it is possible to make a comparison between units that were subject to the programme and those that were not. As long as the two groups are similar in all respects except for the implementation of the specific project, observing the situation of those where the project was not implemented can provide a good estimate of the counterfactual.

This evaluation focuses on assessing both household- and community-level impacts of the project. Therefore, the aim is to compare the households of project participants with similar households in similar non-project communities.

An ideal approach to an evaluation such as this would be to select at random the sites in which the project is to be implemented, as well as the households who can participate in the project. Random selection minimizes the probability of there being systematic differences between the project participants and non-participants, and so maximizes the confidence that any differences in outcomes are due to the effects of the project. However, in the case of the project examined in this Effectiveness Review, neither the communities where the project was implemented nor the participant households within those communities, were selected at random.

The project implementers targeted communities that were generally poor and more vulnerable to shocks and stresses. Communities' vulnerability was assessed formally by the Zambia Vulnerability Assessment Committee (ZVAC), and Oxfam and PPS were able to draw directly on this information to determine where to work with the CPACC project (and its predecessors) in Mongu District.² As a result, a range of geographical factors, including proximity to the Zambezi River and annual rainfall patterns, influenced the selection of project sites. Other anthropocentric factors were also taken into account. In particular, the economic situation and livelihood strategies in these communities were thought to drive vulnerability to floods and droughts.

However, within Mongu District there were a number of other communities that had similar characteristics and faced similar risks, but were not included in the CPACC project. This allowed a 'quasi-experimental' evaluation approach to be adopted, in which the situations of households in communities not included in the project – in so-called 'comparison' sites – were assumed to provide a reasonable estimate of the counterfactual of households who participated in the project.

It should be noted that for the lower-land communities, the CPACC project was implemented in the same communities as Oxfam's and PPS's previous projects in Mongu, which began in 2009. Therefore, making the kinds of comparison described above in fact means estimating the cumulative impact of the CPACC project *and* its predecessors. Although the indicators utilized in this Effectiveness Review are tailored to the CPACC project's activities and to the present context of resilience, it is not feasible to isolate CPACC's precise contribution to resilience over and above the full set of activities that Oxfam and PPS had implemented in these lower-land communities since 2009. Only in the upper-land communities, where Oxfam and PPS began their activities in 2013, can the specific effects of the CPACC project be identified.

The results presented in Section 6 of this report are those for the average effect across all the project sites included in the Effectiveness Review. Appendix 5 considers whether the CPACC-specific effects differed from these average effects, though no such differences were detected.

Within communities, those who participated in the household-level activities of the project – including the training sessions and the distributions of seeds and farm inputs – were not a random cross-section of residents. In this Effectiveness Review, the evaluation team decided to focus on the households that had received the main distribution of open-pollinated varieties of maize at the start of the CPACC project. A large proportion of the project's household-level activities were channelled to these households, and they were also intended to benefit

from CPACC's attempts to build capacity and improve structures at the community level. PPS maintained lists of these direct project participants, which could be used for sampling, as discussed in Section 4.

The project team identified 'vulnerable but viable' households within each project community using similar criteria to those used by the Farmer Input Support Programme (FISP), which has been working in Zambia since 2002 to address declining crop production resulting from floods and droughts. The FISP criteria meant that households that were assessed to be relatively poorer – especially in terms of asset and livestock ownership – were more likely to be selected for inclusion in the project. However, households that would not have been able to devote sufficient labour to the project activities were classed as ineligible. To ensure that accurate information was used to select the participants, the FISP criteria were applied through discussion with SDMC members.

Within the targeted communities, the proportion of households that received direct support varied substantially. On average, around 30 percent of households in project communities were provided with support, but in some communities the proportion was as low as 25 percent while in others it was as high as 85 percent. This suggests that the FISP criteria were not applied in exactly the same way across the project area. In turn, this implies that there may have been other factors, besides the FISP criteria, that determined which households received the direct benefits of the CPACC project.

Therefore, it is possible that the project participant households differed from their non-participant neighbours in terms, for example, of their wealth, household composition, their sense of initiative, their willingness to take risks or in their social connections. It was therefore necessary to try and identify similar households within the comparison communities to create a suitable counterfactual for the project participants.

The evaluation team attempted to resolve this issue in two ways. Firstly, although households were randomly sampled from the entire population in comparison communities, they were asked 'screening questions' at the start of the questionnaire. These questions were intended to ensure that households that were too wealthy to have been eligible to have participated in the CPACC project were not included in the survey. However, the success of this method relies on knowing all of the criteria that determine whether or not households would have participated, had the project operated in their community. In the event, the project's eligibility criteria did not entirely determine which households participated in the project, so there may have been further differences between the project participants and their neighbours that are not accounted for by using screening questions alone. This process is explained in more detail in Section 4.

Secondly, statistical analysis was used to improve the confidence in comparing outcomes between the project participant and comparison households. This is especially important given the limitations in using screening questions described above. Households in the project communities were 'matched' with households with similar characteristics in the comparison communities. Matching was performed on the basis of a variety of observable characteristics – including household size, education levels, productive activities and indicators of household wealth (including housing conditions and asset ownership). Since some of these characteristics may have been affected by the project itself (particularly those relating to productive activities and wealth indicators), matching was performed on the basis of these indicators before the implementation of the project. Although baseline data were not available, survey respondents were asked to recall some basic information about their household's situation in 2009, before the CPACC project was implemented and, indeed, before Oxfam's and PPS's resilience programming began in Mongu. These recalled baseline data are unlikely to be highly accurate. However, they are the best available proxy for households' baseline situation, so they should enhance the reliability of the comparisons made in this report.

The survey data provided a large number of baseline household characteristics on which matching could be carried out. (The characteristics that were in fact used are listed in Appendix 3.) In practice, it is very difficult to find households in the comparison communities that correspond exactly in all these characteristics to households in the project communities. Instead, these characteristics were used to calculate a 'propensity score' – the conditional probability of the household participating in the project, given particular background variables or observable characteristics. Households in the project and comparison communities were then matched based on this propensity score. After matching, it was possible to test whether the distributions of each baseline characteristic were similar between the two groups. Technical details on this approach are described in Appendix 3.

As a check on the results derived from the propensity score matching (PSM) process, results were also estimated using multivariate regression models. Like PSM, multivariate regression also controls for measured differences between the intervention and comparison groups, but it does so by isolating the variation in the

outcome variable explained by being in the intervention group after the effects of other explanatory variables have been accounted for. The regression models tested are described in Appendix 4.

It should be noted that both PSM and multivariate regression rely on the assumption that the 'observed' characteristics (those that are collected in the survey and controlled for in the analysis) capture all of the relevant differences between the two groups. If there are 'unobserved' differences between the groups – such as individuals' attitudes or motivations, differences in local leadership, weather or other contextual conditions – then estimates of outcomes derived from them may be misleading. This is a cause for particular caution when evaluating a project in which participants were, to some extent, self-selected. This point is further discussed in Section 6, when interpreting the statistical results.

4 DATA

4.1 RESPONDENTS INTERVIEWED

To form a sample of project and comparison households for this evaluation, the evaluation team began by selecting the project communities on which to focus. As mentioned, they elected to restrict the sample to Mongu District, even though the CPACC project and its predecessors had been implemented in Namwala and Kazungula districts as well. Given the geographical dispersion of the project sites, it would not have been possible to survey more than one district due to logistical constraints. Mongu was selected because the project staff suggested that the communities there were likely to be the most vulnerable to floods and droughts and that opportunities for learning would therefore be greater.

Eight of the nine communities where the CPACC project was implemented in Mongu District were included in the sample. The ninth community was excluded on the basis that the project had carried out community-level activities only, so there was no group of direct project-participant households – i.e. no people who had received training or received seeds or agricultural inputs.

Within districts, Zambia is organized into ‘wards’ – collections of communities containing, on average, approximately 1,500 households.³ Within Mongu District, communities in two wards situated in the low-lying Barotse Floodplain had received support from Oxfam and PPS since the start of the series of projects in 2009. By contrast, Oxfam and PPS started working in a third ward, situated in the upper lands in the east of Mongu, only in 2013, at the start of the CPACC project. All three wards in which the CPACC project was working were included in the sample and in the analysis; this means that the results of the Effectiveness Review represent the impact averaged across the wards where Oxfam and PPS have worked since 2009 and also where there have been activities only since 2013. An attempt was made to analyse the results separately for the samples in the upper and lower lands, but (as discussed in Appendix 5), no differences between the two areas were found.

In order to establish which communities would be suitable for comparison purposes, a list of key socio-economic and geographical characteristics was drawn up. This list was based on the original ZVAC criteria used to determine whether communities were eligible to participate in the project. The characteristics used to select the comparison communities were:

- the dominant livelihood strategies employed by community members
- overall wealth levels in the community, especially in terms of livestock ownership
- distance from the Zambezi River
- relief (upper land in the east of Mongu or lower land in the Barotse floodplain)
- distance from Mongu town
- distance from tarmac roads
- presence of schools and/or health clinics in the community.

Through discussions with the project staff, the evaluation team were able to identify a total of 12 suitable comparison communities, encompassing both the low-lying Barotse floodplain and the upper lands to the east of Mongu. These were communities where neither the CPACC project nor any of its predecessor projects had been implemented.

During the discussions with project staff, it was also possible to map out the other government and NGO initiatives that were operating in Mongu District. One of the largest projects active at the time of the survey was the World Bank-funded Pilot Programme for Climate Resilience, which aimed to build resilience in communities across the entire district, working with the District Council. This programme sought to enhance the capacity of local institutions and provide communities with the opportunity to write proposals and apply for funds for adaptation and contingency planning. Despite the importance of this programme in Mongu, it did not affect the selection of the comparison group, as it had been implemented on a reasonably consistent basis across the entire district.

A number of other international NGOs were undertaking resilience-building activities in Mongu at the same time as the CPACC project. In particular, Concern Worldwide and Caritas Internationalis implemented very similar Resilience in Zambia: Impact evaluation of the ‘Citizen Participation in Adaptation to Climate Change’ project Effectiveness Review series 2016/17

projects, providing seeds and inputs to boost and diversify agricultural production. Communities in which Concern and Caritas had been working were excluded from the sample.

The District Council had a stronger presence in certain communities within Mongu than others. In particular, the Departments of Community Development and Agriculture had agents situated in some communities, providing better access to support from those departments. The Department of Community Development works mainly on issues around food security and women's empowerment and the Department of Agriculture provides seeds and other inputs to boost farm productivity. The locations in which these agents were located overlapped substantially with the CPACC project, so it was important to ensure that there were communities in both the intervention and the comparison groups where the two departments were present. This helped to ensure that there were no systematic baseline differences between the intervention and comparison groups.

One difficulty in selecting the comparison group for this Effectiveness Review was that Oxfam had implemented a water, sanitation and hygiene (WASH) project – known as the Australia Oxfam Community Engagement Scheme – which operated in many of the same communities as the CPACC project and at almost no other sites. Therefore, it was difficult to find suitable comparison sites where the WASH project had been active but CPACC had not. Although the WASH project did not work directly on resilience, many of its activities – including constructing or rehabilitating drinking water sources, training women in entrepreneurial activities and supporting Ward Development Committees (WDCs) – could definitely relate to resilience. This should be borne in mind when interpreting the results that follow in Section 6.

Within the project communities, the lists of project participants – those households that had received open-pollinated maize seeds at the start of CPACC – were used for sampling. These lists were digitized, and then the sampled households (and replacement households) were selected at random using a pseudo-random-number generator.⁴ In each intervention community, 35 households were targeted for interview.

A similar procedure was used to sample households in the comparison communities. Through conversation with PPS, members of the District Council and local community leaders, the survey team was able to obtain full lists of all the households that were living in the community at the time of the survey. Systematic random sampling could then be applied to these lists, targeting 44 households for interview in each comparison community.

To help ensure that the comparison households had similar characteristics to the project households, it was necessary to screen out those households that could never have been involved in the CPACC project and would therefore be unsuitable for comparison purposes. In particular, this included households that were too wealthy to have been considered 'vulnerable but viable' before the CPACC project and its predecessor projects began in 2009. To ascertain whether or not households could be suitable for the sample, three 'screening questions' were asked before the start of the main survey to try and provide a proxy for the project's initial eligibility criteria:

- 'Did this household have a roof made from iron sheeting in 2009?'
- 'Were the walls of this household mainly made from brick in 2009?'
- 'Did this household have its own special food storage facility in 2009?'
- Any households in the comparison communities that met *all three* of these conditions were excluded from the sample.

These screening questions were derived from the FISP criteria used to select project participants. In the event, only one household in the comparison communities (out of 545 interviewed) was excluded as meeting all three of these conditions. However, as noted in section 3, only 30 percent of households in the intervention communities participated in the CPACC project. This supports the notion that there were other factors, besides the FISP criteria, determining who was selected to participate in the CPACC project. As such, it is important to check and control for baseline differences between the project and non-project households in the sample, as discussed in Section 4.2.

The data in this survey were principally collected at the household level. Questionnaires were conducted with a particular household member, but they were asked to answer questions for the household as a whole. A household was defined as those individuals who normally (in the last three months) had slept in the same dwelling/compound and shared cooking facilities.

In the project communities, interviews were conducted with the person who was named on the list of project participants. These individuals were typically the head of household or their spouse. The head of household was

a concept that was well understood in the local context, so no extra criteria were applied to define to whom this referred. Approximately 60 percent of the individuals on the list of project participants were women.

In order to select similar individual respondents within the sampled comparison households, the enumerators were instructed to target the head of the household or their spouse for interview. However, they were asked to alternate the gender of the respondent for the sample households, in the first household selecting a woman, in the next household a man and so on. Thus, for a typical enumeration day of five interviews, there would be three female respondents (60 percent) and two male respondents (40 percent), replicating the make-up of the respondents from the intervention areas. (In the event, 58 percent of the comparison respondents were female and 42 percent were male.) Therefore, although the survey focuses on household-level information, this should minimize any differences between the intervention and comparison groups that may arise due to there being systematically different types of individual respondents *within* households in the two groups.

Given the rigidity of this sampling strategy, it was necessary to randomly select a set of replacement households in both the intervention and comparison areas. If the enumerator was unable to find the sampled household, they were instructed to organize one revisit. Only if this revisit was unsuccessful could the enumerator request a replacement household, and they could only do this with the authorization of the field supervisors. It was not possible to schedule further revisits, because of the logistical difficulties associated with reaching the communities in the sample.⁵

Before the survey started, respondents were given some basic information about the purpose of the survey, to help manage their expectations. The enumerators explained that the survey was being undertaken to help better understand the lives of people in the community, and that it was for 'research purposes only'. It was also made clear that no special support would come to households as a result of the answers to questions in the survey. All respondents who were approached consented to be interviewed. Interviews were carried out using mobile devices.

4.2 ANALYSIS

Before analysing the effects of the project on resilience outcomes, project participant households and comparison households were compared in terms of their demographic characteristics, livelihoods activities and economic situation in 2009 (i.e. before the Oxfam and PPS resilience-building activities in Mongu began). Any differences between project and comparison households that existed before the project began had the potential to bias comparisons of outcomes between the project participants and comparison respondents. Therefore, the evaluation team attempted to control for these baseline and demographic differences when making such comparisons.

Some of the data were based on information recalled during the questionnaire. Before beginning the main part of the questionnaire, the enumerators worked with the respondents to establish an event or a season that they recalled from 2009, to assist them in recalling that time as clearly as possible when answering the recall questions. However, given the difficulties of remembering specific aspects of livelihoods, asset ownership and other activities, it is possible that these recall questions may be subject to error. This should be borne in mind throughout the analysis.

The full comparison of project participant households and comparison households in terms of all these characteristics is shown in Appendix 2. There are five key differences that are important to highlight.

Firstly, there were some demographic differences, on average, between the participant and comparison households: participant households, on average, were larger, with older household heads, more school-aged children and more elderly members. Related to this, the participant households were also less likely to have existed in 2009.

Secondly, approximately three-quarters of the comparison households were from upland communities, compared with only half of the participant households. This was a direct consequence of the selection of comparison communities, discussed above, and is an important characteristic to control for in the analysis.

Thirdly, the households of project participants appear to have been wealthier, on average, in 2009 than the comparison households: they are more concentrated in the top two quintiles in terms of baseline wealth indicators, and considerably fewer of them were in the lowest quintile (10 percent, against 25 percent of the

comparison households). This is a surprising finding. As discussed above, the project participants had been targeted partly based on their vulnerability, whereas the comparison households were a random cross-section within the comparison communities. If the project and comparison communities had similar wealth distributions, then it would have been expected that, on average, the project participants were poorer than the comparison households.

Connected to the differences between participant and comparison households in terms of their upland or lowland location, as well as their differences in economic level, there were also significant differences between the two groups in the livelihoods activities in which they engaged in 2009. Unexpectedly, those in the comparison group were less likely to have been engaged in each of the different activities (except for gathering wild products), according to these data. For example, 94 percent of the project participant households reported that they were farming crops in 2009, significantly more than the 85 percent of comparison households, and 42 percent of the project households reported that they were involved in fishing or fish farming, compared with only 18 percent of the comparison households. Project participants also recalled having farmed a greater number of crops in 2009 than did comparison households.

Finally, project participants recalled that they and other household members were participating in significantly more types of community groups in 2009 than were comparison households.

Some of the differences between the project participant households and the comparison group identified above may be down to recall error. However, this would require the project participants to systematically overstate their wealth level and their engagement in various livelihood activities and community groups, and/or for the comparison households to systematically understate. One reason that this may have happened in the survey is that respondents may have been unable to recall whether some change that had occurred during the past several years had occurred before or after 2009. Assuming that some of the changes experienced by the project participants were a result of the project activities, then the survey responses provided by the project participants may include a mix of their true baseline status and the effects of the project. This is particularly a concern when considering variables that require more detailed recollection, which may be particularly vulnerable to error.

However, in the absence of this type of *systematic* bias in recall error, any measurement error that arises due to recall would result in any differences between project and comparison households being *underestimated*.⁶ Thus, it is unlikely that there are truly no differences between project households and the comparison group in terms of wealth or livelihood activities in 2009. As such, it is important to control for these differences in the analysis. On the other hand, the main analysis does not control for differences in the number of crops grown or the types of community groups in which respondents recalled having participated in 2009, because of the lower level of confidence in the reliability of the recalled data for these characteristics. (However, the first of the robustness checks discussed in Appendix 4 *does* control for these recalled pre-project characteristics.)

As described in Section 3, the main approach used in this Effectiveness Review to control for the baseline differences was propensity-score matching (PSM). The variables on which respondents were matched were selected from the full list detailed in Appendix 2, based on two key factors. Firstly, variables were selected that were thought to be the most significant in influencing respondents' participation in the project. Secondly, variables that could affect potential project outcomes *as well as* the likelihood of participating in the project were also included. The list of matching variables selected and the full details of the matching procedure are described in Appendix 3.

After matching, project participant households and comparison households appear to be reasonably well balanced in terms of each of the selected variables. This provides reassurance that, even though the screening process for the comparison group does not perfectly replicate the procedure that was originally used to select project participants, this does not bias the results for the matched sample. In the matching process, three of the 282 project participant households in the sample could not be matched and had to be dropped from the analysis. However, the exclusion of only one percent of the project participant observations at this stage is unlikely to significantly affect the representativeness of the findings.

All the results described in Section 6 of the report were tested for robustness by estimating them using alternative PSM and linear regression models. In particular, an alternative PSM model was constructed that makes use of more of the recalled 2009 data, including data on the number of crop types farmed and the types of community group in which households were participating, based on an alternative assumption that any error in recalling these characteristics is negligible. The results of these robustness checks are shown in Appendix 4. The results of the alternative PSM and regression models generally produced estimates of outcomes that were

similar in magnitude and in statistical significance to those derived from the original PSM model. The few cases where the models produced divergent results are discussed in Section 6, in the text or in endnotes.

As mentioned in section 3, PSM and regression models can only control for the baseline differences between project and comparison households for which data were collected in the survey. If there are any 'unobserved' differences between the two groups – such as individuals' attitudes or motivations, differences in local leadership, or weather or other contextual conditions – then these may bias the estimates of outcomes described in Section 6. The evaluation design and the selection of respondents were intended to minimize any potential for unobserved differences, but this possibility cannot be excluded, and must be borne in mind when interpreting the results.

5 MEASURING RESILIENCE

The project under review was specifically aimed at increasing resilience at a household level. As part of its Global Performance Framework, Oxfam GB has developed an innovative approach to measure households' resilience to shocks and stresses and their ability to adapt to change. This approach involves capturing and aggregating data on various household and community characteristics. In previous Effectiveness Reviews, these characteristics have fallen under five 'dimensions'. However, the measurement approach taken in this Effectiveness Review instead draws directly on *The Future is a Choice*, Oxfam's new guidelines for the design and implementation of resilience-building programmes, in which resilience is framed in terms of three overlapping 'capacities' (Jeans et al., 2016).

Oxfam defines resilience as 'the ability of women and men to realize their rights and improve their well-being despite shocks, stresses and uncertainty'. One reason that measuring resilience is challenging is that it is only really possible to assess whether a system has successfully coped or adapted after the fact.

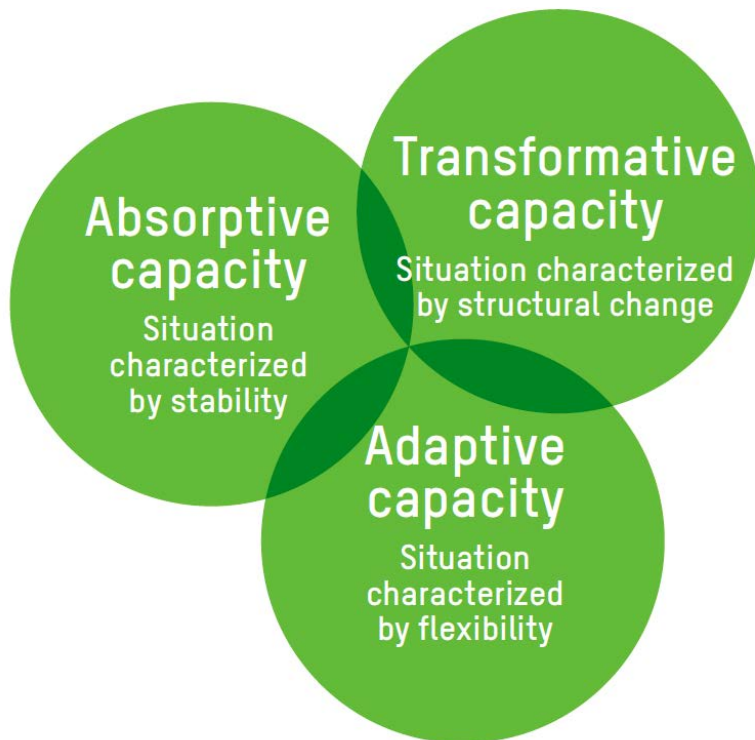
In this Effectiveness Review, the evaluation team were partially able to observe how well households had coped with shocks, stresses and uncertainty, because certain crises have affected communities across Mongu District on an annual basis. Many communities, especially those in the Barotse floodplain, have been affected by flooding every year. Additionally, at the time of the fieldwork Mongu had been subjected to a prolonged period of drought, which had threatened crop production across the project area. Therefore, it was possible to observe how well households were able to maintain their well-being – proxied by crop production, wealth and dietary diversity – in spite of these particular shocks and stresses.

However, looking at these sorts of final outcome is not sufficient to provide information about the project's impact on resilience, for two main reasons. Firstly, while the annual floods that occurred in the years directly prior to the survey were serious, the effects were not as severe or pervasive as those of the 2008–09 floods. Therefore, focusing on measures of current well-being would not reveal how resilient households were to relatively large-scale shocks. Moreover, looking at the ability of households to cope with previous shocks is backward-looking, and does not allow an assessment of the project's impact on resilience in the future.

The 'characteristics approach' to resilience measurement, which has been adopted in this evaluation, is based on the assumption that there are particular characteristics of households and communities that affect how well they are able to cope with shocks and positively adapt to change. Insofar as there are multiple final well-being outcomes which are ultimately of concern, there should also be a wide range of resilience characteristics. Where possible, resilience was conceptualized as operating at many different levels (individual, household, community and so on) as well as for different shocks with different time horizons. As a consequence, the number of resilience characteristics is potentially very high. A limitation, of course, is that it is not known for certain how relevant particular characteristics actually are; rather, it is assumed that they are important based on common sense, theory and an understanding of the local context.⁷

To help structure discussions around the list of characteristics that inform the overall measure of resilience, the framework of three 'capacities' of resilience was applied. Drawing on this framework ensures that this evaluation work is based on the same understanding of resilience as is now being used in the design and implementation of Oxfam programmes.

Figure 5.1: Three resilience capacities



Absorptive capacity is the capacity to take intentional protective action to cope with shocks and stresses. Since shocks and stresses will continue to happen – at least in the medium term – households need to find ways to *stabilize* their well-being. They can do this in two main ways. Firstly, they may anticipate and reduce the impact of a shock or stress through preparedness or planning. e.g. by using early warning systems or understanding the contents of community contingency plans. Secondly, they may find ways to speed up or improve their recovery after exposure to shocks and stresses, e.g. by having access to savings, grain banks or social support networks. As such, absorptive capacity is mainly about the short to medium term.

Adaptive capacity is the capacity to make intentional incremental adjustments in anticipation of or in response to change. This enables households to be more *flexible* in their responses to shocks, stresses and uncertainty. Adaptive capacity relies heavily on learning from previous crises and on households' understanding of patterns of shocks and stresses, so it relates to factors such as understanding of climate change and access to information on prices and markets. Additionally, households need to be able to make certain investments in order to adapt, so access to credit or other streams of reliable income (such as formal employment or remittances) may boost adaptive capacity. Extra opportunities for adaptation, such as through state extension services or access to markets, may also enable households to adapt. Adaptive capacity applies principally to the medium term.

Transformative capacity is the capacity to make intentional change to stop or reduce the drivers of risk, vulnerability and inequality. Transformative capacity is therefore about effecting *long-term change*, altering the stream of shocks and stresses and the uncertainty faced by poor people. This often relies on transforming the systems that drive risk and vulnerability, including intra-household gender dynamics, local governments and even ecosystems. As a result, transformative capacity strongly emphasizes the need to think about resilience at many different scales. Shifting attitudes towards new innovations and the division of labour within households can play a role in transformative capacity. Transformation may also depend on interactions between individuals, such as through community groups or formal government channels.

While the three capacities of resilience described here provide an overall framework, the challenge in creating a measure of resilience is to identify specific characteristics that are appropriate to the local context. For this Effectiveness Review, the evaluation team consulted local Oxfam and PPS staff, as well as officials from the District Council, to identify what factors they considered to be the most important in contributing towards resilience within the project area. Two focus groups were then conducted, one entirely comprised of women and one where the gender of the participants was mixed, enabling the team to further probe people's understanding of the factors that contributed to their resilience.

Table 5.1: Characteristics of resilience examined in the Effectiveness Review

Capacity	Characteristic	Connected to project logic?
<i>Absorptive capacity</i>	Livelihood diversification	Yes
	Crop diversification	Yes
	Diversity of crop-growing sites	No
	Ownership of fungible livestock	No
	Access to drinking water	No
	Savings	Yes
	Access to external early warning information	Yes
	Social support networks	Yes
	Access to back-up seeds	Yes
	Dietary diversity	Yes
<i>Adaptive capacity</i>	Remittances or formal earnings	No
	Access to credit	Yes
	Access to markets	Yes
	Understanding of climate change	Yes
	Use of indigenous early warning information	Yes
	Conservation farming practices	Yes
	Ownership of productive assets	No
	Access to irrigation	Yes
	Improvements in infrastructure	Yes
Understanding of inflation	No	
<i>Transformative capacity</i>	Attitude to change	No
	Adoption of innovative practices	Yes
	Involvement in community-level disaster or development planning	Yes
	Confidence in implementation of community disaster or development plans	Yes
	Integration of community committees or plans at the district level	Yes
	Participation in community groups	Yes
	Voice of women in the community	No
Women's decision-making power in the household	No	
Children's school attendance	No	

This process led to the identification of a set of characteristics of resilience, listed in Table 5.1. It is important to note at this stage that, while not all characteristics considered in this Effectiveness Review may be directly linked to the project activities, all are deemed to be important to a household's overall resilience in this particular context. The right-hand column of Table 5.1 shows the characteristics on which the project was expected to have an impact, in line with the project logic discussed in Section 2. The questionnaire used in the Effectiveness Review included questions relating to each of the characteristics listed in Table 5.1.

Data from these various indicators of resilience were aggregated using an approach adapted from the Alkire-Foster method, which is used by the Oxford Poverty and Human Development Institute (OPHI) for measuring multi-dimensional constructs, such as poverty and women's empowerment (Alkire and Foster, 2011). For each characteristic, a benchmark was defined based on what it means for a household to be faring reasonably well in relation to the characteristic in question. The particular benchmarks used for each characteristic are detailed in Appendix 1. For example, each household was defined as scoring positively in terms of crop diversity if they had farmed at least three different crop types during the 12 months prior to the survey. These cut-offs were developed through conversations with project staff and by checking the summary statistics for each variable to

ensure that the proposed thresholds were not obscuring important variations in the data. There is, however, inevitably a degree of arbitrariness in defining such cut-offs. Alternative cut-offs and formulations of the indicators were tested as a check on the robustness of the results obtained from applying the cut-offs.

Having used the cut-offs to create a binary variable for each characteristic of resilience, it was then necessary to find some way of aggregating scores across all the indicators of resilience. One challenge in constructing an index of this type is how to weight the different indicators, in order to construct an index that adequately reflects what is important for resilience in the local context. In line with previous Effectiveness Reviews, indicators were all weighted equally in the index. That is, the index was simply the proportion of characteristics in which the household scored positively. However, the results of the analysis are unchanged if equal weight is given to each of the three capacities, rather than to each indicator.

One issue with creating an overall index for resilience in this way is that it is implicitly being assumed that the specific resilience characteristics and indeed resilience capacities can be easily substituted for one another.⁸ Since the overall resilience index simply takes the average of the resilience characteristics across the three capacities, a slight loss in transformative capacity, say, can be compensated by a slight increase in absorptive or adaptive capacity. To address this issue, indices specific to each of the three capacities are also analysed, to investigate how the different capacities were affected by the project.

The project's effect on resilience, as measured through these indices, is reported in Section 6.10.

6 RESULTS

6.1 INTRODUCTION

This section presents a comparison of the households interviewed in project and comparison communities in terms of various outcome measures relating to the project under review. This report is intended to avoid excessive technical jargon, with more detailed technical information being reserved for the appendixes and endnotes. However, there are some statistical concepts that cannot be avoided when discussing the results. In this report, results are usually stated as the average difference between the project households (referred to as the 'intervention group') and the matched non-project households (the 'comparison group').

In the tables of results on the following pages, statistical significance is indicated by asterisks, with three asterisks (***) indicating a p -value of less than one percent, two asterisks (**) indicating a p -value of less than five percent and one asterisk (*) indicating a p -value of less than 10 percent. The higher the p -value, the less confident are the authors that the measured estimate reflects a difference that applies across the entirety of the intervention and comparison groups, rather than being due to random variation in the specific sample surveyed. Results with a p -value of more than 10 percent are not considered to be statistically significant.

The results are shown after correcting for observed baseline differences between the households interviewed in the project communities and those in the comparison communities using a propensity score matching (PSM) procedure. More information about the procedure applied is found in Appendix 3. All outcomes discussed here have also been tested for robustness with alternative statistical models, as described in Appendix 4. Where those alternative models produce markedly different results from those shown in the tables in this section, it is discussed in the text or in endnotes.

It is important to reiterate that a key limitation of this analysis is that it is not possible to control for any unobservable differences between the project participants and comparison households – such as individuals' attitudes or motivations, differences in local leadership, weather or other contextual conditions. If these unobserved differences also influence the potential outcomes considered in this section, then the estimates of the project's effects will be biased. This possibility must be borne in mind when interpreting the results.

6.2 INVOLVEMENT IN PROJECT ACTIVITIES

The first step is to examine the extent to which both the project participants and the comparison households were involved in activities corresponding to those implemented under the CPACC project.

Table 6.1 compares the project participant households with the comparison households in terms of their involvement in community groups at the time of the survey. In column 1, it can be seen that most households (92 percent) reported being involved in some community group. Column 2 of the table shows that the *number* of groups in which households participated appears to be slightly higher among the intervention group (at 4.5 groups on average) than the comparison group (3.7 groups on average). However, the single asterisk against this difference shows that it is statistically significant only at the 10 percent level. This means that it cannot be stated with confidence whether this difference between the intervention and comparison groups is specific to the particular sample of respondents interviewed, or whether it is likely to be representative of the whole population.⁹

Columns 3 and 4 of Table 6.1 show data on participation in community groups specifically among women. It can be seen that women in most households (90 percent on average) were said to be involved in some community group. It is not clear whether women in the intervention communities were participating in a significantly larger number of groups than those in comparison communities.

Table 6.2 shows figures for participation in specific types of community group. The largest difference between the intervention and comparison groups was in participation in a WASH committee: 53 percent of those in the project communities said that they (or some other member of their household) attended meetings of a WASH committee, against only 31 percent of those in the comparison communities. As would be expected, this proportion was found to be significantly higher in communities in which the Oxfam WASH project had been implemented than in the other CPACC project communities. The proportions of surveyed households that

participated in most of the other group types were higher among the project participants than among the comparison households, but most of these differences are not statistically significant – even that relating to participation in SDMCs.

Column 5 of Table 6.2 shows that only 17 percent of project participant households were said to be participating in a savings group in the community, compared with 36 percent of the comparison households. This is unexpected, given that the CPACC project involved forming savings groups and encouraging participants to join. According to the recalled baseline data, 9 percent of households in intervention communities were participating in a savings group in 2009, against 21 percent in comparison communities. So although the proportion participating in savings groups in the project communities appears to have increased since 2009, the increase has apparently been larger in the comparison communities. It is known that other organizations have been facilitating the creation of local savings groups in Mongu District, and it appears that they may have been more successful in this respect than the CPACC project. A likely explanation for this is that some other organizations have provided seed capital to savings groups in order to encourage participation; the CPACC project was not able to provide capital.

Table 6.1: Participation in community groups

	1	2	3	4
	Households in which members participate in any community groups (%)	Number of community groups in which household members participate	Households in which women participate in any community groups (%)	Number of community groups in which female household members participate
<i>Intervention group mean</i>	92.1	4.51	91.0	4.19
<i>Comparison group mean</i>	89.8	3.72	88.7	3.51
<i>Difference</i>	2.3 (4.1)	0.81* (0.49)	2.5 (4.4)	0.70 (0.46)
<i>Observations (intervention group)</i>	279	279	279	279
<i>Observations (total)</i>	824	824	824	824

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.2: Types of community group in which household members participate

	1	2	3	4	5	6
	Farmer or producer group (%)	Agricultural cooperative (%)	Non-agricultural cooperative (%)	WASH committee (%)	Savings group (%)	Satellite Disaster Management Committee (SDMC) (%)
<i>Intervention group mean</i>	38.7	30.5	26.2	53.4	17.2	35.8
<i>Comparison group mean</i>	33.9	24.9	17.5	30.9	36.1	24.6
<i>Difference</i>	5.1 (7.6)	5.8 (4.0)	8.9 (6.2)	22.8*** (5.9)	-18.9** (7.7)	11.4 (7.8)
<i>Observations (intervention group)</i>	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Survey respondents were also asked about the types of construction and rehabilitation work that had been carried out in their community since 2009. Table 6.3 provides a breakdown of the responses. The effects of the WASH project are clearly visible in this respect: the proportions of project participants who were aware of wells, boreholes, toilets or other WASH facilities having been either constructed or rehabilitated in their communities

were considerably higher than the proportions in comparison communities. Again, these positive responses were concentrated in the communities in which the Oxfam WASH project had been implemented.

The remaining types of construction and rehabilitation activities listed in Table 6.3 are those that have been led by Oxfam and PPS in at least some communities in Mongu District since 2009, either under the CPACC project or as cash-for-work activities in the post-crisis recovery phase. In fact, for most of these activities there are no clear differences between the project and comparison communities in where they were carried out. The exception is for construction of a seed or crop storage facility: nine percent of the project participants also reported that such a facility had been constructed in their community, compared with only one percent of the comparison respondents. Although the construction of crop storage facilities was not organized directly as an activity of the CPACC or predecessor projects, the CPACC project did aim to raise awareness of the importance of crop storage. This may have led to initiatives to construct storage facilities in some communities.

Table 6.4 goes on to compare the project participant and comparison households in terms of the types of training and information that they reported having received at any time since 2009. The same information is also shown in Figure 6.1. In many of the respects listed, a greater percentage of the project participants reported having received training or information. However, again, most of these differences are not statistically significant, so we cannot state with confidence whether they are representative of the whole population in the intervention and comparison communities or whether they arise from the particular sample of respondents interviewed. On the other hand, there is good evidence that greater proportions of the project participants received training or information on gender issues, on lobbying the District Council for access to goods and services and on hazard identification and vulnerability assessment.

It should be noted that the results in Table 6.4 and Figure 6.1 are based on simple yes/no questions as to whether any household had received training or information from any source since 2009: the data do not indicate whether there was any difference between the project and comparison communities in terms of the quality or intensity of the training or information provided.

Table 6.3: Construction and rehabilitation work carried out in communities since 2009

	1	2	3	4	5	6	7	8	9	10	11	12
	Construction/ rehabilitation of wells or boreholes (%)	Construction of toilets or other WASH facilities (%)	Construction of school (%)	Construction of hospital or clinic (%)	Construction of embankments (%)	Artificial raising of land where people live (%)	Construction/ improvement of irrigation system (%)	Canal cleaning (%)	Construction of seed/crop storage facility (%)	Rainwater harvesting (%)	Demonstration of new farming techniques at a special demonstration plot (%)	Tree planting (%)
<i>Intervention group mean</i>	76.0	60.9	39.8	30.1	23.3	11.8	3.9	39.1	9.3	7.5	21.9	4.7
<i>Comparison group mean</i>	47.9	36.8	25.8	28.5	16.3	8.9	3.4	40.9	0.9	6.2	16.0	4.8
<i>Difference</i>	28.3** (11.1)	24.4*** (5.6)	14.1 (12.1)	1.7 (14.3)	7.2 (5.9)	3.0 (6.0)	0.6 (2.2)	-1.9 (9.7)	8.5*** (2.2)	1.5 (3.3)	6.0 (7.5)	-0.1 (2.2)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.4: Proportion of households that received training or information on various topics since 2009

	1	2	3	4	5	6	7	8	9	10
	Livestock health (%)	Improved farming techniques (%)	Marketing crops (%)	Marketing livestock (%)	Financial management (%)	Running a household business (%)	Gender issues (%)	Claiming goods and services from the District Council (%)	Advocacy (claiming goods and services from the government) (%)	Hazard identification and vulnerability assessment (%)
<i>Intervention group mean</i>	22.9	50.5	24.0	16.8	15.4	19.7	52.7	6.8	8.6	22.2
<i>Comparison group mean</i>	19.1	43.2	19.7	12.9	15.5	15.5	35.9	2.5	6.6	8.0
<i>Difference</i>	3.9 (6.0)	7.4 (6.4)	4.4 (7.4)	4.0 (5.1)	-0.1 (5.1)	4.4 (5.6)	17.1*** (5.0)	4.3*** (1.7)	2.1 (2.7)	14.3*** (3.5)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Figure 6.1: Proportion of households that received training or information on various topics since 2009

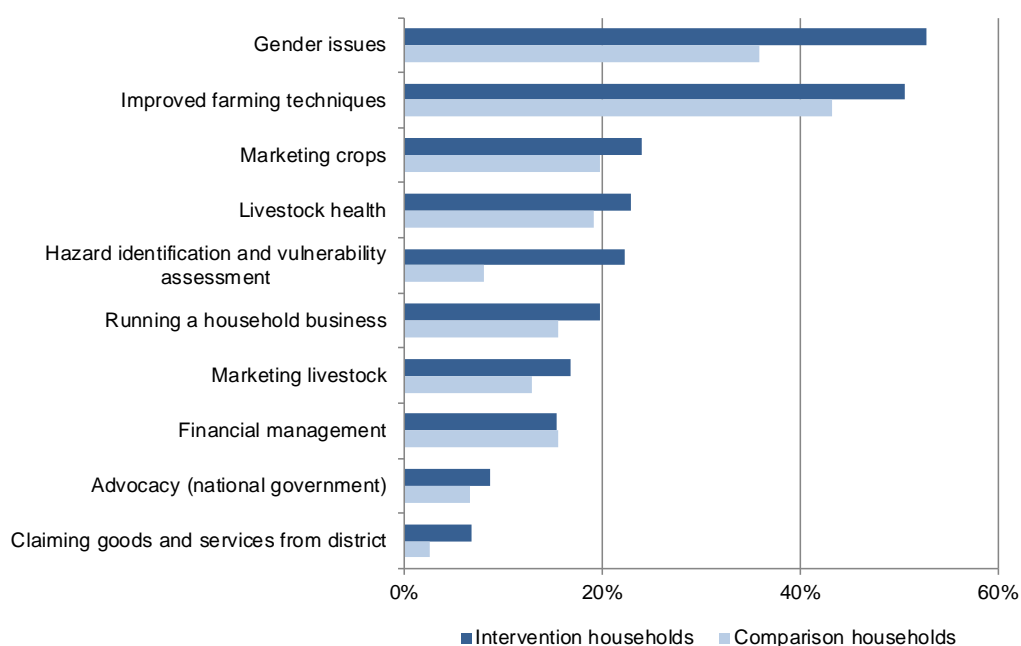


Table 6.5 goes on to examine some more of the survey responses relating to the provision of training. When asked about which bodies or organizations had provided training in their community at any time since 2009, only 24 percent of respondents mentioned the District Council. It is perhaps surprising that this proportion did not differ between the project and comparison communities, given that much of the training carried out under the CPACC project was delivered by local government staff – one explanation may be that many of the participants in the training perceived it to have been delivered by NGOs. As shown in column 2 of the table, the proportions who said that NGOs had delivered training were much higher than those who reported that the District Council had delivered training. As would be expected, more respondents in the project communities were aware of NGOs having provided training than in the comparison communities.

Table 6.5: Indicators of provision of training

	1	2	3	4	5
	Respondents reporting that District Council officers had provided some training since 2009 (%)	Respondents reporting that NGO staff had provided some training since 2009 (%)	Households having received support from an extension agent or government programme in the past 12 months (%)	Households having ever participated in an exchange visit (%)	Respondents expressing a need for further training in order to try new and different livelihood activities ^a (%)
<i>Intervention group mean</i>	21.1	59.1	18.3	9.7	86.4
<i>Comparison group mean</i>	27.1	47.5	20.2	5.7	85.1
<i>Difference</i>	-5.9 (6.7)	11.7** (5.4)	-1.8 (6.3)	4.0 (3.4)	1.2 (5.4)
<i>Observations (intervention group)</i>	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824

^a Proportion of respondents who agreed with the statement 'Before trying new and different livelihood activities, people in my household would require more training' in preference to the statement 'We feel like we have enough knowledge to try new and different livelihood activities for the household'.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

The third column of Table 6.5 shows that 19 percent, on average, of households reported having received support from an extension agent or government programme in the year prior to the survey. There is no indication that this proportion differed between the project and comparison communities. The proportions who reported having participated in an exchange visit to a community outside Mongu (shown in column 4) were also not significantly different between the two groups.

Finally, the survey provides evidence of demand from community members for further training. As shown in column 5 of the table, over 86 percent of intervention respondents expressed the opinion that they would need further training in order to diversify their livelihoods activities, a proportion that was very similar to the comparison households.

6.3 FARMING ACTIVITIES

Many of the activities of the CPACC project were focused on supporting and strengthening crop production. In order to assess the impacts of these activities, survey respondents were asked for information about their household's crop production and sales during the 12 months prior to the survey.

Some of the basic indicators of households' farming activities are shown in Table 6.6. Column 1 shows that most households in the sample reported farming some crops. Columns 2 and 3 show that the project participants were farming approximately a third more land, on average, than comparison households. Since the project participant households and the matched comparison households recalled having farmed similar areas of land, on average, in 2009 (as shown in Appendix 3, Table A3.2), the larger land area farmed by project participants at the time of the survey appears to represent an effect of the project activities.

Columns 3–5 of Table 6.6 show that the project participants were more likely than comparison households to be farming in upper lands, though there is no difference in terms of whether they were also farming on lower land or using irrigated land. The figures in column 6 imply that the number of crop types cultivated was not significantly higher among the project participants; however, an alternative measure of crop diversity examined in Section 6.10.1 does suggest that the project may have had some positive effect in this respect.¹⁰

Table 6.6: Crop production in the 12 months prior to the survey

	1	2	3	4	5	6
	Households that grew any crops (%)	Area farmed (lima)	Households that grew any crops in upper lands (%)	Households that grew any crops in lower lands (%)	Households that grew any crops on irrigated land (%)	Number of crop types grown
<i>Intervention group mean</i>	97.5	4.31	78.9	89.6	24.7	3.87
<i>Comparison group mean</i>	95.7	3.33	64.7	86.2	27.9	3.22
<i>Difference</i>	2.0 (1.5)	1.00** (0.51)	14.6** (6.8)	3.5 (4.5)	-3.2 (5.6)	0.66 (0.47)
<i>Observations (intervention group)</i>	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.7: Farming practices and women’s involvement in farming

	1	2	3	4	5	6
	Households using any improved seeds in the past 12 months (%)	Number of conservation farming practices applied in the past 12 months ^a	Respondents reporting increased yields since 2009 (%)	Respondents reporting decreased yields since 2009 (%)	Households in which female members are most involved in growing at least one type of crop (%)	Households in which female members are most involved in growing maize or rice (%)
<i>Intervention group mean</i>	35.3	2.44	22.4	64.3	49.3	22.8
<i>Comparison group mean</i>	43.7	2.08	15.9	75.9	35.7	23.7
<i>Difference</i>	-8.4 (10.2)	0.36* (0.20)	6.6 (6.3)	-11.4* (6.2)	13.9 (9.4)	-0.6 (6.3)
<i>Observations (intervention group)</i>	272	272	272	272	272	272
<i>Observations (total)</i>	774	774	774	774	774	774

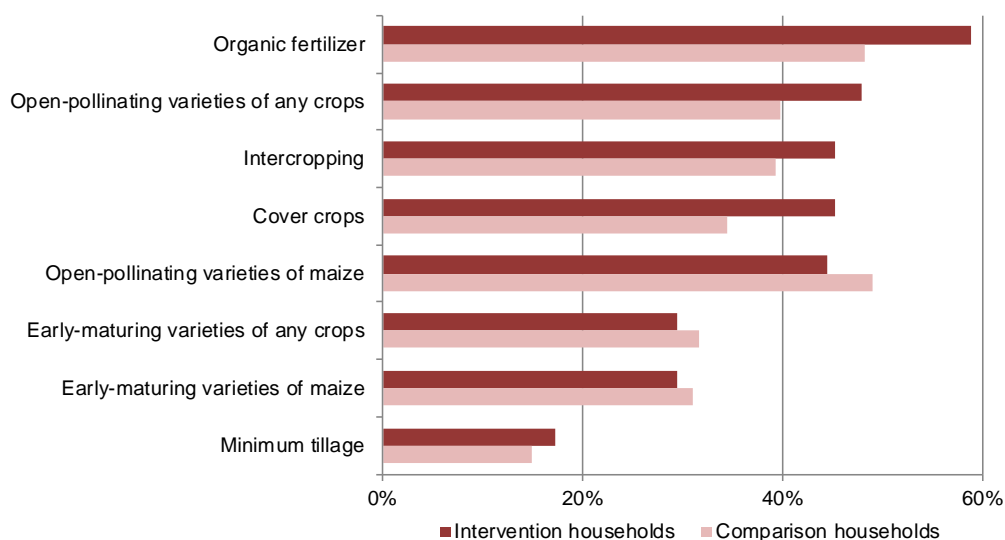
^a From a list of six practices included in the questionnaire: intercropping, organic fertilizer, growing cover crops, early-maturing varieties, open-pollinating varieties and minimum tillage.

Analysis carried out among households that produced any crops in the 12 months prior to the survey.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Respondents were also asked about which improved farming practices they had applied. The results are shown in Table 6.7. In column 1 of the table, it can be seen that approximately 40 percent of all households reported using at least some improved seeds in the previous year, and that this proportion did not differ significantly between the project participants and the comparison households. Column 2 shows the number of conservation farming practices applied by households, out of six listed in the questionnaire (intercropping, organic fertilizer, cover crops, minimum tillage and open-pollinating or early-maturing varieties). There is some evidence that project participant households applied more of these practices than comparison households, although the difference is significant only at the 10 percent level. When adoption of each of the six practices is examined separately (shown in Figure 6.2, though not in the tables), there are clear differences in the proportions of households using organic fertilizer and cover crops, but there are no significant differences in rates of adoption of the other four techniques.¹¹

Figure 6.2: Proportion of households applying conservation farming practices during the 12 months prior to the survey



Detailed data on the volume of crop production were not collected in the survey. However, respondents were asked to estimate whether their yields had increased, decreased or stayed the same since 2009. Columns 3 and 4 of Table 6.7 show that respondents were much more likely to report that there had been a deterioration in their yields since 2009 than to report that there had been an improvement. There is some indication that project participant households were less likely to report a decrease in yields since 2009. However, this difference is again significant only at the 10 percent level and is not supported by all the robustness checks detailed in Appendix 4.

Columns 5 and 6 of Table 6.7 show the results of some analysis of women's involvement in farming activities. Female household members were said to have been mainly involved in farming some crop types in a substantially greater proportion of the households in the project communities (49 percent) than in the comparison communities (36 percent). This seems a large difference, but it is not statistically significant, so it cannot be concluded that it is representative of the whole populations in the project and comparison communities. In any case, it is clear that women in the project communities were no more likely to be responsible for growing maize or rice than were those in the comparison communities, as can be seen in column 6 of the table.

The survey also asked respondents about their sales of crops produced in the previous 12 months. Analysis of the resulting data is shown in Table 6.8. It can be seen from the first column that just under half (45 percent) of households reported having sold some crops, and in the second column that they sold, on average, 23 percent of the crop types they produced. Only a minority of households (16 percent) produced any of what might be called 'cash crops' – i.e. crops that were produced mainly for sale. Nearly a third (30 percent) of households sold crops within their own communities, with smaller proportions selling to visiting buyers (22 percent) and in markets outside the community (14 percent). In none of these respects did the project participants differ significantly from the comparison respondents.

Finally, column 7 of Table 6.8 shows that 15 percent of the project participants reported that they practised 'bulking' – i.e. building up a store of crops before selling – against only eight percent of the comparison households. However, this difference is again not statistically significant.

Table 6.8: Crop sales

	1	2	3	4	5	6	7
	Households that sold any crops, of those produced in the past 12 months (%)	Proportion of crop types produced in the past 12 months that were sold (%)	Households that produced any crop mainly for sale (%)	Households that sold crops within the community (%)	Households that sold crops to a visiting buyer from outside the community (%)	Households that sold crops outside the community (%)	Households that say they always practise bulking (%)
<i>Intervention group mean</i>	47.8	22.8	12.9	29.8	21.0	14.3	14.7
<i>Comparison group mean</i>	42.8	23.8	19.9	31.2	22.7	14.6	7.8
<i>Difference</i>	4.6 (7.9)	-1.1 (3.9)	-7.0 (4.6)	-1.7 (7.1)	-1.9 (7.0)	-0.5 (5.9)	7.0 (4.3)
<i>Observations (intervention group)</i>	272	272	272	272	272	272	272
<i>Observations (total)</i>	774	774	774	774	774	774	774

Analysis carried out among households that produced any crops in the 12 months prior to the survey.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

6.4 LIVESTOCK

Given the importance of livestock to household livelihoods in the project area, survey respondents were asked to provide some information about their ownership of livestock at the time of the survey, as well as about livestock they had lost or sold during the previous 12 months.

It can be seen in Table 6.9 that there are no clear differences between the project and comparison households in the number of livestock owned. This is to be expected, since the CPACC project did not have any activities in Mongu District that were particularly focused on livestock rearing. Overall, 50 percent of households owned some poultry at the time of the survey, and 22 percent owned some cattle; much smaller proportions owned any pigs or goats.

Given that Mongu District was experiencing a particularly severe drought at the time the survey work was carried out, respondents were also asked whether they had experienced any unexpected losses of livestock. A high proportion of respondents said that they had. While the first column of Table 6.10 shows that only a minority of respondents reported having lost any cattle, pigs or goats in the past 12 months, this accounted for approximately two-thirds of households that owned any such livestock. The number of animals lost on average was approximately a third of the holdings from the previous year. When asked the reason for the losses, most respondents cited disease rather than drought, though of course the two causes cannot be easily distinguished.

It can also be seen in Table 6.10 that just under a quarter of respondents reported that they sold some livestock during the 12 months prior to the survey. Roughly equal numbers of respondents had made sales to buyers from their community, to visiting buyers and at a market or other destination outside the community.

Table 6.9: Households' ownership of livestock

	1	2	3	4
	Households owning any livestock (%)	Number of livestock types (cattle, pigs, goats or poultry) owned by the household	Households in which women have primary responsibility for some types of livestock (%)	Number of livestock types for which women have primary responsibility
<i>Intervention group mean</i>	50.5	0.80	45.2	0.55
<i>Comparison group mean</i>	54.5	0.77	51.1	0.57
<i>Difference</i>	-3.8 (7.1)	0.03 (0.12)	-5.8 (7.4)	-0.02 (0.09)
<i>Observations (intervention group)</i>	279	279	279	279
<i>Observations (total)</i>	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.10: Losses and sales of cattle, pigs and goats in the 12 months prior to the survey

	1	2	3	4	5
	Households that lost some livestock to unexpected circumstances (%)	Households that sold some livestock (%)	Households that sold some livestock in the community (%)	Households that sold some livestock to a visiting buyer from outside the community (%)	Households that sold some livestock outside the community (%)
<i>Intervention group mean</i>	20.1	23.7	9.0	8.2	11.1
<i>Comparison group mean</i>	15.9	21.5	9.2	9.1	8.8
<i>Difference</i>	4.2 (4.7)	2.1 (6.8)	-0.2 (2.8)	-0.8 (3.8)	2.3 (3.5)
<i>Observations (intervention group)</i>	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

6.5 NON-AGRICULTURAL ACTIVITIES

The CPACC project aimed to bolster not only crop production, but also participants' non-agricultural income-generating activities. No detailed data on each of the potential sources of non-farm income were collected in the survey, but questions were included about whether household members engaged in any of four important such types of activity: running a household business (such as buying and selling clothes or brewing beer for sale), fishing or fish farming, casual labour and regular, paid employment (e.g. as a teacher or a nurse).

Table 6.11 shows the results of this analysis. The majority of respondents said that they or other household members engaged in at least one of the four off-farm activities listed. This proportion was 10 percentage points higher among the project participants than among the comparison households.¹² On average, households were engaged in only one of these activities. Column 3 of the table shows that women were engaged in these off-farm activities in 40 percent of households. For comparison (though the figures are not shown in the table), men were engaged in off-farm activities in 46 percent of households.

Column 4 of the table shows that 47 percent of the households had some type of household business, and column 5 shows that 42 percent were engaged in fishing or fish farming. There are no clear differences between the project participant and comparison households in either of these respects. However, the two groups did clearly differ when asked specifically about their involvement in fish farming: as shown in column 6 of Table 6.11, project participants were nearly twice as likely to be engaged in fish farming as comparison households. The CPACC project involved providing training on improving fishing techniques and on conserving fish stocks, but it did not specifically encourage participants to start fish farming, so it seems unlikely that this large difference could be an impact of the project. Rather, this difference is likely to reflect an existing, pre-project difference between the two groups in the numbers of fish farmers that is not controlled for in the analysis.¹³

Another large difference between the project participant and comparison households is in the proportions that were carrying out casual (non-agricultural) labour: this applied to 17 percent of the project participant households but only six percent of the comparison households. Again, this seems likely to reflect a pre-existing difference between the two groups, rather than an effect of the project.

Respondents were also asked about whether they had engaged in collecting wild produce from the forest (including foods such as mushrooms or wild fruits, as well as firewood) during the previous 12 months. The results are not shown in the table, but 81 percent of those interviewed responded positively. However, only five percent said that they did this primarily as a commercial activity; the rest gathered such products mainly for domestic use. These figures did not differ significantly between the project participant and comparison households.

Table 6.11: Households' engagement in off-farm productive activities in the 12 months prior to the survey

	1	2	3	4	5	6	7
	Households that engaged in any off-farm productive activity (%)	Number of off-farm productive activities engaged in	Households in which women member(s) engaged in any off-farm productive activity (%)	Households in which some member(s) engaged in a household business (%)	Households in which some member(s) engaged in fishing or fish farming (%)	Households in which some member(s) engaged in fish farming specifically (%)	Households in which some member(s) engaged in casual labour (%)
<i>Intervention group mean</i>	71.7	1.13	40.9	49.1	44.4	17.2	16.8
<i>Comparison group mean</i>	61.8	0.92	39.8	45.3	39.8	9.4	5.8
<i>Difference</i>	9.9** (4.9)	0.20* (0.11)	1.2 (6.1)	3.8 (6.0)	4.7 (7.4)	7.9** (3.6)	11.1*** (3.9)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

6.6 RESPONSE TO CRISES

As discussed in section 2.1, the Effectiveness Review was carried out during a period of particularly severe drought in Mongu District. The lower-lying areas are also prone to frequent flooding. In order to assess how well households were coping with these crises, respondents were asked whether they adopted any of 10 specific actions either to prepare for or respond to crisis. The proportions of households that had taken each of the 10 actions are shown in Table 6.12.

The table shows that larger proportions of the project participants than the comparison households had had recourse to a communal grain bank or seed bank or had been forced to uproot their crops, or (less clearly) had resorted to selling off livestock during the crisis period (when prices were likely to have been low) or to resort to asking for support from others. The greater use of grain and seed banks presumably reflects the wider availability of these resources in the project communities, as identified in Section 6.2. However, the other differences in the table seem to indicate that the effects of drought (and possibly other crises) were felt more keenly in the project communities than in the comparison communities. It does not seem likely that this represents a negative impact of the CPACC project; rather, these results probably indicate that the drought itself tended to be more severe in the project communities than in the comparison communities.

Table 6.12: Proportion of households taking specific actions in response to crises in the past 12 months

	1	2	3	4	5	6	7	8	9	10
	Migrated with entire household (%)	Migrated with livestock only (%)	Uprooted and moved crops (%)	Destocked livestock (sold before the crisis point) (%)	Sold livestock during the crisis (%)	Gave livestock to others to care for (%)	Used a communal food bank (%)	Used a communal seed bank (%)	Sent family members elsewhere to look for work (%)	Asked relatives or friends for support (%)
<i>Intervention group mean</i>	21.5	9.7	25.4	10.8	10.0	14.0	5.7	5.0	9.0	38.7
<i>Comparison group mean</i>	13.1	12.5	12.8	8.5	5.1	17.2	0.5	0.6	6.4	28.6
<i>Difference</i>	8.4 (8.4)	-2.8 (4.6)	12.6*** (3.4)	2.2 (3.3)	4.9* (2.9)	-3.2 (6.0)	5.3*** (1.6)	4.4*** (1.4)	2.5 (2.2)	10.1* (5.6)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.13: Indicators of disaster preparedness in the community

	1	2	3	4	5	6	7
	Respondents aware that the community has an SDMC or disaster management committee (%)	Respondents agreeing that the committee represents community's needs to the District Council (%)	Respondents aware that the community has an action plan or disaster management plan (%)	Respondents aware that the community plan is built into district or national government (%)	Households involved in creating or updating the community plan in the past 12 months (%)	Received flood early warning information from any source in the past 12 months (%)	Received flood early warning information from an SDMC, other group or community leaders, or from district or national government staff (%)
<i>Intervention group mean</i>	64.5	38.7	23.3	15.1	11.8	28.7	22.2
<i>Comparison group mean</i>	44.6	20.3	11.6	7.1	7.0	27.1	10.1
<i>Difference</i>	19.9* (10.7)	18.4* (9.9)	11.7* (6.4)	7.9* (4.4)	4.8 (3.4)	1.6 (3.8)	12.2*** (4.4)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

6.7 DISASTER PREPAREDNESS IN THE COMMUNITY

One of the key areas in which the CPACC project worked was to strengthen the ability to reduce disaster risk at the community and district levels. The impact of activities that were intended to provide benefits to districts as a whole cannot be assessed in this Effectiveness Review, but the project's success in building capacity within communities, and in linking these communities to the District Council, can be.

Table 6.13 shows data relating to some key indicators of community-level disaster preparedness activities. The apparent difference between the project and comparison communities in participation in SDMCs has already been observed in Table 6.2. Columns 1 and 2 of Table 6.13 show that larger proportions of those in the project communities than in the comparison communities knew that the community has an SDMC or other disaster management committee, and agreed that the committee represents the community's needs effectively at the district level. These differences are statistically significant only at the 10 percent level, but the checks carried out in Appendix 4 show that they are reasonably robust.

It appears from column 3 of Table 6.13 that there is also a sizeable difference between the project and comparison communities in terms of the proportion of respondents who know that the community has an action plan or disaster management plan. However, this result is not confirmed by most of the robustness checks discussed in Appendix 4. In any case, it is important to note that fewer than a quarter of respondents in the project communities responded positively to this question.

A surprising result may be that shown in column 5 of the table, that only 12 percent of respondents interviewed in the project communities said that any member of their household had been involved in creating or updating one of these community plans during the past 12 months. In particular, women were said to have been involved in creating or updating community plans in only a third of those cases – i.e. in only four percent of the households surveyed in the project communities. The rate of participation in developing community plans in these communities is not significantly higher than in the comparison communities.

Respondents were also asked about whether they had received any early warning information about flooding during the 12 months prior to the survey. The proportions of those who responded positively were very similar between the project and comparison communities, as shown in column 6 of Table 6.13. However, there is a clear difference in the source of this information: column 7 of the table shows that 22 percent of those in the project communities received early warning information from an SDMC or from other community structures or district officials, compared with only 10 percent of those in comparison communities. Those in the comparison communities were more likely to rely on the radio or on NGO staff for early warning information.

6.8 FOOD CONSUMPTION

If the CPACC project brought an improvement in participants' livelihoods, then it would be expected that this would be reflected in the quantity and quality of food consumed within households. The project also encouraged households to farm new crop types, partly with the aim of increasing the diversity of foods they consumed.

Detailed data on food consumption could not be collected in the survey, but two simple proxy measures of the quantity and quality of food consumption were collected. Firstly, survey respondents were asked how many meals per day they and the rest of their household ate, during the preceding seven days. Column 1 of Table 6.14 shows that most households (93 percent) had eaten at least two meals per day, with no difference between the households of project participants and comparison households. (Only nine percent of respondents said that their households ate at least three meals per day, and again this proportion did not differ significantly between the two groups.)

The second indicator examined in Table 6.14 is a measure of the diversity of food types consumed. Respondents were presented with a list of 13 food types or categories of food (including staples, such as

maize, sorghum and rice, but also milk and dairy products, root vegetables, leafy vegetables, fruit, meat and fish) and were asked for the number of days during the previous seven days on which the food type was consumed by household members. The responses were converted into a dietary diversity score simply by adding up the number of days on which each household consumed each type of food. Again the results do not indicate any difference between the project participants and comparison households.

Table 6.14: Food consumption in the seven days prior to the survey

	1	2
	Households that consumed at least two meals per day (%)	Dietary diversity score (scale of 0 to 91)
<i>Intervention group mean</i>	93.2	26.63
<i>Comparison group mean</i>	91.8	27.11
<i>Difference</i>	1.4 (2.4)	-0.48 (0.97)
<i>Observations (intervention group)</i>	279	279
<i>Observations (total)</i>	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

6.9 HOUSEHOLD WEALTH

This section explores the project's impact on households' wealth. Wealth may be interpreted in two ways from the perspective of resilience. Firstly, wealth may be seen as a *driver* of resilience, insofar as households can sell off assets in times of crisis but also more easily finance the costly investments needed to adapt livelihood strategies and innovate. However, wealth may also be regarded as exactly the type of well-being indicator – a 'final' outcome – that would be improved in spite of shocks, stresses and uncertainty in more resilient households. Typically, these types of final well-being outcome take more time to change than more immediate drivers or characteristics of resilience.

During the course of the questionnaire, respondents were asked to provide information about their household's ownership of various assets (including livestock, productive equipment and household goods), as well as about the condition of the family's house, both in 2009 and at the time of the survey. This information on asset ownership and housing conditions was used to generate an index of overall household wealth.

The wealth index was generated under the assumption that if each of the assets and housing characteristics constituted suitable indicators of household wealth, they should be 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. A small number of items that had low or negative correlations with the others were therefore not considered to be good wealth indicators and so were excluded from the index.¹⁴

A data reduction technique called principal component analysis (PCA) was used to produce two indices of overall wealth, one based on the recalled data from 2009 and one based on the household's situation at the time of the survey. In particular, this wealth index is taken directly from the first principal component.¹⁵ PCA enables weights to be assigned to the different assets, to capture as much information as possible from the data. Broadly, PCA assigns more weight to those assets that are *less* correlated with all the other assets, as these carry more information. By contrast, items with *more* intra-correlation are given less weight.

In order to ensure that the same weights were applied to assets for both the recalled wealth index and the wealth index for the time of the survey, data from these two time periods were pooled before undertaking the PCA procedure. This means that changes in wealth can be more easily compared over time. It should also be noted that the wealth index for 2009 is the measure that has been used throughout this analysis to control for baseline differences in wealth status between intervention and comparison households.

For the analysis in this section, the first step is to ‘normalize’ the wealth index.¹⁶ This means that the impacts of the project that are reported can be directly understood as the *number* of standard deviations by which the project has improved wealth. This means that the results from this Effectiveness Review can be more easily compared with other similar evaluations.

In Table 6.15, the project’s impact on wealth is estimated in two ways. Column 1 reports wealth for the intervention and comparison households at the time of the survey, using the regular matching procedure that has been used throughout the other tables in this report. Column 2, however, takes a slightly different approach, calculating the differences between wealth at the time of the survey and in 2009, and comparing these differences between intervention and comparison households in the matched sample. For the results in Column 2, it is necessary to omit recalled wealth from the matching process.¹⁷

Table 6.15: Index of wealth indicators

	1	2
	Wealth index (normalized)	Change in normalized wealth index since 2009
<i>Intervention group mean</i>	0.44	0.37
<i>Comparison group mean</i>	0.42	0.38
<i>Difference</i>	0.03 (0.09)	-0.01 (0.07)
<i>Observations (intervention group)</i>	279	279
<i>Observations (total)</i>	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

The results do not provide any evidence of a difference between the intervention households and the comparison households in their change in wealth status since 2009.

6.10 RESILIENCE

Section 5 discussed the approach for measuring resilience that was used in this Effectiveness Review. The indicators listed in Table 5.1 were aggregated to produce an overall index of resilience. In Table 6.16 the intervention and comparison households are compared in terms of this index. It can be seen that the intervention participants had index scores of 0.47 on average, meaning that they met the thresholds to score positively in terms of 47 percent of the indicators. This is significantly higher than the 42 percent of indicators in which the comparison households scored positively.

Table 6.16: Indices of resilience

	1
	Base resilience index
<i>Intervention group mean</i>	0.47
<i>Comparison group mean</i>	0.42
<i>Difference</i>	0.05** (0.02)
<i>Observations (intervention group)</i>	279
<i>Observations (total)</i>	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.17 breaks down these results into indices for each of the three resilience capacities. In each case, the index again represents the proportion of indicators within that capacity in which households reach the threshold. It can be seen that the largest difference between the intervention households and comparison

households is clearest in terms of absorptive capacity, but that there is also a positive difference in transformative capacity. There is no indication of any difference between the intervention participants and the comparison households in terms of their adaptive capacity.

Table 6.17: Indices for each of the resilience capacities

	1	2	3
	Index of absorptive capacity	Index of adaptive capacity	Index of transformative capacity
<i>Intervention group mean</i>	0.45	0.43	0.52
<i>Comparison group mean</i>	0.35	0.44	0.48
<i>Difference</i>	0.10*** (0.03)	-0.01 (0.02)	0.04* (0.02)
<i>Observations (intervention group)</i>	279	279	279
<i>Observations (total)</i>	824	824	824

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

It can be concluded from these results, then, that the project seems to have had a positive effect on the resilience of intervention households. It is important to note that the alternative PSM models discussed in Appendix 4 do not show a statistically significant difference between the intervention participants and comparison households in the overall index of resilience. However, even those alternative models show a positive effect on the index of absorptive capacity, which is statistically significant at least at the 10 percent level.

Section 3 discussed the potential for examining whether the estimated impact differs between the intervention communities in lower-land areas – where Oxfam and PPS have been implementing projects since 2009 – and those in the upland areas, where there was no project prior to the CPACC project in 2013. One might expect to find evidence of greater impact in the communities where resilience-building work has been implemented over a longer period of time. However, this turns out not to be the case. Appendix 5 examines the results in the upper-land and lower-land areas separately, and finds that the size of the effects on the various indices of resilience are similar in each.

To understand better what is driving the increases in the resilience index, the following sub-sections compare intervention and comparison households in terms of each of the underlying indicators of resilience. The comparisons of the intervention and comparison households in terms of each of the indicators is shown in Tables 6.18–6.20 and in Figure 6.3.

6.10.1 Absorptive capacity

Ten indicators of absorptive capacity were included in the Effectiveness Review. The proportions of households who met the thresholds to score positively under each of these indicators are listed in Table 6.18. It can be seen that greater proportions of the intervention participants than comparison households score positively on each of these indicators. However, there are statistically significant differences in only five cases: crop diversification, the diversity of crop-growing sites, access to back-up seeds, livelihood diversification and (less clearly) access to drinking water.

As would be expected, the positive result for access to drinking water is concentrated in those communities in which the Oxfam WASH project was implemented. The result for livelihood diversification is caused at least partly by the greater proportion of project participant households who engage in casual labour – something that seems unlikely to have been affected to any great extent by the project.

The difference in terms of the diversity of crop-growing sites is a consequence of more of the intervention participants farming in upland areas than the comparison households. Both this and the higher proportion of intervention participants who met the threshold for crop diversification (defined as having farmed at least three different crop types in the year prior to the survey) appear to reflect results of the CPACC project and its predecessors. (As can be seen in Appendix 4, the difference in crop diversification between the intervention and comparison groups is maintained even after controlling for the recalled level of crop diversity Resilience in Zambia: Impact evaluation of the 'Citizen Participation in Adaptation to Climate Change' project Effectiveness Review series 2016/17

in 2009.) As discussed in Section 6.2, the construction of grain or seed banks in project communities may also have been prompted by the CPACC project activities.

As discussed previously, there is no indication in the data of a positive effect from the project on participation in savings groups – so it is not surprising that the number of intervention participants scoring positively in terms of household savings was no higher than among the comparison households. Nor is there any evidence of an effect on the measure of dietary diversity. The project was also expected to have an effect on access to early warning information and on the strength of networks of social support within the community, but the results do not provide evidence of an improvement in either of these respects.

Table 6.18: Proportion of households scoring positively on indicators of absorptive capacity

	1	2	3	4	5	6	7	8	9	10
	Livelihood diversification (%)	Crop diversification (%)	Diversity of crop-growing sites (%)	Ownership of fungible livestock (%)	Access to drinking water (%)	Savings (%)	Access to external early warning information (%)	Social support networks (%)	Access to back-up seeds (%)	Dietary diversity (%)
<i>Intervention group mean</i>	71.7	75.3	70.6	29.7	78.1	14.3	24.0	20.8	11.1	53.8
<i>Comparison group mean</i>	61.8	53.2	53.0	24.5	52.7	9.0	20.9	18.1	3.8	52.6
<i>Difference</i>	9.9** (4.8)	22.0** (9.1)	17.6*** (5.5)	5.2 (4.6)	25.5* (15.0)	5.4 (3.7)	3.1 (3.6)	2.6 (5.8)	7.3*** (2.7)	1.2 (5.0)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table 6.19: Proportion of households scoring positively on indicators of adaptive capacity

	1	2	3	4	5	6	7	8	9	10
	Remittances or formal earnings (%)	Access to credit (%)	Access to markets (%)	Understanding of climate change (%)	Use of indigenous early warning information (%)	Conservation farming practices (%)	Ownership of productive assets (%)	Access to irrigation (%)	Improvements in infrastructure (%)	Understanding of inflation (%)
<i>Intervention group mean</i>	17.9	17.9	14.0	75.6	47.3	48.0	52.0	24.7	52.3	83.2
<i>Comparison group mean</i>	10.9	33.3	14.0	84.8	44.5	38.6	47.5	27.9	52.4	86.8
<i>Difference</i>	7.0 (4.4)	-15.3** (6.1)	-0.0 (5.5)	-9.2 (5.9)	2.8 (6.2)	9.4 (6.1)	4.5 (8.0)	-3.2 (6.1)	-0.0 (8.1)	-3.6 (3.8)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279	279	279	279
<i>Observations (total)</i>	824	824	824	824	824	824	824	824	824	824

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

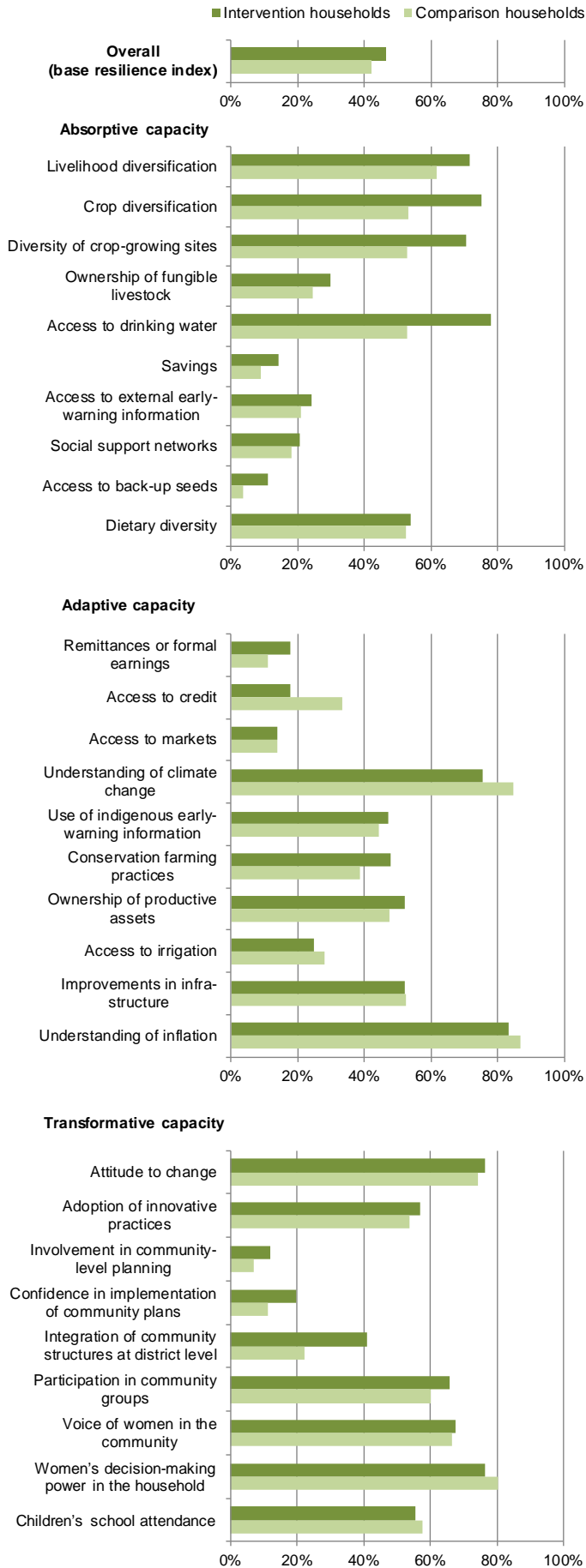
Table 6.20: Proportion of households scoring positively on indicators of transformative capacity

	1	2	3	4	5	6	7	8	9
	Attitude to change (%)	Adoption of innovative practices (%)	Involvement in community-level disaster or development planning (%)	Confidence in implementation of community disaster or development plans (%)	Integration of community committees or plans at the district level (%)	Participation in community groups (%)	Voice of women in the community (%)	Women's decision-making power in the household (%)	Children's school attendance ^a (%)
<i>Intervention group mean</i>	76.3	57.0	11.8	19.7	40.9	65.9	67.4	76.3	55.6
<i>Comparison group mean</i>	74.2	53.8	7.0	11.1	22.1	60.1	66.4	80.3	57.6
<i>Difference</i>	2.1 (4.5)	3.2 (6.5)	4.8 (3.4)	8.7 (6.0)	18.8** (9.2)	5.9 (6.0)	1.0 (5.0)	-4.0 (5.5)	-2.4 (6.8)
<i>Observations (intervention group)</i>	279	279	279	279	279	279	279	279	249
<i>Observations (total)</i>	824	824	824	824	824	824	824	824	657

^a Among households with at least one child aged between seven and 18 years.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Figure 6.3: Proportion of households scoring positively on indicators of resilience



6.10.2 Adaptive capacity

Table 6.19 compares the intervention and comparison households on each of the indicators of adaptive capacity included in the Effectiveness Review. It can be seen that there is little evidence that intervention participants were more likely to score positively than comparison respondents in any of these respects. The only exception to this is in the adoption of conservation farming techniques: it was seen previously (in Section 6.3) that there is evidence that adoption of at least some of these techniques was higher among the project participant households, even though this is not clear from the binary indicator shown in Table 6.19.

There is little evidence of an effect from the project on a number of the indicators of adaptive capacity on which it was expected to have an effect: access to markets, understanding of climate change, use of indigenous early warning information, access to irrigation or improvements in infrastructure in the community. (The infrastructure improvements carried out under the Oxfam WASH project in many of the CPACC project communities are not included in the indicator analysed here.)

Column 2 of Table 6.19 shows that a substantially higher proportion of the comparison households than the project participant households scored positively in terms of access to credit. This is directly related to the greater rate of involvement in savings groups in the comparison communities. The majority of those who were participating in a savings group said that they would be able to borrow 500 kwacha (approximately \$50) from a local savings group if they needed to.

6.10.3 Transformative capacity

The comparison of intervention and comparison households in terms of the nine indicators of transformative capacity is shown in Table 6.20. As is the case for absorptive capacity, most of the differences are positive, but not statistically significant. In particular, it is not clear whether the project had a positive impact on the adoption of innovative practices, involvement in disaster planning or development planning in the community, confidence in the implementation of those plans or involvement in other types of community groups.

The one indicator on which there does appear to be a significant positive effect from the project is the integration of community-level committees or plans into district-level structures. As found earlier (Section 6.7), respondents in the intervention communities were more likely to be aware that the community had a disaster management committee and an action plan or disaster management plan. They were also more likely to express confidence that the SDMC was representing the community's needs at a district level.

7 CONCLUSIONS

7.1 CONCLUSIONS

The results of this Effectiveness Review suggest that the CPACC project made a modest but significant impact on the resilience of participant households. The households of project participants reached the threshold to score positively on 47 percent of the resilience indicators, compared with 42 percent among the matched comparison households. This positive result is driven by an improvement in several of the indicators of absorptive capacity and at least one of the indicators of transformative capacity. In contrast, there is little evidence of the project having a positive impact on indicators of adaptive capacity.

Surprisingly, there is no evidence that those in the lower-land areas – where Oxfam and PPS have been implementing resilience-building projects since 2009 – have benefited more in terms of their resilience than those in the upland areas, where project work has been carried out only since 2013.

In order to understand the reasons for the project's positive effect on the resilience index, it is necessary to examine the underlying indicators in more detail. The area in which the effects of the project are clearest is in community-level disaster preparedness activities. Two-thirds of the project participants were aware of the existence of the SDMCs, a figure that is substantially higher than in the comparison communities, and just over a third said that they or other members of their households participate in the SDMCs directly. The project participants were also more likely to agree that the SDMC (or equivalent committee in the comparison communities) represents the community's needs effectively to the District Council. On the other hand, only 23 percent of respondents in project communities were aware of whether the community has an action plan or disaster management plan, and only 12 percent said that members of their household had been involved in creating or updating the plan during the past year – a figure that is not clearly higher than in the comparison communities. Project participants were no more likely than comparison households to have received early warning information about flooding in the year prior to the survey. However, they were more likely to have received early warning information from SDMCs, other community-based channels or from District Council officials, rather than from the radio. There is also some evidence that the project has led to the construction of grain or seed banks in some of the project communities.

The Effectiveness Review also provides some evidence of positive impacts on households' farming activities. Specifically, the CPACC and predecessor projects appear to have led to an increase in the land area and the range of crop types that project participants are farming. There is some evidence that project participants have also applied more of the practices of conservation farming, particularly the use of organic fertilizer and cover crops. Although nearly two-thirds of them said that their crop yields had decreased since 2009, this appears to be a smaller proportion than among the comparison respondents.

There are several other outcome areas in which the project was expected to have an impact, but for which there is no evidence of such a change having occurred. For example, there was little or no difference between the project participants and comparison respondents in the proportions that were participating in a farmer or producer organization. Respondents in comparison communities received training or information on most of the same themes as those in the project communities – with the important exceptions of training on gender issues, hazard assessment and advocacy. (It should also be noted that no data are available on whether the intensity or quality of the training or information received differs between the two sets of communities). One particularly unexpected finding is that the comparison respondents were twice as likely as the project participants to be members of a community savings group. Consequently, the availability of savings was not clearly any higher among the project participants than the comparison households, and the availability of credit was significantly lower.

Approximately 45 percent of the households surveyed had sold some crops in the year prior to the survey, and 23 percent had sold some livestock. There were no clear differences between the project participants or comparison respondents in the proportions who sold crops or livestock, or in the markets in which they made sales.

Project participant households were found to be engaging in a more diverse range of off-farm livelihoods activities than comparison households – but this was mainly driven by greater rates of engagement in casual

labour, something that does not seem likely to be a result of the CPACC project. There is no indication of a difference between the two groups in the proportions who were running a household business.

The data do not provide any indication that the project had had an impact on households' material welfare at the time of the survey, as measured either by dietary diversity or by using an index of wealth indicators (including housing conditions and asset ownership).

Finally, it is interesting to note that the impacts of the Oxfam WASH project that had also been implemented in several of the CPACC project communities are clear in the results of the Effectiveness Review. This can be seen from the data on the construction and rehabilitation of wells, boreholes and toilets, as well as in households' participation in WASH committees and their access to modern sources of drinking water.

7.2 PROGRAMME LEARNING CONSIDERATIONS

Continue to experiment with the community-led approach to project design, and investigate how to learn from communities with particularly positive experiences.

A central feature of the CPACC project was that members of each community should define their priorities and the activities that would best meet their needs. Since a variety of different activities were carried out in different communities, comparing experiences between communities presents natural opportunities for learning about the effectiveness of the various interventions. A useful supplement to the quantitative results identified in this Effectiveness Review would be to explore qualitatively whether there are communities that have been particularly successful in building resilience (perhaps based on their experience during recent droughts and floods), and to identify the key processes or activities that led to those positive results.

It would also be of interest in future evaluations to assess whether the community-led approach leads to a greater sense of ownership and agency on the part of community members, both women and men. It may also be fruitful to experiment with the degree of involvement that Oxfam has in project implementation, in order to ensure that the organization's concept of resilience is fully reflected and operationalized in the project activities.

Identify opportunities to coordinate with and learn from the experience of other organizations working in the project area.

It is clear from the survey results that there are various NGOs actively implementing projects in Mongu District. Project managers should actively seek to coordinate with organizations that are working in the same local area, in order both to ensure that the activities being carried out are complementary, and to find opportunities to learn from their experiences.

In particular, the greater rates of participation in savings groups in the comparison communities are thought to reflect the activities of other organizations to promote savings groups in Mongu District. The CPACC project provided participants with training and encouraged them to form savings groups, but other organizations are known to have provided more direct support to the formation of groups, particularly in the form of an initial capital injection. Allocating funds to make such grants may be a good method of encouraging participation in savings groups in future projects. It may also be possible to learn from others' experiences about whether supporting the development of household businesses has stimulated demand for savings and credit facilities.

Consider how best to identify participants for new projects, particularly when attempting to target more vulnerable populations.

The direct participants in the CPACC project were selected as being 'vulnerable but viable', using similar criteria to those used by Zambia's Farmer Input Support Programme (FISP). On that basis, the project participants were thought to be generally poorer than their neighbours. In contrast, survey respondents in the comparison communities represented a random sample of all households in those communities. Assuming that the wealth distribution was similar in the project and comparison communities, the project participant households would, therefore, generally be expected to have been poorer than the comparison households before the project was carried out. In fact, the Effectiveness Review data suggests the opposite: the households of project participants were, on average, significantly wealthier than the average comparison household, based on the information on housing conditions and asset ownership recalled from 2009. This suggests that those selected for the CPACC project tended to be better off than their neighbours in 2009.

Careful consideration should be given in future projects to how to identify those who will participate in or benefit directly from the activities. If the intention is to work specifically with a more vulnerable portion of the population, then making this identification through discussion with key informants in the communities may not be adequate. Involving community members as a whole in a participatory wealth ranking may be a useful approach.

Invest in improved monitoring, evaluation and learning practices – including regular tracking of progress, ideally including a comparison group.

Resilience is a complex and dynamic concept. In order to gain a deeper understanding of a project's impact in this area, it is important to invest in robust systems to monitor progress.

One important factor that would improve the ability of programme managers to learn from monitoring and evaluation activities would be to establish a comparison group at baseline. This Effectiveness Review has attempted to assess the impact of the CPACC project as rigorously as possible, within the constraint that the comparison group was identified after the project's implementation. However, confidence in the results of an evaluation such as this would be enhanced if the comparison group had been identified before the project: doing so would allow for baseline characteristics to be controlled for in making comparisons, and external influences on the project's outcomes to be tracked over the project's lifetime. Regular monitoring of the situation in both the project communities and the comparison communities would provide insight into how those within and outside the project are exposed to and respond to shocks, stresses and uncertainty.

Finally, an important component of the CPACC project was aimed at promoting wider changes, in market systems and in the policy and practice of government actors. The effectiveness of some of the local-level interventions – particularly relating to access to markets – was expected to be complemented and enhanced by these higher-level changes. Evaluating the impacts of a project at a systemic level is not possible through a quasi-experimental approach such as that used in this Effectiveness Review. However, it would be valuable to use alternative approaches to assess what systemic changes have taken place and to understand how best they can be reinforced in the future.

APPENDIX 1: THRESHOLDS FOR CHARACTERISTICS OF RESILIENCE

Capacity	Characteristic	Threshold: A household scores positively if...	Directly connected to project logic?
<i>Absorptive capacity</i>	Livelihood diversification	Household engaged in any non-farm activity in the past 12 months.	Yes
	Crop diversification	Household cultivated at least three different crops in the past 12 months.	Yes
	Diversity of crop-growing sites	Household grew any crops in both the upper and lower lands in the past 12 months.	No
	Ownership of livestock	Household owns at least 10 cattle, pigs, goats or poultry.	No
	Access to drinking water	Household uses a modern source as the main source of drinking water (private tap, public tap, borehole with pump, rainwater collection, wells) AND they can reach a source of drinking water on foot during the dry season in less than one hour.	No
	Savings	Respondent reports that the household could last for 30 days or more using the money and other goods they had saved, if they had an emergency now and had to stop working.	Yes
	Access to external early warning information	Household was at least somewhat confident about receiving early warning information about the coming of flooding in the future AND they had received early-warning information about the coming of flooding in the past 12 months.	Yes
	Social support networks	Respondent agrees more with Option 1 out of: <ol style="list-style-type: none"> 1. 'We would help our neighbours with food, money or other commodities when they face hard times, and believe they would do the same for us.' 2. 'It is each household's own responsibility to ensure all their needs are met.' AND respondent agrees more with Option 2 out of: <ol style="list-style-type: none"> 1. 'If we receive livestock, seeds or crops from someone outside the community – such as an NGO or the government – we keep those resources within the household for our own use.' 2. 'Assistance in terms of livestock, seeds or crops from outside the community (e.g. from NGOs or the government) should be passed on to help other households.' AND respondent is able to borrow money from relatives or neighbours in the community or from relatives outside the community.	Yes
	Access to back-up seeds	Respondent reports that a seed bank or a food bank is available in the community during times of crisis, such as floods and droughts.	Yes
	Dietary diversity	During the last seven days, household typically consumed two or more meals per day AND had consumed a carbohydrate source every day, a protein source on at least three days and some fruit or vegetables on at least three days.	Yes

Capacity	Characteristic	Threshold: A household scores positively if...	Directly connected to project logic?
<i>Adaptive capacity</i>	Remittances or formal earnings	Household has at least one member working in formal employment OR has received remittances in the past 12 months.	No
	Access to credit	Household would be able to borrow 500 kwacha (approximately \$50) to invest in a business opportunity from a savings group or revolving fund in the community or from a bank or formal financial institution.	Yes
	Access to markets	Household had sold crops to someone outside the community in the past 12 months.	Yes
	Understanding of climate change	Respondent agrees more with Option 2 out of: 1. 'Ten to 20 years into the future, the weather patterns in this area will be similar to those of the past.' 2. 'The frequency of floods and droughts in this area continues to increase.'	Yes
	Use of indigenous early warning information	Household has used at least two of the following three methods of indigenous early warning: looking at signs from wild plants or trees to decide when/how to plant crops; looking for changes in wind patterns to decide when/how to plant crops; looking at the colour of sand in the river to predict the weather.	Yes
	Conservation farming practices	Household has used at least three of the following conservation farming techniques in the past 12 months: intercropping, using organic fertilizer, growing 'cover crops', growing early-maturing varieties, growing open-pollinated varieties, minimum tillage.	Yes
	Ownership of productive assets	Household owns two or more small assets (including water pumps, wheelbarrows, carts, ploughs, harrows, grinding mills, rice shelling machines, solar panels and bicycles) OR any large assets (including canoes, generators, motorcycles or any motor vehicle).	No
	Access to irrigation	Household has farmed any irrigated land in the past 12 months.	Yes
	Improvements in infrastructure	Respondent reports that at least one of the following types of infrastructure improvement has been carried out in the community since 2009: construction/improvement of irrigation system, construction of embankments, artificial raising of land where people live, cleaning of a canal or tree-planting.	Yes
	Understanding of inflation	Respondent agrees more with Option 2 out of: 1. 'Money is money. It is OK to hold one's wealth in cash and cash alone.' 2. 'It is important to hold one's wealth in many different ways, because the value of cash may be unreliable.'	No
<i>Transformative capacity</i>	Attitude to change	Respondent agrees more with Option 1 out of: 1. 'We should not be afraid to try new and different livelihood activities – sometimes they are better than the traditional livelihood activities.'	No

Capacity	Characteristic	Threshold: A household scores positively if...	Directly connected to project logic?
		2. 'It is best to continue doing what we already know and do well, rather than experimenting with new approaches.'	
	Adoption of innovative practices	Household has adopted any innovations since 2009 that were not directly related to the project activities (including harvesting water, stored livestock in upland areas that do not flood, stored other assets in upland areas that do not flood, purchased feed for storage, or any other innovations).	No
	Involvement in community-level disaster or development planning	Any household member was involved in creating or updating the community's action plans, disaster management plans or contingency plans.	Yes
	Confidence in implementation of community disaster or development plans	The respondent knows that the community has an action plan, disaster management plan or a contingency plan AND they are at least somewhat confident that the community will be able to access the funds required from the district or national government to implement the plan.	Yes
	Integration of community committees or plans at the district level	(The respondent knows that the community has an SDMC or another special committee devoted to disaster management AND they think the committee is representing the community's needs to the district government) OR (The respondent knows that the community has an action plan, disaster management plan or a contingency plan AND they report that the community plan is built into district or national government plans).	Yes
	Participation in community groups	Household members participate in three or more community groups.	Yes
	Voice of women in the community	Respondent agrees more with Option 1 out of: 1. 'The needs of women are well represented to community-level decision makers, such as SDMCs.' 2. 'Community-level decision makers, such as SDMCs, mainly take into account the needs of men.'	No
	Women's decision-making power in the household	Respondent agrees more with Option 1 out of: 1. 'Both women and men in the household are responsible for making decisions about how we spend our money.' 2. 'It is mainly men in the household who make the main decisions about how we spend our money.'	No
	Children's school attendance ^a	All children in the household aged between seven and 18 years attended school in the last week of the previous term.	No

^a Omitted for households that did not have any children aged between seven and 18 years.

APPENDIX 2: BASELINE STATISTICS BEFORE MATCHING

Table A2.1: Descriptive statistics before matching

	Intervention mean	Comparison mean	Difference	Standard error
<i>Household size</i>	6.70	5.38	1.32***	0.19
<i>Proportion of household members who are children (less than 15 years) (%)</i>	41.47	41.48	-0.01	1.68
<i>Proportion of household members who are of school age (7–18 years) (%)</i>	34.53	30.06	4.47**	1.55
<i>Proportion of household members who are elderly (more than 65 years) (%)</i>	8.88	6.44	2.44*	1.24
<i>Proportion of household members who are male (%)</i>	25.26	25.34	-0.07	1.41
<i>Proportion of household members who have completed primary education (%)</i>	25.39	25.15	0.24	1.81
<i>Proportion of household members who have completed secondary education (%)</i>	3.94	2.94	1.00	0.69
<i>Proportion of households that existed in 2009</i>	95.74	88.81	6.94***	2.07
<i>Household head is male (%)</i>	59.93	59.63	0.30	3.60
<i>Age of household head (years)</i>	53.99	45.75	8.24***	1.21
<i>Household head can read and write a simple letter (%)</i>	76.60	71.19	5.40	3.25
<i>Household head completed primary education (%)</i>	41.49	38.90	2.59	3.59
<i>Household head completed secondary education (%)</i>	7.09	5.14	1.95	1.72
<i>Household head is Lozi (%)</i>	81.21	82.02	-0.81	2.84
<i>Household head is Mbunda (%)</i>	14.54	11.93	2.61	2.45
<i>Household head is Luvale (%)</i>	0.71	2.20	-1.49	0.95
<i>Household head is from another ethnic group (%)</i>	3.55	3.85	-0.31	1.40
<i>Household resides in an upland community (%)</i>	48.58	74.50	-25.91***	3.37
<i>Land area farmed in 2009 (lima)</i>	2.94	2.27	0.67*	0.30
<i>Livelihoods activities engaged in by household members in 2009:</i>				
• <i>Farming crops (%)</i>	4.15	2.94	1.21***	0.18
• <i>Fishing or fish farming (%)</i>	93.62	83.85	9.76***	2.43
• <i>Household business (e.g. buying and selling clothes, brewing and selling beer) (%)</i>	41.84	17.98	23.86***	3.12
• <i>Gathering wild products (e.g. mushrooms, wild fruits, firewood) (%)</i>	47.16	33.39	13.77***	3.53
• <i>Paid agricultural labour (%)</i>	79.79	88.62	-8.84***	2.56

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	Intervention mean	Comparison mean	Difference	Standard error
• <i>Casual labour (e.g. construction, masonry) (%)</i>	39.36	30.28	9.09**	3.45
• <i>Regular, paid employment (e.g. as a teacher or nurse) (%)</i>	14.89	2.75	12.14***	1.81
<i>Number of crop types farmed in 2009</i>	3.55	0.37	3.18***	0.87
<i>Any household member received remittances in 2009 (%)</i>	19.50	6.42	13.08***	2.24
<i>Household was in the lowest 20% of the wealth distribution in 2009 (%)</i>	9.93	25.32	-15.39***	2.89
<i>Household was in the second 20% of the wealth distribution in 2009 (%)</i>	16.67	21.65	-4.98	2.93
<i>Household was in the third 20% of the wealth distribution in 2009 (%)</i>	18.79	20.73	-1.94	2.94
<i>Household was in the fourth 20% of the wealth distribution in 2009 (%)</i>	24.82	17.43	7.39*	2.92
<i>Household was in the highest 20% of the wealth distribution in 2009 (%)</i>	29.79	14.86	14.92***	2.89
<i>Household participated in a savings community group in 2009 (%)</i>	8.87	11.19	-2.33	2.24
<i>Number of community groups in which household participated in 2009 (%)</i>	4.12	3.00	1.12***	0.21
<i>Observations</i>	282	545	827	

The construction of the wealth index is described in Section 6.

Variables dated 2009 are estimates, based on recall data.

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

APPENDIX 3: METHODOLOGY USED FOR PROPENSITY SCORE MATCHING

The results presented in Section 6 of this report were estimated using propensity score matching (PSM). PSM is a statistical technique that allows the effect of an intervention to be estimated by accounting for the covariates that predict receiving the intervention, or 'treatment'. The idea behind PSM is to match households in the intervention group to similar households in the comparison group, based on observed characteristics at baseline. After each participant is matched with a non-participant, the average treatment effect on the treated (those who benefited from the intervention) is equal to the difference in average outcomes of the intervention and the comparison groups after project completion. This appendix describes and tests the specific matching procedure employed in this Effectiveness Review. The approach follows the guidance provided by Caliendo and Kopeinig (2008).

Estimating propensity scores

Finding an exact match for treated individuals, based on various baseline characteristics, would be very hard to implement in practice. Rosenbaum and Rubin (1983) demonstrated that a 'propensity score' could summarize all this information in one single variable. The propensity score is defined as the conditional probability of receiving the intervention given background variables. Specifically, propensity scores are calculated using a statistical probability model (e.g. probit or logit) to estimate the probability of participating in the project, conditional on a set of characteristics.

Table A3.1 shows the variables used to estimate the propensity score. This reports the marginal effects at the mean, and the corresponding standard errors. Following Caliendo and Kopeinig (2008), only variables that influence the participation decision, but which are not affected by participation in the project, were included in the matching model. In the table, the dependent variable corresponds to whether or not the household received the intervention: it is equal to one if the household participated in the project activities, and zero otherwise. The coefficients in the table correspond to the marginal effects, i.e. the change in the probability of receiving the intervention if the independent variable is increased by one.

Defining the region of common support

After estimating the propensity scores, it is necessary to verify that there is a potential match for the observations in the intervention group with those from the comparison group. This means checking that there is *common support*. The area of common support is the region where the propensity score distributions of the intervention and comparison groups overlap. The common support assumption ensures that each 'treatment [intervention] observation has a comparison observation "nearby" in the propensity score distribution' (Heckman, LaLonde and Smith, 1999). Figure A3.1 shows the propensity score density plots for both groups. It can be observed that, although the distributions of propensity scores are clearly different between the intervention and comparison groups in each case, there is a reasonably good area of overlap between the groups. However, in constructing the model for household-level outcomes, three observations from the intervention group were dropped because there was no suitable match for them in the comparison group.

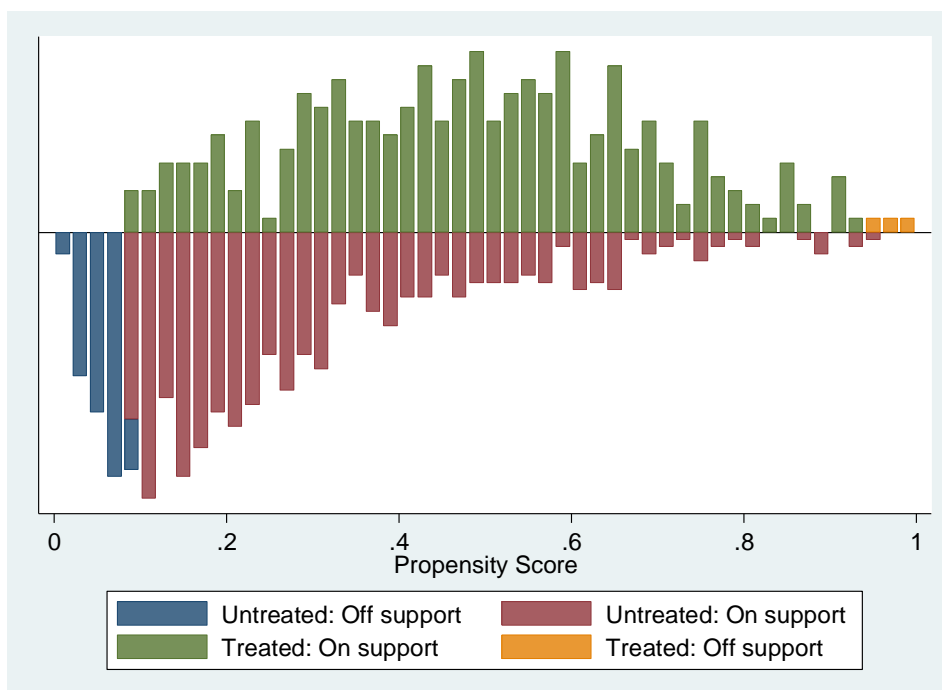
Table A3.1: Estimating the propensity score

	Marginal effect	Standard error	p-value
Household head is male (1=Y, 0=N)	-0.07	0.04	0.05
Household size	0.03***	0.01	0.00
Age of household head (years)	0.01***	0.00	0.00
Household head can read and write a simple letter (1=Y, 0=N)	0.06	0.04	0.15
Household resides in an upland community	-0.19***	0.04	0.00
Land area farmed in 2009 (lima)	0.00	0.00	0.71
Household undertook farming of crops in 2009 (1=Y, 0=N)	0.05	0.06	0.41
Any household member engaged in fishing or fish farming in 2009 (1=Y, 0=N)	0.22***	0.04	0.00
Any household member engaged in regular, paid employment in 2009 (1=Y, 0=N)	0.38*	0.17	0.03
Any household member received remittances in 2009 (1=Y, 0=N)	0.17**	0.06	0.00
Household was in the lowest 20% of the wealth distribution in 2009	-0.11*	0.06	0.07
Household was in the second 20% of the wealth distribution in 2009	-0.07	0.05	0.21
Household was in the third 20% of the wealth distribution in 2009	-0.03	0.05	0.61
Household was in the fourth 20% of the wealth distribution in 2009	0.01	0.05	0.81
Observations	827		

The construction of the wealth index is described in Section 6. Variables dated 2009 are estimates, based on recall data. Dependent variable is binary, taking 1 for project participant households, and 0 otherwise.

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

Figure A3.1 Histogram of propensity scores in the intervention and comparison groups



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Matching intervention households to comparison households

Following Rosenbaum and Rubin (1983), households were matched on the basis of their propensity scores using a kernel matching algorithm. Kernel matching assigns more weight to the closest comparison group observations that are found within a selected 'bandwidth'. Thus 'good' matches are given greater weight than 'poor' matches. The *psmatch2* module in Stata (Leuven and Sianesi, 2003) was used with a bandwidth of 0.15 and the analysis was restricted to the area of common support. When using PSM, standard errors of the estimates were bootstrapped using 1,000 repetitions to account for the additional variation caused by the estimation of the propensity scores, and were clustered at the community level.¹⁸

Checking balance

For PSM to be valid, the intervention group and the matched comparison group need to be balanced. In other words, the intervention and comparison groups need to be similar in terms of their observed characteristics. The most straightforward method of doing this is to test whether there are any statistically significant differences in baseline covariates between both groups in the matched sample. The balance of each of the matching variables after kernel matching is shown in Table A3.2. There are no statistically significant differences between the intervention and comparison groups in the matched sample for any of the matching variables. For most of these variables, the *p*-values for the difference in means tests are larger than 0.2 – the exception being that for receipt of remittances, where the *p*-value is close to this threshold. It can therefore be concluded in each case that a satisfactory match has been found for the intervention group in the sample, according to this set of matching variables.

Table A3.2: Balancing test on matching variables

	Intervention group mean	Comparison group mean	<i>p</i> -value
<i>Household head is male (%)</i>	59.50	56.80	0.53
<i>Household size</i>	6.69	6.60	0.69
<i>Age of household head (years)</i>	53.80	53.84	0.98
<i>Household head can read and write a simple letter (%)</i>	76.34	74.04	0.54
<i>Household resides in an upland community (%)</i>	48.75	47.49	0.77
<i>Land area farmed in 2009 (lima)</i>	2.92	2.90	0.95
<i>Livelihoods activities engaged in by household members in 2009:</i>			
• <i>Farming crops (%)</i>	93.55	94.62	0.58
• <i>Fishing or fish farming (%)</i>	41.58	42.00	0.92
• <i>Regular, paid employment (e.g. as a teacher or nurse) (%)</i>	2.51	1.09	0.25
<i>Any household member received remittances in 2009 (%)</i>	18.64	14.29	0.20
<i>Household was in the lowest 20% of the wealth distribution in 2009 (%)</i>	10.04	8.96	0.64
<i>Household was in the second 20% of the wealth distribution in 2009 (%)</i>	16.85	16.33	0.87
<i>Household was in the third 20% of the wealth distribution in 2009 (%)</i>	19.00	21.11	0.55
<i>Household was in the fourth 20% of the wealth distribution in 2009 (%)</i>	25.09	25.87	0.84

The construction of the wealth index is described in section 6.

Variables dated 2009 are estimates, based on recall data.

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

It was also considered whether the sample was balanced in terms of the other demographic variables and recalled baseline variables included in Table A3.1 that were not used for matching. This analysis should provide a check on how successfully the matching model balances household characteristics *other* than those specifically used as matching variables.

It can be seen that there are statistically significant differences between the matched intervention and comparison groups in terms of the proportion of household members who have completed primary education, whether the household was running a household business in 2009, the number of crops that respondents recalled having grown in 2009, and the community groups in which they recalled their household having participated in 2009. The number of crop types grown and the number of community groups in which household members were participating in 2009 are important factors that could affect the analysis of outcomes in this report, but it cannot be known how accurately this information was recalled during the survey. Most respondents identified few changes in the range of crops grown or the groups in which they were participating between 2009 and the time of the survey; it seems likely that respondents tended to err in recalling the 2009 situation as being more similar to their current situation than it was in reality.

There are, then, two potential explanations for the differences between the project participant and comparison households in these characteristics from 2009. Firstly, it is possible that the project households were already growing more crops and participating in more groups in 2009 than the comparison households were. Alternatively, it is possible that the project in fact had a positive effect on crop diversity and crop diversification, but many respondents mis-remembered their situation in 2009 as being more similar to their current situation than it really was. In adopting the PSM model described here to derive the project effect estimates presented in Section 6 of this report, it is assumed that the latter is the case. In reality, the truth may lie between the two extremes. In Appendix 4 the robustness of the results is checked by constructing an alternative PSM model that includes some additional variables relating to households' activities in 2009 as matching variables – including the recalled number of crops grown and the recalled number of community groups in which households were participating at that time.

Table A3.3: Balancing test on remaining demographic and recalled baseline variables

	Intervention group mean	Comparison group mean	p-value
<i>Proportion of household members who are children (less than 15 years) (%)</i>	41.63	40.31	0.49
<i>Proportion of household members who are school age (7–18 years) (%)</i>	34.65	34.78	0.94
<i>Proportion of household members who are elderly (more than 65 years) (%)</i>	8.87	9.79	0.57
<i>Proportion of household members who are male (%)</i>	25.35	25.90	0.73
<i>Proportion of household members who have completed primary education (%)</i>	25.18	28.86	0.09
<i>Proportion of household members who have completed secondary education (%)</i>	3.78	3.76	0.98
<i>Proportion of households that existed in 2009 (%)</i>	95.70	96.13	0.79
<i>Household head completed primary education (%)</i>	41.22	42.12	0.84
<i>Household head completed secondary education (%)</i>	6.81	5.01	0.41
<i>Household head is Lozi (%)</i>	81.36	84.41	0.34
<i>Household head is Mbunda (%)</i>	14.34	10.38	0.16
<i>Household head is Luvale (%)</i>	0.72	1.04	0.62
<i>Household head is from another ethnic group (%)</i>	3.58	4.17	0.72
<i>Livelihoods activities engaged in by household members in 2009:</i>			
• <i>Household business (e.g. buying and selling clothes, brewing and selling beer)</i>	4.14	3.35	0.00
• <i>Gathering wild products (e.g. mushrooms, wild fruits, firewood) (%)</i>	47.31	41.64	0.20
• <i>Paid agricultural labour (%)</i>	79.93	84.24	0.22
• <i>Casual labour (e.g. construction, masonry) (%)</i>	39.78	33.25	0.12
<i>Number of crop types farmed in 2009</i>	15.05	3.83	0.00
<i>Household participated in a savings community group in 2009 (%)</i>	8.96	21.02	0.00
<i>Number of community groups in which household participated in 2009 (%)</i>	4.13	3.40	0.01

APPENDIX 4: ROBUSTNESS CHECKS

In order to assess the robustness of the results presented in Section 6, a series of checks were carried out to determine whether the main findings of this report are sensitive to the estimation procedure – propensity score matching with the kernel method – that was used to control for observable differences between the intervention and comparison groups. This appendix presents five types of robustness check.

1 PSM kernel model with additional recalled baseline characteristics

In constructing the PSM model described in Appendix 3, recalled variables relating to households' activities in 2009 that seem particularly likely to be vulnerable to recall error were omitted. In Table A3.3 it can be seen that there were some imbalances between the matched intervention and comparison groups, particularly in terms of the number of crops farmed and the number of community groups in which household members were participating in 2009. Inference based on the main PSM model assumes that the recall of these characteristics is not reliable, and that the project has had a positive effect in these two respects.

This section tests whether the results described in Section 6 are sensitive to this assumption by constructing an alternative matching model that includes additional recalled characteristics of households' activities in 2009. Specifically, the revised model includes all the matching variables included in the model described in Appendix 3, as well as recalled data on:

- a. whether any household member engaged in a household business in 2009
- b. whether any household member engaged in gathering wild products in 2009
- c. whether any household member engaged in paid agricultural labour in 2009
- d. whether any household member engaged in casual labour in 2009
- e. the number of crop types farmed in 2009
- f. whether any household member participated in a savings group in the community in 2009
- g. the number of community groups in which household members participated in 2009.

These variables were used to construct a PSM kernel model, following a similar procedure to that described in Appendix 3. Nine of the intervention group observations and 137 of the comparison group observations were dropped as being outside the area of common support. A bandwidth of 0.08 was applied, and there were no statistically significant differences between the intervention and comparison groups in the matched sample. The tables below report the estimated differences between the intervention and comparison groups.

2 PSM nearest neighbour model

The nearest neighbour (NN) matching algorithm matches each observation from the intervention group with an observation from the comparison group that is closest in terms of their propensity scores.¹⁹ This robustness check uses the propensity scores derived in Appendix 3 and applies NN matching 'with replacement', meaning that comparison observations can be matched to intervention observations more than once. A caliper of 0.007 was applied to provide a limit on the difference in propensity scores over which pairs of observations are matched. Fifteen of the intervention observations could not be matched, and so were dropped from the analysis. The resulting model is not ideally balanced: four of the 14 matching variables have differences that are significant with $p < 0.2$. Using a smaller caliper would improve the matching quality, but would also result in further intervention observations being dropped from the sample, making the results less representative of the intervention group as a whole. In the tables below, the estimated differences between the intervention and comparison groups are reported.

3 OLS regression

The robustness of the outcome estimates was also tested by estimating the impact of project participation using ordinary least squares (OLS) regressions. The idea behind OLS is to isolate the variation in the

outcome variable that is due to the intervention status – the project’s impact – by controlling directly for the influence that observable differences between the intervention and comparison group have on outcomes. To do this, Equation 1 is estimated.²⁰

$$Y_i = \alpha + \beta_1 \tau_i + \mathbf{X}_i' \boldsymbol{\delta} + \varepsilon_i$$

Here, Y_i is the dependent variable (the outcome) and \mathbf{X}_i is a column vector of the matching variables listed in Table A3.1. The intervention status is given by a dummy variable (τ_i), which takes the value one if the household participated in the project and zero otherwise. The key difference between this OLS regression model and the PSM procedure used in the main report is that the OLS regression estimates a direct parametric relationship between the covariates in \mathbf{X}_i and the dependent variable Y_i . This means that it is possible to include the observations that were excluded due to being off common support in Section 6 by extrapolating the relationship between \mathbf{X}_i and Y_i . It should be borne in mind, however, that extrapolating in this way may bias the results if the covariates are distributed very differently between the intervention and comparison groups (Rubin, 2001). However, in the case of these data, it appears that the covariates are sufficiently balanced for OLS regression methods to be valid.²¹ In the tables that follow, only the estimate of β_1 is reported.

4 OLS regression with propensity-score weighting

Following the example of Hirano and Imbens (2001), an alternative set of OLS regressions were also estimated that apply the same model as in Equation 1, but weighting the observations according to the propensity score. Observations are assigned weights equal to one for the intervention households and $\hat{P}(\mathbf{X}_i)/(1 - \hat{P}(\mathbf{X}_i))$ for the comparison households. The variable $\hat{P}(\mathbf{X}_i)$ represents the probability of a household being in the intervention group, given their observable characteristics, measured through the vector of matching variables \mathbf{X}_i – this was estimated in the probit regressions in Appendix 3. The estimates of β_1 are reported in the same way as the standard OLS regressions.

In the remainder of this appendix, the results are reported for each of these four robustness checks for the main results presented in the main body of the report. Table numbers in this appendix correspond to those in Section 6 of the report: Table A4.1 reports analysis of the same outcomes as Table 6.1, Table A4.2 reports analysis of the same outcomes as Table 6.2, and so on.

It is important to note that, as with the PSM methods used in the main body of the report, these alternative PSM and OLS models can only account for observable differences between the intervention and comparison groups. Unobservable differences may still bias the results.

Table A4.1: Participation in community groups

	1	2	3	4
	Households in which members participate in any community groups (%)	Number of community groups in which household members participate	Households in which women participate in any community groups (%)	Number of community groups in which female household members participate
<i>PSM kernel with additional baseline variables</i>	0.1 (3.8)	0.22 (0.32)	0.5 (3.9)	0.14 (0.33)
<i>N</i>	818	818	818	818
<i>PSM nearest neighbour</i>	0.8 (5.0)	0.46 (0.57)	0.0 (5.3)	0.39 (0.50)
<i>N</i>	809	809	809	809
<i>OLS regression</i>	2.6 (3.6)	0.84** (0.36)	3.0 (3.8)	0.71** (0.36)
<i>N</i>	827	827	827	827
<i>OLS with propensity-score weighting</i>	0.8 (3.3)	0.72** (0.34)	0.9 (3.4)	0.60* (0.33)
<i>N</i>	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.2: Types of community group in which households participate

	1	2	3	4	5	6
	Farmer or producer group (%)	Agricultural cooperative (%)	Non-agricultural cooperative (%)	WASH committee (%)	Savings group (%)	Satellite disaster management committee (SDMC) (%)
<i>PSM kernel with additional baseline variables</i>	0.1 (7.9)	-4.0 (5.9)	-0.8 (7.0)	19.4*** (5.4)	-15.5** (6.7)	7.8 (10.7)
<i>N</i>	818	818	818	818	818	818
<i>PSM nearest neighbour</i>	0.8 (8.7)	-3.0 (5.8)	9.5 (7.1)	26.1*** (8.0)	-22.7** (9.6)	4.9 (9.1)
<i>N</i>	809	809	809	809	809	809
<i>OLS regression</i>	6.1 (5.8)	6.1* (3.4)	9.4** (3.9)	23.6*** (6.0)	-16.8** (6.8)	9.7 (6.7)
<i>N</i>	827	827	827	827	827	827
<i>OLS with propensity score weighting</i>	7.8 (5.7)	5.5 (3.4)	4.6 (4.2)	20.8*** (5.1)	-20.7*** (6.5)	15.9*** (5.9)
<i>N</i>	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.5: Indicators of provision of training

	1	2	3	4	5
	Respondents reporting that district government officials provided some training since 2009 (%)	Respondents reporting that NGO staff provided some training since 2009 (%)	Households having received support from an extension agent or government programme in the past 12 months (%)	Households having ever participated in an exchange visit (%)	Respondents expressing a need for further training in order to try new and different livelihoods activities ^a (%)
<i>PSM kernel with additional baseline variables</i>	-8.4 (7.2)	11.9* (6.5)	-6.2 (7.9)	2.1 (4.3)	-2.0 (5.1)
<i>N</i>	818	818	818	818	818
<i>PSM nearest neighbour</i>	-5.7 (7.4)	16.3** (7.1)	-8.0 (7.5)	1.1 (4.1)	0.0 (6.9)
<i>N</i>	809	809	809	809	809
<i>OLS regression</i>	-3.5 (5.6)	13.6*** (5.2)	-0.6 (4.7)	5.1* (2.7)	-0.6 (5.4)
<i>N</i>	827	827	827	827	827
<i>OLS with propensity-score weighting</i>	-6.2 (5.1)	13.8*** (4.7)	-0.3 (5.7)	5.0* (2.9)	2.9 (4.6)
<i>N</i>	827	827	827	827	827

^a Proportion of respondents who agreed with statement 'Before trying new and different livelihood activities people in my household would require more training' in preference to the statement 'We feel like we have enough knowledge to try new and different livelihood activities for the household'.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.6: Crop production in the 12 months prior to the survey

	1	2	3	4	5	6
	Households that grew any crops (%)	Area farmed (lima)	Households that grew any crops in upper lands (%)	Households that grew any crops in lower lands (%)	Households that grew any crops on irrigated land (%)	Number of crop types grown
<i>PSM kernel with additional baseline variables</i>	1.2 (1.4)	1.04* (0.56)	17.7*** (5.2)	1.1 (4.5)	-8.6 (6.4)	0.37 (0.44)
<i>N</i>	818	818	818	818	818	818
<i>PSM nearest neighbour</i>	0.8 (2.4)	-0.42 (0.77)	12.5 (8.5)	4.5 (5.8)	-9.5 (7.4)	0.37 (0.52)
<i>N</i>	809	809	809	809	809	809
<i>OLS regression</i>	2.5* (1.3)	0.77* (0.41)	13.6** (5.5)	4.1 (4.3)	-4.9 (4.3)	0.58* (0.35)
<i>N</i>	827	827	827	827	827	827
<i>OLS with propensity-score weighting</i>	1.5 (1.2)	1.18*** (0.40)	14.5** (6.2)	3.0 (3.7)	-5.5 (4.7)	0.65* (0.34)
<i>N</i>	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.7: Farming practices and women's involvement in farming

	1	2	3	4	5	6
	Households using any improved seeds in the past 12 months (%)	Number of conservation farming practices applied in the past 12 months ^a	Respondents reporting increased yields since 2009 (%)	Respondents reporting decreased yields since 2009 (%)	Households in which female members are most involved in growing at least one type of crop (%)	Households in which female members are most involved in growing maize or rice (%)
<i>PSM kernel with additional baseline variables</i>	-10.0 (9.1)	0.25 (0.25)	1.5 (6.7)	-7.7 (6.7)	14.2 (10.8)	-1.1 (6.7)
<i>N</i>	765	765	765	765	765	765
<i>PSM nearest neighbour</i>	-5.2 (11.1)	0.39 (0.25)	6.4 (6.7)	-12.7* (7.1)	13.9 (10.0)	-1.6 (7.5)
<i>N</i>	753	753	753	753	753	753
<i>OLS regression</i>	-11.5 (8.0)	0.30 (0.19)	5.7 (4.8)	-10.0** (4.9)	12.4* (7.5)	0.1 (5.1)
<i>N</i>	777	777	777	777	777	777
<i>OLS with propensity-score weighting</i>	-9.1 (7.7)	0.36* (0.19)	6.1 (5.2)	-12.1** (4.9)	16.2* (8.7)	0.2 (5.0)
<i>N</i>	777	777	777	777	777	777

^a From a list of six practices included in the questionnaire: intercropping, organic fertilizer, growing cover crops, early-maturing varieties, open-pollinating varieties and minimum tillage.

Analysis carried out among households that produced any crops in the 12 months prior to the survey.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.8: Crop sales

	1	2	3	4	5	6	7
	Households that sold any crops, of those produced in the past 12 months (%)	Proportion of crop types produced in the past 12 months that were sold (%)	Households that produced any crop mainly for sale (%)	Households that sold crops within the community (%)	Households that sold crops to a visiting buyer from outside the community (%)	Households that sold crops outside the community (%)	Households that said they always practised bulking (%)
<i>PSM kernel with additional baseline variables</i>	4.3 (6.6)	-0.01 (0.04)	-5.5 (5.0)	0.2 (5.5)	-1.5 (6.6)	-2.3 (6.3)	6.5 (4.1)
<i>N</i>	765	765	765	765	765	765	765
<i>PSM nearest neighbour</i>	5.6 (9.1)	-0.02 (0.05)	-6.8 (6.4)	0.8 (8.4)	-0.4 (8.2)	0.0 (6.7)	6.8 (5.0)
<i>N</i>	753	753	753	753	753	753	753
<i>OLS regression</i>	3.1 (6.6)	-0.01 (0.04)	-8.7** (4.1)	-3.4 (5.4)	-2.7 (5.7)	-2.7 (5.2)	6.0** (3.0)
<i>N</i>	777	777	777	777	777	777	777
<i>OLS with propensity-score weighting</i>	2.1 (5.8)	-0.02 (0.03)	-11.5*** (3.5)	-5.4 (5.2)	-3.7 (4.9)	1.3 (5.2)	4.2 (3.7)
<i>N</i>	777	777	777	777	777	777	777

Analysis carried out among households that produced any crops in the 12 months prior to the survey.

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

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Table A4.11: Households' engagement in off-farm productive activities in the 12 months prior to the survey

	1	2	3	4	5	6	7
	Households that engaged in any off-farm productive activity (%)	Number of off-farm productive activities engaged in	Households in which women member(s) engaged in any off-farm productive activity (%)	Households in which some member(s) engaged in a household business (%)	Households in which some member(s) engaged in fishing or fish farming (%)	Households in which some member(s) engaged in fish farming specifically (%)	Households in which some member(s) engaged in casual labour (%)
<i>PSM kernel with additional baseline variables</i>	5.6 (4.4)	0.10 (0.11)	0.1 (5.8)	0.9 (5.3)	3.1 (7.7)	8.1** (3.8)	6.7* (3.9)
<i>N</i>	818	818	818	818	818	818	818
<i>PSM nearest neighbour</i>	7.6 (7.4)	0.19 (0.14)	4.5 (7.4)	3.8 (8.0)	1.9 (8.3)	6.8 (4.7)	12.9*** (4.5)
<i>N</i>	809	809	809	809	809	809	809
<i>OLS regression</i>	10.2** (4.0)	0.15* (0.08)	2.3 (5.3)	3.2 (6.1)	4.5 (4.1)	6.9** (2.8)	8.0*** (2.9)
<i>N</i>	827	827	827	827	827	827	827
<i>OLS with propensity-score weighting</i>	7.0* (3.6)	0.11 (0.08)	0.2 (4.5)	-0.8 (5.6)	3.0 (4.1)	8.3*** (3.1)	8.9*** (3.3)
<i>N</i>	827	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.12: Proportion of households taking specific actions in response to crises in the past 12 months

	1	2	3	4	5	6	7	8	9	10
	Migrated with entire household (%)	Migrated with livestock only (%)	Uprooted and moved crops (%)	Destocked livestock (sold before the crisis point) (%)	Sold livestock during the crisis (%)	Gave livestock to others to care for (%)	Used a communal food bank (%)	Used a communal seed bank (%)	Sent family members elsewhere to look for work (%)	Asked relatives or friends for support (%)
<i>PSM kernel with additional baseline variables</i>	8.1 (7.1)	-3.2 (4.8)	8.4** (3.6)	3.4 (4.5)	3.3 (3.3)	-5.3 (7.0)	5.5*** (1.8)	4.2*** (1.3)	0.6 (3.8)	3.9 (6.5)
<i>N</i>	818	818	818	818	818	818	818	818	818	818
<i>PSM nearest neighbour</i>	4.9 (8.6)	0.0 (5.6)	9.8* (5.1)	0.8 (4.6)	2.3 (3.6)	-4.9 (6.9)	5.3*** (2.0)	4.5*** (1.8)	0.4 (3.6)	8.7 (7.0)
<i>N</i>	809	809	809	809	809	809	809	809	809	809
<i>OLS regression</i>	8.9 (6.2)	-1.3 (3.6)	12.1*** (3.1)	2.7 (2.9)	4.7* (2.5)	-1.4 (5.0)	4.1*** (1.6)	3.1*** (1.2)	1.9 (1.7)	7.8** (3.9)
<i>N</i>	827	827	827	827	827	827	827	827	827	827
<i>OLS with propensity-score weighting</i>	9.2 (6.7)	-7.2* (3.8)	11.7*** (2.6)	2.8 (3.7)	3.1 (3.0)	-8.1 (5.2)	5.7*** (1.8)	4.7*** (1.3)	0.0 (2.5)	5.4 (3.8)
<i>N</i>	827	827	827	827	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.13: Indicators of disaster preparedness in the community

	1	2	3	4	5	6	7
	Respondents aware that the community has an SDMC or disaster management committee (%)	Respondents agreeing that the committee represents community's needs to the District Council (%)	Respondents aware that the community has an action plan or disaster management plan (%)	Respondents aware that the community plan is built into district or national government (%)	Households involved in creating or updating the community plan in the past 12 months (%)	Received early warning information from any source in the past 12 months (%)	Received early warning information from an SDMC, other group or community leaders, or from district or national government staff (%)
<i>PSM kernel with additional baseline variables</i>	15.5 (11.4)	12.1 (10.7)	5.8 (7.3)	5.6 (4.5)	2.0 (4.3)	-1.9 (5.0)	10.8** (5.2)
<i>N</i>	818	818	818	818	818	818	818
<i>PSM nearest neighbour</i>	20.8* (12.1)	17.0* (10.2)	12.5* (7.2)	9.8** (4.9)	8.0* (4.3)	-3.4 (6.2)	12.1** (5.3)
<i>N</i>	809	809	809	809	809	809	809
<i>OLS regression</i>	16.0* (8.7)	14.4* (7.7)	8.8 (5.6)	6.1 (3.8)	3.1 (2.5)	0.7 (3.6)	11.7*** (4.1)
<i>N</i>	827	827	827	827	827	827	827
<i>OLS with propensity-score weighting</i>	21.2*** (8.0)	19.1*** (6.7)	8.0 (5.1)	3.8 (3.9)	1.8 (2.6)	5.8* (3.2)	13.4*** (3.5)
<i>N</i>	827	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.14: Food consumption in the seven days prior to the survey

	1	2
	Households that consumed at least two meals per day (%)	Dietary diversity score (scale of 0 to 91)
<i>PSM kernel with additional baseline variables</i>	1.6 (2.6)	-0.6 (1.1)
<i>N</i>	818	818
<i>PSM nearest neighbour</i>	1.1 (3.7)	-0.3 (1.3)
<i>N</i>	809	809
<i>OLS regression</i>	2.2 (2.0)	-0.3 (0.9)
<i>N</i>	827	827
<i>OLS with propensity-score weighting</i>	0.5 (2.3)	-1.6** (0.7)
<i>N</i>	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.15: Index of wealth indicators

	1	2
	Wealth index (normalized)	Change in normalized wealth index since 2009
<i>PSM kernel with additional baseline variables</i>	-0.08 (0.11)	-0.04 (0.08)
<i>N</i>	818	820
<i>PSM nearest neighbour</i>	-0.09 (0.15)	-0.10 (0.10)
<i>N</i>	809	810
<i>OLS regression</i>	-0.02 (0.07)	-0.05 (0.06)
<i>N</i>	827	827
<i>OLS with propensity-score weighting</i>	-0.09* (0.05)	-0.10 (0.06)
<i>N</i>	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.16: Indices of resilience

	1	2
	Base resilience index	Resilience index with equally weighted dimensions
<i>PSM kernel with additional baseline variables</i>	0.02 (0.02)	0.02 (0.02)
<i>N</i>	818	818
<i>PSM nearest neighbour</i>	0.03 (0.02)	0.03 (0.02)
<i>N</i>	809	809
<i>OLS regression</i>	0.04** (0.01)	0.04** (0.01)
<i>N</i>	827	827
<i>OLS with propensity-score weighting</i>	0.03** (0.01)	0.03** (0.01)
<i>N</i>	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.17: Indices for each of the resilience capacities

	1	2	3
	Index of absorptive capacity	Index of adaptive capacity	Index of transformative capacity
<i>PSM kernel with additional baseline variables</i>	0.09*** (0.03)	-0.04 (0.02)	0.01 (0.03)
<i>N</i>	818	818	818
<i>PSM nearest neighbour</i>	0.09** (0.04)	-0.03 (0.03)	0.03 (0.03)
<i>N</i>	809	809	809
<i>OLS regression</i>	0.09*** (0.02)	-0.02 (0.02)	0.04* (0.02)
<i>N</i>	827	827	827
<i>OLS with propensity-score weighting</i>	0.09*** (0.02)	-0.03 (0.02)	0.03 (0.02)
<i>N</i>	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.18: Proportion of households scoring positively on indicators of absorptive capacity

	1	2	3	4	5	6	7	8	9	10
	Livelihood diversification (%)	Crop diversification (%)	Diversity of crop-growing sites (%)	Ownership of fungible livestock (%)	Access to drinking water (%)	Savings (%)	Access to external early warning information (%)	Social support networks (%)	Access to back-up seeds (%)	Dietary diversity (%)
<i>PSM kernel with additional baseline variables</i>	5.6 (4.4)	17.1** (6.7)	18.3*** (5.9)	3.9 (5.8)	31.5** (13.4)	4.6 (5.3)	-1.0 (4.7)	1.9 (6.6)	6.3** (3.1)	2.6 (5.8)
<i>N</i>	818	818	818	818	818	818	818	818	818	818
<i>PSM nearest neighbour</i>	7.6 (7.1)	18.9* (10.4)	16.3** (7.4)	2.3 (6.4)	22.7 (14.9)	3.8 (4.8)	2.7 (5.8)	4.9 (7.0)	6.4* (3.3)	1.9 (7.4)
<i>N</i>	809	809	809	809	809	809	809	809	809	809
<i>OLS regression</i>	10.2** (4.0)	18.0*** (6.8)	16.6*** (4.7)	4.2 (4.1)	20.6* (10.9)	4.9 (3.1)	2.6 (3.1)	3.8 (4.3)	5.9*** (2.0)	2.1 (4.7)
<i>N</i>	827	827	827	827	827	827	827	827	827	827
<i>OLS with propensity-score weighting</i>	7.0* (3.6)	17.3*** (6.3)	17.0*** (5.1)	1.2 (3.7)	29.0** (11.7)	2.3 (3.5)	6.3** (2.8)	2.2 (4.2)	8.4*** (2.2)	-2.5 (4.3)
<i>N</i>	827	827	827	827	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.19: Proportion of households scoring positively on indicators of adaptive capacity

	1	2	3	4	5	6	7	8	9	10
	Remittances or formal earnings (%)	Access to credit (%)	Access to markets (%)	Understanding of climate change (%)	Use of indigenous early warning information (%)	Conservation farming practices (%)	Ownership of productive assets (%)	Access to irrigation (%)	Improvements in infrastructure (%)	Understanding of inflation (%)
PSM kernel with additional baseline variables	2.2 (6.0)	-17.3*** (6.2)	-1.9 (6.3)	-9.0 (6.1)	-3.9 (9.2)	6.8 (6.5)	0.7 (7.2)	-8.6 (6.7)	-3.8 (10.0)	-2.3 (4.3)
N	818	818	818	818	818	818	818	818	818	818
PSM nearest neighbour	6.4 (5.0)	-19.7** (7.8)	-6.8 (6.2)	-10.2 (6.4)	6.8 (7.6)	4.5 (8.0)	6.8 (8.6)	-9.5 (7.4)	-3.8 (9.8)	-5.3 (5.0)
N	809	809	809	809	809	809	809	809	809	809
OLS regression	5.4* (3.1)	-14.1*** (5.0)	-2.1 (5.0)	-9.8** (4.6)	2.2 (5.4)	6.8 (5.7)	2.6 (5.2)	-4.9 (4.3)	-1.3 (8.3)	-4.0* (2.2)
N	827	827	827	827	827	827	827	827	827	827
OLS with propensity-score weighting	1.7 (3.1)	-20.6*** (4.5)	1.5 (5.1)	-11.9** (5.6)	-1.5 (5.7)	9.3* (5.6)	1.3 (5.3)	-5.5 (4.7)	1.2 (8.2)	-2.1 (3.0)
N	827	827	827	827	827	827	827	827	827	827

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

Table A4.20: Proportion of households scoring positively on indicators of transformative capacity

	1	2	3	4	5	6	7	8	9
	Attitude to change (%)	Adoption of innovative practices (%)	Involvement in community-level disaster or development planning (%)	Confidence in implementation of community disaster or development plans (%)	Integration of community committees or plans at the district level (%)	Participation in community groups (%)	Voice of women in the community (%)	Women's decision-making power in the household (%)	Children's school attendance (%)
PSM kernel with additional baseline variables	1.3 (5.2)	-1.7 (7.8)	2.0 (4.3)	3.3 (7.0)	11.7 (10.2)	-2.3 (4.7)	-4.2 (5.2)	-4.0 (6.3)	-4.9 (7.6)
N	818	818	818	818	818	818	818	818	642
PSM nearest neighbour	0.0 (5.9)	-5.3 (8.2)	8.0* (4.3)	9.8 (6.6)	16.3* (9.4)	-1.5 (7.5)	3.8 (6.8)	-1.9 (6.2)	-2.6 (8.7)
N	809	809	809	809	809	809	809	809	636
OLS regression	0.9 (3.6)	3.9 (5.1)	3.1 (2.5)	6.1 (5.0)	14.7* (7.6)	6.3 (4.9)	1.7 (4.6)	-3.8 (3.6)	-0.7 (6.0)
N	827	827	827	827	827	827	827	827	661
OLS with propensity-score weighting	-0.8 (3.1)	0.3 (4.9)	1.8 (2.6)	5.1 (4.7)	16.9** (6.6)	2.9 (4.4)	-2.7 (4.1)	-2.5 (4.3)	0.1 (4.5)
N	827	827	827	827	827	827	827	827	661

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

APPENDIX 5: SUB-GROUP ANALYSIS

It will be recalled from Section 3 of this report that the impacts estimated in it are an average across the lower-land communities, where Oxfam and PPS have carried out resilience-building work since 2009, and the upper-land communities, where only the CPACC project has been implemented, from 2013 onwards. This appendix considers whether the impact on the indices of resilience is different between these two areas.

Two approaches have been taken to this analysis. Firstly, to assess whether the upper-land or lower-land area has an effect on the outcome estimates, OLS regressions similar to the third robustness check discussed in Appendix 4 were run. In these regressions, interaction variables were added, defined as the intervention status (τ_i) multiplied by a dummy variable designating communities that are located in the upper lands (U_i). These regression models also include the matching variables as covariates (X_i), to control for observable baseline differences between the project and non-project households when estimating the effects of the project. The regression equation estimated is shown in Equation 2.²²

$$Y_i = \alpha + \beta_1\tau_i + \beta_2(\tau_i \times U_i) + \beta_3U_i + X_i'\delta + \varepsilon_i \quad (2)$$

If the coefficient β_2 is statistically significant, this suggests that there have been differential effects between the upper- and lower-land communities.

The results of this analysis for the indices of overall resilience and the three capacities are shown in Table A5.1. The estimated coefficients β_1 , β_2 and β_3 are shown in the table.

Table A5.1: Differential effects on resilience by upper- or lower-land location

	1	2	3	4	5
	Base resilience index	Resilience index with equally weighted dimensions	Index of absorptive capacity	Index of adaptive capacity	Index of transformative capacity
<i>Intervention</i>	0.03 (0.02)	0.03 (0.02)	0.08* (0.05)	-0.02 (0.02)	0.04* (0.02)
<i>Intervention × upper land</i>	0.01 (0.03)	0.00 (0.03)	0.01 (0.06)	0.01 (0.04)	-0.01 (0.03)
<i>Upper land</i>	-0.00 (0.03)	-0.00 (0.02)	0.05 (0.05)	-0.04 (0.02)	-0.01 (0.02)
<i>Observations</i>	827	827	827	827	827

Robust standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The results in Table A5.1 do not suggest that the project had differential effects between the upper and lower lands, since none of the interaction terms are statistically significant. Neither do the results provide evidence that the level of resilience (as measured by the various indices) differed significantly between the upper- and lower-land areas.

The conclusion that there is no difference in project effects between the upper- and lower-land areas is tested in Table A5.2, which shows the results on the various indices of resilience from two PSM models constructed specifically among observations in the upper lands and lower lands. It can be seen that the estimated project effects on the resilience indices have similar magnitudes in each of the two areas. The effects on the overall indices are not statistically significant in the lower lands, but that is likely to be a result of the smaller sample size, more than an indication of a difference in the effects of the project.

Table A5.2: PSM estimates of project effect in upper- and lower-land areas

	1	2	3	4	5
	Base resilience index	Resilience index with equally weighted dimensions	Index of absorptive capacity	Index of adaptive capacity	Index of transformative capacity
<i>PSM: upper-land area</i>	0.04* (0.02)	0.04* (0.02)	0.07** (0.03)	-0.00 (0.03)	0.06 (0.04)
<i>Observations</i>	534	534	534	534	534
<i>PSM: lower-land area</i>	0.04 (0.03)	0.04 (0.03)	0.10** (0.05)	-0.02 (0.02)	0.04 (0.03)
<i>Observations</i>	279	279	279	279	279

Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions and clustered by community.

NOTES

- 1 'Chronic vulnerability' was the term used by Oxfam and partner organization staff to describe the situation of households in the project areas.
- 2 Similar criteria were used to select communities for the initial phases of Oxfam's and PPS's activities in Mongu District in 2009 and specifically for the CPACC project in 2013.
- 3 This is calculated using the 2010 census data for Mongu District.
- 4 The RANDBETWEEN function in Microsoft Excel was used to generate the pseudo-random number.
- 5 More replacements were required in the intervention group than in the comparison group. This was because the lists of project participants had been created in 2013, while the lists of households for the comparison group were created at the time of the fieldwork in 2016.
- 6 This arises due to classical measurement error, which attenuates effect sizes – including for basic *t*-tests – towards zero.
- 7 This approach to measuring resilience is discussed further in Hughes and Bushell (2013) and Fuller and Lain (2015).
- 8 In fact, since an arithmetic mean has been used to create the indices of resilience, all of the characteristics and, indeed, all of the capacities are effectively considered as perfect substitutes in the economic sense.
- 9 It should also be recalled that (as discussed in Section 4.2 and Appendix 3) there is a similar difference in the figures on the number of groups that respondents recalled participating in in 2009. The alternative PSM model that controls for this recalled baseline characteristic (for which the results are shown in Appendix 4) implies that there was no significant effect from the project on the number of groups in which households were participating. However, the accuracy of the data recalled from 2009 cannot be known.
- 10 As discussed in Appendix 3, a difficulty with interpreting this result is that there is also a significant difference between the range of crops produced by project participants and comparison households in 2009, according to the recalled data. It cannot be known how accurate these recalled data are, so it is difficult to draw conclusions about whether the project participants were already producing a greater range of crops in 2009 or whether this difference has arisen over the course of the project's lifetime.
- 11 In addition, there were no differences between the project participants and comparison households in the proportions reporting that they applied chemical fertilizer or used potholing for tilling soil – two practices that are considered undesirable.
- 12 As discussed in section 4.2 and Appendix 3, there was some imbalance between the intervention and comparison groups in terms of engagement in some of the off-farm livelihoods activities in 2009, based on the recalled data. Under the alternative PSM model outlined in Appendix 4, which controls for involvement in more of these activities in 2009, there is no significant difference between the groups in the proportions engaging in any off-farm activity at the time of the survey.
- 13 Respondents were not asked to recall whether they were specifically engaged in fish farming in 2009, so this cannot be controlled for in the analysis. However, the PSM model does control for whether respondents recalled having been engaged in fish or fish farming (considered together) in 2009.
- 14 The item-rest correlation for each asset was greater than 0.1. Cronbach's alpha (a measure of internal consistency) was confirmed to be greater than 0.7, following the guidance of Bland and Altman (1997).
- 15 This follows the approach of Filmer and Pritchett (2001). The first principal component captures sufficient variation in the data.
- 16 This was done by subtracting the mean of the wealth index, and then dividing by its standard deviation.
- 17 These results present something similar to a difference-in-differences specification. However, the baseline data are recalled rather than measured at baseline.
- 18 The model was tested both with and without clustering at the community level, and it was found that the standard errors were larger in the model with clustering, in spite of the small number of clusters in the data.
- 19 Choosing whether to match with and without replacement involves a trade-off between bias and variance. If replacement is allowed, the average quality of matching will increase and the bias will decrease, especially when the distribution of the propensity score is very different in the intervention and comparison groups. However, allowing for replacement increases the variance of the estimates because, in effect, the number of distinct comparison observations is reduced (Caliendo and Kopeinig, 2008).
- 20 It should be noted that, for all these regression techniques, robust standard errors are reported. However, the standard errors are not bootstrapped as in the main results in Section 6.
- 21 It is possible to test whether the covariates are distributed sufficiently similarly for the intervention and comparison groups using Rubin's (2001) tests. For the matching variables used in this report, with the kernel matching algorithm,

Rubin's *B* statistic is 19.7 and Rubin's *R* statistic is 1.84. Both of these are within the bounds that Rubin recommends to ensure that covariates are sufficiently balanced for OLS regression methods to be valid.

- 22 Equation 2 is estimated without restricting the data to the area of common support. However, a test has also been run as to whether the results are sensitive to re-estimating the regressions with propensity-score weighting, using the approach described as the fourth robustness check in Appendix 4. This makes little difference to the results shown in Table A5.1.

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