RESILIENCE IN BOLIVIA

Impact evaluation of supporting communities to adapt to changing weather patterns and improve their livelihoods

Effectiveness Review Series

2015/16

Photo: View over the camellones project on the outskirts of the town of Trinidad. Credit: Alejandro Chaskielberg

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EXECUTIVE SUMMARY

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

During the 2014/15 financial year, one of the projects that was randomly selected for an Effectiveness Review was 'Supporting communities in Bolivia to adapt to changing weather patterns and improve their livelihoods'. This project was carried out by Oxfam in partnership with the Kenneth Lee Foundation in several communities of the municipality of Trinidad in the Beni Region of Bolivia between 2010 and 2013. The key activities of this project (together with its predecessor, launched in 2008) were to construct and promote the use of 'camellones', an indigenous land-management system intended to protect livelihoods (agriculture and fish farming) against drought or flood. This Effectiveness Review, for which fieldwork was carried out in April 2015, was aimed at evaluating the success of this project in enabling households that directly participated in the camellones to strengthen their livelihoods, to minimise risk from shocks and to adapt to emerging trends and uncertainty.

EVALUATION APPROACH

This Effectiveness Review used a quasi-experimental evaluation design to assess the impact of the project activities among the people who directly participated in production from one of the camellones constructed under the two projects between 2008 and 2013. It is important to note that a major emphasis of the camellones projects – and an important reason for constructing the camellones in and around the regional capital of Trinidad – has been to influence municipal, regional and national government bodies to take an interest in and eventually to invest in the construction of camellones themselves. The success of these advocacy activities on influencing policymakers was not evaluated in this Effectiveness Review. In particular, the effects of more recent investments in the camellones made by the municipality of Trinidad are not covered by the Effectiveness Review.

To implement the Effectiveness Review, a survey was carried out in the three rural communities and one peri-urban area in which camellones were constructed by Oxfam and the Kenneth Lee Foundation between 2008 and 2013. All the households that were registered as participating in production at one of the camellones sites in at least one year between 2008 and 2013 were targeted for interview. There were 179 such households, of which 135 could be identified and located and were willing to be interviewed. For comparison purposes, 459 households were interviewed at random from rural communities and from neighbourhoods in the city of Trinidad with similar characteristics to those from where the project participants were drawn. At the analysis stage, 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, to increase confidence when making estimates of the project's impact.

The potential of this Effectiveness Review to draw conclusions about the impacts of the project was limited by the small number of project participants that were available to be interviewed, by the fact that many of them had participated in the project activities only in earlier years, and by production from the camellones having been disrupted by severe flooding in the year prior to the survey. In addition, the survey was conducted soon after contentious elections, which may have affected respondents' willingness to provide sensitive information during the survey questions. Nevertheless, some conclusions can be drawn with reasonable confidence.

Table 1: Key results of this Effectiveness Review

Outcome area	Linked to project logic?	Evidence of positive impact?	Comments
<i>Engagement in fish farming and crop production</i>	Yes	Yes	Significantly higher proportions of households of project participants were engaging in fish farming and crop production in 2013 than were comparison households.
<i>Increased household income</i>	Yes	No	No evidence that household income was higher in 2014/15 among project households than comparison households, nor that there have been significant improvements in other indicators of household wealth over the projects' lifetimes.
<i>Better able to cope with the 2014 flood</i>	No	Not clear	Project participants in the rural communities were more likely to have been negatively affected by the floods, but also appear to have increased their ownership of physical assets between 2013 and 2015 by more than those in comparison communities.
<i>Indicators of resilience</i>	Yes	No	Evidence of positive impact on only two or three of the characteristics of resilience, and not on the overall index. (See breakdown of characteristics at Table 2.)
<i>Women's involvement in productive work</i>	Yes	Yes	Women in project households were contributing a much higher proportion of overall household income than they were in comparison households – or, at least, their contribution was better recognised.
<i>Women's ability to make and influence decisions</i>	Yes	No	Little or no difference between the project and comparison households in indicators of women's self-confidence or influence in decisions in the household or community.

Results apply across all households that were registered producers in one of the camellones established under this project in at least one year between 2008 and 2013, and who were available and willing to be interviewed during the survey period. The impact of the advocacy work and of the various project activities in communities where camellones were not constructed was not evaluated in this Effectiveness Review.

The project was intended to help households cope with moderate floods, whereas the 2014 flood was extreme.

'No evidence of positive impact' does not mean 'evidence of no impact'. This table reports only whether or not there was strong evidence of a positive impact.

RESULTS

The survey results clearly show that most of those who were identified by the implementers as project participants had taken part in production at one of the camellones sites at some point. Even though a substantial proportion of the project participants were no longer working on the camellones by 2013, the number of project households engaged in fish farming and/or crop production at that time was still significantly larger than among comparison households.

The survey data do not provide any indication that the camellones have made a major contribution to income for the average participant household. No evidence of a significant positive change was found when considering the detailed data on household income (with the caveat that the income data refer to 2013/14, when many of the participants had already withdrawn from the project, and when the functioning of the camellones had been disrupted by the severe flood of 2014), nor the data on crop production in 2013, nor changes in indicators of household wealth (housing conditions and ownership of assets and livestock) since 2008. It should be noted that the project would have had to have made a considerable impact on

participants' livelihoods for that change to be detectable from our data. However, it should be noted that when camellones participants were asked qualitative questions about the project, most reported having generated only a small amount of income from the camellones. Only a minority (12 out of 52 camellones participants who responded to the question) reported having generated significant enough income from the project to make savings or investments. When asked about why they stopped participating in the project, only two respondents said that they had moved on to a more lucrative livelihood activity. (Unfortunately, the project participants who said they had worked only in fish farming with the camellones were not asked the qualitative questions. The results do, however, include responses from those who said that they had been engaged in *both* fish farming and crop production with the camellones.)

Project participant households were found to have been just as affected by the flood of 2014 as were comparison households – although that there is some indication that project households in the rural communities may have been more successful in protecting their assets than were comparison households in rural communities. However, the 2014 flood was exceptionally severe and caused damage to most of the camellones sites, so we do not expect this experience to provide a comprehensive picture of how the project affected participants' ability to deal with risk. Instead, the Effectiveness Review examined a selection of characteristics of resilience, which are thought to be indicators of people's ability to deal with shocks, stresses and uncertainty more generally. The influence of the project could be seen in the increasing number of household members who were involved in producing income (and therefore reducing dependence on the primary earner in each household), and perhaps – though less clearly – on promoting knowledge and understanding of climate change and improving links to agricultural and piscicultural technical advisers from the municipality. No differences were found between the project and comparison households in most of the other characteristics of resilience, so there was no significant difference between the two groups in the overall index of resilience.

One section of the questionnaire was addressed specifically to the senior female member of each household. A clear effect from the project could be seen in promoting women's engagement in livelihoods work: women in the project households were found to be responsible for generating a considerably larger proportion of the household's income than were women in comparison households. However, little difference was found between women in project and comparison households in indicators of women's confidence or in their influence on decisions within the household or community. There is even some tentative evidence that women in project households generally said that they had *less* influence on some types of household decisions (and particularly on family planning) than those in comparison households. This may be an indication that they had higher expectations about the appropriate level of influence that they *should* have, and so more dissatisfaction if this level is not met.

Table 2: Characteristics of resilience examined in this Effectiveness Review

Dimension	Characteristic	Connected to project logic?	Evidence of positive impact?
<i>Livelihood viability</i>	Stable employment	No	No
	Income from sources less vulnerable to flood	Yes	No
	Income from sources less vulnerable to drought	Yes	No
	Multiple income earners	Yes	Yes
	Ownership of productive assets	No	No
<i>Innovation potential</i>	Attitude to change	No	No
	Understanding of climate change	Yes	Not clear
	Access to credit	Yes	No
	Adoption of new practices or initiatives	Yes	No
<i>Access to contingency resources and support</i>	Savings	No	No
	Social support networks	No	No
<i>Integrity of the natural and built environment</i>	Security of ownership of the house	No	No
	House protected from flood	Yes	No
<i>Social and institutional capability</i>	Access to state extension services	Yes	Yes, in peri-urban area only
	Access to and ability to make use of early-warning information	No	No
	Confidence in authorities to support in a crisis	No	No
	Involvement in community decision-making	Yes	No
	Participation in community groups	Yes	No

PROGRAMME LEARNING CONSIDERATIONS

Review the approach used to identify and select project participants, and consider how best to facilitate management of the camellones at the community level.

In the early years of the camellones projects, large numbers of participants were recruited to work on the camellones. In the rural areas in particular, the participants made up a sizeable proportion of the population of each of the communities. However, most of these people participated in the project for only a year or two: by 2013, relatively small numbers of producers were still working on the camellones. This was partly due to a deliberate decision on the part of the implementers in later years to restrict participation in order to allow those who remained to produce at a more efficient scale – but feedback from the participants suggests that withdrawal from the project was also partly due to dissatisfaction on their part. It is natural that not everyone will find that engaging in crop production or fish farming is the best way that they can invest their time, and experimenting with which types of people to work with is to be expected during the first implementation of a new project. However, it will be important in future camellones projects

to have a clear strategy for targeting those who have the most potential to engage in and benefit from work on the camellones.

At the same time, many of the project participants in the rural communities mentioned that disputes about the management of the camellones were an important reason for their choosing to leave the project. Project staff should proactively look for ways to manage relations both among the project participants and with the wider community. Focusing on providing training may not be enough to ensure sustainability and effective results.

Carry out regular monitoring visits with project participants, to gain insight into how the project activities are developing on the ground, as well as with those who have chosen to leave the project.

Some of the weaknesses in the management of the camellones that were mentioned by project participants during the survey could probably have been understood earlier if there had been a stronger system for monitoring participants' experiences with and perceptions of the project. Collecting regular feedback from a sample of participants is crucial, not only in order to identify implementation problems that can be corrected, but also to understand whether expectations about the project's ability to boost livelihoods and resilience are being met. Such monitoring need not be a formal process, but it is important that the results are recorded and reviewed regularly, so that implementers can adjust their approach as necessary.

An even higher priority would be to try to interview people who voluntarily withdraw from a project like this, to understand their reasons for doing so, and how the project could have supported them better. While some may have stopped working on the camellones for positive reasons – such as finding a new job opportunity – these cases appear to have been a minority. It is not enough to be satisfied with reaching targets for the number of participants engaging in the project in each year, if the specific people involved are frequently changing. For a household to generate positive results from a project such as this can be expected to take some time, so it is important to understand and take action if people are leaving before they have been able to realise significant benefits.

Seek to carry out a more comprehensive evaluation of the impacts of camellones projects on household livelihoods and on resilience, in order to build an evidence base for decisions on future scale-up.

This Effectiveness Review did not find clear evidence that the camellones projects have had significant positive effects on household incomes and on risk management. However, the limitations faced by the review – particularly the small number of participant households who could be interviewed, the fact that many of them had withdrawn from participation some time before, and the disruption caused by the 2014 floods – meant that the potential for identifying any positive effects was limited. The data do provide some reasons for optimism that the had a positive impact on the livelihoods of participant households, although the qualitative feedback received from participants was less positive.

The launch of further camellones projects in other municipalities in Beni provides an opportunity to carry out an evaluation of the impact of those projects, preferably when implemented on a larger scale and using a more settled model of implementation. This would ideally include collecting baseline data from project participants and non-participants, then following up after they have been engaged in the project for two to three years, to see what differences can be observed. Investing in good-quality evaluation at this stage would provide evidence that will enable municipalities and other government bodies, as well as Oxfam and partners, to make informed decisions about the implementation of camellones projects in the future and the impacts that can be expected from them.

Further investigate the results that camellones projects are having on women's involvement in livelihoods activities, and what potential there is for this to be translated into empowerment.

The clearest result from the Effectiveness Review was that women in the project households were seen to be more engaged in income-generating activities than are women in comparison households. What is not known is the extent to which this implies that women are engaging in additional productive work - and so increasing overall household income – and the extent to which it reflects better recognition of work that women were doing anyway. This will be an important question to assess in evaluating the impact of future camellones projects.

The natural next question is whether these changes have resulted in any changes in women's position in their households or communities. The suggestion in this report that women in project households may have higher *expectations* about the influence that they should have in household decisions may be seen to be a positive step towards empowerment, though clearly it remains to be seen whether this translates in time into actual increased influence. The project team should clarify the specific changes that they are expecting to see in women's empowerment, and then ensure that projects have a strategy to further those aims.

1 INTRODUCTION

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

During the 2014/15 financial year, one of the projects that was the randomly selected for an Effectiveness Review was 'Supporting communities in Bolivia to adapt to changing weather patterns and improve their livelihoods'. This project was carried out by Oxfam in partnership with the Kenneth Lee Foundation in several communities of the municipality of Trinidad in the department of Beni in the Amazon region of Bolivia, between 2010 and 2013. The key activities of this project (together with its predecessor, launched in 2008) were to construct and promote the use of 'camellones', a land-management system intended to protect livelihoods (agriculture and fish farming) against drought or flood. The Effectiveness Review, for which fieldwork was carried out in April 2015, was aimed at evaluating the success of this project in enabling households to strengthen their livelihoods, to minimise risk from shocks and to adapt to emerging trends and uncertainty.

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

Figure 1.1: Map of Bolivia

Source: Oxfam

2 PROJECT DESCRIPTION

The project under review aimed to provide opportunities for engaging in fish farming and agricultural production, to provide households with an additional source of income in order to reduce vulnerability to climate shocks and improve food security.

The department of Beni is a flat tropical area, which is prone both to drought during the dry season and to seasonal flooding. Recent years have seen some abnormally severe floods, in particular in 2007 and 2014 which led to many communities being submerged or cut off, to crops being destroyed, and much land becoming unusable for farming or grazing livestock for several months. In 2014, flood waters threatened the city of Trinidad, the regional capital, in spite of a defensive barrier that had been constructed in the years previously. While the city centre was saved from flooding through emergency earthworks, much of the peri-urban area – composed of informal settlements where recent migrants to the city had settled – was submerged. In addition to the risk of flooding, water scarcity can be a problem during the dry season, particularly for those dependent for their livelihoods on agriculture or livestock rearing.

‘Camellones’ is an indigenous land management system that was widely used across the region in the pre-Columbian era. A series of parallel channels are dug, and land is built up into raised platforms up to two metres high between the channels. The aim of this being that during a flood, the raised land is still above the water level, while during the dry season, water is preserved in the channels between the camellones, as shown in Figure 2.1. Fish farming can be carried out in the channels, while the platforms of the camellones can be used for crop production throughout the year.

Figure 2.1: Functioning of camellones

Source: James Painter, 'Bolivians look to ancient farming', BBC News, 18 August 2009, <http://news.bbc.co.uk/2/hi/americas/8187866.stm>

A local organisation, the Kenneth Lee Foundation, has worked since the 1960s on researching the use of camellones and on encouraging a revival in their use. Following the floods of 2007, Oxfam worked with the Kenneth Lee Foundation to launch a pilot project to construct camellones in Loma Suárez, a rural community located on the River Ibare, close to the city of Trinidad. This initiative was expanded over the next two years with camellones being built in another two riverine communities, Copacabana and Puerto Almacén. (An attempt to construct camellones in a fourth riverside community failed, as the land was found to be unsuitable.)

The project selected for the Effectiveness Review was a second phase of the camellones work. The project was carried out between April 2010 and October 2013. While continuing to support producers at the three existing camellones sites, this project also established a new site at Pedro Ignacio Muiba (PIM), on the outskirts of the city of Trinidad. Many of those living in PIM and other peri-urban neighbourhoods have informal jobs in the city, and so do not have a regular, stable income. The camellones initiative was intended to provide recent migrants to the city with an additional source of income, and one which was resilient both to floods and drought.

At each of the camellones sites, a local association was established to manage the fish farming. Fish farming is a communal activity carried out by members of the association, who share the workload and the revenue generated. In contrast, agriculture on the camellones is carried out by individual households, who are each allocated a plot of land. The camellones built under this initiative are each 100 metres long and approximately 10 metres wide. In the early years, households were each allocated a quarter of a camellón (an area of 250 m²). This was found not to be an efficient area of land to work with, so in recent years households have instead been allocated a whole camellón each (an area of 1000 m²).

In the rural communities, assemblies were held to select households to be given the opportunity to participate in the camellones projects. For the camellones site at PIM, potential participants were sought firstly by carrying out awareness-raising among community groups in both PIM and nearby neighbourhoods, while radio advertisements broadcast across the city encouraged people to attend a series of training workshops. To be eligible to participate in the camellones, people had to have some experience in agriculture or fishing (which common among recent migrants from rural areas, but not among people who had been settled in the city for many years), and they had to perform well on a test at the end of the training. Most of those participating in fish farming are men. For the agricultural component, the project managers specifically encouraged women to participate in and take responsibility for crop production, even though agricultural work has traditionally been a male role.

Throughout the lifetime over the two projects, Oxfam and the Kenneth Lee Foundation have provided training and technical support to the producers at the camellones sites. They also set up a revolving fund to provide credit for producers to make productive investments, such as the purchase of inputs.

The households that are producing at the camellones sites (in both fish farming and agriculture) have changed over the course of the project.¹ In most cases, households participated for only one or two years, either because they found that the camellones work did not suit them, or because they had been able to find alternative livelihoods opportunities (apparently in some cases because the income from camellones production enabled producers to invest in productive assets).

A major component of Oxfam's and the Kenneth Lee Foundation's work – and an important reason for establishing the camellones in and around Trinidad – has been to influence municipal, regional and national government bodies to take an interest in and eventually to invest in the construction of camellones themselves. A commitment to the use of camellones has been incorporated in a national government development plan for Beni region, and Oxfam and the Kenneth Lee Foundation are now working with other municipalities in the region on the construction of new camellones. In Trinidad itself, the management of the camellones site at PIM was passed to the municipality of Trinidad in 2013. The municipality constructed a storage and processing centre for the production from the PIM camellones site in 2012, and has since made other infrastructure investments (e.g. greenhouses, and now construction of an office). The municipality has also allocated municipal agricultural and piscicultural advisers to provide continuing support to the producers at the camellones sites.

The flood of 2014 was the most severe for several decades, and the water level exceeded the level that the camellones had been designed to cope with. Production at each of the camellones sites was disrupted, and some of the camellones were destroyed. Since then the municipality of Trinidad has taken responsibility for rehabilitating the camellones. Production at some sites, though not all, had re-started by the time of the Effectiveness Review fieldwork in April 2015.

This Effectiveness Review focuses on the impact of the four camellones sites in the Trinidad area on those who directly participated in working at those sites. The impact of the work in influencing municipalities and other government bodies to invest in camellones is not assessed. However, the impact of the investments that have been made in these four camellones sites by the municipality cannot be completely differentiated from the impact of the work carried out by Oxfam and the Kenneth Lee Foundation: thus this Effectiveness Review will, by its nature, conflate the impact of the investments that all the partners have made in these sites. It is important to note, however, that the majority of project participants had stopped working on the camellones by 2013, whereas most of the investments made by the municipality were made after that date.

As mentioned above, the project also attempted to construct camellones at a fourth rural community, Puerto Varador, but that area was found to be not suitable for the construction. Producers in Puerto Varador were instead given some support in conventional agricultural production. There was also a small project to support elderly people doing kitchen gardening in a peri-urban area on the eastern side of the city of Trinidad. The impact of those activities is not evaluated in this Effectiveness Review.

Other activities carried out under the project included a series of workshops on gender issues and women's rights, on family planning, and on elderly people's rights. These workshops were not restricted to the camellones participants, but were carried out among the wider population in those same rural communities, as well as in PIM and the surrounding neighbourhoods.

3 EVALUATION DESIGN

The central problem in evaluating the impact of any project or programme is how to compare the outcomes that result from that project with *what would have been the case* without that project having 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 carried out. In any evaluation, that ‘counterfactual’ situation cannot be directly observed: it can only be estimated.

In the evaluation of programmes that involve a large number of units (whether individuals, households, or communities), common practice is to make a comparison between units that were subject to the programme and those that were not. As long as the two groups can be assumed to be 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.

An ideal approach to an evaluation such as this is to select the sites in which the programme will be implemented at random. Random selection minimises the probability of there being systematic differences between the project participants and non-participants, and so maximises the confidence that any differences in outcomes are due to the effects of the project.

In the case of the project examined in this Effectiveness Review, the communities where the project was implemented were not selected at random. Instead, the implementers targeted specific communities and areas that were seen to be particularly vulnerable to climate-related risks (particularly to flood), and which were suitable for construction of camellones. However, within the same area there were a number of other communities with similar characteristics and that face similar risks, but which were not included in the camellones project. This allowed a ‘quasi-experimental’ evaluation approach to be adopted, in which the situation of people living in communities not included in the project was assumed to provide a reasonable counterfactual for the situation of people who benefited from the project.

It is important to note that within the project communities, those who participated in the project were not a random cross-section of residents. Instead, participants had to make an active decision to participate. (The exception to this is in the village of Copacabana, where the community decided that *all* households residing in the community would be involved in producing from the camellones.) The process for identifying and selecting project participants differed between the different project sites. In the rural communities, participation was normally open to any household in the community, while in the peri-urban area (for the camellones site at Pedro Ignacio Muiba), a media campaign in the first year invited potential participants to participate in training, with a test at the end of the workshop to select those who would be allocated a space in the camellones. A further complication is that, as discussed in Section 2, the participants in the camellones changed from year to year, and the processes by which new participants were identified were idiosyncratic.

For all these reasons, it is likely that the people who chose to participate in the camellones project tended to differ from their neighbours who did not – for example, in their education level, their sense of initiative, willingness to take risks, or in their social connections. For comparison purposes, it would have been ideal to interview people in the comparison communities who had similar characteristics. Unfortunately there was no clear way to identify who in the comparison areas would have similar characteristics.

Instead, interviews were conducted in the comparison areas with a sample of households from across the community.² At the analysis stage, households in the project communities were then ‘matched’ with households with similar characteristics in the non-project (or ‘comparison’) communities. Matching was performed on the basis of a variety of observable characteristics – including household size, education level, productive activities, and indicators of material wellbeing, such as housing conditions and ownership of assets. Since some of these characteristics may have been affected by the project itself (particularly those relating to productive activities and wealth indicators), matching should be performed on the basis of these

indicators *before* the implementation of the project. Although baseline data were not available in this case, survey respondents were asked to recall some basic information about their household's situation in 2008, before the project was implemented. This recalled baseline data is unlikely to be highly accurate, but – in the absence of any alternative – using it as a proxy to provide some measure of households' baseline situation is thought to enhance the reliability of the comparison used to make conclusions 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 2.) One practical problem is that it would be 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 being in an intervention community, given particular background variables or observable characteristics. Households in the project and comparison communities were then matched based on their having propensity scores within certain ranges. Tests were carried out after matching to assess 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 process, results were also estimated using multivariate regression models. Like propensity-score matching, multivariate regression also controls for measured differences between 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 propensity-score matching 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 motivation, 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 in evaluating a project in which participants were to some extent self-selected. This point is further discussed in Sections 5 and 6, when interpreting the statistical results.

4 DATA

4.1 RESPONDENTS INTERVIEWED

All households that had participated in production from one of the camellones for at least one year were targeted for interview under this Effectiveness Review. A full list of project participants was drawn up from project records, giving a total of 191 names. Twelve of these were found during the course of fieldwork to be members of the same household as others on the list, so that the total number of project participant households was 179. In the event, 10 of these households were found to have left the Trinidad area, one was deceased, two declined to participate in the survey, and 31 could not be identified by the survey team. The final number of interviews conducted with project participants was 135.³

The approach to identifying comparison areas was different in the rural and the peri-urban areas. The rural communities included in the project were chosen specifically for their vulnerability and for their being suitable for the construction of camellones. The three project communities (as well as the fourth, Puerto Varador, where the project was launched, but was found not to be suitable for construction of camellones) were located along the River Ibare within 20 kilometres to the west of the city of Trinidad. The Effectiveness Review team endeavoured to find communities for comparison purposes with similar characteristics within the same area. Two of these (Puerto Ballivián and Puerto Geralda) were located in the same area, also on the River Ibare. At the time of the fieldwork, the municipality of Trinidad was planning the construction of camellones in Puerto Geralda, but the work had not yet begun. No additional communities suitable for comparison could be found within the same immediate area; instead, three comparison communities with similar characteristics to the project communities were found to the south-east of the city of Trinidad, in an area seen as equivalently vulnerable to flooding.

In the rural communities, participation was open only to residents of the community itself, while in the peri-urban area (for the camellones site at Pedro Ignacio Muiba), participation was in principle open to anyone from across the city. The opportunity to participate in the project was initially advertised by radio across the city. However, in practice the majority of those who expressed an interest came from Pedro Ignacio Muiba and from other neighbourhoods on the western side of the city. Many of the residents of neighbourhoods located further away from the camellones site were thought either not to be aware of the camellones project and the opportunity to participate, or were prevented from doing so by the inconvenience of travelling to the camellones site. For comparison purposes, therefore, three neighbourhoods in the peri-urban area to the south and east of the city were identified, which had similar characteristics to Pedro Ignacio Muiba, but where very few camellones participants were residing. Importantly, those comparison neighbourhoods were (like Pedro Ignacio Muiba and most of the other neighbourhoods where project participants resided) areas of recent settlement that had experienced a high level of recent inward migration. The comparison areas were also like Pedro Ignacio Muiba and other neighbourhoods of project participants in that they were located outside the main 'ring' of the city that protects against flooding.

As discussed in Section 3, in the comparison areas it was not possible to identify who the specific individuals and/or households were who would have participated in the project, if they had had the opportunity. Instead, a random sample of households was interviewed in each of the comparison areas; identification of the households most appropriate for comparison to the project participants was made at the analysis stage using propensity-score matching (discussed further in Section 4.2 and Appendix 2).

In the rural communities identified for comparison, all households in the community were targeted for interview. In the three peri-urban neighbourhoods used for comparison, households were selected at random. The process of random selection was as follows:

- Detailed maps of the three neighbourhoods were obtained from the national statistical office, and the total number of city blocks in each neighbourhood was counted.
- The number of comparison interviews required was divided by the number of city blocks across the three neighbourhoods, so that three interviews would be conducted in each block.
- Upon arriving at each block, enumerators counted the number of dwellings in the block.
- Dwellings of households to target for interview were selected through systematic random sampling – that is, by selecting a random start point and using a constant sampling interval. This process was carried out electronically: enumerators entered the block number and the number of dwellings into the survey interface, and the interface informed them of the first, second and third dwellings at which households should be targeted for interview in that block. Dwellings were each identified by a number, counting clockwise starting at the north-east corner of each block.

In each household, in project and comparison areas, enumerators were instructed to carry out the interview with either the head of household or the spouse or partner of the head of household. In cases where neither the head of household nor his/her spouse was present or was not available to participate on the initial visit, the enumerator made further visits in order to interview as many as possible of the selected households. Only in the case of one household was no respondent found after repeated visits.

Neither enumerators nor survey respondents were informed that the survey was commissioned by Oxfam, and no link to any specific project work was mentioned. However, enumerators were aware from the content of the questionnaire that the camellones work was a particular subject of interest. It is possible that the targeting of named respondents in the project areas as those who had participated directly in the camellones, also led respondents to suspect a link to the camellones project.

It should be noted that the survey was carried out immediately following local and regional elections in Bolivia, which was a period of uncertainty and heightened tension. This may have affected respondents' trust in the survey and their willingness to provide sensitive information. If so, the accuracy of some of the survey data collected – particularly that relating to household income – would be reduced. However, this would have been equally likely to affect responses from both project participant and comparison households, so it is not thought to bias the comparison of outcomes between the two groups.

All respondents were given a small gift in return for their participation. Just under five per cent of targeted households in the comparison areas declined to participate in the survey, with no significant difference between the rural and peri-urban areas. Two of 137 project participant households also declined to participate in the survey.

Interviews were carried out at respondents' homes. Responses were recorded on electronic tablets. For the small number of open questions in the questionnaire, an audio recording was made of responses, which was transcribed later by the survey managers.

Table 4.1: Intervention areas and numbers of households interviewed

Area	Community or neighbourhood	Project participant households interviewed	Project participant households that could not be interviewed
<i>Rural</i>	Puerto Almacén	22	5
	Copacabana	26	13
	Loma Suárez	24	4
<i>Peri-urban</i>	Various, but concentrated in Pedro Ignacio Muiba and neighbouring areas	63	22
Total		135	44

Table 4.2: Comparison areas and numbers of households interviewed

Area	Community or neighbourhood	Households interviewed
<i>Rural</i>	Puerto Ballivián	37
	Puerto Geralda	15
	Peroto	41
	Samopae	37
	Miraflores	12
<i>Peri-urban</i>	13 de Abril	201
	Venecia and Patanal	70
	Plataforma	46
Total		459

4.2 ANALYSIS

Project participant households and comparison households were compared in terms of their demographic characteristics, livelihoods activities and economic situation in 2008 (that is, before the camellones projects began). Some of these data were based on information recalled during the questionnaire.

The full comparison of project participant households and comparison households in terms of all these characteristics is shown in Appendix 2. It can be seen that there are considerable differences between the project participants and comparison households. For example, the project participants tended to be poorer and less well-educated than the comparison households, as well as being older and having more adults and fewer children as household members. On the other hand, they seemed to have stronger social connections in 2008 than the comparison respondents did, as measured by a question about how often they used to meet socially with others from their own community or neighbourhood at that time.

The project participants were also considerably more likely to have recalled that they were engaged in crop production, fishing or fish farming, and the timber trade in 2008 than were comparison respondents.⁴ It is possible that recall errors are also partly responsible for these differences. For example, few if any people in the Trinidad area were thought to have engaged in fish farming before the camellones project was launched, but in the survey 17 per cent of the project households recalled having been engaged in fish farming in 2008. If respondents made errors in recalling during the questionnaire when they started fish farming, it is possible that those who engaged in crop production for the first time under the camellones project also made similar errors about whether that was before or after 2008. Recall errors of this type would imply that the true difference between the project and comparison households in engagement in fish farming and crop production in 2008 may not be as large as is implied by the data shown in Appendix 2.

Any differences between project and comparison households that existed before the project have the potential to bias any comparison of the project's outcomes between the members of the project and comparison respondents. It was therefore important to control for these baseline and demographic differences when making such comparisons. 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 among the full list detailed in Appendix 2, based on which ones were thought to be the most significant in influencing respondents' participation in the project. In particular, whether or not households recalled having been engaged in fish farming or in crop production in 2008 were used for matching, in spite of the doubts about the degree of recall error in those data. 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 appeared to be reasonably well balanced in terms of each of the selected variables. One caveat is that six of the 133 project participant households could not be matched and had

to be dropped from the analysis: the consequence of this is that the estimates of the project's impact presented in Section 5 are not based on the whole population interviewed, but exclude a non-random minority.

All the results described in Section 5 of the report were tested for robustness by estimating them with several alternative statistical models, including alternative PSM models and linear or probit regression models. The results of these robustness checks are shown in Appendix 4. Importantly, one of the alternative PSM models did *not* include households' recalled participation in fish farming or crop production in 2008 as matching variables, to test for the possibility that recall error may have been influencing the outcomes derived from the main PSM model. However, 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 5, in the text or in footnotes.

It would clearly have been of interest to understand the impact of the project not only for the participant households as a whole, but also for specific sub-groups. Unfortunately the small number of project participants that were interviewed limits the sub-group analysis that can be done. Nevertheless, the results presented here were examined for differential impacts between the rural and peri-urban areas, as well as for differences between those who engaged in fish farming and those who engaged in agriculture.⁵ Where any significant differences in outcomes have been found between these subgroups, this has been noted in the text in Section 5.

5 RESULTS

This report is intended to be free from excessive technical jargon, with more detailed technical information being restricted to the appendixes and footnotes. However, there are some statistical concepts that cannot be avoided in discussing the results. In this report, results will usually be stated as the average difference between households living in villages where the project was implemented (that is referred to as the 'intervention group') and the matched households in villages where the project was not implemented (named the 'comparison group'). In the tables of results on the following pages, statistical significance will be indicated with asterisks, with three asterisks (***) indicating a p -value of less than 10 per cent, two asterisks (**) indicating a p -value of less than 5 per cent and one asterisk (*) indicating a p -value of less than 1 per cent. The higher the p -value, the less confident we are that the measured estimate reflects the true impact. Results with a p -value of more than 10 per cent are not considered to be statistically significant.

5.1 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. In the tables of results, asterisks are used to indicate where the differences are statistically significant at least the 10 per cent significance level.

The results are shown after correcting for apparent baseline differences between the households interviewed in the project communities (the 'intervention group') 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, this is discussed in the text or in footnotes.

It is important to stress that the results presented in this section are average results across the whole group of project participants interviewed. Clearly it would be of interest to understand the impact of the project at a more local level, and among particular sub-groups of participants. Unfortunately the small number of project participants that were interviewed limits the sub-group analysis that can be done. Where any significant differences in outcomes have been found between the rural communities and the peri-urban area, this has been noted in the text.

Two further points should be recalled when interpreting the results presented in this section. Firstly, six of the 133 project participant households surveyed were excluded from the analysis during the matching process. This means that the results shown in the tables in this section are not based on a fully representative sample of households in the project communities. However, some of the alternative statistical models tested (and discussed in the text or in footnotes where appropriate) do include the full set of households interviewed in the project communities. Secondly, if there are any 'non-observable' differences between the project participants and comparison households – such as individuals' attitudes or motivation, differences in local leadership, weather or other contextual conditions – then these may affect the estimates of outcomes. Given that the project participants are a self-selected group, this possibility cannot be excluded and must be borne in mind when interpreting the results.

5.2 INVOLVEMENT IN PROJECT ACTIVITIES

The first step in understanding what impact this project has had is to examine the extent to which respondents reported that they have received the types of support and participated in the various activities implemented under the project. Table 5.1 shows the differences between those interviewed in the project and comparison communities in terms of their knowledge of and participation in the camellones.

As would be expected, nearly all those (94 per cent) who had been identified by the implementers as project participant households recognised the word ‘camellones’. In contrast, only a third of the comparison respondents did so. As can be seen in column 2 of the table, just over three quarters of those identified as project participants reported that their household had worked on producing from a camellón at some stage. Nearly half of these said that they had participated in both fish farming and agriculture (a considerably higher proportion than was implied by the administrative records from the project), with the remaining participants split evenly between fish farming and agriculture.

The fact that nearly a quarter of those identified as households of project participants said that they had *not* participated in production from a camellón is itself interesting. Of these 30 cases, nearly half (13 households) were from Copacabana, where all households in the community were said to have been involved in producing from the camellones. Most of the remaining cases were from households living in the peri-urban area. It should be recalled that interviews were conducted not necessarily with the designated respondent, but with the head of household or his or her spouse. It is conceivable, especially in the peri-urban area, that a household member may have worked on the camellones at some point without his or her spouse clearly understanding what this work involved, and even without being familiar with the term ‘camellones’. It is also possible that, since these questions were asked at the end of the questionnaire, some respondents preferred to answer ‘no’ so as to avoid having to answer follow-up questions. If either of these were the case, then the figures shown in Table 5.1 for project participation among the intervention group would be underestimated.

The figures in Table 5.1 also imply that significant minorities of the comparison households had in fact participated in the camellones. In the two rural comparison communities that were closest to the project sites (Puerto Ballivián and Puerto Geraalda), the majority of respondents had heard of the camellones, and nearly a third reported having participated. It seems possible that some households from these communities may have had some involvement in work in the nearby project communities, without their having been recorded by the project as participants. If so, this would mean that the comparison of outcomes between the project and comparison households in this report would underestimate the true outcomes of the project. For this reason, an alternative propensity-score matching model was created which excluded all those comparison households that claimed in the questionnaire to have participated in the camellones, and that model was used to derive alternative estimates for each of the outcome measures examined in this report. In no cases did the alternative PSM model produce any results that were markedly different from those presented in the tables. (Details are shown in Appendix 4.) It should also be noted that in the other rural comparison communities and among the comparison respondents in the peri-urban areas of Trinidad, only very small numbers reported having participated in the camellones project; these cases seem likely to be a result of misunderstanding on the part of respondents, rather than actual contact with or involvement with camellones.

Table 5.1: Households' awareness of and participation in production from camellones

	1	2	3	4
	Respondents who recognised the term 'camellones'	Households that have participated (at any time) in fish farming or agriculture with camellones	Households that have participated (at any time) in fish farming with camellones	Households that have participated (at any time) in agriculture on a camellón
	%	%	%	%
<i>Intervention group mean:</i>	93.8	77.5	57.4	54.3
<i>Comparison group mean:</i>	32.2	13.1	8.5	9.5
<i>Difference:</i>	61.6*** (3.8)	64.4*** (4.0)	48.9*** (4.2)	44.8*** (4.4)
<i>Observations (intervention group):</i>	129	129	129	129
<i>Observations (total):</i>	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Several supplementary questions were asked about the length of time for which households were involved in working on the camellones, and about other aspects of their experience. Most (approximately two thirds) said that they had worked on the camellones for one or two years in total – a result that concurs with the project records. When asked about what they did with the income earned from the camellones work, nearly a third of the respondents said that the amount received had been very small. (A technical error unfortunately prevented this latter question from being asked to those households that said they had engaged in fish farming, but not in crop production in the camellones. However, the results do include those – a larger number – who said that they had engaged in fish farming *and* crop production.⁶) Most of the remainder reported using the income from the camellones work for food and other day-to-day household expenses. Only 12 of 52 respondents who provided an answer mentioned saving or making any positive investment with the proceeds from the camellones work. Investments mentioned included the purchase of a freezer or other productive equipment, and purchase of agricultural inputs.

Approximately a quarter of the project participants said that they were still working on the camellones at the time of the questionnaire – a figure that was higher than expected, and which presumably includes some who are not officially registered as current participants. Just under a third of those who had worked on the camellones at some point but then stopped, said that they believed they would have the opportunity to participate again in the coming season if they wanted to. However, when asked in an open question for the specific reasons why they stopped working on the camellones, the majority of those in the rural communities mentioned disputes. Many stated that they felt that others had benefited from their work on the camellones, or that had not received income which they believed was due to them. This was different in the peri-urban area, where respondents were more likely to say that they stopped either because of the physical difficulty of reaching the camellones, or because of the floods of 2014. Only two of the 51 respondents who provided an answer said that they had stopped work on the camellones because they had found a better economic opportunity: in one case a household member found a salaried job, and in one case a household decided to focus on cultivating their own land. (Again this question was not asked to those who reported having been engaged in fish farming only, though it does include the larger number who said they had been engaged in both fish farming and crop production in the camellones.)

Apart from the camellones themselves, an important aspect of the project was the training and support that was provided to participants. Table 5.2 compares project participants and

comparison households in terms of the proportions who reported having participated in various forms of training during the project's lifetime. As would be expected, project participants were much more likely than comparison households to have received training in agriculture and in fish farming. A somewhat smaller proportion of the project participants also confirmed that they had received training in marketing their produce. There was no corresponding effect on the proportion of households who reported having received training on climate change. However, it should be noted that promoting understanding of the risks of climate change was implicit within the broader training provided under the project, rather than discussed explicitly as a separate theme.

It will be recalled from Section 2 that, apart from the livelihoods support, the project also involved carrying out workshops and awareness-raising sessions on women's rights (including on family planning) and on rights for elderly people. These activities were not targeted specifically at the camellones project participants, but they were carried out in the same communities and neighbourhoods, and so it would be expected that many of the camellones participants had also taken part in these sessions. (These workshops were not carried out in the communities and neighbourhoods used for comparison in this review.) Columns 5 to 7 of Table 5.2 show that the proportions who reported receiving training in women's rights or elderly people's rights were no higher on average among the project participants than among the comparison households, while the evidence for such a difference in receipt of training in family planning is weak. In fact alternative statistical models provide some evidence that the project participants in the peri-urban areas of Trinidad were more likely than corresponding comparison households to have participated in workshops on family planning and (less clearly) on women's rights,⁷ but that was not the case in the rural communities.

Table 5.3 shows the proportions who reported having received various forms of practical support during the lifetime of the project. A little more than half the project participant households reported having received improved seeds, compared to just over a third of the comparison households. It is not clear that there is any difference between the proportion of project participants and comparison households having received other agricultural inputs (except in the peri-urban area, where few comparison households were engaged in agriculture at all, and so few had received such inputs). A quarter of the project participants reported having received inputs for fishing or fish farming, against very few of the comparison households.

Finally, nearly one in five project participants (most of whom were from the rural communities) said that they had been given support in raising their house on stilts – approximately twice the proportion as among the comparison respondents. This activity was carried out by the municipality rather than by Oxfam or its partner organisations, though the support seems to some extent to have been targeted at a similar group of communities as the camellones project.⁸

Table 5.2: Households' participation in training workshops during the project period

	1	2	3	4	5	6	7
	Fish farming %	Crop production %	Marketing of production %	Climate change %	Women's rights or gender equality %	Elderly people's rights %	Family planning %
<i>Intervention group mean:</i>	39.6	48.1	22.5	14.0	33.3	17.1	30.2
<i>Comparison group mean:</i>	10.6	24.7	12.7	11.1	27.0	14.4	22.0
<i>Difference:</i>	28.9*** (4.5)	23.4*** (4.8)	9.8** (4.3)	2.9 (3.6)	6.3 (5.0)	2.6 (4.0)	8.2* (4.6)
<i>Observations (intervention group):</i>	129	129	129	129	129	129	129
<i>Observations (total):</i>	580	580	580	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table 5.3: Households having received practical support during the project period

	1	2	3	4
	Households having received seeds %	Household having received other agricultural inputs %	Households having received inputs for fishing or fish farming %	Households having been provided with a house raised on stilts %
<i>Intervention group mean:</i>	55.8	38.8	25.6	18.6
<i>Comparison group mean:</i>	38.8	31.5	4.6	8.7
<i>Difference:</i>	15.9*** (5.0)	6.2 (5.3)	21.4*** (3.6)	9.8*** (3.6)
<i>Observations (intervention group):</i>	129	129	129	129
<i>Observations (total):</i>	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.3 FISH FARMING ACTIVITIES

This and the following section will examine the evidence that the project had an impact on participant households' engagement in fish farming and in agriculture, respectively. The first column of Table 5.4 shows the proportion of survey respondents who reported having been engaged in fish farming at the time of the survey. Since the floods of 2014 are known to have disrupted work on the camellones,⁹ and since the project itself ended in 2013, respondents were also asked about whether their household was engaged in fish farming in 2013: these results are shown in the second column of the table. It is clear from these results that a significant proportion of project participants reported being involved in fish farming, against only a small number of comparison respondents. (Only one of the comparison respondents said that they had been involved in fish farming at a camellones site.) The majority of the project participants who were engaged in fish farming during 2013 reported that they (or other household members) were generally dedicating more than four hours a week to this activity.

In another section of the questionnaire, respondents were asked to provide information on their household's income during the past 12 months. For each source of income, respondents were asked for the frequency with which they received income from that source and the typical amount received, so as to estimate the approximate gross income that the household generated over those 12 months.¹⁰ It should be noted here that this data referred to the period approximately from April 2014 to March 2015 – that is, during and after the severe flooding of 2014. Since many of the project participants are known to have been participating in fish farming from the camellones only during earlier years, and since all the activities are known to have been disrupted by the 2014 flood, we would not expect to see a majority of project participants generating significant income from fish farming during that period. Nevertheless, the figures were smaller than expected: only eight of the project participant households reported receiving any income from fish farming, so (as can be seen in column 3 of the table), this made up only two per cent of the total gross income of project participant households during the year.¹¹ Among those eight households that reported some income from fish farming, the median gross income reported was 5,000 bolivianos (approximately US\$ 725), which was approximately 15 per cent of their total gross household income. Even among those who said that they were still engaged in fish farming at the time of the survey, the majority reported receiving no income from that source during the past 12 months.

Table 5.4: Households' engagement in fish farming

	1	2	3
	Households engaged in fish farming at the time of the survey %	Households engaged in fish farming in 2013 %	Proportion of gross household income in 12 months prior to the survey coming from fish farming %
<i>Intervention group mean:</i>	5.5	26.4	1.9
<i>Comparison group mean:</i>	7.1	5.7	0.0
<i>Difference:</i>	8.4** (3.5)	20.6*** (4.0)	1.9** (1.0)
<i>Observations (intervention group):</i>	129	129	129
<i>Observations (total):</i>	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.4 AGRICULTURAL ACTIVITIES

Table 5.5 shows the proportion of households interviewed who reported being engaged in crop production at the time of the survey and in 2013. As expected, the proportion of households who were farming declined between 2013 and 2015, presumably as a consequence of the 2014 floods. Also as expected, more households in rural communities were engaged in agriculture than in the peri-urban area: 60 per cent of households in rural communities reported producing crops in 2013, against only 21 per cent in the peri-urban area.¹² The figures in Table 5.5 (columns 1 and 2) do not show statistically significant differences in engagement in crop production among the project households and comparison households as a whole. However, among those project households that were registered as taking part in crop production (rather than fish farming), there is a clear difference: 53 per cent reported that they were farming in 2013, against only 37 per cent of the matched comparison households.¹³

Approximately half of those who were farming in 2013 said that at least a part of their land had access to a source of water that enabled them to cultivate during the dry season. Despite the access to water provided by the camellones, it is not clear that this proportion differed between project and comparison households.

Those who had been farming during 2013 were asked to estimate the value of the crops that they produced during that year. They were asked first to recall the approximate (gross) revenue made from crop sales, and then to estimate the value of any crops that were consumed in the home, exchanged in kind or donated to others. The resulting data are summarised in column 3 of Table 5.5, where it can be seen that households on average estimated producing crops worth 1,750 bolivianos (approximately US\$ 250) during 2013. Average crop production was of course higher among those who were actually farming at that time: approximately 3,500 bolivianos among the rural households who were farming, and 6,400 bolivianos among the (relatively small number of) peri-urban households who were farming.

Since the range of figures for total crop production was large, logarithmic transformation was carried out to reduce the influence on the overall result of households with usually high production (or that had substantially over-estimated the value of their production). It can be seen in columns 3 and 4 of Table 5.5 that there was no significant difference between the production of project participant and comparison households. This is the case even among the households who had been engaged in farming on the camellones.

As already discussed in Section 5.3, detailed data were collected on households' income from all their different sources during the 12 months prior to the survey. These data were used to estimate the proportion of (gross) household income coming from crop production. The right-hand column of Table 5.5 shows that households received an average of 13 per cent of their gross income from crop production. As would be expected, that figure was considerably higher in the rural communities (22 per cent) than in the peri-urban area (where it was only 2.4 per cent), but again there is no indication that it was significantly higher among the project participants than among comparison households. However, it should be recalled that these income data relate to the 12 months immediately prior to the survey, when farming activities (and the operation of the camellones in particular) had been disrupted by the flood, so these data cannot be taken to provide a complete picture of the impact of the project on households' farming activities.

Table 5.5: Households' engagement in crop production

	1	2	3	4	5
	Households engaged in crop production at the time of the survey %	Households engaged in crop production in 2013 %	Total value of households' crop production during 2013 (bolivianos)	Total value of households' crop production during 2013 (Natural logarithm of 1 + value in bolivianos)	Proportion of household income in 12 months prior to the survey coming from crop production %
<i>Intervention group mean:</i>	31.8	43.4	1847	2.80	12.7
<i>Comparison group mean:</i>	31.3	38.6	1633	2.81	11.9
<i>Difference:</i>	0.5 (4.4)	4.8 (4.6)	216 (632)	-0.01 (0.39)	0.8 (3.3)
<i>Observations (intervention group):</i>	129	129	129	129	127
<i>Observations (total):</i>	580	580	579	579	578

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.5 OVERALL HOUSEHOLD INCOME

As discussed in the previous sections, the Effectiveness Review questionnaire included detailed questions on the income that households earned from all their various activities during the 12 months prior to the survey. It has already been noted that many of the project participants were no longer engaged in working on the camellones by 2014, and that production from the camellones was anyway disrupted by the severe flood during that year. Both of those factors probably limit the extent to which household income during the year prior to the survey demonstrates an impact of the project. Nevertheless, there are two reasons why analysis of this data may demonstrate an impact from the project. Firstly, although many of the project participants had left the camellones by 2014, if those who remained had higher income as a result of their participation in the camellones, then this should have raised the average income for the whole project participant group. Secondly, it was believed by implementers that at least some of the participants in earlier years of the project had benefited to such an extent that they were able to make investments in productive assets (such as the purchase of a motorcycle, enabling them to work as motorcycle taxi drivers), which may have raised their income in the longer term.

Table 5.6 shows various measures of households' overall gross income as reported in the survey.¹⁴ Households on average reported having a total gross income during the 12-month period of 43,000 bolivianos (approximately US\$ 6,200), with a median of 27,000 bolivianos. These figures were significantly higher in the peri-urban area than in the rural communities. Although the income of the project participant households is estimated to be higher than that of the comparison households, this difference is not statistically significant. There is some evidence of a significant positive difference in income between project and comparison households specifically in the rural communities, but there are reasons to be particularly cautious about interpreting this difference as a result of the project activities.¹⁵

Overall, then, the data do not provide evidence that the project had a positive effect on households' income, at least as measured in the year prior to the survey. However, in interpreting this result, we should bear in mind that the small number of project households interviewed provides low power for detecting a statistically significant difference. The results shown in column 2 of Table 5.6 are compatible with there being no difference in average income between the project and comparison households, but they are also compatible with average income among the project households being 50 per cent greater than that among the comparison households. It should also be emphasized that the accuracy of the data on household income may be limited by respondents' willingness to provide this information, particularly since the survey was conducted shortly after elections in Bolivia. The lack of clear evidence for a difference in income between the project and comparison households, therefore, does not imply that no such difference exists.

Table 5.6: Household income

	1	2	3	4	5
	Total gross household income in the 12 months prior to the survey (bolivianos)	Total gross household income in the 12 months prior to the survey (Natural logarithm of income in bolivianos)	Proportion of household income in the past 12 months coming from self-employment %	Proportion of household income in the past 12 months coming from formal employment %	Proportion of household income in the past 12 months coming from casual labour %
<i>Intervention group mean:</i>	44 493	10.04	45.2	16.9	15.5
<i>Comparison group mean:</i>	37 339	9.88	42.7	17.9	19.5
<i>Difference:</i>	7 154 (4 803)	0.16 (0.14)	2.5 (4.6)	-1.0 (3.4)	-4.0 (3.4)
<i>Observations (intervention group):</i>	129	129	129	129	129
<i>Observations (total):</i>	580	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

It is important not only to examine the overall level of household income, but also the balance of sources from which that income is generated. If the project had enabled households to make productive investments, then we would expect to see less reliance on temporary, vulnerable forms of employment (such as casual labour), and more concentration on more stable, lucrative forms of employment. The three right-hand columns of Table 5.6 show the proportions of household income coming from the three main sources: self-employment (such as being a taxi driver or working in a household business), formal employment (for a municipal or government body, or a private company), and casual labour.¹⁶ Self-employment made up nearly half (45 per cent) of all the income recorded in the survey, while the other two categories made up 16 to 17 per cent each. There is no indication in the data that these proportions differed between the project participants and comparison households.¹⁷

5.6 INDICATORS OF WELLBEING

Apart from the details of their households' income, several complementary indicators of households' material wellbeing were examined in the questionnaire.

First among these was the diversity of food items consumed in the household, the results for which are shown in Table 5.7. Rather than asking for a complete list of food items that households may have consumed, the questionnaire focused on consumption of fruit and vegetables, meat and dairy products, which were all thought to be good indicators of prosperity at a household level. Firstly, survey respondents were asked about the number of days on which they and other members of their household had consumed any of 15 different types of fruit and vegetable, during the seven days prior to the survey. A score was created by totalling the number of days on which households consumed the various types of fruit and vegetables, creating a score ranging from zero to 105. The results of this analysis are shown in column 1 of Table 5.7. There is no indication of any difference in terms of this indicator between project and comparison households.¹⁸

Respondents were also asked about the number of days on which they had consumed items thought to be indicators of a household's economic level: meat, fish and dairy products. Results are not shown here, but again there was little indication of a significant effect from project participation on these indicators.¹⁹

Another indicator that was examined was the proportion of the household's children that were reported to have been attending school. In fact, as can be seen in column 2 of Table 5.7, most households with children reported that all of them were attending school. Again this proportion did not differ significantly between the project and comparison households.

Table 5.7: Indicators of households' material wellbeing

	1	2	3	4
	Household's fruit and vegetable consumption (score from 0 to 105)	Proportion of children in household aged between 6 and 18 years currently attending school ^a %	Respondents who have saved any money during the past one month %	Estimated number of days for which households could live from their current savings
<i>Intervention group mean:</i>	40.5	90.2	37.2	17.1
<i>Comparison group mean:</i>	39.6	94.3	38.9	14.5
<i>Difference:</i>	0.9 (1.7)	-3.8 (3.4)	-1.7 (5.0)	2.6 (5.8)
<i>Observations (intervention group):</i>	129	80	129	129
<i>Observations (total):</i>	580	368	580	580

^a Among households with any children of this age.

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table 5.7 also shows results for two indicators of households' savings. Firstly, survey respondents were asked whether they personally had saved any money during the past month. Thirty-eight per cent responded positively, with no significant difference between project and comparison households. Respondents were not asked for the amount of savings they held, but instead were asked to estimate how long they and their household could survive from their

current savings in an emergency. As can be seen in column 4 of the table, the average response was 16 days – though just over half of households said that they had no savings at all. No differences were found in these measures of savings between the project participants and comparison households.

In the course of the questionnaire, respondents were also asked to provide information about their household's ownership of various assets (including livestock, productive equipment and household goods), as well as about the conditions of the family's house, both in 2008 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 observation used to generate the wealth index was that, if each of the assets and housing characteristics are indicators of household wealth, they should be correlated with each other. 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 correlations with the others were therefore not considered to be good wealth indicators and so were excluded from the index.²⁰

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 2008, and one based on the household's situation at the time of the survey. PCA produces a measure that maximises the variation in asset types by assigning more weight to those assets that are most highly correlated with the inter-item variation. Hence, each household's weighted index score is determined by both the number of assets it owns, and by the weight assigned to each asset type. The resulting index enables the relative wealth status of the households to be compared. The wealth index for 2008 is the measure that has been used throughout this analysis to control for baseline differences in wealth status between households in the project and comparison communities.

Table 5.8 shows the figures for the change in wealth index for project and comparison households between 2008 and the date of the survey. The change in wealth index is scaled so that a household that saw no changes in wealth indicators has a score of zero, while the household that saw the greatest change in wealth indicators has a score of 1. (The household that experienced the largest *negative* change in wealth index has a score of approximately -0.9 on this scale.) It can be seen that both project and comparison households experienced on average improvements in their wealth indicators since 2008 (that is, the changes in wealth index were positive), but that there is no evidence of a difference between project and comparison households in this respect.

Table 5.8: Indicators of material wealth

	1
	Change in wealth index between 2008 and the date of the survey (scale from -1 to 1)
<i>Intervention group mean:</i>	0.237
<i>Comparison group mean:</i>	0.224
<i>Difference:</i>	0.013 (0.022)
<i>Observations (intervention group):</i>	129
<i>Observations (total):</i>	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.7 EFFECTS OF THE 2014 CRISIS

It has already been noted that the flooding of 2014 was the most severe that has been experienced in the Trinidad area for several decades. Survey respondents were asked for some basic information about how they were affected by or responded to the flood, to provide an indication of whether the camellones project enabled them to withstand it better. In particular, respondents were asked whether they had to take any of the following actions as a result of the flood:

- Evacuate their house.
- Sell household assets or livestock.
- Ask relatives or friends for assistance or for a loan.
- Borrow from moneylenders, traders, or a financial institution.
- Start to cut or trade timber.
- Engage in a less-profitable livelihood activity than normal because of lack of alternatives.
- Reduce the variety of food consumed in the household because of lack of resources to buy food.
- Reduce the quantity of food consumed in the household because of lack of resources to buy food.

These were originally assumed to be negative coping strategies, which would be adopted only by households that had been negatively affected by the flood. If the project had enabled people to adapt to risk and to respond better to crises, then adoption of these strategies should be lower among the project participants.

However, in the survey, adoption of these coping strategies was in fact reported to be *higher* among the project households than among the comparison households. The overall results can be seen in the first two columns of Table 5.9. In particular, more of the project participants had to leave their house (77 per cent, against 51 per cent of the comparison households), ask friends or relatives for support (41 per cent, against 26 per cent of the comparison households), and perhaps to engage in timber cutting or selling (though the proportions reporting doing this were small). All of these differences seem to be restricted to the rural communities: the proportions engaging in each of these coping strategies in the peri-urban area were very similar between the project and comparison households.

It does not seem likely that the camellones project could have had a *negative* impact on people's vulnerability to the 2014 floods. Rather, the higher degree of adoption of these coping strategies may be an indication that the particular rural communities where the project was implemented were more affected by the flood than were the comparison communities – a difference which is not controlled for by the propensity-score matching approach.

Another factor to consider is that it appears that some households from the project communities moved their residence to the city of Trinidad as a result of the floods and had not yet returned to live in their communities by the time of the survey. The survey team was still able to locate and interview many of these households. However, since the selection of respondents in the comparison communities was based on residence in the community at the time of the survey, any households that had lost their home and had moved to the city would not have been interviewed at all. This could potentially produce results like those shown in Table 5.9 even if there had not been any difference in how the floods had affected households in the project and comparison communities.

Table 5.9: Effects of the 2014 flood

	1	2	3	4
	Households that adopted any of the eight coping strategies listed in 2014 %	Number of coping strategies (from the eight listed) adopted by households in 2014	Change in number of asset types owned by households between 2013 and 2015	Change in number of livestock (cattle, pigs, horses and mules) owned by households between 2013 and 2015
<i>Intervention group mean:</i>	89.1	3.50	0.53	-1.85
<i>Comparison group mean:</i>	81.6	2.75	0.29	-0.61
<i>Difference:</i>	7.5** (3.4)	0.75*** (0.20)	0.23** (0.11)	-1.24 (0.80)
<i>Observations (intervention group):</i>	129	129	129	129
<i>Observations (total):</i>	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

An alternative indicator of how households were affected by the crisis of 2014 is to examine their change in asset ownership during that period. For each of the types of physical asset and livestock that were asked about in the questionnaire (discussed in Section 5.6), respondents were asked not only to state whether they currently owned the item and whether they did so in 2008, but also whether they did so in 2013. Comparison of the data on asset and livestock ownership between 2013 and early 2015 (when the survey was carried out) should provide an indication of whether assets were lost due to the flood.

Unexpectedly, column 3 of Table 5.9 shows that the number of asset types owned by households generally increased between 2013 and 2015. This suggests that any losses in asset ownership due to the floods were outweighed by other factors, such as a general positive economic change. The results in the table also provide some evidence that the number of asset types owned increased by more among the project participants than among the comparison households. This result appears to have been restricted to the rural communities – there does not seem to be any such effect in the urban area. If project participants in the rural communities increased their asset ownership at a higher rate between 2013 and 2015 than did the comparison households, this may be because they were better able to protect their assets from the flood, or it may simply reflect a positive effect from the project activities on household livelihoods over those two years. The fact that little other evidence has been found of a positive effect from the project on livelihoods suggests that the asset protection explanation is the stronger one. This case is strengthened by the observation that asset ownership between 2008 and 2013 increased at the same rate among the project participants and comparison households. However, the finding is particularly surprising given that the project participants in the rural communities seem to have been more affected by the flood (in terms of coping strategies adopted) than were those in the comparison communities.

On the other hand, the number of livestock owned had generally decreased between 2013 and 2015, and (as shown in column 4 of the table) there was no indication of a difference between project and comparison households in this regard.

5.8 INDICATORS OF RESILIENCE

The project under review was specifically aimed at increasing households' resilience to crises. As part of Oxfam GB's Global Performance Framework, an innovative approach has been developed to measuring the resilience of households to shocks and stress and their ability to adapt to change.²¹ This approach involves capturing data on various household and community characteristics falling under the five interrelated dimensions presented in Figure 5.1.

One reason why measuring resilience is challenging is that we can only really assess whether a system has successfully coped or adapted after the fact. In Section 5.7 we examined households' responses to the severe flooding in 2014, but this can provide only a partial view of the overall effect that the project has had on resilience. One reason is that this was only one specific type of crisis, whereas a full understanding of resilience would consider all the various types of shocks and stresses that an individual, household or community may undergo. In particular, the 2014 flood was a very severe event, which we know caused severe damage to the camellones; it does not tell us what effect the project may have had on resilience to more typical, smaller-scale shocks. Since this Effectiveness Review aimed to assess the project's impact on participants' resilience to shocks, stresses and uncertainty in the *future*, examining their response to the flood in 2014 was not sufficient.

The characteristic approach to resilience measurement 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. A limitation, of course, is that we do not know for certain how relevant these characteristics actually are; rather, we assume they are important based on common sense, theory, and an understanding of the local context.

The characteristics that inform the overall measure of resilience fall under the five dimensions presented in Figure 5.1. First, if we think about what a household would need in order to cope with current and future shocks, stresses and uncertainty, a **viable livelihood** is likely to be one of them. If a shock happens, for instance, a household dependent on just one precarious livelihood activity is likely to be more negatively affected than another that has one or more less sensitive alternatives to fall back on, *all other things being equal*. In addition, households that are on the margins of survival are less likely to be resilient than their relatively more wealthy counterparts. Where longer-term climatic trend prediction information exists, it is also important to assess how viable current livelihood strategies would be given the range of likely future climatic scenarios.

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

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

Figure 5.1: Dimensions affecting the ability of households and communities to minimise risks from shocks and adapt to emerging trends and uncertainty

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

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

While the five dimensions 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 team consulted local staff from the Kenneth Lee Foundation and from Oxfam to identify what factors they considered the most important for contributing towards resilience within the Trinidad area. Two focus groups were then carried out, one in a rural community and one in a peri-urban community (neither of which were later included in the survey), to further probe people's understanding of what factors contribute to their resilience.²² This process led to a set of characteristics of resilience being identified, listed in Table 5.10. 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 5.10 shows on which characteristics the project activities may be expected to have an impact.

Table 5.10: Characteristics of resilience examined in this Effectiveness Review

Dimension	Characteristic	Connected to project logic?
<i>Livelihood viability</i>	Stable employment	No
	Income from sources less vulnerable to flood	Yes
	Income from sources less vulnerable to drought	Yes
	Multiple income earners	Yes
	Ownership of productive assets	No
<i>Innovation potential</i>	Attitude to change	No
	Understanding of climate change	Yes
	Access to credit	Yes
	Adoption of new practices or initiatives	Yes
<i>Access to contingency resources and support</i>	Savings	No
	Social support networks	No
<i>Integrity of the natural and built environment</i>	Security of ownership of the house	No
	House protected from flood	Yes
<i>Social and institutional capability</i>	Access to state extension services	Yes
	Access to and ability to make use of early-warning information	No
	Confidence in authorities to support in a crisis	No
	Involvement in community decision-making	Yes
	Participation in community groups	Yes

The questionnaire used in the Effectiveness Review included questions relating to each of the characteristics listed in Table 5.10. Indeed, several of these indicators have already been discussed in earlier sections of this report.

Data from these various indicators of resilience were aggregated using an approach known as the Alkire-Foster method, adapted from that used by the Oxford Poverty and Human Development Institute for measuring multidimensional constructs, such as poverty and women's empowerment. 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 savings if they said that they could finance an investment of 1,000 bolivianos from their household's current savings if necessary. There is inevitably a degree of arbitrariness in defining such cut-offs. In many cases, alternative cut-offs and alternative formulations of the indicators were tested as a check on the robustness of the results obtained from applying the cut-offs.

A measure of overall resilience was then derived by counting the proportion of characteristics in which the household scored positively. We refer to this measure as the *base resilience index*. A household was then defined as having positive resilience overall if it scored positively in at least two thirds of the characteristics. A second resilience index was then created, which takes a value of 1 if the household reaches that benchmark for overall resilience and otherwise is equal to the proportion of characteristics in which the household scored positively. This modified index is known as the *Alkire-Foster resilience index*.²³ (In fact only a small number of households – three per cent of all those interviewed – met the threshold for overall resilience, so the results for the AF resilience index are little different from those for the base resilience index.)

Table 5.11 compares the project participant and comparison households in terms of each of these two indices of resilience. It can be seen that there is little indication of any significant difference between them in either of the indices.²⁴

To examine more closely whether the project has had any impact on resilience, it is important to compare the project and comparison households in terms of the underlying indicators. Figure 5.2 shows a comparison of the households in project and comparison communities in terms of each of the indicators of resilience. The following sub-sections describe the results under each of the dimensions of resilience specifically.

Table 5.11: Overall indices of resilience

	1	2
	Base resilience index	Alkire-Foster resilience index
<i>Intervention group mean:</i>	0.429	0.639
<i>Comparison group mean:</i>	0.417	0.625
<i>Difference:</i>	0.012 (0.014)	0.014 (0.021)
<i>Observations (intervention group):</i>	129	129
<i>Observations (total):</i>	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.8.1 Dimension 1: Livelihood viability

Four indicators of resilience falling under the ‘livelihood viability’ dimension were examined in this Effectiveness Review. The first indicator was highlighted by local partners and by focus group participants (particularly in the peri-urban area) as the most important characteristic enabling people to respond to shocks and stresses: that someone in the household should have regular employment with a dependable salary. The project under review had the potential to influence this indicator only indirectly (conceivably, by providing extra temporary income which could have enabled some households to overcome a capital constraint to engage in formal employment), but it was nevertheless clearly important to resilience at the household level. The first column of Table 5.12 shows the proportion of households that met the threshold of having regular employment (or, in a few cases, income from remittances or government transfers) which provided them with at least a third of their income during the 12 months prior to the survey. As expected, no difference was found between the project participants and comparison households in this regard.

A second indicator of livelihood viability related to whether the household’s activities and sources of income are vulnerable to flooding. The income data collected in the survey referred to the 12-month period between (approximately) April 2014 and March 2015, and the first several months of that period were dominated by the severe flood of 2014, so it could be considered that all income received during that 12-month period was in some sense ‘resilient’ to the flood: this income was received in spite of the flood. However, for the purposes of this indicator, an attempt was made to differentiate between income from more secure and reliable sources (including formal employment, self-employment, fishing, fish farming, remittances and government transfers) and income from sources that are more vulnerable to crises and/or that may have been adopted only as a strategy of coping with crisis during that period (such as casual day labour, cutting and selling timber, or processing of agricultural products). Agriculture was included in the first group as long as respondents stated that at least part of the land they were cultivating in 2013 would be protected if there were a *moderate* flood (though not necessarily a severe flood like that of 2014), and livestock rearing was included if their livestock would be protected in the event of a moderate flood. Households were scored positively if the income from the more secure sources made up at least two thirds of household income during the 12 months prior to the survey. As can be seen in column 2 of Table 5.12, there was no significant difference between project and comparison households in terms of this indicator.

Figure 5.2: Results for characteristics of resilience

Another important vulnerability, particularly for crop producers, is the dry season. Similarly to the previous indicator, households were scored positively if at least two thirds of their income in the previous 12 months came from sources considered to be less vulnerable to drought. These sources could include crop production if the respondent reported that at least some of the land they were farming in 2013 was irrigated or could be watered through some other means (such as from the channels at a camellones site). As can be seen in column 3 of Table 5.12, there was again no evidence of a difference in this indicator between the project and comparison households. Indeed, even among the households who had been engaged in crop production in 2013, project households were no more likely to say that they had a source of water for dry season farming than were comparison households. Only four of the project participants mentioned the camellones as a means of providing water for dry-season cultivation.

Table 5.12: Households scoring positively in terms of characteristics of livelihood viability

	1	2	3	4	5
	Formal employment %	Income from sources less vulnerable to flood %	Income from sources less vulnerable to drought %	Multiple income earners in household %	Ownership of productive assets %
<i>Intervention group mean:</i>	21.7	69.8	74.4	44.2	51.9
<i>Comparison group mean:</i>	23.7	67.3	71.7	35.5	52.0
<i>Difference:</i>	-2.0 (4.4)	2.4 (5.0)	2.7 (4.4)	8.7* (4.9)	-0.1 (5.4)
<i>Observations (intervention group):</i>	129	129	129	129	129
<i>Observations (total):</i>	580	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

The fourth indicator relates to the diversification of income earners within the household. Clearly if a household depends on one member for most of its income, then the household is vulnerable to that person falling ill or losing their employment. This is a characteristic that the camellones project was intending to influence through involving women, who were previously economically inactive in agricultural production. Households were scored positively in terms of this indicator if no single household member contributed more than three quarters of the household's income. In this respect, significantly more of the project households scored positively than did the comparison households, as shown in column 4 of Table 5.12.

The final indicator considered under the livelihood viability dimension was the household's ownership of productive assets, such as vehicles, boats, mobile phones, and so on. There was no indication of a difference between the project participants and comparison households in this respect.

5.8.2 Dimension 2: Innovation potential

Four characteristics of people's 'innovation potential' were examined in this Effectiveness Review. Firstly, respondents' general attitude to change was assessed by asking whether they agreed or disagreed with the statement that 'We should concentrate on our existing ways of living, which we know best, instead of trying new things'. Column 1 of Table 5.13 shows that approximately a third of respondents disagreed with this statement, implying a willingness to innovate.

The extent to which respondents understand the risks presented by climate change may also affect how willing they are to carry out proactive adaptations. In the course of the survey, respondents were asked, firstly, if they recognised the term ‘climate change’ at all, and if so, to mention some of the risks that climate change presents to them and their household. They were scored positively if they had heard of climate change and could name at least three types of phenomena that it might imply (such as more frequent droughts, more severe flooding, soil degradation, and the presence of new pests or diseases). As can be seen in column 2 of Table 5.13, more of the project participants than the comparison respondents scored positively in this respect. Although the evidence of the statistical significance of this difference is not completely clear,²⁵ it is possible that the difference reflects some impact from the project on this indicator.

Table 5.13: Households scoring positively in terms of characteristics of innovation potential

	1	2	3	4
	Attitude to change %	Understanding of climate change %	Access to credit %	Adoption of new practices or initiatives %
<i>Intervention group mean:</i>	37.2	40.3	33.3	59.7
<i>Comparison group mean:</i>	31.4	31.3	28.4	56.4
<i>Difference:</i>	5.8 (4.9)	9.0* (5.0)	4.9 (4.9)	3.3 (5.1)
<i>Observations (intervention group):</i>	129	129	129	129
<i>Observations (total):</i>	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

One factor that is likely to be important in determining whether an individual or a household can carry out any positive adaptation is access to credit. The results shown in column 3 of Table 5.13 are based on households who said that they would be able to borrow 1,000 bolivianos (approximately US\$ 145) from at least one source (other than relatives and friends) if it were needed for an investment opportunity. There is no indication that this proportion varied between the project and comparison households, in spite of the revolving funds that were established under the camellones project.

The final indicator considered under this dimension was whether households had tried any innovation, or made some change in their way of life, during the past few years. In the questionnaire, this was asked as an open question, allowing respondents to cite any innovation at all that they or other household members had made.²⁶ Whether these innovations proved to be successful or not was not taken into account, since it is the willingness and ability to try something new that is considered important as an indicator of resilience. Just under a third of households interviewed (29 per cent) were able to cite some innovation that they had made, most of which were related to agricultural practices or to engaging in a new type of household business. As can be seen in column 4 of Table 5.13, there was no difference between the project and comparison households in the probability of their having carried out an innovation.

5.8.3 Dimension 3: Access to contingency resources and support

Two indicators of a household’s ability to access contingency resources and support were examined in this Effectiveness Review. Households’ savings have already been discussed in Section 5.6 and no differences were found in this respect between the project participants and comparison households.

The measure of access to social support was based on survey questions in which respondents were asked whether their household had either given or received practical support from others in the community or neighbourhood during the past 12 months. Households were scored positively if they reported having given or received support on at least three occasions during the 12-month period. (The frequency with which respondents reported having provided support to others was much greater than the frequency with which they reported having received support, but these are treated as equivalent in constructing this indicator.) Again, there is no indication of a difference between the project participants and comparison households in this respect.

Table 5.14: Households scoring positively in terms of characteristics of access to contingency resources and support

	1	2
	Savings	Social support networks
	%	%
<i>Intervention group mean:</i>	43.4	45.7
<i>Comparison group mean:</i>	48.5	45.9
<i>Difference:</i>	-5.1 (5.2)	-0.2 (5.5)
<i>Observations (intervention group):</i>	129	129
<i>Observations (total):</i>	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.8.4 Dimension 4: Integrity of the natural and built environment

While characteristics of the natural environment are certainly of high importance to resilience in the Trinidad area, there were few indicators that could be assessed in a household-level survey. However, two characteristics of the built environment were included, relating to the physical security and security of ownership of the house itself. Preparatory work for the Effectiveness Review highlighted the lack of documentation of ownership of property as a factor that makes households vulnerable to eviction, particularly in the newer, peri-urban, settlements of Trinidad. To score positively in terms of the first indicator, therefore, households had to own their own house (which applied to nearly 80 per cent of households interviewed) and to have a contract or some other type of documentation as evidence of that (which applied in only a minority of cases, as can be seen in column 1 of Table 5.15). Perhaps of interest is that there seemed to be little or no difference in the proportions of households with documented evidence of their ownership between the rural communities and the urban areas. Of course, it may be that a lack of documentation implies greater vulnerability for those residing in the urban area.

The second characteristic under this dimension relates to whether the house would be flooded in the event of a 'moderate' flood. Households were scored positively if they said that not all of the rooms of their house would be under water if a moderate flood were to occur. The proportion scoring positively in fact seemed to be slightly lower among the project participants than among the comparison households, though the statistical significance of this difference is not completely clear. (There is a much clearer difference in terms of those who said that all the rooms of their house would be flooded; project households in rural communities appeared to be much more vulnerable in this respect than those in the comparison rural communities. In spite of the use of the word 'moderate' in posing this question, the responses are probably linked to the experience of flooding in 2014, which appears to have been more severe among the rural project households than the rural comparison households.)

Table 5.15: Households scoring positively in terms of characteristics of integrity of the natural and built environment

	1	2
	Security of ownership of the house	House protected from flood
	%	%
<i>Intervention group mean:</i>	32.6	71.3
<i>Comparison group mean:</i>	38.3	78.0
<i>Difference:</i>	-5.8 (5.2)	-6.7 (4.5)
<i>Observations (intervention group):</i>	129	129
<i>Observations (total):</i>	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

5.8.5 Dimension 5: Social and institutional capability

A further five characteristics of resilience were examined under the dimension of social and institutional capability. Firstly, as discussed in Section 2, the project implementers worked with the municipality of Trinidad to improve links between the camellones participants and the municipal agricultural and piscicultural advisers. The first column of Table 5.16 shows the proportions of households that reported having received support or advice from a technical adviser at least once a year over the previous two years. The proportions having had some contact with these advisers are small, and are little different between the project and comparison households overall. However, specifically in the peri-urban area, the proportions that had received support do seem to be significantly higher among project households (16 per cent of whom had received support) than among comparison households (only three per cent of whom had received support). To some extent this may simply be because more of those households were engaging in agriculture or fish farming: clearly households who were not engaged in these activities would not have received any such support at all. However, it appears from the data that project participants were more likely to have had contact with a technical adviser even after controlling for whether they were engaged in agriculture or pisciculture.

Although not directly connected to this project, access to early-warning information can be of importance in enabling people to prepare for a flood in the days before its arrival. Just over a third (37 per cent) of households reported that they received early warning in advance of the flood of 2014. The indicator for which results are shown in column 2 of Table 5.16 relates to the proportion of respondents who said that they were at least moderately sure they would receive early warning of an impending crisis in the future, and were at least moderately sure that they knew what they should do to protect themselves if they received such a warning. This applied to only a third of respondents – with the proportions again being similar among the project and comparison households.

Table 5.16: Households scoring positively in terms of characteristics of social and institutional capability

	1	2	3	4	5
	Access to state extension services %	Access to and ability to make use of early-warning information %	Confidence in authorities to support in a crisis %	Involvement in community decision-making %	Participation in community groups %
<i>Intervention group mean:</i>	12.4	34.1	10.1	19.4	69.8
<i>Comparison group mean:</i>	9.7	33.7	8.4	22.3	67.6
<i>Difference:</i>	2.7 (3.6)	0.4 (5.3)	1.7 (2.9)	-2.9 (4.4)	2.2 (5.1)
<i>Observations (intervention group):</i>	129	129	129	129	129
<i>Observations (total):</i>	580	580	580	580	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Respondents' confidence in the authorities to support them in times of crisis was tested by asking whether they agreed or disagreed with two different statements on this theme. As shown in column 3 of Table 5.16, only nine per cent of respondents both agreed strongly that 'If there were another crisis, I am confident that the authorities would bring support to those who need it most' and did not agree strongly that 'Each time there is a crisis, we have to rely on ourselves and on our family, neighbours or friends, because the authorities do not support us'.

Column 4 of the table shows that a larger – though still quite small – proportion of respondents agreed that 'If a new project were being started in this community, I and my household would have the opportunity to ask questions about the benefits of that project' and did not strongly agree that 'NGOs are carrying out a lot of projects that benefit few people'. Again this proportion did not differ between the project and comparison households. It is important to note that (as already discussed in Section 5.2), when asked open-ended questions about their experience of the camellones project and their reasons for stopping, a large number of participants, particularly in the rural areas, mentioned disputes with others about the participation in the project or the division of the proceeds.

The final indicator of resilience included in the Effectiveness Review was the participation of household members in community groups. In the majority of households both male and female members were participating in at least one community group, and this proportion did not differ between project and comparison households.

5.9 INDICATORS OF WOMEN'S EMPOWERMENT

The project under review intended to have a positive effect not only on household income and resilience, but also in increasing opportunities for women to participate in productive activities and so result in a positive change in women's positions in their households and communities. The project specifically encouraged women to take responsibility for cultivation on the camellones, while also holding workshops on gender equality and women's rights in the project communities. The questionnaire used for this Effectiveness Review allows the project's success in this dimension to be analysed. As well as the income data included in the questionnaire being

itemised for each household member, a short section of the questionnaire was carried out with the senior female member of each household (that is, either with the head of household, or with the wife or partner of the head of household²⁷).

Table 5.17 compares project and comparison households in terms of indicators relating to the income earned by the female respondent. It can be seen from the first column that a larger proportion of women in the project households were engaged in some economic activity at the time of the survey. Columns 2 to 4 analyse the proportion of household income that was recorded as having been earned by the female respondent. It can be seen that the income share of the female respondent was much higher in the project households than in the comparison households: women in the project households were recorded as having generated 36 per cent of household income on average, against only 29 per cent in the comparison households.²⁸ These proportions were calculated from the detailed breakdown of household income. Interestingly, when women were asked to estimate the proportion that they contribute to their households' income, their estimates were larger, but the difference between the project and comparison respondents was maintained. As can be seen in the last column of the table, respondents in project households estimated that their contribution to household income had increased since 2008, while the comparison respondents estimated that their contribution had slightly decreased.

Table 5.17: Women's contribution to household income

	1	2	3	4	5
	Respondent carries out some activity to generate income or produce food for the household %	Respondent's total gross income from all sources in the past 12 months (bolivianos)	Respondent's total gross income from all sources in the past 12 months (natural logarithm (Ln) of 1 + income in bolivianos)	Respondent's contribution to total household income %	Respondent's perception of change in her contribution to household income since 2008 %
<i>Intervention group mean:</i>	80.0	22 149	6.88	35.9	4.0
<i>Comparison group mean:</i>	63.1	10 459	4.89	29.4	-3.2
<i>Difference:</i>	16.9*** (5.5)	11 705*** (3 887)	2.00*** (0.52)	6.5 (4.5)	7.2* (3.7)
<i>Observations (intervention group):</i>	105	104	104	104	105
<i>Observations (total):</i>	493	488	488	488	493

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

The finding that women's contributions to household income are larger in the project households than in comparison households may seem to be at odds with the earlier finding (in Section 5.5) that overall household income was not statistically significantly higher among the project households than among the comparison households. There are two potential explanations for this apparent contradiction. Firstly, it is possible that overall income *is* in fact higher in the project households, but that the difference is too small to have been observed in Section 5.5 as statistically significant. Alternatively, it may be that women are in reality not generating any more income in the project households than in comparison households, but that their contribution is more recognised in the project households. Of course, it is possible that some combination of these two factors has produced the results seen in Table 5.17.

If women have been contributing more to household income as a result of this project – or if their contribution has been better recognised – then the next question to ask is what impact this change has had on relations within the household. In the section of the questionnaire carried out specifically with women, respondents were asked to state which household member tends to take decisions in six different decision-making areas. If the respondent stated that decisions are taken by someone other than herself (or if decisions are made jointly with others), she was then asked to what extent she would be able to have influence if she did not agree with a decision that had been made. Table 5.18 shows that, in each of these respects, women in the project households were *less* likely to say that they had influence over decisions than were women in comparison households. The differences are mostly not statistically significant, though they are significant in the case of family planning.

It is surprising that increased women's participation in generating income for the household should be accompanied by a reduction in women's influence in decision-making. One explanation may be that women who have participated in the project activities have higher expectations about the influence they should have in household decisions, and so were more likely to answer negatively if these expectations have not been met.

Table 5.18: Areas in which female respondent has decision-making power^a

	1	2	3	4	5	6
	Making daily household purchases %	Making larger purchases or investments %	Participation in group meetings or activities %	Decisions over borrowing %	Travel to visit relatives %	Decisions over when to have children %
<i>Intervention group mean:</i>	79.0	67.3	69.6	69.8	70.4	73.9
<i>Comparison group mean:</i>	82.5	73.1	79.3	67.9	73.3	85.2
<i>Difference:</i>	-3.5 (4.8)	-5.5 (5.5)	-9.5* (4.9)	1.5 (5.8)	-2.7 (5.474)	-11.4** (4.8)
<i>Observations (intervention group):</i>	105	104	102	96	98	88
<i>Observations (total):</i>	493	491	474	464	478	423

^a Among households where each type of decision is applicable.

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Several other dimensions of women's empowerment were assessed by reading respondents a series of statements, and asking whether they agreed or disagreed with each. A selection of the results is shown in Table 5.19. The first column shows that the majority of respondents agreed that domestic or care responsibilities act as a barrier to their working more outside the home, and that there was no difference in this respect between women in project and comparison households.²⁹ When the analysis is restricted to the households that participated in crop production with the camellones – where women tended to play a more active role than in fish farming – there is some indication that women were more likely to respond positively. The proportion of positive responses among the project households engaged in crop production was 52 per cent, against only 42 per cent among the corresponding comparison households. This would be consistent with the project having encouraged women to manage their care responsibilities alongside their participation in crop production – but the statistical significance of the result is not clear, so that this cannot be treated with confidence.³⁰

Columns 2 to 4 of Table 5.19 show the results of three indicators of respondents' confidence and ability to voice their opinions: within the household, in group discussions, and in making

demands to office-holders. In none of these respects is there any evidence of a difference between women in project and comparison households.³¹

Finally, respondents were asked whether women seem to be taking a more active part in community affairs than they used to. Nearly all respondents agreed that this was the case, and 39 per cent agreed strongly. However, as shown in the right-hand column of Table 5.19, there was again no difference in this respect between women in project and comparison households.

Table 5.19: Further indicators of women's empowerment

	1	2	3	4	5
	Respondent does <u>not</u> agree that she is prevented from working more outside the home because of domestic work or care responsibilities %	Respondent strongly agrees that she now feels more confident than in the past in expressing her opinion about livelihoods activities in the household %	Respondent does <u>not</u> agree that she normally remains silent if she disagrees with others in a group discussion %	Respondent strongly agrees that she would be willing to make demands to the municipality on behalf of her community or neighbourhood, if necessary %	Respondent strongly agrees that women now participate more in community affairs than they used to %
<i>Intervention group mean:</i>	43.8	27.6	42.9	44.8	38.1
<i>Comparison group mean:</i>	43.1	23.7	41.8	38.9	39.6
<i>Difference:</i>	0.7 (5.6)	3.9 (5.2)	1.0 (5.7)	5.9 (5.7)	-1.5 (5.9)
<i>Observations (intervention group):</i>	105	105	105	105	105
<i>Observations (total):</i>	493	493	493	493	493

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

6 CONCLUSIONS

The potential of this Effectiveness Review to draw conclusions about the impacts of the camellones project was limited by the small number of project participants that were available to be interviewed, by the fact that many of them had participated in the project activities only in earlier years, and by the fact that work on the camellones was disrupted by severe flooding in the year prior to the survey. Nevertheless, the survey results clearly show that most of those who were identified by the implementers as project participants had taken part in production at one of the camellones sites at some point. Even though a substantial proportion of the project participants were no longer working on the camellones by 2013, the number of the project households engaged in fish farming and/or crop production at that time was still significantly larger than among the comparison households.

The survey data do not provide any indication that the camellones have made a major contribution to income for the average participant household. No evidence of a significant positive change was found when considering the detailed data on household income (with the caveat that the income data refer to 2013/14, when many of the participants had already withdrawn from the project, and when the functioning of the camellones had been disrupted by the severe flood of 2014), nor the data on crop production in 2013, nor changes in indicators of household wealth (housing conditions and ownership of assets and livestock) since 2008. It should be noted that the project would have had to have made a considerable impact on participants' livelihoods for that change to be detectable from our data. However, it should be noted that when camellones participants were asked qualitative questions about the project, most reported having generated only a small amount of income from the camellones. Only a minority (12 out of 52 camellones participants who responded to the question) reported having generated significant enough income from the project to make savings or investments. When asked about why they stopped participating in the project, only two respondents said that they had moved on to a more lucrative livelihood activity. (The qualitative questions were unfortunately not asked to the project participants who reported having been engaged only in fish farming; they do, however, include responses from those who said that they had been engaged in *both* fish farming and crop production with the camellones.)

Project participant households were found to have been just as affected by the flood of 2014 as were comparison households – although that there is some indication that project households in the rural communities may have been more successful in protecting their assets than were comparison households in rural communities. However, the 2014 flood was exceptionally severe and caused damage to most of the camellones sites, so we do not expect this experience to provide a comprehensive picture of how the project affected participants' ability to deal with risk. Instead, the Effectiveness Review examined a selection of characteristics of resilience, which are thought to be indicators of people's ability to deal with shocks, stresses and uncertainty more generally. The influence of the project could be seen in increasing the number of household members who were involved in producing income (and therefore reducing dependence on the primary earner in each household), and perhaps – though less clearly – on promoting knowledge and understanding of climate change and improving links to agricultural and piscicultural technical advisers from the municipality. No differences were found between the project and comparison households in most of the other characteristics of resilience, so there was no significant difference between the two groups in the overall index of resilience.

One section of the questionnaire was addressed specifically to the senior female member of each household. A clear effect from the project could be seen in promoting women's engagement in livelihoods work: women in the project households were found to be responsible for generating a considerably larger proportion of the household's income than were women in comparison households. However, little difference was found between women in project and comparison households in indicators of women's confidence or in their influence on decisions within the household or community. There is even some tentative evidence that women in project households reported having *less* influence on some types of household decisions (and particularly on family planning) than those in comparison households. This may be an indication that they had higher expectations about the appropriate level of influence that they *should* have, and so more dissatisfaction if this level is not met.

6.1 PROGRAMME LEARNING CONSIDERATIONS

Review the approach used to identify and select project participants, and consider how best to facilitate management of the camellones at the community level.

In the early years of the camellones projects, large numbers of participants were recruited to work on the camellones. In the rural areas in particular, the participants made up a sizeable proportion of the population of each of the communities. However, most of these people participated in the project for only a year or two: by 2013, relatively small numbers of producers were still working on the camellones. This was partly due to a deliberate decision on the part of the implementers in later years to restrict participation in order to allow those who remained to produce at a more efficient scale – but feedback from the participants suggests that withdrawal from the project was also partly due to dissatisfaction on their part. It is natural that not everyone will find that engaging in crop production or fish farming is the best way that they can invest their time, and experimenting with which types of people to work with is to be expected during the first implementation of a new project. However, it will be important in future camellones projects to have a clear strategy for targeting those who have the most potential to engage in and benefit from work on the camellones.

At the same time, many of the project participants in the rural communities mentioned that disputes about the management of the camellones were an important reason for their choosing to leave the project. Project staff should proactively look for ways to manage relations both among the project participants and with the wider community. Focusing on providing training may not be enough to ensure sustainability and effective results.

Carry out regular monitoring visits with project participants, to gain insight into how the project activities are developing on the ground, as well as with those who have chosen to leave the project.

Some of the weaknesses in the management of the camellones that were mentioned by project participants during the survey could probably have been understood earlier if there had been a stronger system for monitoring participants' experiences with and perceptions of the project. Collecting regular feedback from a sample of participants is crucial, not only in order to identify implementation problems that can be corrected, but also to understand whether expectations about the project's ability to boost livelihoods and resilience are being met. Such monitoring need not be a formal process, but it is important that the results are recorded and reviewed regularly, so that implementers can adjust their approach as necessary.

An even higher priority would be to try to interview people who voluntarily withdraw from a project like this, to understand their reasons for doing so, and how the project could have supported them better. While some may have stopped working on the camellones for positive reasons – such as finding a new job opportunity – these cases appear to have been a minority. It is not enough to be satisfied with reaching targets for the number of participants engaging in the project in each year, if the specific people involved are frequently changing. For a household to generate positive results from a project such as this can be expected to take some time, so it is important to understand and take action if people are leaving before they have been able to realise significant benefits.

Seek to carry out a more comprehensive evaluation of the impacts of camellones projects on household livelihoods and on resilience, in order to build an evidence base for decisions on future scale-up.

This Effectiveness Review did not find clear evidence that the camellones projects have had significant positive effects on household incomes and on risk management. However, the limitations faced by the review – particularly the small number of participant households who could be interviewed, the fact that many of them had withdrawn from participation some time before, and the disruption caused by the 2014 floods – meant that the potential for identifying any positive effects was limited. The data do provide some reasons for optimism that they had a positive impact on the livelihoods of participant households, although the qualitative feedback received from participants was less positive.

The launch of further camellones projects in other municipalities in Beni provides an opportunity to carry out an evaluation of the impact of those projects, preferably when implemented on a larger scale and using a more settled model of implementation. This would ideally include collecting baseline data from project participants and non-participants, then following up after they have been engaged in the project for two to three years, to see what differences can be observed. Investing in good-quality evaluation at this stage would provide evidence that will enable municipalities and other government bodies, as well as Oxfam and partners, to make informed decisions about the implementation of camellones projects in the future and the impacts that can be expected from them.

Further investigate the results that camellones projects are having on women's involvement in livelihoods activities, and what potential there is for this to be translated into empowerment.

The clearest result from the Effectiveness Review was that women in the project households were seen to be more engaged in income-generating activities than are women in comparison households. What is not known is the extent to which this implies that women are engaging in additional productive work - and so increasing overall household income – and the extent to which it reflects better recognition of work that women were doing anyway. This will be an important question to assess in evaluating the impact of future camellones projects.

The natural next question is whether these changes have resulted in any changes in women's position in their households or communities. The suggestion in this report that women in project households may have higher *expectations* about the influence that they should have in household decisions may be seen to be a positive step towards empowerment, though clearly it remains to be seen whether this translates in time into actual increased influence. The project team should clarify the specific changes that they are expecting to see in women's empowerment, and then ensure that projects have a strategy to further those aims.

APPENDIX 1: THRESHOLDS FOR CHARACTERISTICS OF RESILIENCE

Dimension	Characteristic	Threshold: A household scores positively if...	Directly connected to project logic?
<i>Livelihood viability</i>	Stable employment	Some household member has regular salaried employment (or receives remittances or government transfers) from which the household received at least a third of its income in the past 12 months.	No
	Income from sources less vulnerable to flood	Household generates at least two thirds of its income from sources that are less vulnerable to disruption from a moderate flood (formal employment, self-employment, fishing, fish farming, remittances, government transfers, livestock rearing if the respondent reported that the household's animals would all be protected in the event of a moderate flood, and crop production if the household reported that at least some of the land farmed in 2013 would be protected in the event of a moderate flood).	Yes
	Income from sources less vulnerable to drought	Household generates at least two thirds of its income from sources that are able to continue being practised during the dry season (formal employment, self-employment, fishing, fish farming, livestock rearing, timber, remittances, government transfers, or crop production if the household reported having had access (at least in 2013) to a source of irrigation for their farmland.)	Yes
	Multiple income earners	No individual in the household contributed more than three quarters of household income during the past 12 months.	Yes
	Ownership of productive assets	Household owns at least one large asset (a motorbike of a quality brand, a car or other motor vehicle, a boat or a computer), or at least three small assets (including a mobile phone, a bicycle, a lower-quality motorbike, a horse-drawn cart or handcart) or some livestock (including cattle, pigs, horses or mules).	No
<i>Innovation potential</i>	Attitude to change	Respondent disagrees with the statement that 'We should concentrate on our existing ways of living, which we know best, instead of trying new things'.	No
	Understanding of climate change	Respondent is aware of the concept of climate change, and mentioned at least three types of risk that climate change brings to their household.	Yes
	Access to credit	Household would be able to borrow 1,000 bolivianos (approximately US\$ 145) from at least one source (including a <i>pasanako</i> (local savings and loans) group, a moneylender or trader, a community group or community bank, or a formal financial institution), if it were needed for an investment opportunity.	Yes
	Adoption of new practices or initiatives	Respondent mentioned (in response to an open question) that the household has tried at least one innovation or new practice in the past few years.	Yes

Dimension	Characteristic	Threshold: A household scores positively if...	Directly connected to project logic?
<i>Access to contingency resources and support</i>	Savings	Respondent reports that household currently has at least 1,000 bolivianos in savings, which could be used for an investment opportunity if necessary.	No
	Social support networks	Respondent reports that the household provided support to others in the community and/or received support from others in the community at least three times during the past 12 months.	No
<i>Integrity of the natural and built environment</i>	Security of ownership of the house	The house is owned by the household (even if they have not finished making payments), and household members have some contract or other document to provide evidence of this.	No
	House protected from flood	Respondent reports that, if there were a moderate flood, none of the bedrooms of the house would be under water.	Yes
<i>Social and institutional capability</i>	Access to state extension services	Household members have received support or advice from an agricultural or piscicultural technical officer at least once a year during the past two years.	Yes
	Access to and ability to make use of early-warning information	The respondent is at least moderately confident that the household would receive early warning if there were a crisis in the future (which would be reliable and would arrive at the appropriate time), and is at least moderately confident that they would know how to respond they were to receive such warning.	No
	Confidence in authorities to support in a crisis	Respondent agrees strongly that 'If there were another crisis, I am confident that the authorities would bring support to those who need it most' and does not agree strongly that 'Each time there is a crisis, we have to rely on ourselves and on our family, neighbours or friends, because the authorities do not support us'.	No
	Involvement in community decision-making	Respondent strongly agrees that 'If a new project were being started in this community, I and my household would have the opportunity to ask questions about the benefits of that project' and does not agree strongly that 'NGOs are carrying out a lot of projects that benefit few people'.	No
	Participation in community groups	At least one female and one male adult household member both regularly participate in meetings of at least one type of group in the community.	Yes

APPENDIX 2: BASELINE STATISTICS BEFORE MATCHING

**Table A2.1: General characteristics, used for modelling outcomes at a household level
(Sections 5.2 to 5.8)**

	Intervention mean	Comparison mean	Difference	Standard error
<i>Household resides in a rural (as opposed to peri-urban) community (%)</i>	53.4	30.4	23.0***	(4.64)
<i>Household existed in its current form in 2008 (%)</i>	93.2	75.4	17.8***	(3.92)
<i>Household size</i>	4.45	4.60	-0.15	(0.21)
<i>Number of household members who were engaging in some work to generate income or food for the household in 2008</i>	1.83	1.58	0.26***	(0.10)
<i>Proportion of household members who are under 18 years of age (%)</i>	29.2	38.0	-8.79***	(2.31)
<i>Household has only one adult member (%)</i>	7.52	9.53	-2.02	(2.84)
<i>Household has no adult male members (%)</i>	4.51	6.43	-1.92	(2.34)
<i>All household members were aged 60 years or over in 2008 (%)</i>	10.5	3.55	6.98***	(2.16)
<i>Household head is female (%)</i>	27.1	27.9	-0.87	(4.43)
<i>Age of household head (years)</i>	50.9	41.4	9.50***	(1.41)
<i>Household head was engaging in some work to generate income or food for the household in 2008 (%)</i>	91.7	79.8	11.9***	(3.72)
<i>Household head is aged 60 years or over (%)</i>	29.3	13.5	15.8***	(3.67)
<i>Household head completed primary education (%)</i>	57.1	70.5	-13.4***	(4.60)
<i>Household head completed secondary education (%)</i>	19.5	38.1	-18.6***	(4.62)
<i>Respondent was born in Trinidad or the municipality of Cercado (%)</i>	51.1	55.4	-4.30	(4.92)
<i>Respondent was born elsewhere in the department of Beni (%)</i>	38.3	33.3	5.09	(4.69)
<i>Respondent was born in a city outside the department of Beni (%)</i>	7.52	9.53	-2.02	(2.84)
<i>Respondent was born in a rural area outside the department of Beni (%)</i>	3.01	1.77	1.23	(1.40)
<i>Proportion of household members aged 18 years or over who completed primary education (%)</i>	56.5	71.4	-14.9***	(3.64)
<i>Proportion of household members aged 18 years or over who completed secondary education (%)</i>	24.1	42.4	-18.3***	(3.79)
<i>Sources from which household received income in 2008:</i>				
Regular, salaried employment (%)	27.1	29.5	-2.42	(4.48)
Self-employment (%)	60.2	55.2	4.94	(4.90)

	Intervention mean	Comparison mean	Difference	Standard error
Casual labour (%)	31.6	37.5	-5.89	(4.74)
Fishing (%)	17.3	3.77	13.5***	(2.43)
Fish farming (%)	16.5	3.10	13.4***	(2.31)
Crop production (%)	30.8	9.76	21.1***	(3.37)
Livestock rearing (%)	12.0	7.10	4.93*	(2.71)
Timber clearing or sales (%)	17.3	6.21	11.1***	(2.75)
Processing of agricultural products (%)	3.01	1.11	1.90	(1.21)
Receiving remittances (%)	2.26	3.55	-1.29	(1.75)
Transfers from government (%)	10.5	3.10	7.42***	(2.09)
<i>Respondent was meeting socially with others from the community or neighbourhood at least once a week in 2008 (%)</i>	61.7	48.8	12.9***	(4.91)
<i>Respondent was meeting socially with others from outside the community or neighbourhood at least once a week in 2008 (%)</i>	35.3	34.4	0.97	(4.70)
<i>Household was in the lowest 20% of the sample according to wealth indicators recalled from 2008 (%)</i>	29.3	14.4	14.9***	(3.73)
<i>Household was in the second 20% of the sample according to wealth indicators recalled from 2008 (%)</i>	24.8	19.7	5.08	(4.01)
<i>Household was in the middle 20% of the sample according to wealth indicators recalled from 2008 (%)</i>	23.3	19.7	3.57	(3.99)
<i>Household was in the fourth 20% of the sample according to wealth indicators recalled from 2008 (%)</i>	15.0	21.7	-6.69*	(3.96)
<i>Household was in the upper 20% of the sample according to wealth indicators recalled from 2008 (%)</i>	7.52	24.4	-16.9***	(3.93)
Number of observations	133	451	584	

The construction of the wealth index is described in Section 5.6.

Variables dated 2008 are estimates, based on recall data.

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

Table A2.2: Additional characteristics of the individual respondent, used for modelling women's empowerment outcomes (Section 5.9)

	Intervention mean	Comparison mean	Difference	Standard error
<i>Age of female respondent (years)</i>	48.2	38.7	9.46***	(1.54)
<i>Female respondent is aged 60 years or over (%)</i>	21.7	10.3	11.4***	(3.63)
<i>Female respondent completed primary education (%)</i>	47.2	67.3	-20.1***	(5.23)
<i>Female respondent completed secondary education (%)</i>	17.0	35.1	-18.1***	(5.02)
<i>Female respondent was engaging in some work to generate income or food for the household in 2008 (%)</i>	71.7	58.0	13.7**	(5.32)
<i>Female respondent was meeting socially with others from the community or neighbourhood at least once a week in 2008 (%)</i>	54.7	46.9	7.81	(5.48)
<i>Female respondent was meeting socially with others from outside the community or neighbourhood at least once a week in 2008 (%)</i>	31.1	31.4	-0.31	(5.10)
Number of observations	106	388	494	

Variables dated 2008 are estimates, based on recall data.

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

Five observations that were not included in the models of household-level outcomes (because the section of the questionnaire on household income was not completed satisfactorily) are included in the analysis of the women's empowerment outcomes. For this reason, the household-level descriptive statistics used for modelling women's empowerment outcomes are slightly different from those shown in Table A2.1.

APPENDIX 3: METHODOLOGY USED FOR PROPENSITY SCORE MATCHING

Results presented in Section 5 of this report were estimated using propensity-score matching (PSM). PSM is a statistical technique that allows us to estimate the effect of an intervention by accounting for the covariates that predict receiving the intervention, or ‘treatment’. The idea behind PSM is to match similar individuals in the treatment or intervention group to those in the comparison group, based on observed characteristics they share 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. A practical guide on the different approaches to matching may be found in 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 summarise 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.

Tables A3.1 and A3.2 show the variables used to estimate propensity scores for the household-level outcomes and for women’s empowerment outcomes, respectively. As suggested in Caliendo and Kopeinig (2008), only variables being likely to influence the participation decision and simultaneously not be affected by participation in the project, were included in each model. In the table, the dependent variable corresponds to whether or not an individual received the intervention – it is equal to one if the household belongs to one of the villages that benefited from the project activities, and zero otherwise. Coefficients in the table correspond to the marginal effects, i.e. the change in the probability of receiving the intervention if the independent variable changes in one unit.

Defining the region of common support

After estimating the propensity scores, we need to verify that there is a potential match for the observation in the intervention group with those from the comparison group. We need to verify then the presence of a good *common support area*. 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). Figures A3.1 and A3.2 show the propensity score density plots for both groups. We observe 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, six observations from the intervention group were dropped because there was not a suitable match for them. No observations were dropped in the model for the women’s empowerment outcomes.

Table A3.1: Estimating the propensity score for household-level outcomes

	Coefficient	Standard error	p-value
<i>Household resides in a rural (as opposed to peri-urban) community = 1</i>	-0.003	0.041	0.943
<i>Household existed in its current form in 2008 = 1</i>	0.090	0.044	0.075
<i>Number of household members who were engaging in some work to generate income or food for the household in 2008</i>	0.015	0.018	0.393
<i>Household has no adult male members = 1</i>	-0.054	0.064	0.449
<i>All household members are aged 60 years or over = 1</i>	0.022	0.082	0.782
<i>Age of household head (years)</i>	0.004	0.001	0.005
<i>Respondent was born outside Trinidad or the municipality of Cercado, elsewhere in the department of Beni = 1</i>	0.000	0.037	0.991
<i>Respondent was born in a city outside the department of Beni = 1</i>	-0.018	0.060	0.772
<i>Respondent was born in a rural area outside the department of Beni = 1</i>	0.138	0.151	0.298
<i>Proportion of household members aged 18 years or over who completed primary education = 1</i>	0.036	0.058	0.530
<i>Proportion of household members aged 18 years or over who completed secondary education = 1</i>	-0.099	0.060	0.098
<i>Household received income from regular, salaried employment in 2008 = 1</i>	0.065	0.044	0.124
<i>Household received income from self-employment in 2008 = 1</i>	0.042	0.035	0.230
<i>Household received income from casual labour in 2008 = 1</i>	-0.053	0.035	0.142
<i>Household received income from fish farming in 2008 = 1</i>	0.314	0.093	0.000
<i>Household received income from crop production in 2008 = 1</i>	0.133	0.060	0.014
<i>Respondent was meeting socially with others from the community or neighbourhood at least once a week in 2008 = 1</i>	0.043	0.035	0.227
<i>Household was in the lowest 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.285	0.094	0.001
<i>Household was in the second 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.172	0.079	0.018
<i>Household was in the middle 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.221	0.081	0.003
<i>Household was in the fourth 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.097	0.075	0.168

Probit regression. Variables dated 2008 are estimates, based on recall data. Explanatory variables expressed as x=1 represent binary variables taking values of either 0 or 1. The dependent variable is 1 for project participant households, and 0 otherwise. The coefficients represent the change in the probability of participation of a change in each independent variable (marginal effects).

Table A3.2: Estimating the propensity score for women's empowerment outcomes

	Coefficient	Standard error	p-value
<i>Household resides in a rural (as opposed to peri-urban) community = 1</i>	0.069	0.044	0.103
<i>Household existed in its current form in 2008 = 1</i>	0.092	0.046	0.084
<i>Number of household members who were engaging in some work to generate income or food for the household in 2008</i>	-0.001	0.019	0.967
<i>Household has no adult male members = 1</i>	-0.068	0.058	0.307
<i>All household members were aged 60 years or over in 2008 = 1</i>	-0.081	0.060	0.275
<i>Age of female respondent (years)</i>	0.005	0.002	0.001
<i>Respondent was born outside Trinidad or the municipality of Cercado, elsewhere in the department of Beni = 1</i>	-0.008	0.038	0.828
<i>Respondent was born in a city outside the department of Beni = 1</i>	-0.024	0.064	0.721
<i>Respondent was born in a rural area outside the department of Beni = 1</i>	0.121	0.167	0.408
<i>Female respondent completed primary education = 1</i>	-0.030	0.045	0.496
<i>Female respondent completed secondary education = 1</i>	-0.019	0.049	0.708
<i>Household received income from regular, salaried employment in 2008 = 1</i>	0.063	0.045	0.147
<i>Household received income from self-employment in 2008 = 1</i>	0.040	0.036	0.267
<i>Household received income from casual labour in 2008 = 1</i>	-0.060	0.036	0.108
<i>Female respondent was meeting socially with others from the community or neighbourhood at least once a week in 2008 = 1</i>	0.005	0.037	0.902
<i>Household was in the lowest 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.104	0.065	0.078
<i>Household was in the second 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.008	0.052	0.875
<i>Household was in the middle 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	-0.064	0.047	0.214
<i>Household was in the fourth 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	-0.140	0.043	0.011

Probit regression. Variables dated 2008 are estimates, based on recall data. Explanatory variables expressed as x=1 represent binary variables taking values of either 0 or 1. The dependent variable is 1 for women in project participant households, and 0 otherwise. The coefficients represent the change in the probability of participation of a change in each independent variable (marginal effects).

Figure A3.1: Density plot of propensity scores for modelling household-level outcomes

Figure A3.2: Density plot of propensity scores for modelling women's empowerment outcomes

Matching intervention households to comparison households

Following Rosenbaum and Rubin (1983), households were matched on the basis of their propensity scores. The literature has developed a variety of matching procedures. After a series of checks, we decided to employ the kernel matching algorithm for the results presented in this Effectiveness Review.³² 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. We used the *psmatch2* module in Stata with a bandwidth of 0.11 for the household-level outcomes and a bandwidth of 0.06 for the women's empowerment outcomes, and restricted the analysis on 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 the determination of the common support.

Check balancing

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 Tables A3.3 and A3.4. Looking at the third column in each of these tables, we find that none of the variables implemented for the matching is statistically significant in the matched samples: all variables have a *p*-value larger than 0.2. We can therefore conclude in each case that we have found a satisfactory match for our sample.

Table A3.3: Balancing test on matching variables for household-level outcomes

	Intervention group mean	Comparison group mean	<i>p</i> -value
<i>Household resides in a rural (as opposed to peri-urban) community = 1</i>	0.519	0.522	0.968
<i>Household existed in its current form in 2008 = 1</i>	0.930	0.916	0.678
<i>Number of household members who were engaging in some work to generate income or food for the household in 2008</i>	1.845	1.822	0.868
<i>Household has no adult male members = 1</i>	0.047	0.057	0.717
<i>All household members are aged 60 years or over = 1</i>	0.093	0.095	0.953
<i>Age of household head (years)</i>	50.163	49.668	0.785
<i>Respondent was born outside Trinidad or the municipality of Cercado, elsewhere in the department of Beni = 1</i>	0.388	0.370	0.768
<i>Respondent was born in a city outside the department of Beni = 1</i>	0.078	0.069	0.797
<i>Respondent was born in a rural area outside the department of Beni = 1</i>	0.031	0.024	0.742
<i>Proportion of household members aged 18 years or over who completed primary education = 1</i>	0.567	0.576	0.848
<i>Proportion of household members aged 18 years or over who completed secondary education = 1</i>	0.240	0.250	0.801
<i>Household received income from regular, salaried employment in 2008 = 1</i>	0.271	0.278	0.898
<i>Household received income from self-employment in 2008 = 1</i>	0.597	0.604	0.907
<i>Household received income from casual labour in 2008 = 1</i>	0.310	0.329	0.741
<i>Household received income from fish farming in 2008 = 1</i>	0.140	0.108	0.438

	Intervention group mean	Comparison group mean	p-value
<i>Household received income from crop production in 2008 = 1</i>	0.287	0.265	0.693
<i>Respondent was meeting socially with others from the community or neighbourhood at least once a week in 2008 = 1</i>	0.612	0.633	0.734
<i>Household was in the lowest 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.287	0.297	0.864
<i>Household was in the second 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.248	0.258	0.850
<i>Household was in the middle 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.233	0.239	0.899
<i>Household was in the fourth 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.155	0.139	0.709

Variables dated 2008 are estimates, based on recall data. Explanatory variables expressed as x=1 represent binary variables taking values of either 0 or 1.

Table A3.4: Balancing test on matching variables for women's empowerment outcomes

	Intervention group mean	Comparison group mean	p-value
<i>Household resides in a rural (as opposed to peri-urban) community = 1</i>	0.552	0.547	0.938
<i>Household existed in its current form in 2008 = 1</i>	0.933	0.918	0.667
<i>Number of household members who were engaging in some work to generate income or food for the household in 2008</i>	1.838	1.821	0.903
<i>Household has no adult male members = 1</i>	0.057	0.070	0.704
<i>All household members were aged 60 years or over in 2008 = 1</i>	0.076	0.076	0.997
<i>Age of female respondent (years)</i>	47.781	47.566	0.914
<i>Respondent was born outside Trinidad or the municipality of Cercado, elsewhere in the department of Beni = 1</i>	0.400	0.410	0.883
<i>Respondent was born in a city outside the department of Beni = 1</i>	0.067	0.063	0.903
<i>Respondent was born in a rural area outside the department of Beni = 1</i>	0.019	0.020	0.947
<i>Female respondent completed primary education = 1</i>	0.476	0.471	0.945
<i>Female respondent completed secondary education = 1</i>	0.171	0.181	0.863
<i>Household received income from regular, salaried employment in 2008 = 1</i>	0.286	0.293	0.906
<i>Household received income from self-employment in 2008 = 1</i>	0.600	0.601	0.988
<i>Household received income from casual labour in 2008 = 1</i>	0.333	0.349	0.812
<i>Female respondent was meeting socially with others from the community or neighbourhood at least once a</i>	0.552	0.590	0.586

	Intervention group mean	Comparison group mean	p-value
<i>week in 2008 = 1</i>			
<i>Household was in the lowest 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.305	0.301	0.958
<i>Household was in the second 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.238	0.221	0.765
<i>Household was in the middle 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.143	0.142	0.990
<i>Household was in the fourth 20% of the sample according to wealth indicators recalled from 2008 = 1</i>	0.067	0.063	0.907

Variables dated 2008 are estimates, based on recall data. Explanatory variables expressed as x=1 represent binary variables taking values of either 0 or 1.

APPENDIX 4: ROBUSTNESS CHECKS

In order to address the validity of the results presented in Section 5, a series of robustness checks were carried out to check whether the preferred matching algorithm is the one that best performs the matching between intervention and comparison groups. This section presents a number of alternative matching algorithms used to test the robustness of the estimates presented in Section 5.

1 Propensity-score matching, omitting baseline participation in fish farming or agriculture

The first alternative model tested is a PSM kernel model, similar to that described in Appendix 3, including all the variables shown in Table A3.1 as matching variables *except for* households' having recalled receiving income from fish farming or crop production in 2008. This model tests for the possibility that recall error in these variables may have been influenced the outcomes derived from the main PSM model presented in this report. The resulting model was found to be reasonably well balanced, with all the variables in the matched sample having *p*-values larger than 0.2. (Note that no equivalent model was tested for the women's empowerment outcomes, since, as shown in Appendix 3, participation in fish farming and crop production in 2008 were not used as matching variables in the main PSM model for women's empowerment outcomes.)

2 Propensity-score matching, omitting comparison households that reported being involved in camellones

Secondly, another alternative PSM kernel model was tested, including all the of variables listed in tables A3.1 or A3.2, but in which comparison households that reported having been in engaged in the camellones at some point were excluded from the comparison group. This model tests for the possibility that some of those in the comparison group may have in fact participated in the project, which would result in the impacts of the project being underestimated by the main PSM model presented in this report. Again, the resulting models were found to be reasonably well balanced, with all the variables in the matched samples having *p*-values larger than 0.2.

3 Multivariate regression

The first basic specification for estimating the impact of project participation is

a probit model when the dependent variable is binary, or an ordinary least squares (OLS) model otherwise.

$$Y_i = \alpha + \beta_1 \text{Project participation}_i + \delta' X_i + \varepsilon_i$$

Where Y_i is the dependent variable and X_i is a vector of the covariates listed in tables A3.1 or A3.2. The variable of interest is the dummy variable *Project participation_i* that assumes value equal to one when the household is enrolled in the project, zero otherwise. When the dependent variable Y_i is binary variable, a probit model replaces the OLS specification. It is important to note that in the absence of randomised allocation of the project among the population in our sample, OLS and probit models fail to identify the causal effect of the programme, and can only be used as additional qualitative checks for the non-parametric estimates. Only the estimate of β_1 will be reported.

4 Propensity-score weighting

Following the example of Hirano and Imbens (2001) we implemented a regression adjustment with weights based on the propensity score. The average treatment effect can be estimated in a parametric framework as follows:

$$Y_i = \alpha + \beta_1 \text{Project participation}_i + \delta'_2 Z_i + \delta'_1 X_i + \varepsilon_i$$

Where Y_i represents the outcome of interest; $\text{Project participation}_i$ is a dummy binary variable equal to one if an individual/household is enrolled into the programme and zero otherwise; X_i is a vector of matching covariates used to estimate the propensity score match; and Z_i is a vector of control variables which cannot be used for the matching as they are not supposed to influence project participation. The regression is estimated with weights equal to one for the treated units and $\hat{e}(x)/(1 - \hat{e}(x))$ for control units. This parametric regression analysis framework has the advantage of controlling for variables that cannot be included in the propensity score equation.

Table A4.1: Households' engagement in fish farming

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS/probit	Propensity-score weighting
Households engaged in fish farming at the time of the survey (%)	10.0*** (3.4)	10.5*** (3.6)	4.7*** (1.4)	7.3** (2.9)
N	580	546	572	541
Households engaged in fish farming in 2013 (%)	22.9*** (3.9)	22.2*** (3.9)	8.5*** (1.9)	18.5*** (3.7)
N	580	546	584	580
Proportion of gross household income in the 12 months prior to the survey coming from fish farming (%)	1.9* (1.0)	1.9** (1.0)	1.9* (1.1)	1.9* (1.0)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.2: Households' engagement in crop production

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS/probit	Propensity-score weighting
Households engaged in crop production at the time of the survey (%)	6.2 (4.6)	-0.1 (4.7)	0.7 (3.9)	0.1 (5.7)
N	580	546	584	580
Households engaged in crop production in 2013 (%)	11.4** (4.8)	5.7 (4.9)	5.4 (4.5)	6.8 (6.5)
N	580	546	584	580
Total value of households' crop production during 2013 (bolivianos)	405 (619)	321 (650)	182 (592)	160 (610)
N	579	545	583	579
Ln of 1 + total value of households' crop production during 2013 (bolivianos)	0.41 (0.38)	0.10 (0.40)	0.03 (0.32)	-0.06 (0.33)
N	579	545	583	579
Proportion of household income in 12 months prior to the survey coming from crop production (%)	0.3 (3.3)	-1.0 (4.0)	0.6 (2.8)	0.8 (3.1)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.3: Household income

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS	Propensity-score weighting
Total gross household income in the 12 months prior to the survey (bolivianos)	10 947** (5 533)	8 909* (4 977)	4 568 (5 643)	6 903 (5 308)
N	580	546	584	580
Ln of total gross household income in the 12 months prior to the survey (bolivianos)	0.15 (0.13)	0.24 (0.16)	0.11 (0.14)	0.15 (0.14)
N	580	546	584	580
Proportion of household income in the past 12 months coming from self-employment (%)	3.2 (4.6)	2.4 (5.1)	1.6 (4.5)	1.5 (4.4)
N	580	546	584	580
Proportion of household income in the past 12 months coming from formal employment (%)	-0.3 (3.4)	-0.8 (3.7)	-0.7 (2.9)	-0.9 (2.8)
N	580	546	584	580
Proportion of household income in the past 12 months coming from casual labour (%)	-5.2 (3.5)	-3.9 (3.5)	-3.1 (3.3)	-3.3 (3.2)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.4: Indicators of households' material wellbeing

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS/probit	Propensity-score weighting
Household's fruit and vegetable consumption (score from 0 to 105)	1.0 (1.6)	2.3 (1.7)	0.9 (1.8)	1.0 (1.8)
N	580	546	584	580
Proportion of children in household aged between 6 and 18 years currently attending school ^a (%)	-2.5 (3.4)	-4.3 (3.4)	-3.9 (3.6)	-3.5 (3.5)
N	368	341	371	368
Respondents who have saved any money during the past one month (%)	-1.1 (5.0)	0.5 (5.3)	-1.6 (5.6)	-2.6 (5.5)
N	580	546	584	580
Estimated number of days for which households could live from their current savings	-0.9 (7.2)	2.9 (5.7)	0.8 (5.7)	3.2 (6.1)
N	580	546	584	580

^a Among households with any children of this age.

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.4: Indicators of material wealth

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS	Propensity-score weighting
Change in wealth index between 2008 and the date of the survey (scale from -1 to 1)	0.020 (0.021)	0.015 (0.023)	0.023 (0.022)	0.020 (0.022)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.5: Effects of the 2014 flood

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS/probit	Propensity-score weighting
Households that adopted any of the eight coping strategies listed in the questionnaire in 2014 (%)	8.4** (3.4)	8.1** (3.8)	8.7* (4.9)	8.0** (3.3)
N	580	546	584	580
Number of coping strategies (from the eight listed) adopted by households in 2014	0.85*** (0.21)	0.87*** (0.21)	0.70*** (0.21)	0.74*** (0.21)
N	580	546	584	580
Change in number of asset types owned by households between 2013 and 2015	0.22* (0.11)	0.24** (0.12)	0.21* (0.12)	0.23** (0.11)
N	580	546	584	580
Change in number of livestock (cattle, pigs, horses and mules) owned by households between 2013 and 2015	-1.20 (0.81)	-0.87 (0.82)	-0.73 (0.87)	-1.10 (1.01)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.6: Overall indices of resilience

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	OLS	Propensity-score weighting
Base resilience index	0.026* (0.014)	0.013 (0.015)	0.011 (0.013)	0.010 (0.013)
N	580	546	584	580
Alkire-Foster resilience index	0.036* (0.021)	0.016 (0.022)	0.013 (0.019)	0.011 (0.020)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.7: Households scoring positively in terms of characteristics of livelihood viability

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	Probit	Propensity-score weighting
Stable employment (%)	-1.5 (4.3)	-1.8 (4.8)	-2.2 (4.8)	-1.8 (3.8)
N	580	546	584	580
Income from sources less vulnerable to flood (%)	3.9 (5.1)	1.5 (5.4)	1.2 (5.3)	2.2 (5.2)
N	580	546	584	580
Income from sources less vulnerable to drought (%)	4.7 (4.8)	4.6 (5.1)	2.3 (5.1)	2.7 (4.8)
N	580	546	584	580
Multiple income earners (%)	9.5* (5.2)	9.8* (5.5)	11.9** (5.5)	10.4* (5.9)
N	580	546	584	580
Ownership of productive assets (%)	2.1 (4.9)	0.5 (5.6)	-3.5 (5.6)	-1.0 (5.9)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.8: Households scoring positively in terms of characteristics of innovation potential

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	Probit	Propensity-score weighting
Attitude to change (%)	5.0 (4.9)	4.1 (5.5)	5.5 (5.4)	6.2 (5.4)
N	580	546	584	580
Understanding of climate change (%)	10.1* (5.3)	13.2*** (5.1)	8.0 (5.4)	8.6 (5.5)
N	580	546	584	580
Access to credit (%)	5.7 (4.9)	3.1 (5.3)	3.8 (5.0)	5.0 (5.2)
N	580	546	584	580
Adoption of new practices or initiatives (%)	5.1 (5.0)	9.1* (5.2)	4.6 (5.5)	4.9 (5.8)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.9: Households scoring positively in terms of characteristics of access to contingency resources and support

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	Probit	Propensity-score weighting
Savings (%)	0.6 (5.1)	-5.3 (5.4)	-4.3 (5.5)	-6.9 (5.7)
N	580	546	584	580
Social support networks (%)	2.0 (5.3)	-0.2 (5.7)	0.2 (5.5)	-1.4 (5.7)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.10: Households scoring positively in terms of characteristics of integrity of the natural and built environment

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	Probit	Propensity-score weighting
Security of ownership of the house (%)	-2.3 (4.6)	-9.3* (5.3)	-6.1 (5.4)	-6.3 (5.4)
N	580	546	584	580
House protected from flood (%)	-6.1 (4.4)	-9.7** (4.8)	-6.7 (4.4)	-6.6 (4.9)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.7: Households scoring positively in terms of characteristics of social and institutional capability

	(1)	(2)	(3)	(4)
	PSM kernel: no baseline fish farming or agriculture	PSM kernel: restricted comparison group	Probit	Propensity-score weighting
Access to state extension services (%)	4.9 (3.2)	4.7 (3.7)	2.6 (1.7)	2.3 (3.1)
N	580	546	584	580
Access to and ability to make use of early- warning information (%)	3.5 (5.0)	2.8 (5.5)	-0.7 (5.2)	-0.5 (5.4)
N	580	546	584	580
Confidence in authorities to support in a crisis (%)	2.7 (2.8)	0.3 (3.4)	0.9 (2.5)	0.4 (2.3)
N	580	546	584	580
Involvement in community decision-making (%)	-2.0 (4.4)	-5.0 (4.8)	-1.6 (4.3)	-4.2 (4.1)
N	580	546	584	580
Participation in community groups (%)	-0.9 (4.9)	0.8 (5.2)	3.2 (5.4)	4.1 (5.2)
N	580	546	584	580

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.8: Women's contribution to household income

	(1)	(2)	(3)
	PSM kernel: restricted comparison group	OLS/probit	Propensity-score weighting
Respondent carries out some activity to generate income or produce food for the household (%)	19.1*** (5.6)	20.2*** (6.3)	18.9*** (5.5)
N	465	494	493
Respondent's total gross income from all sources in the past 12 months (bolivianos)	12 523*** (3 695)	9 409** (4 744)	11 241** (4 653)
N	460	489	488
Ln of 1 + respondent's total gross income from all sources in the past 12 months (bolivianos)	2.19*** (0.53)	1.75*** (0.52)	1.95*** (0.52)
N	460	489	488
Respondent's contribution to total household income (%)	9.0** (4.4)	6.3* (3.7)	6.3 (4.0)
N	460	489	488
Respondent's perception of change in her contribution to household income since 2008 (%)	7.6** (3.5)	6.8** (3.3)	7.2** (3.5)
N	465	494	493

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.9: Areas in which female respondent has decision-making power^a

	(1) PSM kernel: restricted comparison group	(2) Probit	(3) Propensity-score weighting
Making daily household purchases (%)	-4.5 (4.8)	-2.6 (4.3)	-3.8 (4.6)
N	465	494	493
Making larger purchases or investments (%)	-4.0 (5.6)	-4.7 (5.6)	-6.3 (5.6)
N	463	492	491
Participation in group meetings or activities (%)	-7.7 (5.6)	-7.1 (4.7)	-8.6 (5.3)
N	446	475	474
Decisions over borrowing (%)	-2.5 (5.8)	0.9 (5.4)	3.7 (5.9)
N	436	465	464
Travel to visit relatives (%)	-3.1 (5.5)	-3.5 (5.8)	-3.7 (5.9)
N	450	445	444
Decisions over when to have children (%)	-11.0** (5.1)	-9.4** (4.4)	-9.1* (4.9)
N	396	423	423

^a Among households where each type of decision is applicable.

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

Table A4.10: Further indicators of women's empowerment

	(1) PSM kernel: restricted comparison group	(2) Probit	(3) Propensity-score weighting
Respondent does <u>not</u> agree that she is prevented from working more outside the home because of domestic work or care responsibilities (%)	1.1 (6.0)	6.2 (5.9)	1.5 (6.2)
N	465	494	493
Respondent strongly agrees that she now feels more confident than in the past in expressing her opinion about livelihoods activities in the household (%)	3.0 (5.8)	3.8 (4.9)	4.2 (5.2)
N	465	494	493
Respondent does <u>not</u> agree that she normally remains silent if she disagrees with others in a group discussion (%)	0.6 (5.9)	1.5 (6.0)	0.2 (6.3)
N	465	494	493
Respondent strongly agrees that she would be willing to make demands to the municipality on behalf of her community or neighbourhood, if necessary (%)	5.6 (6.1)	3.9 (5.7)	6.1 (6.3)
N	465	494	493
Respondent strongly agrees that women now participate more in community affairs than they used to (%)	-3.9 (6.1)	-4.4 (5.7)	-2.8 (6.2)
N	465	494	493

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1000 repetitions, with standard errors clustered by community.

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NOTES

1 The fact that, for agricultural production, each 1000 m² camellón was initially shared between four households, but in more recent seasons has been dedicated to a single household in any case implies that the number of participant households has decreased considerably since the early years of the project.

2 In fact, in the rural communities used for comparison, all the households in each community were targeted for interview.

3 Interviews were also conducted in the community of Mangalito, where Oxfam had supported a different local partner organisation (as part of a related project) to raise houses, and had successfully lobbied the municipality to construct camellones. All 20 households in Mangalito were interviewed. However, the slightly different nature of the project activities in Mangalito means that these 20 households have not been included in the intervention group in this report. In addition, because of severe flooding in Mangalito, the majority of households there were found to have moved their normal residence to Trinidad or to other communities: they were interviewed on a day in which they had returned to Mangalito for the formal launch of a new project. The nature of the event at which they were interviewed may have affected their responses to the survey, which would make their responses not comparable to those in the comparison communities. In any case, it appears that the camellones had not been constructed by the time of the survey, since none of those 20 households reported ever having worked on farming or fish farming with the camellones.

4 This is partly due to a higher proportion of the project participants having come from rural communities than the comparison respondents (a consequence of the sampling strategy), but the differences in these baseline livelihoods activities are still present even after controlling for the rural/urban split.

5 This analysis was done both by constructing PSM models specifically for these sub-groups, and by adding interaction terms to the parametric PSM and linear regression models for each of the outcome measures examined in this report.

6 Since respondents' reports of which camellones activities they had engaged in differed from the project records, this question was asked to nearly half of those who were recorded in the project records as having been engaged in fish farming. However, those households for whom this question was omitted were clearly not a random sample of the fish-farming participants. It is possible that those who were not asked this question had tended to benefit more than those from whom answers were collected.

7 PSM models that are restricted to respondents in the peri-urban areas produced estimates for participation in training on family planning that are positive and statistically significant at the 5 per cent level, and for participation in training on women's rights that are positive and statistically significant at the 10 per cent level. OLS regression models for the same outcomes produce similar results.

8 Oxfam and a local partner organisation supported the construction of raised houses for all households in the community of Mangalito, the community where the Effectiveness Review survey was carried out, but which is not included in the main results. Surprisingly, only half (10 of the 20 households) responded positively to this question. It was observed during the survey that many of these households were residing primarily outside Mangalito, so it may be that it did not occur to them all to consider the houses that were constructed in the community as being of practical support to them.

9 However, when asked specifically whether they could continue to carry out fish farming during the 2014 flood, nearly of those who were doing so in 2013 responded positively.

10 The calculation of total gross income from each source was presented immediately to respondents, who were then asked either to confirm that the total seemed accurate, or to provide an alternative estimate of the total. The figures presented in this report are based on respondents' estimates after having been presented with the totals – but none of the results are significantly different when derived instead purely from the calculations.

11 An attempt was also made to collect data on costs incurred in the course of earning income from each source. However, many respondents reported that their costs were approximately equal to the revenue they generated from one or more of their sources, so this data proved to be of limited use. For example, of the eight project participant households that reported generating some gross income from fish farming during the 12 months prior to the survey, six of them reported that their costs were equal to that revenue, so only two reported any net income.

12 In addition, 19 per cent of households in the rural communities and seven per cent in the peri-urban area had a kitchen garden (*huerto familiar*), the production from which is not included in the figures presented in this section.

13 These figures are derived from a PSM model constructed specifically among those who registered as being crop producers on the camellones under this project. The difference between the project and comparison households in this case (as well as the difference derived from alternative PSM and regression models) is statistically significant at the 5 per cent level.

14 As mentioned in footnote 11, the survey also asked respondents to estimate the expenses they had incurred in generating this income, in order to measure net household income. However, many respondents reported that their costs were approximately equal to the revenue they generated from one or more of their sources. That a large number of households reported having zero net revenue reduces the usefulness of these data. The results presented in this report are therefore based on the gross income data, without adjusting for costs.

15 PSM models constructed using only the project participants and comparison households interviewed in the rural communities produce estimates that are positive and statistically significant at the 5 per cent or 1 per cent level. The estimated magnitude of the effect is large: the estimated coefficients for the outcome in logarithmic terms are approximately 0.5 or 0.6, which implies an estimate of income being 50 or 60 per cent higher among the project participants than among comparison households in the rural areas.

The reason for caution in interpreting this result as a positive effect of the project is that some of those who were interviewed as project participants from rural communities were actually found during the survey to be residing mainly in the city of Trinidad, where incomes are generally higher. Equivalent households in the rural comparison communities would not have been interviewed because they would not have been present in those communities at the time of the survey.

It should also be noted that the PSM models for overall household income among households in the peri-urban area produce estimates that are negative in sign, some of which are statistically significant at the 10 per cent or 5 per cent level.

16 The distinction between self-employment (*cuenta propia*) and casual labour (*jornalero*) largely seems to have been clear to the survey staff and respondents, though it seems likely that there is some cross-over between these two categories.

17 The data do show some significant differences between the project and comparison households in terms of their income from some of the more minor sources. Project households generated a smaller proportion of their income from remittances (0.1 per cent, against 1.9 per cent among comparison households), and more from cutting and trading timber (4.0 per cent, against 0.5 per cent among comparison households). However, only small proportions of the respondents reported any income from these sources, meaning that the estimates are dependent on a few observations. The statistical significance of each of these estimates is reduced after controlling for whether the household recalled obtaining income from the respective source in 2008.

18 The score for fruit and vegetable consumption was estimated to be significantly higher (at the 5 per cent level) among project participant households than comparison households specifically in the rural communities, but this conclusion should be treated with caution for reasons discussed in footnote 14.

19 In fact, there are suggestions in the data that project households consumed dairy products on significantly fewer days than comparison households: the difference was statistically significant at the 5 per cent or 10 per cent level under several of the models tested, but not significant under other models. Within the peri-urban area, households had arguably eaten meat on significantly more days (at the 10 per cent level), but once again, results for these subgroup analyses should be treated with caution.

20 Cronbach's alpha was used to measure this inter-item correlation. The Cronbach's alpha obtained for all the indicators for the recalled 2008 data was 0.77. This alpha was increased to 0.83 by removing those items that had a low correlation with the others. The alpha derived for the index of change in wealth indicators was originally 0.78, and was increased to 0.82 by removing those items that had a low correlation with the others.

21 This approach is described in 'A Multidimensional Approach to Measuring Resilience', Oxfam GB working paper, August 2013: <http://policy-practice.oxfam.org.uk/publications/a-multidimensional-approach-to-measuring-resilience-302641>.

22 The two focus groups were also aimed at identifying indicators of women's empowerment, and so they were conducted only with women. Time constraints did not allow focus groups also to be carried out with men. However, women participants in the focus groups were asked what factors they thought their husbands or partners would identify if the team had had the opportunity to ask the same question to them.

23 It will be noted that in calculating these overall measures of resilience, each of the individual characteristics presented in Table 5.10 was weighted equally. Alternative weights could be given to the various characteristics and dimensions, which would necessarily result in changes in the overall indices.

24 As shown in Table A4.6 in Appendix 4, the results for the resilience indices were larger when estimated with the PSM model in which baseline fish farming and agriculture were not used as matching variables. However, these differences are statistically significant only at the 10 per cent level, providing only weak evidence of a difference between project participants and comparison households in terms of the resilience indices.

25 Of the alternative PSM and regression models tested, some produced estimates that were not statistically significant at conventional levels, although most produced estimates that were significant at the 10 per cent or 5 per cent level.

26 Participation in the camellones project was counted as an innovation. However, only two respondents (both of them project participants) mentioned the camellones in response to this question. Why the

question about innovative activities did not prompt project participants to mention their participation in the camellones is itself an interesting question that may be amenable to further investigation.

27 This part of the survey was omitted in cases (approximately 17 per cent of the total) where the head of household was male and he did not have a spouse or partner living in the household. For this reason, the numbers of observations used to evaluate outcomes are smaller in this section than in previous sections.

28 This result (and the other results discussed in this section) are maintained with little change in magnitude even after controlling for whether the woman was recalled to have been carrying out some activity to generate income or produce food for the household in 2008.

29 On the other hand, almost all the survey respondents agreed that their partner or other people would support them in these responsibilities if they wanted free time to participate in a group meeting or community activity – though only a quarter agreed strongly that this is the case. Results for this indicator are not shown in the table, but again there was no indication of a difference between respondents in project and comparison households.

30 PSM and regression models for households that were registered (according to the project's administrative records) as having participated in crop production in the camellones consistently provide estimates of a difference between project and comparison households that is approximately nine percentage points in size. The results derived from PSM models are not statistically significant at conventional levels, although those derived from the regression models are statistically significant at the 10 per cent level.

31 Nor is there any evidence of a difference in two alternative indicators not shown in the table, about women's confidence in approaching somebody they do not know to seek work, or about whether they see meetings and community affairs as the domain of men rather than women.

32 Kernel matching outperformed the other matching algorithms tested: nearest-neighbour and caliper matching. Kernel matching was found to have the lowest pseudo- R^2 after matching, the maximum reduction in mean and median bias, and no signs of bad variance.

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