



# **TESTING THE ADDED VALUE OF MARKET INCENTIVES ON DISASTER RISK REDUCTION IN WESTERN NEPAL**

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# EXECUTIVE SUMMARY

Central and Western Nepal experienced several devastating flooding events from August 11 – 14, 2017, resulting in 180 deaths, 445,000 displaced households, 63,000 fully destroyed homes and 118,000 partially destroyed homes<sup>1</sup>. In addition to this, the Ministry of Agriculture reported that 10 million U.S. dollars' worth of crops were destroyed and nearly 70,000 livestock died due to the flooding<sup>2</sup>. The 2017 floods covered 35 of 75 districts across Nepal, inundating up to 80% of the land in the Terai region where Mercy Corps works. Since 2013, the Managing Risk through Economic Development (MRED) program, funded by MACP, has been working to build resilience to flooding in the Far Western region of Nepal. MRED promotes an integrated intervention model ("nexus model") that combines traditional community-based disaster risk reduction (DRR) approaches with interventions designed to increase market access for crops that have risk reduction potential. The following market models under the nexus approach were implemented:

- Planting sugarcane on erosion-prone riverbanks to prevent river cutting while increasing productivity of marginal lands and increasing income
- Planting fodder species in marginal lands of hilly areas to mitigate landslides while also contributing as an input for growth of the dairy sub-sector

The core nexus model is complemented by interventions that address multiple dimensions of vulnerability to disaster risk. These include building access to financial services, improving land management and protection mechanisms on communal risk-prone land and addressing gender-based norms and attitudes that limit women's ability to support risk reduction.

This study aims to understand whether households living in communities benefiting from combined market-based and traditional DRR activities (MRED's nexus model) were better off after the 2017 floods relative to households living in communities without these integrated activities. Specifically, the study explores whether nexus households 1) accessed key resilience resources - financial, social, physical, human and natural prior to the flood, 2) used those capacities to respond to appropriately respond to the flooding and 3) were able to maintain or improve their well-being relative to non-nexus households.

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<sup>1</sup> Relief Web (2017). Nepal: Terai Flood – August 2017 (Version 2.0, Date Released 28 August 2017). Retrieved from <https://reliefweb.int/report/nepal/nepal-terai-flood-august-2017-version-20-date-released-28-august-2017>

<sup>2</sup> Relief Web (2017). Nepal: Flood 2017 – Office of the Resident Coordinator Situation Report No. 3 (as of 18 August 2017). Retrieved from <https://reliefweb.int/report/nepal/nepal-flood-2017-office-resident-coordinator-situation-report-no-3-18-august-2017>

# Key Findings

**KEY FINDING STATEMENT 1:** MRED households benefiting from the DRR and market-based nexus model had higher levels of household-level capacities important for disaster preparedness and were able to use these capacities at higher levels to respond to the 2017 floods than non-nexus households.

Households participating in the nexus interventions reported that they had household-level DRR plans 16% more often than non-nexus households and that once the flooding hit, they evacuated to a safe place, collected documents and assets, evacuated livestock and warned neighbors 17% - 25% more often than non-nexus households. Nexus households reported that they were familiar with risk-mitigating agricultural techniques 23% more often than non-nexus households, which are targeted at increasing nexus crop cultivation and improving land management, and reported access to savings at higher rates than households living in non-nexus communities (70% versus 50%) prior to the monsoon. Nexus households also used these savings to respond to the 2017 flooding events 20% more often than non-nexus households. However, this was only true when including geographic location in the model. This suggests that using savings to respond to the 2017 flooding events was not uniform across all MRED target areas.

**KEY FINDING STATEMENT 2:** MRED's nexus approach overwhelmingly supported households' access to community-level resilience capacities at higher rates – relative to households not participating in the nexus interventions.

In comparison to non-nexus households, nexus households reported higher levels of pre-monsoon community-level resources and strategies important for reducing the causes of natural hazards, including: 47% higher usage of structural mitigation to protect land, higher confidence in bio-engineering techniques to stabilize river beds (0.5 out of 1 – 5 confidence scale), 26% higher rates of active community disaster management committees (CDMCs) and more reporting of community disaster response plans (51%) and EWS (50%). Agreement that CDMCs and early warning task force actors work actively to help the community prepare for flooding prior to the monsoon was much higher among nexus households in comparison to non-nexus households (1.5 and 1.3 difference out of a 1 – 5 agree/disagree scale).

Households participating in nexus interventions reported working with and supporting social networks both within and outside their own caste/community following the 2017 flooding events at higher rates than non-nexus households. This included engaging in collective land protection measures, participating in *perma* (mutually beneficial exchange of labor), being able to count on people when they needed help, supporting others to recover from shocks, and regularly cooperating with communities on recovery and restoration measures. The high level of bonding (ability to rely on members of one's own caste/community for help) and bridging (ability to rely on members of other castes/communities for help) before and after the 2017 flooding events indicates that the drive to work together and help others did not erode in nexus communities after this disaster. In contrast, non-nexus households reported much lower rates of bonding and bridging social capital before and after the 2017 flooding

events. Nexus households were also more likely to believe they can influence their CDMC and district level office than non-nexus households, which demonstrates greater linkages with government and outside organizations.

**KEY FINDING STATEMENT 3:** Nexus households relied on fewer negative coping strategies and lost fewer crops and agricultural inputs than non-nexus households after the 2017 flooding events.

Overall, nexus households reported lower rates of reliance on negative food coping strategies after the 2017 flooding events than non-nexus households. On average, their negative food coping strategies score was 3.35 points lower than non-nexus households. Considering the mean Coping Strategies Index (CSI) core was about 12, this is a large absolute difference. Nexus households took out loans from local money lenders 11% less often than non-nexus households as a response to the 2017 flood events. However, this effect may not be uniform across all MRED implementation areas. Nexus households lost fewer crops (408 kilos) and reported lower rates of agricultural input loss (6-8 percentage points lower) than non-nexus households. Although these decreases are relatively small, they are statistically significant.

**KEY FINDING STATEMENT 4:** Nexus households reported higher-levels of dietary well-being, perceived higher levels of recovery, and were more confident in their ability to recover from similar shocks in the future, relative to non-nexus households.

Nexus households reported less income disruption (2-13 percentage points less) and greater diet diversity (0.5 more food groups) following the 2017 flooding events than non-nexus households. However, these benefits were not achieved across all MRED communities. There were no statistically significant differences in whether income was interrupted or restarted (after it was interrupted) or in expenditures following the 2017 flooding events between nexus and non-nexus households. In addition, nexus households were 12% more likely to strongly agree that they had recovered from the 2017 flooding events than non-nexus households when controlling for other factors. Nexus households were also 21.5% more likely to be “fully confident” in their ability to cope with future shocks and stresses than non-nexus households when controlling for other factors. These results did not differ by caste or head of household gender. Positive perceptions of recovery and ability to cope in the future are key indicators of whether households feel resilient after a shock. Feeling more resilient allows households to move forward and live healthy and productive lives despite facing shock and stresses.

**KEY FINDING STATEMENT 5:** Marginalized groups were not able to achieve the same positive outcomes as more privileged groups in MRED target areas, suggesting social inequalities may have a large influence on outcomes.

Social inequalities had a significant influence on recovery and wellbeing trajectories. Janajatis lost 7 quintals less crops on average and reported losing agricultural inputs due to flooding 23% less often than Dalits (most marginalized caste group). This may be driven by an over representation of Janajati households in the MRED sample population. Female heads of household lost 4 quintals more crops on average due to flooding than male heads of household. Brahmin/Chetris (the most privileged caste group) and Janajatis reported 10-13 less CSI score points on average than households in the Dalit caste group – a difference that is equal to the overall average CSI score. Brahmin/Chetri households borrowed from informal money lenders 23% less often than Dalit

households in response to the 2017 flooding events. Female heads of household had to borrow from money lenders 12% more often than male heads. Brahmin/Chetri households also had much better diet diversity (1.4 more food groups) than Dalit households.

## Recommendations

**Committees, trainings and plans are not enough: promote holistic approaches to DRR that address ecological, economic, and social vulnerabilities.**

Households that lived in MRED communities and participated in an integrated and holistic package of interventions were better off than households who did not live in MRED communities after the 2017 flooding events. These integrated interventions helped to address the ecological, economic and social vulnerabilities (such as erosion-prone riverbanks, limited market access for climate adaptive crops and harmful gender norms) that usually prevent households and communities from mitigating, coping and recovering from disasters. Future resilience programs should design integrated intervention approaches that focus on improving existing DRR systems while also addressing context-specific vulnerabilities.

**Access to resources is not enough: support communities to plan and respond to disasters by employing resilience strategies.**

Effective resilience programs go beyond just improving access to resources. They allow households to draw on key resources and improve knowledge and skills to mitigate and respond to shocks and stresses. MRED was deliberately designed to promote sustainable uptake of resilience strategies and demonstrated that nexus households were able to use savings, early warning information, DRR plans, improved agricultural techniques, structural mitigation, green infrastructure measures and social networks to mitigate, cope and respond to the 2017 flooding events. Resilience programs should focus their implementation approach on uptake of context and shock-specific strategies for crisis mitigation, which requires effective targeting of interventions, demonstration of benefits of adopting new strategies and creation of incentives.

**Use market-based incentives to nudge behavior and promote long-term and sustainable investment in DRR.**

The nexus model focuses on strengthening markets for high-value crops that both protect land and property from natural disasters and allow households to earn income. These benefits provide an important economic incentive to maintaining nexus activities, which makes them more likely to independently invest in DRR measures and sustain them over the long-term. Focus disaster risk assessments on investigating ways to reinforce positive behaviors through market-based incentives, which can then be embedded into the design of the intervention approach. Agencies engaged in local disaster management planning should look beyond disaster mitigation planning and explore resilient livelihoods and nexus opportunities. This will require better cooperation with wider actors including the private sector. Financial service providers are particularly important to engage with so that households can access improved financial products that allow them to maintain and grow their businesses. Sustainable investment in DRR is also ensured through working with government agencies, which can provide technical input and co-financing of projects.

Actively address discriminatory social norms and aggressively promote inclusion to achieve disaster resilience for the most vulnerable groups.

Gender and social inequalities introduce additional barriers to accessing resources and using resilience strategies to cope and respond to shocks and stresses. Resilience programs must make transformative change for marginalized groups central to their programmatic approach. Development practitioners should explore gender and social inclusion barriers in disaster risk assessments to better design targeted resilience intervention approaches for marginalized groups. Findings from these assessments should be shared with key community decision making structures (e.g. Disaster Management Committees and Farmer Groups) so that these groups understand the impact of excluding marginalized groups from community decision-making processes. The focus of engagement with key decision-making bodies should also be on creating spaces for dialogue within administrative bodies, community user groups and committees to ensure active participation and engagement of women and marginalized groups in disaster planning and to encourage adoption of resilience strategies. Programs should also integrate proven gender and social inclusion interventions, such as intra-household dialog activities, into existing program approaches.

## BACKGROUND

### Description of Research

In order to measure whether MRED communities used key resilience capacities to cope and respond to the 2017 flooding events and whether they were able to maintain or increase their wellbeing outcomes in the face of this shock event, the program team implemented a post-shock monitoring survey from November 27, 2017 to December 15, 2017. This analysis leverages that survey data aiming to identify the factors and capacities that most promote resiliency in both the short and long-term. The findings from this report will lead to a more efficient and localized intervention, which may in turn lead to better outcomes.

### Description of Nexus Approach

MRED promotes an integrated intervention model (“nexus model”) that combines traditional community-based DRR approaches with interventions designed to increase market access for crops that have risk reduction potential. The following market models under the nexus approach were implemented:

- Planting sugarcane on erosion-prone riverbanks to prevent river cutting while increasing productivity of marginal lands and increasing income
- Planting fodder species in marginal lands of hilly areas to mitigate landslides while also contributing as an input for growth of the dairy sub-sector



The core nexus model is complemented by interventions that address multiple dimensions of vulnerability to disaster risk. These include building access to financial services, improving land management and protection mechanisms on communal risk-prone land, and addressing gender-based norms and attitudes that limit women's ability to support risk reduction.

#### COMPARING THE "NEXUS" MODEL TO TRADITIONAL DRR

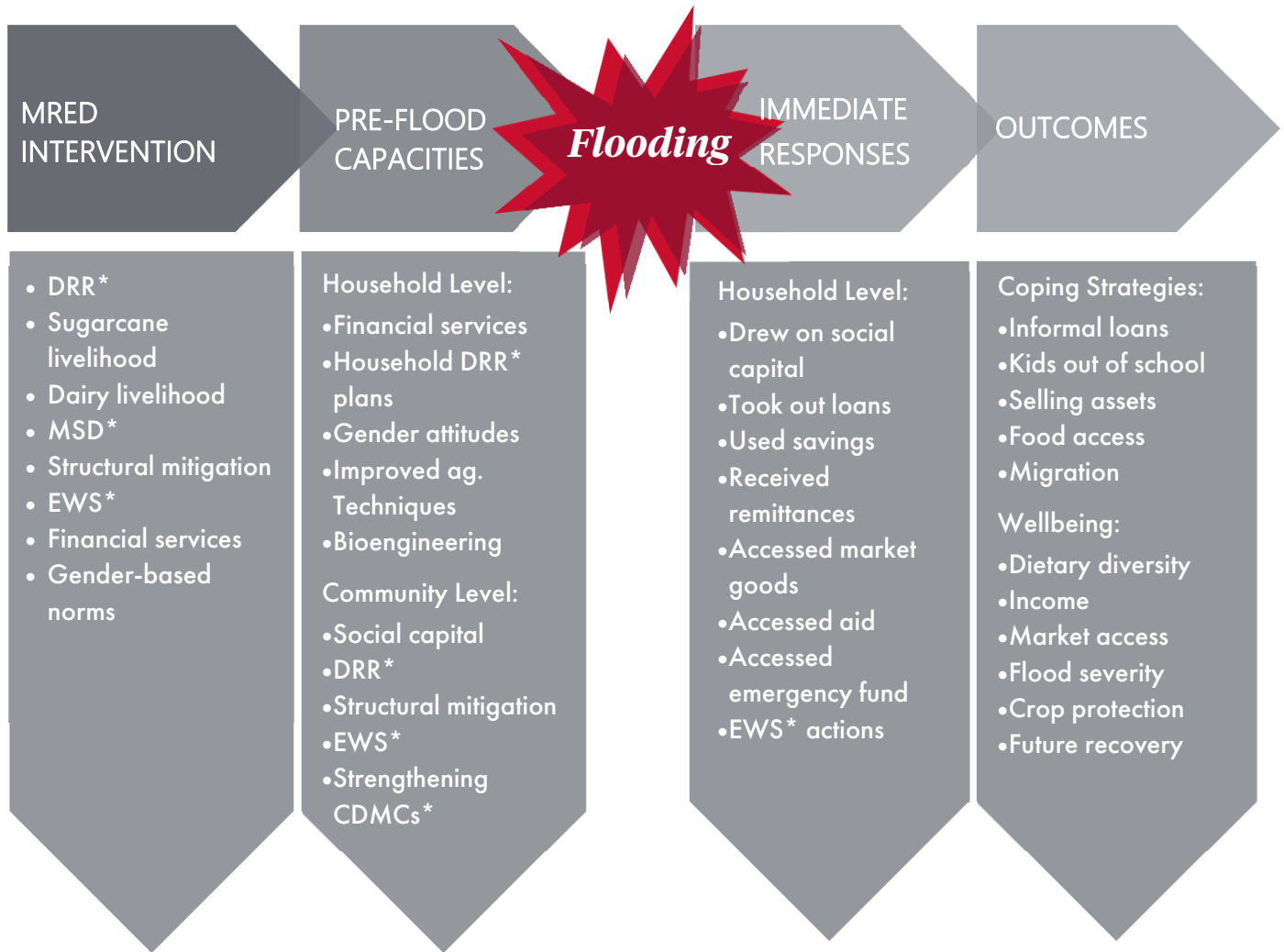
In Nepal, **traditional government-led DRR models** historically consist of forming and/or strengthening local government-led disaster management and response committees, developing local Disaster Management Plans, training committees on key aspects of response, including First Aid and Search and rescue, and linking committees with EWS.

The **MRED Nexus Model** seeks to economic incentives for investment disaster resilience, by building market linkages for crops that have the potential to protect land from natural disaster risk. These market-based interventions are complemented by building access to financial services, improving bio-engineering and land management on risk prone land, and addressing gender-based norms and attitudes.

## Research Questions

1. Are households living in "nexus communities" more resilient to flooding than flood-affected households living in non-nexus communities?
  - How did "nexus" households compare to "non-nexus" households in their ability to access resilience capacities prior to the floods?
  - How did nexus and non-nexus households differ in their use of resilience capacities to respond to the 2017 floods?
  - How did nexus households differ in their use of negative coping strategies to respond to the 2017 floods?
  - How did nexus and non-nexus households, compare in their wellbeing outcomes after the flood?
2. Do nexus households' results differ by key demographic and social attributes (caste, gender of the head of household, proportion of community who have migrated)?

Figure 1: MRED Theory of Change



\* DRR = Disaster Risk Reduction

\* EWS = Early Warning System

\* MSD = Market System Development

\* CDMC = Community Disaster Management

Figure 2: MRED's Nexus Approach



## RESILIENCE TERMINOLOGY

**Capacity:** A resource or strategy that households, communities and systems have access to or use prior to a shock/stress that will enable them to achieve improved wellbeing in the face of shocks and stresses.

**Response:** Specific actions households, communities and systems take to respond to shocks and stresses. These actions draw on the capacities that exist prior to the shock/stress.

**Coping strategy:** A type of response households employ to cope with the immediate effects of a shock/stress. The coping strategy does not need to draw on existing capacities.

**Resilience outcome:** An intermediate outcome that demonstrates a reduction in a direct cause (e.g., deforestation) or immediate effect (e.g., loss of crops) of a shock/stress.

**Wellbeing outcome:** A development outcome that demonstrates an improvement in a household's overall wellbeing.

**Shock:** Rapid onset disturbance that has a large impact on a system.

**Stress:** Long-term trends/pressures that undermine a system's stability and increases vulnerability within it.

# METHODOLOGY

## Design

This analysis uses a quasi-experimental design called Propensity Score Matching (PSM), developed by Rosenbaum and Rubin (1983), which builds an inference about the impact of a treatment on the outcome of an individual based on matching with individuals who share the same probability of receiving treatment.<sup>3</sup> In this analysis, the treatment is measured through recorded MRED (Nexus) activities at the village level and the individual level. The probability of receiving treatment is calculated through explanatory variables that are likely to be associated with individuals that participate in the MRED (Nexus) program. This probability is then collapsed into a 'propensity score' which is used in analysis. This approach allows for a comparison between beneficiary households who participated in the Nexus activities against households from other communities with similar demographic and disaster-risk profiles. When implemented correctly, any difference between the two groups can then be attributed to the program.

Figure 3: Map of MRED Target Districts



This evaluation design is well suited to an ex-post shock monitoring framework, but as baseline data is unavailable for households that were impacted by the flooding we can only compare levels of outcomes found during the post-shock monitoring survey. This means that we cannot control for the change due to local or regional markets or climate over time, but the analysis will control for fixed effects across communities. Using propensity score matching, the analysis will still account for both observed and unobserved characteristics and will produce a valid, though less precise, measure of program effect. The cross-sectional ex-post estimate is considered the best possible estimate for outcomes measured at the endline only, since it benefits from the propensity score's bias reduction but does not account for baseline values and time trends.

## Sampling Frame/Identification

Households were put into the MRED nexus group if they had received the full package of integrated activities (DRR, sugarcane, dairy, financial services, gender, and other activities) and had experienced impact from the 2017 flooding events. Among the 52 Nexus communities in the MRED implementation area, 28 communities

<sup>3</sup> Rosenbaum PR, Rubin DB. *The central role of the propensity score in observational studies for causal effects*. Biometrika 1983 70: 41-55.

were selected for this study. They were matched with an equal number of communities in the same municipalities who shared as many characteristics as possible (except for participation in MRED). These communities were matched based on elevation, access to markets and road length. Program staff noted that sampling across characteristics was unnecessary, as communities within the same municipality share nearly all characteristics. However, statistical analysis showed that there were definitive differences in elevation and access across the intervention groups (see annex 2). In addition, some comparison communities in proximity to treatment communities began take-up of certain aspects of the MRED program. In those instances, these communities were passed over to maintain as pure a comparison as possible.

## Household Sampling Methodology

The sampling protocol used by Mercy Corps leveraged flood exposure metrics by highlighting high-risk communities and then identified high-risk households within those communities. The flood exposure metrics considered three main qualifications: whether the household lives in a flood-affected area, was impacted by landslides/flooding and has crops near the river and/or has communal land near the river. This household sampling methodology was applied for both selected nexus communities and comparison (non-nexus) communities. Within nexus and non-nexus communities, 20 and 10 households were selected respectively. Households living in MRED nexus communities are referred to as “nexus households” throughout the report. Households that do not live in MRED nexus communities and were included in the study as a comparison group are referred to as “non-nexus households.”

There may have been undocumented differences between the two groups that prompted MRED staff to choose some communities rather than others. However, program staff ensured that the selected communities were generally similar via the selection criteria. Ideally, the same should be representative of flood-affected households living in a flood-impacted area with crops near the river and/or communal land near the river. Through leveraging PSM, the analysis builds upon the sampling procedure to mimic randomization as closely as possible.

## Analytical Approach

To answer research question 1i (do nexus household have higher levels of pre-flood resilience capacities than non-nexus households?), the analytical approach uses difference of means tests. This analysis approach is the most appropriate method to determine whether the nexus group exhibits higher levels of these indicators because many of the variables are intermediary outcomes or outputs. All other research questions used regression analysis. Model 1A is the “unadjusted” model that does not take geography or social demographic variables into consideration. Model 1B controls for geography (village development committee) and Model 1C control for household characteristics (caste and gender head of household) and geography. The regression analysis also explored whether there were interactions between caste groups, gender of the head of household or intervention dosage. Including this array of models allows for trends to appear. When results are statistically significant across all models the findings can be assumed to be more robust than if it is

only present in one model (although this does not indicate that significant results found in one model alone do not indicate a statistical relationship). The next section describes the models used in the regression analysis and how the intervention dosage variables were constructed.

## Models

### VILLAGE LEVEL

Table 1. Covariates for Estimation Models

Model	1A	1B	1C
MRED Activity	•	•	•
Village Development Committee (VDC)		•	•
Gender of Household Head			•
Caste			•

**Model 1A** - Is the general model which reports the average treatment effect across all households in the treatment group. The interpretations of Model 1A tell us how, on average, the treatment group differs from the comparison group, but it lacks information about subpopulations and does not take VDCs into account.

**Model 1B** - Controls for VDC. This attempts to account for the differences due to VDC alone. Findings from this model include the idea that at the level of VDC there may be geographic or governmental factors that explain some of the differences between Model 1A and Model 1B.

**Model 1C** - adds household Caste and head of household gender as controls, in addition to VDC. The purpose of adding these is to see if the combination of these controls explains an outcome better than the treatment. For example, findings could conclude that one's Caste explains income continuity through the monsoon season better than being in a treatment area. Interpretations should be made with some caution, as Caste is not well balanced across groups.

### DOSAGE

MRED's nexus interventions may not have been implemented uniformly across households. Because of this, this analysis also explores how various levels of participation in the program affected results.

Table 2. Covariates for Dosage Estimation Models

Model	2A	2B
MRED Activity	•	•
VDC	•	•
Gender of Household Head		•
Caste		•

**Model 2A and 2B** - These models use treatment ‘dosage’ variables which are employed to explain all the possible correlated or unobserved latent variables in the treatment. Using factor analysis, the research identified three distinct grouping of interventions that exhibited covariance.

- DRR activities
- Livelihood activities: Dairy
- Livelihood activities: Sugarcane etc.

Interpretations of these models should be created with care. Factors do not increase by any unit, so we cannot make any associations between their increase and the magnitude of change in any outcome, but they do hint at relationships between a group of interventions and the changes we see in outcomes. Thus, when we see strong, significant results we can conclude that the particular treatment group is driving the outcome more than the others.

### Model 2C and 2D - Dosage Covariate Groups

Run as exploratory analysis but will not be used in this report.

## Dosage Component

The intervention groups consisted of varied components that in total equal the MRED (Nexus) intervention. Table 3 below outlines administrative data on the components of treatment received from Mercy Corps. Using exploratory analysis, the main components of the Livelihood Intervention were split into Sugarcane and Dairy groups. The remaining interventions (Community Disaster Committee, mitigation monitoring and financial literacy classes) were classified as the Disaster Risk Reduction (DRR) intervention group. Individual MRED beneficiaries may participate in more than one intervention group.

Table 3. Description of Dosage Components

Intervention Groups	Description
Livelihood (sugarcane)	Local level input and technical service providers
	Field Farmer School
	Sugarcane Farming Training
	Women in farming
	Village Savings and Loan Association
	Formal Financial Savings and Credit Group
Livelihood (dairy)	Dairy Farmer
	Cold chain for milk
DRR	Community Disaster Committee
	Mitigation Monitoring
	Flt group formation

## Matching Strategy

Running an effective and valid PSM requires that only variables which simultaneously influence the participation decision and the outcome variable be included as estimators. These variables should be unaffected by participation or the anticipation of participation. To ensure this, variables that are either fixed over time, or measured beforehand should be included. However, without baseline values this analysis will leverage fixed over time variables like demographic controls and recall questions covering pre-flooding capacities. Additionally, as recall can be faulty (especially after traumatic events), the analysis will aim to leverage as many fixed variables as possible. Furthermore, because the MRED program was implemented prior to the attainment of pre-flood capacities, recall questions are likely strongly associated with MRED itself. The analysis proposes using the following indicators (Table 4) as the primary matching variables for the analysis.

Table 4. Propensity Score Matching Estimators

Variable	Variable Description
PPI Score	Poverty Probability Index
HOH Age	Age of the Household Head
HOH Education	Education of the Household Head
HH Size	Number of Members



Community Flood Exposure (Log)	Log of Community Level Flood Exposure (Elevation, Distance to Market, Distance to Watee, etc.)
Access to inputs Before Monsoon	Did the HH have access to inputs before the Monsoon Season
Savings Before Monsoon	Did the family have savings before the Monsoon Season
Loans Before Monsoon	Did the family have loans before the Monsoon Season
Insurance Before Monsoon	Did the family have insurance before the Monsoon Season

## RESULTS

### Household-Level Preparedness and Response

**KEY FINDING:** MRED nexus households had higher levels of household-level capacities important for disaster preparedness – including savings, household DRR plans, improved agricultural techniques and access to early warning system (EWS) information – and were able to use these resources at higher levels to respond to the 2017 floods than non-nexus households.

#### Financial Services

Access to financial services, especially savings, has been proven to be a critical component in supporting households’ recovery after a disaster<sup>4,5,6</sup>. When coupled with robust and context-specific financial literacy training and messaging, households are also more likely to engage in positive financial behaviors<sup>7</sup>. Conversely, taking informal loans after a disaster leaves household more vulnerable overtime because these loans usually have high interest rates and unfavorable terms<sup>5</sup>. As part of its extended nexus model, MRED delivers financial literacy training and supports linkages to local savings groups, which have a strong focus on helping households to manage their budgets and to anticipate and manage risks.

<sup>4</sup> Toth, R. & Hoy, C. (2017). The use of Financial Products in Mitigating Natural Disaster Risk. Retrieved from <https://www.mercycorps.org/sites/default/files/Mercy-Corps-Financial-Product-Mitigating-Natural-Disaster-Risk-June-2017-full%20report.pdf>

<sup>5</sup> Scantlan, J. & Petryniak, O. (2018). What Matters for Recovery: Ten Week, One Year, and Two Years after the Gorkha Earthquake. Retrieved from [https://www.mercycorps.org/sites/default/files/GhorokaEarthquake\\_Recovery\\_MercyCorps\\_April2018\\_0.pdf](https://www.mercycorps.org/sites/default/files/GhorokaEarthquake_Recovery_MercyCorps_April2018_0.pdf)

<sup>6</sup> Hudner, D. & Kurtz, J. (2015). Do Financial Services Build Disaster Resilience? Examining the Determinants of Recovery from Typhoon Yolanda. Retrieved from [https://www.mercycorps.org/sites/default/files/MercyCorps\\_FinancialServicesDRRStudy\\_2015.pdf](https://www.mercycorps.org/sites/default/files/MercyCorps_FinancialServicesDRRStudy_2015.pdf)

<sup>7</sup> Mercy Corps & Causal Design (2015). The Impact of Electronic Cash Transfer Approaches on Disaster Recovery and Financial Inclusion. Retrieved from <https://www.mercycorps.org/research-resources/beyond-meeting-immediate-needs-impact-electronic-cash-transfer-approaches>

## Savings

Households participating in nexus interventions reported having more savings before the 2017 monsoon more often than non-nexus households (70% versus 50%). Nexus households reported using savings to respond to flooding 20% more than non-nexus households, but only when including geographic location (Village Development Community) in the model. This suggests that using saving to respond to the 2017 flooding events was not uniform across all MRED target areas. Although participation in financial literacy training contributed positively to use of savings after the 2017 flooding events, it is possible that there are barriers to accessing savings in certain MRED target communities.

## Loans

Nexus households accessed loans at slightly higher rates than non-nexus households before the monsoon (62% versus 56%). Following the 2017 flooding events, the majority of nexus and non-nexus households reported taking out informal loans; however, nexus households borrowed at a slightly lower rate (6% less). Households that participated in the sugarcane and savings and loan activities (member of village, savings and loans organization and savings group) were associated with lower instances of informal borrowing. One common practice among sugarcane farmers is to borrow seed from neighboring sugarcane farmers at the beginning of the plantation season and to pay back the cost of these seeds via the profit from the crop cultivation, which would avoid the need for loans all together. There were no differences in formal borrowing between nexus and non-nexus communities post-monsoon.

## Remittances

Households participating in nexus interventions reported having more savings and remittances from within Nepal and overseas before the 2017 monsoon more often than non-nexus households (21% and 12% difference, respectively). There were no significant differences in receiving remittances between nexus and non-nexus communities post-monsoon.

## Insurance Payments

Nexus households had higher rates of livestock or crop insurance before the monsoon in comparison to non-nexus households (19% versus 14%). After the flooding events, nexus households were 1-2 percentage points more likely to report receiving an insurance payment over non-nexus households.

Figure 4: Loans/Savings/Remittances Before Flooding

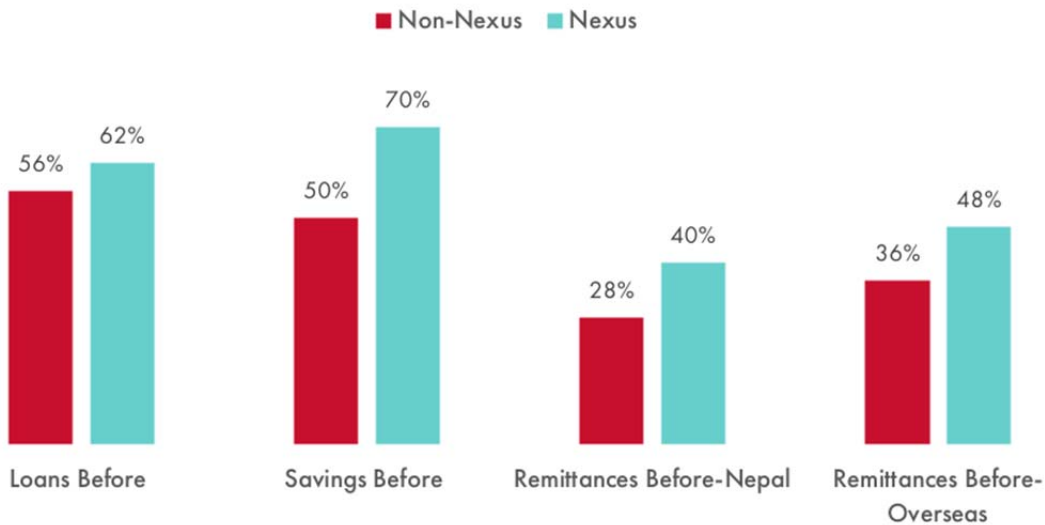
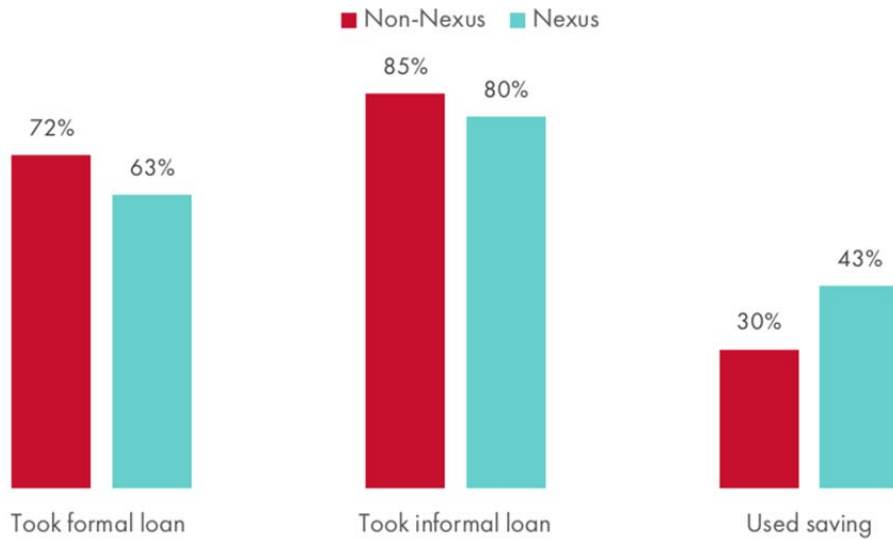


Figure 5: Proportion of MRED and non-MRED households Using Loans and Savings Post-Monsoon

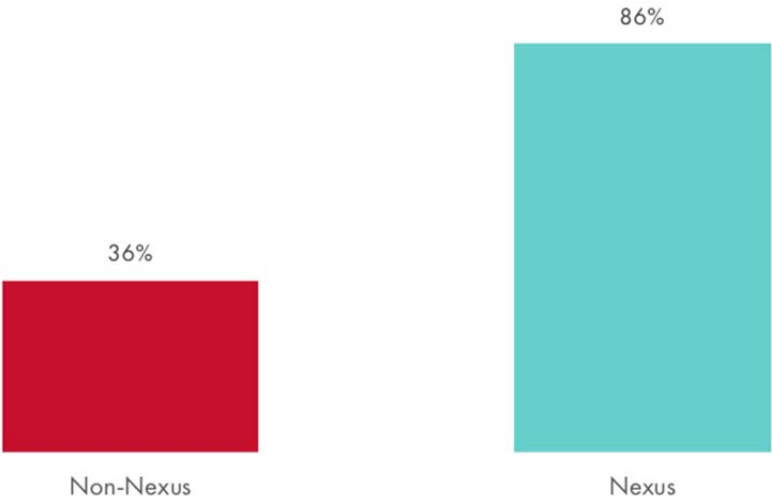


### Household-level DRR Plans and Early Warning Information

MRED expands on traditional DRR approaches by creating tailored preparedness plans for households living in disaster-prone areas of the community. Their DRR plan includes specific details on what to do in case of an emergency that takes things like the composition of their household (e.g., whether they have members who are disabled or lactating mothers) and their distance from the river into consideration. MRED also helps to establish and strengthen early warning task force groups at the community-level, whose members are the focal points in the community for early warning information.

After the 2017 flooding, households in both nexus and non-nexus communities were also asked whether they actually received early warning information during the floods and what actions they took afterwards. Households participating in nexus interventions reported higher rates of receiving EWS information (44% higher) than non-nexus households when controlling for all other factors. This is not surprising given that nexus households also reported that their communities had EWS prior to the monsoon season at much higher rates (86% versus 36%) than non-nexus communities. However, what it does demonstrate is that established EWS in nexus communities were able to provide necessary information once communities were faced with flooding. Nexus households also reported higher rates of having a disaster management plan (12% difference) than non-nexus households. Financial literacy training, DRR (mitigation monitoring and engagement with CDMCs) and nexus dairy activities contributed the most to this positive outcome. This may be because the hilly regions in MRED target areas (where dairy interventions are more common) experienced the most severe flooding<sup>8</sup> (enough to trigger a response from the EWS).

Figure 6: Household Received Early Warning Information



Nexus households reported responding to early warning information by evacuating to a safe place with their family 21% more often than non-nexus households. Nexus households also went to the top of their houses at higher rates (15%) than non-nexus households after receiving early warning messages about flooding. Surprisingly, nexus households that participated in sugarcane activities reportedly received the reported lower rates of going to the top of their house after receiving early warning information. Again, this may be due to flood severity being less in sugarcane implementation areas than in areas where the dairy interventions were more common. Nexus households reported higher rates (15% higher) of warning their neighbors in response

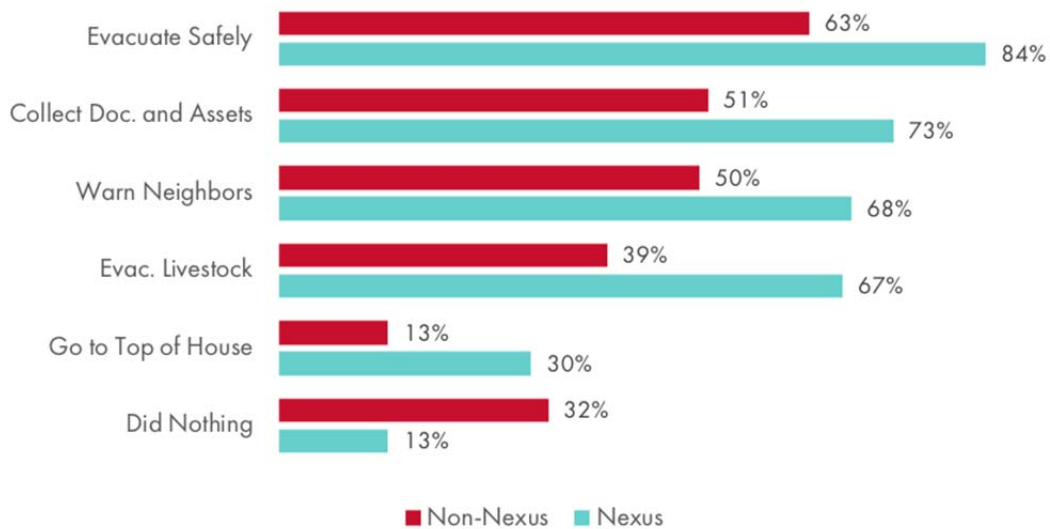
<sup>8</sup> Based on local reporting, the Terai region of Western Nepal where MRED works received more sporadic episodes of rain during the 2017 flooding events. Inundation was slower, which prevented multiple river systems from flooding. In contrast, there were more intense instances of flash flooding in the hilly regions of Western Nepal where MRED works.

to receiving early warning information than non-nexus households. There were no significant differences between demographic groups or groups that received a particular set or package of interventions.

Households in MRED communities were 17-18% more likely to respond that they collected important documents and valuable assets after receiving EWS alerts over non-MRED households. Households in MRED communities also respond that they had evacuated their livestock after receiving EWS information 25% more often than non-MRED households. Female-headed households within these same groups were 14% more likely to have evacuated livestock. These findings were predominately driven by households that participated in the package of dairy interventions.

Nexus households were 18% less likely to report that they did nothing upon receiving EWS information. Households that received financial literacy training and DRR (mitigation monitoring and engagement with CDMC activities contributed positively to this outcome. In contrast, nexus households that participated in the sugarcane, savings and loan activities, member of village, savings and loans organization and savings group) contributed negatively to this outcome, which may mean they were more likely to do nothing than the nexus households participating in the DRR/financial literacy and dairy interventions. Again, this may be due to flooding being less severe in the sugarcane implementation areas, which would have decreased the intensity of early warning messaging in these areas.

**Figure 7: Actions Households Took after Receiving Early Warning Information**



### Improved Agricultural Techniques

MRED nexus households use improved agricultural techniques, including intercropping (planting different crops together to maximize the productivity of the land), polyhouse farming (using white plastic sheet to protect crops during cold seasons), off-season vegetable farming, drip irrigation, and integrated pest

management to improve land management and nexus crop productivity. Increasing crop productivity through improved agricultural and land management techniques is an essential component of the nexus approach because increased income from cultivation provides financial incentives to invest in DRR activities over the long-term. Nexus households reported that they were familiar with improved agricultural techniques 23% more often than non-nexus households.

## Gender Attitudes

Simply having access to resources does not ensure that all members of a household will be able to have the agency to make decisions over the use of this resource. Changing attitudes on women’s control of assets, use of savings, and household decision-making is important for breaking down gender barriers to using financial and other resources to respond to shocks<sup>910</sup>. To address these gender barriers, MRED incorporated household dialog sessions into financial literacy training with the aim of fostering inclusive decision-making and gender equity in the household. There were no statistically significant differences between how nexus and non-nexus household’s attitudes towards women’s control over assets and savings. Surprisingly, nexus households were more likely to agree that men should make major decisions (such as buying land or other assets or building a house) than non-nexus households (4.23 versus 3.53 out of a 1 – 5 scale). It is possible that because the MRED gender interventions were only integrated in a few pilot areas that their impact was not felt in all MRED target areas.

Table 5. Household Capacities Pre-Monsoon: Difference in Means Tests

Variable	Non-Nexus	Nexus	Diff
Financial Services			
Able to buy desired agricultural inputs	57%	56%	-1%
Loans	56%	62%	6%*
Savings	50%	70%	21%***
Remittances (from Nepal)	28%	40%	12%**
Remittances (from overseas)	36%	48%	12%**
Insurance (Agriculture/Livestock)	14%	19%	-5%*
Household Disaster Risk Reduction			
Household has disaster response plan (formalized)	12%	28%	16%***

<sup>9</sup> Anderson, A. (2018). Resilience in Action: Gender Equity and Social Inclusion. Produced by Mercy Corps as part of the Resilience Evaluation, Analysis and Learning (REAL) Associate Award. Retrieved from <https://www.mercycorps.org/sites/default/files/REAL%20Resilience%20in%20Action.pdf>

<sup>10</sup> Anderson, A., Ho, R., Ragazzi, C. (2018). Priming Resilience with Intra-household Change: Addressing Gender Norms. Retrieved from [https://www.mercycorps.org/sites/default/files/BRIGE\\_Report\\_Full.pdf](https://www.mercycorps.org/sites/default/files/BRIGE_Report_Full.pdf)

Improved Agricultural Techniques			
Familiar with Improved Agriculture Techniques	36%	59%	23%***
Gender Attitudes			
Assets: Women and Men same control (Likert scale 1 = strongly disagree; 5 = strongly agree)	4.66	4.7	0.04
Savings: Women and Men same control (Likert scale 1 = strongly disagree; 5 = strongly agree)	4.66	4.6	-0.06
Men should make major decisions (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.53	4.23	0.70***

Significance levels: \* < 10% \*\* < 5% \*\*\* < 1%

**Table 6. Use of Financial Services Capacities (Nexus versus non-Nexus households)**

Financial Services	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Used Formal Loans After	760	-4%	4%	5%
Used Informal Loans After	760	-6%**	-2%**	-1%**
Used Savings After	760	7%	21%***	20%***
Received Insurance Payment (Agriculture/livestock)	760	2%**	2%***	3%***
Received Remittances	332	16%	0.3%	-1%

\*\*\* p<0.01, \*\* p<0.05, \* p<0.01

**Table 7. Use of Early Warning System Capacity (Nexus versus non-Nexus households)**

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Received early warning information during flood	760	44%***	45%***	44%***
Evacuate to safe place (EWS response)	760	21%***	22%***	22%***
Collect documents and assets (EWS response)	760	18%***	17%***	17%***
Evacuate livestock (EWS response)	760	26%***	24%***	25%***
Go to top of the house (EWS response)	760	14%***	-2%	-2%
Warn neighbor (EWS response)	760	15%***	17%***	17%***
Do nothing (EWS response)	760	-18%***	-22%***	-23%***

\*\*\* p<0.01, \*\* p<0.05, \* p<0.01

# Community-Level Prevention, Preparedness and Response

**KEY FINDING:** MRED's nexus approach overwhelmingly supported households' access to community-level DRR resources and use of related strategies - including building and drawing on strong social networks, establishment of EWS, and use of structural mitigation and green infrastructure measures for flood risk reduction on communal lands - relative to households not participating in the nexus interventions.

## Community DRR

The MRED nexus approach builds on communities' existing DRR systems by addressing gaps in access to early warning information and reducing the ecological vulnerabilities that increase the risk of disasters. The MRED program does this by integrating its core nexus activities (sugarcane plantation in riverbeds and fodder plantation on hillsides) with building and maintaining physical structures (such as gabion boxes and bamboo fences) along the river and hillsides to reduce the exposure and severity of flooding, river cutting and landslides. Communities also require EWS to communicate emergency information and government structures to help them better plan and respond to disasters. To address this, MRED works with early warning task force groups in each community, which are the main focal points in the communication channel between rain gauge stations and the local community. MRED also works through Community Disaster Management Committees (CDMC) to implement all of its DRR activities, which helps to build the capacity of these institutions while also ensuring longer-term sustainability of activities.

Prior to the 2017 monsoon season, households participating in nexus interventions reported higher levels of all community-level DRR capacities than non-nexus households. The largest differences were found in household members' using structural mitigation (89% versus 42%), reporting that their community has a disaster response plan (63% versus 12%) and EWS (86% versus 36%) and perceptions that CDMCs and early warning task forces were actively working to help their community prepare for disasters (equivalent of "strongly agreeing" versus "neutral" attitudes).



Figure 8. Average Levels of Community Capacities

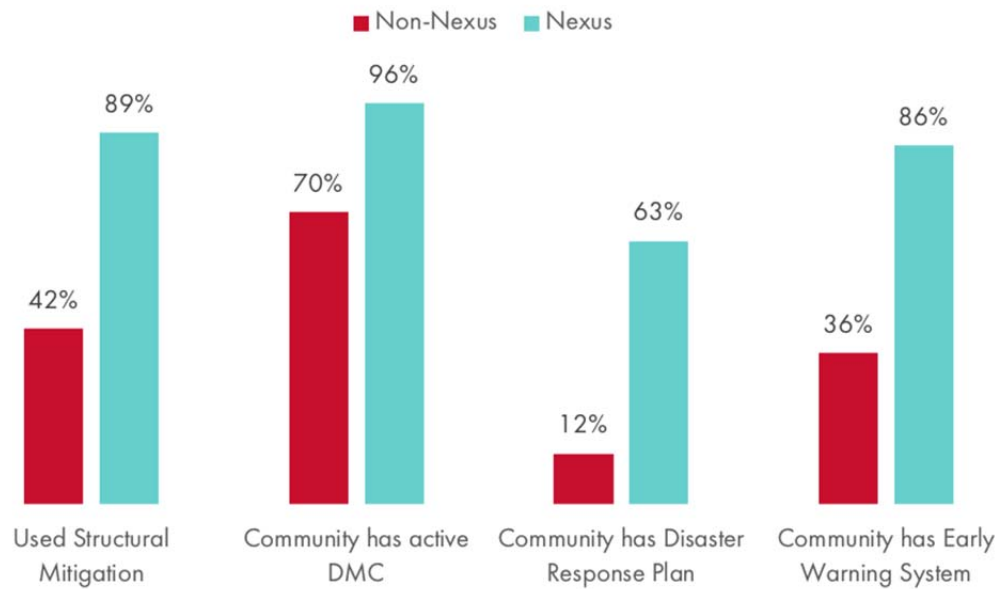


Table 8. Community DRR (Output) Difference in Means Tests (Pre-Monsoon)

Variable	Non-Nexus	Nexus	Diff
Community DRR			
Used Structural Mitigation	42%	89%	47%***
Confident in Bio-engineering (Likert scale 1 = strongly disagree; 5 = strongly agree)	2.98	3.48	0.496***
Community has active DMC	70%	96%	26%***
Community has disaster response plan	12%	63%	51%***
Community has EWS	36%	86%	50%***
CDMC worked actively to help our community prepare for disasters (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.00	4.52	1.522***
EWTF worked actively to help our community prepare for disasters (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.17	4.43	1.258***

## Social Networks

Previous research in Nepal shows that building strong social networks is important for short and long-term recovery from a shock<sup>5</sup>. With this understanding, MRED’s nexus approach focuses on building strong social networks through its community DRR and nexus crop interventions. For example, the structural mitigation, bio-

engineering (i.e., green infrastructure) and sugarcane interventions requires cooperation from farming groups in different communities to be successful because river cutting affects multiple communities who live along a river system. These structures also need financial investment to be maintained over time, so links to government stakeholders is essential for sustainability. Early warning systems are also designed to promote information sharing from communities living upstream (where signs of flooding first appear) with downstream communities. MRED's nexus approach also builds strong social networks within communities through collective cultivation and management of sugarcane production and through the village savings and loan associations, which manages their funds collectively. All of these intervention approaches combined contribute to building strong social networks, which provide a crucial safety net that households can rely on for help when faced with shocks and stresses.

## Bonding

Bonding social capital is present when households work together with other members of their own community of social group. Before the 2017 monsoon, nexus and non-nexus households reported similar levels of Perma<sup>11</sup> in their own communities (with statistically significant higher rates among nexus households). After the 2017 flooding events, nexus households responding were much more likely to agree that "following the monsoon season, our community regularly participates in Perma" than non-nexus households. This represents a movement from nexus households' answer of "somewhat agree" up to "strongly agree." The analysis showed that nexus households were 17.5% more likely to answer "strongly agree". This demonstrates that bonding social capital was not depleted in MRED communities following the 2017 flooding events. Households that participated in the sugarcane, savings and loan activities, member of village, savings and loans organization and savings group), financial literacy training, and DRR (mitigation monitoring and engagement with CDMCs) were associated with higher Perma rates than the dairy intervention package. This is most likely because sugarcane cultivation and mitigation activities are conducted collectively, and benefits are shared communally. Village, savings and loan associations and savings groups also rely on collective management to function.

Nexus households agreed that they could count on members of their own caste prior to the monsoon at higher rates than non-nexus households (4.04 versus 4.45 out of a 1 – 5 scale). After the 2017 flooding events, nexus households were 15.5% more likely to strongly agree with the statement "I was able to count on members of my own caste to help me cope and recover from shocks associated with this monsoon season (i.e. lending money, lending food, supporting recovery of damaged farmlands)" than non-nexus households. These responses correspond strongly with the respondents who participated in financial literacy training and DRR activities (mitigation monitoring and engagement with CDMCs). Nexus households participating in the sugarcane, savings and loan activities, (member of village, savings and loans organization and savings group) may be associated with a lower response rate for counting on members of their own caste.

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<sup>11</sup> The Perma system is a self-help, labor exchange system in Nepal. It applies particularly to agriculture, where an individual works on someone else's land and receives the same favor in return.

Prior to the 2017 monsoon, nexus households agreed that they protect common land from flooding, landslides and other disasters in their own community at higher rates than non-nexus households (3.8 versus 4.6 out of a 1 – 5 scale). Following the 2017 flooding events, households participating in nexus interventions were more likely to agree that members of their community regularly worked together on recovery and restoration measures. The average difference (0.7 units higher out of a 1 – 5 scale) indicates a movement from answering “somewhat agree” to “strongly agree.” In other words, households in treatment communities are 20% more likely to answer they “strongly agree” when controlling for geographic area and demographic variables. The high level of agreement on communal protection of land and recovery from nexus households before and after the 2017 flooding events indicates that the drive to participate in collective action did not erode in MRED communities after the disaster.

Figure 9: Bonding: Following Monsoon, Community Worked Together on Recovery and Restoration

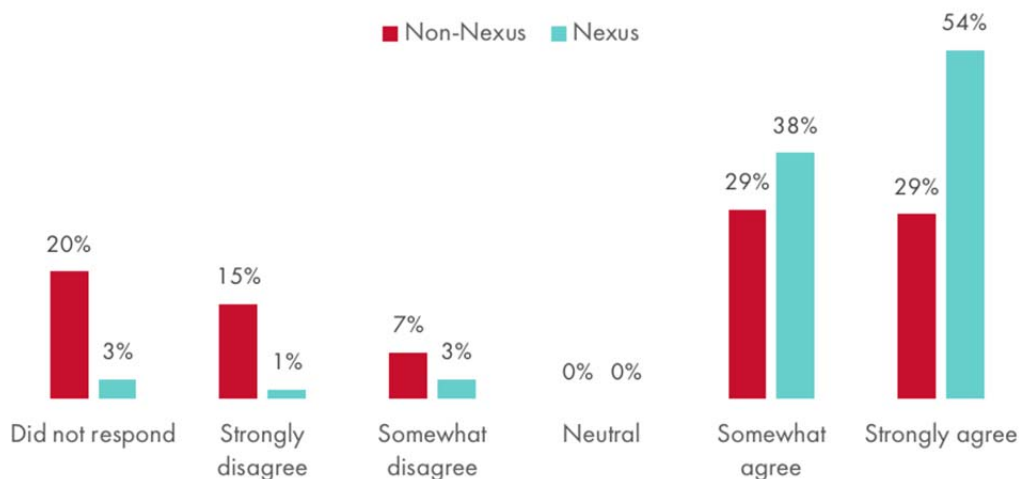


Table 9: Bonding Social Capital Capacities (Output) Difference in Means Tests (Pre-Monsoon)

Variable	Non-Nexus	Nexus	Diff
<b>Bonding Social Capital</b>			
Protect common land in own community	3.8	4.58	0.79***
Participate in reciprocal labor exchange system (perma)	4.15	4.47	0.32***
Can count on members of own caste	4.04	4.45	0.41***
Community members help one another	4.45	4.6	0.15***
Trust people in their own caste (trust not at all = 1; trust completely = 5)	3.97	3.9	-0.07

Significance levels: \* < 10% \*\* < 5% \*\*\* < 1%

Table 10: Use of Bonding Social Capital Capacity (Nexus versus non-Nexus Households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Worked with own community on recovery after monsoon	691	0.5***	0.8***	0.7***
Could count on own caste after monsoon	693	0.3***	0.6***	0.7***
Could count on own community after monsoon	757	0.2***	0.2***	0.2***
Participated in perma	701	0.5***	0.9***	0.8***

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

**Bridging**

Bridging social capital is present when households work together with members outside their own community and/or social group. Prior to the monsoon, nexus households agreed that they worked with other communities to protect common land at higher rates than non-nexus households (3.55 versus 4.1 out of a 1 – 5 scale). Similarly, nexus households agreed that members of their own community help people in other communities if they needed help (4.14 versus 4.36 out of a 1 – 5 scale).

After the 2017 flooding events, nexus households were 13% more likely to strongly agree that their own community regularly cooperates with members of other communities on recovery and restoration measures than non-MRED households (difference 0.4 out of a 1 – 5 scale). Households participating in nexus interventions were also about 20% percent more likely to answer “strongly agree” that people in their own community would help someone in a nearby community if they experienced something unfortunate (difference 0.2 out of a 1 – 5 scale). Supporting others in communities other than their own was rated lower by female headed households and higher for Brahmin/Chetris. Social/cultural norms around talking with outsiders and traditional norms around work may have reduced female heads of household’s ability to make connections with communities outside their own. Conversely, in some MRED communities the population is fairly homogenous (consisting mostly of the Brahmin/Chetri caste group), which would make collective action on recovery and restoration measures easier to implement.

The sugarcane, savings and loan activities, member of village, savings and loans organization and savings group), financial literacy training, and DRR (mitigation monitoring and engagement with CDMCs) activities contributed to nexus household’s positive responses on cooperation and helping communities outside their own. One possible explanation for why the dairy nexus activities are not correlated with any bridging social capital responses is that travel in between communities is much harder in the hilly areas (where most dairy nexus activities occur), which may have affected positive interactions between communities.

Prior to the monsoon, there were no statistically significant differences in nexus and non-nexus household's level of trust in people outside their community and caste. After the 2017 flooding events, nexus households were 11% more likely to respond "strongly agree" that they can count on members of other caste to help them cope and recover with shocks associated with the monsoon season (difference 0.5 out of a 1 – 5 scale). Nexus households were 9% more likely to answer "strongly agree" that most people in other communities can be trusted after the flooding events (difference 0.3 out of a 1 – 5 scale). DRR (mitigation monitoring and engagement with CDMCs) activities contributed positively to this finding. Furthermore, female-headed households were more likely to rate their trust of other communities higher than male heads of household after the monsoon.

**Table 11. Bridging Social Capital Capacities (Output) Difference in Means Tests (Pre-Monsoon)**

Variable	Non-Nexus	Nexus	Diff
Bridging Social Capital			
Protect common land in communities outside their own (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.55	4.1	0.56***
Can count on members of castes outside their own (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.74	4.04	0.30***
Community members help people in communities outside their own (Likert scale 1 = strongly disagree; 5 = strongly agree)	4.14	4.36	0.22***
Can trust people in communities outside their own (trust not at all = 1; trust completely = 5)	3.62	3.69	0.08
Trust people in castes outside their own (trust not at all = 1; trust completely = 5)	3.49	3.56	0.07

Significance levels: \* < 10% \*\* < 5% \*\*\* < 1%

**Table 12: Use of Bridging Social Capital Capacity (Nexus versus non-Nexus households)**

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Worked with other communities on recovery and restoration after monsoon	665	0.4**	0.5**	0.4*
Could count on other castes after monsoon	701	0.3**	0.4***	0.5***
Could count on other communities after monsoon	755	0.4***	0.2***	0.2**
Can trust people outside own community	752	0.2***	0.3**	0.3***

\*\*\* p<0.01, \*\* p<0.05, \* p<0.01

## Links to Emergency Funds

Linking social capital is present when households and communities are able to access resources and have good relationships with government institutions and other organizations. One important resource during a disaster is an emergency management fund. This fund adds value to traditional community DRR systems because it allows households and communities to access funds immediately after a shock and also builds strong social networks because the community has to manage the fund collectively.

Although most non-nexus households reported that their community had a disaster management committee (70%) prior to the monsoon, only 19% also reported that their community had an emergency management fund. In contrast, nearly all nexus households (96%) reported that they had a disaster management committee and 72% reported that they had an emergency fund prior to the monsoon. Of the communities with emergency management funds, 52% of households in non-nexus communities (32 out of 55) and 43% of nexus households (147 out of 340) reported receiving support from the Emergency Management Fund after the 2017 flooding events; however, the difference was not statistically significant. It is possible that nexus households did not need immediate financial assistance or had other sources to draw on to meet their needs after the flood. For example, nexus households had higher rates of savings (20% higher) and remittances (12% higher) than non-nexus households prior to the monsoon.

## Attitudes towards Early Warning Task Forces and Disaster Management Committees

Nexus households agreed at higher rates that they could influence the Community Disaster Management Committee (4.39 versus 3.16 out of a 1 – 5 scale) and district level office (4.08 versus 3.41 out of a 1 – 5 scale) to meet their needs prior to the 2017 monsoon season. After the 2017 flooding events, nexus households were 38% more likely to strongly agree and 23% less likely to strongly disagree that their Early Warning Task Force worked actively to help them respond to disasters, relative to non-nexus households. Similarly, nexus households were 39.5% more likely to strongly agree and 25.6% less likely to strongly disagree that their Disaster Risk Management Committee (DMC) worked actively to respond and help them recover from disasters during the monsoon than non-nexus households. These findings were associated with an increase for the Janajati caste group over the Dalits caste group, which is not surprising due to the fact that the majority of nexus households in the sample came from the Janajati caste group. Positive opinions of the Early Warning Task Force and DMC were associated with all nexus activities.

Table 13. Linking Social Capital Attitudes (Output) Difference in Means Tests (Pre-Monsoon)

Variable	Non-Nexus	Nexus	Diff
Linking Social Capital			
VDC Chairman works on community's behalf (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.52	3.56	0.04
VDC Secretary works on community's behalf (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.57	3.74	0.17*

Community able to influence CDMC (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.16	4.39	1.23***
Community able to influence District Level Office (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.41	4.08	0.68***
Influence over local and national government (Likert scale 1 = strongly disagree; 5 = strongly agree)	3.81	3.93	0.12

Significance levels: \* < 10% \*\* < 5% \*\*\* < 1%

Table 14: Attitude toward Early Warning Task Force and Disaster Management Committee (Nexus versus non-Nexus households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
DRMC worked actively to respond and help us recovery from disasters (1-5 scale)	645	1.7***	1.3***	1.3***
Early Warning Task Force worked actively to help us respond to disasters (1-5 scale)	646	1.4***	1.2***	1.1***

\*\*\* p<0.01, \*\* p<0.05, \* p<0.0

### Humanitarian Assistance Access

Access to timely aid helps households mitigate the worst effects in the immediate aftermath of a shock<sup>56</sup>. At the time of the survey (three months post-flood) only 29% of households reported having received humanitarian assistance. However, households participating in nexus interventions reported accessing more sources on average than non-nexus households (0.63 more organizations). Specifically, nexus households were more likely to have received assistance from international non-governmental organizations (INGOs) and assistance from their own community after the 2017 flooding events than non-nexus households when controlling for other factors. Interestingly, nexus households reported receiving less assistance from private organizations than non-nexus communities (difference -10%) when controlling for other factors. The models that do not include geographic location in the analysis primarily show that nexus communities received more assistance than non-nexus households. However, when the analysis controls for geographic location (VDC), the difference between nexus and non-nexus communities disappears. This indicates that getting assistance was more dependent on location than on participating in nexus interventions.

Table 15: Able to Access Assistance after Monsoon (Nexus versus non-Nexus households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Number of Organizations providing assistance	760	0.6***	-0.03	-0.04
Assistance from INGOs	760	14%***	5%***	5%**
Assistance from Red Cross	760	18***	-2%	-2%
Assistance from government	760	11%***	-1%	-1%
Assistance from own community	760	25***	3%***	3%**
Assistance from other communities	760	0%	0%	0%
Assistance from private organizations	760	-5%	-8%***	-10%***

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

## Avoidance of Negative Coping Strategies

**KEY FINDING:** Households participating in nexus interventions relied less on negative food coping strategies and money lenders to respond to the 2017 flooding events than non-nexus households. However, these positive results were not achieved by the most marginalized groups (female heads of households and Dalits). Reliance on other negative coping strategies to respond to the 2017 flooding events (migrating for work, taking kids out of school, and selling assets) was not common in both nexus and non-nexus households.

Based on MRED's theory of change, if nexus households are able to access key resources and use specific strategies to prepare and respond to disasters – and are less impacted by flooding, river cutting, and landslides because of this – they will avoid having to rely on negative coping mechanisms in the short-term. This includes taking high interest loans from money lenders, using negative food coping strategies, taking kids out of school to recover financial losses, selling assets that they may have normally kept, and migrating for work.

Overall, nexus households reported lower rates of reliance on negative food coping strategies after the 2017 flooding events than non-MRED households. On average, their negative food coping strategies score was 3.35 points lower than non-MRED households. Considering the mean Coping Strategies Index (CSI) core was about 12, this is a large absolute difference. Further analysis showed that the financial literacy training and DRR (mitigation monitoring and engaging with community disaster committees) contributed most to these positive outcomes. When controlling for head of household gender and caste group, these findings were no



longer statistically significant. Further analysis showed that female-headed households and households in the Dalit caste group were on average worst off in this outcome. This demonstrates that the protective effect of MRED on avoiding negative food coping strategies does not extend to more marginalized groups.

Very few respondents reported migrating for work (8%), taking kids out of school (4%) or selling assets (2%) to respond to the 2017 flooding events. There were no statistically significant differences in these coping behaviors between nexus and non-nexus households. Households were also asked whether they have migrated since the start of the monsoon (not specifically as a response to the flooding). Although more households reported migration since the start of the monsoon, there were no statistically significant differences between nexus and non-nexus communities (46% versus 40%, respectively). Migration can have both negative and positive effects on a community. Members who have migrated usually do so for work and are able to send money (remittances) to members back home. However, having large proportions of communities not present in the community during a disaster can make households and communities more vulnerable during a disaster.

Nexus households took out loans from local money lenders less often than non-nexus households as a response to the 2017 flood events (11% less). However, this effect disappears when controlling for geography and demographic variables. Further analysis showed that female heads of household and households in the Dailt caste group reported higher rates of borrowing from money lenders than male heads of household and the Brahmin/Chetri (most privileged) caste group.

**Table 16: Negative Coping Behaviors in Response to Flooding (Nexus versus non-Nexus households)**

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Coping Strategies Index	760	-3.4***	-2.4**	-1.1
Migration	677	-2%	3%	5**
Took kids out of school	677	0%	1%	2%
Took more debt from money lenders	677	-11%***	-7%	-6%
Sold assets	677	0%	-2%	-2%

\*\*\* p<0.01, \*\* p<0.05, \* p<0.0

## Effects on Wellbeing Outcomes

**KEY FINDING:** Households participating in nexus interventions lost fewer crops and agricultural inputs than non-nexus households after the 2017 flooding events. However, caste and the head of household’s gender may have had the largest influence on these outcomes. Nexus households reported less impact from the 2017 flooding events than non-nexus households.

In MRED’s theory of change, if communities are able to invest in and maintain nexus crops (sugarcane and fodder for dairy), structural mitigation and bio-engineering structures and use key resilience strategies to respond to disasters they will be able to access markets and will lose less land, crops and agricultural inputs when natural disasters occur. This section of the report outlines the effect MRED had on achieving these intermediate outcomes.

### Market Access

Nexus households reported they were able access agriculture inputs after the monsoon 8% less often than non-nexus households. However, this result was only statistical significant to the 90% confidence level. This finding was not significant when VDC level fixed effects were incorporated, which indicates that location may be a better indicator of a household’s access to inputs than participation in nexus activities. All of these impacts combined will reduce the overall impact of flooding, river cutting and landslides on households and communities.

Table 17: Able to Access Agriculture Inputs after Monsoon (Nexus versus non-Nexus households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Able to access crop inputs (after the monsoon)	760	-8%*	-8%	-7%

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

### Land, Crops and Agricultural Inputs Lost Due to Flooding

The average area of agricultural land and total land lost due to the 2017 events is lower among non-nexus households (1,185 square meters and 599 square meters less, respectively). However, this average difference was small and not statistically significant. It is possible that a larger study sample size would have showed a statistically significant difference. It is also probable that large differences were not observed between nexus and non-nexus communities because the flooding was not severe enough to destroy large areas of land in the sampled communities.

Nexus households were associated with a 4.08 quintals (408 kilos) decrease in crops destroyed or lost due to flooding. Although this decrease is relatively small, it is statistically significant. However, when controlling for caste, Janajati households seem to explain the majority of the decrease in crop loss. On average, Janjatis had 6.8 quintals lesser crops lost due to flooding versus other castes. Because of the high number of Janajati households in the treatment group it is possible that caste is diluting MRED’s effect on crop loss<sup>12</sup>. Lastly, Female heads of household were also more likely to report higher crop loss than male head of households (4.2 quintals). As previously mentioned, female heads of households and households in the Dalit caste group live on more vulnerable land and more likely to experience worse effects from flooding.

Nexus households reported lower rates of agricultural input loss due to the 2017 flooding events than non-nexus households (6-8 percentage points lower). However, when adding caste to the model the effect disappears. Janajati households reported that they lost agricultural inputs 23% less often than Dalit households. This is likely explained by the Dalit caste group living on more vulnerable land than the Janajati caste group. Nexus households participating in the dairy interventions were more likely to have suffered from a loss of inputs. This could be due to the fact that hilly areas (where the dairy interventions are more common) experienced more flooding and destruction of fodder (which is planted near the river as a stabilizer and also used as livestock feed).

**Table 18: Land, Crops and Inputs destroyed due to Flooding (Nexus versus non-Nexus households)**

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Loss of agricultural land (square-meters)	401	-1,185	33	287
Total land lost (square-meters)	760	-599	-235	-24
Crop loss (quintal)	641	-4***	-1**	-0.2
Lost agricultural inputs	677	-7%**	-9%**	-6%

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

1 acre = 4,046 square meters; 1 hectare = 10,000 square meters

1 quintal = 100 kilograms

### Severity of Flood Impact

On average, nexus households rated the severity of the flood’s impact on their livelihoods lower than non-nexus households. This corresponds to nexus households being 10% more likely to respond that they experienced “little to no impact” from the flood and 25% less likely to respond that they were “very affected” by the flooding. There were no significant differences between intervention packages and reporting little or no

<sup>12</sup> Because the treatment group had a higher number of Janajati households, the reduction in crop loss being due to being in the treatment group and the reduction being due to being in a more privileged caste group are likely conflating each other

impact from the flood. However, Janajatis were associated with a higher rate (11%) of answering that they experienced little to no impact from the flooding over Dalits. Janajatis were also less likely to report they were “somewhat impacted” from flooding over Dalits (20% higher). Households in the Dalit caste group tend to live on more vulnerable land (closer to the river and landslide areas) than households in more privileged caste groups. All nexus activities were associated with nexus households’ lower likelihood of reporting severe impact from flooding.

Table 19: Subjective Assessment of Impact from Flooding (Nexus versus non-Nexus households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Experienced severe impact from flooding	760	-25%***	-19%***	-20%***

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

**KEY FINDING:** Nexus households reported less income disruption and better diet diversity following the 2017 flooding events. However, these outcomes were not achieved across all MRED communities. Nexus households perceived higher levels of recovery and confidence in their ability to recover from flooding in the future than non-nexus communities.

In MRED’s theory of change, if nexus households are able to access and use key resilience resources and strategies, reduce land, crop, and input loss and avoid negative coping strategies, they will be able to maintain their income and expenditures, have better food security (diet diversity), and have positive perceptions of their recovery and their ability to cope with shocks in the future. This section of the report outlines the effect MRED had on achieving these development outcomes.

### Income Source Disruption and Restarting Income Sources

Nexus households reported less income disruption following the 2017 flooding events (2-13 percentage points less). When controlling for geography, this finding was no longer significant. This indicates that location/ market access may play a part in whether a household’s income was interrupted. Participating in the dairy intervention package was also associated with income disruption, which may be because hilly areas (where the dairy intervention package is more common) were impacted the most by the 2017 flooding events. There were no statistically significant differences in whether nexus versus non-nexus household were able to recover their income if it was interrupted following the 2017 flooding events. It is possible that a longer follow-up period may allow for more differences to appear.

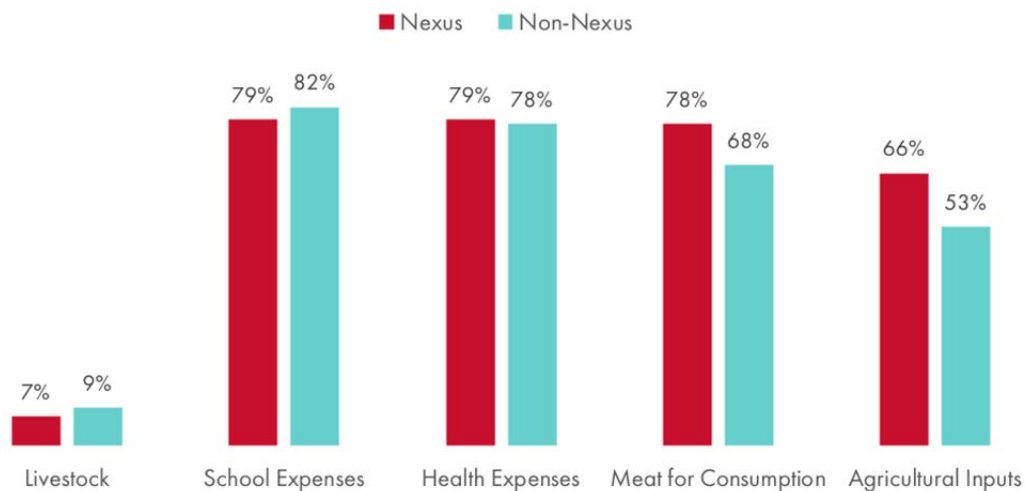
Table 20. Ability to Restart Income Activities

	Nexus	Non-Nexus
Wasn't Interrupted	56% (262)	49% (138)
Not Yet	4% (19)	9% (26)
Just Started	18% (83)	19% (53)
Little	14% (68)	13% (37)
Fully	8% (40)	9% (26)
Total	472	280

### Expenditure and Asset Purchase Past 30-day

Being able to make normal expenditures soon after a shock or stress event is a proxy measure for quick economic recovery. Overall, both nexus and non-nexus households reported spending money on school expenses, meat (for consumption), livestock and health at similar rates in the past 30 days. The high rates of health expenditure may signal that households were experiencing greater than usual illness and injury following the 2017 flooding events (although it is unclear how often households normally spend money on health). However, there were no statistically significant differences between nexus and non-nexus households.

Figure 10: Rates of Different Expenditure in the Past 30 days



## Diet Diversity

Nexus households had better diet diversity than non-nexus households after the flooding events only when taking into account differences due to geography (VDC). This suggests that food access was not uniform across VDCs. The difference in dietary diversity was relatively small (0.5 food groups) and may not be meaningful. Households in the most privileged caste group (Brahmin/Chetri) had much better diet diversity (1.4 food groups) than Dalit households, suggesting that a household's caste had more influence on diet diversity than participation in nexus activities.

Table 21: Economic Recovery and Food Security after Flooding (Nexus versus non-Nexus Households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
<b>Economic Recovery</b>				
Loss of Income Activities	760	-12%***	-6%	-4%
Income resilience	760	5%	16%	16%
Purchased fixed household assets past 30 days	760	0%	0%	1%
Purchased agricultural inputs past 30 days	760	-2%	-13%***	-13%***
Purchased meat for consumption past 30 days	760	2%	-8%	-9%
Paid for health expenses past 30 days	760	-3%	-3%	-3%
Paid for any school expenses past 30 days	760	-7%**	2%	3%
Purchased livestock past 30 days	760	-4%	-2%	-2%
<b>Food Security</b>				
Household Dietary Diversity Score (0-12)	760	-0.08	0.5***	0.4**

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

## Self-Reported Recovery and Ability to Cope with Shocks in the Future

Nexus households were 12% more likely to strongly agree that they had recovered from the 2017 flooding events than non-MRED households when controlling for other factors. Nexus households were also 21.5% more likely to be "fully confident" in their ability to cope with future shocks and stresses than non-nexus households when controlling for other factors. These results did not differ by caste or head of household

gender. Participating in the DRR intervention package contributed the most to nexus households' confidence in their ability to cope with shocks in the future.

## Locus of Control

Households were asked a series of questions about how much control they thought they have over their lives. Feeling like you have control over your life is one way to measure psychosocial wellbeing. Households living in MRED communities were associated with a small but statistically significant lower average locus of control score (a negative outcome). However, this difference was only significant when controlling for geography (VDC), which suggests that the location or local government conditions of the household play a large part in perception of control over their life. Households in the most privileged caste group (Brahim) had higher locus of control score than Dalit households.

Table 22: Psychosocial Wellbeing after Flooding (Nexus versus non-Nexus households)

	Observations	Model 1A: Unadjusted	Model 1B: Geography Control	Model 1C: Geography and Social Controls
Psychosocial				
Locus of control (1-5 scale)	760	-0.2***	-0.02	-0.02
Self-reported recovery (1-5 scale)	760	0.4***	0.4***	0.4***
Ability to cope with shocks and stresses in the future (1-5 scale)	760	0.3***	0.4***	0.4***

\*\*\* p<0.01, \*\* p<0.05, \*p<0.01

# CONCLUSION

The MRED program's "nexus model" aims to build resilience to ecological and economic shocks by implementing program strategies that both mitigate the risk of natural disasters and provide a profitable income generating source. This study sought to evaluate whether the nexus model added value to a traditional DRR approach among communities who experienced several severe flooding events in August 2017 in Western Nepal. Results from this study show a clear benefit of MRED's nexus model over the traditional DRR approach. Households participating in the nexus intervention reported higher rates of key household and community-level capacities and use of these capacities prior, during and after the 2017 flooding events than non-nexus households. After the 2017 flooding events, nexus households perceived higher levels of recovery, were more confident in their ability to recover from future shocks and reported less income disruption than non-nexus households. Although nexus households lost fewer crops and agricultural inputs, relied less on negative coping strategies and had better diet diversity than non-nexus households after the 2017 flooding events, marginalized groups were not able to achieve the same results. Development actors should integrate learning from MRED's nexus approach into future resilience programming by designing integrated intervention approaches that improve existing DRR systems and address context-specific vulnerabilities, embedding market-based incentives into program approaches, focusing on increasing uptake of context and shock-specific strategies and creating transformative change for marginalized groups within target communities so that they able to build resilience even in the most vulnerable groups.



# ANNEX 1: METHODOLOGY CHALLENGES AND LIMITATIONS

The MRED program and the nature of the context of DRR activities poses some potential challenges to conducting the proposed evaluation. The first revolves around the potential for “endogeneity” of outcomes, or the threat that the capacities and outcomes that the program hoped to change were somehow driving participation in the MRED program. This is of particular concern given that MRED treatment communities were not chosen randomly. Like many DRR programs, MRED specifically identified hazard-prone communities which would benefit from risk mitigation. If the treatment communities were substantially more vulnerable to disasters, or less developed economically than the comparison groups, this could be due to unobservable variables that cannot be controlled for when estimating the results. Alternatively, the program may have focused on communities with cohesive, well-functioning leadership in the belief that activities would be more effective and sustainable than in lower-functioning groups. Households who joined the program may also have been either more vulnerable, or more entrepreneurial and motivated, than their counterparts. For these reasons, a simple comparison of the two groups at endline would provide a biased estimate of the program’s impact. The analysis attempts to address this through the use of a PSM model that matches households based on a likelihood of treatment.

The second potential issue and challenge revolves around a dilemma of causality between DRR activities and the ability to mitigate both the severity of disaster and rate of disaster occurrence. We would normally account for this by controlling for disaster-affectedness, allowing the research to estimate the extent to which “MRED reduced the probability of losing property for households that were equally affected by disasters.” However, because MRED activities also aim to make households less likely to be affected by disasters at all, then accounting for it would potentially underestimate MRED’s impact. Instead the analysis relies on geographical proxies that aim to account for wider probability of the occurrence of natural disasters across the communities involved.

Finally, due to sampling constraints, we can only generalize findings to communities in Nepal that are likely to be flood-affected. This is further exacerbated due to the mechanics of PSM that restrict the sample to characteristics of communities and households that are most associated with flood-prone communities that received the MRED program. There may be some underlying characteristics that make this group inherently different from the wider population, prompting caution when applying these findings to other contexts and communities.

# ANNEX 2: DIFFERENCES BETWEEN TREATMENT AND CONTROL GROUPS

## Household Demographics

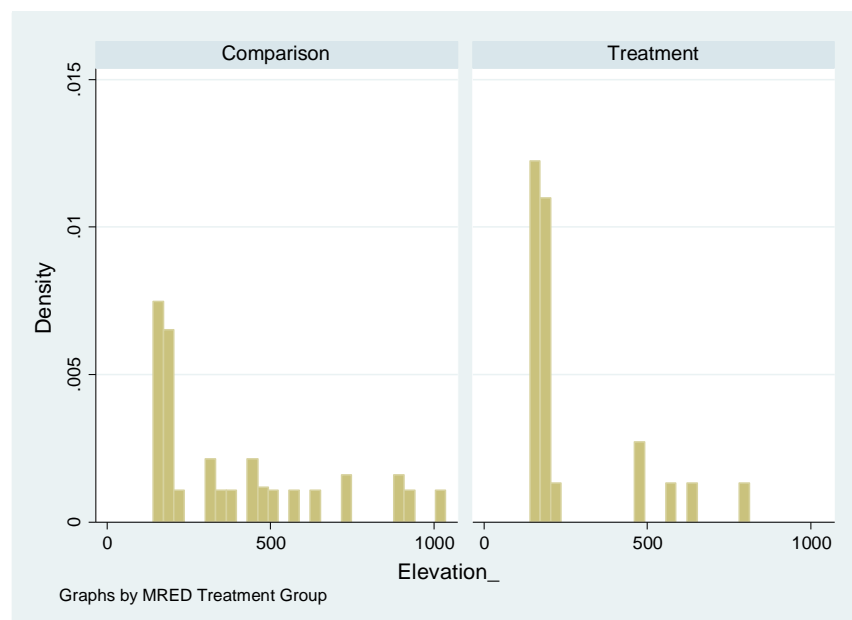
The table below illustrates the balance between research groups. We see that age and caste are unbalanced across treatment and control. The treatment group contains a majority of nearly 70% Janajati, while the comparison group contains a majority of 52% Brahmin/Chettri and a larger portion of Dalit. In the larger MRED population, there are 42% Brahmin/Chettri, 9% Dalit, and 50% Janajati.

Variable	Non-MRED	MRED	Diff
HOH Female	0.87	0.89	0.023
HOH Age	47.86	45.55	-2.314**
Brahmin/Chettri	0.52	0.27	-0.249***
Dalit	0.16	0.04	-0.119***
Janajati	0.3	0.68	0.374***
HH Mem. Migrate Before Flooding	0.5	0.46	-0.035

Significance levels: \* < 10% \*\* < 5% \*\*\* < 1%

Below in Figure 2 you can see the distribution of villages by elevation between the treatment group and comparison groups. A difference of means test revealed that the comparison group was on average more significant at the 99% level of confidence. This suggests that across many key characteristics used for matching the groups are significantly different. This introduces uncertainty when evaluating the results.

Figure 1. Distribution of Treatment and Comparison Groups by Elevation (Meters)



## Coping Strategies Index

Below you will find a graph showing the outcome on the Y-axis and assigned propensity scores on the X-axis. The wedge (>) shape of the comparison groups distribution suggests that these communities may be fundamentally different from each other and from the treatment group. However, the comparison communities overall exhibit higher CSI scores (a negative outcome). This suggests that Nexus communities are associated with less usage of coping strategies.

Figure 2. Binned Scatterplot of 100 Blocks of Mean CSI Scores against estimated propensity scores

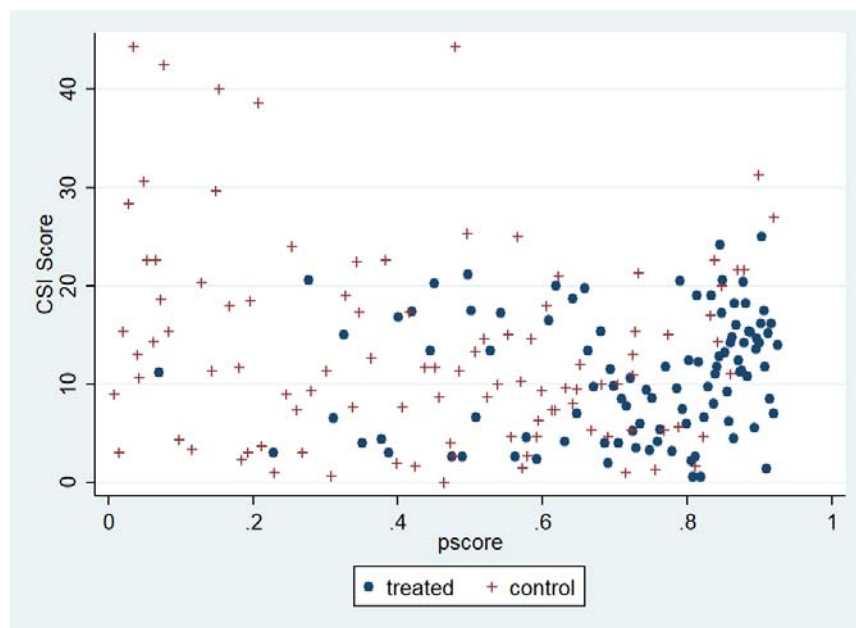
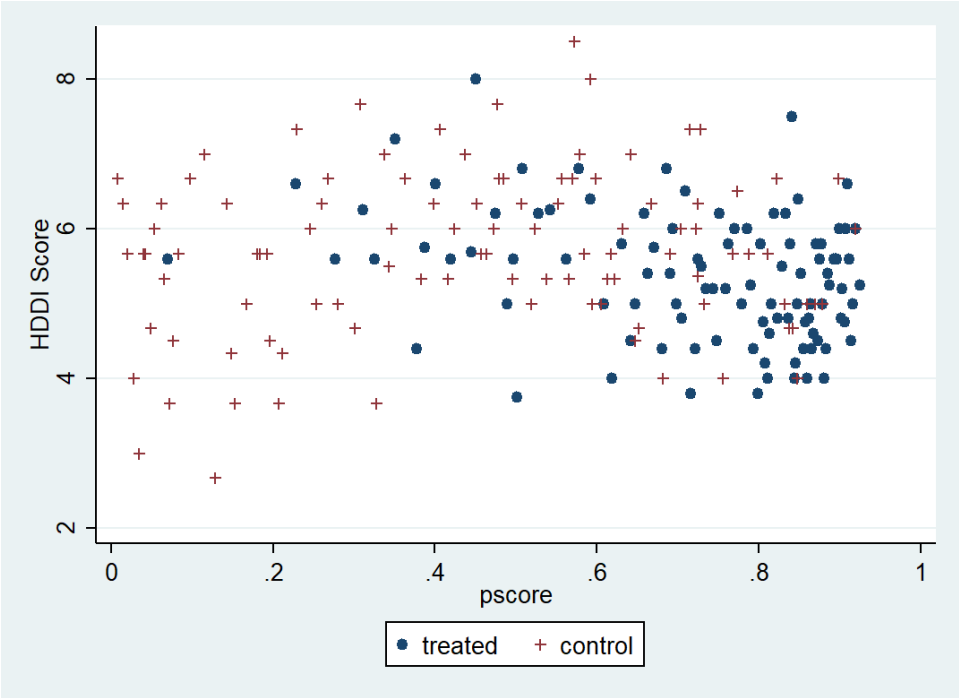


Figure 2 highlights that although treatment groups have some support, comparison groups exhibit a wider range of variation at lower propensity scores. This suggests that we should be cautious in interpreting these findings widely.

### Household Dietary Diversity Index

Figure 3. Binned Scatterplot of 100 Blocks of HDDS Scores against P-scores



# ANNEX 3: FUNCTIONAL FORMS IN MATHEMATICAL NOTATION

## Village Level

$$1A) Y_i = \beta_0 + \beta_1 \text{Treatment Binary} + p(X) + \varepsilon_i$$

$$1B) Y_i = \beta_0 + \beta_1 \text{Treatment Binary} + p(X) + \mu_i + \varepsilon_i$$

$$1C) Y_i = \beta_0 + \beta_1 \text{Treatment Binary} + p(X) + \beta_2 \text{Additional Controls} + \mu_i + \varepsilon_i$$

## Dosage

$$2A) Y_i = \beta_0 + \beta_1 \text{Dosage Factors} + p(X) + \mu_i + \varepsilon_i$$

$$2C) Y_i = \beta_0 + \beta_1 \text{Dosage Factors} + p(X) + \beta_2 \text{Additional Controls} + \mu_i + \varepsilon_i$$

$$2B) Y_i = \beta_0 + \beta_1 \text{Dosage Groups} + p(X) + \mu_i + \varepsilon_i$$

$$2D) Y_i = \beta_0 + \beta_1 \text{Dosage Groups} + p(X) + \beta_2 \text{Additional Controls} + \mu_i + \varepsilon_i$$

These estimates will be inversely weighted by the propensity score to estimate the Average Treatment Effect:  $WATE = \frac{1}{P_i}$  for the treatment group, and  $WATE = \frac{1}{(1-P_i)}$  for the comparison group. The cross-sectional post-ex estimate is considered the best possible estimate for outcomes measured at the endline only, since it benefits from the propensity-score's bias reduction though does not account for baseline values and time trends.

# ANNEX 4: VARIABLE DESCRIPTIONS

Annex 4 Table 1. Pre-Flood/Existing Household Resilience Capacities - Outputs

Capacity	Unit	Question in Survey
Able to buy desired agricultural inputs	Binary (0-1)	Has access to agricultural inputs
Loans	Binary (0-1)	Has access to loans
Formal loans	Binary (0-1)	Has access to formal loans
Insurance (Agriculture/livestock)	Binary (0-1)	Did your family have insurance (ag or livestock)
Savings	Binary (0-1)	Did your family save?
Savings Formal/Informal Access	Binary (0-1)	Has your household had difficulty accessing a local savings group, cooperative, MFI, or Bank?
Remittances	Binary (0-1)	Did your household receive remittances from family members working overseas or in Nepal
Bonding: Trust (community non-community) (caste/non-caste)	Ordinal (1-5)	caste/non-caste members of the same community can be trusted or have to be careful
Bonding: Can rely on others for assistance (Caste/Non-Caste)	Ordinal (1-5)	Rely on members of Caste/Non-Caste in difficult periods
Linking: Connection to local and national government	Ordinal (1-5)	Has connection to CDMC, EWTF
Linking: Influence over local and national government	Ordinal (1-5)	Has Influence over CDMC, EWTF and VDC chairman works on behalf of HH
Attitudes towards women's access to financial resources	Ordinal (1-5)	Gender equity in controlling assets and decision-making on how to use money
Household has disaster response plan (formalized)	Binary (0-1)	Household has plan

Annex 4 Table 2. Community Level Capacities

Capacity	Unit	Question in Survey
Structural Mitigation	Binary (0-1)	Use structural mitigation to protect land
Confident in Bio-engineering	Ordinal (1-5)	Use bio-engineering to protect land
Familiar with Improved Ag Techniques	Binary (0-1)	Use improved agricultural techniques to protect land
Community has DMC	Binary (0-1)	Do you have an active DMC?

Frequency of DMC meetings in past year	Binary (0-1)	Is your community's CDMC active and meeting regularly?
Community has disaster response plan	Binary (0-1)	Does community have DRP
Community has EWS	Binary (0-1)	Does community have EWS

Annex 4 Table 3. Household Flood Response Outcomes

Response	Unit	Question in Survey
Took out loans to respond	Binary (0-1)	Took out loans (formal versus informal) since monsoon
	Binary (0-1)	
Used savings to respond	Binary (0-1)	Used saving since monsoon
Received insurance payout	Binary (0-1)	Received payout since monsoon
Received remittances	Binary (0-1)	Received remittances since monsoon
Drawing on bonding social capital	Ordinal (1-5)	Community worked together on recovery and restoration measures after monsoon
	Ordinal (1-5)	Can count on members of own community after monsoon
	Ordinal (1-5)	Participated in Perma after monsoon
	Ordinal (1-5)	Can count on members of own caste after monsoon
Drawing on bridging social capital	Ordinal (1-5)	community worked together with members of OTHER communities on recovery and restoration measures after monsoon
	Ordinal (1-5)	Can count on members of other communities after monsoon
	Ordinal (1-5)	Can count on members of other castes after monsoon
	Ordinal (1-5)	Trust in other communities
Received assistance post-disaster	Number	Number of aid sources
Accessed emergency fund	Binary (0-1)	Received support from Emergency Management fund after monsoon
Household knows how to respond in case of disaster	Binary (0-1)	Does the HH have a plan in place to response to EWS

Annex 4 Table 4. Household High-Level Response Outcomes

Outcome	Unit	Question in Survey
Coping Strategies Index	Index (0-100)	Negative coping strategies to access food
Other coping responses	Binary (0-1)	Migration
	Binary (0-1)	Took kids out of school
	Binary (0-1)	Took more debt from money lenders
	Binary (0-1)	Sold assets
Sold assets	Number	Number of different assets sold
Migration	Binary (0-1)	Did a member of the household have to migrate for income

Annex 4 Table 5. Community / System / DRR / Market response indicators - Outcomes

Outcome	Unit	Question in Survey
DRMC was active after monsoon	Binary (0-1)	DRMC worked actively to respond and help us recovery from disasters
Early Warning Task Force was active during monsoon	Binary (0-1)	Early Warning Task Force worked actively to help us respond to disasters
Input Access	Binary (0-1)	Able to access crop inputs (after the monsoon)

Annex 4 Table 6. Disaster Mitigation / Community Outcomes

Outcome	Unit	Question in Survey
Loss of Land	Binary (0-1)	Did the household lose any land due to flooding
Loss of Property	Binary (0-1)	Did the household lose any agricultural inputs due to flooding
Crop loss	Quintals (100 kgs)	Amount of crops lost
Loss ag inputs	Number	Amount of crop inputs lost



Annex 4 Table 7. Flood Exposure Outcomes

Outcome	Unit	Question in Survey
Flood severity	Ordinal (1-5)	Perception of flood severity by the household

Annex 4 Table 7. Income Source Disruption Outcomes

Outcome	Unit	Question in Survey
Loss of Income Activities	Binary (0-1)	Did the household lose any sources of income
Restart Income Activities	Binary (0-1)	Did the household restart those lost income activities

Annex 4 Table 8. Economic Wellbeing Outcomes

Outcome	Unit	Question in Survey
HDDS	Index (0-12)	Household Dietary Diversity Index
Expenditure	Binary (0-1)	Does household direct expenditure to livestock, school expenses, health, meat, ag inputs, and household assets

Annex 4 Table 9. Psychosocial Wellbeing Outcomes

Outcome	Unit	Question in Survey
Locus of Control	Average of Ordinal (1-5)	Average locus of control over 5 questions
Self-reported recovery	Ordinal (1-5)	To what extent do you feel your household has recovered from this shock
Ability to cope with shocks and stresses in the future	Ordinal (1-5)	How confident are you that you will be able to cope with shocks and stresses in the future?

# ANNEX 5: RESULTS TABLES

Confidence Level	Contribution to Result	Color
99 Percent- Strong	Positive	<span style="background-color: #4CAF50; color: white;"> </span>
95 Percent- Likely	Positive	<span style="background-color: #8BC34A; color: white;"> </span>
99 Percent- Strong	Negative	<span style="background-color: #F44336; color: white;"> </span>
95 Percent- Likely	Negative	<span style="background-color: #E57373; color: white;"> </span>

Annex 5 Table 1. Contribution of Intervention Packages to Resilience Responses

Contribution of Intervention Package	Observations	Nexus: Sugarcane	Nexus: Dairy	DRR
<b>Financial Services</b>				
Used Formal Loans After	760			
Used Informal Loans After	760	<span style="background-color: #4CAF50; color: white;"> </span>		
Used Savings After	760			<span style="background-color: #8BC34A; color: white;"> </span>
Received Insurance Payment (Agriculture/livestock)	760			
Received Remittances	332		<span style="background-color: #8BC34A; color: white;"> </span>	<span style="background-color: #8BC34A; color: white;"> </span>
<b>Bonding Social Capital (1-5 scale)</b>				
Bonding: Own community Recovery	691	<span style="background-color: #4CAF50; color: white;"> </span>		<span style="background-color: #4CAF50; color: white;"> </span>
Bonding: Can count on own community after monsoon	757		<span style="background-color: #8BC34A; color: white;"> </span>	
Bridging: can count on other communities after monsoon	755	<span style="background-color: #8BC34A; color: white;"> </span>		<span style="background-color: #8BC34A; color: white;"> </span>
Bonding: Perma	701	<span style="background-color: #4CAF50; color: white;"> </span>		<span style="background-color: #4CAF50; color: white;"> </span>
<b>Bridging Social Capital (1-5 scale)</b>				
Bridging: Other community Recovery	665	<span style="background-color: #4CAF50; color: white;"> </span>		<span style="background-color: #4CAF50; color: white;"> </span>
Bonding: count on own caste after monsoon	693	<span style="background-color: #F44336; color: white;"> </span>		<span style="background-color: #4CAF50; color: white;"> </span>
Bridging: count on other castes after monsoon	701			
Bridging: Trust non-community	752			<span style="background-color: #4CAF50; color: white;"> </span>
<b>Linking Social Capital</b>				
Number of Organizations providing assistance	760	<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>
DRMC worked actively to respond and help us recovery from disasters (1-5 scale)	645	<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>
Early Warning Task Force worked actively to help us respond to disasters (1-5 scale)	646	<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>
<b>Market Access</b>				
Able to access crop inputs (after the monsoon)	760	<span style="background-color: #F44336; color: white;"> </span>	<span style="background-color: #F44336; color: white;"> </span>	<span style="background-color: #F44336; color: white;"> </span>
<b>Disaster Risk Reduction / Early Warning System (EWS) Response</b>				
Household has disaster response plan	760		<span style="background-color: #4CAF50; color: white;"> </span>	<span style="background-color: #4CAF50; color: white;"> </span>
Received early warning information during flood	760		<span style="background-color: #8BC34A; color: white;"> </span>	<span style="background-color: #8BC34A; color: white;"> </span>

Evacuate to safe place (EWS response)	760			
Collect documents and assets (EWS response)	760			
Evacuate livestock (EWS response)	760			
Go to top of the house (EWS response)	760			
Warn neighbor (EWS response)	760			
Do nothing (EWS response)	760			

Annex 5 Table 2. Contribution of Intervention Packages to Negative Coping Behaviors

	Observations	Nexus: Sugarcane	Nexus: Dairy	DRR
Coping Strategies Index	760			
Migration	677			
Took kids out of school	677			
Took more debt from money lenders	677			
Sold assets	677			

Annex 5 Table 3. Contribution of Intervention Packages to Land, Crops, Inputs Destroyed and Flood Severity

	Observations	Nexus: Sugarcane	Nexus: Dairy	DRR
Loss of agricultural land (square-meters)	401			
Total land lost (square-meters)	760			
Crop loss (quintal)	641			
Lost agricultural inputs	677			
Severe impact from flood	760			

1 acre = 4,046 square meters; 1 hectare = 10,000 square meters

1 quintal = 100 kilograms

Annex 5 Table 4. Contribution of Intervention Packages to Recovery and Wellbeing Outcomes

	Observations	Nexus: Sugarcane	Nexus: Dairy	DRR
<b>Economic Recovery</b>				
Loss of Income Activities	760			
Income resilience	760			
Purchased fixed household assets past 30 days	760			
Purchased agricultural inputs past 30 days	760			
Purchased meat for consumption past 30 days	760			
Paid for health expenses past 30 days	760			
Paid for any school expenses past 30 days	760			
Purchased livestock past 30 days	760			
<b>Food Security</b>				
Household Dietary Diversity Score (0-12)	760			

Psychosocial				
Locus of control (1-5 scale)	760			
Self-reported recovery (1-5 scale)	760			
Ability to cope with shocks and stresses in the future (1-5 scale)	760			

Annex 5 Table 4. Differences in Results by Gender and Caste

	Observations	Female head of household (vs. male)	Brahmin/Chetri Caste (vs. Dalit Caste)	Janajati Caste (vs. Dalit Caste)
<b>Response to Flooding</b>				
Bonding: can count on own community after monsoon (1-5 scale)	757	-0.2**		
Bridging: can count on other communities after monsoon (1-5 scale)	755		0.4**	
Bridging: Trust non-community (1-5 scale)	752	0.2**		
Number of Organizations providing assistance	760	0.1***		
DRMC worked actively to respond and help us recovery from disasters (1-5 scale)	645			0.5**
Able to access crop inputs (after the monsoon)	760	12%**	-13%**	
Household has disaster response plan	760		10%**	15%***
Evacuate livestock (EWS response)	760	14%***		
<b>Negative Coping Behaviors</b>				
Coping Strategies Index	760	3.5**	-10***	-13***
Took more debt from money lenders	677	12%**	-23%**	
<b>Land, Crops, and Inputs Destroyed &amp; Flood Severity</b>				
Crop loss (quintal)	641	4**		-7***
Lost agricultural inputs	677			-23%**
<b>Wellbeing Outcomes</b>				
Loss of Income Activities	760		-15%**	
Household Dietary Diversity Score (0-12)	760		1.4***	0.8**
Locus of control (1-5 scale)	760		0.2**	

1 quintal = 100 kilograms

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### About Mercy Corps

Mercy Corps is a leading global organization powered by the belief that a better world is possible. In disaster, in hardship, in more than 40 countries around the world, we partner to put bold solutions into action — helping people triumph over adversity and build stronger communities from within.

Now, and for the future.



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