RESILIENCE IN NORTH EAST GHANA

Impact evaluation of the Climate-Resilient Agricultural and Food Systems project

Effectiveness Review Series 2017/18

Caption: Mmalebna holding a pickaxe given to her as part of the CRAFS (Climate-Resilient Agriculture and Food System) programme. Mmalebna was shown how to make compost and given the tools to do it. Photo Credit: Nana Kofi Acquah/Oxfam

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EXECUTIVE SUMMARY

Oxfam GB's Global Performance Framework is part of the organization's effort to better understand and communicate its effectiveness, as well as enhance learning across the organization. Under this Framework, a small number of completed or mature projects are selected each year for an evaluation of their impact, known as an 'Effectiveness Review'.

During the 2017/18 financial year, the Climate-Resilient Agricultural and Food Systems (CRAFS) project in the northern regions of Ghana was selected for an Effectiveness Review. This project took place in four districts of the Upper East, Northern and Upper West regions, between April 2015 and March 2018, by Oxfam and PAS-Garu, PARED, ProNet North and NANDRIDEP.

The CRAFS project aimed at building the resilience of women and men by promoting resilient livelihood activities and improving food supply, while regenerating the natural resource base.

The project activities first aimed at raising awareness throughout the districts on climate change impact, the need to adapt to it, and the restoration of the natural resource base. This included participatory vulnerability risk assessment and dissemination of the results at the district level, provision of sensitization materials to bush burning practices and the broadcasting of radio agricultural programmes with a focus on conservation agriculture practices[1] and climate change adaptation. Climate change is creating more and more difficult conditions to grow food, and CRAFS focused on promoting agricultural practices that would not deteriorate the resource base further and provide food during both rainy and dry seasons. Diversification of livelihood activities was also promoted, through providing training and inputs for activities that are not dependent on land access and are sustainable from a natural resource management perspective (such as beekeeping or tree nurseries, for example). Protection and management of the natural resource base was also supported through village committees' support.

These activities took place at different scales: district, community, household and individual, women and men. Indeed, the project logic took into account the fact that gender norms manifest in different responsibilities within the household and livelihood activities for women and men, constrained in part by different access to land and access to liquidity to buy inputs.

EVALUATION APPROACH

The Effectiveness Review, for which the fieldwork was carried out in February and March 2018, was aimed at evaluating the success of this project in building resilience capacities. The Effectiveness Review focused on the Northern and Upper East regions.

A quasi-experimental impact evaluation design was used to measure the effect that is causally attributable to – and representative of – the project's intervention. The evaluation design involved comparing the households of project participants to households from nearby communities who are thought to have had similar characteristics to the project participants, before the project was carried out. Because of the high coverage of radio programmes on agricultural practices and climate change (of the shows supported by the project or other similar shows), this review focuses on the impact of CRAFS activities, excluding radio messaging and other wide-coverage messaging (through billboards for example). Similarly, Oxfam and partners are not working in isolation, and participation in any village savings and loans associations (VSLAs) is widespread in the review areas (comparison and project groups), in spite of CRAFS' support of the creation or strengthening of VSLAs.

First, 14 comparable communities were identified following the criteria used for selecting the 10 CRAFS communities at the onset of the project in the Northern and Upper East regions. In the CRAFS communities, a random sample of households whose members had participated in CRAFS was selected, and compared to a random sample of households in the comparison communities.

Within the household, the main women and men decision-makers were surveyed separately for an individual survey, and then together for a household survey. A total of 1,005 households were surveyed, 369 in the CRAS communities and 636 in the comparison ones. 1,962 individuals took part in the survey: 972 men and 990 women, main decision-makers. At the analysis stage, the statistical tools of propensity-score matching and multivariate regression were used to control for demographic and baseline differences between the households and individuals surveyed in the CRAFS and comparison communities, to provide additional confidence when estimating the project's impact.

Resilience was assessed through examining 32 characteristics that are thought to be associated with the capacity to absorb, adapt or transform. A list of the resilience indicators, their distribution per capacity, and a breakdown of the results for each is shown in Table 1.Multi-dimensional indices of resilience, and of resilience capacities were developed at the household level, taking into account household-level characteristics, individual level characteristics for women and men individuals, and intra-household dynamics (through involvement of different individuals in decision-making processes and access to resources).

RESULTS

CRAFS had a positive and significant impact on the overall resilience index, at 57 percent on average in the intervention group, while households in the comparison group scored positively on 52 percent of indicators (a difference significant at 1 percent).

It appears that the project did not have a measurable positive impact on absorptive capacity indicators. Only one of the 11 indicators appears to be positive and significant: access to remittances, although this is not directly linked to the project logic. No significant impact is observed on average on diversification of income sources, crop diversification, dietary diversity, availability of food at the beginning of lean season 2018, quantity of food, access to drinking water and feeling of preparedness in case of low rainfall during rainy season or heavy flooding. A negative impact on this last indicator is observed among households whose main decision-maker was a woman in 2014.

The project seems to have had a positive and significant effect on indicators of adaptive capacity through access to credit and control over its use within the household, control over decisions to sell livestock heads within the household and participation in groups (stronger for women-headed households). There is no evidence of impact on average on cattle vaccination, savings, ownership of fungible livestock, productive asset ownership, social support network, adoption of improved climate SMART agricultural practices, knowledge of conservation agricultural practices, knowledge of climate change's impact, understanding of climate change, control over decision to sell livestock heads or attitude towards change. However, among households whose main decision-maker was a woman at the onset of the project, we observe improved ownership of fungible livestock and productive asset ownership, which contributed to building the adaptive capacity of such households in particular.

There is evidence that transformative capacity was built thanks to better awareness of existing regulation, better interaction with district institutions and more control over income within the household (all stronger for women-headed households). While there is no overall impact on women's access to land nor on opinion on women's political role, we have observed better access to land for women among households in which a woman was the

main decision-maker at the onset of the project, but a negative impact on opinion on women's political role. In addition, there is no significant impact on attitude towards change, education of children, acceptability of (unpaid) care work being done by men, ability to support a partner in unpaid care work, feeling heard when voicing an issue in village assemblies, belief in collective action's effectiveness and opinion on acceptability of violence inside the household.

When it comes to looking at different steps along the theory of change, we observe that a higher share of respondents received information or training sessions on VSLAs in the CRAFS areas than in the comparison ones, and there is evidence for the VSLAs in CRAFS areas to be working differently from in the comparison communities. Participation in bush fire committees is also a key component of the project logic. Such committees are in place in the comparison areas, and participation is not significantly improved by CRAFS overall (although more women attended meetings of such a committee as a result of the project – not significant but close to the 10 percent threshold).

Overall, climate change awareness is high in both comparison and CRAFS communities. CRAFS's climate change awareness raising activities resulted in better awareness on whether regulation on bush fire was in place at the community level or not among women. Similarly, while participation in village meetings is high for both comparison and CRAFS communities, CRAFS has an impact for both men and women on awareness of community's action plan. Among them, awareness of the plan being built into district and national plan is very different by gender (lower for women respondents than men respondents).

CRAFS has a focus on diversification of livelihood activities, in particular through off-farm activities, which are less constrained for women, and through distribution of small ruminants. This resulted in an impact on decision-making and control over resources within the household; more women have a say in decisions related to livestock raising activities (decisions over the activity itself, and the generated revenue), an area where fewer women are involved than men in the first place.

Wider access to credit and slightly improved access to savings for women and men (although this is not significant) are observed as a result of the project. This enhanced access to credit seems driven by access to credits from VSLAs for both women and men. Hence, CRAFS seems to have enabled better functioning or richer VSLAs (ceiling reached), and/or involvement in several VSLAs for participants, resulting in an enhanced access to credit. The project did not result in larger spent in investments or overall improved access to assets. This raises questions around the amounts of credit or additional revenue obtained as a result of the project, which may not be enough to result in investments. Note that a significant impact for women-headed households on access to savings and livestock ownership is observed, which seems to be a reflection of the targeting focus of the livestock component of the intervention on women-headed households.

There is no evidence that food security, measured by a two indicators at the household level, was improved by CRAFS. However, there seems to be evidence for a differential impact for men and women, which will require further investigation (see programme learning considerations): women respondents are significantly more likely to have reduced the size of meals in the seven days prior to the survey (while this indicator is not significantly different among men).

Finally, CRAFS seems to have resulted in an improvement in the natural resource base, as self-assessed by respondents.

Table 1: Indicators of resilience examined in this Effectiveness Review

Capacity		Connected to the project logic?	Characteristic	Evidence of positive impact?
Absorptive capacity		Yes	Diversification of income sources – off-farm activities and government benefits	No
		Yes	Crop diversification	No
		Yes	Dietary diversity	No
		Yes	Availability of food at the beginning of lean season 2018	No
		Yes	Quantity of food – did not have to reduce the size of meals in the last 7 days	No
		No	Access to drinking water	No
	Adaptive capacity	No	Would feel prepared, in case of low rainfall during rainy season or heavy flooding	No
		Yes	Cattle vaccination	No
		Yes	Savings	No
		Yes	Ownership of fungible livestock	No
		No	Remittances	Yes
		Yes	Productive assets ownership	No
		Yes	Access to credit and control over its use	Yes
		No	Social support network	No
		Yes	Adoption of improved climate SMART agricultural practices	No
		Yes	Knowledge of conservation agricultural practices	No
		Yes	Knowledge of climate change's impact	No
		Yes	Understanding of climate change	No
	Transformative capacity	Yes	Control over decision to sell livestock heads	Yes
		No	Attitude towards change	No
		Yes	Participation in community groups	Yes
		Yes	Control over income from livestock sales and livestock products, and off-farm economic activities (petty trading, processing)	Yes
		No	Women's access to agricultural land	No
		Yes	Regulation within community about bush fires (and awareness of it)	Yes
		No	Education of children	No
		No	Acceptability of (unpaid) care work being done by men	No
		No	Supporting partner doing unpaid care work	No
		No	Feel heard when voicing an issue in village assembly	No
		No	Belief in collective action's effectiveness	No
		No	Opinion on women's political role	No
		No	Opinion on acceptability of violence inside the household	No
		Yes	Interaction with district institutions	Yes

PROGRAMME LEARNING CONSIDERATIONS

Consider complementary strategies to ensure livelihood activity diversification translates into higher income, access to savings and assets for women and men

CRAFS led to more involvement for women in decision-making over some activities and the revenue generated from these within the household. It also led to improved access to credit for both women and men, but this did not result in more productive asset ownership – in men-headed households, improved wealth or investments. Further exploration is needed to better understand what the amounts borrowed through VSLAs are used for, and if the amounts are sufficient to allow for significant investments. This also raises questions around the revenue generated at household level thanks to the diversification strategy, and for women and men within households. This is particularly critical in households traditionally identified as being men-headed (as we notice an impact on productive asset ownership for women-headed households).

Improved market access for off-farm products (cooperative to improve bargaining power in price negotiation, supported transportation, etc.)[2] and/or facilitated and safe access to institutions that enable access to credits of higher amounts, may be considered as areas of development for CRAFS.

Challenging social norms and current task distribution within the household when it comes to unpaid care and domestic work is another area to facilitate women's access to income.

Consider strengthening activities which could lead to a better enforcement of bush fire regulations and tackle root causes behind current occurrences of bush fires

Sixty percent of respondents participate in bush fire committee meetings and, overall, respondents assessed that bush fires have happened less since the rainy season of 2014 and the dry season of 2014–2015 (90 percent in the CRAFS community). CRAFS resulted in higher shares of women being aware of the existence of bush fire regulations, and such regulation seems widely in place (91 percent of respondents reported being aware of it in the CRAFS areas). However, among respondents who are aware of the regulation being in place, approximately a third of respondents are aware of such regulation not having been enforced, women in particular. Bush fires are a source of degradation of natural resources (soil fertility, tree coverage). Oxfam and partners could explore further what are the reasons behind recent bush fire occurrences and which dynamics lead to existing regulations not being enforced. This will enable revision and strengthening of the activities on the matter.

Build on the current integrated approach to enhancing resilience capacities and explore additional areas that could contribute to enhancing well-being further

This review highlights a few additional areas to explore to contribute to enhancing resilience capacities. First, while CRAFS resulted in better land access for women in women-headed households, land access for women within men-headed households is still a major constraint to women's access to revenue from on-farm activities. Second, 80 percent of respondents agree or partially agree that 'violence inside the household can be justified in certain circumstances' in the CRAFS villages (and only 8 percent disagree with the statement). While this review does not explore prevalence of domestic violence, this may be an important aspect to take into account in the project's context.

Consider current barriers to enhancing food security and potential differentiated risks within the household, to improve project strategy on the matter

Food security is a major concern in Ghana's northern regions, and the data show that 82 percent of households were worried about not having enough food during the lean season 2017, that is between April and September. At time of the survey (February–March 2018), two thirds of respondents declared that they had had to reduce the size of meals in the previous seven days because there was not enough food. This was not impacted by the project activities overall. In addition, among women, women from the CRAFS communities were more likely to have reduced size of meals. This needs further investigation to understand what the mechanisms are behind this result (are women reducing the size of meals for themselves only or for the whole household? Was the size of meals initially improved, and then reduced at the time of the survey?) and make sure that future projects take this gendered effect into account.

Take a more strategic approach to evaluation design, looking for synergies between baseline activities and final evaluation ones

To investigate questions around the impact of the project on women and men, this Effectiveness Review deployed a quasi-experimental ex-post methodology. Extensive inputs of project staff, partner staff, the survey team and inhabitants of the project areas were required to identify suitable comparison communities and identification of relevant indicators of resilience capacities. However, it would have been better to have had these discussions before the project activities began. This could have enabled the implementation of a stronger impact evaluation design if the comparison group had been established before the project started and baseline data had been collected in a large enough number of project and non-project communities.

While inception and baseline activities were key elements of CRAFS design, and several studies were implemented to adapt and monitor the project, a more holistic approach to monitoring, evaluation and learning could have brought these activities together with the final evaluation in a more articulated way.

1   INTRODUCTION

The northern regions of Ghana – the Upper West, Northern and Upper East regions – are particularly vulnerable to the rising temperatures and changes in rainfall patterns and levels, due to climate change, in a setting where livelihoods are highly dependent on natural resources through subsistence agriculture. In addition, these regions have historically suffered from lower economic resources: in 2014, the Demographics Health Survey estimated that inhabitants from these regions were over-represented in the national lowest wealth quintile (60 percent of the Upper West inhabitants, 72 percent in the Northern region and 78 percent in the Upper East region).

The Climate-Resilient Agricultural and Food Systems in Northern Ghana (CRAFS) project aimed at building resilience of women and men by securing their livelihood and food supply, while regenerating the natural resource base. The project took place between 2015 and 2018 in 20 communities of four districts. It was designed and implemented by Oxfam in Ghana, PAS-Garu, PARED, ProNet North and NANDRIDEP.

Figure 1.1: Map of Ghana with the project districts[3]
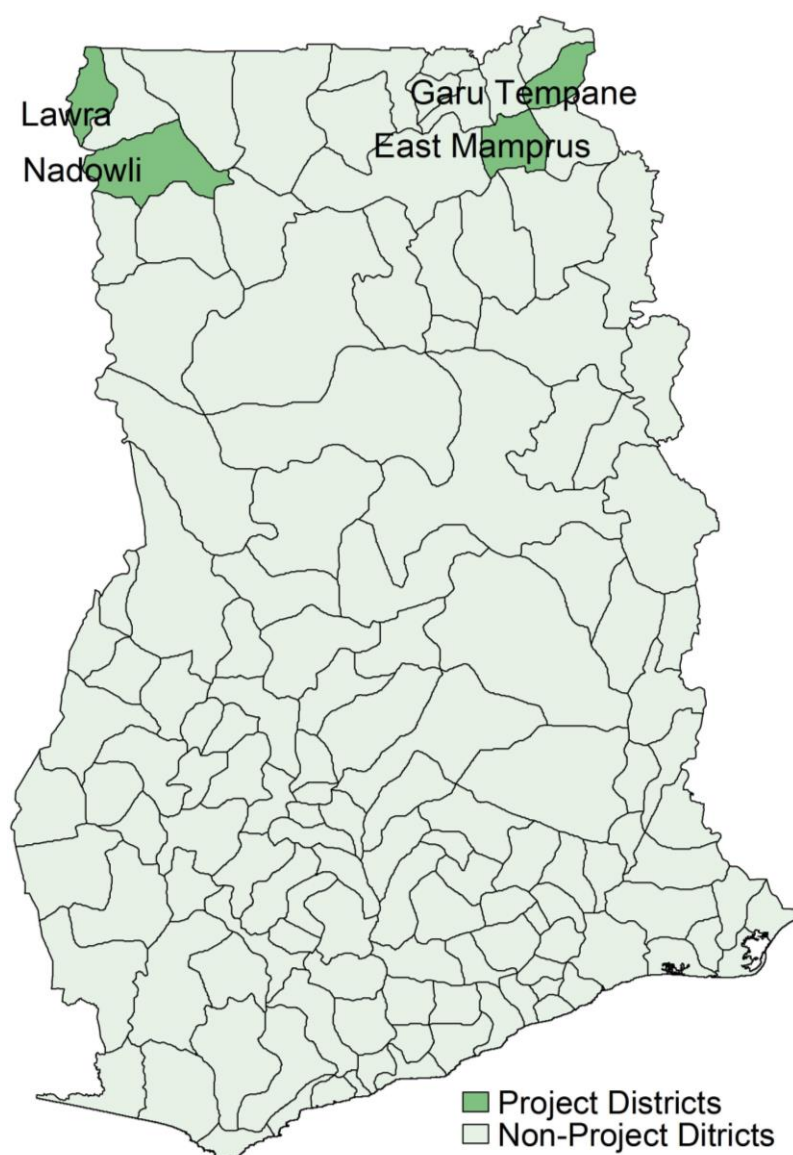
Oxfam GB's Global Performance Framework is part of the organization's effort to better understand and communicate its effectiveness, as well as enhance learning across the organization. Under this Framework, a small number of completed or mature projects are selected each year for an evaluation of their impact, known as an 'Effectiveness Review'. During the 2017/18 financial year, the CRAFS project was selected among the thematic area of resilience.

This Effectiveness Review will explore the impact of the project on the three capacities of resilience at the household and individual level, exploring differential impacts for men and women within the household. The review will focus on activities that were implemented at the village level and potential knock-on effects of district-level advocacy, but will not include the wide information campaign conducted by the project team, which by design was spread out throughout the regions. Finally, because of resource constraints, the review will focus on the Upper East and Northern regions, where the project areas belong to the same ecosystem.

2 PROJECT DESCRIPTION

The Climate-Resilient Agricultural and Food Systems in Northern Ghana (CRAFS) project started in 2015 in 20 communities of four districts, across three regions. CRAFS built on the approach developed in the Enhancing Livelihood Security through Climate Change Adaptation Learning Project (ELCAP), which started in 2012 in 16 communities. CRAFS and ELCAP were conducted in different communities in the Upper East, Upper West and Northern regions of Ghana.

Table 2.1: CRAFS targeted population

Region	District	Number of communities
Upper East	Garu Tempane	5
Upper West	Nandom	5
Upper West	Daffiama-Bussei-Issah	5
Northern	East Mamprusi	5

Garu Tempane and East Mamprusi districts constitute one ecosystem, with communities facing similar climatic conditions and situations and with similar livelihood strategies and characteristics, while the two districts in Upper West constitute a second distinct one. For example, according to the baseline report (Kanton, Bidzakin and Sugri, 2015) citing data from the 2012 Comprehensive Food Security and Vulnerability Analysis (CFSVA), 77.7 percent of households were food-secure in East Mamprusi and 65 percent in Garu Tempane, while levels were higher in the two other districts. Given the complexity linked to working across the three regions in a setting of constrained resources, this review focused on the Upper East and Northern regions.

The partner organizations are PAS-Garu in Garu Tempane district and PARED in East Mamprusi, two local farmers' organizations.

2.1 PROJECT ACTIVITIES

The project was developed around four sets of activities:

- Climate change awareness raising
- Improved farming methods for secured livelihoods and diversification of livelihood activities
- Protecting and managing the natural resource base
- Influencing and institutional capacity.

These activities took place at different scales: district, community, household and individual.

The first set of activities was designed to raise awareness throughout the district on climate change impact and adaptation need. Activities such as participatory vulnerability risk assessment, results dissemination at the district level for a better articulation of local and district-level action plans, and training of community volunteers and journalists were designed and implemented. Billboards, leaflets and sensitization materials were developed and distributed. CRAFS worked with five community-based radio stations, Tizaa FM in the East Mamprusi district and Quality FM in Garu district, to develop and air agricultural programmes, with a focus on conservation agriculture practices[4] and climate change adaptation. One focus of these awareness-raising activities was a reduction in the prevalence of bush burning, which harms soil fertility.

With climate change, rainfall is becoming less and less reliable, with women and men farmers facing more and more difficult conditions to grow food. In addition, in a setting where

the natural base is already deteriorated, there is a risk that current agricultural practices are deteriorating it even further. Hence, the project aimed at supporting smallholder farmers through dry season gardening, seed production, tree nurseries, compost making, and more broad conservation agriculture practices. These practices not only aimed at securing livelihoods and restoring the natural resource base, but also took into account the fact that women farmers may be lacking resources to go and buy inputs, such as fertilizers; practices such as compost making would hence be accessible to them in a sustainable manner.

The project strategy also involved an acknowledgement that women's and men's livelihood conditions differ in the project areas, with women being less likely to have access to their own land for agricultural production. Therefore, this project aimed at developing livelihood activities that are less dependent on land access and that are sustainable from a natural resource management point of view (such as beekeeping and honey making or tree nurseries for example). This was done through training and input distribution. In addition, small ruminants were distributed, and mechanisms of redistribution of the livestock's newborn were put in place ('pass-on the gift'). To support in part the development of new livelihood options, village savings loans associations (VSLA) were encouraged and supported.

In addition, natural base restoration was enhanced through supporting village committees to mobilize around water management or bush burning (bush burning squads were put in place, for example). Women were also trained in how to build improved cook stoves, which are more fuel-efficient than traditional ones, so that it can become an income-generating activity for them.

Finally, the project also aimed at influencing the local government for project activities to be ultimately replicated and scaled-up by the government. This was done through partners influencing budget planning at the district level, and through the creation of various learning and communication materials.

2.2 PROJECT LOGIC AND EXPECTED OUTCOMES

The project aims at building resilience, and at achieving the following outcomes: knowledge on climate change and behaviour changes to adapt to it, food security thanks to diversified livelihoods, a restored natural base and building institutional capacity.

The diagram below presents the expected pathways. One core assumption behind the theory of change of CRAFS is that access to information and training will lead to long-term changes in behaviours.

Diagram 2.2: Project logic
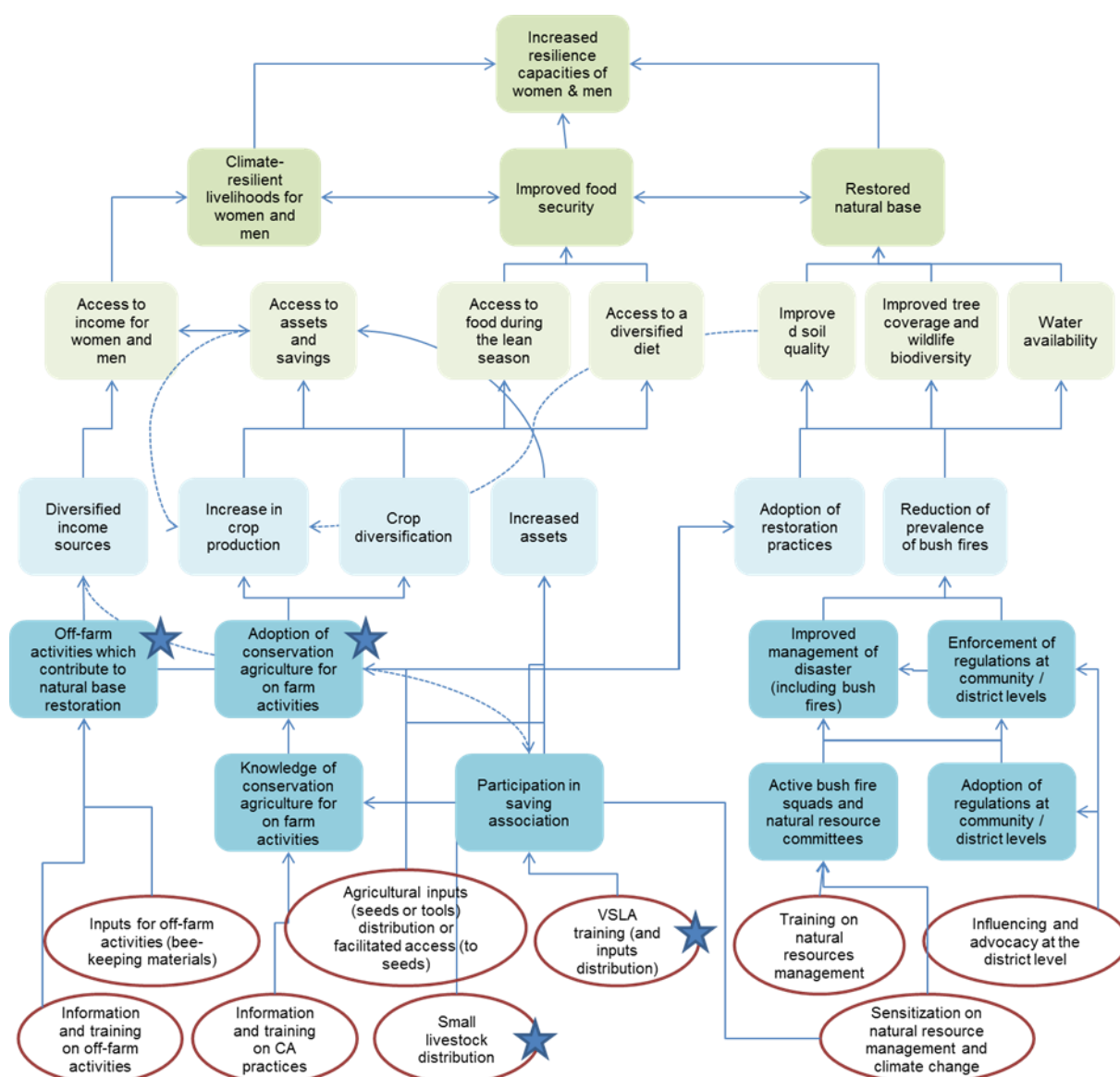
The stars on the diagram highlight the gender-specific rationale integrated at programme design. The assumptions were as follows:

- Lack of liquidity for women reduces their ability to buy traditional inputs, hence conservation agriculture, and compost making in particular, would enhance their on-farm production
- Given the limited access to land for women, off-farm activities are key to enhancing women's access to income
- Women are traditionally the ones in charge of small livestock raising, hence supporting this activity would be beneficial for women's access to savings (livestock being an informal saving mechanism) and income
- Collective saving mechanisms – susu boxes - were traditionally organized by women; supporting the formalization of saving boxes through VSLA should primarily benefit women's access to credit and savings (although VSLA could be mixed).

2.3 SELECTION OF PROJECT SITES AND PARTICIPANTS

At the inception phase of the CRAFS project, Oxfam and partners identified criteria to select communities to take part in the project, based on their needs and interests in 2015. First, even though CRAFS was built on the experience of ELCAP, CRAFS would benefit communities that had never worked with Oxfam, and in which no similar interventions were implemented at the time, which had no specific government support, and which were interested in taking part in the project. Second, small communities (roughly less than 1,000 individuals) were targeted, taking into account the food security situation in 2015, and the natural base (access to water or to forest, prone to disaster). Finally, in East Mamprusi communities in the district that were not easily accessible were targeted.

Once the communities were identified, collaboration with village leaders and district stakeholders led to identifying criteria for targeting of project participants. The criteria involved some dimensions of vulnerability (widows, households headed by a woman who did not have a partner or was not living with her partner, and persons with disabilities).The selection process was then a participatory one, based on participants' interest (particularly for activities such as beekeeping or participation in VSLA) and commitment. In East Mamprusi, involvement in the community in 2015 (through attendance to village meetings or other village events) was identified as a sign of commitment. Readiness to share knowledge (and inputs) with others and ability to mobilize others was also identified as key. In Garu, women were specifically targeted, and 70 percent of participants were expected to be women.

Finally, the same person (mainly women) could participate in several project activities (training on compost making and beekeeping for example). And several persons from the same household could participate separately (one woman was part of the VSLA, and another did training on an improved cook-stove).

3   EVALUATION DESIGN

3.1 QUASI-EXPERIMENTAL APPROACH

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 lives, perception and livelihoods of community members was collected through household and individual questionnaires – but clearly it was not possible to observe what their situation would have been had they not had the opportunity to participate in this project. 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), it is possible to make a comparison between units that were subject to the programme and those that were not. As long as the two groups are similar in all respects except for the implementation of the specific project, observing the situation of those where the project was not implemented can provide a good estimate of the counterfactual. It is important to take note of these two terms, *intervention* and *comparison*, since they are used frequently in this report. The intervention group is made of surveyed project community members; the comparison group is made of surveyed community members from communities where the project is not ongoing (and never was). In quasi-experimental impact evaluations, the comparison group is chosen to be as similar as possible as the intervention group at onset of the project, so that the comparison group provides a good estimate of what would have

happened to the participants in the absence of the project, that is to say the counterfactual situation.

An ideal approach to an evaluation such as this is to select at random among communities that could receive the project the communities in which the project will be implemented – that is with similar geographical and social vulnerabilities. Random selection among a big enough pool of communities minimizes the probability of there being systematic differences between the project communities and communities where the project is not ongoing, and so maximizes the confidence that any observed differences in outcomes later on are due to the project.

In the case of the project examined in this Effectiveness Review, the selection of the communities involved in the project was not made at random; in fact, communities were deliberately chosen based on their food security situation, natural base, inaccessibility and isolation from social services (governmental or private ones through NGOs' projects) – see Section 2.2.3.

Discussions with partners and Oxfam staff led to identifying the criteria used at inception phase to identify potential comparison communities. The process is detailed in Section 3.3.1.

To improve the confidence in making this comparison, households and individuals in the project communities were 'matched' with households and individuals with similar characteristics in the non-project (or 'comparison') communities. Matching was performed on the basis of a variety of characteristics – including household size at the ,onset of the project, participation in village meetings and community groups prior to baseline, and indicators of material well-being, such as housing conditions and ownership of assets (two matching models are used in this review, and these are detailed in Appendix 3). Since some of these characteristics may have been affected by the project itself (particularly those relating to participation in groups), matching was performed on the basis of these indicators *before* the implementation of the project. Baseline data were not available and so survey respondents were asked to recall some basic information about their household's and their own situation during the rainy season 2014 and dry season 2014–2015. While this recall data is unlikely to be completely accurate, it is the best-available proxy for households' and individuals' pre-project situation.

Recall survey data provided a variety of baseline household and individual characteristics on which matching could be carried out. These characteristics were used to calculate a 'propensity score', which is the conditional probability of the household or individual being a project participant, given the set of observable characteristics on the baseline. Project households and comparison households were then matched based on their having propensity scores within certain ranges. Please refer to Appendix 3 for a more extensive explanation of the matching procedure and tests carried out after matching to assess whether baseline characteristics are similar between the two groups.

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 a project participant 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 that matter for project participation, then estimates of outcomes derived from them may be misleading. Unobserved differences between the groups could potentially include differences in attitudes or motivation (particularly

important when individuals have taken the initiative to participate in a project), differences in community leadership, or local-level differences in weather or other contextual conditions faced by households, such as risks of conflicts. The choice of which intervention and comparison villages to survey for this Effectiveness Review was made principally to minimize the potential for any such unobservable differences to bias the results, but the possibility of unobserved bias cannot be ruled out.

3.2 SAMPLING APPROACH

The sampling approach of this review was key from two different standpoints:

- First, to maximize comparability of the intervention and comparison communities, in 2014–2015
- Second, to ensure representation of men's and women's livelihood condition and voices within the household and enable = systematic analysis on outcomes at the household and individual levels for different social groups in different positions of power.

The strategy is presented in this section.

3.3.1 Sampling of communities

CRAFS was implemented in four districts, and five communities per district took part in the project. This review included all of the 10 communities in the East Mamprusi and Garu districts.

Comparison communities that fit similar criteria used by the project team at the inception phase were identified. The criteria were as follows: communities with less than 1,000 individuals were targeted, as well as communities in which partner organizations had never worked, and in which no agricultural or climate change related project had been ongoing in the past five years (other NGO projects or government support projects may have been ongoing, although we tried to minimize this), and in which food security was of concern in 2014–2015.

In the Northern region, comparison communities were identified within the district, given that the East Mamprusi district is very large, and in spite of some CRAFS activities taking place at the district level. This is because knock-on effect of these activities on comparison communities was not expected to be strong. Also, following the inception phase criteria, inaccessibility of communities was a criterion for comparison community selection (on average, at the time of the survey, intervention communities were 20 minutes away from the main road via motorbike, and comparison communities 26 minutes away). In addition, as much as possible, communities that are out of reach of the main radio station with which CRAFS is partnering in the Northern region, Tizaa FM, were selected for the comparison communities. Finally, Mamprusi-speaking communities were targeted as one of the main languages in the project community in the district.[5]

In the Upper East region, comparison communities were identified outside of the project district, but within the region, to avoid potential knock-on effects of the district-level activities in the comparison communities. Other districts in the region were identified as being part of the same environmental and social system, with overall comparable livelihood conditions. Kusaal-speaking communities were targeted. In the Upper East region, CRAFS partnered with Quality FM, which has a large air coverage, hence being out of reach of Tizaa FM radio coverage was not included as a criterion to target comparison communities. This will be discussed in the results section (Section 6).

Partner organizations identified a few communities their organization could have worked in, but is not currently, following similar criteria as in CRAFS (for Upper East). The survey team then visited these communities to gather information and make sure they fitted the various

criteria and identified other communities, cross-checked by the partner organizations. Seven comparison communities in each region were thus identified.

3.3.2 Selection of households and individuals

In each community, the number of households to be surveyed was identified in proportion to the community size, with the target number of 500 households per region.

In the comparison group, once in the community the survey team was trained to do on-the-spot random sampling of households through random walk, as lists of households were not available (and on-the-spot listing was not doable due to constraints). Random sampling was done to ensure representation of the various subsections of the communities.

In the project areas, households were randomly sampled using partners' lists of project participants.

Gender is one dimension of systemic inequality in the context of this review that is at play at different scales, including within the household. To be able to look at the household level, including individual-level characteristics of resilience capacities (see Section 5) and the impact of the project at the individual level for women and men within the household, the following survey protocol was defined:

- Once the household is selected, enumerators asked for household members to identify the current heads of the household, defined as self-identified head and her or his partner (spouse's decision-maker); in case of polygamous spouses and several wives living in the household, the first wife was surveyed as much as possible; in cases of the main decision-maker, traditionally identified as the head of the household, not having a partner or not living with his or her partner, a second decision-maker was identified.
- Both decision-makers were surveyed separately. but simultaneously, by an enumerator of the same gender; this is to take into account potential gender power dynamics in the interviewee–interviewer relationship;
- As much as possible, both decision-makers were surveyed together, and with other household members as needed, for the household survey.

In cases of one respondent thus identified not being available at time of the survey, enumerators had as much as possible to arrange and come back to complete the survey.

This definition of survey respondents allows us to focus on intra-household dynamics between spouses, and between the two main decision-makers in what is traditionally identified as single-headed households.

3.4 DATA COLLECTION TOOL

Following discussions and workshops with Oxfam and partners, as well as qualitative fieldwork conducted during three days in the Northern region, a household questionnaire and an individual one were developed to capture recalled information used for matching, some output and outcome information related to the programme, and different dimensions of resilience at the household and individual levels following Oxfam's conceptualization of resilience capacities. As much as possible, the questionnaires were built on survey questions already piloted by Oxfam or by other organizations. Questionnaires' content and development are presented in Section 5.

4 DATA

4.1 RESPONDENTS INTERVIEWED

Data collection took place between 12 February 2018 and 10 March 2018. It was conducted by Oxford Research Group – Ghana, a Ghanaian consultancy firm specializing in conducting surveys. Two teams of eight enumerators and one supervisor conducted the survey – each team in a given region. In total 1,005 households were surveyed, 37 percent being in the intervention group.[6] In total 1,962 individual surveys were conducted, 36 percent in the intervention group.

Table 4.1: Individual surveys conducted per region

Region	Number of individual surveys	Number of individual surveys in the intervention group	Share of households with 2 individual surveys
Northern region	973	355	97%
Upper East region	989	353	98%
Total	1962	708	98%

Table 4.1 shows the share of households for which two individual surveys were conducted. The survey team was unable to survey two decision-makers for only 2 percent of households.[7] Note that for 89 households (9 percent), the survey was conducted with two decision-makers who were not spouses (traditionally identified as single-headed households).

4.2 ANALYSIS OF BASELINE CHARACTERISTICS

As mentioned earlier, information was collected about household and household members' situations in 2014–2015, the start year of the project under review.[8] Differences between intervention and comparison groups will be presented, as well as how these differences are corrected, in the rest of the report.[9]

4.2.1 Description of the population and main differences between intervention and comparison groups

CRAFS and this review targets villages in the Northern and Upper East regions. Households and household members of intervention and comparison villages were compared in terms of their demographic characteristics, livelihoods activities and income situation in 2014, as the respondents recalled it at time of the survey in February–March 2018. Information on the individual respondents' characteristics were constructed from information at the time of the survey, assuming that these were not impacted by the project's implementation. The full comparison is shown in Appendix 2.

Characteristics of the households

In 2014, households were made up on average of six members, of which three members on average were below 15. Four crops were grown on average and two types of livestock were owned.

Consistent with the CSVA 2012, households were worried about having enough food during the lean season, June, July, August in particular (this is not different between comparison

and intervention groups, as shown in Figure 4.1). Important to note that the survey conducted for this review finds lower shares of households being worried about having enough food than the CSVA 2012.

Figure 4.1: Perceived food security during the lean season 2014
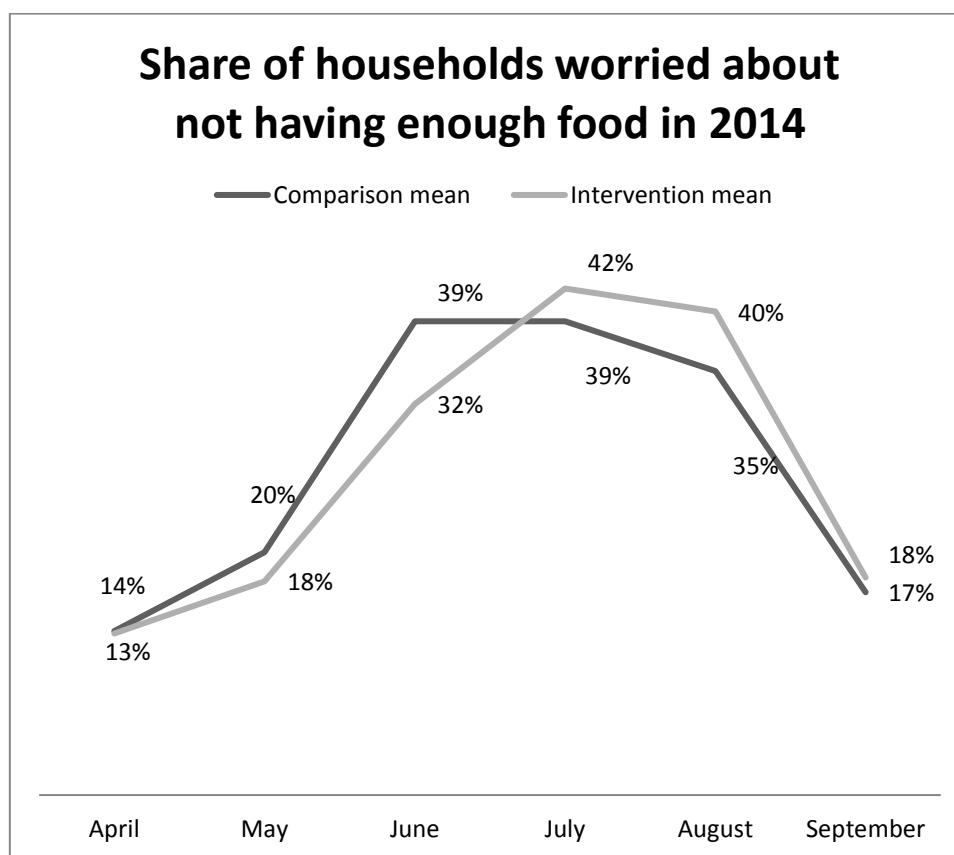
The main differences between the two groups are first observed on the household structure: 19 percent of households were headed by a woman in the intervention group, vs 8 percent in the comparison group, which seems to reflect the targeting strategy of partners; households were also more likely to exist in their current structure at baseline – 97.6 percent vs 95.6 percent (difference significant at 10 percent). Second, differences are observed on livelihood characteristics, such as access to agricultural land (92.1 percent vs 87.3 percent), the type of crops grown (90.5 percent vs 83.8 percent of households grew maize in the rainy season 2014, and 60.7 percent vs 43.1 percent grew bambara beans) and engagement in off-farm activities (the largest difference being on processing activities: 34.4 percent were engaged in such activities in 2014 in the intervention group, vs 11.3 percent in the comparison group).

In addition, using data from households' asset ownership (livestock, productive equipment, and household goods), as well as about the conditions of the house, both in 2014 and at the time of the survey, an index of overall household wealth was generated. This was generated under the assumption that if each of the assets and housing characteristics constituted suitable indicators of household wealth, they should be correlated with 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 or negative correlations with the others were therefore not considered good wealth indicators and so were excluded from the index.[10]

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 2014, and one based on the household's situation at the time of the survey. In particular, our wealth index is taken directly from the first principal component.[11] PCA enables us to assign weights to the different assets, to capture as much information as possible from the data. Broadly, PCA assigns more weight

to those assets that are *less* correlated with all the other assets, as these carry more information. By contrast, items with *more* intra-correlation are given less weight. The wealth index hence computed is a score, which characterizes the distribution of wealth in the population. In Appendix 2, comparison and intervention households are compared based on their distribution on this wealth index, and households in the intervention groups were over-represented in the highest 40 percent of the distribution (47.7 percent against 35.5 percent).

Characteristics of the individual respondents

The main decision-makers surveyed for this review were married in most cases (93.6 percent, of which 42.3 percent were in a polygamous marriage); 87.5 percent of respondents never attended school and 8.2 percent of respondents knew how to read and write a simple letter. These figures are not statistically different between the two groups.

However, respondents in the intervention group were more likely to be disabled at the time of the survey (2.8 percent vs 1.5 percent) and a woman (51 percent vs 50.2 percent).[12]

The main differences were observed on attendance at community meetings, with respondents in the intervention group much more likely to have attended such meetings at baseline. Respondents in the intervention group recalled attending meetings of 2.3 groups on average, this was only 0.7 in the comparison group (out of the five listed in the survey). This difference is observed for each type of group as well. While the difference is of less significance, attendance at the village assembly meeting was also different between the two groups (69.9 percent vs 60.8 percent), and so was the existence – and awareness – of a regulation on bush fire (83.2 percent vs 52.1 percent). Finally, respondents in the intervention group were much more likely to be listening to the radio once a week or more at baseline (75.6 percent vs 56 percent).[13]

4.2.2 Correction of differences

Differences that existed before the project have the potential to bias any comparison between the project and comparison groups at endline. It is therefore important to control for these baseline differences when making such comparisons.

As described in Section 3, the main approach used in this Effectiveness Review 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 two key factors. Firstly, we selected variables that were thought to be the most significant in influencing respondents' participation in the project. Secondly, we aimed to include variables that could affect potential project outcomes *as well as* the likelihood of participating in the project. The list of matching variables selected and the full details of the matching procedure applied are described in Appendices 2 and 3. Appendix 3, in particular, presents the different matching models used in this review.

After matching, households and individuals in the project and comparison communities were well balanced in terms of the recalled baseline variables used for matching in all of the models used. A small share of households and individuals could not be matched and so were dropped from the analysis (see details in Appendix 3). A few recalled baseline variables were still imbalanced after matching at the household level, and this is presented in Appendix 3 and robustness to controlling for this imbalance is tested in Appendix 4.

As presented in Appendix 3, the household-level matching model takes into account individual-level characteristics and corrects for imbalances on these variables (education, group participation, village meeting attendance, radio exposure), but does not fully correct for imbalance in participation in each specific group (although the gap between comparison and intervention group is reduced in size thanks to the PSM model). If participation of different household members in specific group at project onset is related to household-level outcomes

at time of the survey, the estimates in the report will not fully correct for this. However, there is a trade-off in the number of variables one can include in a matching model, and the most important variables in terms of defining participation in the project activities drove the choices made in this report. On the other hand, the individual PSM model does not take into account household level characteristics. This is because household information is not independent and identically distributed at individual level, given that up to two individuals belong to the same household. While the individual level PSM model effectively corrects for imbalance on individual level characteristics at project onset, it does not fully correct for all household-level imbalances.[14] This is a limitation of the results presented in this report. This strategy was followed as using household-level information in the individual PSM model was deemed not appropriate.

All the results described in Section 6 of the report were also tested for robustness by estimating them with various linear regression models. These robustness checks are shown in Appendix 4. The alternative models produced results that are mainly similar (in size) to those presented in the tables in Section 6, and are less conservative in terms of statistical significance. Results are discussed in Section 6 when this is not the case.

5   ASSESSING RESILIENCE CAPACITIES

5.1 OXFAM'S UNDERSTANDING OF RESILIENCE CAPACITIES

Oxfam defines resilience as 'the ability of women and men to realize their rights and improve their well-being despite shocks, stresses and uncertainty'. The approach taken in this Effectiveness Review to understanding resilience draws on *The Future is a Choice* (Jeans et al., 2016), Oxfam's guidelines for the design and implementation of resilience-building programmes, is an approach which 'affirms people's right to determine their own futures by enhancing the capacities of people and institutions to address the causes of risk, fragility, vulnerability and inequality'. In particular, resilience is considered to consist of three interlinked capacities: to absorb, adapt and transform.

Figure 5.1: Resilience capacities
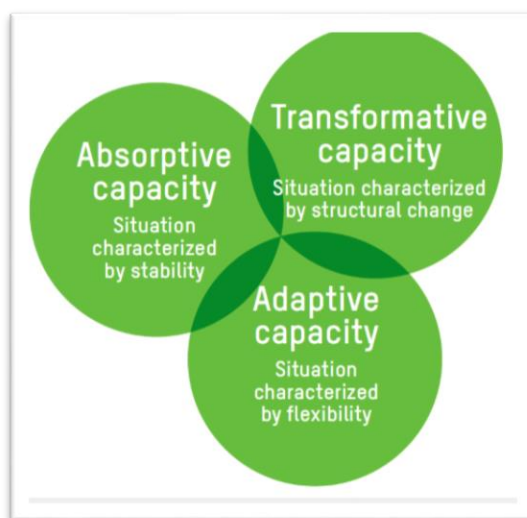
Oxfam's understanding of each of these three capacities is described in *Absorb, Adapt, Transform* (Jeans et al., 2017):

> **Absorptive capacity** *is the capacity to take intentional protective action and to cope with known shocks and stress. It is needed as shocks and stress will continue to happen, for example due to extreme weather events caused by climate change, protracted conflict, and disasters.*
>
> *Simply stated this is the capacity to 'bounce back' after a shock. It involves anticipating, planning, coping and recovering from specific, known shocks and short-term stresses. Absorptive capacity is about ensuring stability because it aims to prevent or limit the negative impact of shocks on individuals, households, communities, businesses and authorities.* (Jeans et al., 2017, p. 3)
>
> **Adaptive capacity** *is the capacity to make intentional incremental adjustments in anticipation of or in response to change, in ways that create more flexibility in the future. It is necessary because change is ongoing and uncertain, and because intentional transformation takes time and sustained engagement.*
>
> *Adaptation is about making appropriate changes in order to better manage, or adjust to a changing situation. A key aspect of adaptive capacity is accepting that change is ongoing as well as highly unpredictable. That is why adaptive capacity is about flexibility, and the ability to make incremental changes on an ongoing basis through process of continuous adjusting, learning, and innovation.* (Jeans *et al.*, 2017, p. 4)
>
> **[T]ransformative capacity** *is the capacity to make intentional change to stop or reduce the causes of risk, vulnerability, poverty, and inequality, and ensure the more equitable sharing of risk so it is not unfairly borne by people living in poverty or suffering from discrimination or marginalisation.*
>
> *Transformation is about fundamental changes in the deep structures that cause or increase vulnerability and risk as well as how risk is shared within societies and the global community. Another way to think about this is that transformation is about addressing the underlying failures of development or power imbalances that cause or increase and maintain risk and poverty. Transformation is not about addressing the close or proximate causes of risk and vulnerability but their structural or root causes.*
>
> *[…] [T]ransformation is a deep change in the very structures that cause and maintain poverty and injustice. Therefore, transformative capacity is the capacity of women and men to generate and engage in deep ongoing change that addresses the root causes of poverty, and injustice, vulnerability and risk.* (Jeans et al., 2017, p. 5)

While the three capacities of resilience are capacities that co-exist at different scales in a given system, the approach developed in this review focuses on the capacities of households and individuals.

In addition, from a monitoring and evaluation perspective, '*we need to differentiate two different situations at which to assess resilience capacities: a chronic situation where stress, change and uncertainty are affecting people and systems and a crisis situation where shock has occurred*' (Febles, 2018, p. 13). This review focuses on investigating the chronic situation faced by households and individuals.

5.2 ENSURING THE REPRESENTATION OF WOMEN AND MEN'S VOICES AND LIVELIHOOD CONDITIONS

Building resilience is about bringing about changes '*in the very structures that cause and maintain poverty and injustice*' (Jeans et al, 2017, p. 5, about the transformative capacity). Gender is one power dimension at play at different scales, including within the household, and at play differently for different social groups. Oxfam recently highlighted the importance of taking gender justice into account when building resilience (Sotelo Reyes, 2017). Being blind to gender dynamics when building resilience may indeed lead to perverse effects of our programming, and building resilience is ultimately about tackling root causes of inequalities, gender being one dimension of systemic inequalities.

From an evaluation perspective, '*recognizing that women, men, girls and boys have differentiated vulnerabilities, i.e. that they are exposed differently to risks and uncertainties and are affected differently by the*' (Sotelo Reyes, 2017, p. 4), leads not only to considering household vulnerabilities and capacities, but also individual ones, of women and men, within the household. The sampling strategy followed in this review, presented in Section 3 and inspired by the Women Empowerment in Agriculture Index (WEAI) methodology, developed by the International Food Policy Research Institute, is key to enabling representation of men and women's livelihood conditions, opinions and voices. This review focuses on men and women main partner decision-makers, in cases of household heads being in partnership. In cases of the main decision-maker, traditionally identified as the head of the household, not having a partner or not currently living with his or her partner, a second decision-maker in the household was identified.

'*Recognizing that the distinct capacities of individuals to face and cope with risks and shocks are shaped – and often limited – by a system of power and privileges. In most cases, existing gender-based discrimination and inequalities limit women's and girls' access to key information, strategic decision-making opportunities, or the resources they would need to adequately adapt to changes. This is no accident: it is due to deep-rooted gender-based inequalities and unequal power relations*' (Sotelo Reyes, 2017, p. 4). Access to information, decision-making opportunities or access to resources within the household are key dimensions to be investigated, and some questions from the WEAI individual questionnaires were used around access to and control over resources, income and credit. Distribution of tasks within the household in general, and about unpaid care and domestic work in particular, is not gender-neutral. Its burden most often falls under women's responsibility, in addition to participation in farming activities and other income generating activities, and affect women's opportunities. A few questions were introduced in this review, building on Oxfam's survey materials, such as the *Household Care Survey* (Rost and Koissy-Kpein, 2018; Rost, 2018). '*Transformative capacity relates to systems and long-term change […]. Intra-household power dynamics, including the interactions between women and men, are likely to be vital drivers in the long-run*', as highlighted by Jonathan Lain (blog post 4 October 2016).

Following Jones and Tanner, 2015, and Lockwood et al., 2015, this review investigates different dimensions of resilience, including subjective resilience: one's perceived ability to deal with future shocks. As underlined in Bene et al., 2016, 'Although shocks, unforeseen events and changes affecting people's lives and livelihoods are part of an "objective" (i.e. measurable) reality, the evidence suggests that individual and collective responses and adaptation are also influenced by the subjective perceptions that people have about that reality'. Similarly, perceptions and subjective resilience may differ from one social group to another, depending on power relations, including between men and women, as social groups, and within the household.

A qualitative fieldwork was conducted in collaboration with Oxford Research Group – Ghana, to explore what resilience, and each resilience capacity, means for women and men. The qualitative fieldwork took place in the Northern region from 29–31 January. It contributed to developing the conceptual framework of this review, and to testing survey tools, subjective measurements in particular.

5.3 HOUSEHOLD AND INDIVIDUAL CHARACTERISTICS OF RESILIENCE CAPACITIES

The household and individual questionnaires developed for this review intended to allow the construction of a measurement of resilience capacities. In common with previous Effectiveness Reviews carried out under the resilience theme, this approach was based on the assumption that there are particular characteristics of households and individuals that affect how well they are able to cope with shocks, positively adapt to change, and transform deeper causes of inequalities.

Insofar as there are multiple final well-being outcomes, there should also be a wide range of resilience capacity characteristics. Resilience is understood as operating at many different scales (individual, household, community, and so on) as well as for different shocks, stresses, uncertainties, and causes of inequalities, with different time horizons. Resilience is also about challenging deep causes of inequalities. As a consequence, the number of resilience characteristics is potentially very high. A limitation, of course, is that it is not known for certain how relevant particular characteristics actually are; rather, it is assumed that they are important based on common sense, theory, and an understanding of the local context.[15]

A workshop conducted with the project team in Tamale on 24 and 25 January, and qualitative research carried out during the planning phase of the Effectiveness Review, led to identification of the shocks, stresses, uncertainties or deep causes of inequalities to which to absorb, adapt or transform.

It also led to a list being drawn up of 32 characteristics that are thought to be associated with resilience in the project areas in general and with different resilience capacities in particular. Appropriate data were then generated through the household and individual questionnaires (see Table 5.1).

It is important to note that while not all characteristics considered in this Effectiveness Review may be directly linked to the project activities, all are thought to be important to a household and individual's overall resilience in the project area. The second column of Table 5.1 shows the characteristics on which the project was expected to have an impact, in line with the project logic.

Table 5.1: Characteristics of resilience examined in this Review

Capacity	Connected to the project logic?	Characteristic	Rationale	Measurement level
Absorptive capacity	Yes	Diversification of income sources – off-farm activities and government benefits	Household members have alternative sources of income to rely on if some activities become untenable during a crisis.	Household
	Yes	Crop diversification	Reduces the likelihood that all crops will be lost or damaged by a single cause (on-farm).	Household
	Yes	Dietary diversity	Associated with nutritional balance in the diet, and hence with physical health.	Household
	Yes	Availability of food at the beginning of lean season 2018	During the lean season (April to September), it is difficult for households to access food; for the most vulnerable households, it is even difficult to access food before the beginning of lean season (see CFSVA survey).	Household
	Yes	Quantity of food – did not have to reduce the size of meals in the last 7 days	Having enough food is a prerequisite to health and well-being ultimately, and future shock absorption (lean season ahead).	Individual
	No	Access to drinking water	Improved sources of drinking water lead to improved physical health for household members.	Household
	No	Would feel prepared, in case of low rainfall during rainy season or heavy flooding	Sense of preparedness in case of a future disaster (heavy flooding or low rainfall during rainy season) matters for dealing with such a shock.	Individual

Table 5.1: Characteristics of resilience examined in this Review (cont.)

Capacity		Connected to the project logic?	Characteristic	Rationale	Measurement level
Absorptive capacity		Yes	Cattle vaccination	Vaccinated livestock are less prone to disease.	Household
		Yes	Savings	Can be used to bounce back from a crisis, or to invest in proactive adaptations.	Individual
		Yes	Ownership of fungible livestock	Fungible livestock are a saving device, and can be sold in anticipation to a shock, or to adapt livelihood.	Household
	Adaptive capacity	No	Remittances	Can provide a dependable source of income in the event of a crisis, or a source of finance for proactive adaptations.	Household
		Yes	Productive assets ownership	Provides a means of generating income.	Household
		Yes	Access to credit and control over its use	Ensures that different individuals within the household have access to credit as an adaptation mechanism (credit can be used to invest in proactive adaptations).	Individual
		No	Social support network	Social networks can provide practical, financial or moral support in times of crisis.	Household
		Yes	Adoption of improved climate SMART agricultural practices	Enhances the resistance of crops to adverse weather conditions and to diseases, and improves soil fertility.	Household
		Yes	Knowledge of conservation agricultural practices	Conservation agriculture allows for a more sustainable food production. Knowledge of conservation agricultural practices is a step towards adoption of practices.	Individual
		Yes	Knowledge of climate change's impact	Knowledge of impacts of climate change is a prerequisite to adapt to it.	Individual
		Yes	Understanding of climate change	Understanding of climate change is needed to adapt to medium-term changes.	Individual
	Transformative capacity	Yes	Control over decision to sell livestock heads	Ensures that different individuals within the household have access to using livestock as an adaptation mechanism.	Individual
		No	Attitude towards change	Individuals are inclined to proactively adapt their livelihood activities.	Individual
		Yes	Participation in community groups	Provides a forum for voicing concerns and for engaging in collective action.	Individual
		Yes	Control over income from livestock sales and livestock products, and off-farm economic activities (petty trading, processing)	Access to off-farm income sources and control over its use enhances individuals' well-being and opportunities.	Individual

Table 5.1: Characteristics of resilience examined in this Review (cont.)

Capacity	Connected to the project logic?	Characteristic	Rationale	Measurement level
Transformative capacity	No	Women's access to agricultural land	Women's access to land is restricted, constraining their livelihood opportunities.	Individual
	Yes	Regulation within community about bush fires (and awareness of it)	Bush fires degrade natural resources (soil fertility, tree coverage). Institutional changes through the communal law are an important step towards changes in practices and social norms.	Individual
	No	Education of children	Education provides a basis for improved ability to realize rights and improve well-being in the next generation.	Household
	No	Acceptability of (unpaid) care work being done by men	Changes in norms related to men's role in carrying unpaid care work will enable more shared responsibilities in carrying care tasks.	Individual
	No	Supporting partner doing unpaid care work	Domestic and unpaid care work falls under women's responsibility most of the time, on top of livelihood activities, affecting women's opportunities.	Individual
	No	Feel heard when voicing an issue in village assembly	Ensures representation of different opinions in governance bodies, and involvement in decision making to some extent.	Individual
	No	Belief in collective action's effectiveness	Belief in collective action's effectiveness is a sign of power within being built, and is needed for individuals to be able to claim their rights.	Individual
	No	Opinion on women's political role	Social norms around women's political leadership would foster women's ability to voice issues and women and girls' opportunities.	Individual
	No	Opinion on acceptability of violence inside the household	Social norms around unacceptability of domestic violence would reduce vulnerability and long-term inequalities.	Individual
	Yes	Interaction with district institutions	Access to district-level governance institutions or actors ensures that the needs of the community are taken into account in district level planning and budgeting.	Individual

Different opinions and livelihood conditions are shaped by values, social norms, and structural inequalities. By integrating individual-level indicators for different household members in the household, we attempt to better take into account these differences in our assessment of resilience capacities.

To aggregate all indicators in resilience capacities indices, the number of indicators in which each household reaches the threshold is counted, and the total is divided by the number of indicators (see Appendix 1). The resulting ratio – the proportion of indicators in which each household scored above the threshold – is defined as the index of each resilience capacity. Individual and household-level indicators are given the same weight in the index. For individual-level indicators, the indicator for each respondent is given half the weight; if only one respondent is being surveyed in a given household, the indicator takes the value of the observation for this respondent (less than 5 percent of households in the overall sample).

Similarly, the overall resilience index is calculated by taking the arithmetic mean over all of the indicators. This leads to giving the same weight to each indicator (1/32 to each household-level indicator), counting every indicator once, and making it easily interpretable as a household-level score. The drawback is that it does not give equal weight to each capacity, due to the fact that more indicators were identified for some capacities than for others. As a robustness check, we also compute the overall index as the average over the three capacity indices – the results are very similar to those presented in Section 6.8.

Households headed by women (often living without a partner, and the main decision-maker) are often considered more at risk of vulnerability, and certainly were at the onset of the CRAFS project. This was indeed taken into account by Oxfam and partners when identifying targeting criteria. For this reason, we systematically look at differences between households in which the main decision-maker was a woman in 2014 and those in which a man was, and the potential differential impacts.[16] This was identified as a key learning question by the project team when working on this review.

One overall comment, however, is that women main decision-makers are more likely to be living without their partner (either because they are single, widowed or because their partner migrated), while men main decision-makers are more likely to be living with their partner. We do not have this information at baseline, but a more relevant comparison could have been to look at differential impact depending on the gender of the head in 2014, among households in which the main decision-maker is in the same situation (single, widowed, not living with her/his partner, living with her/his partner).

Finally, the resilience indices are calculated at the household level, and baseline differences between the two groups are accounted for through the household-level PSM model described in Appendix 3. As mentioned earlier, there is a risk that this model does not fully correct for the baseline differences at the individual level, which would lead to overestimate the results on resilience capacities, particularly on the adaptive and transformative capacities, for which more indicators are measured at the individual level in the first place. As a robustness check, the same indices are calculated at the individual level, using the individual level PSM model. Results are consistent with the one presented in Section 6.8, and slightly less conservative, which provides additional reassurance in the results presented below.[17]

6 RESULTS

6.1 INTRODUCTION – STATISTICAL INTERPRETATION

Section 6 presents a comparison of the interviewed households and women and men from communities who participated in the programme, and those from communities who did not, in terms of various output and outcome measures relating to the project under review.

This report is intended to be free from excessive technical jargon, with more detailed technical information being reserved for the appendices and endnotes. However, there are some statistical concepts that cannot be avoided when discussing the results. In this report, results will usually be stated as the average difference between the programme households or individuals (referred to as the 'intervention group') and the matched households and individuals in communities who did not benefit from the programme (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 1 percent, two asterisks (**) indicating a p-value of less than 5 percent and one asterisk (*) indicating a p-value of less than 10 percent. The higher the p-value, the less confident we are that the measured estimate reflects a difference that applies across the entirety of the intervention and comparison groups, rather than being due to random variation in the specific sample surveyed. Results with a p-value of more than 10 percent are not considered to be statistically significant. Statistical significance is shown in the tables and graphs.

The results are shown after correcting for observed baseline differences between the households interviewed in the project communities and those in the comparison communities using a propensity-score matching (PSM) procedure. More information about the procedure applied is found in Appendix 3. All outcomes discussed here have also been tested for robustness with alternative statistical models, as described in Appendix 4. Major differences between the results reported in Section 6 and the robustness checks are highlighted when these lead to more conservative results than the main models.

At the individual level, the average overall effect is presented (for the average individual in the sample), estimated through PSM, and means in comparison and intervention groups for men and women separately, correcting for PS weights. Whether impacts for men and women are different are systematically tested. Under the section 'Testing for differential impacts', the tables will indeed show three rows,[18] as per the example shown in Table 6.1.1:
- Effect of being a woman in the comparison group: this shows the differences between men and women, in spite of the intervention
- Effect of being in intervention among men: this shows the impact of the intervention among men
- Differential impact for men and women: this tests whether the impact of the intervention is different for men compared to women.

These effects correct for differences between the two groups in 2014 through propensity-score weighting, controlling for matching baseline variables. Note that using this specification, the effect size of the impact of the programme among women is obtained by adding the coefficients from the last row and the row before.

Table 6.1.1: Example of interpretation of table of results at the individual level

	1 Having received training or information on livestock health since the dry season 2014–2015 (%)	Interpretation
Testing for differential impacts		
Effect of being a woman in the comparison group (compared to being a man in the comparison group)	-14.3*** (4.5)	In spite of the intervention, women were less likely than men to have received information or training on livestock health since the dry season 2014–2015 – the coefficient is negative and statistically significant
Effect of being in intervention among men (compared to men in the comparison group)	9.0* (5.3)	Men in the intervention group were more likely than men in the comparison group to have received such information – positive coefficient, statistically significant
Differential impact for men and women	4.3 (6.0)	The impact of the intervention is not statistically different for men and women – the coefficient is not statistically significant. Given the above line, this means that there is a positive impact of the intervention on women's access to information or training on livestock health

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

Finally, in order to make the reading of the narrative easier, tables are referenced in the main texts, and presented at the end of each subsection.

6.2 INVOLVEMENT IN PROJECT ACTIVITIES

The first step of this review is to measure the programme's direct outputs, and particularly participation in training or information sessions, community group and exposure to radio, as key components of the project activities. We observe a strong difference between the two groups in exposure to training or information sessions focused on livelihood or risk and vulnerability assessments, as shown in Figure 6.2.1.

Figure 6.2.1: Participation in training or information session since the dry season 2014–2015

% of respondents who received training or information, since the dry season 2014–2015, about...

■ Comparison mean   ■ Intervention mean

Category	Comparison mean	Intervention mean
Hazard identification and vulnerability assessment (**)	47	68
Claiming goods and services from the district assembly	45	55
Health and sanitation practices	93	93
Children's nutrition	91	90
Running or launching a VSLA (**)	63	77
Starting a new income generating activities (***)	45	74
Marketing/selling crops or livestock (*)	51	64
Climate SMART agricultural practices (***)	53	75
Improved techniques for farming (***)	60	85
Livestock health (*)	65	76

While such training or information sessions have been ongoing in the comparison group as well, a larger share of respondents have been exposed to these in the intervention group: 68 percent vs 47 percent of respondents participated in sessions on hazard identification and vulnerability assessments, 77 percent vs 63 percent in sessions on VSLA, 75 percent vs 45 percent on sessions related to starting new income generating activities, 64 percent vs 51 percent on sessions marketing/selling crops or livestock (although significant only at 10 percent), 75 percent vs 53 percent on sessions climate SMART agricultural practices, 85 percent vs 60 percent on sessions on improved techniques for farming and 75 percent vs 65 percent on sessions on livestock health. Such impacts are not considered statistically significantly different for women and men respondents, except for participation in sessions related to climate SMART agriculture, for which the project has had a significantly larger impact on women: while only 38 percent of women in the comparison group had participated in such sessions since the dry season 2014–2015, this was 66 percent of women in the intervention group (effect size of 28.3). This seems to reflect the particular focus of the project to including women.

It is important to highlight that a larger share of respondents has participated in sessions related to claiming goods and services from the district assembly in the intervention group than in the comparison group (55 percent vs 45 percent), but this is not statistically significant. In addition, 90 percent of respondents in the intervention group have attended sessions on children's nutrition and 93 percent on health and sanitation practices, and this is not different between the two groups. This is consistent with the fact that other actors (CSOs, NGOs, government) have most likely been working on these topics in the areas included in this review.

Respondents in the intervention group are more likely to have attended meetings of any group in the last 12 months, among the groups the project implemented: farmer or producer groups, bush fire management committees, climate field schools, VSLA, natural resources management committees. While 88 percent of respondents have attended meetings of at least one of these groups in the intervention areas, this is only 83 percent in the comparison areas (see Table 6.2.2); the project's impact is not different between women and men respondents. On average, respondents who participated in meetings attended meetings of more groups (2.9 vs 2.7 in the comparison group), and this effect is driven by women respondents: women who are involved in groups, are involved in significantly more groups in the intervention group than in the comparison group (2.9 vs 2.2).

When looking at each group in particular, it seems that this is driven by an increase in participation of women in farmer producer groups (but not of men): 39 percent of women respondents attended the meetings of farmer producer groups in the comparison group, and 51 percent in the intervention group (effect size of 11.6). This is also driven by an increased participation of both women and men to climate field schools (40 percent vs 34 percent) and natural resources management committee (37 percent vs 29 percent), although not statistically significant using the main PSM model.[19]

Finally, we highlight that participation in any VSLA is quite common in the areas included in this review, particularly among women, and the project did not make a difference in increasing the participation in those (78 percent of women and 42 percent of men in the intervention group). We observe than in the CRAFS communities, these VSLAs are more likely to be made of a mixed group of women and men than in the comparison community, however, suggesting that the saving associations may be different between the two groups as a result of the project. Similarly, the project did not make a significant difference in increasing participation in bush fire committees or squads, although it seems to have had a small impact for women (close to statistical significance). Participation in these groups is significantly lower among women (52 percent among women vs 68 percent among men in the intervention group).

One component of CRAFS relies on radio broadcasting. Radio is widely listened to in the areas included in this review at time of the survey. Indeed 76 percent of respondents listened to the radio at least once a week in the past 12 months in the intervention areas; this is slightly lower in the comparison areas (70 percent) but not statistically different. It is important to highlight, however, that radio exposure varies between the two regions included in this review. In particular, we observe that more respondents have never listened to the radio in the last 12 months in the comparison group in the Northern region, than in the comparison group in the Upper East region (not statistically significant).

Of those who have ever listened to the radio in the last 12 months, radio programmes on agriculture practices and/or climate change are widely listened to and on a regular basis: 90 percent of respondents in the intervention group listened to such programmes at least once a week, and this is not statistically different between the two groups.

While we observe an increase in the share of respondents who have listened to the radio programmes which partnered with CRAFS (Table 6.2.3), this increase is not statistically significant in the Northern region. In addition, of the respondents who listened to an agricultural radio programme, almost all listened to Donyomo (98 percent) in the Northern region (not different between the two groups). In the Upper East region, CRAFS communities are much more likely to have listened to Ten Lebigir than in the comparison group (77

percent vs 42 percent). However, there seems to be a substitution between this programme and other agricultural programmes on other radio channels (Source FM, Sunrise FM, Rural FM, etc.), that comparison group respondents are much more likely to have listened to than that of the intervention group.

While the sampling strategy was developed to maximize differential exposure to the project radio programmes between comparison and intervention groups, particularly in the Northern region, the data shows that this is not the case. This means that this review will be measuring impacts of the project activities in the Northern region, excluding the radio programme (which diffusion was spread out in both the intervention and comparison groups). In the Upper East region, this review will be measuring additional exposure to Ten Lebigir, but as a substitute to exposure to other agricultural radio programmes.

Tables of the subsection

Table 6.2.1: Participation in training or information session since the dry season 2014–2015

	1	2	3	4	5
	Livestock health (%)	Improved techniques for farming (%)	Climate SMART agricultural practices (%)	Marketing/selling crops or livestock (%)	Claiming goods and services from the district assembly (%)
Overall					
Intervention mean	75.96	84.96	74.75	63.73	55.25
Comparison mean	64.57	60.41	53.07	50.62	44.54
Difference	11.5* (6.2)	24.6*** (6.5)	21.8*** (6.6)	13.6* (7.1)	11.0 (8.9)
Observations (intervention group)	703	705	693	681	619
Observations (total)	1932	1927	1877	1848	1721
Testing for differential impacts					
Effect of being a woman in the comparison group	-14.3*** (4.5)	-15.0*** (5.7)	-15.9*** (6.1)	-11.6 (7.9)	-13.5 (10.3)
Effect of being in intervention among men	9.0* (5.3)	18.2*** (6.3)	16.9*** (5.5)	16.2* (8.5)	14.3 (11.1)
Differential impact for men and women	4.3 (6.0)	9.6 (6.2)	11.4* (6.9)	-4.2 (9.7)	-6.0 (11.5)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.2.1: Participation in training or information session since the dry season 2014–2015 (cont.)

	6	7	8	9	10
	Hazard identification and vulnerability assessment (%)	Starting new income generating activities – beekeeping, soap making, dry season (%)	Running or launching a VSLA – structured saving box group (%)	Children's nutrition (%)	Health and sanitation practices (%)
Overall					
Intervention mean	67.99	73.54	76.50	89.74	92.62
Comparison mean	47.15	44.90	62.60	90.88	92.94
Difference	21.0** (9.8)	28.7*** (7.2)	14.0** (6.4)	-1.1 (2.2)	-0.3 (2.3)
Observations (intervention group)	681	703	698	702	705
Observations (total)	1868	1918	1922	1936	1943
Testing for differential impacts					
Effect of being a woman in the comparison group	-5.8 (6.0)	8.5 (9.7)	14.1 (8.8)	6.3* (3.7)	4.4** (1.9)
Effect of being in intervention among men	25.3*** (5.8)	30.7*** (5.1)	13.0 (8.4)	-5.1 (3.2)	-2.3 (2.5)
Differential impact for men and women	-8.3 (6.8)	-5.8 (9.1)	-2.2 (8.2)	6.8 (4.3)	3.3 (2.1)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.2.2: Participation in groups

	1	2	3	4	5	6	7
	Attended meeting of a farmer producer group in the last 12 months (%)	Attended meeting of the bush fire management committee or squads in the last 12 months (%)	Attended meeting of the climate field school in the last 12 months (%)	Attended meeting of the VSLA in the last 12 months (%)	Attended meeting of a natural resources management committee in the last 12 months (%)	The respondent attended meetings of any of the listed groups in the last 12 months (%)	Total number of groups the respondent attended meetings of in the last 12 months
Overall							
Intervention mean	61.95	59.55	40.45	60.11	36.63	87.98	2.59
Comparison mean	54.37	54.89	33.53	56.80	28.53	83.11	2.28
Difference	7.6 (4.8)	4.7 (4.1)	6.9 (5.5)	3.3 (5.2)	8.1 (5.7)	4.9** (2.1)	0.31** (0.15)
Observations (intervention group)	707	707	707	707	707	707	707
Observations (total)	1959	1959	1959	1959	1959	1959	1959
Testing for differential impacts							
Effect of being a woman in the comparison group	-12.8** (5.1)	-10.5** (5.2)	-5.2 (4.3)	11.9** (5.1)	-2.5 (4.7)	-0.1 (5.3)	-0.19 (0.20)
Effect of being in intervention among men	0.2 (2.9)	1.6 (1.8)	8.7** (4.4)	-1.9 (4.6)	5.6** (2.8)	2.8 (2.5)	0.14 (0.10)
Differential impact for men and women	11.4** (4.6)	7.4 (4.9)	1.5 (5.6)	4.9 (4.9)	6.4 (4.8)	2.2 (4.4)	0.32** (0.16)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.2.3: Exposure to the radio programmes supported by CRAFS, by region

	1	2
	Has listened to Donyomo on Tizaa fm (%)	Has listened to Ten Lebigir on Quality fm (%)
	In the Northern region	**In the Upper East region**
Intervention mean	79.44	76.99
Comparison mean	67.21	42.18
Difference	12.1 (8.3)	38.3*** (8.9)
Observations (intervention group)	355	352
Observations (total)	973	986

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions

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6.3 KNOWLEDGE OF CLIMATE CHANGE AND GOVERNANCE

In CRAFS's theory of change, access to information and knowledge are key steps towards changes in practices and regulations. Hence, the review investigated the respondents' understanding, knowledge and observation of climate change.

We observed no impact on the understanding of climate change, assessed through asking respondents to pick between two statements: 'The frequency and severity of floods and droughts in this area continue to increase' and '10 to 20 years into the future, the weather patterns in this area will be similar to those of the past' (Table 6.3.1).[20] However, respondents in the intervention group are significantly more likely to agree with the fact that rising temperature is affecting crop outputs than in the comparison group (67 percent vs 54 percent), and more likely to agree with the fact that floods and droughts are signs of climate change (64 percent vs 41 percent). These results are not statistically different between women and men respondents. Important to highlight, however, is that a very large proportion of respondents agree or partially agree with each statement (91 percent and 92 percent respectively in the intervention group), and these percentages are not statistically different between intervention and comparison groups. To put it differently, the programme leads respondents to substitute their responses to these questions from 'partially agree' to 'agree', that is, building their confidence in the association between climate change and signs and effects.

The project did not lead to a significant difference in terms of prevalence of bush fires, as assessed by respondents (Table 6.3.2). Indeed, 90 percent of respondents consider that bush fires have happened less, compared to the rainy season 2014, and dry season 2015, while 88 percent do so in the comparison area (difference not statistically significant). While this implies an overall reduction of the frequency of bush fires in the areas under review, the project does not seem to make an additional difference.

However, CRAFS respondents are significantly more likely to be aware of a community regulation being in place against bush fires, than comparison communities: 91 percent of respondents in the CRAFS communities are aware of the community having such regulation, against 80 percent in the comparison communities. This impact is driven by impact on women respondents (71 percent of women in the comparison group against 88 percent in CRAFS communities, effect size of 17 percentage points), while impact on men is not considered statistically significant. This suggests that CRAFS made women much more aware of the existence of this regulation than they would have been in the absence of the project. Finally, 33 percent of respondents in the CRAFS communities who are aware of the existence of such regulation are aware of it not having been enforced in the last 12 months. This is not different between intervention and comparison groups. This is driven by women respondents being much more likely in the intervention group to declare so: 32 percent in the comparison group against 45 percent among CRAFS participants.

Figure 6.3.1: Community governance and interaction with district assembly person
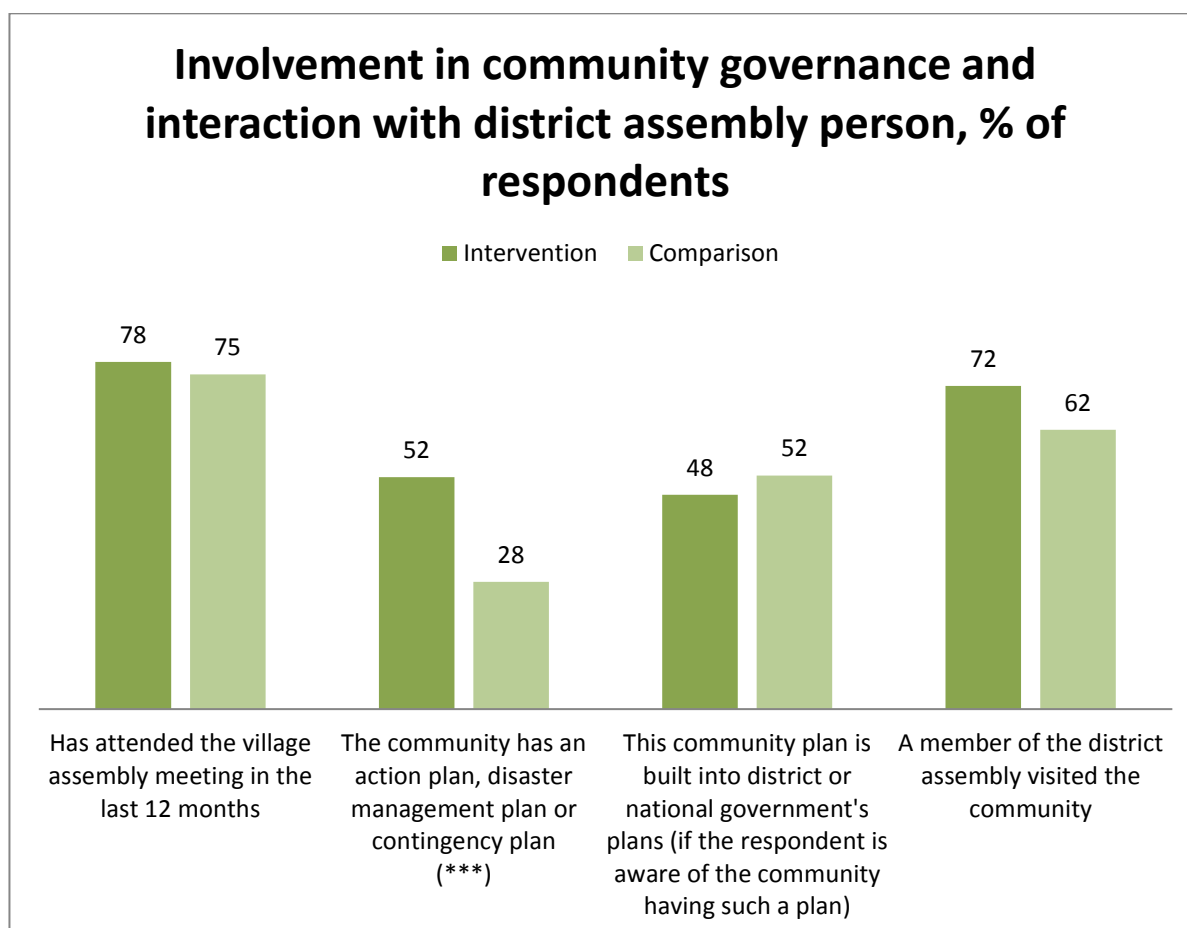
As shown in Figure 6.3.1 and in Table 6.3.3, CRAFS did not impact individual participation in village assembly meetings (for women and men equally). It did impact, however, the fact that the community has an action plan, disaster management plan or contingency plan, and that the community members are aware of it: 52 percent of respondents in the CRAFS communities, against 28 percent of respondents in the comparison communities, and this effect is not different between women and men. Among these respondents, it seems that CRAFS has had no significant impact on the fact that the respondent is aware of the community plan being built into the district or national government's plan. It is important to highlight the gender differences on this: women are less likely than men to be aware of this in the comparison group (73 percent of men against 29 percent of women), and CRAFS seems to have been building such awareness up (effect size of 13.8, not statistically significant, but close to the 10 percent threshold).

Finally, slightly more respondents identify that a member of the district assembly visited the community in the CRAFS communities than in the comparison group (72 percent vs 62 percent), but this is not statistically significant.

Tables of the subsection

Table 6.3.1: Understanding and knowledge of climate change signs

	1 Understanding of climate change (%)	2 Agrees that rising temperature is affecting crop output (%)	3 Agrees that floods and drought are signs of climate change (%)
Overall			
Intervention mean	32.11	66.76	64.36
Comparison mean	33.67	54.22	41.47
Difference	-1.6 (7.2)	12.5* (6.9)	22.9*** (6.2)
Observations (intervention group)	707	707	707
Observations (total)	1959	1959	1959
Testing for differential impacts			
Effect of being a woman in the comparison group	-9.5 (6.3)	9.8 (7.0)	0.8 (7.2)
Effect of being in intervention among men	0.7 (9.5)	14.0 (9.0)	26.3*** (7.6)
Differential impact for men and women	-2.1 (8.6)	-6.2 (9.9)	-9.3 (8.4)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.3.2: Prevalence of bush fires and regulation[21]

	1 Bush fires have happened less, compared to rainy season 2014, and dry season 2014–2015 (%)	2 The community has a regulation on bush fires – by law (%)	3 In the last 12 months, the respondent has been aware of such regulation NOT being enforced (%)
Overall			
Intervention mean	89.96	91.09	32.76
Comparison mean	88.07	80.06	31.13
Difference	1.9 (3.5)	11.0*** (3.1)	1.4 (5.8)
Observations (intervention group)	707	707	644
Observations (total)	1959	1959	1454
Testing for differential impacts			
Effect of being a woman in the comparison group	10.4*** (3.4)	-8.6* (4.6)	4.7 (9.4)
Effect of being in intervention among men	1.7 (5.2)	3.4 (2.7)	-8.1 (5.9)
Differential impact for men and women	-1.1 (4.5)	13.6*** (4.6)	21.4** (10.4)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.3.3: Community governance and interaction with district assembly person[22]

	1	2	3	4
	Has attended the village assembly meeting in the last 12 months (%)	The community has an action plan, disaster management plan or contingency plan (%)	This community plan is built into district or national government plans (%)	A member of the district assembly visited the community (%)
Overall				
Intervention mean	77.68	51.91	47.96	72.28
Comparison mean	74.91	28.49	52.25	62.45
Difference	2.6 (5.0)	23.4*** (6.6)	-7.5 (12.4)	9.8 (6.5)
Observations (intervention group)	681	707	367	707
Observations (total)	1871	1959	648	1959
Testing for differential impacts				
Effect of being a woman in the comparison group	-2.9 (5.8)	-6.0 (4.6)	-44.3*** (14.1)	-6.2 (8.7)
Effect of being in intervention among men	3.3 (3.0)	19.7*** (5.7)	-6.1 (11.9)	8.1 (7.4)
Differential impact for men and women	2.6 (5.3)	8.6 (6.7)	19.9 (12.5)	3.2 (9.8)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

6.4 ON-FARM ACTIVITIES

Conservation agriculture (CA) practices seem well known in the areas under review, in both intervention and comparison groups, as assessed through responses to a true or false quiz[23] following the baseline study (Kanton et al., 2015). For five statements out of six, more than 80 percent of respondents identified the right statement, and this is not different between intervention and comparison groups (see Table 6.4.1).

One statement about tillage made exception: only 6 percent of respondents assessed that the statement 'Tillage assists in water infiltration' is false, and this is not different between intervention and comparison groups. Such a low share, and striking difference with other statements, is surprising and raises questions about the logic behind conservation agriculture being well known on the one hand, and the survey methodology on the other hand. This statement was indeed the only false one, coming third out of six statements in the survey. Potential anchoring effect of the responses could explain in part such a striking difference.

Overall, respondents identified 4.7 right statements out of 6 (not different between the two groups).

No differential impacts are observed on each individual statement and on the overall index between women and men. However, women significantly have a lower CA knowledge score than men, and this seems to be driven by difference in rightly identifying statements about the role of manure in soil water-holding capacity (99 percent of men in the comparison group, against an estimated 93.5 percent of women), and the impact on the organic matter of not

ploughing before planting (88 percent of men in the comparison group, against 76 percent of women).

During the household interview, respondents were asked about farming techniques their households used in the past 12 months. Figure 6.4.1 and Table 6.4.2 show changes in agricultural practices attributable to the project.

Figure 6.4.1: Agricultural practices used in the last 12 months

% of households who used different farming techniques in the last 12 months

Comparison group ■ Intervention group

Technique	Comparison group	Intervention group
Intercropped cereals with legumes on the same plot	77	82
Used soil conservation techniques (e.g. zai, terrace) (*)	44	58
Did minimum tillage	72	77
Did crop rotation of cereals followed by legumes (on the same plot)	76	83
Used pesticides	49	60
Used scientific weather forecasts to decide when/how to plant crops (**)	32	48
Did crop nursery before planting in the field (**)	32	48
Used organic fertiliser (e.g. manure, compost, vermi-compost, animal…)	69	81
Used chemical fertilizer	79	78
Grew drought-resistant varieties of any crops	46	56

The project significantly changed farming practices regarding adoption of soil conservation techniques (44 percent in the comparison group vs 58 percent in the intervention group), usage of scientific weather forecasts to decide when/how to plant crops (32 percent vs 48 percent) and crop nursery adoption (32 percent vs 48 percent). Overall, the project led to an increase in adoption of other conservation agricultural practices, but also of use of pesticides (Figure 6.4.1) and improved seeds for the main crops (Table 6.4.3), although these are not statistically significant. Usage of chemical fertilizer stayed unchanged (78 percent of households in the CRAFS communities).

Note that the number of crops grown is not affected by the project (Table 6.4.4): slightly less than five on average, out of the eight main crops included in the survey (maize, sorghum, late millet, groundnut, soybean, bambara beans, rice, cowpea, following the baseline report – Kanton et al., 2015). CRAFS did have an impact on the number of crops sold per household (1.45 vs 2.25).[24] This is driven by larger shares of households selling any sorghum, out of those producing any (from 10 percent to 36 percent), rice (from 26 percent to 49 percent) and cowpeas (from 26 percent to 53 percent). Out of the late millet producers, more households are selling some in the CRAFS communities (51 percent against 27 percent), but this is not statistically significant due to a large variation between regions, millet being more widely sold in the Northern region than in the Upper East region.

Tables of the subsection

Table 6.4.1: Knowledge of conservation agriculture practices

	1	2	3	4	5	6	7
	Manure DOES improve water-holding capacity of the soil (%)	Planting directly into the soil without ploughing DOES keep the organic matter (%)	Tillage does NOT assist in water infiltration (%)	Seedbed DOES improve aeration in the soil (%)	Rotating cereals and legumes DOES prevent some plant diseases (%)	Cover crops DO prevent soil erosion (%)	Conservation techniques - Score out of 6
Overall							
Intervention mean	97.60	84.72	6.36	93.07	93.92	91.37	4.67
Comparison mean	96.23	80.65	8.89	90.53	91.93	93.13	4.61
Difference	1.4 (1.4)	4.1 (5.6)	-2.5 (2.7)	2.5 (2.8)	2.0 (2.1)	-1.8 (1.9)	0.06 (0.08)
Observations (intervention group)	707	707	707	707	707	707	707
Observations (total)	1959	1959	1959	1959	1959	1959	1959
Testing for differential impacts							
Effect of being a woman in the comparison group	-5.2** (2.4)	-11.5** (5.7)	-7.0 (5.9)	-7.1 (5.2)	-2.6 (3.2)	-5.1 (3.8)	-0.38*** (0.15)
Effect of being in intervention among men	0.4 (0.9)	1.7 (4.5)	-1.0 (3.8)	-1.3 (3.2)	2.2 (1.7)	-3.0 (2.7)	-0.01 (0.09)
Differential impact for men and women	2.0 (2.7)	5.7 (8.2)	-2.8 (4.9)	7.8 (6.1)	-0.5 (3.7)	3.1 (4.9)	0.15 (0.18)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.4.2: Agricultural practices used in the last 12 months

	1 Grew drought-resistant varieties of any crops	2 Used chemical fertilizer	3 Used organic fertilizer (e.g. manure, compost, vermi-compost, animal droppings)	4 Did crop nursery before planting in the field	5 Used scientific weather forecasts to decide when/how to plant crops
Intervention group mean	0.56	0.78	0.81	0.48	0.48
Comparison group mean	0.46	0.79	0.69	0.32	0.32
Difference:	0.10 (0.07)	-0.02 (0.10)	0.13 (0.10)	0.16** (0.06)	0.16** (0.07)
Observations (intervention group)	366	366	366	366	366
Observations (total)	994	994	994	994	994

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

Table 6.4.2: Agricultural practices used in the last 12 months (cont.)

	6 Used pesticides	7 Did crop rotation of cereals followed by legumes (on the same plot)	8 Did minimum tillage	9 Used soil conservation techniques (e.g. zai, terrace)	10 Intercropped cereals with legumes on the same plot
Intervention group mean	0.60	0.83	0.77	0.58	0.82
Comparison group mean	0.49	0.76	0.72	0.44	0.77
Difference:	0.10 (0.09)	0.07 (0.06)	0.05 (0.08)	0.15* (0.09)	0.05 (0.07)
Observations (intervention group)	366	366	366	366	366
Observations (total)	994	994	994	994	994

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

Table 6.4.3: Usage of improved seeds in the last 12 months

	1 Use of any improved seeds for the main crops grown
Intervention group mean	0.59
Comparison group mean	0.57
Difference:	0.02
	(0.14)
Observations (intervention group)	359
Observations (total)	976

Standard errors in parentheses, clustered at the village level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions

Table 6.4.4: Crops grown and sold

	1 Number of crops grown in the last 12 months	2 Number of crops sold in the last 12 months
Intervention group mean	4.91	2.25
Comparison group mean	4.81	1.45
Difference:	0.10	0.80**
	(0.41)	(0.33)
Observations (intervention group)	366	366
Observations (total)	994	994

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

6.5 DIVERSIFIED LIVELIHOOD

CRAFS' theory of change focused on enhancing off-farm activities as an absorption mechanism to changes in weather pattern that affects main farm production and as a transformative one, given that women have less access to land.

Table 6.5.1 shows that the proportion of households doing vegetable gardening is not affected by the programme (45 percent in the CRAFS communities, against 42 percent in the comparison ones). However, women's decision-making power seem to have been enhanced in the CRAFS communities: in 47 percent of the households doing vegetable gardening in the CRAFS areas, a woman is the main decision-maker for decisions about vegetable production, against 33 percent in the comparison areas. Regarding decisions about the use of harvested vegetables, this is 52 percent against 35 percent.[25]

Figure 6.5.1 shows respondents' involvement in off-farm activities in the 12 months preceding the survey, and Table 6.5.2 shows the detailed results, including the testing for gender differences. The project has had an impact on involvement in off-farm activities, with more respondents having themselves done these processing and petty trading activities. A statistically significant increase is observed for beekeeping (28 percent of respondents in the intervention group vs 5 percent in the comparison group), soap making (9 percent vs 2 percent), shea butter processing (26 percent vs 9 percent), seed nursery (46 percent vs 37 percent) and other processing activities (21 percent vs 13 percent).

Figure 6.5.1: Involvement in off-farm activities, at the individual level

% of respondents involved in off-farm activities

Legend: Intervention group | Comparison group

Activity	Intervention group	Comparison group
Has done tree nursery	53	43
Has done bee keeping and honey making (***)	28	5
Has made soap (***)	9	2
Has done shea butter processing (**)	26	9
Has done seed nursery (*)	46	37
Has done other processing activities - brewery, etc. (**)	21	13
Has done other trading or pretty trading activities - selling cakes, etc.	41	29

As shown in Table 6.5.2, effects are not statistically different between women and men, although effect sizes are higher for women, except for other processing activities: the overall effect described above is driven by women respondents (25 percent involved in it, against 11 percent in the comparison communities – effect size of 14.5), while the share of men involved is not impacted by the project.

At the household level, we indeed observe an increase in the share of households involved in any processing activities due to the project (from 30 percent in the comparison group to 46 percent in the intervention group), as shown in Table 6.5.3. Slightly more households are also involved in trading activities, but the difference is not statistically significant (46 percent against 43 percent). On the other hand, fewer households are involved in regular and paid employment (only 4 percent in the intervention group, against 11 percent in the comparison group). Finally, we highlight that more households receive remittances or government benefits as a result of the project (respectively 24 percent vs 15 percent, and 10 percent vs 5 percent).

Within the household, increase in off-farm activities, for main adult decision-makers within the household and for women ones in particular, may come as an additional burden on women if responsibility for domestic tasks still falls on them. Table 6.5.4 shows that respondents in the CRAFS communities are more likely to say that the men participated in water or fuel collection or meal preparation in the last month (asked to the respondent himself, or about the respondent's husband or son(s), if the respondent is a woman): 61 percent in the CRAFS communities, against 51 percent in the comparison group. Participation of men in washing and drying clothes or cleaning the house or compound is not impacted by the project (according to men respondents in the intervention group, 49 percent did so in the last month, and this is not different between the two groups). Participation of men in caring for children, the elderly, ill or disabled is not impacted either, according to women respondents, but increased according to men respondents (from 82 percent of men in the comparison group, to 90 percent). Although this is not significant, we notice that a larger share of women in the intervention group had asked for help regarding water or fuel collection, or meal preparation in the last month than in the comparison group. During the workshop held in Tamale in January as part of this review, women project participants

underlined that domestic task distribution within the household was an important area that would require change in the future.

Table 6.5.5 shows the differences in terms of livestock ownership: most households own some livestock in the areas under review, and the project has not made a significant impact on this (97 percent of households in the CRAFS communities own any livestock, not statistically different in the comparison communities). We observe a slight increase in the number of livestock types owned, out of the six types included in the survey, but this is not significant. This is driven by households whose main decision-maker was a woman at onset of the project owning more livestock types and cows or oxen and goats in particular. For both women and men-headed households, a slight increase in pig ownership is observed (not significant). The project distributed small ruminants, and ensured that the gift was passed on as the livestock reproduced; women-headed households were identified as being at higher risks of vulnerability and specifically targeted for this component of CRAFS, which seems reflected in the data at the household level.

Table 6.5.6 shows the proportion of livestock owned vaccinated in the 12 months preceding the survey. No statistically significant differences are observed between the two groups, except for horses and donkeys, for which significantly lower shares of vaccination is observed in the CRAFS communities, compared to the comparison ones.[26]

Finally, taking a look at ownership and control over decisions to sell livestock within the household, two main points are observed (see Table 6.5.7). First, for all livestock types but pigs, women are significantly less likely than men to consider that they own the livestock (including shared ownership), or that they can decide whether to sell the livestock (including shared decision), and the project is not making a difference in this. There seems to be a substitution effect on ownership and control over decisions related to goats between men and women within the household, but this is not significant. Second, pig ownership and involvement in decisions to sell seems to be much more balanced between women and men (no significant differences by gender in the comparison group), and the project is giving more ownership and more say to women over decisions to sell regarding pigs (while it stays unchanged for men): 33 percent of women considered that they own pigs, against 19 percent in the comparison group, and 34 percent that they have a say over the decision to sell these animals, against 20 percent in the comparison group.

Similarly, and considering all livestock types together, CRAFS seems to have had an impact on women's input into decisions related to livestock raising and in decisions pertaining to the use of income related to livestock raising (with women being much less involved than men in these decisions in the comparison group) (see Table 6.5.8). On the other hand, women are more involved than men in decisions related to non-farm economic activities and decisions related to the use of income related to these activities in the comparison group, and CRAFS increases this difference further (although this is not statistically significant).

The project has had an impact on access to savings for both women and men (59 percent of respondents in the CRAFS communities, against 47 percent in the comparison group) although this is not statistically significant (Table 6.5.9).[27] It is worth highlighting that women are more likely to have access to savings than men in the first place: 35 percent of men in the comparison group, against 44 percent of women.

More households have had access to credit thanks to the project (78 percent vs 56 percent, Table 6.5.10).[28] At time of the survey, 25 percent of households in the intervention group still had to reimburse credits they had taken, against 16 percent of households in the comparison group. This difference is statistically significant, but driven by the fact that more households had access to credit (in other words, among households who took a credit, the same share of households still have to reimburse some in both groups). This enhanced access to credit as a result of CRAFS seems driven by access to credits from VSLAs for both women and men. In the light of the results in Section 6.2, although the same share of respondents participates in any VSLAs between comparison and intervention groups, CRAFS seems to have enabled better functioning or richer VSLAs (ceiling reached), and/or involvement in several VSLAs for participants, resulting in an enhanced access to credit.

As presented in Section 4.1, we constructed an asset-based measure of wealth. No impact on it is observed (very small effect size and large standard errors), as shown in Table 6.5.10.

During the preparation of this review, one question that was identified as key for learning and future programming was to better understand if the project would give access to more resources for households and household members, and how these resources would be invested by households.

We do observe larger shares of households selling crops and wider access to credit, which have slightly resulted in more savings (although this is not significant), but not in investment in more livestock (slight diversification of the number of livestock types). Overall, and in the 12 months preceding the survey, we observe a slight decrease in expenditure (not statistically significant) in the CRAFS communities, when accounting for expenditure on clothes and shoes, community events and ceremonies, building materials and repairs, rent of farming land and farming tools, livestock and farm inputs, health costs, and educational expenses. We observe that a lower share of households had expenditure on rent of farming land and farming tools (significant at 10 percent), and a slightly higher one had expenditure related to education (not significant). Among those who had expenditure of a given type, the amount of the expenses was significantly lower on community events and ceremonies in the CRAFS communities compared to the comparison ones (table not shown). The project does not seem to have resulted in more investment in livestock or farm inputs on the one hand, or on health or education expenses on the other. This raises questions around the amounts of credit or additional revenue obtained as a result of the project, which may not be enough to result in investments.

Tables of the subsection

Table 6.5.1: Dry season gardening or backyard gardening

	1 Cultivation of vegetables – dry season gardening or backyard gardening	2 A woman is the main person responsible for decisions about vegetable production	3 A woman is the main person responsible for decisions about the use of harvested vegetables
Intervention group mean	0.45	0.47	0.52
Comparison group mean	0.42	0.33	0.35
Difference:	0.04	0.12*	0.15*
	(0.10)	(0.07)	(0.08)
Observations (intervention group)	366	148	148
Observations (total)	994	344	344

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

Table 6.5.2: Involvement in off-farm activities, individual level

	1 Has done tree nursery (%)	2 Has done bee keeping and honey making (%)	3 Has made soap (%)	4 Has done shea butter processing (%)	5 Has done seed nursery (%)	6 Has done other processing activities – brewery, etc. (%)	7 Has done other trading or petty trading activities – selling cakes, etc. (%)
Overall							
Intervention mean	53.32	28.43	9.05	26.17	45.83	21.50	40.74
Comparison mean	43.03	5.10	1.71	9.14	36.53	12.73	28.76
Difference	10.3 (7.8)	23.3*** (4.6)	7.3*** (2.8)	17.0** (7.0)	9.3* (5.6)	8.8** (4.0)	12.0 (7.4)
Observations (intervention group)	707	707	707	707	707	707	707
Observations (total)	1959	1959	1959	1959	1959	1959	1959
Testing for differential impacts							
Effect of being a woman in the comparison group	-10.5 (6.6)	-0.2 (3.5)	-0.3 (2.0)	5.5 (3.8)	-3.1 (10.4)	-3.8 (5.4)	-0.1 (4.9)
Effect of being in intervention among men	6.6 (8.8)	22.0*** (3.9)	4.9** (1.9)	15.3*** (4.4)	5.7 (5.5)	2.8 (5.5)	11.0 (8.4)
Differential impact for men and women	7.2 (9.0)	2.2 (4.2)	4.1 (2.6)	1.6 (7.0)	6.7 (11.3)	11.7* (6.3)	-1.7 (6.4)

Standard errors in parentheses, clustered at the community level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.5.3: Involvement in off-farm activities, household level

	1 Processing activities (e.g. bee-keeping and honey making, soap making, shea nut	2 Trading or petty trading (e.g. buy-and-sell, selling cakes)	3 Paid agricultural labour	4 Casual labour (e.g. construction, masonry)	5 Regular and paid employment (e.g. teacher, nurse, services)
Intervention group mean	0.46	0.46	0.44	0.13	0.04
Comparison group mean	0.30	0.43	0.38	0.07	0.11
Difference:	0.16** (0.07)	0.03 (0.09)	0.06 (0.04)	0.06 (0.05)	-0.07** (0.03)
Observations (intervention group)	366	366	366	366	366
Observations (total)	994	994	994	994	994

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

Table 6.5.3: Involvement in off-farm activities, household level (cont.)

	6 Receipt of remittances	7 Receipt of any pension or social benefit (e.g. LEAP)
Intervention group mean	0.24	0.10
Comparison group mean	0.15	0.05
Difference:	0.08**	0.05*
	(0.04)	(0.03)
Observations (intervention group)	366	366
Observations (total)	994	994

Standard errors in parentheses, clustered at the community level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions

Table 6.5.4: Participation of men in domestic work and unpaid care in the last month

	1 The woman respondent's husband – or sons – or the man respondent participated in water or fuel collection (%)	2 The woman respondent's husband – or sons – or the man respondent participated in meal preparation, washing and drying clothes, cleaning the house or compound (%)	3 The woman respondent's husband – or sons – or the man respondent participated in caring for children, elderly, ill or disabled (%)
Overall			
Intervention mean	61.17	54.47	87.94
Comparison mean	50.52	48.24	82.99
Difference	10.6* (5.8)	6.2 (5.8)	5.0 (3.6)
Observations (intervention group)	703	705	705
Observations (total)	1947	1954	1954
Testing for differential impacts			
Effect of being a woman in the comparison group	18.7** (8.0)	11.9* (6.2)	2.1 (6.0)
Effect of being in intervention among men	9.8 (8.7)	4.8 (6.4)	7.8** (3.6)
Differential impact for men and women	-1.1 (9.1)	-0.3 (6.9)	-7.4 (5.3)

Standard errors in parentheses, clustered at the community level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.5.5: Household's livestock ownership

	1 The household owns any livestock	2 Number of types of animals owned
Intervention group mean	0.97	3.22
Comparison group mean	0.96	3.09
Difference:	0.01	0.13
	(0.02)	(0.28)
Observations (intervention group)	366	366
Observations (total)	994	994

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

	3 Ownership of any cows, buffaloes, oxen	4 Ownership of any donkeys, horses	5 Ownership of any goats	6 Ownership of any sheep	7 Ownership of any pigs	8 Ownership of any poultry
Intervention group mean	0.45	0.19	0.71	0.52	0.44	0.90
Comparison group mean	0.39	0.17	0.72	0.54	0.35	0.92
Difference:	0.07	0.02	-0.01	-0.01	0.09	-0.02
	(0.10)	(0.06)	(0.07)	(0.07)	(0.11)	(0.02)
Observations (intervention group)	366	366	366	366	366	366
Observations (total)	994	994	994	994	994	994

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

Table 6.5.6: Livestock vaccination

	1 Proportion of cows, buffaloes, oxen vaccinated	2 Proportion of donkeys, horses vaccinated	3 Proportion of goats vaccinated	4 Proportion of pigs vaccinated	5 Proportion of poultry vaccinated
Intervention group mean	0.70	0.55	0.61	0.49	0.49
Comparison group mean	0.82	0.79	0.66	0.41	0.56
Difference:	-0.13	-0.26**	-0.07	0.06	-0.06
	(0.09)	(0.11)	(0.10)	(0.11)	(0.09)
Observations (intervention group)	166	70	261	161	329
Observations (total)	417	193	688	370	863

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

Table 6.5.7: Ownership of goats and pigs and decision-making within the household

	1 Would say he/she owns most of the goats – include shared ownership (%)	2 Would say he/she can decide whether to sell most of the goats – include shared decision (%)	3 Would say he/she owns most of the pigs – include shared ownership (%)	4 Would say he/she can decide whether to sell most of the pigs – include shared decision (%)
Overall				
Intervention mean	42.29	44.70	23.90	26.73
Comparison mean	43.05	44.57	17.92	19.77
Difference	-0.8 (6.1)	0.1 (5.8)	6.0 (5.6)	7.0 (6.2)
Observations (intervention group)	707	707	707	707
Observations (total)	1959	1959	1959	1959
Testing for differential impacts				
Effect of being a woman in the comparison group	-49.0*** (6.7)	-48.5*** (6.6)	0.7 (2.9)	1.9 (3.7)
Effect of being in intervention among men	-6.7 (6.4)	-5.9 (6.6)	-3.0 (4.2)	-0.5 (5.5)
Differential impact for men and women	14.1 (9.3)	14.4 (9.2)	17.5*** (4.8)	14.5*** (5.1)

Standard errors in parentheses, clustered at the community level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.5.8: Decisions related to livestock raising and non-farm economic activities

	1 Inputs in some, most or all the decisions related to livestock raising (%)	2 Inputs in some, most or all the decisions related to the use of income from livestock raising (%)	3 Inputs in some, most or all the decisions related to non-farm economic activities (%)	4 Inputs in some, most or all the decisions related to the use of income from non-farm economic activities (%)
Overall				
Intervention mean	52.76	52.19	32.96	31.40
Comparison mean	38.43	37.78	27.16	26.05
Difference	14.3** (6.9)	14.4** (6.3)	5.8 (5.7)	5.4 (5.2)
Observations (intervention group)	707	707	707	707
Observations (total)	1959	1959	1959	1959
Testing for differential impacts				
Effect of being a woman in the comparison group	-30.8*** (6.5)	-31.4*** (6.3)	9.2** (4.6)	8.2* (4.6)
Effect of being in intervention among men	7.5 (5.9)	7.2 (5.9)	-0.7 (5.9)	-0.5 (5.8)
Differential impact for men and women	14.9* (7.7)	15.7** (7.5)	10.3 (8.4)	9.8 (7.4)

Standard errors in parentheses, clustered at the community level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.5.9: Savings

	1 Has any savings – her or himself (%)
Overall	
Intervention mean	58.81
Comparison mean	47.29
Difference	11.5 (7.9)
Observations (intervention group)	704
Observations (total)	1946
Testing for differential impacts	
Effect of being a woman in the comparison group	9.3** (4.7)
Effect of being in intervention among men	5.4 (6.9)
Differential impact for men and women	6.8 (6.1)

Standard errors in parentheses, clustered at the community level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.5.10: Credit

	1 The household has taken loans – in cash/in kind – in the past 12 months	2 The household still has to reimburse cash credit
Intervention group mean	0.78	0.25
Comparison group mean	0.56	0.16
Difference:	0.22***	0.09*
	(0.08)	(0.05)
Observations (intervention group)	366	366
Observations (total)	994	994

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

Table 6.5.11: Asset-based wealth index

	1 Wealth index	2 Normalized wealth index
Intervention group mean	0.71	0.27
Comparison group mean	0.68	0.26
Difference:	0.02	0.01
	(0.44)	(0.17)
Observations (intervention group)	366	366
Observations (total)	994	994

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

6.6 FOOD SECURITY

CRAFS is aimed to build more resilient food systems and food security. As shown in Table 6.6.1, slightly higher levels of household dietary diversity and number of meals per person per day are observed in the intervention group than in the comparison group, but this difference is not statistically significant.

Similarly, while a slightly larger share of households had food in store from the last harvest at the time of the survey in the intervention areas (83 percent vs 79 percent), this is not statistically significant (see Table 6.6.2). In both groups, 82 percent of households were worried about not having enough food during last lean season.

Finally, significantly more women had to reduce the size of meals in the 7 days preceding the survey in the intervention areas than in the comparison ones (70 percent in the CRAFS areas against 60 percent of women in the comparison group), as shown in Table 6.6.3. On the other hand, fewer men had to, but this difference is not statistically significant (63 percent of men vs 68 percent in the comparison group, PS weighted effect size of -5.8). This suggests that CRAFS did not impact this indicator overall, due to a positive effect on men respondents, but a negative one on women. On those who reduced the size of meals, this took place on average 3.4 days out of 7, and this is not different between intervention and comparison groups, nor by gender of the respondents. This result is puzzling, and the mechanisms behind it need to be explored further to adjust programme strategies accordingly.

Tables of the subsection

Table 6.6.1: Food consumption in the past seven days

	1 Dietary diversity	2 Number of meals per person per day
Intervention group mean	0.41	2.80
Comparison group mean	0.37	2.77
Difference:	0.04 (0.07)	0.03 (0.06)
Observations (intervention group)	366	366
Observations (total)	994	994

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

Table 6.6.2: Availability of food at time of the survey and during the last lean season

	1 Food in store from the last harvest	2 Worried about not having enough food in lean season 2017
Intervention group mean	0.83	0.82
Comparison group mean	0.79	0.82
Difference:	0.04 (0.07)	-0.00 (0.04)
Observations (intervention group)	366	366
Observations (total)	994	994

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

Table 6.6.3: Size of meals in the last 7 days

	1 Had to reduce the size of meals in the past 7 days, because there was not enough food (%)	2 Number of days the respondent had to reduce the size of meals
Overall		
Intervention mean	66.19	3.43
Comparison mean	64.72	3.34
Difference	1.5 (6.2)	0.07 (0.17)
Observations (intervention group)	704	468
Observations (total)	1952	1268
Testing for differential impacts		
Effect of being a woman in the comparison group	-2.9 (4.8)	-0.13 (0.26)
Effect of being in intervention among men	-5.8 (7.3)	0.05 (0.22)
Differential impact for men and women	15.5** (6.4)	0.15 (0.29)

Standard errors in parentheses, clustered at the community level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

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6.7 RESTORATION OF NATURAL RESOURCE BASE

Respondents in the CRAFS communities are much more likely to have tried different activities related to natural resources management (Figure 6.7.1 and Table 6.7.1), in line with the project's logic. In particular, 74 percent of respondents are likely to have done mulching since the end of the dry season 2015 in the CRAFS communities, against only 61 percent in the comparison communities.

Figure 6.7.1: Activities related to natural resources management
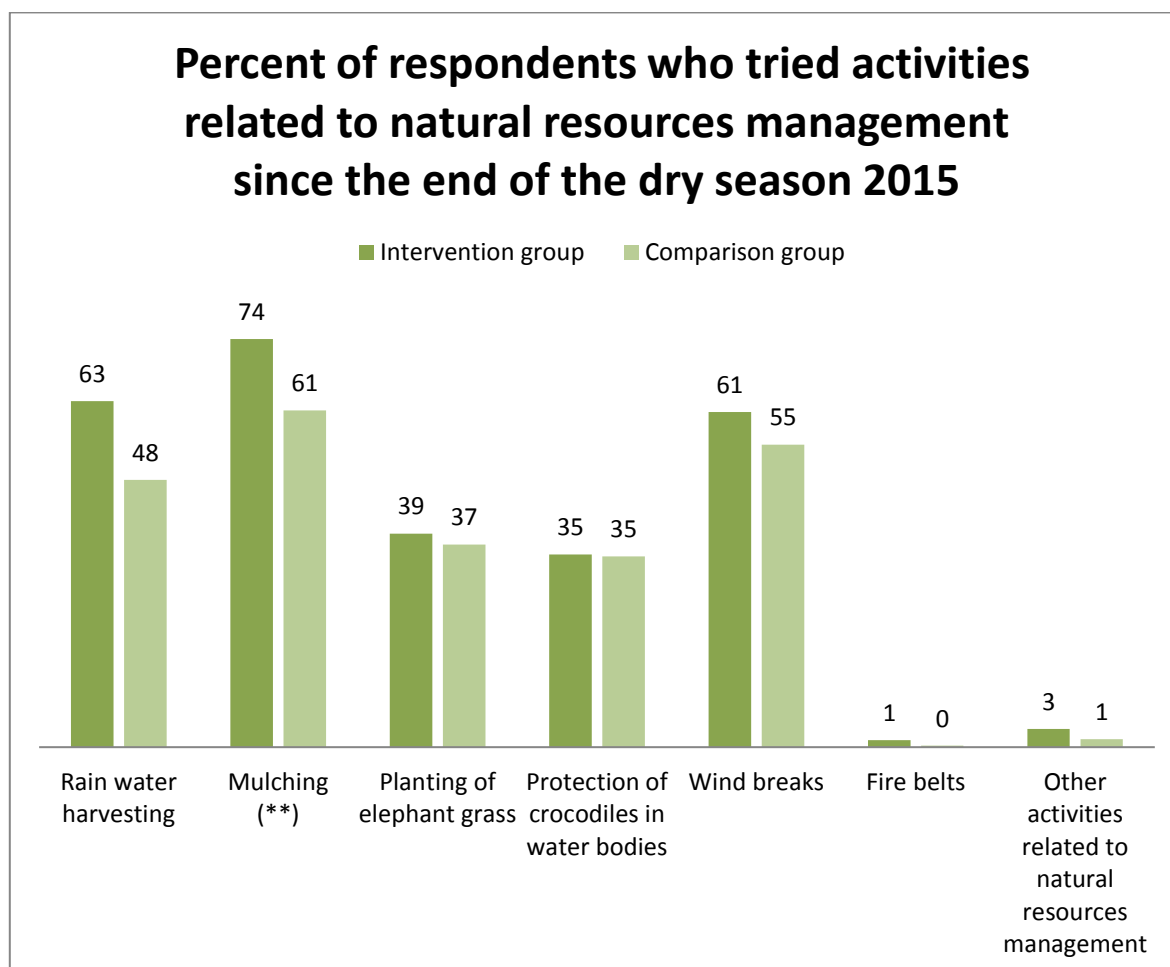
We also observed that 63 percent of respondents in the CRAFS communities have done rain water harvesting, against only 48 percent in the comparison communities, and 61 percent trying to implement wind breaks, against 55 percent, although these differences are not statistically significant.

While no statistically significant differential impacts are detected between women and men, we observed that adoption of these practices are significantly different between women and men: women are indeed significantly less likely than men to have tried implementing mulching, planting of elephant grass, protection of crocodiles in water bodies and implementing wind breaks.

In addition, the project did change practices when it comes to tree planting: 65 percent of households declared having planted trees on personal or communal land in the last 12 months, against only 25 percent in the comparison areas (Table 6.7.2). Finally, we also observed a significant increase in the share of households with an energy conserving stove (18 percent against 1 percent).

Adoption of such practices seems to have resulted in improvement in the natural base. Respondents in CRAFS communities observed an improvement in the natural base, as assessed through two questions (Table 6.7.3), in which respondents were asked to compare the current situation with the state of the natural base in the dry season 2014–2015. Overall, 10 percent of respondents in the comparison group considered that the water bodies are less dried than they used to be in the dry season 2014–2015, while this is 22 percent in the intervention group. In the comparison group 16 percent consider that forest products are more abundant than they used to be, while this is 42 percent in the intervention group.[29] Impacts are not considered statistically different between women and men respondents.

Table of the subsection

Table 6.7.1: Activities related to natural resource management

	1	2	3	4	5	6	7
	Rain water harvesting (%)	Mulching (%)	Planting of elephant grass (%)	Protection of crocodiles in water bodies (%)	Wind breaks (%)	Fire belts (%)	Other activities related to natural resources management (%)
Overall							
Intervention mean	62.73	73.97	38.72	34.91	60.74	1.27	3.33
Comparison mean	48.46	61.03	36.75	34.61	54.85	0.26	1.47
Difference	14.2 (9.0)	12.9** (5.9)	2.1 (5.8)	0.3 (8.2)	5.8 (8.2)	1.0 (0.7)	1.8 (2.0)
Observations (intervention group)	703	703	674	656	698	707	570
Observations (total)	1949	1943	1844	1806	1926	1959	1528
Testing for differential impacts							
Effect of being a woman in the comparison group	-1.6 (7.6)	-26.0*** (5.9)	-26.0*** (9.9)	-25.7*** (7.0)	-20.9*** (6.7)	-0.4 (0.6)	-1.7* (0.9)
Effect of being in intervention among men	10.7 (9.4)	7.4 (7.3)	3.4 (8.5)	2.1 (9.9)	7.0 (6.4)	2.1* (1.2)	3.1 (3.4)
Differential impact for men and women	6.2 (9.2)	10.9 (9.0)	1.0 (11.7)	2.8 (11.3)	-0.3 (9.5)	-2.4 (1.5)	-2.0 (2.8)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.7.2: Tree planting by the household, and adoption of energy conserving stove

	1 The household has planted tree on personal or communal land in the last 12 months	2 The household currently owns any energy conserving stove
Intervention group mean	0.65	0.18
Comparison group mean	0.25	0.01
Difference:	0.40***	0.17**
	(0.08)	(0.07)
Observations (intervention group)	347	366
Observations (total)	931	994

Standard errors in parentheses, clustered at the village level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions

Table 6.7.3: Observation of the natural base

	1 Water bodies are less dry, compared to 2014–2015 dry season (%)	2 Forest products are more abundant, compared to 2014–2015 dry season (%)
Overall		
Intervention mean	21.64	42.37
Comparison mean	10.33	16.04
	11.3*	26.2***
Difference	(6.7)	(7.0)
Observations (intervention group)	707	701
Observations (total)	1959	1898
Testing for differential impacts		
Effect of being a woman in the comparison group	22.8*** (7.6)	5.1 (7.0)
Effect of being in intervention among men	12.7*** (4.5)	25.0*** (7.1)
Differential impact for men and women	-4.6 (8.6)	0.7 (8.2)

Standard errors in parentheses, clustered at the village level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

6.8 IMPACT ON RESILIENCE CAPACITIES

A key learning question by the project team when working on this review, was whether the project has had a differential impact depending on the gender of the main household decision-maker in 2014. For this reason, in this section, the average overall impact is presented, estimated through PSM. Whether impacts for households whose main decision-maker was a man or a woman in 2014 are different are systematically tested. Under the

section 'Testing for differential impacts', the tables will indeed show three rows,[30] as per the example shown in Table 6.8.0:
- Effect of being in a household whose main head was a woman in 2014 in the comparison group: this shows the differences between men-headed and women-headed households, in spite of the intervention
- Effect of being in intervention among households whose main head was a man in 2014: this shows the impact of the intervention among men-headed households
- Differential impact by gender of the main head: this tests whether the impact of the intervention is different for men-headed compared to women-headed households.

Note that, using this specification, the effect size of the impact of the programme among women-headed households is obtained by adding the coefficients from the last row and the row before.

Table 6.8.0: Example of interpretation of table of results by gender of the main decision-maker in 2014

	3 Index of transformative capacity	Interpretation
Testing for differential impacts		
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.04* (0.02)	In spite of the intervention, households headed by women in 2014 had a lower score than households headed by men in 2014 on the transformative capacity – the coefficient is negative and statistically significant.
Effect of being in the intervention among households whose main head was a man in 2014	0.05*** (0.01)	Households whose main decision-maker was a men in the intervention group have a higher score than households whose main decision-maker was a man in the comparison group, as a result of the project – positive coefficient, statistically significant.
Differential impact by gender of the main head in 2014	0.04 (0.03)	The impact of the intervention is not statistically different for households headed by men or women in 2014 – the coefficient is not statistically significant. Given the above line, there is a positive impact of the intervention on transformative capacity of households headed by women in 2014.

6.8.1 Resilience capacities indices

The project overall has a positive impact on resilience capacities indices, adaptive and transformative capacities in particular, and on the overall index (Figure 6.8.1 and Table 6.8.1).

The first column of Table 6.8.1 shows that households in CRAFS communities scored positively in terms of 49 percent of the indicators on average, while this is only 45 percent among the comparison households. This difference is positive but not statistically significantly different from zero.[31]

A similar effect size is observed for adaptive capacity: households in CRAFS communities scored positively on 57 percent of the indicators on average, while this is 53 percent on average in the comparison communities, and the difference is statistically significant at 5 percent.

The effect on transformative capacity is stronger: households in the intervention group scored positively on 63 percent of the indicators against 58 percent in the comparison group. The difference is significant at 1 percent. As shown in Table 6.8.1, households in which the main decision-maker was a woman in 2014 are more likely to score lower on transformative capacity than households in which the main decision-maker was a man in 2014, in the absence of the intervention. This will be discussed further when looking at impacts on each indicator in next section.

Figure 6.8.1: Resilience indices
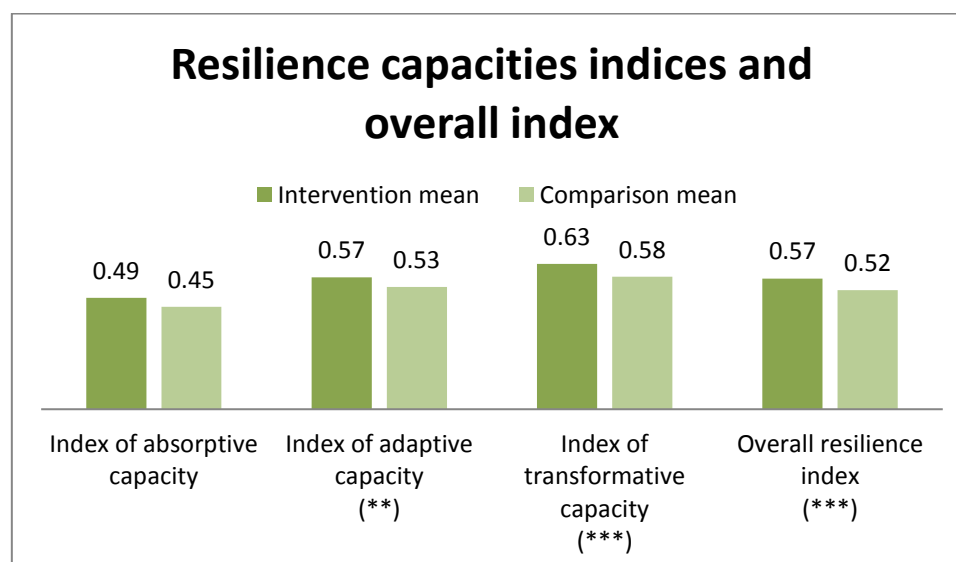
CRAFS had a positive and significant effect on the overall resilience index: while households in the comparison group scored positively on 52 percent of indicators, this is 57 percent on average in the intervention group (difference significant at 1 percent).

Table 6.8.1 also explores potential differential impact between households whose main head was a woman in 2014 and those whose main head was a man in 2014. For the capacity indices, as well as for the overall resilience index, even though impacts among women-headed households seem to be of slightly larger magnitude than among men-headed households, this difference is not considered statistically significant.

Table 6.8.1: Resilience indices

	1 Index of absorptive capacity	2 Index of adaptive capacity	3 Index of transformative capacity	4 Overall resilience index
Overall				
Intervention mean	0.49	0.57	0.63	0.57
Comparison mean	0.45	0.53	0.58	0.52
Difference	0.04 (0.03)	0.04** (0.02)	0.06*** (0.02)	0.05*** (0.02)
Observations (intervention group)	366	366	366	366
Observations (total)	994	994	994	994
Testing for differential impacts				
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.02 (0.02)	-0.02 (0.03)	-0.04* (0.02)	-0.02 (0.02)
Effect of being in the intervention among households whose main head was a man in 2014	0.04** (0.02)	0.04** (0.02)	0.05*** (0.01)	0.05*** (0.01)
Differential impact by gender of the main head in 2014	0.00 (0.02)	0.03 (0.04)	0.04 (0.03)	0.02 (0.02)

Standard errors in parentheses, clustered at the village level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

6.8.2 Dimensions breakdown

In this section, we present the breakdown for each indicator, for each capacity of resilience. The figures first present household-level indicators, which can be interpreted as the share of households who score positively on a given indicator, and the household score for individual level indicators. The household score is the average over both individual respondents, and will take the value 0 if none of the respondents score positively, 0.5 if only one does, and 1 if both do.

Among indicators of absorptive capacity, a significant impact on access to remittances is observed (15 percent in the comparison groups score positively on this indicator, against 23 percent in the intervention group). We also observe a large difference between the two groups on access to drinking water, but this difference is not statistically significant (although close to the 10 percent threshold).

Figure 6.8.2: Indicators of absorptive capacity

Indicators of absorptive capacity – % of households who score positively

■ Comparison group ■ Intervention group

Indicator	Comparison	Intervention
Cattle vaccination	51	41
Availability of food at the beginning of lean season 2018	65	72
Dietary diversity	37	41
Crop diversification	62	64
Diversification of income sources	70	77
Remittances (**)	15	24
Ownership of fungible livestock	40	37
Access to drinking water	32	51

Indicators of absorptive capacity – Household level score of individual indicators

■ Comparison group ■ Intervention group

Indicator	Comparison	Intervention
Subjective resilience – HH score	37	32
Quantity of food – did not have to reduce the size of meals in the last 7 days – HH score	30	35
Savings – HH score	52	59

While there is no evidence of overall impact of CRAFS on ownership of fungible livestock, access to savings and subjective resilience, the results seem different depending on the
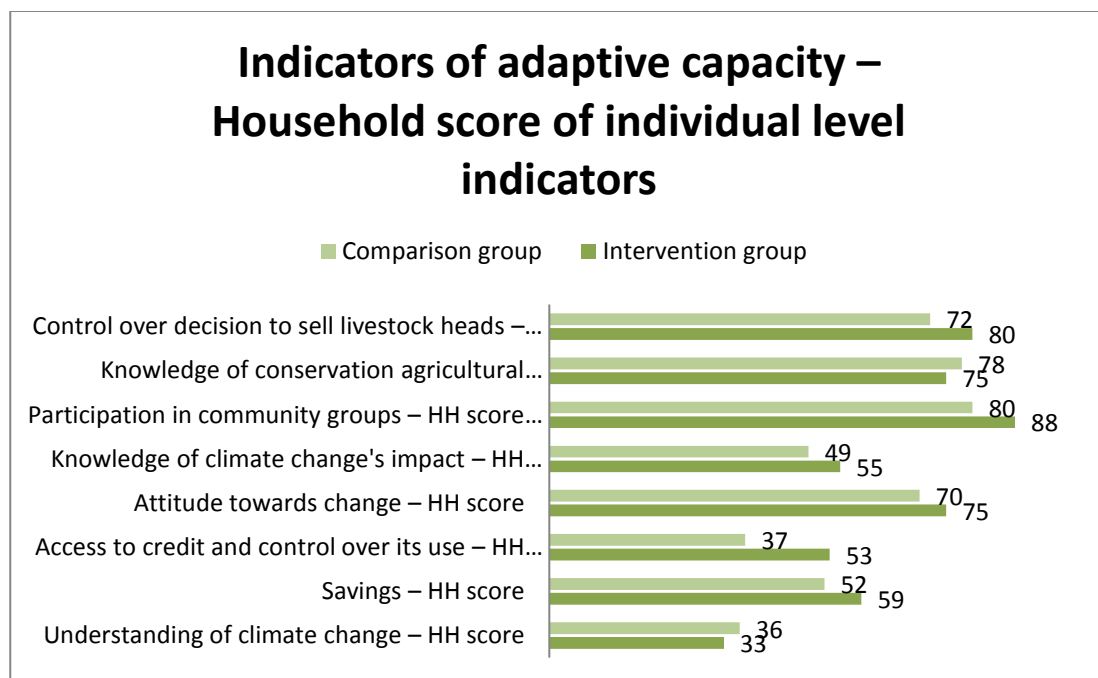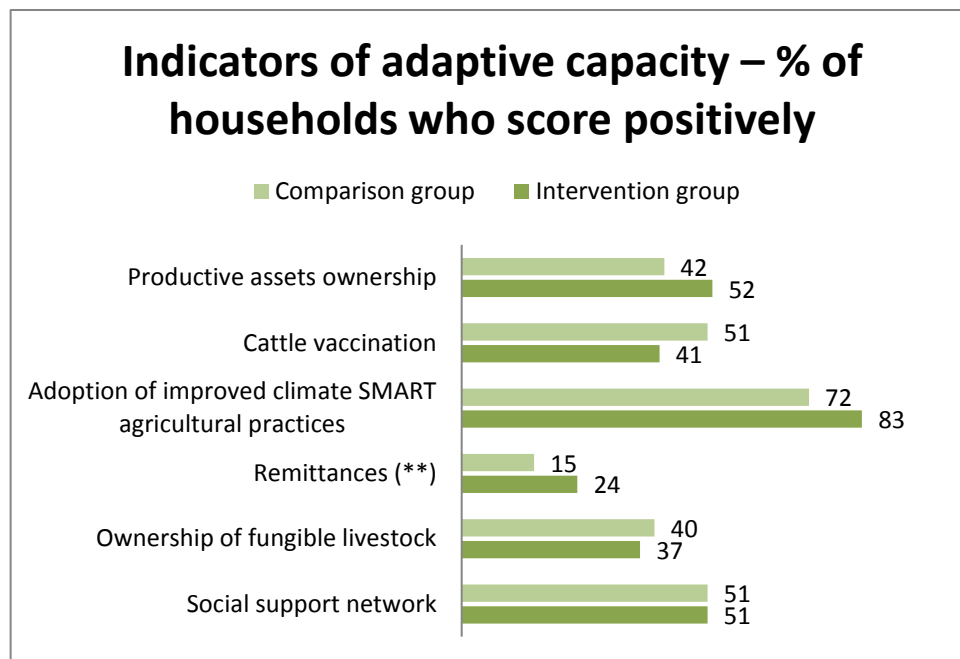
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gender of the main decision-maker at the onset of the project (Table 6.8.2). While the project has had no significant impact on households in which main decision-maker was a man at onset of the project, it seems that it has had one on households where a woman was, who are more likely to own fungible livestock.[32] Note that we also notice differential impacts statistically significant at 10 percent (positive ones on access to savings, and negative ones on subjective resilience) among women-headed households, while no overall impact is observed among men-headed ones.

When looking at adaptive capacity indicators (Table 6.8.3), and at indicators which are not common to the absorptive capacity, we notice an overall significant impact of CRAFS on households' access to credit and control over its use by different household members, control over decision to sell livestock by different household members and participation in community groups by different household members.

Figure 6.8.3: Indicators of adaptive capacity

Indicators of adaptive capacity – % of households who score positively

■ Comparison group   ■ Intervention group

Indicator	Comparison	Intervention
Productive assets ownership	42	52
Cattle vaccination	51	41
Adoption of improved climate SMART agricultural practices	72	83
Remittances (**)	15	24
Ownership of fungible livestock	40	37
Social support network	51	51

Indicators of adaptive capacity – Household score of individual level indicators

■ Comparison group   ■ Intervention group

Indicator	Comparison	Intervention
Control over decision to sell livestock heads –…	72	80
Knowledge of conservation agricultural…	78	75
Participation in community groups – HH score…	80	88
Knowledge of climate change's impact – HH…	49	55
Attitude towards change – HH score	70	75
Access to credit and control over its use – HH…	37	53
Savings – HH score	52	59
Understanding of climate change – HH score	33	36

On a few indicators, we observe differential impacts depending on the gender of the main decision-maker (Table 6.8.3). Indeed, while there are no statistically significant impacts for men-headed households on access to productive assets, impact is large and statistically significant for women-headed households. On the other hand, participation in community groups for individuals within the household is higher as a result of the project for both types of households, but impact is stronger among women-headed households.

Regarding indicators of transformative capacity (Figure 6.8.4 and Table 6.8.4), CRAFS has had a statistically significant impact on the community having a regulation on bush fires (and several household members being aware of it existence), on interaction of community members with district institutions,[33] and on control over income from livestock sales and livestock products and off-farm activities. On these two last indicators, we notice that the effect is statistically stronger for households in which the main decision-maker was a woman in 2014.

Figure 6.8.4: Indicators of transformative capacity

Indicators of transformative capacity - % of households who score positively

■ Comparison group ■ Intervention group

Indicator	Comparison	Intervention
Education of children	69	76
Women's access to agricultural land	80	82

Indicators of transformative capacity - Household score of individual level indicators

■ Comparison group ■ Intervention group

Indicator	Comparison	Intervention
Opinion on women's political role – HH score	45	42
Opinion on acceptability of violence inside the household – HH score	8	8
Control over income from livestock sales and livestock produces, and off-farm economic…	48	64
Interaction with district institutions – HH score (***)	61	75
Regulation within community about bush fires (and awareness of it) – HH score (***)	76	91
Supporting partner doing unpaid care work – HH score	90	91
Acceptability of (unpaid) care work being done by men – HH score	54	61
Feel heard when voicing an issue in village assembly – HH score	9	11
Participation in community groups – HH score (***)	80	88
Belief in collective action's effectiveness – HH score	60	60
Attitude towards change – HH score	70	75

In addition, while there is no significant overall impact on women's access to land, and on opinion on women political leadership, the situation is different for households depending on the gender of the main decision-maker at time of the project onset (Table 6.8.4). While the situation has not significantly changed among households whose main decision-maker was a man at baseline, women's access to land has significantly improved as a result of the project among households whose main decision-maker was a woman. On the other hand, among these households, overall opinion on women's political leadership has changed: fewer respondents in the intervention group agree that 'Women are as good as men as political leader'.

Finally, while no impact of the project can be detected on this indicator, it is important to highlight that very few households score positively on the indicator on opinion about acceptability of violence measured through individual respondents in the household disagreeing that 'Violence inside the household can be justified in certain circumstances'.

Tables of the subsection

Table 6.8.2: Absorptive capacity indicators

	1 Access to drinking water	2 Ownership of fungible livestock	3 Remittances	4 Diversification of income sources	5 Crop diversification
Overall					
Intervention mean	0.51	0.37	0.24	0.77	0.64
Comparison mean	0.32	0.40	0.15	0.70	0.62
Difference	0.19 (0.12)	-0.03 (0.08)	0.08** (0.04)	0.07 (0.05)	0.02 (0.09)
Observations (intervention group)	366	366	366	366	366
Observations (total)	994	994	994	994	994
Testing for differential impacts					
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.04 (0.09)	-0.25*** (0.07)	0.00 (0.08)	0.03 (0.04)	0.09 (0.10)
Effect of being in the intervention among households whose main head was a man in 2014	0.20* (0.11)	-0.05 (0.05)	0.09*** (0.03)	0.05** (0.02)	0.05 (0.04)
Differential impact by gender of the main head in 2014	-0.02 (0.13)	0.21** (0.09)	-0.03 (0.10)	0.02 (0.05)	-0.10 (0.11)

Standard errors in parentheses, clustered at the village level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

	6	7	8	9	10	11
		Availability of food at the beginning of lean season 2018			Quantity of food – did not have to reduce the size of meals in the last 7 days – HH score	Subjective resilience – HH score
	Dietary diversity		Cattle vaccination	Savings – HH score		
Overall						
Intervention mean	0.41	0.72	0.41	0.59	0.35	0.32
Comparison mean	0.37	0.65	0.51	0.52	0.30	0.37
Difference	0.04 (0.07)	0.07 (0.06)	-0.09 (0.09)	0.07 (0.07)	0.05 (0.05)	-0.05 (0.08)
Observations (intervention group)	366	366	354	366	366	366
Observations (total)	994	994	923	994	994	994
Testing for differential impacts						
Effect of being in a household whose main head was a woman in 2014 in the comparison group	0.02 (0.08)	0.02 (0.15)	0.08 (0.10)	-0.09 (0.07)	-0.17** (0.07)	0.12* (0.07)
Effect of being in the intervention among households whose main head was a man in 2014	0.05 (0.06)	0.08 (0.06)	-0.07 (0.06)	0.06 (0.06)	0.04 (0.05)	-0.02 (0.06)
Differential impact by gender of the main head in 2014	-0.10 (0.10)	-0.03 (0.16)	-0.02 (0.11)	0.14* (0.08)	0.11 (0.08)	-0.14* (0.08)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.8.3: Adaptive capacity indicators

	1	2	3	4	5
	Social support network	Ownership of fungible livestock	Remittances	Adoption of improved climate SMART agricultural practices	Cattle vaccination
Overall					
Intervention mean	0.51	0.37	0.24	0.83	0.41
Comparison mean	0.51	0.40	0.15	0.72	0.51
Difference	-0.00 (0.06)	-0.03 (0.08)	0.08** (0.04)	0.11 (0.07)	-0.09 (0.09)
Observations (intervention group)	366	366	366	359	354
Observations (total)	994	994	994	976	923
Testing for differential impacts					
Effect of being in a household whose main head was a woman in 2014 in the comparison group	0.19* (0.10)	-0.25*** (0.07)	0.00 (0.08)	-0.08 (0.09)	0.08 (0.10)
Effect of being in the intervention among households whose main head was a man in 2014	0.01 (0.04)	-0.05 (0.05)	0.09*** (0.03)	0.12*** (0.04)	-0.07 (0.06)

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Differential impact by gender of the main head in 2014	-0.12 (0.13)	0.21** (0.09)	-0.03 (0.10)	-0.03 (0.12)	-0.02 (0.11)

	6	7	8	9	10
	Productive assets ownership	Understanding of climate change – HH score	Savings – HH score	Access to credit and control over its use – HH score	Attitude towards change – HH score
Overall					
Intervention mean	0.52	0.33	0.59	0.53	0.75
Comparison mean	0.42	0.36	0.52	0.37	0.70
Difference	0.09 (0.07)	-0.03 (0.06)	0.07 (0.07)	0.16** (0.06)	0.05 (0.06)
Observations (intervention group)	366	366	366	366	366
Observations (total)	994	994	994	994	994
Testing for differential impacts					
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.20** (0.09)	0.11 (0.08)	-0.09 (0.07)	0.07 (0.08)	-0.12 (0.09)
Effect of being in the intervention among households whose main head was a man in 2014	0.06 (0.04)	-0.01 (0.07)	0.06 (0.06)	0.17*** (0.06)	0.03 (0.03)
Differential impact by gender of the main head in 2014	0.23*** (0.08)	-0.14 (0.10)	0.14* (0.08)	-0.02 (0.09)	0.03 (0.10)

	11	12	13	14
	Knowledge of climate change's impact – HH score	Participation in community groups – HH score	Knowledge of conservation agricultural practices – HH score	Control over decision to sell livestock heads – HH score
Overall				
Intervention mean	0.55	0.88	0.75	0.80
Comparison mean	0.49	0.80	0.78	0.72
Difference	0.06 (0.05)	0.08*** (0.03)	-0.03 (0.04)	0.08** (0.04)
Observations (intervention group)	366	366	366	366
Observations (total)	994	994	994	994
Testing for differential impacts				
Effect of being in a household whose main head was a woman in 2014 in the comparison group	0.02 (0.06)	-0.04 (0.05)	0.09 (0.07)	-0.09 (0.07)
Effect of being in the intervention among households whose main head was a man in 2014	0.05 (0.05)	0.06*** (0.02)	-0.03 (0.04)	0.05 (0.03)
Differential impact by gender of the main head in 2014	-0.00 (0.07)	0.11* (0.06)	-0.03 (0.08)	0.14 (0.08)

Standard errors in parentheses, clustered at the village level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

Table 6.8.4: Transformative capacity indicators

	1 Women's access to agricultural land	2 Education of children	3 Attitude towards change – HH score	4 Belief in collective action's effectiveness – HH score
Overall				
Intervention mean	0.82	0.76	0.75	0.60
Comparison mean	0.80	0.69	0.70	0.60
Difference	0.02 (0.04)	0.07 (0.08)	0.05 (0.06)	-0.00 (0.03)
Observations (intervention group)	358	366	366	366
Observations (total)	979	994	994	994
Testing for differential impacts				
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.09 (0.10)	-0.01 (0.11)	-0.12 (0.09)	0.15 (0.09)
Effect of being in the intervention among households whose main head was a man in 2014	-0.02 (0.04)	0.08 (0.05)	0.03 (0.03)	0.01 (0.04)
Differential impact by gender of the main head in 2014	0.22** (0.10)	0.01 (0.13)	0.03 (0.10)	-0.06 (0.12)

	5 Participation in community groups – HH score	6 Feel heard when voicing an issue in village assembly – HH score	7 Acceptability of (unpaid) care work being done by men – HH score	8 Supporting partner doing unpaid care work – HH score
Overall				
Intervention mean	0.88	0.11	0.61	0.91
Comparison mean	0.80	0.09	0.54	0.90
Difference	0.08*** (0.03)	0.02 (0.02)	0.07 (0.05)	0.01 (0.03)
Observations (intervention group)	366	366	366	366
Observations (total)	994	994	994	994
Testing for differential impacts				
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.04 (0.05)	-0.09*** (0.03)	-0.09* (0.05)	-0.05 (0.04)
Effect of being in the intervention among households whose main head was a man in 2014	0.06*** (0.02)	0.01 (0.03)	0.07 (0.05)	0.01 (0.02)
Differential impact by gender of the main head in 2014	0.11* (0.06)	0.06 (0.04)	0.02 (0.08)	0.01 (0.04)

	9	10	11	12	13
	Regulation within community about bush fires (and awareness of it) – HH score	Interaction with district institutions – HH score	Control over income from livestock sales and livestock products, and off-farm economic activities – HH score	Opinion on acceptability of violence inside the household – HH score	Opinion on women's political role – HH score
Overall					
Intervention mean	0.91	0.75	0.64	0.08	0.42
Comparison mean	0.76	0.61	0.48	0.08	0.45
Difference	0.15*** (0.04)	0.14*** (0.05)	0.15*** (0.04)	-0.00 (0.03)	-0.02 (0.04)
Observations (intervention group)	366	366	366	366	366
Observations (total)	994	994	994	994	994
Testing for differential impacts					
Effect of being in a household whose main head was a woman in 2014 in the comparison group	-0.09 (0.07)	-0.12** (0.05)	-0.15** (0.07)	-0.06*** (0.02)	0.21*** (0.07)
Effect of being in the intervention among households whose main head was a man in 2014	0.15*** (0.03)	0.11*** (0.03)	0.14*** (0.03)	-0.00 (0.03)	0.02 (0.04)
Differential impact by gender of the main head in 2014	0.08 (0.08)	0.13* (0.07)	0.13* (0.08)	0.03 (0.04)	-0.23*** (0.08)

Standard errors in parentheses, clustered at the village level; * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions; differential impacts are tested through PS weighted regressions with robust clustering at the village level.

7   CONCLUSIONS

7.1 CONCLUSIONS

This Effectiveness Review investigated the impact of the CRAFS project in Northern and Upper East regions of Ghana. CRAFS adopts an integrated approach to enhancing resilience capacities through the emphasis on gender roles and their materialization in different livelihood options for women and men, and the interconnectedness between livelihood activities and the natural base, as well as on the need to adaptation to climate change. Due to high coverage of radio programmes on agricultural practices and climate change (of the shows supported by the project or other similar shows), this review focuses on the impact of CRAFS activities excluding radio messaging and other wide-coverage messaging (through billboards for example). Similarly, Oxfam and partners are not working in isolation, and participation in VSLA is widespread in the review areas (comparison and project groups), in spite of CRAFS' support to the creation or strengthening of VSLAs.

Overall, CRAFS had a positive and significant impact on the overall resilience index: 57 percent on average in the intervention group while households in the comparison group scored positively on 52 percent of indicators (a difference significant at 1 percent).

It appears that the project did not have a measurable positive impact on absorptive capacity indicators. Only one of the 11 indicators appears to be positive and significant: access to remittances, although this is not directly linked to the project logic. No significant impact is observed on average on diversification of income sources, crop diversification, dietary diversity, availability of food at the beginning of lean season 2018, quantity of food, access to drinking water, and feeling of preparedness in case of low rainfall during rainy season or heavy flooding. A negative impact on this last indicator is observed among households whose main decision-maker was a woman in 2014.

The project seems to have had a positive and significant effect on indicators of adaptive capacity through access to credit and control over its use within the household, control over decisions to sell livestock heads within the household, and participation in groups (stronger for women-headed households). There is no evidence of impact on average on cattle vaccination, savings, ownership of fungible livestock, productive asset ownership, social support network, adoption of improved climate SMART agricultural practices, knowledge of conservation agricultural practices, knowledge of climate change's impact, understanding of climate change, control over decision to sell livestock heads or attitude towards change. However, among households whose main decision-maker was a woman at the onset of the project, we observed improved ownership of fungible livestock and productive asset ownership, which contributed to building the adaptive capacity of such households in particular.

There is evidence that transformative capacity was built thanks to better awareness of existing regulation, better interaction with district institutions, and more control over income within the household (all stronger for women-headed households). While there is no overall impact on women's access to land nor on opinion on women's political role, we have observed better access to land for women among households in which a woman was the main decision-maker at the onset of the project, but a negative impact on opinion on women's political role. In addition, there is no significant impact on attitude towards change, education of children, acceptability of (unpaid) care work being done by men, ability to support a partner in unpaid care work, feeling heard when

voicing an issue in village assemblies, belief in collective action's effectiveness and opinion on acceptability of violence inside the household.

When it comes to looking at different steps along the theory of change, we observe that a higher share of respondents received information or training sessions on VSLAs in the CRAFS areas than in the comparison ones, and there is evidence for the VSLAs in CRAFS areas to be working differently from in the comparison communities. Participation in bush fire committees is also a key component of the project logic. Such committees are in place in the comparison areas, and participation is not significantly improved by CRAFS overall (although more women attended meetings of such a committee as a result of the project – not significant but close to the 10 percent threshold).

Overall, climate change awareness is high in both comparison and CRAFS communities. CRAFS's climate change awareness raising activities resulted in better awareness on whether regulation on bush fire was in place at the community level or not among women. Similarly, while participation in village meetings is high for both comparison and CRAFS communities, CRAFS has an impact for both men and women on awareness of community's action plan. Among them, awareness of the plan being built into district and national plan is very different by gender (lower for women respondents than men respondents).

CRAFS has a focus on diversification of livelihood activities, in particular through off-farm activities which are less constrained for women, and through distribution of small ruminants. This resulted in an impact on decision-making and control over resources within the household: more women have a say in decisions related to livestock raising activities (decisions over the activity itself, and the generated revenue), an area where fewer women are involved than men in the first place.

Wider access to credit and slightly improved access to savings for women and men (although this is not significant) are observed as a result of the project. This enhanced access to credit seems driven by access to credits from VSLAs for both women and men. Hence, CRAFS seems to have enabled better functioning or richer VSLAs (ceiling reached), and/or involvement in several VSLAs for participants, resulting in an enhanced access to credit. The project did not result in larger spent in investments or overall improved access to assets. This raises questions around the amounts of credit or additional revenue obtained as a result of the project, which may not be enough to result in investments. Note that a significant impact for women-headed households on access to savings and livestock ownership is observed, which seems to be a reflection of the targeting focus of the livestock component of the intervention on women-headed households.

There is no evidence that food security, measured by two indicators at the household level, was improved by CRAFS. However, there seems to be evidence of a differential impact for men and women, which will require further investigation (see Section 7.2): women respondents are significantly more likely to have reduced the size of meals in the seven days prior to the survey (while this indicator is not significantly different among men).

Finally, CRAFS seems to have resulted in an improvement in the natural resource base, as self-assessed by respondents.

7.2 PROGRAMME LEARNING CONSIDERATIONS

Consider complementary strategies to ensure livelihood activity diversification translates into higher income, access to savings and assets for women and men

CRAFS lead to more involvement for women in decision-making over some activities and the revenue generated from these within the household. It also lead to improved access to credit for both women and men, but this did not result in more productive asset ownership – in men-headed households, improved wealth or investments. Further exploration is needed to better understand what the amounts borrowed through VSLAs are used for, and if the amounts are sufficient to allow for significant investments. This also raises questions around the revenue generated at household level thanks to the diversification strategy, and for women and men within households. This is particularly critical in households traditionally identified as being men-headed (as we notice an impact on productive asset ownership for women-headed households).

Improved market access for off-farm products (cooperative to improve bargaining power in price negotiation, supported transportation, etc.)[34] and/or facilitated and safe access to institutions that enable access to credits of higher amounts may be considered as areas of development for CRAFS.

Challenging social norms and current task distribution within the household when it comes to unpaid care and domestic work is another area to facilitate women's access to income.

Consider strengthening activities which could lead to a better enforcement of bush fire regulations and tackle root causes behind current occurrences of bush fires

Sixty percent of respondents participate in bush fire committee meetings and overall, respondents assessed that bush fires have happened less since the rainy season 2014 and the dry season of 2014–2015 (90 percent in the CRAFS community). CRAFS resulted in higher shares of women being aware of the existence of bush fire regulations and such regulation seems widely in place (91 percent of respondents reported being aware of it in the CRAFS areas). However, among respondents who are aware of the regulation being in place, approximately a third of respondents are aware of such regulation not having been enforced, women in particular. Bush fires are a source of degradation of natural resources (soil fertility, tree coverage). Oxfam and partners could explore further what are the reasons behind recent bush fire occurrences and which dynamics lead to existing regulations not being enforced. This will enable revision and strengthening of the activities on the matter.

Build on the current integrated approach to enhancing resilience capacities and explore additional areas that could contribute to enhancing well-being further

This review highlights a few additional areas to explore to contribute to enhancing resilience capacities. First, while CRAFS resulted in better land access for women in women-headed households, land access for women within men-headed households is still a major constraint to women's access to revenue from on-farm activities. Second, 80 percent of respondents agree or partially agree that 'violence inside the household can be justified in certain circumstances' in the CRAFS villages (and only 8 percent disagrees with the statement). While this review does not explore prevalence of

domestic violence, this may be an important aspect to take into account in the project's context.

Consider current barriers to enhancing food security, and potential differentiated risks within the household, to improve project strategy on the matter

Food security is a major concern in Ghana's northern regions, and the data show that 82 percent of households were worried about not having enough food during the lean season 2017, that is between April and September. At time of the survey (February – March 2018), two thirds of respondents declared that they had to reduce the size of meals in the previous seven days, because there was not enough food. This was not impacted by the project activities overall. In addition, among women, women from the CRAFS communities were more likely to have reduced size of meals. This needs further investigation to understand what the mechanisms are behind this result (are women reducing the size of meals for themselves only or for the whole household? Was the size of meals initially improved, and then reduced at the time of the survey?) and make sure that future projects take this gendered effect into account.

Take a more strategic approach to evaluation design, looking for synergies between baseline activities and final evaluation ones

To investigate questions around the impact of the project on women and men, this Effectiveness Review deployed a quasi-experimental ex-post methodology. Extensive inputs of project staff, partner staff, the survey team and inhabitants of the project areas were required to identify suitable comparison communities and identification of relevant indicators of resilience capacities. However, it would have been better to have had these discussions before the project activities began. This could have enabled the implementation of a stronger impact evaluation design if the comparison group had been established before the project started and baseline data had been collected in a large enough number of project and non-project communities.

While inception and baseline activities were key elements of CRAFS design, and several studies were implemented to adapt and monitor the project, a more holistic approach to monitoring, evaluation and learning could have brought these activities together with the final evaluation in a more articulated way.

APPENDIX 1: THRESHOLDS FOR CHARACTERISTICS OF RESILIENCE

Capacity	Connected to the project logic?	Characteristic	Measurement level	Definition
Absorptive capacity	Yes	Diversification of income sources – off-farm activities and government benefits	Household	Any off-farm income source that can be maintained in case agricultural activities are affected by CC (processing activities, trading, casual non-agricultural labour, regular paid employment, government benefits).
	Yes	Crop diversification	Household	The household is growing strictly more than four crops on farm (median).
	Yes	Dietary diversity	Household	In the past 7 days, carbohydrates were eaten every day, protein during at least 3 days and fruit and vegetables at least 3 days.
	Yes	Availability of food at the beginning of lean season 2018	Household	Has food in store from last harvest at time of the survey, and will not run out before the beginning of the lean season (April).
	Yes	Quantity of food – did not have to reduce the size of meals in the last 7 days	Individual	The respondent did not have to reduce the size of meals in the last 7 days, because there was not enough food.
	No	Access to drinking water	Household	Access to improved sources of drinking water (private or public tap, through tube wells/borehole with pump/hand pump) and the water is available 12 months out of 12.
	No	Would feel prepared, in case of low rainfall during rainy season or heavy flooding	Individual	Two dimensions of preparedness are considered, and the respondent agrees with the statement in at least one dimension.
Adaptive capacity	Yes	Cattle vaccination	Household	More than half of the household's holdings of each type of livestock were vaccinated and/or de-parasitized in the last 12 months. *(This indicator is omitted in households that do not own any livestock.)*
	Yes	Savings	Individual	The respondent has savings (her or himself) at time of the survey.
	Yes	Ownership of fungible livestock	Household	The households owns more than two large (strictly) or more than 25 small livestock (strictly) (thresholds set as the 75th percentile of the distribution for each type).
	No	Remittances	Household	Household received regular remittances during last 12 months.
	No	Productive assets ownership	Household	The household owns at least two of large assets (machines, vehicles, solar panel, generator).
	Yes	Access to credit and control over its use	Individual	Respondent makes decisions (by herself or himself or with other household members) about what to do with the money, for credit from group-based (VSLA, structured susu box), NGO, formal and informal credits.
	No	Social support network	Household	Household members gave support to and/or received support from others in the community at least twice during last 12 months.
	Yes	Adoption of improved climate SMART agricultural practices	Household	Household did at least four of the following: planting tree, using drought resistant varieties of crops, using organic fertilizer, using scientific weather forecasts, doing minimum tillage, using soil conservation techniques, intercropping. (This indicator is omitted in households that did not farm any crops in the past 12 months).
	Yes	Knowledge of conservation agricultural practices	Individual	More than four out of six statements on conservation agricultural practices identified correctly as true or false.
	Yes	Knowledge of climate change's impact	Individual	Respondent agrees that rising temperature is affecting crop output and that floods and droughts are signs of climate change.

Capacity	Connected to the project logic?	Characteristic	Measurement level	Definition
Adaptive capacity	Yes	Understanding of climate change	Individual	Respondent picks 'The frequency and severity of floods and droughts in this area continue to increase' over '10 to 20 years into the future, the weather patterns in this area will be similar to those of the past'.
	Yes	Control over decision to sell livestock heads	Individual	Respondent is involved in decisions to sell (cattle, donkey, horses, goats, sheep, pigs, poultry).
	No	Attitude towards change	Individual	Respondent picks 'We should not be afraid to try new and different livelihood activities – sometimes they are better than the traditional livelihood activities' over 'It is best to continue doing what we already know and do well, rather than experimenting with new approaches'.
	Yes	Participation in community groups	Individual	Respondent participates in any community group.
Transformative capacity	No	Control over income from livestock sales and livestock products, and off-farm economic activities (petty trading, processing)	Individual	Respondent has inputs in some, most or all the decisions on the use of income generated from livestock raising (sell of livestock products) or off-farm activities.
	No	Women's access to agricultural land	Individual	The woman respondent has cultivated her own plot in the last 12 months preceding the survey.
	Yes	Regulation within community about bush fires (and awareness of it)	Individual	Respondent states that the community has a regulation on bush fires (by law).
	No	Education of children	Household	Any child below 15 in the household is enrolled at school and attended school in the last 4 weeks (no matter the level of school); will be 0 for household without any child below 15 (12 percent of households).
	No	Acceptability of (unpaid) care work being done by men	Individual	Respondent considers that roughly half or a majority of men would consider acceptable for men to do at least one of the following task categories: water collection or fuel collection (1), meal preparation, washing and drying clothes, cleaning the house or compound (2), caring for children, elderly, ill or disabled (3).
	No	Supporting partner doing unpaid care work	Individual	Respondent or respondent's partner participated in the last month in at least one of the following task categories: water collection or fuel collection (1), meal preparation, washing and drying clothes, cleaning the house or compound (2), caring for children, elderly, ill or disabled (3). In case a woman respondent is not living with her partner, the question is asked about her son(s) in the household.
	No	Feel heard when voicing an issue in village assembly	Individual	Respondent feels that her/his opinion is taken into account to a large extent in village assembly meetings.
	No	Belief in collective action's effectiveness	Individual	Respondent picks 'Ordinary citizens can do a lot to influence the government, if they make the effort' over 'There is not much that ordinary citizens can do to influence the government'.
	No	Opinion on women's political role	Individual	Respondent agrees that 'Women are as good as men as political leaders'.
	No	Opinion on acceptability of violence inside the household	Individual	Respondent disagrees that 'Violence inside the household can be justified in certain circumstances'.
	Yes	Interaction with district institutions	Individual	Members of the district assembly visited the community in the last 12 months, or the respondent is aware of the community action or contingency plan being built in district or national government plan.

APPENDIX 2: DESCRIPTION OF THE POPULATION

Table A2.1: Comparison between intervention and comparison households (at onset of the project)

	Mean in comparison villages	Mean in intervention villages	P-value of the difference	Observations	
Household characteristics					
Number of household members in the dry season 2014–2015	5.981	6.577	(0.199)	1005	
The household existed at the time of the dry season 2014–2015	0.956	0.976	(0.080)	1005	*
The household is newly formed because the household head married	0.033	0.016	(0.128)	1005	
The household is newly formed for other reason	0.011	0.008	(0.674)	1005	
Household members below 15 years in 2014–2015	2.728	2.848	(0.533)	1005	
Household head was a woman in 2014	0.08	0.192	(0.000)	1005	***
The parents of the HHH lived in the same compound in 2014–2015	0.487	0.522	(0.598)	1002	
The in–laws of the HHH lived in the same compound in 2014–2015	0.079	0.071	(0.756)	1000	
The household lives in the Upper East region	0.506	0.496	(0.963)	1005	
On-farm activities					
Access to any agricultural land during 2014–2015	0.873	0.921	(0.090)	1003	*
Total area of CULTIVATED agricultural the household had access to in 2014–2015	6.126	6.723	(0.598)	1002	
Cultivation of any vegetable (dry season gardening or backyard gardening) in 201	0.295	0.374	(0.439)	999	
Number of crops cultivated in 2014–2015	4.134	4.777	(0.133)	1003	
Grew MAIZE in the rainy season 2014	0.838	0.905	(0.075)	1005	*
Grew SORGHUM in the rainy season 2014	0.407	0.407	(0.992)	1005	
Grew LATE MILLET in the rainy season 2014	0.72	0.775	(0.311)	1005	
Grew GROUNDNUT in the rainy season 2014	0.428	0.488	(0.438)	1005	
Grew SOYBEAN in the rainy season 2014	0.539	0.637	(0.306)	1005	
Grew BAMBARA BEANS in the rainy season 2014	0.431	0.607	(0.001)	1005	***
Grew RICE in the rainy season 2014	0.442	0.539	(0.568)	1005	
Grew COWPEA in the rainy season 2014	0.329	0.393	(0.416)	1005	
Food security					
The HH was worried about not having enough food in April 2014	0.135	0.133	(0.933)	1005	
The HH was worried about not having enough food in May 2014	0.2	0.176	(0.460)	1005	
The HH was worried about not having enough food in June 2014	0.39	0.322	(0.413)	1005	

The HH was worried about not having enough food in July 2014	0.39	0.417	(0.771)	1005	
The HH was worried about not having enough food in August 2014	0.349	0.398	(0.506)	1005	
The HH was worried about not having enough food in September 2014	0.167	0.179	(0.725)	1005	
Livestock					
Number of cattle (COWS, BUFFALS or OXEN) owned in 2014–2015	2.406	2.117	(0.605)	1005	
Number of DONKEYS or HORSES owned in 2014–2015	0.3	0.293	(0.938)	1005	
Number of GOATS owned in 2014–2015	4.418	4.61	(0.826)	1005	
Number of SHEEP owned in 2014–2015	3.651	3.862	(0.806)	1005	
Number of PIGS owned in 2014–2015	1.157	1.862	(0.220)	1005	
Number of POULTRY owned in 2014–2015	16.134	16.434	(0.923)	1005	
Ownership of small animals in 2014–2015	25.36	26.767	(0.774)	1005	
Off-farm activities and other characteristics					
Engaged in processing activities in 2014–2015	0.113	0.344	(0.000)	1005	***
Engaged in trading or petty trading in 2014–2015	0.267	0.407	(0.018)	1005	**
Engaged in paid agricultural labour in 2014–2015	0.336	0.428	(0.024)	1005	**
Engaged in paid casual labour (construction, masonry) in 2014–2015	0.06	0.117	(0.092)	1005	*
Engaged in a regular/paid employment in 2014–2015	0.055	0.035	(0.315)	1005	
Receive any remittances in 2014–2015	0.142	0.225	(0.032)	1005	**
Receive any pension or social benefits from the government in 2014–2015	0.035	0.087	(0.046)	1005	**
Any HH member engaged in any off-farm act and receive any pension/remittance in	0.631	0.743	(0.024)	1005	**
Any HH member engaged in any off-farm activity in 2014–2015	0.563	0.694	(0.015)	1005	**
Distance to the market in min in 2014–2015	70.659	62.921	(0.640)	1005	
The household was in the lowest 20% of the wealth distribution, in 2014–2015	0.239	0.133	(0.102)	1005	
The household was in the second 20% of the wealth distribution, in 2014–2015	0.208	0.187	(0.571)	1005	
The household was in the third 20% of the wealth distribution, in 2014–2015	0.198	0.203	(0.855)	1005	
The household was in the fourth 20% of the wealth distribution, in 2014–2015	0.168	0.255	(0.034)	1005	**
The household was in the highest 20% of the wealth distribution, in 2014–2015	0.187	0.222	(0.552)	1005	

Table A2.2: Comparison between intervention and comparison individual respondents (at onset of the project)

	Mean in comparison villages	Mean in intervention villages	P-value of the difference	Observations	
Respondent's demographics					
The respondent is a woman	0.502	0.51	(0.046)	1962	**
The household lives in the Upper East region	0.507	0.499	(0.969)	1962	
The respondent is between 15 and 24 years old	0.108	0.068	(0.111)	1962	
The respondent is between 25 and 34 years old	0.238	0.218	(0.610)	1962	
The respondent is between 35 and 44 years old	0.231	0.246	(0.596)	1962	
The respondent is between 45 and 54 years old	0.191	0.203	(0.660)	1962	
The respondent is between above 55 years old	0.232	0.266	(0.397)	1962	
The respondent is married	0.945	0.919	(0.267)	1962	
The respondent is a widow	0.032	0.059	(0.132)	1962	
The respondent is in a polygamous marriage	0.391	0.484	(0.123)	1836	
Number of wives in the polygamous marriage	2.339	2.279	(0.431)	778	
Rank of marriage – women in polygamous marriage only	1.359	1.453	(0.104)	393	
The respondent never went to school	0.883	0.86	(0.416)	1962	
The respondent had some primary education or completed primary	0.066	0.083	(0.377)	1962	
The respondent can read and write a simple letter in any language	0.07	0.102	(0.145)	1959	
The respondent is disabled	0.015	0.028	(0.046)	1962	**
Baseline information					
The respondent cultivated her/his own plot in 2014–2015	0.629	0.698	(0.104)	1962	
The respondent attended meetings of any of the listed groups in 2014	0.427	0.816	(0.000)	1962	***
Total number of groups the respondent attended meetings of in 2014	0.704	2.331	(0.000)	1962	***
Attended meeting of a farmer producer group in 2014	0.223	0.558	(0.000)	1962	***
Attended meeting of the bush fire management committee or squads in 2014	0.197	0.556	(0.000)	1962	***
Attended meeting of the climate field school in 2014	0.055	0.363	(0.000)	1962	***
Attended meeting of the VSLA in 2014	0.188	0.542	(0.000)	1962	***
Attended meeting of a natural resources management committee in 2014	0.041	0.311	(0.000)	1962	***
Attended the village assembly meeting in 2014	0.608	0.699	(0.054)	1962	*
The community had a regulation on bush fires in 2014	0.521	0.832	(0.000)	1962	***
Listened to the radio once a week or more in 2014	0.56	0.756	(0.007)	1962	***

APPENDIX 3: METHODOLOGY USED FOR PROPENSITY-SCORE MATCHING

The analysis of outcome variables presented in Section 6 of this report involved group mean comparisons using propensity-score matching (PSM). The basic principle of PSM is to match each participant with a non-participant that was observationally similar at baseline and to obtain the programme treatment effect by averaging the differences in outcomes across the two groups after project completion. Unsurprisingly, there are different approaches to matching, i.e. to determining whether or not a household (or individual) is observationally 'similar' to another household (or individual). For an overview, we refer to Caliendo and Kopeinig (2008).

The following sections describe and test the specific matching procedures followed in this Effectiveness Review.

Two models are used in this review:

1. A model at the household level
2. A model at the individual level

The first model is discussed in detail below, and the main results are presented for the second model.

Note that the balancing tests presented in this appendix correct for the potential correlation of error terms within villages (clustering at the community level). With 24 villages in the sample, the number of clusters is relatively low, by statistical standards. In the Effectiveness Review, given that statistical methods correcting for low number of clusters are not available for PSM models, we adopt a pragmatic approach (following Jonathan Lain's blog post of 21 December 2016). We indeed checked whether regular clustering led to reducing our standard errors, which would lead to over-rejecting the null hypothesis that the project had an impact. Regular clustering seems to increase our standard errors, as one would expect, in spite of the relative low number of clusters. For this reason, the whole analysis in this report is correcting for the clustered structure of the data.

Household-level model

Estimating propensity scores

Given that it is extremely hard to find two individuals with exactly the same characteristics, Rosenbaum and Rubin (1983) demonstrated that it is possible to match individuals using a prior probability for an individual to be in the intervention group, naming this its *propensity score*. More specifically, propensity scores are obtained by pooling the units from both the intervention and comparison groups and using a statistical probability model (e.g. a *probit* regression) to estimate the probability of participating in the project, conditional on a set of observed characteristics.

Table A3.1 presents the probit regression results used to estimate the propensity scores in our context. To guarantee that none of the matching variables were affected by the intervention, we only considered variables that were measured at baseline, and only those variables that were unlikely to have been influenced by anticipation of project participation (Caliendo and Kopeinig, 2008).

Table A3.1: Estimating the propensity score on variables used for matching

	Marginal effect	Standard error	p-value
Number of household members in the dry season 2014–2015	0.01[*]	0.01	0.02
Household head was a woman in 2014	0.29[***]	0.06	0.00
The household lives in the Upper East region	-0.11[*]	0.04	0.01
The woman respondent never went to school	-0.19[*]	0.07	0.01
The man respondent never went to school	-0.02	0.04	0.57
Access to any agricultural land during 2014–2015	-0.04	0.06	0.49
Total area of cultivated agricultural land the household had access to in 2014–2015	-0.00	0.00	0.84
Cultivation of any vegetable (dry season gardening or backyard gardening) in 201	-0.01	0.04	0.84
The household was in the second 20% of the wealth distribution, in 2014–2015	0.02	0.06	0.76
The household was in the third 20% of the wealth distribution, in 2014–2015	0.03	0.06	0.68
The household was in the fourth 20% of the wealth distribution, in 2014–2015	0.02	0.06	0.77
The household was in the highest 20% of the wealth distribution, in 2014–2015	-0.07	0.06	0.27
Any HH member engaged in any off-farm act and receive any pension/remittance in	-0.02	0.04	0.61
Engaged in processing activities in 2014–2015	0.24[***]	0.05	0.00
HH worried about not having enough food from April to September 2014	-0.04	0.06	0.45
The woman respondent attended meetings of any group in 2014	0.31[***]	0.03	0.00
The man respondent attended meetings of any group in 2014	0.31[***]	0.03	0.00
The woman respondent attended the village assembly meeting in 2014	-0.03	0.04	0.45
The man respondent attended the village assembly meeting in 2014	-0.06	0.05	0.21
The woman respondent listened to the radio once a week or more in 2014	0.08[*]	0.04	0.03
The man respondent listened to the radio once a week or more in 2014	0.10[*]	0.04	0.01
Observations	1005		

Marginal effects

The construction of the wealth index is described in Section 5. Variables dated 2014 are estimates, based on recall data.

Dependent variable is binary, taking 1 for project participant households, and 0 otherwise.

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

Defining the region of common support

After estimating the propensity scores, the presence of a good *common support area* needs to be checked. The area of common support is the region where the propensity-score distributions of the treatment and comparison groups overlap. The common support assumption ensures that 'treatment observations have a comparison observation "nearby" in the propensity-score distribution' (Heckman, LaLonde and Smith, 1999). Since some significant differences were found between the intervention and comparison groups in terms of the baseline and demographic characteristics (as detailed

in Section 4.2), some of the households in the intervention group are too different from the comparison group to allow for meaningful comparison. We developed a minima and maxima comparison, deleting all observations whose propensity score was smaller than the minimum and larger than the maximum in the opposite group (Caliendo and Kopeinig, 2008). In this particular case, eight of the 636 households surveyed in the comparison communities and three of the 369 households surveyed in the intervention communities were dropped because they lay outside the common support area. This means that the estimates of differences in outcome characteristics between the two groups apply to this subsample of project participants and non-participants; that is, they do represent the surveyed population as a whole (less than 2 percent of observations fell out of the common support).

Figure A3.1 illustrates the area of common support and indicates the proportion of households lying on and off the common support area, by treatment group.

Figure A3.1: Propensity score on and off common support
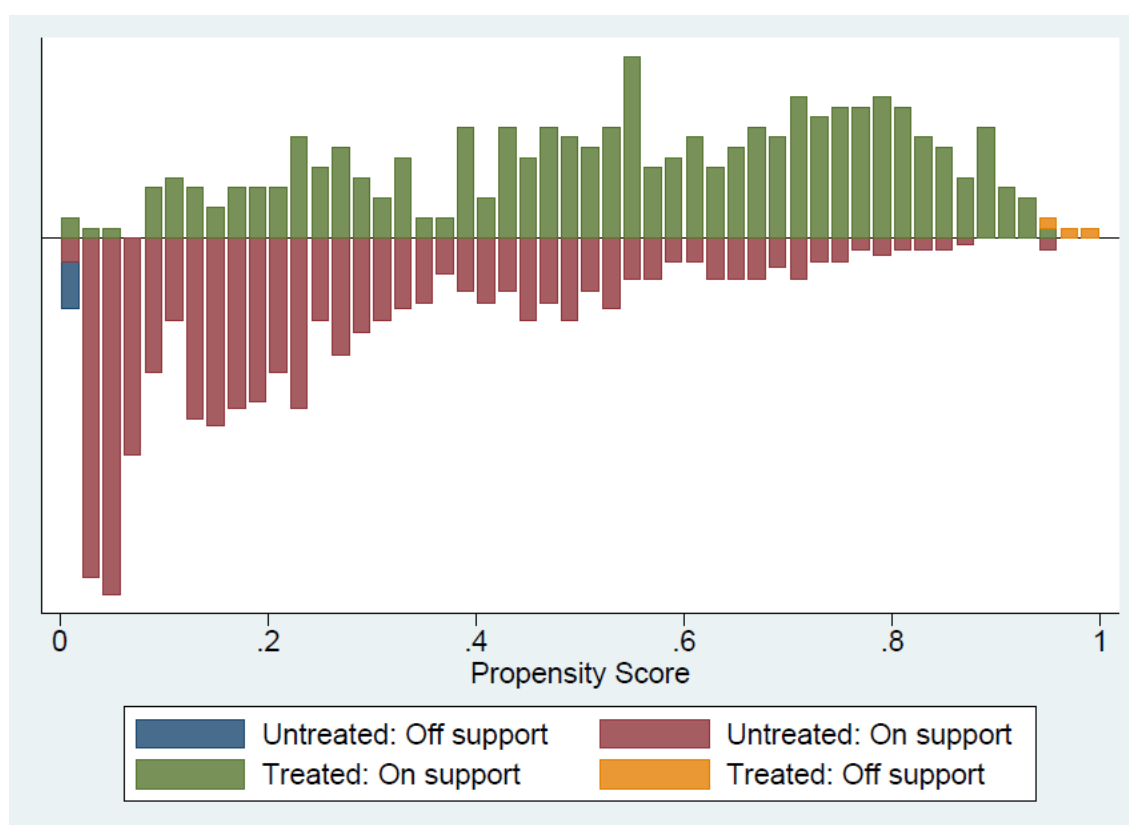
Matching intervention households to comparison households

Following Rosenbaum and Rubin (1983), after estimating the propensity scores and defining the area of common support, individuals are matched on the basis of their propensity score. The literature has developed a variety of matching procedures. For the main results presented in this Effectiveness Review we chose to employ the method of kernel matching (for both models). The kernel matching method weights the contribution of each comparison group member, attaching greater weight to those comparison observations that provide a better match with the treatment observations. One common approach is to use the normal distribution with mean zero as a kernel, and weights given by the distribution of the differences in propensity score. Thus 'good' matches get a larger weight than 'poor' matches.

We used the *psmatch2* module in STATA using 0.075 as a bandwidth 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.[35]

Check balancing

For PSM to be valid, the intervention group and the matched comparison group need to be balanced in that they need to be similar in terms of their observed baseline characteristics. This should be checked. The most straightforward method to do this is to test whether there are any statistically significant differences in baseline covariates between the intervention and comparison group in the matched sample. The balance of each of the matching variables after kernel matching is shown in Table A3.2 (the estimates are provided using PS weighted regressions, clustering at the village level). None of the variables implemented for the matching is statistically significant once the matched sample is used.

Table A3.2: Balancing test on the set of covariates used for matching, after matching, household-level model

	Intervention group mean	Comparison group mean	p-value
Household head was a woman in 2014	0.19	0.18	0.78
Number of household members in the dry season 2014–2015	6.56	6.64	0.87
The household lives in the Upper East region	0.5	0.56	0.81
The woman respondent never went to school	0.91	0.92	0.77
The man respondent never went to school	0.74	0.69	0.4
Access to any agricultural land during 2014–2015	0.92	0.91	0.74
Total area of cultivated agricultural land the household had access to in 2014–2015	6.72	6.28	0.66
Cultivation of any vegetable (dry season gardening or backyard gardening) in 201	0.38	0.37	0.97
The household was in the second 20% of the wealth distribution, in 2014–2015	0.19	0.17	0.49
The household was in the third 20% of the wealth distribution, in 2014–2015	0.2	0.23	0.35
The household was in the fourth 20% of the wealth distribution, in 2014–2015	0.26	0.26	0.91
The household was in the highest 20% of the wealth distribution, in 2014–2015	0.22	0.22	0.95
Any HH member engaged in any off-farm act and receive any pension/remittance in	0.74	0.73	0.8
Engaged in processing activities in 2014–2015	0.34	0.33	0.8
HH worried about not having enough food from April to September 2014	0.89	0.85	0.46
The woman respondent attended meetings of any group in 2014	0.79	0.78	0.96
The man respondent attended meetings of any group in 2014	0.78	0.78	0.89

	Intervention group mean	Comparison group mean	p-value
The woman respondent attended the village assembly meeting in 2014	0.6	0.6	0.98
The man respondent attended the village assembly meeting in 2014	0.75	0.75	0.95
The woman respondent listened to the radio once a week or more in 2014	0.74	0.75	0.84
The man respondent listened to the radio once a week or more in 2014	0.71	0.71	0.96

The matching process reduces the differences between the two groups on other recalled variables, as showed in Table A3.3, for a subset of key variables.

Table A3.3: Balancing test on other household-level baseline characteristics, after matching, household-level model

	Intervention group mean	Comparison group mean	p-value	
Household characteristics				
The household existed at the time of the dry season 2014–2015	0.98	0.97	0.84	
The household is newly formed because the household head married	0.02	0.02	0.53	
The household is newly formed for other reason	0.01	0.00	0.36	
Household members below 15 years in 2014–2015	2.83	2.91	0.73	
The parents of the HHH lived in the same compound in 2014–2015	0.52	0.45	0.33	
The in-laws of the HHH lived in the same compound in 2014–2015	0.07	0.06	0.53	
On-farm activities				
Number of crops cultivated in 2014–2015	4.79	4.67	0.78	
Grew MAIZE in the rainy season 2014	0.90	0.91	0.92	
Grew SORGHUM in the rainy season 2014	0.41	0.44	0.70	
Grew LATE MILLET in the rainy season 2014	0.77	0.81	0.39	
Grew GROUNDNUT in the rainy season 2014	0.48	0.50	0.82	
Grew SOYBEAN in the rainy season 2014	0.64	0.62	0.79	
Grew BAMBARA BEANS in the rainy season 2014	0.61	0.50	0.08	*
Grew RICE in the rainy season 2014	0.54	0.50	0.84	
Grew COWPEA in the rainy season 2014	0.40	0.39	0.93	
Food security				
The HH was worried about not having enough food in April 2014	0.13	0.12	0.79	
The HH was worried about not having enough food in May 2014	0.17	0.20	0.55	
The HH was worried about not having enough food in June 2014	0.32	0.33	0.91	
The HH was worried about not having enough food in July 2014	0.41	0.40	0.94	
The HH was worried about not having enough food in August 2014	0.40	0.43	0.67	
The HH was worried about not having enough food in September 2014	0.18	0.18	0.94	
Livestock				
Number of cattle (COWS, BUFFALOES or OXEN) owned in 2014–2015	2.13	2.19	0.91	
Number of DONKEYS or HORSES owned in 2014–2015	0.29	0.24	0.60	
Number of GOATS owned in 2014–2015	4.64	4.53	0.88	
Number of SHEEP owned in 2014–2015	3.89	3.89	1.00	
Number of PIGS owned in 2014–2015	1.86	1.77	0.88	
Number of POULTRY owned in 2014–2015	16.42	17.41	0.76	
Ownership of small animals in 2014–2015	26.82	27.60	0.87	

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Off-farm activities and other characteristics				
Engaged in trading or petty trading in 2014–2015	0.41	0.41	0.96	
Engaged in paid agricultural labour in 2014–2015	0.43	0.35	0.05	**
Engaged in paid casual labour (construction, masonry) in 2014–2015	0.12	0.07	0.25	
Engaged in a regular/paid employment in 2014–2015	0.04	0.08	0.15	
Receive any remittances in 2014–2015	0.23	0.18	0.23	
Receive any pension or social benefits from the government in 2014–2015	0.09	0.04	0.09	*
Any HH member engaged in any off-farm activity in 2014–2015	0.69	0.67	0.70	
Distance to the market in min in 2014–2015	63.15	62.91	0.99	
The household was in the lowest 20% of the wealth distribution, in 2014–2015	0.13	0.11	0.65	

The model is correcting for most imbalanced at the household level, except for a few characteristics: 61 percent of households in the intervention group were growing bambara beans, while this is only 50 percent in the comparison group; this is 43 percent vs 35 percent in paid agricultural labour, 9 percent vs 4 percent who received any pension or social benefits in 2014–2015. Robustness checks to controlling for this imbalance will be presented in Appendix 4.

Finally, even though the household-level matching model corrects for individual respondents participation in groups in 2014 (participation in any group), participation in village assembly and exposure to radio, the matching model at the household level does not fully correct for each surveyed individual's participation in specific groups (higher in the intervention group than in comparison group, even after correction, although the gap is reduced in size). Such participation may be related to household-level outcomes, and hence need to be borne in mind when analysing the main results.

Individual level model

To estimate results at the individual level presented in this review, we estimate a matching model using individual-level recall information.

Table A3.4: Estimating the propensity score on variables used for matching

	Marginal effect	Standard error	p-value
The respondent is a woman	0.05	0.03	0.15
The household lives in the Upper East region	-0.09	0.19	0.63
The respondent is between 15 and 24 years old	0.00	0.06	0.99
The respondent is between 25 and 34 years old	0.01	0.05	0.80
The respondent is between 35 and 44 years old	0.03	0.04	0.53
The respondent is between 45 and 54 years old	-0.01	0.03	0.77
The respondent is a widow	0.17	0.09	0.06
The respondent is disabled	0.18	0.10	0.08
The respondent never went to school	-0.01	0.05	0.79
The respondent cultivated her/his own plot in 2014–2015	-0.11*	0.04	0.02

Attended meeting of a farmer producer group in 2014	0.14*	0.05	0.01
Attended meeting of the bush fire management committee or squads in 2014	0.09*	0.04	0.02
Attended meeting of the climate field school in 2014	0.30***	0.05	0.00
Attended meeting of the VSLA in 2014	0.22***	0.06	0.00
Attended meeting of a natural resources management committee in 2014	0.24***	0.06	0.00
Attended the village assembly meeting in 2014	-0.11	0.06	0.05
The community had a regulation on bush fires in 2014	0.23***	0.06	0.00
Listened to the radio once a week or more in 2014	0.15*	0.06	0.01
Observations	1962		

Marginal effects

The construction of the wealth index is described in Section 6. Variables dated 2014 are estimates, based on recall data.

Dependent variable is binary, taking 1 for project participant villages, and 0 otherwise.

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

This model is estimated using kernel matching, with a bandwidth of 0.07. Definition of the common support leads to excluding less than 1 percent of observations, one individual out of 708 in intervention communities, and two out of 1,254 in comparison communities.

Figure A3.2: Propensity score on and off common support, individual level model
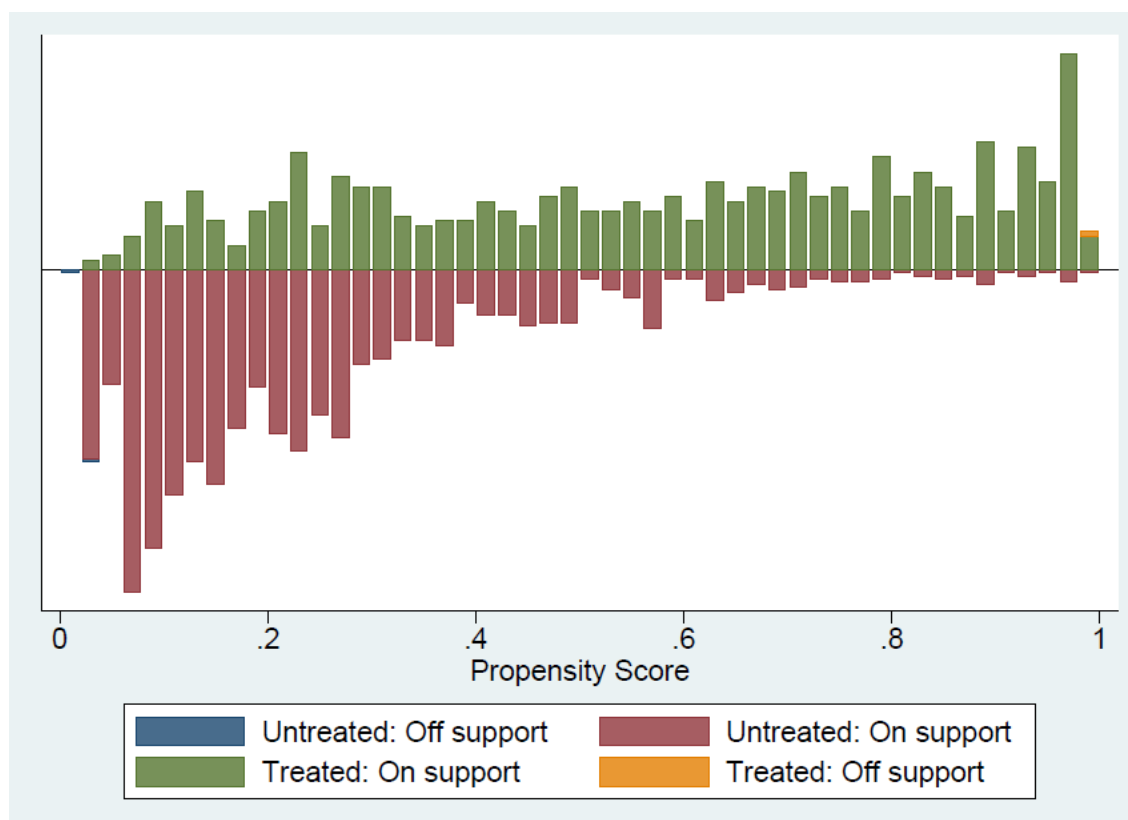
The model is correcting for imbalanced baseline variables for both matching variables and other variables, as shown in Tables A3.5 and A3.6.

Table A3.5: Balancing test on the set of covariates used for matching, after matching, individual-level model

	Intervention group mean	Comparison group mean	p-value
The respondent is a woman	0.51	0.47	0.37
The household lives in the Upper East region	0.5	0.49	0.98
The respondent is between 15 and 24 years old	0.07	0.07	0.93
The respondent is between 25 and 34 years old	0.22	0.23	0.77
The respondent is between 35 and 44 years old	0.25	0.2	0.13
The respondent is between 45 and 54 years old	0.2	0.19	0.76
The respondent is a widow	0.06	0.06	0.85
The respondent is disabled	0.03	0.04	0.55
The respondent never went to school	0.86	0.85	0.78
The respondent cultivated her/his own plot in 2014–2015	0.7	0.68	0.71
Attended meeting of a farmer producer group in 2014	0.56	0.53	0.58
Attended meeting of the bush fire management committee or squads in 2014	0.56	0.56	0.93
Attended meeting of the climate field school in 2014	0.36	0.4	0.57
Attended meeting of the VSLA in 2014	0.54	0.52	0.73
Attended meeting of a natural resources management committee in 2014	0.31	0.32	0.87
Attended the village assembly meeting in 2014	0.7	0.73	0.69
The community had a regulation on bush fires in 2014	0.83	0.82	0.62
Listened to the radio once a week or more in 2014	0.76	0.71	0.51

Table A3.6: Balancing test on other baseline characteristics, after matching, individual level model

	Intervention group mean	Comparison group mean	p-value
The respondent is above 55 years old	0.27	0.31	0.31
The respondent is married	0.92	0.93	0.86
The respondent is in a polygamous marriage	0.48	0.44	0.60
Number of wives in the polygamous marriage	2.28	2.50	0.20
Rank of marriage – women in polygamous marriage only	1.45	1.47	0.95
The respondent had some primary education or completed primary education	0.08	0.07	0.69
The respondent can read and write a simple letter in any language	0.10	0.11	0.72
The respondent attended meetings of any of the listed groups in 2014	0.82	0.82	0.85
Total number of groups the respondent attended meetings of in 2014	2.33	2.33	0.99

APPENDIX 4: ROBUSTNESS CHECKS

In order to check for the validity of the results presented in Section 6, additional analyses with different estimation techniques were performed. This section presents the different econometric models used to test the robustness of the estimates presented in Section 6.

This appendix presents three types of robustness checks.

Model 1 Linear regression

We test the robustness of our outcome estimates by estimate the impact of project participation using ordinary least squares (OLS) regressions, standard errors being clustered at the community level (consistently with the main analysis). The idea behind OLS is to isolate the variation in the outcome variable that is due to the intervention status – the project's impact – by controlling directly for the influence that observable differences between the intervention and comparison groups have on outcomes. To do this, we estimate Equation 1.

$$Y_i = \alpha + \beta_1 \tau_i + \boldsymbol{\delta X_i} + \varepsilon_i \qquad (1)$$

Here, Y_i is the dependent variable (the outcome) and $\boldsymbol{X_i}$ is a column vector of the matching variables listed in Tables A3.1 (household level analysis) and A3.4 (individual level analysis). The intervention status is given by a dummy variable (τ_i), which takes the value one if the household participated in the project, and zero otherwise. The key difference between this OLS regression model and the propensity-score matching procedure used in the main report is that the OLS regression estimates a direct parametric relationship between the covariates in $\boldsymbol{X_i}$ and the dependent variable Y_i. This means that it is possible to include the observations that were excluded due to being off common support in Section 6 by extrapolating the relationship between $\boldsymbol{X_i}$ and Y_i. In the tables that follow, only the estimate of β_1 will be reported.

Model 2 Linear regression with propensity-score weighting

Following the example of Hirano and Imbens (2001) we also estimate an alternative set of OLS regressions that apply the same model as in Equation 1, but weighting the observations according to the propensity score. Observations are assigned weights equal to 1 for the intervention households and $\hat{P}(\boldsymbol{X_i})/(1 - \hat{P}(\boldsymbol{X_i}))$ for the comparison households. The variable $\hat{P}(\boldsymbol{X_i})$ represents the probability of a household being in the intervention group, given their observable characteristics, measured through the vector of matching variables $\boldsymbol{X_i}$ – this was estimated in the probit regressions in Appendix 3. We report the estimates of β_1 in the same way as the standard OLS regressions. As per the previous model, standard errors are corrected for clustering at the community level.

Model 3 Linear regression with propensity-score weighting, with additional control variables (household-level outcomes only)

Using linear regressions as robustness checks also allow for controlling for additional variables. As flagged in Appendix 3, the household-level matching model does not entirely correct for baseline imbalance on three variables: whether the household grew bambara beans, whether the household was in involved in paid agricultural labour and whether the household received government transfers in 2014–2015. We report the estimates of β_1 in the same way as the standard OLS regressions. As per the previous model, standard errors are corrected for clustering at the community level.

Model 4 Linear regression with propensity-score weighting, with enumerator pair fixed effects

From a survey methodology perspective, there may be differences in the way enumerators understand and administer specific questions, as well as in the way they interact with respondents (which itself depends on the respondents as well). While training, data monitoring and oversight are aimed at diminishing these differences and potential biases, it is likely that ultimately some of those differences still persist and affect the quality of the estimates.[36] As a robustness check, we therefore ran a linear regression model with propensity-score weighting (similar to model 2), including enumerator pair fixed effects (that is a dummy for each enumerator pair, but one in each state, given that enumerator teams were state specific and the matching variables X_i already include state dummies). Given the survey protocol, in which a woman and a man enumerator were paired-up to visit households, and could conduct the household survey together, we include pair of enumerators rather than dummy for each enumerator. We report the estimates of β_1 in the same way as the standard OLS regressions. This robustness checks is important to check for the size of the effect (the coefficient β_1). On the other hand, adding control variables will most likely reduce the standard error of this coefficient, thus making the effect more likely to be significant. As per the previous models, standard errors are corrected for clustering at the community level.

While these were run for all the outcomes presented in Section 6 (and commented in the main body of the report when the results are not robust), we only present here the robustness checks for the most important result, i.e. Table 6.8.1.

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

Table A4.8.1

	1 Index of absorptive capacity	2 Index of adaptive capacity	3 Index of transformative capacity	4 Overall resilience index
OLS regression				
Difference (standard error)	0.05*** (0.02)	0.04** (0.02)	0.05*** (0.01)	0.05*** (0.01)
Observations (intervention group)	369	369	369	369
Observations (total)	1005	1005	1005	1005
OLS regression with PS weighting				
Difference (standard error)	0.04*** (0.02)	0.05** (0.02)	0.06*** (0.01)	0.05*** (0.01)
Observations (intervention group)	366	366	366	366
Observations (total)	994	994	994	994
OLS regression with PS weighting and additional control variables				
Difference (standard error)	0.04** (0.02)	0.04** (0.02)	0.06*** (0.01)	0.05*** (0.01)
Observations (intervention group)	366	366	366	366
Observations (total)	994	994	994	994
OLS regression with PS weighting and enumerator pair fixed effects				
Difference (standard error)	0.04** (0.01)	0.05*** (0.01)	0.06*** (0.01)	0.05*** (0.01)
Observations (intervention group)	366	366	366	366
Observations (total)	994	994	994	994

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NOTES

[1] Conservation agriculture is defined by the FAO as a 'farming system that promotes maintenance of a permanent soil cover, minimum soil disturbance (i.e. no tillage), and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production'.

[2] Through the Gendered Enterprise and Markets programme (2014–2018), Oxfam and partners worked on enhancing market linkages, for women in particular, in rural areas in Zambia, Bangladesh and Tajikistan. The final evaluation report will be published and recommendations could be drawn from it on the appropriate approach to develop.

[3] This map is showing the district division as it was prior to 2012. Nandom district was then created from the Northern part of Lawra district, and Daffiama-Bussei-Issah district from the Western part of Nadowli.

[4] Conservation agriculture is defined by the FAO as a 'farming system that promotes maintenance of a permanent soil cover, minimum soil disturbance (i.e. no tillage), and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production'.

[5] For practical reasons with regard to survey team recruitment and training, two languages were identified for the survey: Mamprusi and Kusaal, the main languages in the project areas, even though other languages are spoken in the Northern and Upper East regions.

[6] The choice was made to conduct more surveys in the comparison group than in the intervention group to maximize chances of finding matches of good quality between comparison and intervention groups when using propensity-score matching.

[7] However, this is statistically different between the two groups, with on average 1.97 individual surveys conducted per household in the comparison group, against 1.92 in the intervention group (p-value of the difference: 0.007).

[8] While the primary focus of this review is at the household and individual levels, the analysis in this report takes into account the fact that characteristics and outcomes are linked for households and individuals in a given community. The analysis in this report corrects for this through robust clustering at the village level, hence adjusting standard errors.

[9] The tables presented in Appendix 2 and 3 take into account the clustered structure of the data at the village level, and robust clustering is used to adjust the standard errors.

[10] We ensured the item-rest correlation for each asset is greater than 0.1. We also ensured that Cronbach's alpha is at least 0.7, following the guidance of Bland and Altman (1997). Finally, we ensured that indicators not only contributed positively overall, but within each state.

[11] We followed the approach of Filmer and Pritchett (2001). In this case, the first component explains a small share of the total variance (16 percent), which is consistent with general practice presented in Vyas and Kumaranayake (2006), the studies reviewed by the authors consider first components that explain between 12 to 27 percent.

[12] This small difference is due to the fact that in cases where the team was only able to survey one respondent, this respondent is much likely to be a woman (in 69 percent of the cases, out of 48 observations).

[13] The DHS 2014 estimated that 37 percent of women and 58 percent of men in the Northern region, and 52 percent of women and 69 percent of men in the Upper East region had listened to the radio at least once a week in the 12 months preceding the survey.

[14] This was tested by running post-match balance checks using the individual-level PSM model on household-level recalled variables that were imbalanced prior to matching (as per table A2.1). Eight of the 15 household level variables are imbalanced after individual level matching, although the size of the difference between the two groups is reduced for four of them.

[15] This approach to measuring resilience is discussed further in Hughes and Bushell (2013) and Fuller and Lain (2015).

[16] Note that gender of the main head in 2014 and at time of the survey is the same for 95 percent of households.

[17] This model leads to slightly larger effect sizes overall, and a similar level of significance except for absorptive capacity index, which turns significant at 10 percent.

[18] The tables show the coefficient, standard error and statistical significance of a propensity-score weighted regression, of a model with an interaction term. The first row shows the coefficient on the dummy variable for being a woman, the second row the coefficient for being in the intervention and the third row the coefficient for the interaction dummy variable – being a woman and in the intervention

group. The regressions control for the matching variables and correct for the clustered nature of the data at the village level.

The average effect calculated on the overall sample in these tables, under the section 'Overall', is calculated through PSM model with bootstrapped standard errors. Hence there may be differences between the results presented under 'Overall' section and under 'Testing for differential impacts' (coefficient size or statistical significance). We will comment the most conservative results.

[19] As shown in the 'Testing for differential impacts' of Table 6.2.2 and in Appendix 4, effect sizes are higher when estimated through other models, thus reaching the bar of statistical significance.

[20] A shown in Appendix 4, these effects are of smaller magnitude when controlling for enumerator effects, and not significant any more when it comes to the opinion on rising temperature.

[21] In column 2 and 3 of Table 6.3.2, respectively 9 percent of respondents and 19 percent of respondents chose the option 'Does not know'; these observations are included (i.e. counted as 0) in the table. Important to highlight, however, that fewer respondents chose 'does not know' in the intervention group than in the comparison group.

[22] In column 2, 3 and 4 of Table 6.3.3, respectively 38 percent, 30 percent and 17 percent of respondents chose the option 'Does not know'; these observations are included (i.e. counted as 0) in the table. Fewer respondents chose 'does not know' in the intervention group than in the comparison group for column 2 and 4.

[23] 'Does not know' was an option – selected by between 2 and 6 percent of respondents – and observations are included in the analysis, counted as 0.

[24] Note that the effect size is smaller when adding additional control variables in PS weighted regressions, as shown in the Appendix 4, but still strongly significant.

[25] Effect sizes are reduced when using PS weighted regressions with additional control variables, as shown in Appendix 4. Significance is affected on the variable on decisions about vegetable production.

[26] As shown in Appendix 4, the effect size is smaller when using PS weighted regressions controlling for enumerator pair effects, but still significant.

[27] And the effect size is smaller when using PS weighted regression and additional control variables as shown in Appendix 4, but significant or close to the 10 percent significance threshold.

[28] Credits included in the survey were in cash or in kind, from group-based micro-finance such as a VSLA or structured saving box, formal lender (bank/financial institution), informal money lender and NGO.

[29] As shown in Appendix 4, the effect sizes are smaller when controlling for enumerator pair effects.

[30] The tables show the coefficient, standard error and statistical significance of a propensity-score weighted regression, of a model with an interaction term. The first row shows the coefficient on the dummy variable for the household being headed by a woman in 2014, the second row the coefficient for being in the intervention and the third row the coefficient for the interaction dummy variable – the household was headed by a woman in 2014 and in the intervention group. The regressions control for the matching variables and correct for the clustered nature of the data, at the village level.

The average effect calculated on the overall sample in these tables, under the section 'Overall' is calculated through PSM model, with bootstrapped standard errors. Hence there may be differences between the results presented under 'Overall' section and under 'Testing for differential impacts' (coefficient size or statistical significance). We will comment the most conservative results.

[31] The effect on the absorptive capacity is not statistically significant when using PSM, but it is when using PS weighted regression, as shown in table 6.8.1 and in the robustness checks.

[32] As detailed in Appendix 1, ownership of fungible asset means that the household owns more than two large (strictly) or more than 25 small livestock (strictly) (thresholds set as the 75th percentile of the distribution for each type), while access to savings is the household-level score over the two respondents' individual access to savings in the last year.

[33] Measured as members of the district assembly visited the community in the last 12 months, or the respondent is aware of the community action or contingency plan being built in district or national government plan.

[34] Through the Gendered Enterprise and Markets programme (2014-2018), Oxfam and partners worked on enhancing market linkages, for women in particular, in rural areas in Zambia, Bangladesh and Tajikistan. The final evaluation report will be published and recommendations could be drawn from it on the appropriate approach to develop.

[35] Bootstrapping is a statistical procedure where repeated samples are drawn from the original sample and parameters, such as standard errors, are re-estimated for each draw. The bootstrapped parameter is calculated as the average estimate over the total number of repeated draws.

[36] How to deal with potential enumerator effects is a live discussion in the sector, and is discussed on the World Bank Development Impacts blog (Issues of data collection and measurement, 23/05/2016).

The information in this publication is correct at the time of going to press.

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