

MARCH 2018



An Analysis of Food Security Resilience in Rural Nepal

A FEINSTEIN INTERNATIONAL CENTER PUBLICATION 

Poshan Dahal, Jeeyon Janet Kim, Daniel Maxwell, Matteo Smerlak,
Elizabeth Stites, and Bapu Vaitla

Tufts
UNIVERSITY

FRIEDMAN SCHOOL OF
NUTRITION SCIENCE AND POLICY

Feinstein
International Center



Citation: Dahal, Poshan, Jeeyon Janet Kim, Daniel Maxwell, Matteo Smerlak, Elizabeth Stites, and Bapu Vaitla. *An Analysis of Food Security Resilience in Rural Nepal*. Boston: Feinstein International Center, Tufts University, 2018.

Corresponding author: Bapu Vaitla
Corresponding author email: vaitla@hsph.harvard.edu

Photo credits

Cover photo: Jeeyon Janet Kim

Page 6, clockwise from top left: Jeeyon Janet Kim; Bhaskar Bhattarai/USAID (<https://creativecommons.org/licenses/by-nd/2.0/>); Jeeyon Janet Kim; Robert Stansfield/Department for International Development (<https://creativecommons.org/licenses/by/2.0/>)

Images 1, 4-7: Jeeyon Janet Kim

Images 2-3: Asian Development Bank (<https://creativecommons.org/licenses/by-nc-nd/2.0/>)

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of author/organization and do not necessarily reflect the views of USAID or the United States Government.

Copyright 2017 Tufts University, all rights reserved.
"Tufts University" is a registered trademark and may not be reproduced apart from its inclusion in this work without permission from its owner.

**Feinstein International Center, Friedman School of
Nutrition Science and Policy
Tufts University**

114 Curtis Street
Somerville, MA 02144 USA
Tel: +1 617.627.3423
Twitter: @FeinsteinIntCen
fic.tufts.edu

Acknowledgements

We would like to thank the following people for their contributions to this report, and for supporting FIC's research in Nepal for the last several years: Cary Farley, Jon Kurtz, Olga Petryniak, Kyung Endres, Sagar Pokharel, Mark Pommerville, Jared Rowell, Justin 'Jay' Jackson, Bradley Sagara, and Jess Cote. Many thanks to Ms. Gomati Awasthi for her invaluable contributions to the qualitative component of this project. Jeeyon Janet Kim also gratefully acknowledges the support of the Gerald J. Friedman Fellowship in Nutrition and Citizenship. Thank you to the enumerators who helped collect the data in Maulali: Ishowari Kumari Abasty, Ramesh Bahadur Bohara, Rana Bahadur Dakarmi, Shiva Raj Joshi, Prakash Bahadur Karmi, and Menaka Kumari Upadhyay. We gratefully acknowledge the support of Mercy Corps' staff in both Kathmandu and in the Far West. Last but not least, we are indebted to the women and men of Maulali who so generously shared their experiences, challenges, and hopes; *dhanyavaad*.

Contents

Acknowledgments	3
Acronyms	5
Glossary of local terms	7
Executive summary	8
1. Introduction	26
1.1 Objectives	26
1.2 Timeline and implications of shortened project	26
2. The Food Security Monitoring System	31
2.1 Overview	31
2.2 Household trajectories of FCS and CSI	32
2.3 Measuring resilience	35
2.4 Building a resilience monitoring system	40
2.4(a) Logistics and cost of scale-up	40
2.4(b) Future prospects: Passively collected digital data	43
3. The determinants of food security	46
3.1 Capital stocks and flows	46
3.1(a) Human capital	46
3.1(b) Financial capital	52
3.1(c) Physical capital	54
3.1(d) Social capital and community networks	56
3.2 The drivers of food security	62
3.2(a) Conceptual framework and analytical methodology	62
3.2(b) The analysis	64
4. Transnational migration and remittances	70
4.1 Migration as “livelihood strategy”	71
4.2 Migration’s effect on food security	78
4.3 Migration’s effect on family	81
4.4 Intra-household roles and responsibilities	85
5. Conclusion: Programmatic implications	88
References	93
	95

Acronyms

ACF	Autocorrelation Function
CDR	Call Detail Records
CV	Coefficient of Variation
CSI	Coping Strategies Index
DHS	Demographic and Health Surveys
FCS	Food Consumption Score
FGD	Focus Group Discussion
FIC	Feinstein International Center
IME	International Monetary Exchange
LGCDP	Local Governance and Community Development Program
MOD	Mobile Operator Data
MSE	Mean Squared Error
NPR	Nepalese Rupee
PAF	Poverty Alleviation Fund
PAHAL	Promoting Agriculture, Health, and Alternative Livelihoods
RMSE	Root Mean Squared Error
TLUs	Tropical Livestock Units
VDC	Village Development Committee



Glossary of Local Terms

Bhagne A phenomenon of adolescent boys escaping the strict controls of their village to explore life beyond

Bhat Rice

Brahmin Highest social class in the Hindu caste system

Chhetri Second highest social class in the Hindu caste system

Chithi Informal credit pooling cooperative in which one member receives funds per month

Daal Split pulses, such as lentils, peas, or beans

Damai Dalit caste

Kami Dalit caste

Matey An arrangement in which a landowner allows another farmer to cultivate his/her land in exchange for a loan; land use rights return to the owner when the loan is repaid

Padimu A labor sharing arrangement in which families help each other in agricultural activities, especially planting and harvesting; neither cash nor food are paid when one family helps another, but there is an expectation that the other party will return the assistance when needed

Roti Flat bread made from wheat flour

Seth A term that refers to a wealthy person who employs a laborer

Vogecchak magne A coping strategy in which a Dalit household requests food from higher-caste families, especially employers or patrons

Executive Summary

The Promoting Agriculture, Health, and Alternative Livelihoods (PAHAL) consortium, led by Mercy Corps and funded by USAID/FFP, commissioned the Feinstein International Center (FIC) of the Friedman School of Nutrition Science and Policy at Tufts University to study resilience in food-insecure areas of rural Nepal. The research had four major objectives:

1. To implement a low-cost quantitative food security resilience monitoring system;
2. to develop a theoretical framework and quantitative methodology for analyzing the determinants of household food security;
3. to qualitatively explore important drivers of food security resilience, especially transnational migration; and
4. to use the results to inform PAHAL's programmatic activities.

We implemented the research in the village development committee (VDC) of Maulali, in Bajhang district of the Far West region. The project was originally slated to run from September 2014 to August 2019, with field data collection commencing in October 2015 and running for 42 months. However, based on the changing priorities of the donor and consortium and upon agreement between FIC and PAHAL, research activities terminated in June 2017.

Implications of shortened implementation of the research

The shortened period of data collection had implications for the results presented in this report. With respect to **Objective 1**, our resilience measurement methodology (described in the Year 1 Report) relies on a minimum number of data points to produce accurate results. The 15 monthly data points for each household do not adequately eliminate noise in the resilience signal. This is partly because the Maulali field site did not experience

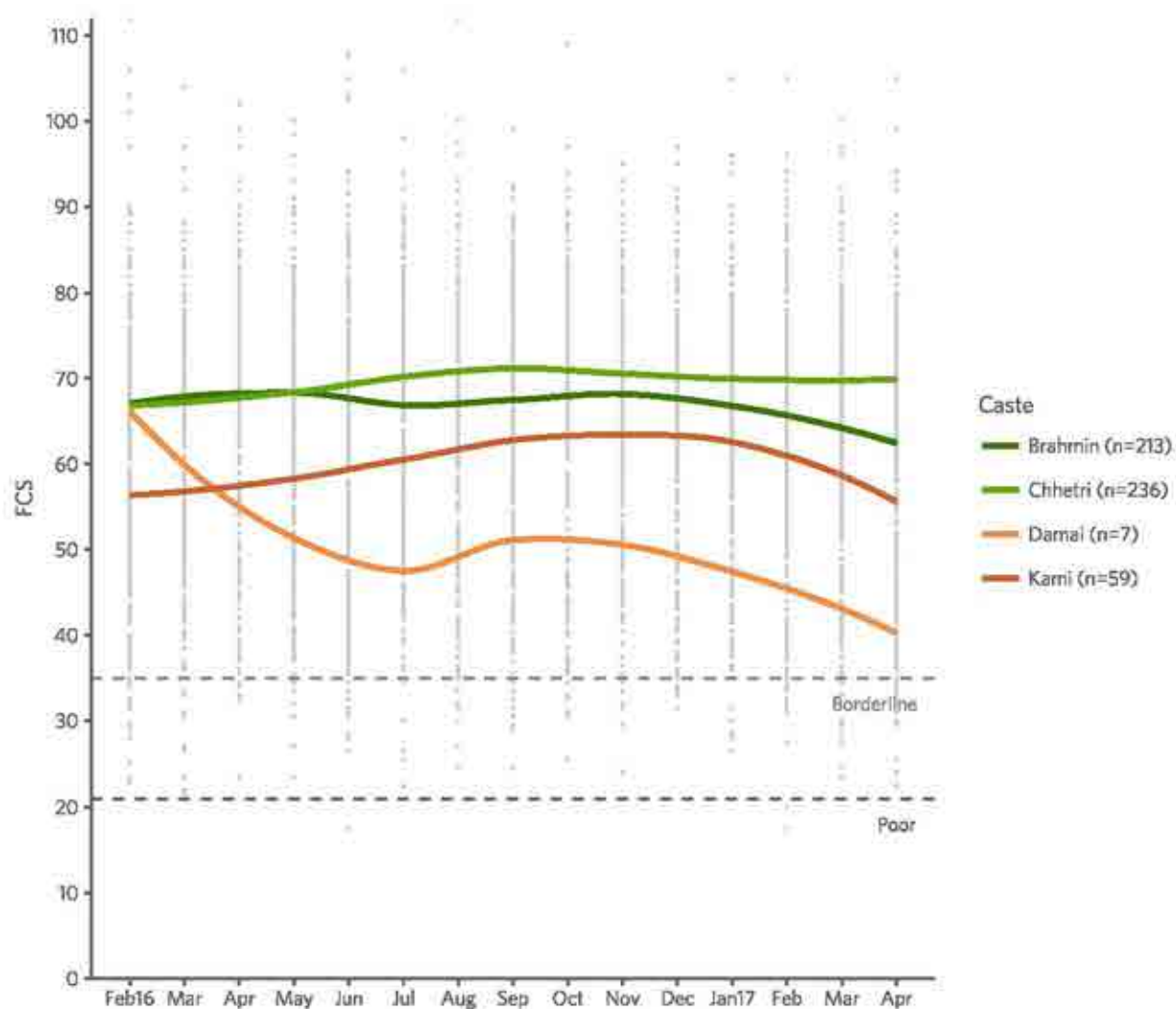
major acute shocks to food security over the research period, despite its being initially selected because of its status as one of the most shock-prone and food-insecure VDCs in Nepal. In addition, the shorter-than-expected research timeline forestalled the planned geographic expansion of food security surveillance using mobile operator data. Despite these constraints, community-level resilience can still be evaluated with the collected data.

Objective 2 is affected by the shortened research period to the extent that the lack of shocks and the remittance income flows led to limited variation in food security outcomes, both over time in the same household and across households in the VDC. However, the baseline and subsequent four rounds of capital flows data still provide a considerable amount of information by which to analyze the variation in food security and other well-being outcomes that we do see.

With respect to **Objective 3**, a qualitative investigation of the drivers of food security, we found that transnational migration and remittances were the key factors in allowing household resilience. We conducted extended field research in both the origin location, Maulali, and a scoping trip to the primary migrant destination, the city of Bangalore in India. Although research in India was not approved under the PAHAL grant, we are seeking external funds for this work. Hence while the shortened project timeline means we were unable to investigate this critical migratory and economic link, our results from Maulali provide important insights into how a migration-centered livelihood strategy affects household food security and intra-household gender dynamics.

Regarding **Objective 4**, given early termination of research and the delayed implementation of PAHAL's activities, we are not able to provide location-specific programmatic recommendations. However, using evidence from Maulali, we make a case for PAHAL to generally adopt a dual approach, focusing on facilitating transnational livelihoods

Figure A. FCS score by caste, over all 15 rounds of the survey. Colored lines are lowess smoothers.



while also supporting family members left behind and those who may choose not to migrate.

Objective 1: Measuring food security resilience

Trajectories of food security

As measured by two food security indicators, the Food Consumption Score (FCS) and the Coping

Strategies Index (CSI), the food security situation in Maulali is much better than expected, despite the VDC's historical status as a chronically food insecure VDC. This is likely due to the strong effect of remittances in supporting food consumption. However, we see significant differences across caste groups; Figure A shows household FCS observations (gray dots) and caste-specific trend lines (colored lines). Using the typical FCS categorical cut-offs, only four times in the survey period did any household report "poor" consumption, and only 156 times (2.1% of all observations) did a household report "borderline" consumption.

Trends of the constituent food groups within the FCS score (Figure 4 in Section 2.2), however, suggest that the constancy of the aggregate scores mask some internal seasonal variation in dietary composition. Similarly, coping behaviors measured by the CSI are most commonly reported between January and April, when food stocks from the last harvest are diminishing and the winter wheat and barley crops have not yet matured.

We note also that the association between FCS and CSI scores is weak for the 7,456 household observations over 15 rounds (Figure 6 in Section 2.2), suggesting that the two indicators may be gathering information on overlapping but distinct aspects of food security. Food security is multi-dimensional, and no single indicator is likely to capture all relevant aspects.

Measuring resilience

Our approach to quantifying resilience is based on autocorrelation, the relationship of present well-being to past well-being (see Year 1 Report for more details). A correlation coefficient of zero suggests that household food security in the present is unrelated to the past; a positive coefficient indicates that current food security tends to be similar to the past; and a negative coefficient that present food security tends to be inversely related to the past. In the context of ongoing shocks and stresses, therefore, a negative coefficient implies resilience—an ability to overcome past adverse events. A positive coefficient implies “holding on” to shocks. In Maulali, most households have a negative autocorrelation coefficient (Figure B). The mean household in Maulali has an ACF1 coefficient

Figure B. FCS resilience, as indicated by food security autocorrelation, of households in Maulali.

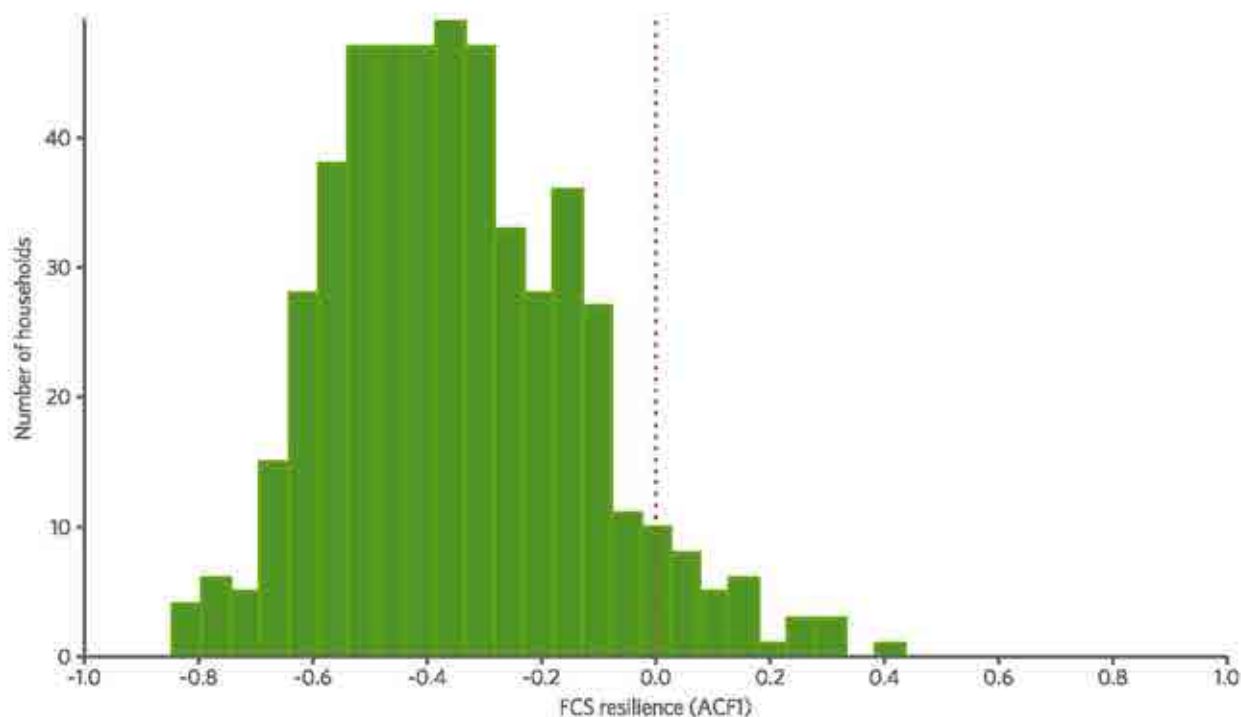
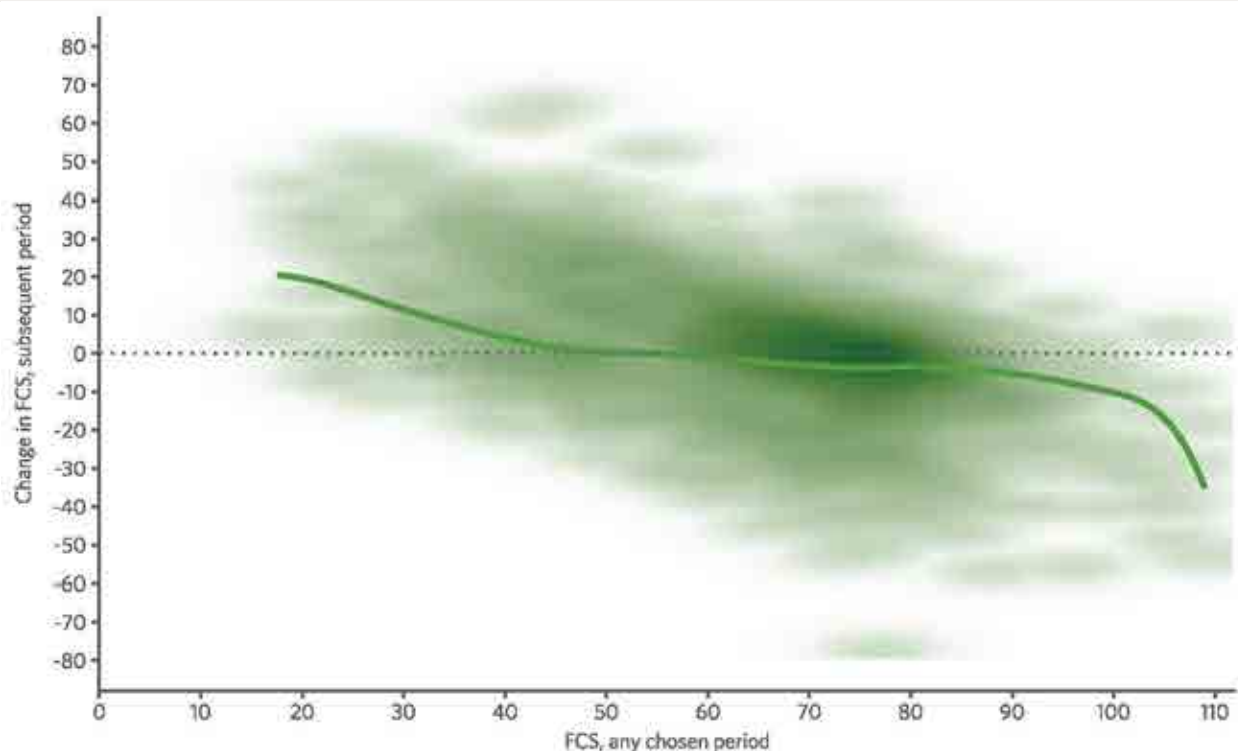


Figure C. Period-to-period change in FCS.



of -0.35, and the median household -0.37. Overall, households in Maulali are relatively food security resilient, as measured by FCS.

Unfortunately, the low number of data points in our dataset—15, instead of the anticipated 42—hinders our ability to assess household-level resilience. This is a sampling issue: much like samples taken over a small area in space produce biased, high-variance estimates of a group mean (at a single point in time), samples taken over a small timespan produce biased, high-variance estimates of the mean over time (for a single household or other unit).

We can, however, obtain a general sense of household-level resilience by looking at change in FCS from period to period (Figure C). Despite the fact that households reported a diverse set of

stressors occurring during the survey period (see Section 4), food security was not adversely affected. We also see a tendency toward increased FCS when the benchmark score is very low (left side of graph) and a tendency toward decreased FCS when the benchmark score is very high (right side of graph), suggesting a possible “food security equilibrium” in the middle of the FCS range. However, we have too few observations to determine whether these trends are structural or the result of noise. The key point is that food consumption, as measured by FCS, is generally stable; households in Maulali are resilient.

We also measured the distinct concept of “resistance”—the ability to absorb shocks without suffering a food security impact—by calculating the coefficient of variation (CV; standard deviation divided by the mean) of the FCS of each household.

We found that households in Maulali are quite resistant to shocks and stresses (see Figure 10 in Section 2.3). For the median household, FCS standard deviation is just 15% of the mean FCS score over all rounds of the survey. We again note variance between castes: the Dalit castes, Damai and Kami, have lower resistance than Brahmin and Chhetri families.

Building a PAHAL food security monitoring system

An FCS/CSI-based food security resilience monitoring system can be implemented rapidly and inexpensively. In the Maulali research design, six full-time enumerators working six days a week for two weeks—approximately 400 person-hours—covered 505 households in each round for the food security survey. The use of mobile data collection made high-frequency data collection possible, especially in the context of remote management, and greatly reduced data cleaning time.

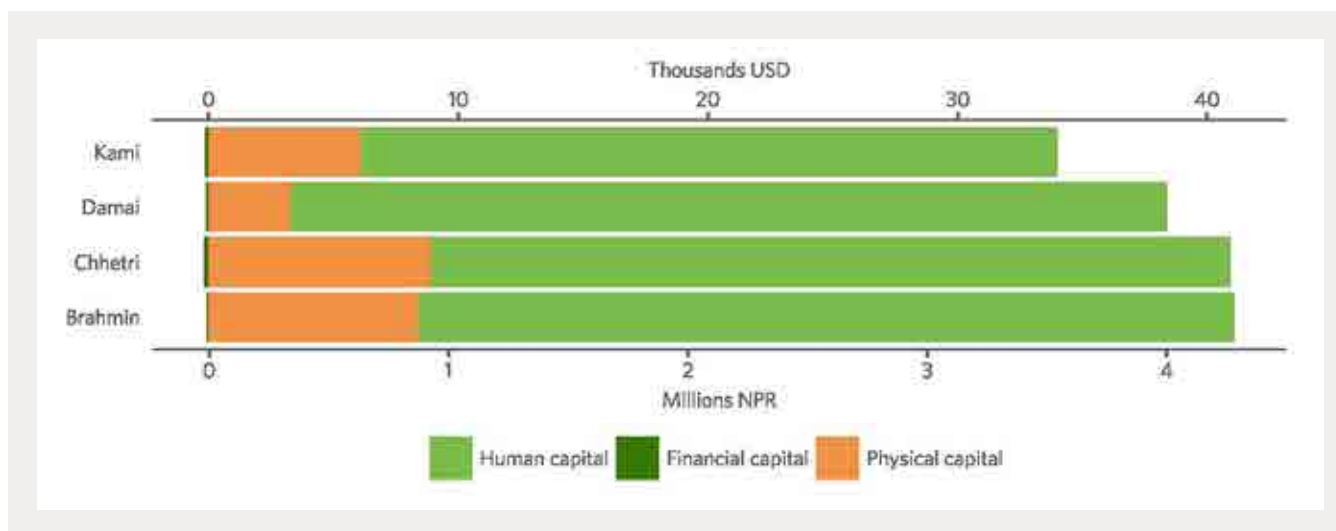
We estimate that a food security resilience monitoring system based on FCS and CSI, using local enumerators in a similarly sized village, would cost about \$400/month to run, or approximately

\$2/household/month, plus any management costs for data collection supervisors, analysts, etc. We also calculated potential costs for scaling up such a system to the entire PAHAL area. Given the sample sizes required to obtain representative statistics in each VDC, and the assumptions of simple random sampling, a 95% confidence level, and acceptable error of 5%, 21,636 households will need to be sampled across the 84 PAHAL VDCs. In addition to one-time scoping and training investments for the 84 sites, maintaining the food security monitoring system for the entire PAHAL area would require just under \$45,000 every month. The annual operating costs thus amount to about \$540,000 to cover the whole PAHAL area. An FCS/CSI-based food security monitoring system is thus feasible for at least a subset of PAHAL VDCs.

We reiterate that building such a system demands intensive sampling over time, which comes with tradeoffs in the ability to sample over space. However, digital data, especially passively collected cell phone data, can greatly assist in high-frequency, high spatial resolution measurement of well-being (see Section 2.4(b)).



Figure D. Capital value by type of stock.



Objective 2: The determinants of resilience

The second objective of this research is to look at the forces that drive variation in food security, both across households and across time within a given household. We extend the set of possible determinants to include not only the typical predictors—human capital and demographic characteristics (sex of household head, caste, education, etc.), as well as physical and financial capital (material assets, net debt/savings, etc.)—but also consider social capital, which we capture by analyzing the structure of community networks: the web of relationships within which economic transactions are made. We find that over 78% of all capital value held by households in Maulali is in the form of human capital (Figure D).

Human capital

We found that labor, more than land, livestock, or financial capital, is the primary resource families in Maulali have for generating income and improving

food security. Labor markets in and around Maulali, however, are weak. Over the last year of the research, only 31% of Maulali's population between the ages of 18 and 65 found work, and only a third of these jobs were regular employment; the rest was irregular manual labor piece work, especially in construction and agriculture. Nearly half of the available regular jobs are in schools, with NGOs (including the PAHAL program) and shops being the other major providers of regular employment. In all, the 267 individuals in Maulali who found work earned a mean of 506 NPR/day for 70 days per year, for a total individual mean income of 35,420 NPR (\$340). Wage work is indeed an important source of family income in Maulali—if one can find a job.

Given the importance of human capital, optimizing the value of a household's capital stock entails a search for optimally remunerative labor markets, leading to extensive transnational migration. Nearly one quarter of Maulali's household members, and over 36% of its men, live and work in India. Taken together, these observations suggest that the development of nearby urban job markets for youth graduating from school may be the most important long-term intervention that could be undertaken if supporting local livelihoods is the goal; developing

Figure E. Stocks of different types of financial capital, by caste and survey round.

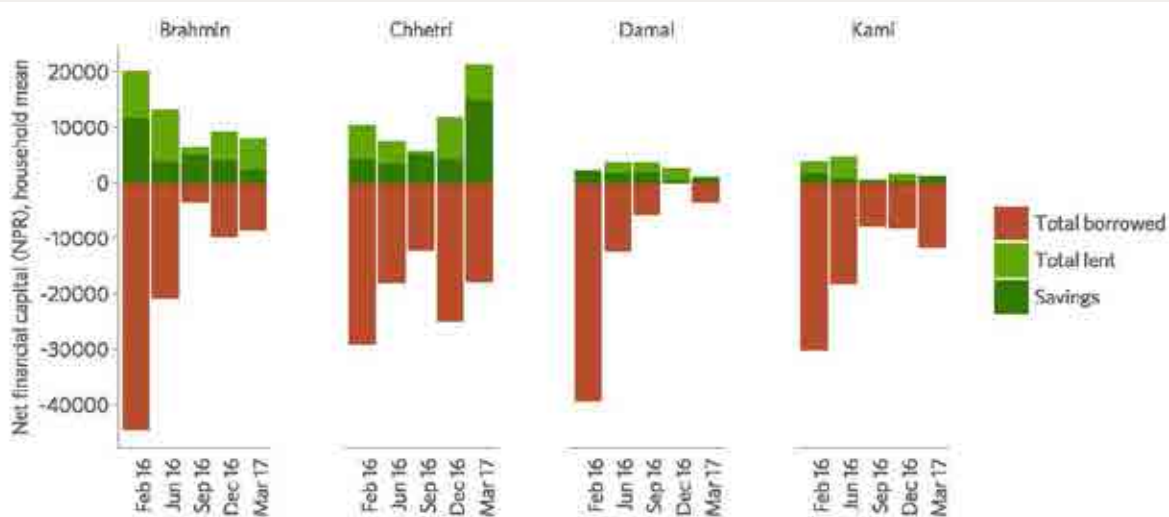
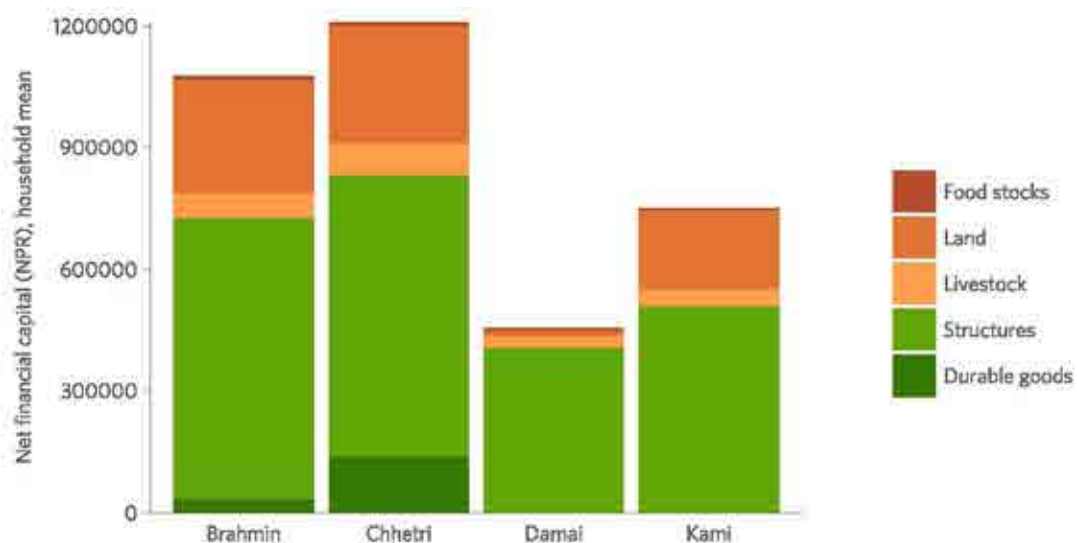


Figure F. Stocks of different types of physical capital, by caste.



safe, profitable possibilities for transnational work may be the quickest means of improving livelihoods more generally.

In addition to wage work, labor sharing is an important part of work life in Maulali, particularly through *padimu*, an arrangement in which families help each other in agricultural activities, especially planting and harvesting. No wages, in cash or food, are paid when one family helps another, but there is an expectation that the other party will return the assistance when needed. The volume of *padimu* work is considerable; in the last year of the survey, over 2,300 hours of labor was exchanged between 261 households. These flows equaled nearly 1.2 million NPR worth of labor, equivalent to about 12% of all cash income obtained through wage work.

Financial capital

The amount of net financial capital households possess is varied, but the median household—which encompasses 24–39% of families, depending on the survey round—has no financial capital at all. In addition, the mean household is in fact in debt. We see strong differences across survey rounds; stocks of financial capital appear to be quite fluid, changing in response to remittance income, agricultural loans, and other flows. We also observe variation across castes; in general, savings and lending is dominated by Brahmin and Chhetri families; net debt is greater among Dalit castes (Figure E). However, a large group of households, about 40% of families in Maulali, are left out entirely from the lending/borrowing network.

Physical capital

The mean stock of physical wealth per capita in Maulali is 219,630 NPR, or about \$2104. At the household level, the median Kami family has 621,427 NPR (~\$5952) worth of physical capital and only a very few have more than 1.3 million NPR; in contrast, median Brahmin and Chhetri households have over 800,000 NPR in wealth, and many exceed 1.5 million.

In an environment of serious ecological hazards, weak local labor markets, and heavy dependence on remittances, families choose to invest in structures, especially houses (Figure F). Many households are using remittance income to buy houses not only in Maulali, but also in the district capital of Chainpur, the market center of Dadeldhura, and the border city of Dhangadhi to the south. Families perceive construction to be a more secure investment, in terms of current value and future appreciation, than livestock and local land. The median household in Maulali owns only 1/20th of a hectare and 0.77 tropical livestock units.

Food stocks, dominated by paddy rice and wheat, vary seasonally, with quantities peaking in the September–December postharvest period. Dalit castes have considerably lower stocks of food throughout the year, and especially in the hunger season from June to August. In June 2016, for example, the mean Kami household had only 90 kilograms of stored food on hand, or around 24 kg per capita—around a month’s supply.

Social capital

The census design of our research allows us to conceptualize social capital in terms of network properties. We can visualize Maulali's economy in a single diagram that sums all types of capital flows—labor contracts and padimu labor sharing, wages and other cash transfers, land, livestock, loans, sharecropping and matey value, and gifts (Figure G).

The size of each household-circle in the figure is proportional to the size of its capital stock per capita. The width of the links connecting households is proportion to the size of total capital flow. The position of the households corresponds to their actual geographic location within Maulali. The figure

illustrates several features. First, we see that castes tend to cluster together in space. Second, we see that proximity is not the fundamental determinant of capital flow; households exchange with others across the VDC. Third, when human capital is considered, there is relative equality of wealth in the community, after adjusting for household size.

Tracing capital flows allows us to quantify certain social characteristics of households, for example their degree (the number of families with whom a household conducts transactions) and strength (the volume of capital that flows through a household). We can then assess the relationship between these characteristics and household food security. Overall, just over 16 million NPR (\$154,265) in capital

Figure G. The Maulali network.

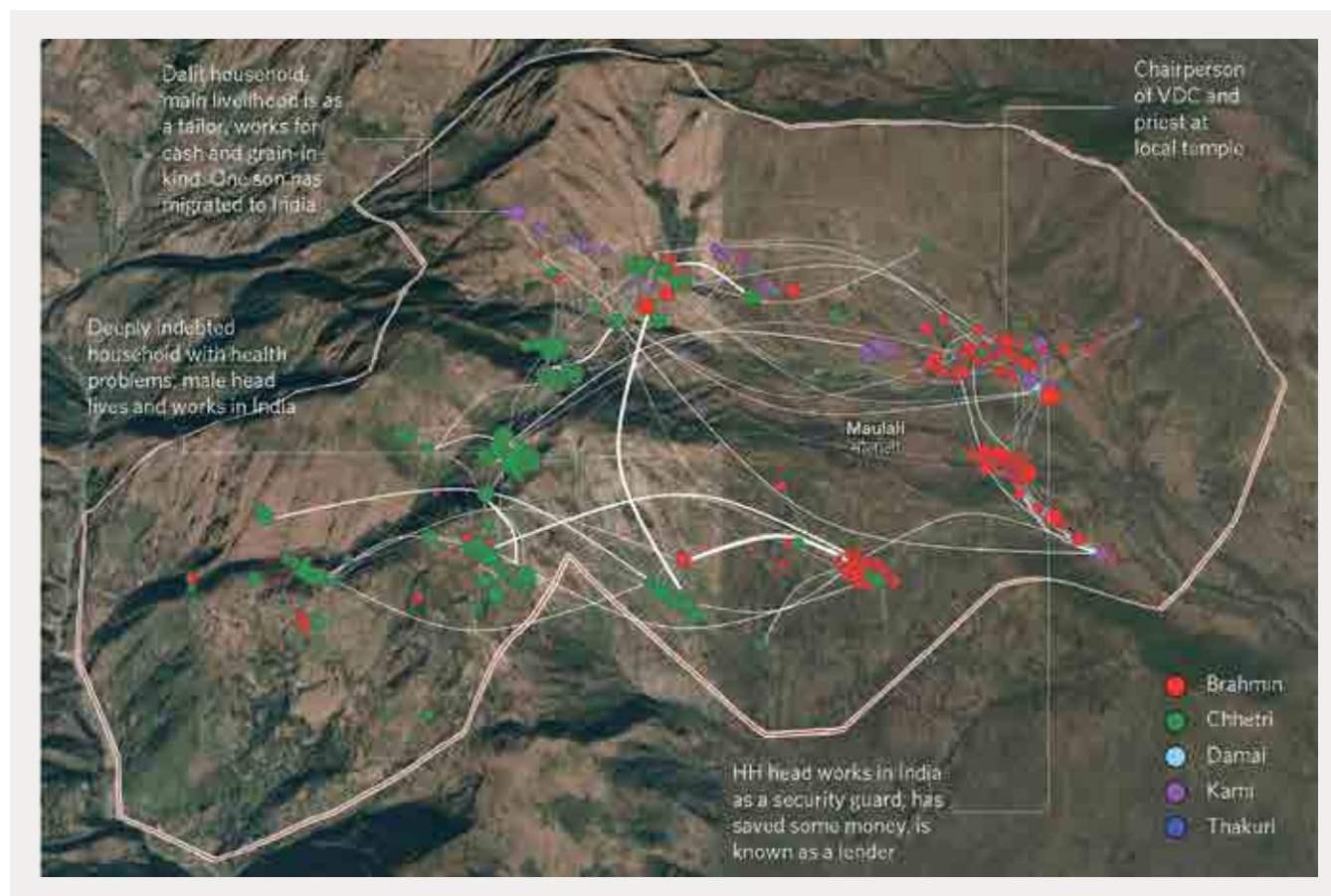
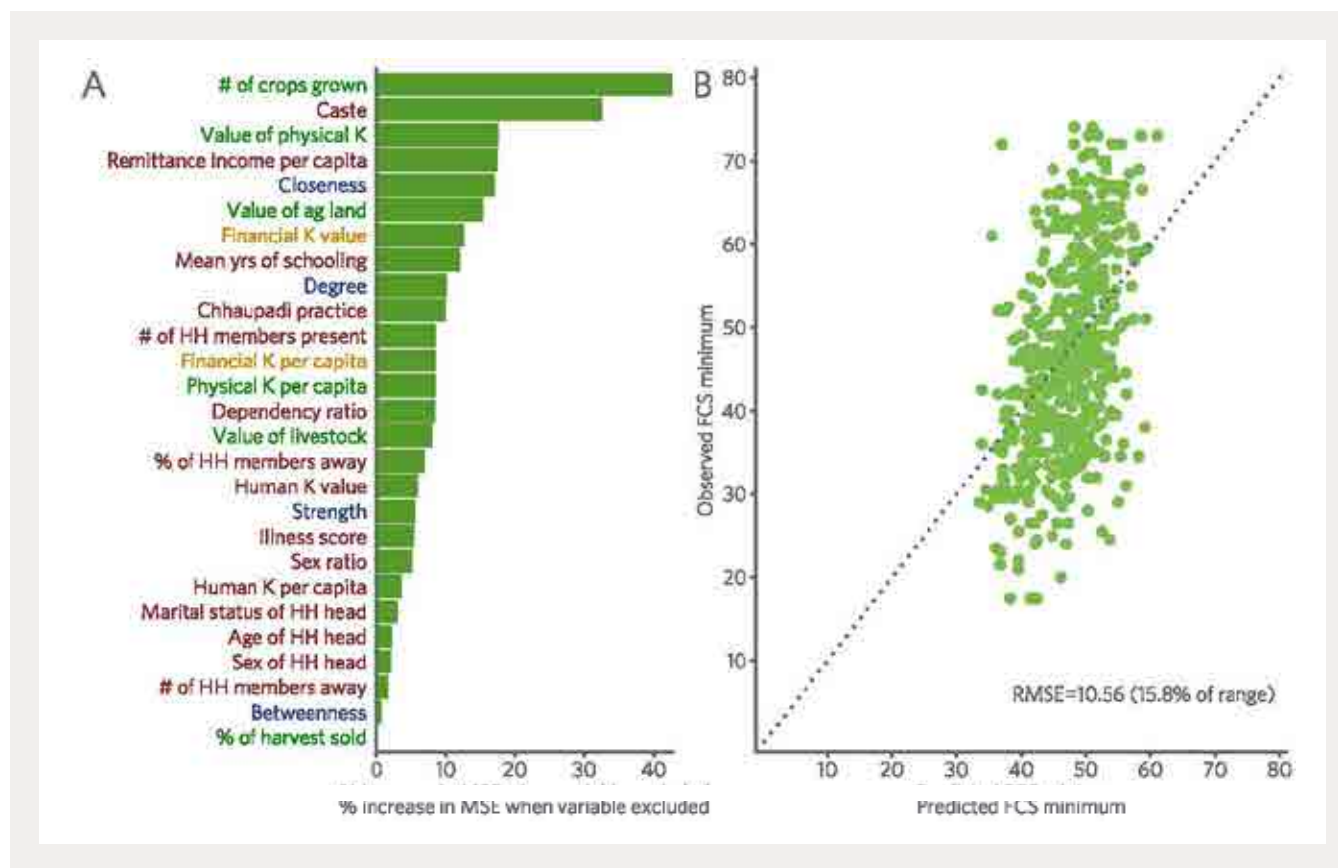


Figure H. Random forests prediction of FCS minimum score over the survey period. Panel A indicates the percent increase in mean squared error (MSE) when a variable is included, and thus shows each variable's importance. Panel B shows how well the overall model predicts FCS mean; the x-axis contains model-predicted values and the y-axis contains empirically observed values. The dotted line indicates perfect prediction. See Section 3.2 for more methodological details.



value was transferred between households over the period of this research. This figure is almost double the 8.8 million NPR (\$85,172) earned by all individuals in wage work (excluding that earned from other households), and nearly equals the 19.7 million NPR (\$190,058) in remittances received by households, a topic we discuss further in Section 4. Community networks are clearly fundamental to well-being in Maulali.

Analysing the determinants of food security

We used machine learning—specifically a random forests approach—to untangle the myriad causal forces determining food security in Maulali. We looked at the determinants of 12 outcomes: FCS resilience, resistance, and mean; three constituent

FCS items (vegetable, tuber, and grain consumption in the past week); CSI resistance, mean, and max; two constituent CSI items (food purchased on credit and consumption of less preferred foods); and the total value of food stocks held by each household. We focus in this analysis on presenting the results for FCS mean; the other results are available upon request.

Although the paucity of time points in the data prevents us from predicting FCS resilience precisely, models predicting the minimum household FCS score over the survey period (that is, the peak food insecurity experience) perform better. The set of human, financial, physical, and social capital predictors explain nearly a quarter of the variation in FCS. Figure H shows the FCS resistance model.

Some messages emerge from considering the results of the various models together. First, caste is consistently an important predictor of food security, even when controlling for demographic factors and various forms of capital stocks. This suggests that meaningful livelihoods programming will have to consider how the structure of capital flow networks interact with caste identity. Second, the importance of remittance income differs depending on the outcome of interest, but it is generally among the strongest predictors. Third, social capital variables, especially closeness (and to a lesser extent degree) are consistently associated with food security; no household with high degree or closeness centrality had a very low FCS or CSI score.

Objective 3: Migration as a key driver of food security resilience

Migration is a central economic fact in the lives of households in Maulali, and a key driver of food security resilience. Through in-depth qualitative fieldwork, we explored the perceptions and effects of migration on household food security, family, and intra-household roles and responsibilities. Transnational migration is changing the landscape of food insecurity in Maulali. Households in Maulali, once one of the most food-insecure VDCs in all of Nepal, appear to be walking a tightrope between present consumption and future well-being.

Income via remittances and improved access to loans/credit

Households in Maulali rely heavily on remittances to meet daily consumption needs, including food, school fees, clothing, and paying back loans. This heavy reliance on remittances may explain why quantitatively (as indicated through CSI and FCS) households appear to be generally food secure: remittances are helping them avoid negative coping strategies and meet consumption needs. Having a

migrant member in India also makes it easier for households to acquire loans and credit in Maulali. Lenders feel more assured that they will be paid back eventually when they know that a household member is abroad, and hence are more likely to provide loans.

We find that nearly all respondents report only changing food consumption behavior *after* taking out a loan or getting food on credit. Most feel that their diets are already so limited that cutting back on meals or amounts consumed would be detrimental to their well-being. Many respondents also report that fruit remains too expensive and not readily available to purchase at the market, a fact reflected in the FCS quantitative data.

Moreover, it is unclear if migration is contributing to household resilience to shocks (including through food insecurity) in any substantial or sustainable manner. Remittance amounts appear also to be insufficient to contribute to longer-term productivity through savings or investments in assets. Remittance amounts are dictated by the migrants' earnings and ability to save, rather than the situation back at home. In addition, remittances are often not enough to cover all expenses (including food, education fees, medical care, and other expenses).

Anxiety and worry

Many respondents— male and female of both lower and higher castes—shared that they worried or felt anxious about having enough food. Their concerns about having enough to eat were heightened during the pre-harvest months, especially in the summer monsoon season. However, having a migrant household member in India appears to significantly alleviate women's anxieties and worries about having enough to eat. Female respondents repeatedly referred to a sense of "hope" and "expectation" they had from having a migrant household member who might be able to send money home. However, once their husbands or sons returned to Maulali, female respondents noted that they worried again about

having enough food. As such, we see that migration offers only a temporary reprieve to households' food insecurity and does little to contribute to sustained food security resilience or longer-term consumption smoothing. This is due in large part to the fact that remittances only cover basic daily needs and are rarely invested in longer term productive asset growth or savings.

Agricultural labor and production

The majority of men who out-migrate are able-bodied and young, creating a sizeable void in the availability of agricultural labor in Maulali. This contributes to what some have referred to as a "feminization" of agriculture. Women who have migrant husbands but have other adult male family members (such as sons or other relatives) still residing in Maulali are often able to get help plowing their fields. Those without male relatives have to rely on male neighbors whom they are not related to. For women without male relatives, securing help is a challenge, and they reported that they often have to make requests multiple times. Additionally, they reported that the men they hire often plow their own fields first and complete tasks in the women's fields carelessly. In some instances, these delays and carelessness lead to decreased production. When production is decreased, women have to purchase a greater portion of food from the markets. This means that women are spending remittances on hired help to replace the labor of the migrant household member but often also spending more at the market. While the effects of male out-migration on agricultural yield remain inconclusive, these qualitative results echo the findings from a few other studies conducted in Nepal.

Qualitatively, we find that male out-migration is helping to provide a temporary and precarious reprieve to household food insecurity, namely through remittances, increased access to loans and credit, and alleviating worry and anxiety about having enough to eat. However, male migration also comes with large social costs. As part of the in-depth

qualitative thematic study, we explored the effects of mass male out-migration on those left-behind, namely children, women, and the elderly.

Children's education and inter-generational migration

Men's absence has a direct negative impact on children's education. The role of fathers within households includes discipline and helping children with their school work; many women noted that they were unable to provide such assistance because they were illiterate or were too busy with domestic work. Teachers reported that children seemed less motivated and focused without their fathers' supervision. Moreover, once a father has migrated, older children are more likely to be pulled out of school to take care of younger siblings while women work in the fields. With limited opportunities at home, many children aspire to go to India from a young age. Children grow up watching men migrate to India and return with new clothes and money, and often feel inspired to migrate themselves. Hence, the out-migration of male labor appears to perpetuate the intergenerational cycle of low skilled labor: growing up without their fathers, children fail to get the education required to help them to break out of this cycle and instead are motivated to migrate themselves.

Grandparents and older parents left behind

We found that many older parents rely heavily on the remittances their adult children send from India. A few of these older respondents lamented that their children would or could not send them money; they suffered financial hardship as a result. Older parents who rely on their children's remittances are often not able to engage in the physical labor required by agrarian livelihoods and depend primarily on charitable handouts and loans to make ends meet. Some of these respondents were additionally tasked with taking care of their grandchildren in instances in which both their son and daughter-in-law out-migrated.

Household division of labor and decision-making roles

All household responsibilities fall to women in their husbands' absence. There are large seasonal effects on women's workload, with women feeling especially spread thin during harvest and planting time. Women rely heavily on their daughters, neighbors, and/or relatives to help with household and fieldwork. Those who do not have these social connections are especially burdened by their husbands' absence.

It appears that even through their extended absences, men maintain decision-making authority in their households. Women shared that they could freely make decisions about day to day expenditures and household work, but they preferred if men made more substantial decisions, like about taking loans and credit, children's marriages, and selling or buying livestock. Some women noted that their husbands sometimes consulted them to solicit their views on these more substantial matters but that the men still made the final decision. Household structure appears to play a role in determining the extent of a woman's decision-making role. When a daughter-in-law lives in an extended household with her in-laws, household level decisions are made—sometimes exclusively—by the parents-in-law, the tulo manche, or the more senior members of the household.

It appears that cell phones may be eroding the limited decision-making authority women previously had in men's absence. However, many women seem to prefer for men to continue to act as the primary decision-maker in absentia. Citing their illiteracy, lack of experience, and existing work burdens, women shared that they preferred that men make and carry out major decisions, like the terms of a loan. When these decisions lay in women's hands, they reported feeling stress and it being another addition to their already heavy workload. Women were also afraid of making mistakes (such as selling livestock for the wrong price) and the potential repercussions that might follow, such as getting beaten by their husbands. Women noted that they

were economically dependent upon their husbands who were in India; men were the breadwinners, and women felt that the men therefore had the authority to make household decisions.

In Maulali, male out-migration appears to offer a temporary reprieve to household food insecurity through migrants' remittances, increased access to loans and credits, and by alleviating anxiety and worry about having enough to eat. However, given the unstable and infrequent remittance flows, additional burden on women's workload, and hampered agricultural productivity, migration does not appear to be contributing to sustainable or substantial improvements in household food security. Moreover, mass male out-migration in Maulali appears to come at substantial educational and social costs for the children, women, and elderly household members left behind, and perpetuates inequitable intra-household identity roles.

Objective 4: Programs

In discussing the programmatic implications this research has for PAHAL, we focus on the topic of migration, which is the central fact of economic life in rural Nepal, with effects on food security, intrahousehold equality, resources for local agricultural livelihoods, and other aspects of well-being.

Mass male migration—whether seasonal, temporary or long-term—should be understood as a central component of food security and resilience at the household level, but one that has both positive and negative consequences. Migration can benefit the household members left behind—for example, by making it easier to access credit, alleviating anxiety about having enough to eat, and receiving remittances to help cover basic expenses. But it also comes at a high cost. These include economic drawbacks, such as women having to pay to replace male agricultural labor with resulting decreases in

production and increases in market expenditures for basic commodities. In addition, while migration may provide temporary relief from food insecurity through remittances, the process of inter-generational chain migration creates a cycle of unskilled work, early departure from school, and a debt cycle to help make ends meet between remittances. As such, migration may also serve as a pathway into food insecurity and entrenched poverty in areas with high rates of male out-migration. In addition, this report also details many negative social impacts of high rates of migration, including separation of family members and added physical and psychological burdens for the women left behind. Furthermore, the migratory cycle perpetuates discriminatory intra-household gendered roles and responsibilities. It reinforces the notion that to be a man is to earn and to financially support your family, even if this requires being absent from your family for long periods of time and engaged in demeaning, low-paid, and insecure labor. To be a woman is to stay at home, raise your family, and take care of the homestead and field, all the while still succumbing to the will of an absent husband, in-laws, or other male relatives.

Migration and the decision to migrate entail many trade-offs within the household and around household livelihood decisions. PAHAL and other programs should consider the costs as well as benefits of male out-migration in their activities. As such, we recommend that Mercy Corps and other stakeholders adopt a dual approach to programming, outlined below.

Supporting and improving migration

The first approach, supporting and improving migration, recognizes that for the foreseeable future, migration will remain a major source of livelihood stability for many rural Nepali households. Interventions to improve migration might be grouped into categories of i) informed labor migration, ii) safer working conditions for migrants, and iii) facilitating remittance transfers.

Informed labor migration

Men currently rely heavily on their social networks—family members and friends who have previously migrated—for informal leads. Chain migration is common, whereby a sizeable portion of migrants from Maulali end up in the same location. Currently, there is no formal information source for men who are considering migration to India. Many of the young men and adolescents contemplating migrating for the first time have little to no information, or largely inaccurate information about distances, conditions, wages, ease of finding work, life in India, etc. Mercy Corps and other organizations are already engaged in safer migration programming; these efforts should be expanded and their impact evaluated. In particular, incorporating feedback from migrants as to what they wish they had known or understood prior to migration could be particularly helpful.

Safer working conditions for migrants

Most Nepali migrants to India work in unregulated, undignified, and often dangerous conditions. They work long hours for low pay and have limited recourse to lobby for improved wages, rights, or conditions. Many who work as “security guards” live on the their employers’ property and rely heavily on the goodwill of their employers to ensure continued payment and decent conditions. Others do heavy manual labor, such as construction, and are often assigned the riskiest jobs. Recognizing the centrality of migration to rural livelihoods, organizations like Mercy Corps and donors like USAID should invest in urban programs, gather evidence and disseminate research regarding conditions, and support advocacy efforts to improve workers’ rights in the informal and migrant-dominated sectors.

Facilitating remittance transfers

Our data showed a range of methods used for transmitting and receiving remittances, from

carrying by hand to sending through new wire transfer systems. Much more effort is needed to alleviate the costs associated with sending and receiving remittances, whether these be transfer fees, risk, time spent picking up money by those who remain at home in Nepal, or intimidation when women fear that they do not understand the system or have the correct documents. The expansion of cell phone technology and the ubiquitous nature of mobile payment systems in India suggests that an investment to enable fast, very low cost, and safe trans-border transactions should be a relatively simple intervention with likely buy-in from private sector companies.

To improve migration, more information will first be needed from the perspective of migrants themselves. What, for instance, makes migration “successful” in the eyes of migrants and/or their families? What are the benchmarks that lead men to decide it is time to return to Nepal and stop working in India? Importantly, what skills do men acquire during their time abroad that might be transferable to diversified and sustainable livelihood activities in Nepal? From the perspective of the families left behind, are there aspects that make migration “worth it” and what are these? How can remittance flows be improved? Without evidence about the perspectives and experiences of migrants and their families, efforts to improve migration systems will fall short.

Improving local livelihood opportunities and supporting those left behind

The second approach includes interventions in place to improve local livelihood opportunities and support those left behind in the transnational migration process, namely women, children, and the elderly. These interventions are grouped into the following categories: i) agrarian livelihoods, ii) vocational training, and iii) support for those left behind.

Agrarian livelihoods

Based on our data and observations in Far West Nepal, the notion of sustainable agrarian livelihoods on smallholder plots needs to be examined in more depth. There may be ways to make this a viable livelihood strategy, but more likely small-scale agriculture will be one component of a more diversified household approach. In Maulali, we observed that households are already diversifying because they are unable to survive based purely on agriculture, and the struggle to survive on cultivation alone is not unique to Maulali. Yet agriculture remains an important component of the livelihoods of many households, and hence should be supported in the most constructive way possible. This could be through the introduction of and training on specific cash crops (for locations where market access is possible), training regarding post-harvest storage (if appropriate), encouraging greater diversification of crops across a community, facilitating trade and exchange in local markets, and improving the efficiency of input use for existing crops and agricultural practices. Services such as water taps and improved roads would also benefit all residents. Information regarding crops and planting, price data, and transport costs would be useful for producers. Program implementers are likely to encounter numerous challenges, however, such as the lack of water for farming in Maulali. Such issues should not disqualify these locations from interventions, but rather lead to community discussions regarding the ways that local livelihoods can best be supported within the program’s parameters. Guidelines for PAHAL and partners on this process may be helpful in this regard.

Vocational training

Given poor production and lack of employment opportunities, men are forced to migrate to India to make ends meet. Men overwhelmingly shared that they would prefer to stay in Maulali, though, and they voiced the need for vocational training and workshops in cooking, house wiring, plumbing,

mobile repair, plastering, furniture making, and so on. With such capacity building opportunities, Mercy Corps and other partner organizations can help bolster livelihood options for the men who remain in the rural area. Additionally, livelihood opportunities for women are severely limited in Maulali. Limited to construction support and transportation of goods from market, these casual opportunities often pay discriminatory wages. There is ample opportunity for PAHAL to provide vocational training and develop women's livelihoods in Maulali. However, given the already heavy household and childcare responsibilities of women, Mercy Corps should first engage with women to understand the types of livelihood opportunities that they desire and can perform without undue burden on them. Moreover, programming should carefully consider the social norms at play (e.g., men's traditional role as "breadwinner").

Supporting those left behind

Migration from Maulali is highly gendered, with many men migrating alone and leaving their families behind. For women, male out-migration brings about many hardships, including the burden of greater household, agricultural, and childcare work. Women noted feeling especially spread thin during harvest and plantation time. PAHAL should support the women left behind to offset the psychological and physical burden they take on due to men's extended absences. There may be an opportunity to facilitate women's empowerment through male out-migration: both men and women expressed interest in women taking on a greater role in household decision-making processes. However, many women expressed that they prefer the current set-up, in which men continue to act as the primary decision-makers in absentia, facilitated by use of cell phones. Citing their illiteracy, lack of experience, and existing work burden, women shared that they preferred for men to make and carry out major decisions like the terms of loans. It is critical that Mercy Corps and partner organizations first support women so that they feel prepared to take on these additional responsibilities

(e.g., through financial literacy training, alternative livelihood opportunities) and second, avoid inadvertently burdening women further in an effort to "empower" them. Feedback from men and women will be essential to understand the specifics of how programs can facilitate women's empowerment in a context of mass male out-migration.

Many older parents rely heavily on the remittances their adult children send from India to make ends meet. Given unstable and infrequent remittance flows, it appears that the elderly often face financial hardships and lack alternative income sources like casual labor opportunities due to their physical conditions. Additional information is needed about the level of dependence of the elderly on precarious income sources, such as remittances. Mercy Corps and partner organization should support these older parents to help facilitate alternative income sources.

In Maulali, male labor out-migration encourages children's early departure from school, perpetuating an inter-generational cycle of low-skilled labor: growing up without their fathers, children are themselves motivated to migrate, and fail to get the education needed to break out of this cycle. Even among those who remain in school, a majority terminate their education around the 10th grade (after which point parents are required to pay a school fee). Mercy Corps and its partners can help families break out of this inter-generational cycle of low-skilled labor by promoting continued education and providing support to help retain children in school beyond the 10th grade. It is critical that both boys and girls be supported in this endeavor. While it is culturally taboo for women to seek employment outside of Maulali, continued education can promote women's literacy, including financial, to allow them to seek livelihood opportunities in place.

1. Introduction: Objectives and Timeline

1.1 Objectives

The Promoting Agriculture, Health, and Alternative Livelihoods (PAHAL) consortium, led by Mercy Corps and funded by USAID/FFP, commissioned the Feinstein International Center (FIC) of the Friedman School of Nutrition Science and Policy at Tufts University to study resilience in food-insecure areas of rural Nepal. The research had four major objectives:

1. To implement a low-cost quantitative food security resilience monitoring system;
2. to develop a theoretical framework and quantitative methodology for analyzing the determinants of household food security;
3. to explore, qualitatively and in-depth, important drivers of food security resilience; and
4. to use the results to inform PAHAL's programmatic activities.

The previous report for this project, "The Measurement and Analysis of Food Security Resilience, Year 1 Report" (henceforth referred to as "Y1 Report") outlines these objectives and describes the context in which the research takes place, the Village Development Committee (VDC) of Maulali, located in Bajhang district of Nepal's Far West region. The sections below provide a timeline of research activities, discuss the implications of the project's early termination for the above objectives, and summarize the results of the research.

1.2 Timeline and implications of shortened project

The project was originally slated to run from September 2014 to August 2019, with field data collection commencing in October 2015 and running for 42 months. However, upon agreement between FIC and PAHAL, research activities terminated in June 2017. The timeline below illustrates the activities of the research between October 2014 and the present.

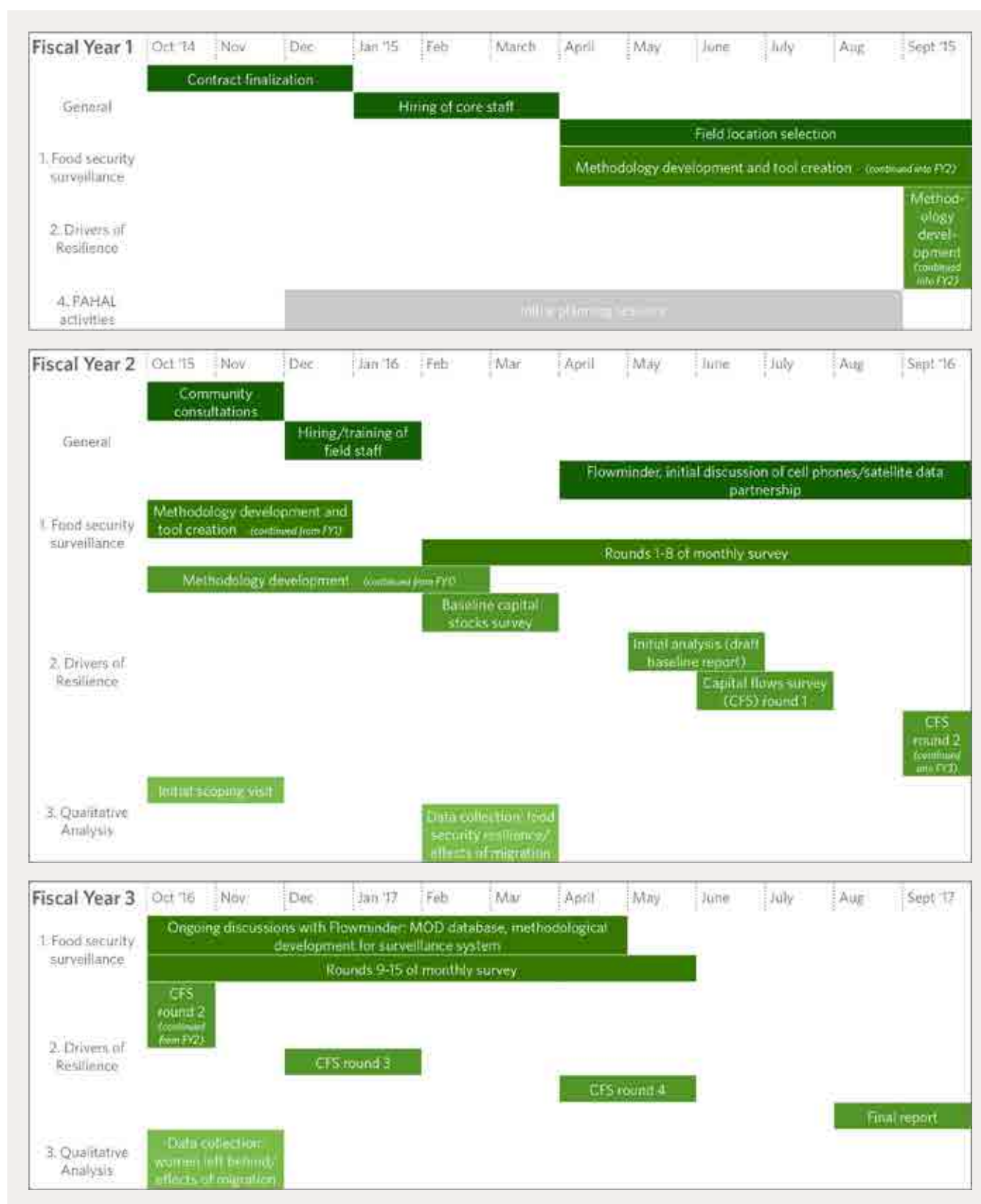
We implemented three overarching research activities over the 21-month research period:

1. 15 rounds of a food security monitoring system, based on rapid assessment indicators;
2. a baseline and four subsequent rounds of a capital flows/network census; and
3. an in-depth qualitative investigation of the effects of transnational migration and remittances on food security, family, and intra-household roles.

One additional research activity was halted before implementation due to the reduced timeframe for the research: a mobile operator data (MOD)-based food security monitoring system covering all PAHAL project areas, to be established in partnership with the non-profit Flowminder Foundation. FIC is currently pursuing other funding opportunities to complete this work.

The shortened timeframe for the research affected objectives 1 and 4 considerably, and objectives 2 and 3 moderately. With respect to **Objective 1**, our resilience measurement methodology (described in the Y1 Report) relies on a minimum number of data points to produce accurate results. The 15 monthly data points for each household do not adequately eliminate noise in the resilience signal. This is partly because the Maulali field site did not experience major acute shocks to food security over the research period, although we initially

Figure 1. Timeline of research activities.



selected Maulali due to its status as one of the most shock-prone and food-insecure VDCs in Nepal. Table 1 summarizes the mean food security phase classification scores of PAHAL VDCs for the period between November 2014 and November 2016. The 15 most food insecure VDCs, of the total set of 84 in PAHAL, are shown. Maulali ranks as the 3rd most food insecure VDC by this metric, and only one of three VDCs that were classified as highly food insecure in at least 2 of the last 6 monitoring periods. Additional information, especially on sex ratio, percentage of households belonging to the Dalit caste, and environmental/health hazard exposure, confirmed Maulali's vulnerability, and Maulali's risk of drought and hailstorms rated among the highest among PAHAL VDCs.

Nevertheless, no major climatic shocks occurred during the research period. In addition, the unexpected intensity of migration and remittance flows in the local economy appears to be mitigating short-term food stresses, as we discuss in detail in Sections 3 and 4. In the absence of major shocks, the overall quantification of household resilience is made problematic by various sources of uncertainty, including random events (illnesses, festivals, etc.), having different respondents from round to round, and other factors. While these issues are not specific to our resilience measurement method, they do interfere with our ability to generate an accurate measure of household-specific resilience. In addition, the shortened timeframe of the research forestalled the planned geographic expansion of food security surveillance using mobile operator data. Despite these constraints, however, community-level resilience can still be evaluated with the collected data.

Objective 2 is affected by the shortened research timeframe to the extent that the lack of shocks and remittance income flows led to limited variation in

food security outcomes, both over time in the same household and across households in the VDC. In addition, three planned auxiliary research activities were not yet implemented: a kinship network survey, a mapping of information exchange networks in the VDC, and an environmental quality survey to profile hydrological and soil nutrient conditions. However, the baseline and subsequent four rounds of capital flows data still provide a considerable amount of information by which to analyze the variation in food security and capital stocks that we do see.

With respect to **Objective 3**, qualitative investigation of the drivers of food security, we found that transnational migration and remittances were key factors. We conducted extended field research in both the origin location, Maulali, and the key migrant destination, the city of Bangalore in India. Our results provide important insights into how a migration-centered livelihoods strategy affects food consumption, intra-household gender dynamics, and outcomes by gender, including for children. We are presently seeking additional funding to conduct fieldwork in India to identify ways in which a range of programs can support migrants and their families to facilitate a "successful" migration experience.

Regarding **Objective 4**, given the shortened timeframe for data collection and the delayed implementation of PAHAL's activities, we are not able to provide location-specific programmatic recommendations. However, the concluding remarks in Section 5 review the literature on the impact of development programs that engage with migration; we make a case for PAHAL to adopt a dual approach, focusing on facilitating transnational livelihoods while also supporting family members left behind and those who may choose not to migrate.

Table 1. Food security phase classification, PAHAL VDCs, November 2014 to November 2016. Top 15 most food insecure VDCs shown. Note that a food security phase classification of “1” indicates mild food insecurity, “2” moderate, and “3” high. Data source: DFSNs NeKSAP, MoAD GoN and WFP Nepal, 2015/16.

Rank	District	VDC	Mean fs phase score (1-5)	# periods (of last 6) highly food insecure
1	Bajura	Dahakot	2.00	2
2	Bajura	Dogadi	1.83	2
3	Bajhang	Maulali	1.67	2
4	Bajura	Gudukhati	1.67	1
5	Bajura	Jayabageswori	1.67	1
6	Achham	Paval	1.33	1
7	Bajura	Kanda	1.67	1
8	Bajura	Manakot	1.67	1
9	Achham	Devisthan	1.50	1
10	Achham	Duni	1.50	0
11	Baitadi	Udayadeb	1.50	1
12	Bajhang	Dahabagar	1.50	1
13	Bajhang	Deulikot	1.50	1
14	Bajhang	Sunikot	1.50	1
15	Bajhang	Sunkuda	1.50	1



2. The Food Security Monitoring System

2.1 Overview

The original research strategy called for us to test the following two hypotheses:

1. monthly food security surveys based on rapid assessment indicators can accurately characterize household resilience in the face of myriad shocks and stressors; and
2. these surveys can serve as the core of a low-cost, logistically feasible food security surveillance system.

To obtain monthly measurements of food security, we utilized two types of rapid assessment indicators: the Food Consumption Score (FCS) and the Coping Strategies Index (CSI) (ODAV WFP 2008; Maxwell and Caldwell 2008). FCS and CSI are two of the most commonly used tools for food security measurement, in both acute and chronic contexts.

The FCS asks respondents the number of days in the past week they consumed each of seven food groups: staples (grains, roots, and tubers), pulses, vegetables, fruit, meat and fish, milk, sugar, and oil. The overall FCS score is a weighted sum of those food group frequencies, with weights representing the “nutrient density” of each group (ODAV WFP 2008). Typically, an FCS score of ≤ 21 is considered “poor” food security, >21 and <35 “borderline”, and >35 “acceptable”; these thresholds are increased by 7 if households consume oil and sugar daily.

The CSI captures behavioral responses to food insecurity, including reduction in size and number of meals, borrowing of food and money to purchase food, gathering of wild foods, consumption of seed stock, and others (see Appendix A in Y1 Report for full list of questions). Most of these behavioral responses have strongly negative implications over time; by utilizing these coping strategies, households are generally compromising human or material capital to meet present needs. The CSI typically asks about the week or month prior to the survey; in this research, we concentrated on the past week.

We implemented the food security surveillance system in the VDC of Maulali, in Bajhang district of the Far West region. A second site was dropped due to political obstacles, and a planned digital data-based expansion of the surveillance scope was forestalled by early termination of the research (see Box 1 for more information on the location selection process).

Section 2.2 below summarizes the trajectories of FCS and CSI, by household and demographic group, in Maulali. Section 2.3 quantifies community and household resilience, using several resilience measurement techniques. Section 2.4 outlines the advantages and disadvantages of this rapid assessment indicator-based approach to food security monitoring, and discusses options for scaling up monitoring to all PAHAL areas.

Box 1. Depth versus breadth: FIC's location selection process

FIC's original research design called for in-depth research—including a food security resilience monitoring system, quarterly capital flows/network census surveys to look at the determinants of resilience, qualitative investigation of special topics, and programmatic recommendations—in two locations: Maulali VDC of Bajhang district and Gaguda VDC in Doti district. The research in Maulali was implemented as planned. However, we encountered considerable political difficulties in Gaguda; our data collection supervisor was threatened, and we dropped the site.

We then weighed the costs and benefits of selecting an alternative second research location versus pursuing a new opportunity: partnering with the Flowminder Foundation, among the world's leading academic groups in analysis of digital data, to use mobile operator data (MOD) as the basis of a countrywide food security resilience monitoring system. Such a methodology, described in Section 2.4(b), relies on the association between signals in cell phone data—frequency of top-ups, call frequency and duration, size and structure of calling networks, and

mobility—and measures of well-being, including food security. Some initial cross-sectional studies suggest that this association is promising (Blumenstock 2015, Steele et al. 2016), but validation of this relationship over time, especially in the context of shocks, would be an important step forward. Such a system would also be highly resolved in space, allowing measurements at cell tower level or, conditional on informed consent, even at the household or individual level. Temporal resolution would also be extremely high, allowing daily monitoring of well-being and mobility, the latter an important consideration in areas where migration is a key determinant of food security and other well-being outcomes.

Given Flowminder's access to MOD from the largest private network provider in Nepal, and the consequent ability to monitor well-being across the entire PAHAL area, we chose to invest in this research. The design was completed and analysis had begun, but the adjusted timeframe for research activities ended this work. We are currently pursuing other funding opportunities to continue this research.

2.2 Household trajectories of FCS and CSI

Food security in Maulali in the study period was far better than expected, despite the VDC's historical status as a chronically food insecure community.

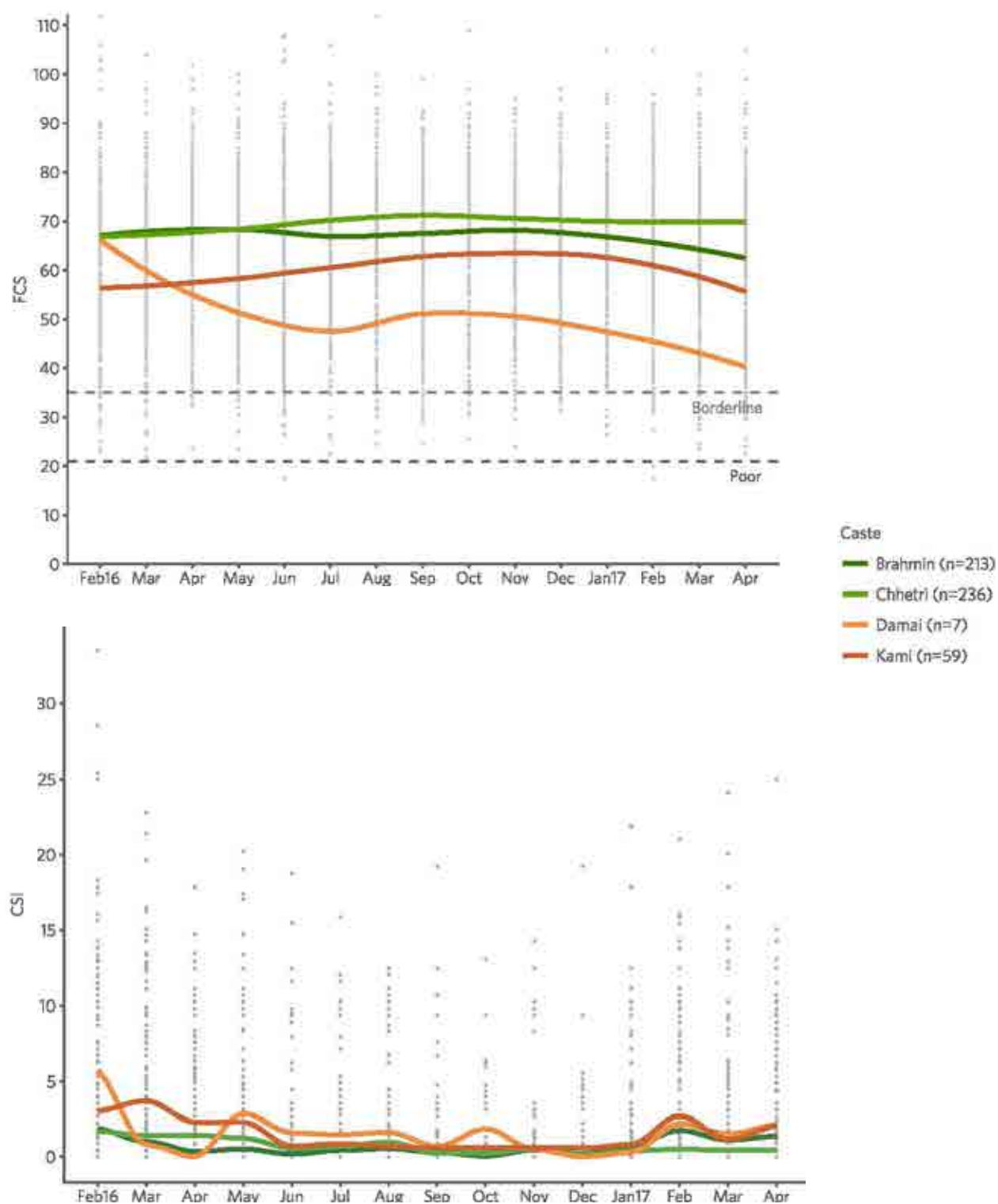
Figure 2 shows FCS and CSI scores over the survey period; lines represent caste-specific means, and gray dots are household observations. The typically used FCS cut-offs, <21 for "poor" consumption, 21-35 for "borderline", and >35 for "acceptable", are shown (Panel A). We do see significant differences between

castes, an issue discussed at greater length in Section 3, but only four times in the survey period did any household report "poor" consumption, and only 156 times (2.1% of all observations) did a household report "borderline" consumption. It should be noted that the universal applicability of FCS thresholds is questionable (see Vaitla, Coates, and Maxwell 2015 for a discussion of this issue), but households in Maulali are, broadly speaking, food secure.

CSI generally confirms this picture (Panel B):

89% of household observations are a zero score, indicating no coping behaviors at all used in the past week. No universal thresholds exist for

Figure 2. FCS and CSI by round and caste. Gray points are household observations; lowess-smoothed trendlines for castes are shown.



interpreting CSI in terms of food security, but the very low frequency of coping behaviors suggests that households are generally not having to resort to harmful strategies to attain adequate levels of food consumption.

We can also disaggregate each food security indicator by its constituent items (Figure 3). Grains and oils/fats are consumed almost every day throughout the year. Dairy and pulses are also consumed 5-6 days a week throughout the year. Vegetables exhibit the strongest seasonal pattern, peaking in the late monsoon months of July-September; fruits follow this same pattern, but are much more rarely consumed throughout the year. Overall, the food group trends suggest that **the constancy of the aggregate FCS score masks some internal seasonal variation in the composition of the diet.**

Though coping strategies are rarely exercised, we also observe distinct seasonality in such behaviors (Figure 4). The most common coping strategy by far is “vogeckhak magne,” an arrangement wherein Dalit households request food from higher-caste families, especially employers or patrons. **Coping behaviors are most common between January and April, when food stocks from the last are dwindling and the winter wheat and barley crops have not matured.**

Interestingly, **the association between FCS and CSI for the 7,456 household observations over 15 rounds is weak** (Figure 1 in Appendix), suggesting that **the two indicators may be gathering information on overlapping but distinct aspects of food security**—a conclusion broadly consistent with studies investigating the FCS-CSI relationship in other contexts (Vaitla et al. 2017).

Figure 3. FCS food group, by round.

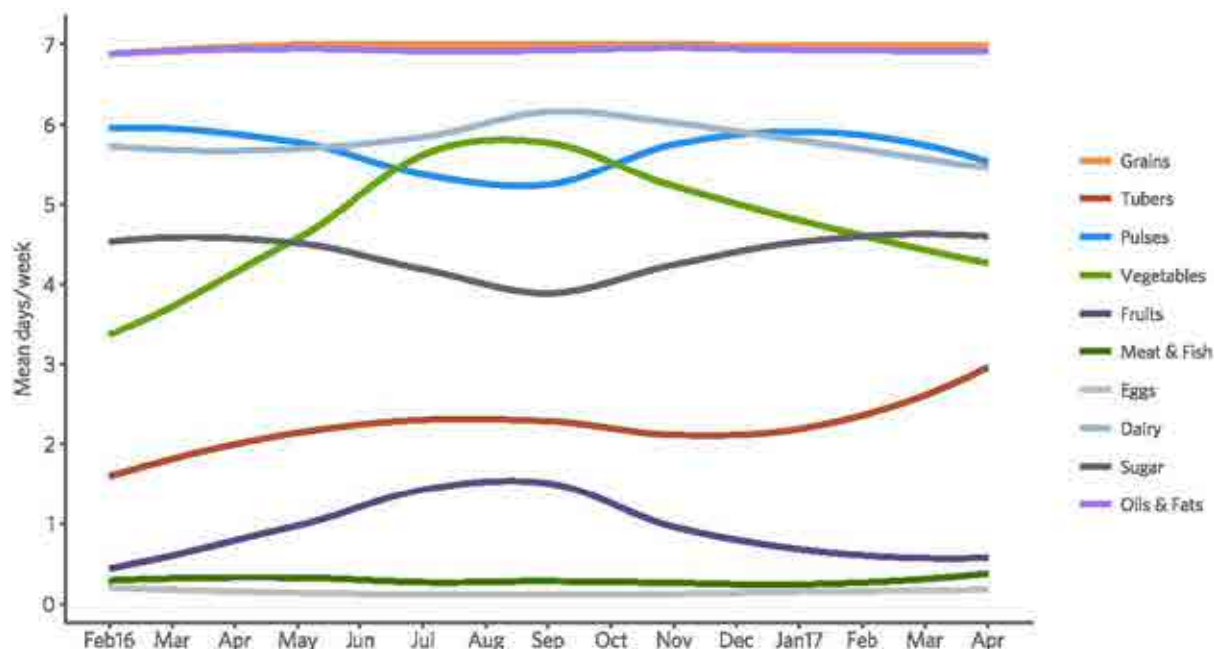
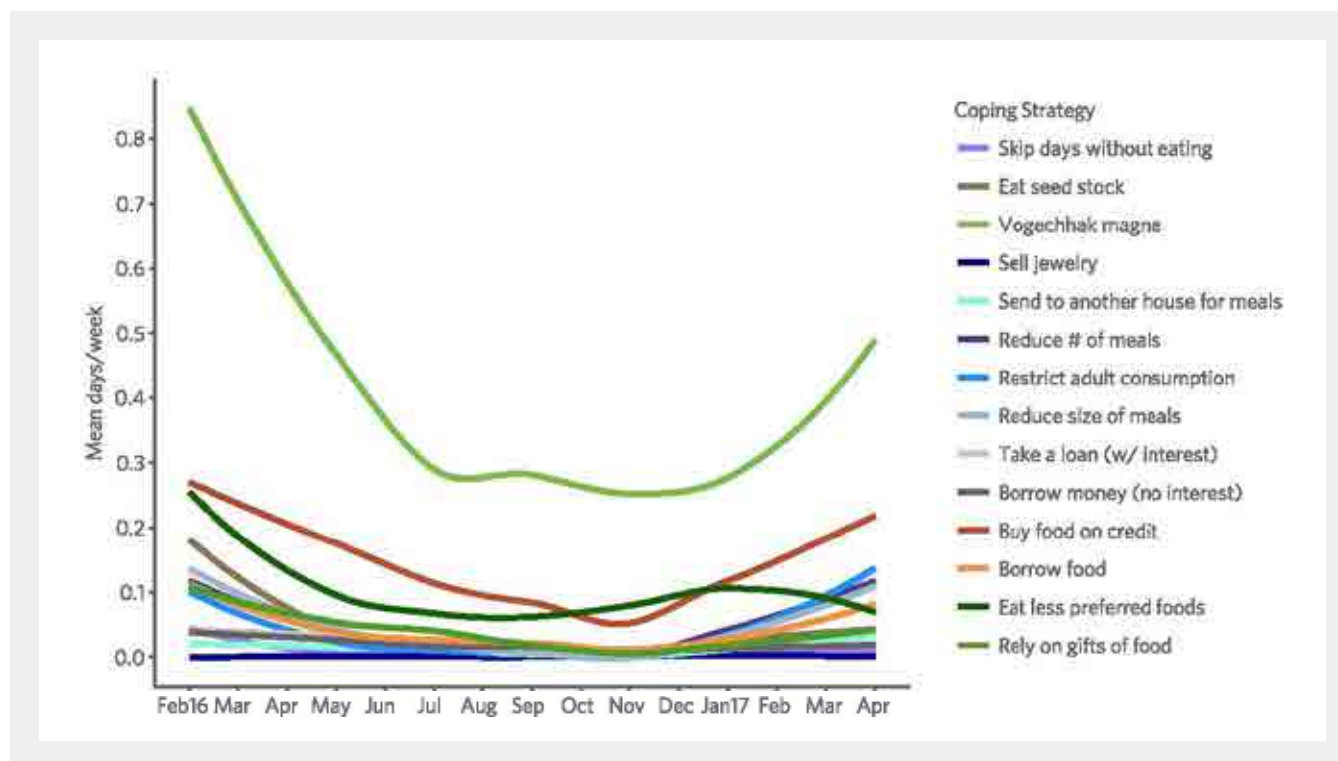


Figure 4. Coping strategies, by round.



We can draw two overall lessons from these results. First, the food security situation in Maulali is much better than expected; as we demonstrate in greater detail in Section 3, this is due to the strong effect of remittances in supporting local food consumption, and may also be due in part to households prioritizing food security over other consumption needs. Second, in the absence of major shocks, CSI and FCS may not be sensitive to smaller fluctuations in food security brought about by chronic stresses. This suggests that alternative, more sensitive indicators of food security may be needed for the measurement of resilience. Data-intensive methods—for example, 24-hour recall surveys—are clearly not viable for high-frequency measurement. We argue in section in 2.4.2 that digital data may in fact be the only feasible data source to accurately quantify household resilience.

2.3 Measuring resilience

We turn now to the measurement of resilience. Given the lack of variation in the CSI data, we focus in this section largely, but not exclusively, on FCS. Section A.2 in the Y1 Report details our approach to quantifying resilience based on autocorrelation, the relationship of present well-being to past well-being. Recall that autocorrelation coefficients measure the association of a present state to a past state (see Section A.2.2 in Y1 Report)¹; a correlation coefficient of zero suggests that household food security in the present is unrelated to the past, a positive coefficient that food security tends to be similar to the past, and a negative coefficient that food security tends to be inversely related to the past. In the context of

¹ Specifically, in our case we look at the association between past changes in FCS/CSI with present changes in the same variables; that is, we construct an ACF from delta FCS/CSI, not levels of FCS/CSI.

ongoing shocks and stresses, therefore, a negative coefficient implies resilience—an ability to overcome past adverse events. A positive coefficient implies “holding on” to shocks.

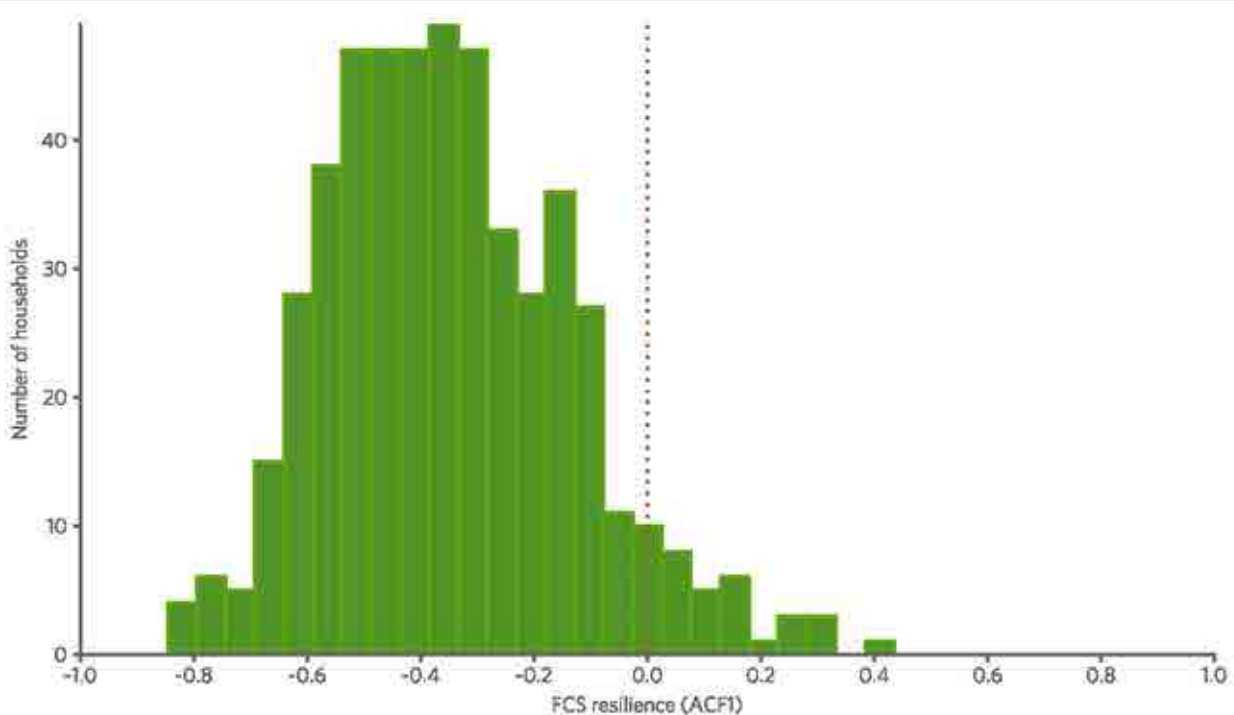
The distribution of household scores in Maulali yields some insights as to how the VDC is doing overall (Figure 5). The graph below pertains to an autocorrelation lag of one time period (ACF1), that is, a measure of the association between changes in the present and past monthly FCS scores (see Footnote 1).

We see here that **most households in the VDC have a negative autocorrelation coefficient; that is, they tend to recover from shocks and stresses**. The mean household in Maulali has an ACF1 coefficient of -0.35, and the median household -0.37. Again, we caution against interpreting any single household’s

resilience score, but overall we see that households in Maulali are relatively food security resilient, as measured by FCS.

Unfortunately, the low number of data points in our dataset—15, instead of the anticipated 42—hinders our ability to assess household-level resilience. This is a sampling issue: much like small samples in space produce biased, high-variance estimates of a group mean (at a single point in time), **small samples in time produced biased, high-variance estimates of the mean over time** (for a single household, or other unit). Figure 6 below illustrates this point using the autocorrelation coefficients of two households; the figure is drawn using synthetic data. The first household, with a “true” $ACF1=0$, is not resilient; in fact, its present state is not associated with the past in any direction. This means that shocks do not necessarily persistently affect food security, but

Figure 5. Autocorrelation coefficients (ACF1) for FCS, all households in Maulali.



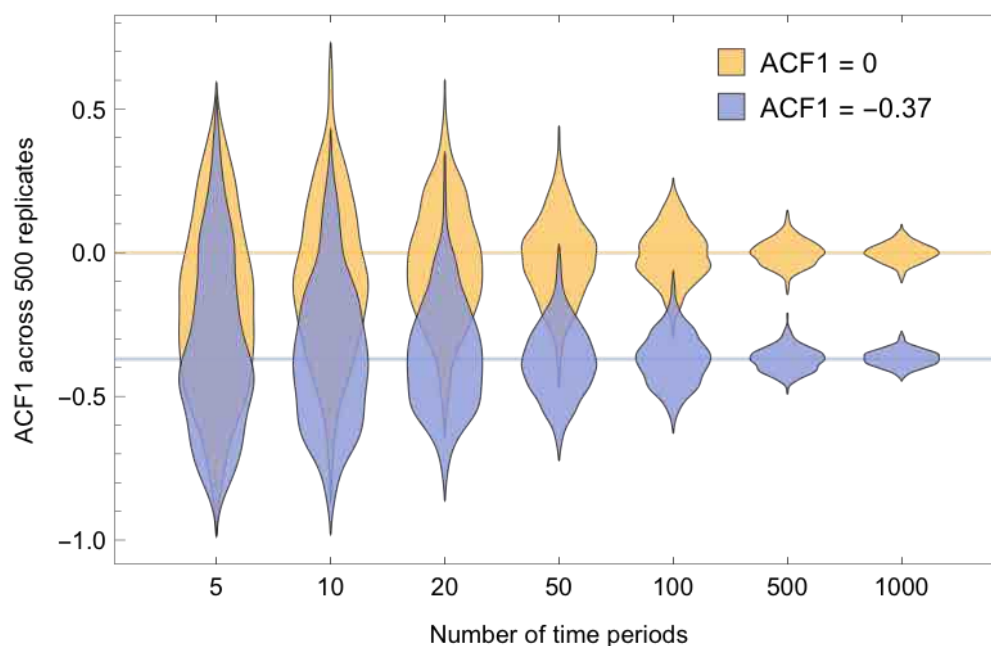
neither does the household bounce back quickly from shocks. The second household, with a “true” $ACF1 = -0.37$, is the median household in Maulali; the negative coefficient suggests resilience. The x-axis represents the number of survey time periods for which data is available. We run the below simulation 500 times. The shaded “violin plot” shapes represent the bias and variance of estimates. If the shape is vertically centered around the true $ACF1$ s on the y-axis, then the estimate contains less bias; on average, we have come closer to estimating the true resilience of the household. If the shape is “shorter,” this denotes less variance around the true mean; we are less likely to have wildly divergent estimates of resilience.

We see that, as we approach 50 time periods, the two households are clearly distinguishable; below

this amount of time periods, however, both bias and variance are unacceptably high. As we discuss in Section 2.4(b), passively collected digital data could allow hundreds of measurements within a short time frame, greatly increasing the accuracy of resilience estimation.

As discussed at length in the Y1 Report, our resilience measurement method has a key feature not found in most other approaches: it does not make any assumptions about the expected shape of well-being over time, including the presence of equilibrium states. Because rural economies are rapidly changing—impacted not only by technological change and state policy, but also by phenomena like transnational migration—and because the expected shape of recovery depends heavily on the magnitude and nature of shocks, we

Figure 6. Violin (distribution) plots of two levels of measured resilience, in relation to number of time periods for which data is available.



believe that this open approach is an important feature of any attempt to quantify resilience.

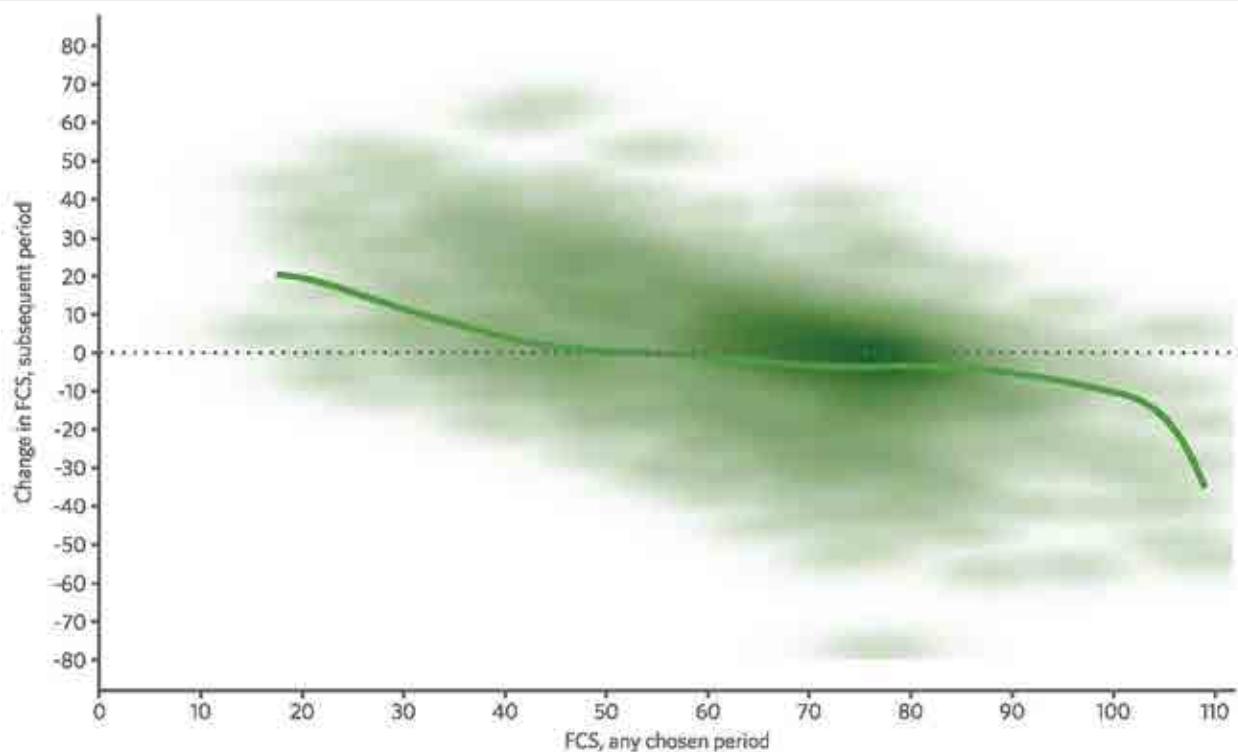
There are other ways in which resilience can be analyzed, however. One prominent approach is to look for the possibility of “traps,” usually thought of in terms of poverty traps, but applicable to any well-being variable, including food security indicators (Barrett and Constanas 2014; Cissé and Barrett 2016). This method suggests a distinction between structural changes—real gains arising from enhanced asset stocks or improved asset productivity—and stochastic changes due to temporary fluctuations (e.g., temporary illnesses or price changes) that, over the long-term, will have a statistically neutral effect on a population. Empirically, food security traps are discovered if households appear, period after period, to be stuck at a low level of food security

despite possessing capital stocks that suggest otherwise. If households are resilient, recovery of consumption after a shock should proceed until food security is attained.

Investigating transitions in food security from one period to another sheds some light on the possible existence of poverty traps. Figure 7 below shows the relationship between every household FCS observation in a chosen period (x-axis) and the change in the same household’s FCS score in the subsequent period (y-axis).

The best-fit line, shown in green, shows the predicted change in FCS given an initial FCS score (x-axis). **Households, in other words, show little change in FCS period-to-period, suggesting that they absorb the impact of any shocks and stressors**

Figure 7. FCS in chosen and subsequent period. Greater density of the cloud indicates more observations. Green line is a spline function with 10 segments. Dotted line shows no change in FCS.



that may have occurred in the survey period without adverse effects of food security. We see a tendency of increased FCS when the benchmark score is very low (left side of graph) and a tendency of decreased FCS when the benchmark score is very high (right side of graph), suggesting the possibility of a single “food security equilibrium” in the middle of the FCS range. However, we have too few observations to assess whether these trends are structural or the result of noise. The key point is that food consumption, as measured by FCS, is generally stable; households in Maulali are resilient.

A look at the concept of resistance—the ability to withstand the impact of a large negative shock without a deterioration in food security (in contrast with resilience, which is the ability to recover rapidly after that deterioration has occurred)—confirms this picture. In the Y1 Report, we suggest that resistance

can be measured by the coefficient of variation (CV; standard deviation divided by the mean) in food security of each household, and evaluated relative to other households in the community. **Note that lower CV scores indicate higher resistance.** Panel A of Figure 8 below shows household-level resistance, as measured by FCS, in Maulali; again, we caution that the small sample size over time may yield biased estimates. Panel B shows the mean resistance score of different castes and wards in the community.

We see in Panel A that households in Maulali are quite resistant, as measured by FCS, to shocks and stresses; for the median household, FCS standard deviation is just 15% of their mean FCS score over all rounds of the survey. Diet diversity stays relatively constant through seasonal agricultural cycles and price fluctuations, as well as idiosyncratic household stresses such as illnesses. Panel B shows

Figure 8. FCS resistance of households and caste-ward groups.

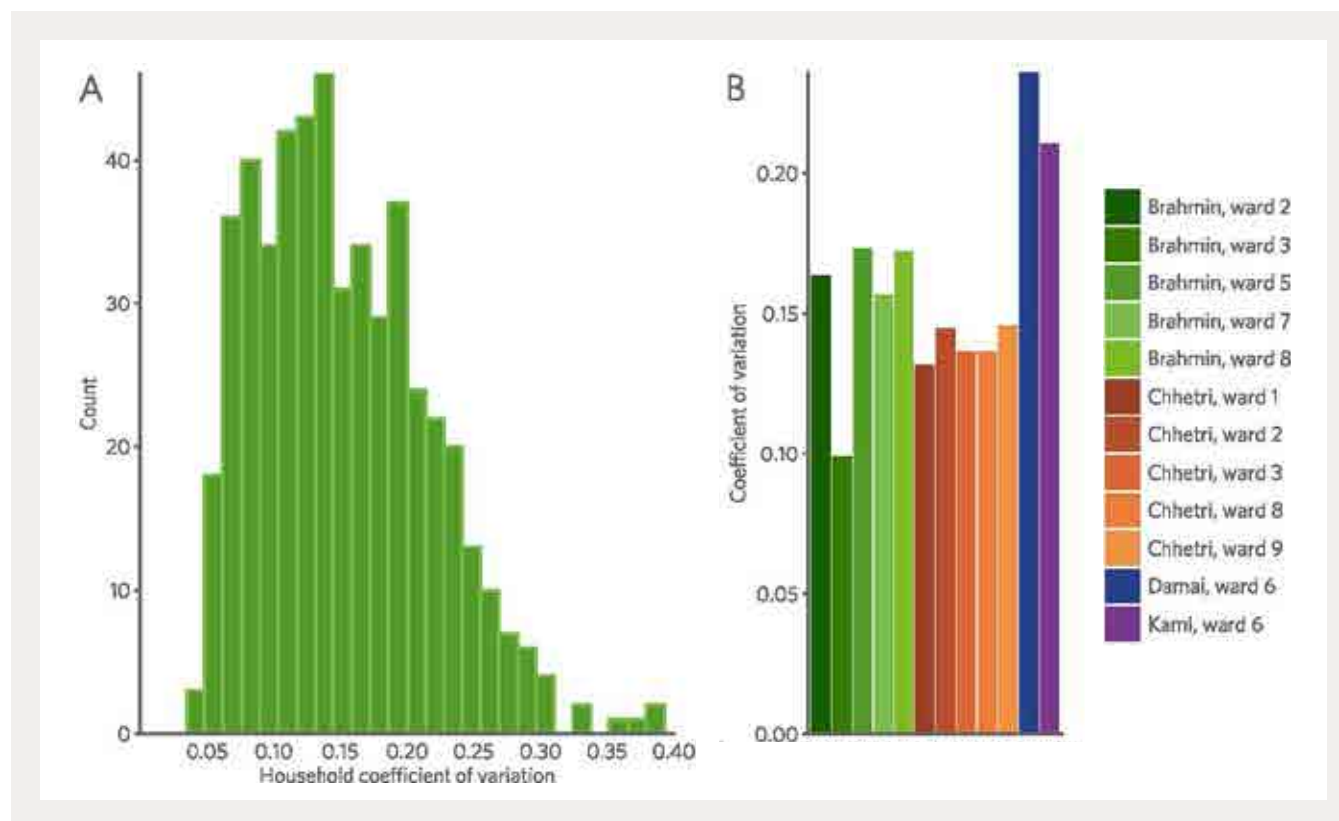
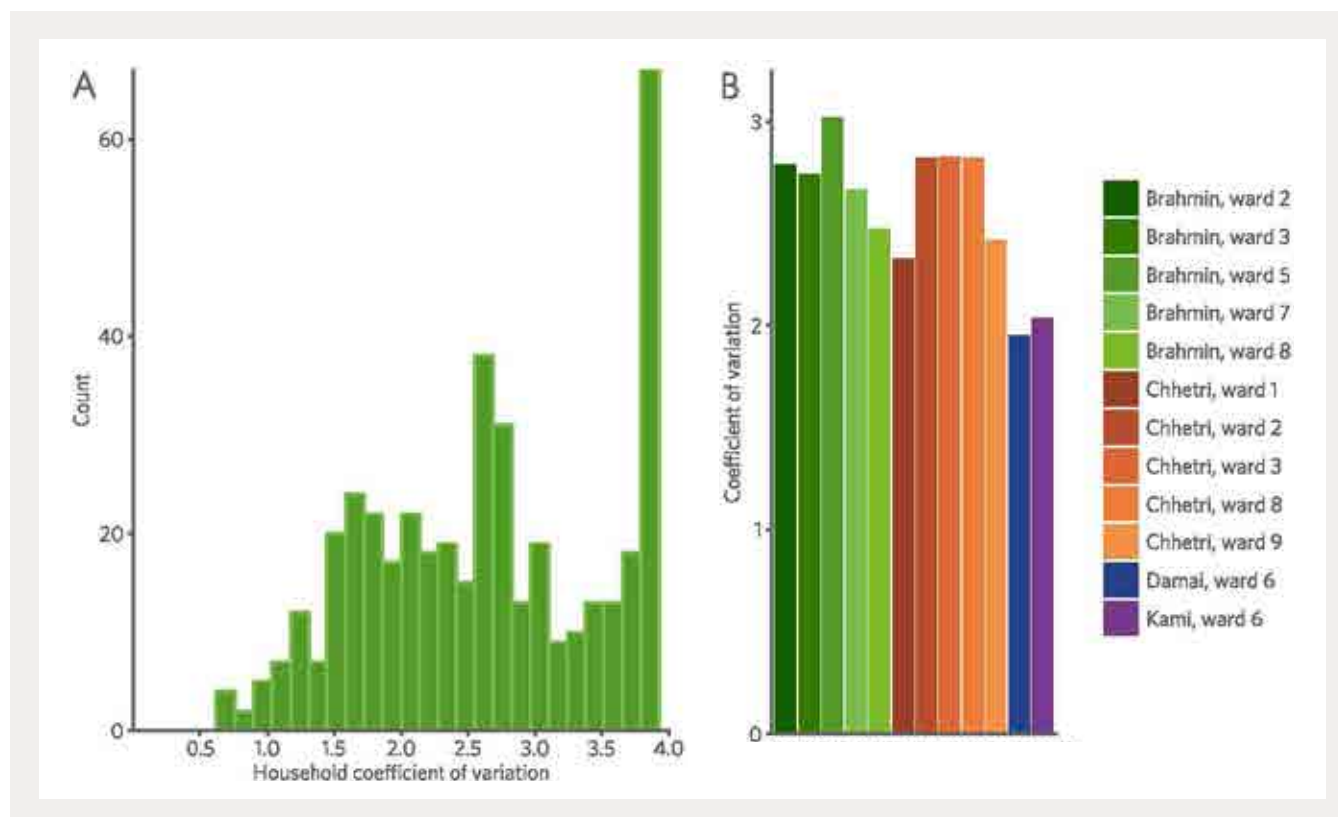


Figure 9. CSI resistance of households and caste-ward groups.



that there is some variation in FCS CV across castes and wards. As expected, **the Dalit castes, Damai and Kami, have a higher CV (lower resistance) than Brahmin or Chhetri families.**

Figure 9 repeats the same analysis using CSI. The results suggest some differences between the two food security indicators, though this is partly an artifact of the large number of zero values in CSI scores. Panel A shows that the CV of CSI is considerably higher than that of FCS, and the most common household value is a CSI standard deviation almost four times that of the (generally low) mean CSI scores. Here we see that the CSI-resistance of Dalit castes is higher (CV lower) than that of other groups, although Dalits are generally worse-off in terms of CSI levels.

Overall, households in Maulali appear to be more resilient and resistant to shocks and stresses than anticipated. However, the absence of shocks in the period of data collection and the short

time series of data prevent us from definitively confirming this result.

2.4 Building a resilience monitoring system

Our experience with implementing the FCS/CSI survey in Maulali allows us to evaluate the logistical and financial feasibility—and analytical strengths and weaknesses—of creating a food security resilience monitoring system in PAHAL areas.

2.4(a) Logistics and costs of scale-up

A FCS/CSI-based food security monitoring system can be implemented rapidly and inexpensively. Below, we describe the process of implementing such a system, and provide some indicative estimates of the costs of scaling up.

Scoping. Initial scoping visits in Maulali and Gaguda (the dropped site) assessed the feasibility of carrying out the longitudinal research, especially through collecting information about livelihoods, food security, the recurrence of (and vulnerability of families and individuals to) different shocks and stressors, the quality of mobile network coverage (for uploading data); we also noted logistical requirements for implementation and shared the research plan and its expected outcomes with the local community. During these initial scoping visits, we obtained information from key informants and focus groups about the most important coping strategies used in the VDCs, and also itemized commonly consumed foods for later classification into food groups. Focus group discussions (FGDs) included sessions with individuals of different genders, wealth groups, and castes. Asking questions about FCS was unproblematic, while CSI-related inquiries necessitated in-depth explanation—a contrast we also observed in the enumerator trainings. FGDs took more time than expected to complete, largely due to the dispersed population in the VDCs and the limited free time of community members. The initial scoping visit took about 7 days.

Hiring. Because of the data-intensiveness of the longitudinal design, local enumerators are a major asset to setting up a food security monitoring system. The major consideration is establishment of a transparent, fair hiring process; especially in areas where local employment is difficult to obtain, even a low paying job becomes attractive to many, and thus hiring decisions invite accusations of political or other bias. The skill requirements of enumerator positions for FCS and CSI, however, are not high; secondary school graduates are generally able to perform the needed tasks. Hiring in Maulali took about 2 days.

Although we followed similar hiring procedures in both Maulali and Gaguda, the outcomes were quite different. In Maulali, we experienced little pressure from local groups to hire their allies and members.

Local politicians observed and supported the hiring process, which included an open call for resumes, a brief written examination, and transparency about non-exam hiring guidelines, including gender and caste balance. In Gaguda, on the other hand, the VDC secretary, political party members, and other individuals attempted repeatedly to influence the selection process. A physical fight between selected and non-selected candidates led to our decision to drop Gaguda as a research site.

CSI/FCS training. After hiring enumerators, we provided a short orientation about the research and training on how to use the mobile phone-based survey instruments. In the training, we reviewed every question contained in the survey instruments and practiced these questions in mock interviews—which also helped us reframe some questions in locally appropriate ways. The training, including pretesting and revision of survey instruments, took about one week.

At the beginning of the data collection, enumerators were sent, in groups of two, to each survey household. They worked for about a week in these groups and before starting to work individually. We also suggested that enumerators be in touch with each other, to share what they learned and to ask questions. Training and pre-testing took about 7 days.

Data collection. The high frequency of data collection risked exhausting households after a few rounds. Even though the monthly survey tool was not long—households were expected to give about 10-15 minutes every month—the baseline and quarterly survey tools were much longer, requiring about an hour of time every three months. To compensate them for their time, the enumerators agreed that 100 NPR worth of goods, largely in coffee and oil, would fairly compensate households every month. Equal amounts of goods were bought from each shop operating within the VDC. Managing the incentive system and carrying goods from shops

to households, especially in the steep mountain topography with widely scattered houses and shops, was a challenge, but succeeded in keeping households motivated throughout the survey; no household elected to drop out of the survey during the 15 months, although some moved out of the VDC and therefore did not participate for the full 15 months.

The high frequency of data collection requires full-time enumerators, which obviates the need to hire new enumerators continually, but also adds management responsibilities: assuring that enumerators obtain leave when needed, having a consistent payment disbursement system, and so on. In general, however, the developing skills of the enumerators quickly enabled remote management; our team's data collection supervisor was based in Kathmandu, and only needed to conduct infrequent field visits. Six full-time enumerators working six days a week for two weeks—approximately 400 person-hours—covered 505 households in each round for the food security survey.

Managing data. We used OpenDataKit, based on the KOBOLCollect application, for data collection. Completed survey forms were sent and stored automatically in the Kobo Toolbox server, and data was later downloaded for cleaning and analysis. Poor mobile network and internet connections sometimes made mobile data collection difficult; uploading revisions of survey instruments, especially, was possible but extremely slow. Overall, however, the use of mobile data collection made high-frequency data collection possible, especially in the context of remote management; it also greatly reduced data cleaning time.

Costs. Scoping and training costs in Maulali totaled about 15,000 NPR (~\$143), not including the salary of the data collection supervisor. Monthly salaries for the six enumerators totaled 90,000 NPR (~\$859), but about half the enumerator time was devoted to quarterly surveys, which would not be part of a

food security monitoring system. We thus estimate about 45,000 NPR (~\$430) for the food security component alone. Household incentives totaled another 55,000 NPR (~\$525) monthly. We thus estimate that a food security monitoring system, based on FCS and CSI, using local enumerators in a similarly sized village, would cost about \$1000/month to run, or approximately \$2/household/month, plus any management costs for data collection supervisors, analysts, etc.

We note also that this survey was a census, including all 500+ households in Maulali. The required size of a random sample to obtain estimates representative at the VDC level will vary based on various contextual factors, including VDC size, variation in FCS/CSI, and the acceptable error. However, we find that in Maulali a sample of approximately 200 would suffice to produce food security estimates within acceptable ranges. The costs of running an ongoing survey of that size would then fall to approximately \$400/month.

We can use these estimates to roughly project what scaling up to all 84 PAHAL VDCs might cost. Given the sample sizes required to obtain representative statistics in each VDC, and the assumptions of simple random sampling, a 95% confidence level, and acceptable error of 5%, 21,636 households will need to be sampled in all. **In addition to one-time scoping and training investments for the 84 sites, just under \$45,000 every month would be needed to maintain the food security monitoring system for the entire PAHAL area. The annual operating costs thus amount to about \$540,000.** We note again that this does not include (largely remote) management costs, secondary data cleaning, or data analysis, all of which will likely increase this figure several-fold. However, we provide these estimates to suggest that, once established, a food security monitoring system based on FCS and CSI (or other rapid assessment indicators) can be run relatively inexpensively if a subset of sites is chosen. For further cost reduction, monitoring systems can rely on digital data, as discussed in the following section.



2.4(b) Future prospects: Passively collected digital data

Digital data—passively collected, high volume, and highly resolved in both space and time—can alleviate some of the challenges in resilience measurement. Cell phone data, especially, has great promise to serve as the foundation for a food security resilience monitoring system. In this section, we briefly review the potential of cell phone data for this purpose.

Around 3.6 billion unique subscribers used cell phones in developing countries by the end of 2016 (GSMA, 2017). Mobile phone call detail records (CDR), meta-data produced by mobile network operators for billing and network monitoring purposes, are hence available for a wide swath of

the world population. Each time a subscriber makes a call or sends an SMS, data are stored on the cell towers to which the call is routed (origin and destination) as well as the identifier of the person who received the call. CDR have been used to produce dynamic population maps (e.g., Deville et al. 2015), for epidemiological modeling (e.g., Bengtsson et al. 2015), for high resolution poverty mapping (e.g. Blumenstock et al. 2015; Steele et al. 2017), and for employment prediction (e.g. Sundsøy et al. 2017). We present below two examples of CDR use in Nepal and Bangladesh. They were carried out by the Flowminder Foundation, a non-profit organization and a pioneer in the use of CDR for humanitarian and development purposes.

The 2015 Nepal earthquake and mobility measurement.

Two months before the 2015 Nepal earthquake devastated the Kathmandu valley, Flowminder Foundation installed servers at the main mobile network operator (NCell) to access and process CDR. When the earthquake hit, Flowminder provided humanitarian stakeholders daily estimates of the size and destination of the population displaced by the earthquake (Wilson et al. 2016). This information proved central in supporting humanitarian decision makers in their effort to allocate aid most effectively (Figure 10). This same kind of information could be used to track labor migration, both within Nepal and

transnationally. Given the importance of migration to livelihoods, tracking mobility is an essential part of well-being monitoring.

Poverty mapping and resilience analysis. As noted earlier, measuring resilience in the field has proven a challenge, with the main stumbling block being a dearth of high frequency data on individual and household well-being. The advance in CDR analytics for poverty measurement suggests that CDR might provide a solution. Steele et al. (2017) used a combination of CDR and satellite imagery to produce a high-resolution poverty map of Bangladesh.

Figure 10. Nepal Earthquake 2015 Emergency Response: Setup and First Insights Within 14 Days. Between April 24, the day before the earthquake, and May 1, the number of people leaving and entering the Kathmandu valley was drastically changed. An estimated 390,000 more people left than would be normal, representing 14% of the population, and 247,000 fewer people entered, representing 8.8% of the population. People leaving Kathmandu Valley went to many different areas, notably the populous areas in the south and the Central and West Development Regions. Taken from Wilson et al. 2016 with permission.

Nepal Population Estimates as of May 1, 2015

2. Kathmandu Valley

Kathmandu Valley is here defined as the districts Kathmandu, Bhaktapur and Lalitpur. Kathmandu Valley is one of the most densely populated areas in Nepal and home to ca 2.8 m people [1].

Key findings:

- An estimated 390,000 people more than normal had left the Kathmandu valley - comparing May 1 with the day before the earthquake April 24 (ratio to the population: 14%).
- An estimated 247,000 persons less than normal had come into the area during the same period (ratio to the population: 8.8%).
- People leaving Kathmandu Valley went to a large number of areas, notably the populous areas in the south and the Central and West Development Regions.

2.8m

+390,000

(246,000-540,000)

-247,000

(-155,000-339,000)

Above normal flows from Kathmandu Valley to other districts

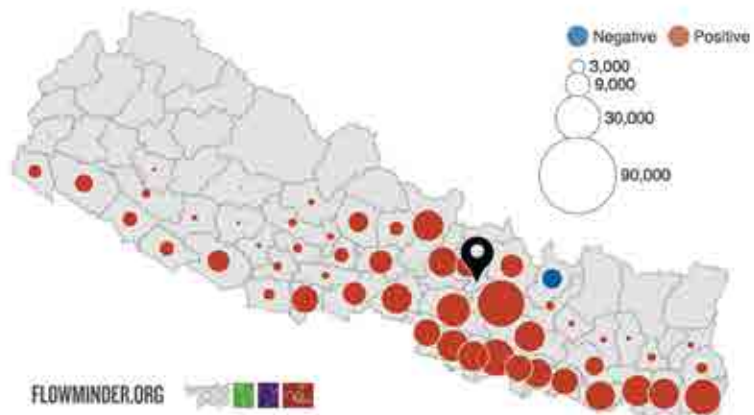
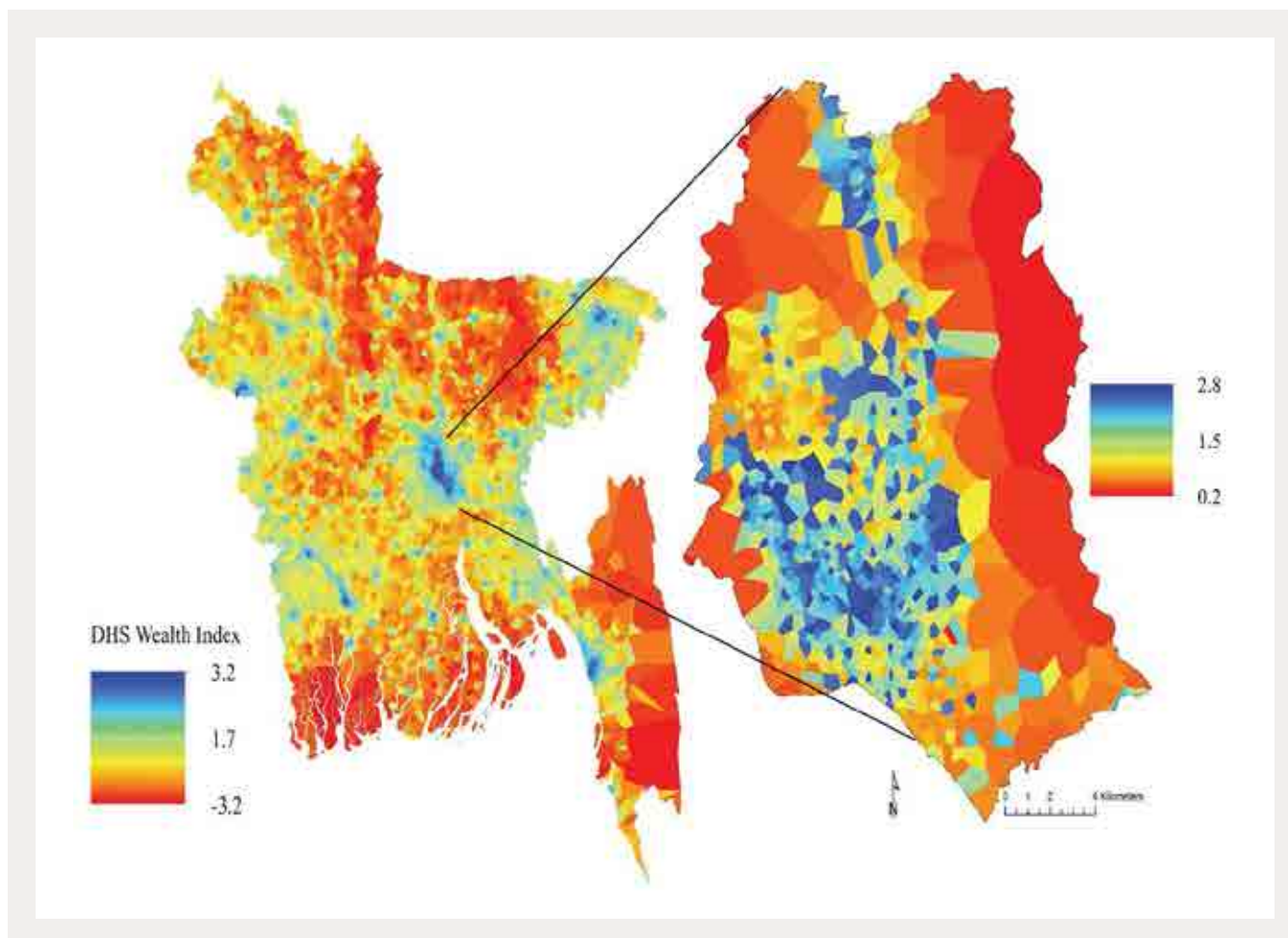


Figure 11. High resolution poverty mapping using cell phone data. Figure and data taken from Steele et al. 2017 with permission.



Training the CDR-satellite model on Bangladesh Demographic and Health Surveys (DHS), they obtained 78% R-squared when predicting a wealth index (Figure 11).

These findings, as well as the results presented in Blumenstock et al. (2015) and Njuguna and McSharry (2017), “indicate the possibility to

estimate and continually monitor poverty rates at high spatial resolution in countries with limited capacity to support traditional methods of data collection” (Steele et al. 2017). Such continual monitoring of poverty rates would allow for robust estimation of the dynamics of poverty over time and hence provide the required material for estimating resilience.

3. The Determinants of Food Security

The second objective of this research is to look at the forces that drive variation in food security, both across households and across time within the same household. As noted in the Y1 Report, we extend the set of possible determinants to include not only the typical predictors—human capital and demographic characteristics (sex of household head, caste, education, etc.) as well as physical and financial capital (material assets, net debt/savings, etc.)—but also consider social capital, which we capture by analyzing the structure of community networks: the web of relationships within which economic transactions are made. Section 3.1 describes stocks of human, financial, physical, and social capital, and Section 3.2 explores how these stocks determine food security.

3.1 Capital stocks and flows

3.1(a) Human capital

No consensus methodology exists for the measurement of human capital. Education-related variables are the most common proxies for human

capital, and when measurement in economic terms is required, the lifetime earnings method is frequently used. In this conceptualization, human capital is the expected income return of a person's labor over their lifetime, accounting for future discounting and the "maintenance" costs of sustaining that labor—food, health, housing, and so on. The value of an individual's human capital increases with higher levels of education, better health, and access to remunerative labor markets. Discrimination based on sex, caste, and other characteristics can artificially suppress the value of human capital. In addition, "income" in the human capital formulation should include the value of household and other work not remunerated by markets. Overall, the key decisions facing families around optimization of human capital can be grouped into temporal and spatial considerations. Temporally, when is it preferable to invest in enhancing future income-earning potential, and forego present income? Spatially, which labor markets are most remunerative?

We calculate the value of each Maulali household's stock of human capital. We generally make very conservative assumptions, as described in Box 2.

Box 2. Assumptions used in calculating human capital value

Working lifetime. All individuals are assumed to begin working at age 18 and stop working at age 65. This is a conservative assumption: children in Maulali typically begin working at age 15 for wages, and are involved in household labor well before adolescence. In addition, many individuals continue to work until after age 65, especially in household activities. Because we do not consider the potential increase in future earnings that would result from the education of children, our assumed age range has the effect of lowering the estimated value of human capital: by our calculation those under the age of 18, or over 65, incur maintenance costs but do not earn income.

Life expectancy. We calculate life expectancy at an individual's current age based on recent Nepal life tables (WHO 2017). These life expectancies consider the possibility of premature mortality, which reduces the potential value of the human capital stock.

Wage rates. For simplicity, we presume a daily wage rate of 500 NPR, regardless of sex, caste, age, education, or health status. This is the prevailing Maulali rate for male agricultural labor. In the current labor market, women are paid around 300 NPR for agricultural work; skilled professions (e.g. carpenters, masons, white collar workers) make a premium; some wage differentials by caste exist; teenagers are paid less; and there is some geographic variation in wage rates. We value unpaid household labor at the same rate. Because of this, we assume a working year of 365 days; household members are engaged every day in either wage or unpaid work.

Maintenance rate. We presume a daily maintenance rate—the cost of sustaining labor in a healthy state, which includes food, health, housing, and other essential goods and services—equivalent to the international poverty line of \$1.90, or 198 NPR, a day. This is more than four times the national poverty line, which is approximately 45 NPR/day, and as such represents a very conservative estimate of the cost of maintenance. The adjusted net daily wage rate thus begins at 302 NPR/day (wage rate minus maintenance).

Per capita income growth. We assume an annual growth rate in income per capita of 2.78%, the average rate for the last decade in Nepal.

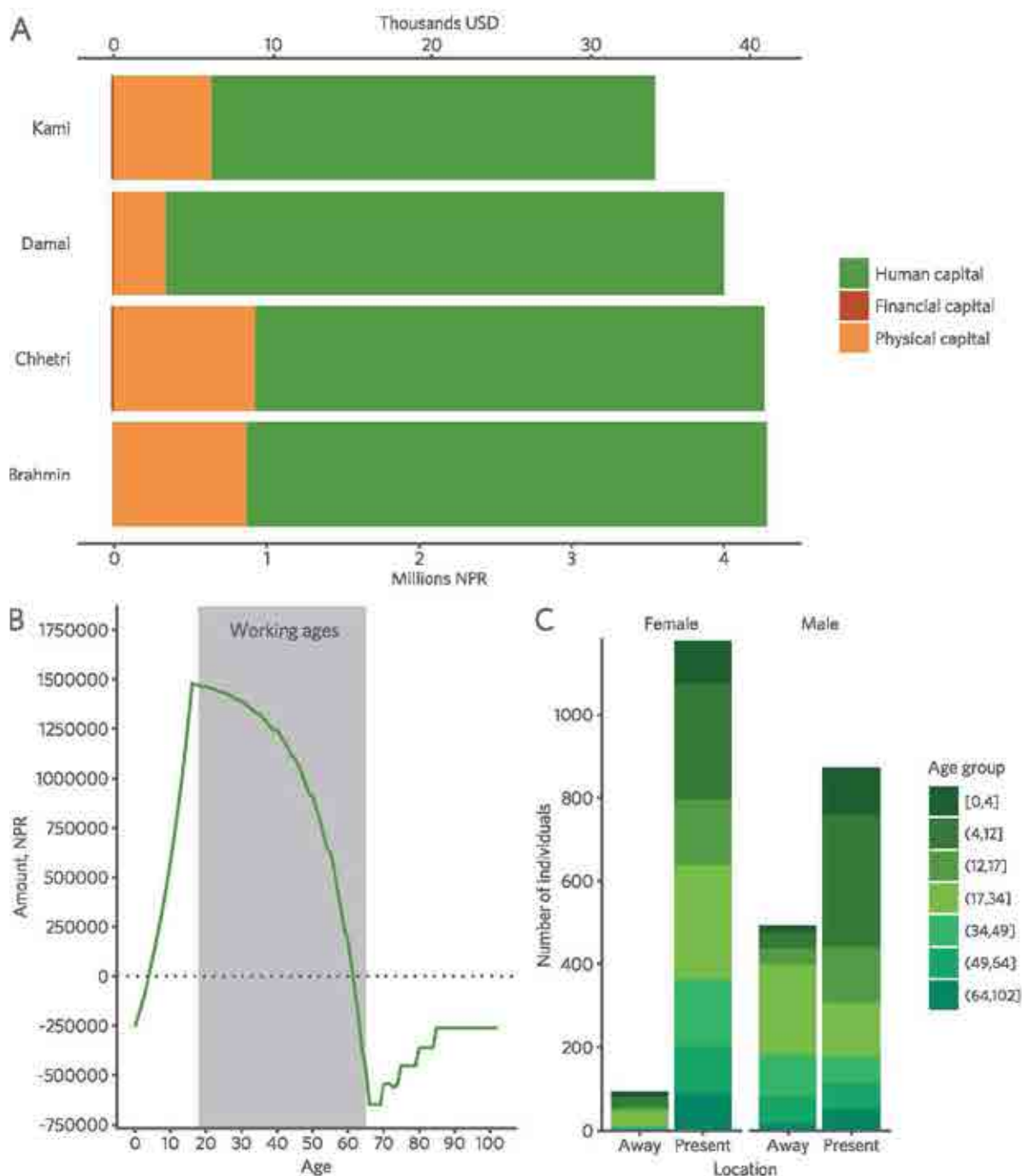
Future discounting. Money held now is worth more than an equal amount of money held in the future, because of the possibility of investing current capital and obtaining an interest return. The discount rate captures the time differences in the value of money. The empirical literature on human capital discounting is varied; estimates range from 2.5% to 20%, with most falling near the low end of this range (Benzoni and Chyruk 2015; Hancock and Richardson 1985). We make the very conservative assumption that households discount their human capital by 10% annually, meaning that potential earnings of 100 NPR earned one year from now are only perceived in the present as being worth 90 NPR. The assumed 10% discount rate thus reduces the long-term value of a human capital stock considerably, especially with respect to children. Considering per capita income growth, the net discount rate is 8.78%.

Using these assumptions we find that, across castes—and even using restrictive assumptions—**over 78% of all capital value held by households in Maulali is in the form of human capital** (Figure 12, Panel A). This reflects in part the paucity of financial and physical capital, as detailed in Sections 3.1(b) and 3.1(c), but more generally, human capital is the primary resource families in Maulali have for generating income and improving food security. Two important implications follow. First, the expected returns from having children greatly outweigh the costs, as shown in Panel B's depiction of the human capital embodied by a household member of a given age. For all except the youngest children and those individuals above age 60, expected earnings exceed maintenance costs over the remaining lifespan. Human capital is valuable despite the weakness of the local job market, as manifest in the low available wages; if white collar or urban job markets develop, education may represent the best livelihood investment families can make. Second, **optimizing the value of the household capital stock entails a search for optimally remunerative labor markets, which leads to extensive transnational migration**, shown in Panel C and investigated in depth in Part 3 of this report; nearly one quarter of Maulali's household members, and over 36% of its men, live and work in India.

Labor markets in and around Maulali, meanwhile, are weak. Over the last year of the research, **only 31% of Maulali's population between the ages of 18 and 65 found work, and only a third of these jobs were regular employment**; the rest was irregular manual labor piece work, done upon request by employers, especially construction and agriculture. Nearly half of the available regular jobs are in schools, and NGOs (including the PAHAL program) and shops are the other major regular employers. In all, the 267 individuals in Maulali who found work earned a mean of 506 NPR/day for 70 days a year, for a total individual mean income of 35,420 NPR (\$340). Wage work is indeed an important source of family income in Maulali—if one can find a job.

Taken together, these observations suggest that **the development of nearby urban job markets for graduating youth may be the most important long-term intervention that could be undertaken if supporting *local* livelihoods is the goal; developing safe, profitable possibilities for transnational work may be the quickest means of improving livelihoods more generally.**

Figure 12. Summary of human capital. Financial capital in panel A is very small in relation to human and physical capital.



Labor sharing is an important part of work life in Maulali, particularly through *padimu*, an arrangement common in the western hills of Nepal. In *padimu*, families help each other with agricultural activities, especially planting and harvesting. No wages, in cash or food, are paid when one family helps another, but there is an expectation that the other party will return the assistance when needed. Families create *padimu* arrangements with trusted friends or neighbors. Households without available labor or land typically do not participate in *padimu*. **The volume of *padimu* work is considerable; in the last year of the survey, over 2,300 hours of labor were exchanged between 261 households. These flows equaled nearly 1.2 million NPR worth of labor, equivalent to about 12% of all cash income obtained through wage work.** Figure 13 provides a representation of the *padimu* network in Maulali. Households (represented by circles) are color-

coded by caste. The amount of labor exchanged is proportional to the thickness of the lines connecting households (as well as to the distance between household nodes).

Several features of this graph are worth noting. First, although *padimu* is a relationship between two households, labor exchanges can occur in clusters of many households who trust each other; several such clusters, including one large cluster comprised of Brahmin households, are evident in the network. Second, the two largest clusters are dominated by a single caste—Brahmin in one case, Chhetri in another—but there is no restriction on cross-caste *padimu*, as seen in one major cluster at the center of the graph and many smaller clusters in the network. Third, over half of all households participate in at least one *padimu* relationship.

Figure 13. Padimu network. Multidimensional scaling used to determine layout. Households labeled in white have missing caste information.

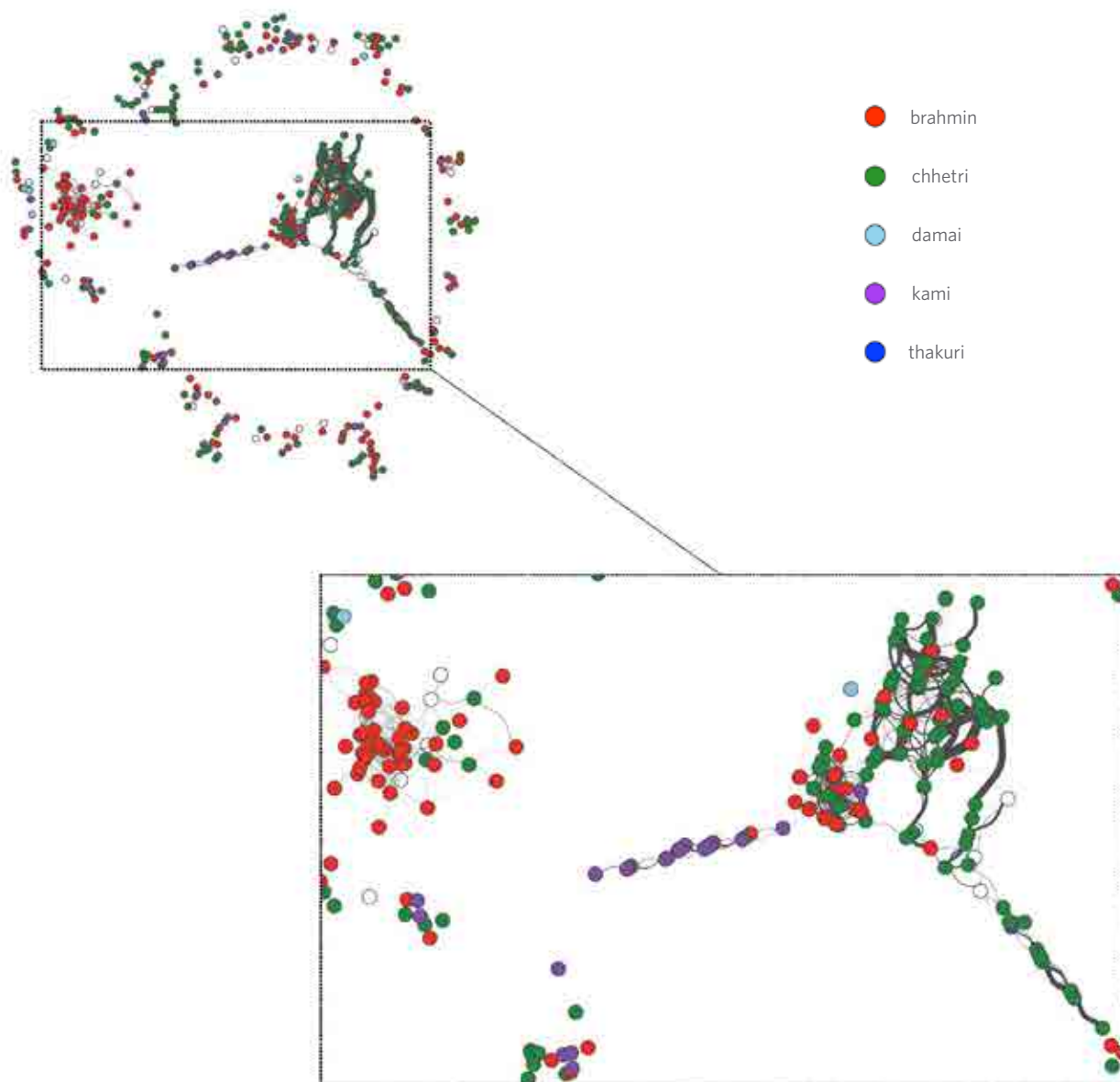
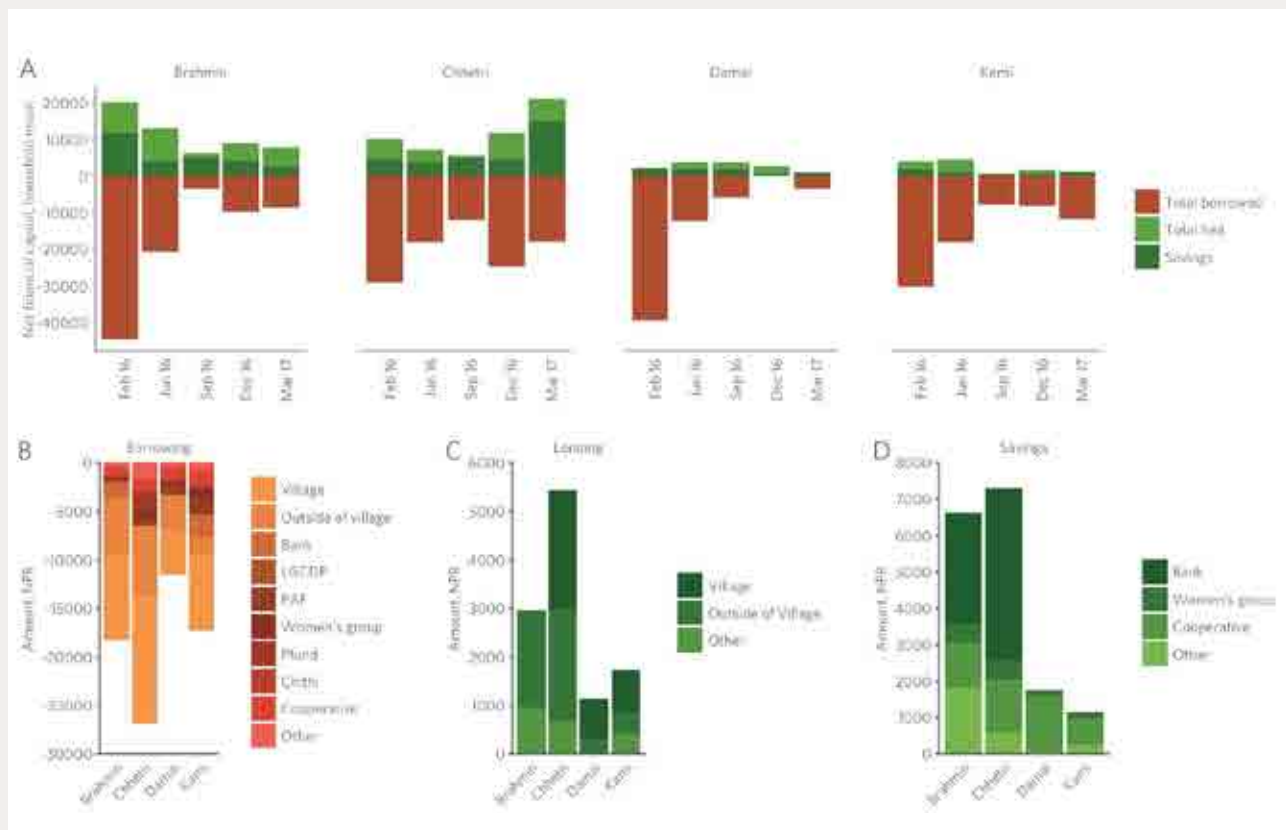


Figure 14. Mean household net financial capital, by caste and round.



3.1(b) Financial capital

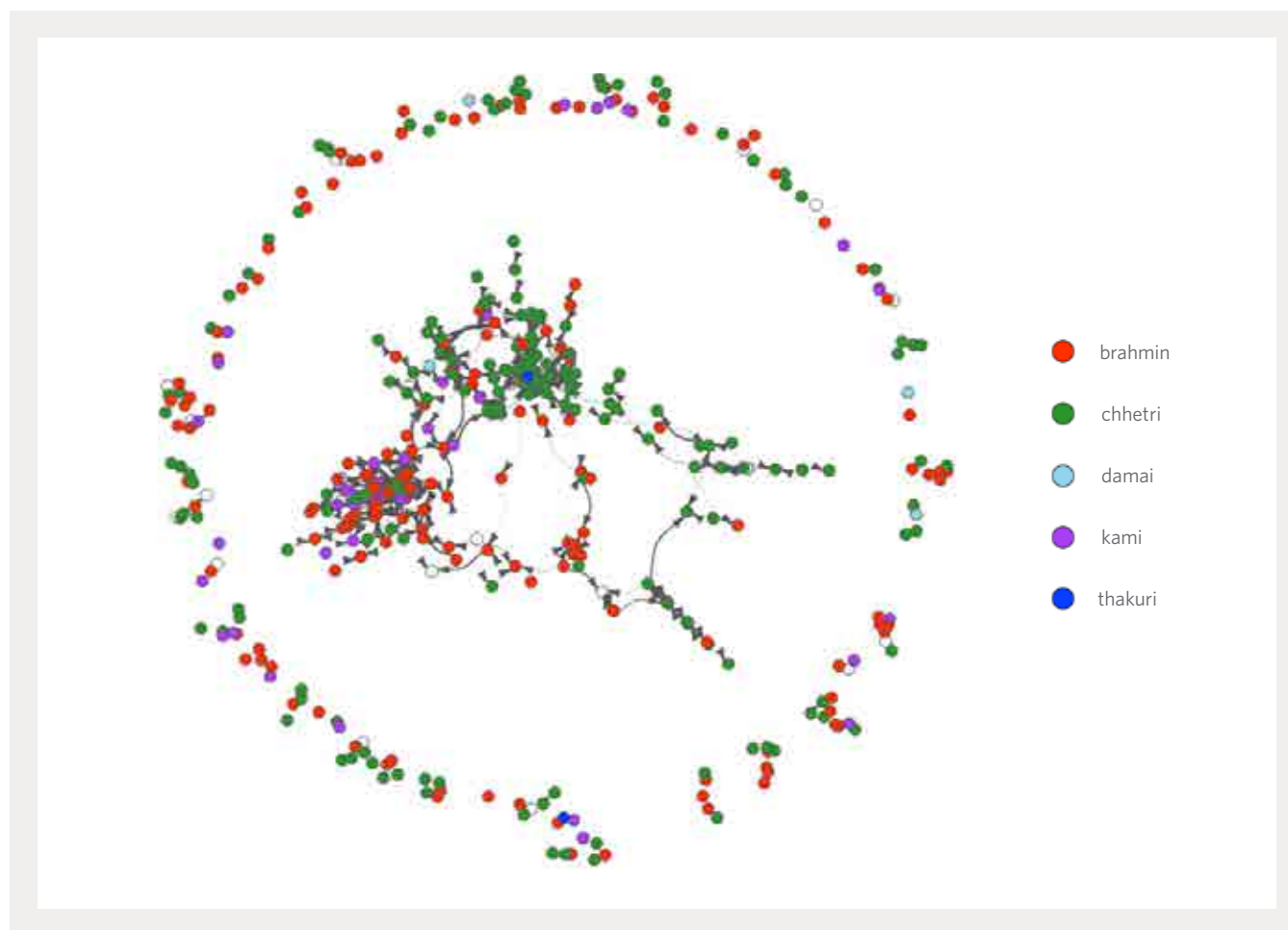
We measure various types of financial capital, including savings in banks, women’s groups, cooperatives, and other locations; insurance schemes; loans from banks and community institutions, including women’s groups, cooperatives, *chithi*, the poverty alleviation fund (PAF), and the local governance and community development program (LGCDP); and goods on credit.

Households vary in the amount of net financial capital they possess, but **the median household—which includes 24-39% of families, depending on the survey round—has no financial capital at all.** Twice as many households have positive financial capital as are in debt. However, **the mean household**

is in fact in debt, especially in the baseline survey round in Feb 2016 (Figure 14, Panel A); these differences between median and mean debt are driven by a relatively small set of households in extreme debt. We see strong differences across survey rounds; stocks of financial capital appear to be quite fluid, changing in response to remittance income, agricultural loans, and other flows. We also observe variation across castes; in general, savings and lending is dominated by Brahmin and Chhetri families; net debt is greater among Dalit castes.

Caste clearly determines patterns of financial access. While households utilize many sources of credit, including public sector-supported programs like the LGCDP and the PAF, most borrowing is from private sources, especially for Brahmin, Chhetri, and Damai

Figure 15. Financial network. Multi-dimensional scaling used to generate node placement.

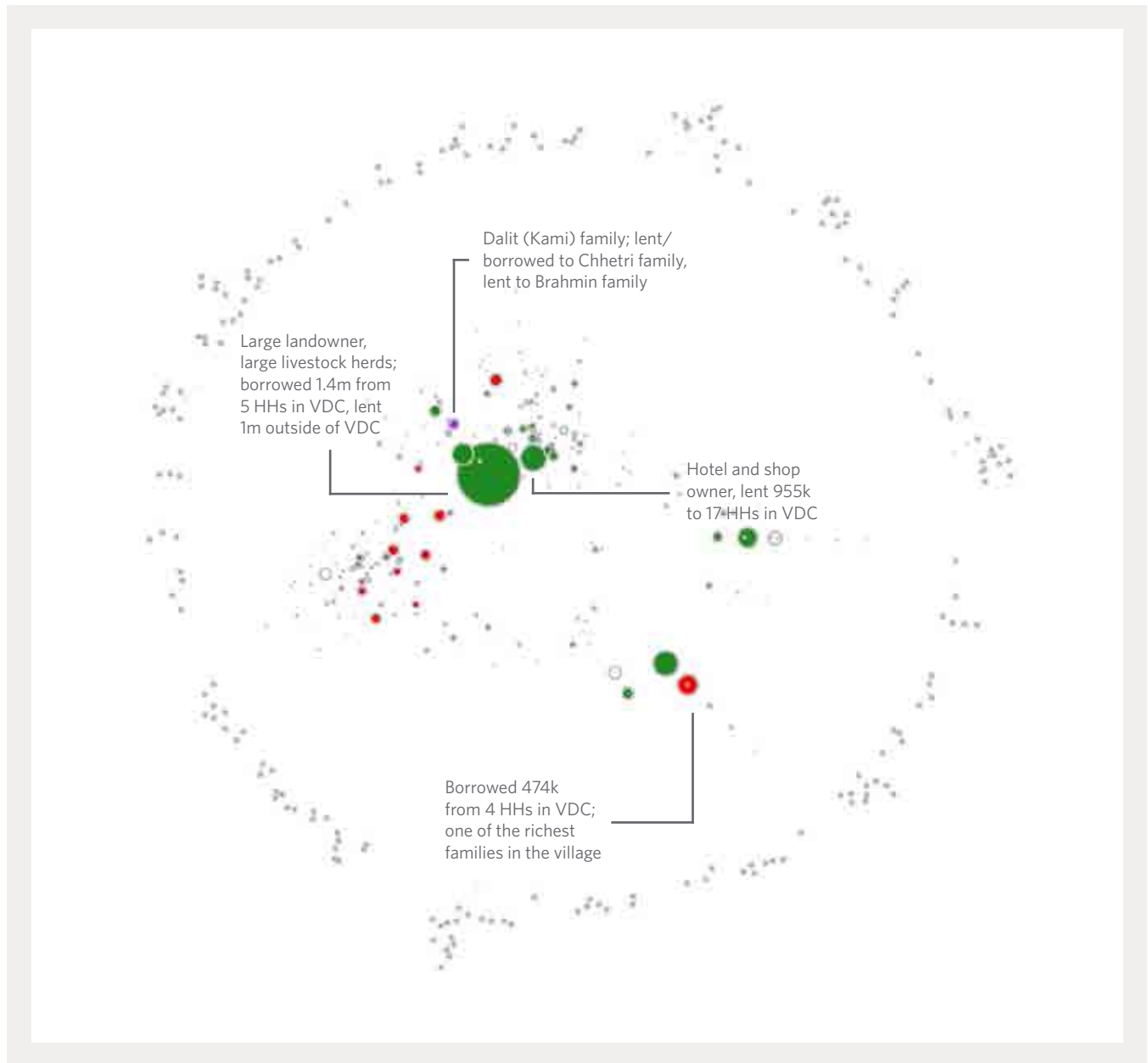


families (Panel A). We see that Chhetri households dominate lending in Maulali (Panel C); few Damai and Kami households are net lenders of capital. With respect to savings (Panel D), only Brahmin and Chhetri households have access to bank savings accounts; for those castes, bank holdings constitute the largest fraction of their savings. Damai and Kami households largely depend on cooperative groups to store savings. We found no strong associations between net financial capital and sex of household head or remittance volume.

A network representation of financial flows in Maulali clearly illustrates key lending/borrowing patterns (Figure 15).

The thickness of lines connecting households illustrates the intensity of lending and borrowing between them. The households are also clustered by the layout algorithm into lending and borrowing communities. The direction of the arrows indicates the flow of money. Several features are worth noting. First, **a large group of households—those on the outer ring, about 40% of families in Maulali—are left out entirely from the lending/borrowing network** (beyond a few minor loans). Second, the part of the network that is linked can be divided into two groups, one dominated by Chhetri borrowers and lenders (green cluster), and one dominated by Brahmin lenders and borrowers of different castes,

Figure 16. Financial network, circle size proportional to total lending plus borrowing.



including Kami households (red/purple-dominated cluster). Third, richer households dominate the lending and borrowing in the network. We can see this by redrawing the interior of the network graph above to make circle size proportional to the amount of money lent and borrowed (Figure 16).

3.1(c) Physical capital

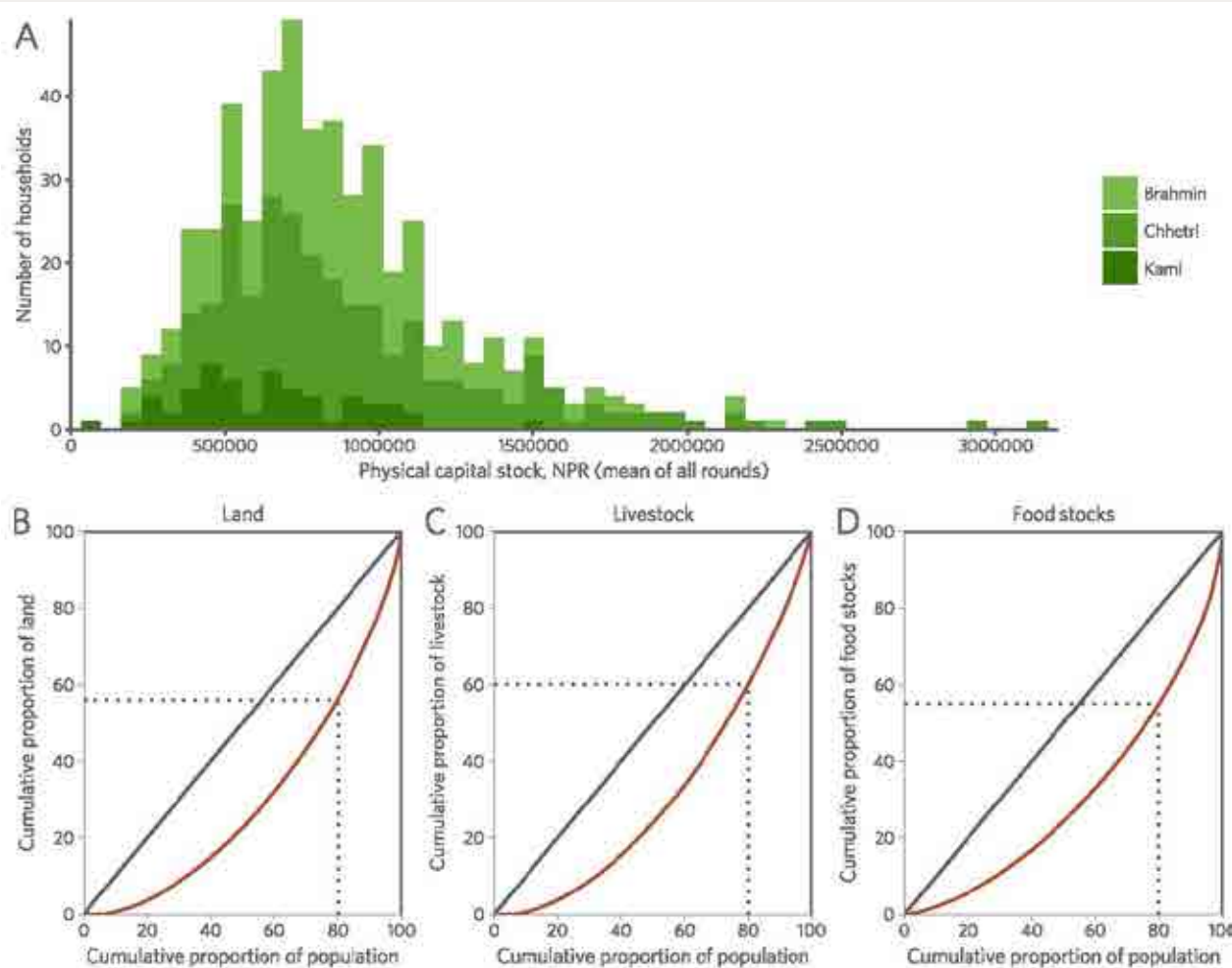
We look in this section at stocks and flows of physical capital, especially food stocks, land, livestock, structures (houses, sheds, and water and sanitation systems), and durable goods. We

also measured the value of durable goods (solar panels, jewelry, vehicles, etc.) in the baseline round, but did not update measures of this stock in subsequent rounds.

Panel A of Figure 17 shows the distribution of wealth (in thousands NPR) in Maulali, by caste (note that, for visual interpretability, we leave out the seven Damai households in this figure). **The median Kami household has 621,427 NPR (~\$5952) worth of physical capital and only a very few have more than 1.3 million NPR; in contrast, median Brahmin**

and Chhetri households have over 800,000 NPR in wealth, and many exceed 1.5 million. Panels B, C, and D show the Lorenz curves of different types of physical wealth; the x-axis indicates the cumulative percentage of households owning the cumulative amount of wealth of the y-axis. The black line denotes perfect equality, and the area between the black and red lines deviations from equality. For example, in all cases, the bottom 80% of households own around 60% of Maulali's physical wealth (dotted line), with slightly greater inequality for land and food stocks than livestock. Physical capital

Figure 17. Distributions of household physical capital stocks, in thousands NPR.



overall has a Gini coefficient of 0.265, suggesting that **inequality in physical capital is not pronounced in the VDC**. Across all households, the mean stock of physical wealth per capita is 219,630 NPR, or about \$2104.

Figure 18 (Panel A) disaggregates the value of physical capital into food stocks, land, livestock, structures, and durable goods. In an environment of serious ecological hazards, weak local labor markets, and heavy dependence on remittances, families choose to invest in structures, especially houses. Many households use remittance income to buy houses, not only in Maulali but also in the district capital of Chainpur, the market center of Dadeldhura, and the border city of Dhangadhi to the south. **Families perceive construction to be a more secure investment, in terms of current value and future appreciation, than livestock and local land.** Panel B depicts disparities in land ownership; the seven Damai families have little land, and Brahmin households have a larger proportion of irrigated land than other castes. Panel C shows livestock ownership in tropical livestock units (TLUs); most investment in animal husbandry goes into cows. Panels B and C also illustrate the scarcity of assets: the median household in Maulali has only 1/20th of a hectare and 0.77 TLUs. Food stocks, dominated by paddy rice and wheat, vary seasonally, with quantities peaking in the September-December postharvest period. **Dalit castes have considerably lower stocks of food throughout the year, especially in the hunger season from June to August.** In June 2016, for example, the mean Kami household had only 90 kilograms of stored food on hand, or around 24 kg per capita—around a month's supply.

Land sales, rentals, and sharecropping are rare in Maulali. Only about one hectare of land within Maulali, split into 25 plots, was sold over the past year, at a total price of around 650,000 NPR (\$6241). An additional 1.4 hectares were sharecropped. No land rentals were recorded. Another land arrangement, called *matey*, is more common. In *matey*, a landowner allows another farmer to cultivate his/her land in exchange for a loan. When the loan is repaid, the land use rights go back to the owner. The loan is zero-interest, but the user of the land is of course allowed to keep the harvest. About 4.5 hectares total in Maulali were placed in *matey* over the past year; during the peak agricultural season, around 3-4% of all land in the VDC is in *matey*.

3.1(d) Social capital and community networks

We conceptualize social capital as the ability to mobilize resources—human, financial, and physical—through connections with others. Network metrics quantify social capital by measuring the extent to which a household exchanges resources with others, how centrally it is placed in the web of capital flows, and other aspects of embeddedness in the social and economic context. **We look especially at four social capital properties of households: degree, strength, closeness, and betweenness.** Degree is a measure of the number of households to which a given household is connected; that is, the number of households with which it has exchanged labor, cash, or goods. Strength sums outflow and inflow: the total amount of capital that goes out from and comes into the household. Closeness measures how “close” a household is to others in the network, based on how

Figure 18. Physical capital types and values.

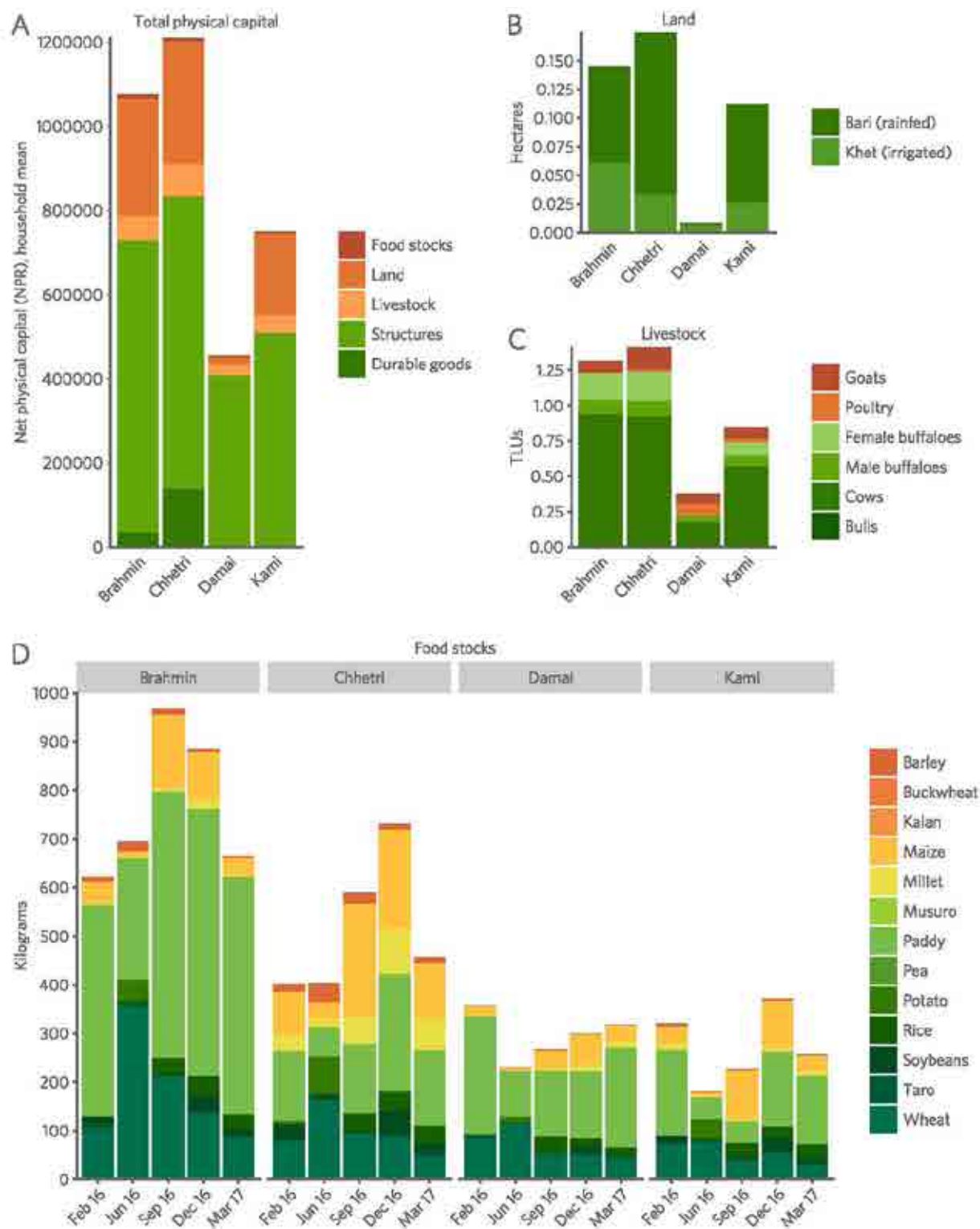
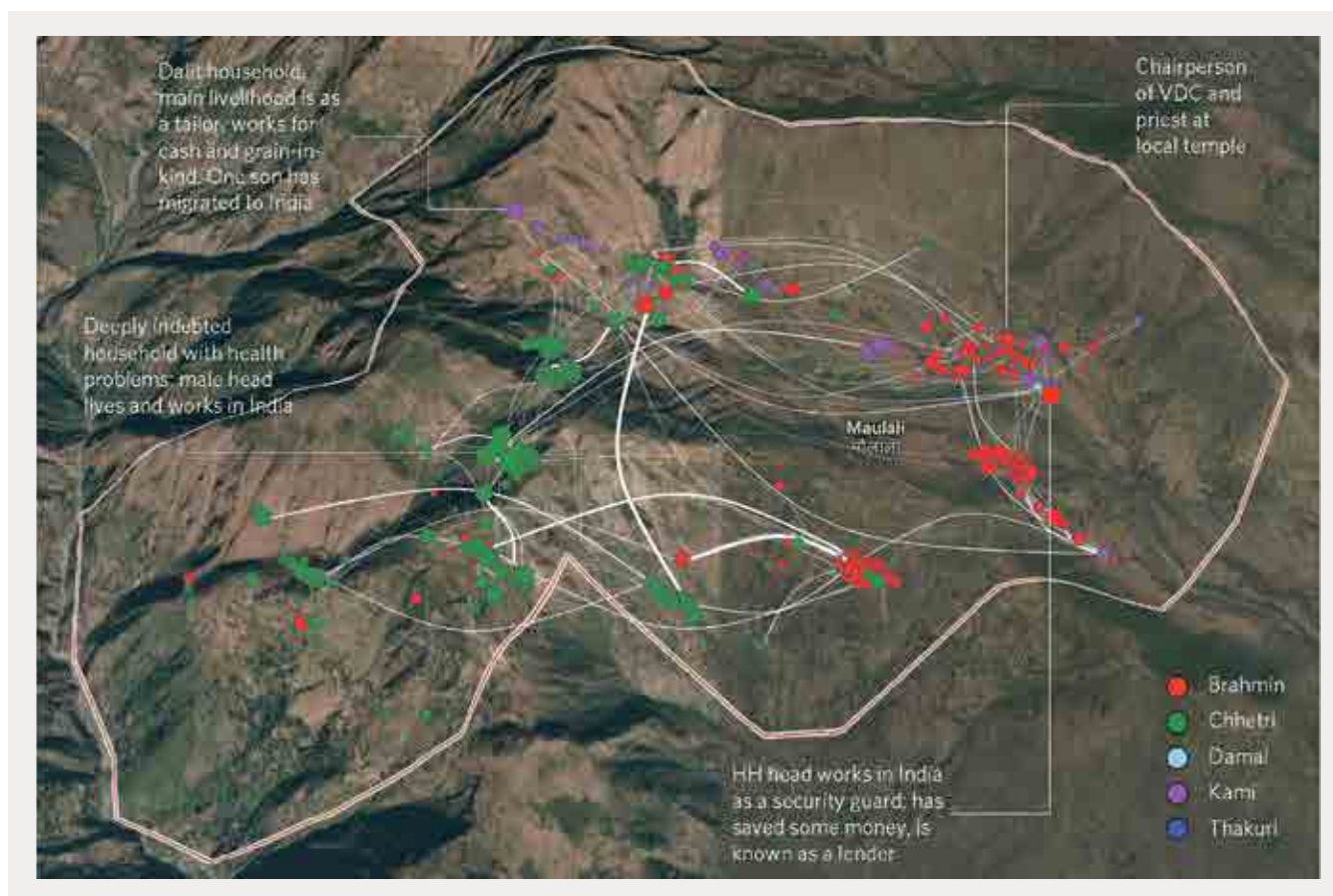




Figure 19. Maulali's capital network.



many “steps” it takes to access other households, with steps determined by whether a capital exchange link exists between each pair of households. Betweenness centrality is a measure of the extent to which a household serves as a “bridge” for capital, linking households which may not have a direct connection. We define these properties more precisely in the discussion below.

First, we can summarize the network in a single diagram that sums all types of capital flows—labor contracts and *padimu* labor sharing, wages and other cash transfers, land, livestock, loans, sharecropping and *matey* value, and gifts (Figure 19).

The size of each household-circle is proportional to the size of its *capital stock per capita*. The width of the links connecting households is proportion to the size of *total capital flow*. The position of the households corresponds to their actual geographic location

within Maulali. We see several obvious features. First, we see that castes tend to cluster together in space. Second, we see that proximity is not the fundamental determinant of capital flow; households exchange with others across the VDC. Third, when human capital is considered, and household size is adjusted for, we see a relative equality of wealth in the community.

Overall, **just over 16 million NPR (\$154,265) in capital value was transferred between households over the time frame of the research. This figure is almost double the 8.8 million NPR (\$85,172) earned by all individuals through wage work (excluding that earned from other households), and nearly equals the 19.7 million NPR (\$190,058) in remittances received by households**, a topic we discuss further in Section 4. Community networks are clearly fundamental to well-being in Maulali.

Figure 20 portrays the network properties discussed above: degree, strength, closeness, and betweenness. The left network graphs show household circles, again placed geographically and with link widths proportional to capital flows between each pair of families. Circle sizes refer to the specific network property referred in each panel.

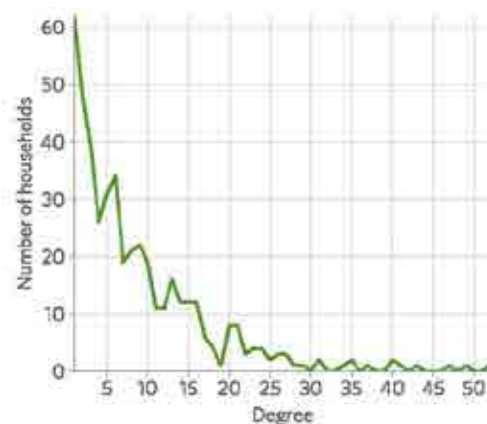
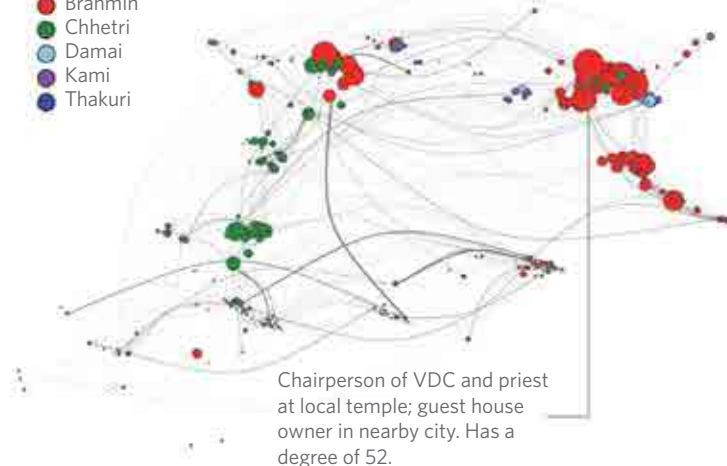
Degree (Panel A) is the number of connections a household had over the survey period; the degree score increases by one each time a household reports exchanging capital with a new partner household. The most connected household in Maulali transacted with 52 households, and the mean household had 9 connections; the graph on the right of Panel A shows the number of households at

Figure 20, panels A and B. Network properties of households.

A

● Brahmin
● Chhetri
● Damai
● Kami
● Thakuri

Degree

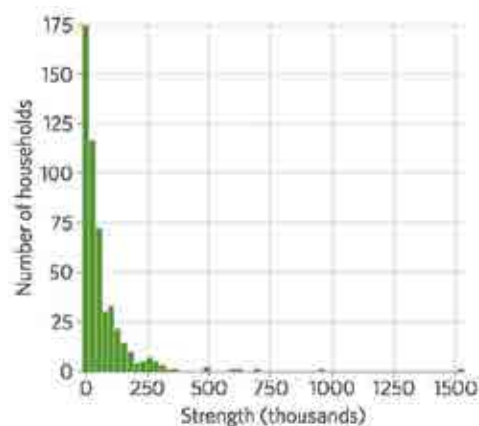
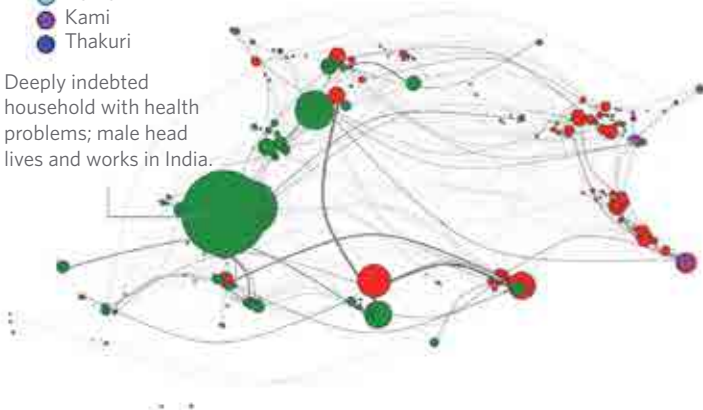


B

● Brahmin
● Chhetri
● Damai
● Kami
● Thakuri

Strength

Deeply indebted household with health problems; male head lives and works in India.

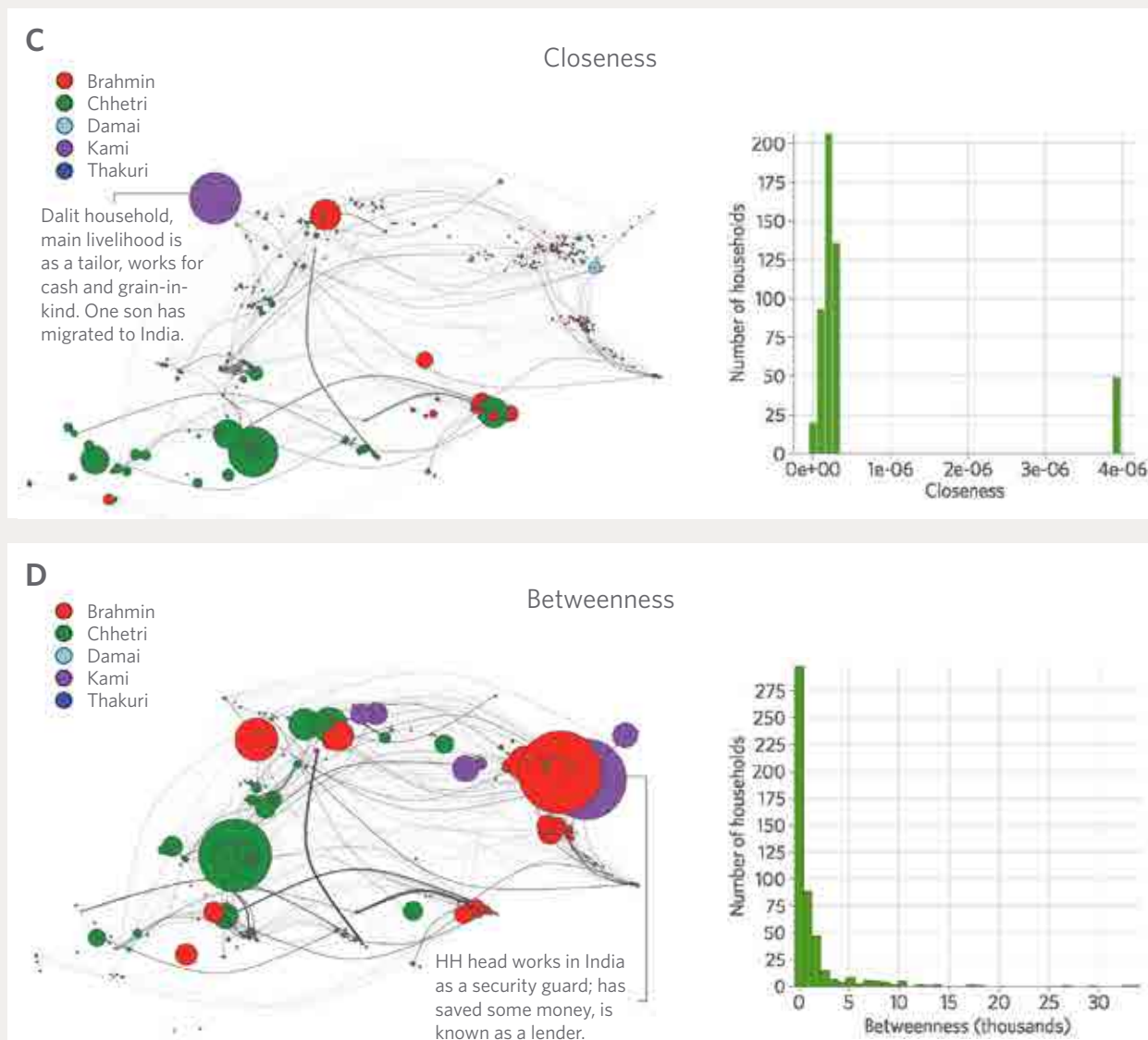


each degree value. **The network diagram suggests that a cluster of Brahmin households is the most strongly connected region in the VDC;** smaller clusters appear throughout the community.

Strength (Panel B) sums the value of all transactions conducted by a household over the survey period. Comparing the network diagram with its counterpart

in Panel A shows clearly that high degree does not imply high strength; a single large transaction—for example, the debt held by the largest node in Panel B's graph—can outweigh the value of many small connections. Note that strength measures social capital in the sense of dependence, not reciprocity; a debtor may be more strongly connected than one who shares labor in a padimu arrangement. The

Figure 20, panels C and D. Network properties of households.



overall distribution of strength is shown on the right side of Panel B. **We see that many households have weak to moderate economic connections; after about 75,000 NPR (\$722), the distribution quickly decays to a small number of households.**

The closeness centrality of a household (Panel C) is calculated by taking the inverse of the mean length—as measured in “steps” (connections between a pair of households) unweighted by the strength of the connection—between the household and all other households in the network. The community is split into two broad categories of closeness, as shown in the bimodal distribution on the right of Panel C.

A small set of households are very close: no more than one or two degrees of separation lie between these families and any of Maulali’s households.

Families in this category possess at least moderate wealth and, except for a few well-connected Kami households in the top left of the graph, are generally Brahmin or Chhetri caste. Most of Maulali’s families, however, fall into the lower mode of the distribution, and no households fall between the “very high” and “low” categories. Note again that closeness is distinct from both degree and strength, as seen by the difference in the various network graphs. For example, the high-degree Brahmin cluster in the top right of Panel A’s network is low in closeness; in other words, the cluster is well connected internally but not externally.

Finally, betweenness centrality (Panel D) measures the number of shortest paths, among the full set of paths in the network connecting any given node to any other node, that go “through” a given household; it is a metric of social bridging. Unlike closeness centrality, betweenness is unimodal, but a few households do serve as key bridges in Maulali. Note, for example, the bridging Brahmin household in the top right of the graph. As noted above, this cluster is relatively low in closeness, that is, poorly connected externally. One Brahmin household, however, does have connections with the rest of the network, and

so most short paths from this region of the network to the other must traverse this household, increasing its betweenness centrality.

In the following section, we examine how these different aspects of human, financial, physical, and social capital determine food security in Maulali.

3.2 The drivers of food security

3.2(a) Conceptual framework and analytical methodology

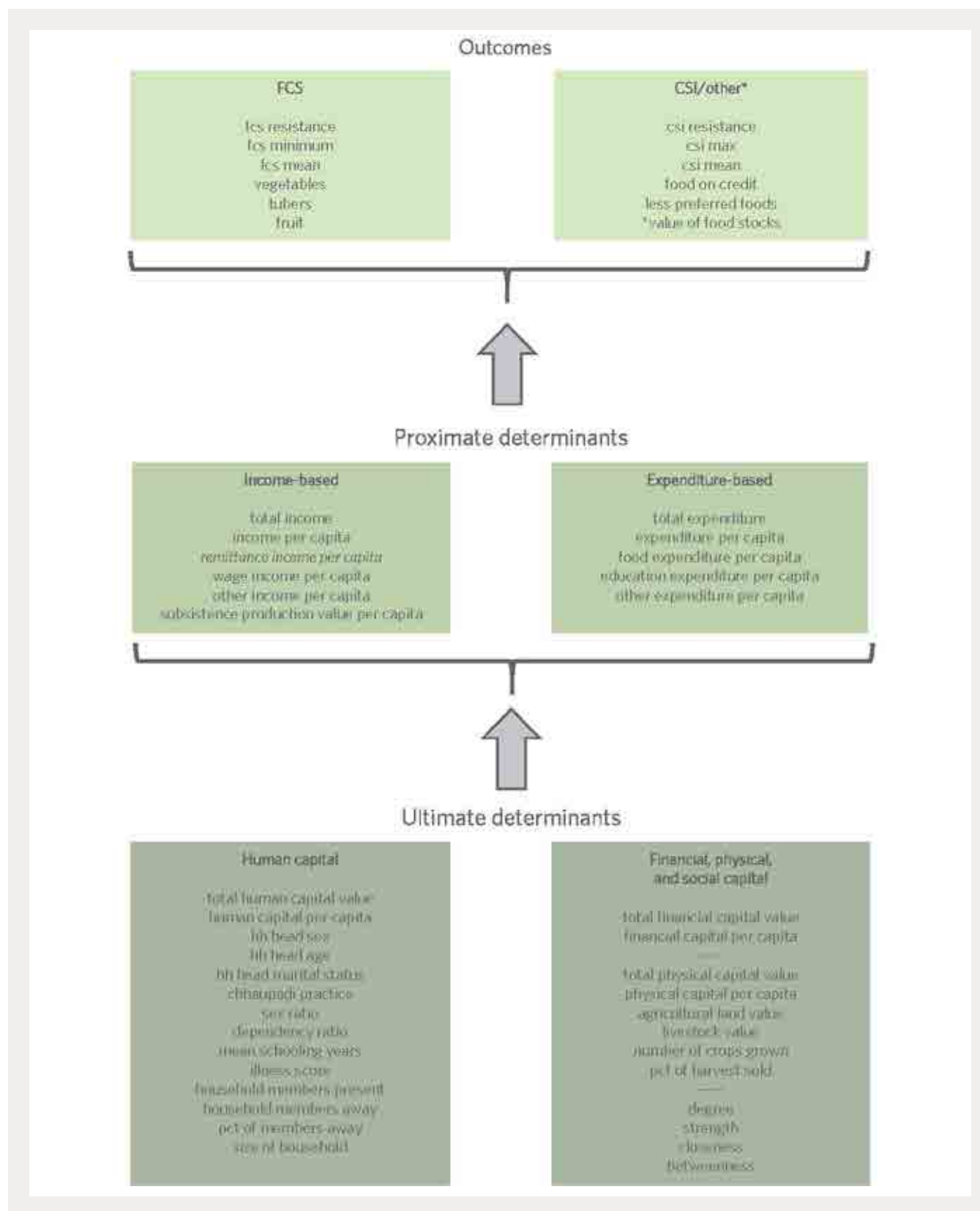
In this final analytical section, **we use machine learning—specifically a random forests approach—to untangle the myriad causal forces determining food security in Maulali.** Figure 21 illustrates the conceptual framework we use in undertaking this analysis.

We look at the determinants of 12 outcomes: FCS resilience, resistance, and minimum over the survey period; three constituent FCS items (vegetable, tuber, and grain consumption in the past week); CSI resistance, mean, and maximum over the survey period; two constituent CSI items (food purchased on credit and consumption of less preferred foods²); and the total value of food stocks held by the households. We present the results of the FCS resistance and minimum models in the following section; the results of other FCS-based models are available in the Appendix, and the CSI models are available upon request.

We examined two levels of determinants, the first encompassing income and expenditure variables and the second capital stock and flow variables. At the first level, we looked at total and per capita income and expenditure, income from remittances, wages, and other sources, the value of subsistence

² A third CSI item that varied over the period, *vogchhak magne*, was excluded because of small sample size; a total of only 44 Dalit households practiced this strategy.

Figure 21. Conceptual framework.



production, and expenditures on food, education, and other goods and services. Section 3.1 described the various types of capital stocks and flows at the second level of determinants; a few additional demographic variables require clarification. “Chhaupadi practice” refers to the practice of isolating menstruating women in separate housing, and reflects household norms about gender. “Dependency ratio” refers to the ratio of dependents (those below age 15 or over 64) to non-dependents. “Mean schooling years” refers to the average educational attainment of all household members. “Illness score” refers to self-reported days of illnesses that prevented work or school attendance, with higher scores indicating greater illness.

This conceptual framework illustrates the problems in untangling the causality of food security. Even with the data-intensive design of the present research, the number of observations available to parameterize models with many predictors—all the proximate and ultimate determinants in Figure 21—is limited. In addition, the functional forms of the relationships between predictors and outcomes are often unknown; when constrained by limited observations, the assumption of linearity is usually imposed on the model, although this assumption often cannot be justified by empirical data.

Machine learning approaches, in which programs inductively learn about model structure from the data, can be effective in addressing these issues. In this analysis, we use the random forest method, an “ensemble learning” approach that generates many models and then aggregates the results. It is beyond the scope of this paper to describe the methodology of random forests in detail. Box 3, however, provides a quick overview of the approach. Two points are worth making now to facilitate analysis of the graphical results below. First, to measure each variable’s importance in the model, we focus this analysis on *percent increase in mean squared error* (%IncMSE). IncMSE measures how much the mean squared error of a model—the sum of squared differences between predicted and observed values,

divided by the number of observations—increases if the variable in question is excluded. Second, to judge the predictive performance of a model in its entirety, we look at the root mean squared error (RMSE), the square root of the MSE. The RMSE is a rough guide to how “wrong” the predictions of the model are expected to be.

We also note two important clarifications about the results. First, the original research called for analyzing the determinants of food security *resilience*, not the levels or changes in food security more broadly. As noted above, the early end of the research did not allow us to obtain the requisite number of data points to make strong conclusions about household-level resilience. We can, however, examine the determinants of food security *levels*. Second, we do not see a great deal of variation in FCS and CSI across the entire range of the indicators, especially at lower levels. The results of the models below thus largely illuminate the determinants of variation within relatively acceptable ranges of the indicators, and less so between strongly food insecure and food secure households.

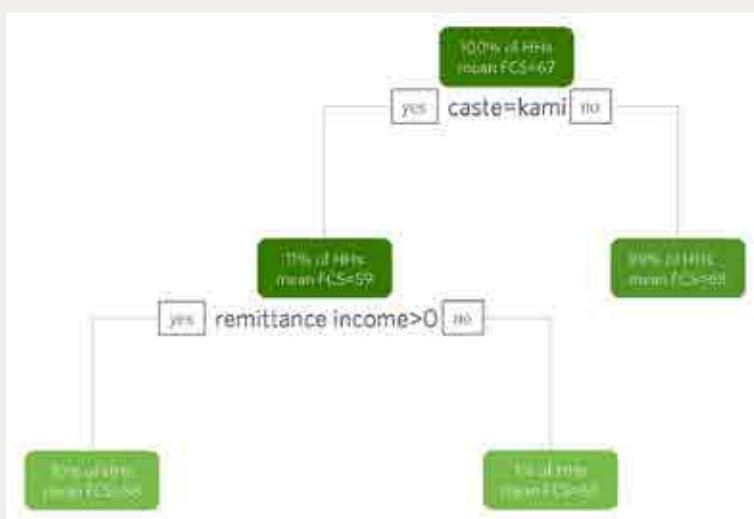
3.2(b) The analysis

We present the results of the FCS resistance and FCS minimum models in the figures below; the results for the other FCS models are available in the Appendix. A few notes on these results:

- We utilize household-specific averages over time (i.e., over all survey rounds) of the variables in Figure 21. We thus perform a cross-sectional analysis of the determinants of food security instead of a panel analysis. We chose to do this for two reasons. First, as seen in the results below, some of the most powerful predictors—especially caste—are strictly or roughly time-invariant. Second, given the short time frame of the survey, many of the variables we observe—including network variables—are only meaningful if observed over extended time frames. If data collection occurs over a longer

Box 3. How random forests work

Random forests are based on decision trees. Decision trees work by sequentially examining the relationships between predictors and an outcome variable. For example, a decision tree may start by looking at the relationship between a household's caste and its FCS score. At the "root node," where the tree starts to grow, the decision tree selects the variable and value—perhaps caste=Kami—that best splits the observations into homogenous (in terms of FCS score) branches. Along the Kami branch, the tree then searches for the next variable and value that again splits the groups into homogeneous FCS groups—perhaps remittance income>0. Both branches continue until all households are grouped. In the decision tree below, drawn from our data, the 11% of HHs that are Kami have a mean FCS score of 59, nine points below non-Kami households. The few Kami households that receive remittances have an FCS mean of 60, two points higher than those not receiving remittances.



Branches in decision trees thus define optimal sets of predictors. Decision trees, however, are prone to "overfitting," in which the model fits the observed data well, but fails to predict well when applied to new data. Random forests deal with this problem in several ways. First, many trees are grown—in our case, 2,500 for each model—using samples bootstrapped (subsamped, with the possibility of duplicate observations) from the original dataset. This helps reduce the risk of overfitting. Second, as trees are grown, instead of choosing the best split from all available predictors, the best split from a subset of predictors is chosen; this "random" element helps ensure that trees are distinct, exploring different corners of the "relationship space" within the model. Third, each tree splits its data into training and test datasets, and checks the accuracy of the trained model against the test set (this validation step can also be done with the aggregate "forest" model). This allows for evaluation of models by predictive accuracy with respect to unobserved data. Fourth, the mean predictions of all the trees are combined to produce an aggregate forest prediction, which reduces the overall variance of the prediction.

time frame, as with digital data, this same research design could be used to perform panel analysis.

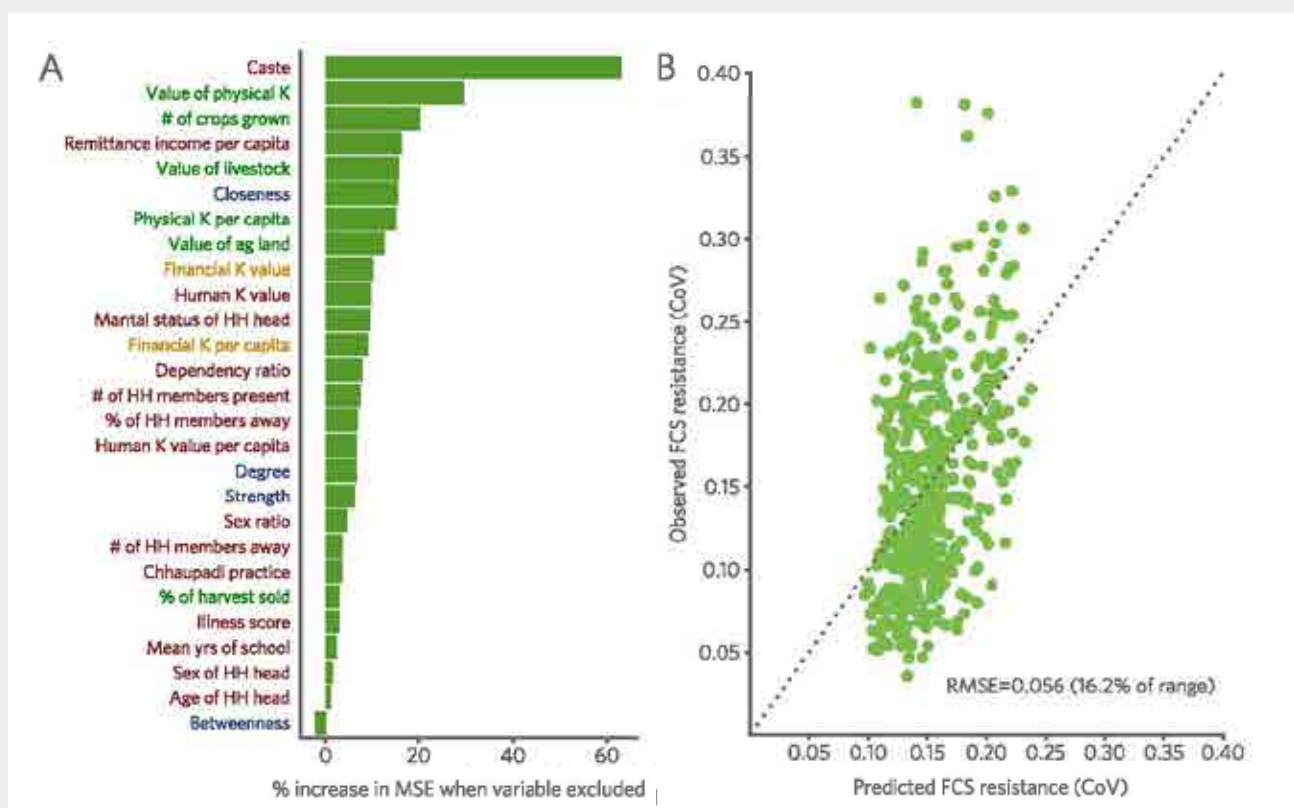
- We constructed models with all variables shown in Figure 21, and these results are available upon request. However, to facilitate interpretability, we show the results of restricted models below. Specifically, in the restricted models we exclude all proximate determinants except *remittance income per capita*. We chose to present the restricted analysis because the limited duration of the research does not allow us to confidently specify the time lags over which the ultimate determinants work through the proximate determinants to generate the food security outcomes of interest. Without a stronger empirical base of evidence to make these

decisions, we are hesitant to treat proximate and ultimate determinants equivalently in the same model. Future analysis could combine time-invariant variables with those that impact of food security over different time frames. We include remittance income, however, because it could be argued to be partially exogenous of the ultimate determinants.

- In Panel A of each of the following figures, variables are color-coded by their capital category to ease interpretation: brown for human capital, yellow for financial capital, green for physical capital, and blue for social capital.

Caste is by far the most important predictor of FCS resistance (Panel A of Figure 22); excluding the variable increases MSE by over 60%. Remittance

Figure 22. Random forest prediction of FCS resistance.



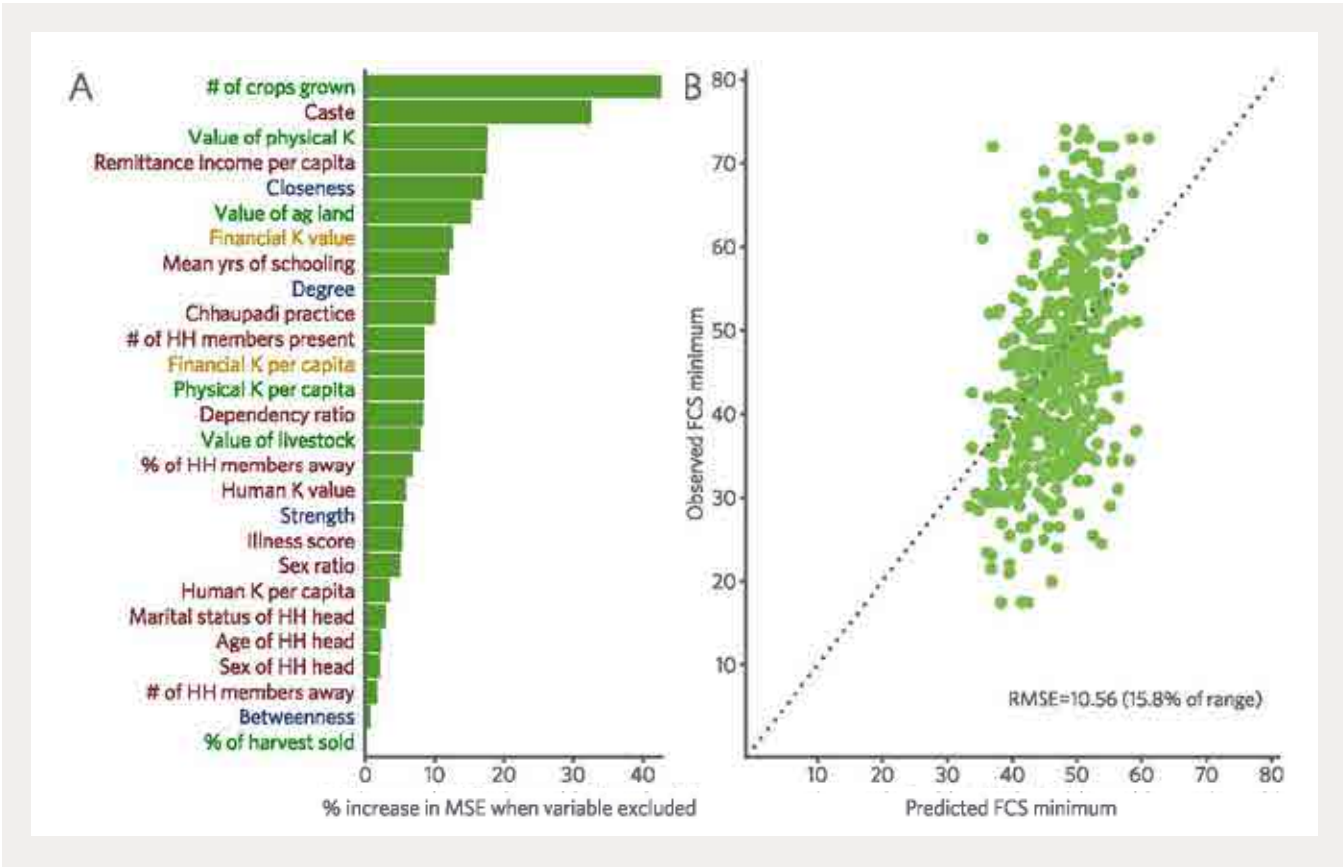
income is also important, as are a few physical capital variables, including the total value of physical capital, number of crops planted, and livestock value. Physical capital, more than social capital, appears to protect households from shocks. Prediction of FCS resistance (Panel B) is relatively poor; the mean squared error spans about one-sixth of the variable's range. Overall, about 22.4% of the variance in FCS resistance is explained by the model.

Figure 23 shows the results of a random forest model predicting the minimum FCS score over the 15 rounds of the survey period—that is, the month in which households had the least diverse, nutrient-dense diet. The minimum FCS score thus represents the most food insecure experience in the survey period for each household.

We see that similar predictors are important (Panel A): crop diversity, caste, the value of physical capital, remittance income, and the social capital variable of closeness. As expected, food security is a function of a mix of demographic, physical, and social factors. Again, predictions of FCS minimum are imprecise (Panel B), clustering in a narrower range than observed minimums. Around 23% of the variance in FCS minimum is explained by the model.

Some patterns emerge from the random forest models above (and from the models in the Appendix). First, caste is by far the most important predictor of food security, even when controlling for demographic factors and various forms of capital stocks. This suggests that meaningful livelihoods programming will have to consider how the structure

Figure 23. Random forest prediction of minimum FCS over survey period.



of capital flow networks interacts with caste identity. Second, remittance income consistently emerges as an important predictor of food security, and motivates the in-depth investigation of its impact, presented in the next section. Third, social capital variables, especially degree and closeness (and to a lesser extent strength) are also associated with food security; no household with high degree or closeness centrality had a very low FCS or CSI score.



4. Transnational Migration & Remittances

We conducted qualitative research in Maulali to serve three related purposes:

1. To complement quantitative components of the study;
2. To conduct in-depth thematic studies on migration; and
3. To facilitate participatory involvement and feedback from VDC stakeholders.

During the survey period, we conducted nearly 100 interviews with women and focus group discussions with over 130 respondents in two rounds of field visits. Following each round of qualitative fieldwork, we analyzed field notes using a qualitative analysis software program, NVivo, to identify emergent themes and areas for follow-up and clarification. Below, we summarize the results from the two rounds of in-depth qualitative data collection and analysis.³

The qualitative efforts contextualize the quantitative components of our research by exploring the social, economic, and political context of the study site, with relevance for other rural areas in Far West Nepal. Our in-depth thematic studies then explored the perceptions and effects of out-migration in Maulali, directly complementing our quantitative efforts on the effect of remittances on food security. In particular, we examined:

- *Migration as a “livelihood strategy”*: We explored the history of labor out-migration in Maulali. Stratifying by gender and caste, we examined perceptions of migration as a livelihood strategy and explored the socio-economic effects of migration.
- *Migration’s effect on food security*: We explored the extent to which migration affected the diets of families in Maulali, highlighting the role of remittances in household food security resilience.
- *Migration’s effect on family*: Migration is highly gendered in Maulali, where men often leave their families behind to earn wages abroad (primarily in India). We examined the effect of migration on the family left behind, namely children and parents. We also explored the cultural, economic, and gendered consequences of male out-migration at the individual and household levels.
- *Intra-household roles and responsibilities*: We carried out an in-depth examination of the effect of male out-migration on intra-household roles, responsibilities, and decision-making. We conducted iterative interviews with women, stratified by husbands’ migration status, to collect data on household division of labor and decision-making, perceptions of these divisions, and the effect of migration on these roles and responsibilities.

Lastly, through the interviews and focus groups we allow respondents from the VDC to share their experiences and perceptions of their own narratives. A large component of this project year’s qualitative efforts focused on women who, in a context like Maulali where gender discrimination is widespread, are rarely provided with such an opportunity. The site visits, iterative interviews, and discussions also helped to further familiarize respondents with FIC research efforts and helped to build trust in FIC’s project in Maulali. In addition, the interviews and discussions offered a direct opportunity for

³ Jeeyon Janet Kim led the development of the qualitative instruments, data collection, and analysis in partial fulfillment of her doctoral degree at Friedman School of Nutrition Science and Policy, Tufts University. This section of the report summarizes the results from Kim et al. (forthcoming).

respondents to identify ways in which PAHAL and other programs can support them.

4.1 Migration as “livelihood strategy”

History of migration in Maulali

Migration is a central economic fact in the lives of households in Maulali. Transnational opportunities for unskilled wage labor and education, particularly across the border in Indian cities, pull migrants in from Maulali, while ecological and economic risks—soil erosion, drought, landslides, and flooding, weak markets for labor and agricultural inputs and outputs, poor transportation infrastructure and consequent price volatility—push people out of the VDC. Male migration appears to have a deep-rooted history in Maulali, where men have been migrating to India since “their grandfather’s father’s time” (focus group with high caste men). One respondent shared that in the past 10-15 years, there has been an increase in the number of men migrating to India due to the limited (productive) land and lack of livelihood opportunities, which made it impossible to meet the needs of a growing population.

Several respondents also noted the role of the Maoist insurgency in pushing men to migrate to India. During the Maoist insurgency, more men from both higher and lower caste households migrated to India. It appears, however, that the effects of the insurgency’s approach varied by caste. Higher caste families shared that they were targeted by the insurgents, who often confiscated their land and killed or maimed male family members. To escape these risks men from the higher castes migrated to India. In contrast, the insurgents encouraged lower caste men to seek alternative livelihood options and to break away from caste-based patronage relationships. While the Maoists did not actively encourage Dalit men to migrate to India, respondents shared that more men from the lower

castes began migrating during this time in search of more lucrative opportunities.

“Livelihood strategy”

Respondents were unanimous—whether men or women of lower or higher castes—in their view that going to India was a compulsion, never a choice. It was the lack of livelihood opportunities and their limited education that pushed men to migrate to India in order to make ends meet. It is thus difficult to refer to migration as a livelihood strategy, which implies careful planning and weighing amongst livelihood options to decide to migrate, whereas in fact, male respondents repeatedly highlighted that they did not have a choice but to migrate to India. If there were opportunities, these men all noted that they would prefer to stay in Maulali, their birthplace:

We want to stay in our country. We don’t have enough to feed our children. We don’t go to India because we’re happy. We have to make money. Here, there is no employment. It is a compulsion. Otherwise we don’t want to go.

(Focus group with low caste men)

Women agreed that most men had no choice except to migrate to support their families. A high caste woman explained that while migration was her husband’s decision, the lack of local opportunities meant that this was the only viable economic option. She said:

Here it is difficult to earn money and feed children. There is no money to feed them, clothe them. But with money from India we can buy food and clothes for the children. We also do not produce enough from the land. It was his decision to go. There are no jobs. I want him to go.

(Interview with high caste woman with migrant husband)

While respondents referred to migration as a compulsion, labor migration to India appears to

be an important part of fulfilling men's identity as a breadwinner (Sharma 2008). Migration to India and sending back remittances allowed men to earn and financially provide for the family while women "wash pots, take care of cows, go to jungle to collect firewood, carry manure and ... take care of the children" (High caste focus group respondent). In turn, male out-migration appears to help maintain gendered intra-household responsibilities and statuses. For example, a focus group respondent shared:

We believe husbands are powerful and like Gods because they are employed and earn money. We are not equal only because we are not educated and not earning.

(Focus group with low caste women)

Migrating alone vs. as a family

Migration from Maulali is highly gendered, with many men migrating alone and leaving their families behind. It is considered socially inappropriate for women to migrate and earn, even if a few female respondents noted their desires to do so:

Men's work is to plow field with ox and to earn. They just work outside and send money. We carry food by buying from Chaudari [a neighboring VDC]. Women should also earn but we should also take care of home and children. We cannot earn like a man. I wish I could go abroad and earn lots of money. There should be a tailoring shop in the village for women so that they could work there... But it is not possible for me to go, I have small children. If we both go, we cannot do it. We have children, we have to take care of land, animals. If our husband would take care of children and land, we would go. If we did this, people would say it is bad. If any woman leaves her husband and children [to earn], she is characterless. They'll say she is like a prostitute. We don't think so but society does. There is no woman here who has left home and children at home to work.

(Focus group with high caste women)

Male respondents also upheld these gendered norms, also highlighting women's limited education and lack of confidence to migrate on their own:

It is men who migrate. Men from 15 and up. Sometimes families go. If they have small children, they sometimes take with them. Women cannot migrate on their own. What will they do there alone? They don't have capacity. They are not educated. Men are also not educated but they have more confidence. Women are insecure if they migrate on their own.

(Focus group with high caste men)

Some women do accompany their husbands to India, bringing along young children or starting a family while living in India. It appears that lower caste families migrate more often as a family unit as compared to their higher caste counterparts. Respondents shared that higher castes families have more property, livestock, and assets to take care of and, in turn, women were left behind to tend to the field and home while men earned wages in India. Lower caste respondents, on the other hand, noted that they had limited land and property (if any at all) and did not have the same obligations to stay back in Maulali. In addition, survival is difficult in rural Nepal without land and livestock, and hence lower caste families without an asset base are more likely to migrate together. By contrast, women from higher caste households were able to rely on these assets for support once their men had migrated. However, many respondents noted that it was much more expensive to support a family in India and felt that their limited income could not keep up with the expenses of raising children in India.

Migration destination

In Maulali and much of rural Nepal, chain migration dictates where men migrate (Seddon, Adhikari, Gurung, 2002). Migrants follow their friends and family members, moving to locations in India where their social contacts reside.

An inventory of the locations where migrants are working or studying also illustrates a stylized fact about labor-motivated movement: individuals will go not only where labor markets are active, but also where they have pre-existing contacts. Nearly half of all migrants from Maulali (45.6%) travel nearly 2,500 kilometers to the south Indian city of Bangalore, where a Nepali community from Bajhang is well established. No other location ranks close as a destination for migrants from Maulali. Some respondents referred to a Bajhangi King who was expelled to India centuries ago and settled in Bangalore, thereby establishing a social connection for men in Bajhang District to begin migrating there. Others (13.8%) go to other districts in the Far West, but a similar number go to other locations in south India. Kathmandu, as well as the Indian megacities of Delhi and Mumbai, rank well behind. In total, 76% of all migration out of Maulali is transnational, the vast majority to India.

Respondents noted that low-skilled jobs were often informally “sold” between contacts (for example, a neighborhood watch position would be transferred between contacts for a price). The most common job for migrants is as a security guard; respondents report that nearly one-third (30.4%) of the family members who are away work primarily in this profession. Another 22.5% are studying, and 18.4% work in homes as domestic workers.

There is no formal information hub for prospective migrants. All respondents in Maulali noted that they migrated without any concrete knowledge about job opportunities, salary expectations, or work conditions. Often neither men nor their families had much information about where they were going, the livelihood opportunities they would find in India, or the potential challenges they would face. This was discussed in a focus group with lower caste men in Maulali:

Sometimes we go to India without any information. We ask friends if there are jobs. We go and buy area to watch. It ranges from 10-20,000. If it is larger

and you can collect regular money, then it is more expensive. If it is smaller and you cannot collect regular money, less expensive. This is not formal. You buy area from former watchman. You sign contract with former guard.

(Focus group with lower caste men)

India is, of course, only one of the many destinations for male migrants from Nepal, but it is the primary destination for men from poor or low caste families, particularly in the western and border areas of the country. High caste men explained that while the poor go to India, within India there are various choices of destination and options for employment:

Men usually go to India. You don't need much money. If you don't have economic sources, you go to India. They also listed Dubai, Qatar, or USA. But you need visa to go to these places. It is more money. In India, people go to Bangalore, Andra, Delhi and Bombay. People go all over India, wherever they can get employment, they go. Most do duty, or are security guards. Others also work as cooks or wash pots in hotels.

(Focus group with high caste men)

Life in India

Migration to India brings both risks and benefits for the migrant and his sending household. Men head to India with only a few thousand rupees in their pockets and depend on the goodwill of friends and relatives to feed and house them while they seek employment. Social networks are also central to finding jobs, most of which are found by word of mouth, as explained by a Dalit male respondent:

Their seth—the rich person who they work for—tells them if they are looking for some worker or watchman. And they tell us, if their seth or someone else is looking for worker/watchmen.

(Focus group with low caste men)

Finding a job can be difficult. Some respondents reported that it could take up to three months to find jobs and longer before they can send remittances back home.

The physical risks of working in India are perceived to be high. Both men and women emphasized that work life in India was difficult. A few male respondents shared that they felt powerless against their Indian supervisors, having to do whatever they were told. They shared that many of them felt like their lives were in danger. India was not “their country” and they felt constantly afraid that they would be robbed, harmed, or killed. Respondents often felt as if they were “living on the edge of the sword” in India as their supervisors often failed to pay them and their wages fluctuated greatly (focus group with mixed caste men).

Women also shared that they worried about their husbands and male relatives. Women spoke generally about what men did in India but did not seem to know exactly what positions their husbands/male family members held in India (and it was considered culturally inappropriate for them to inquire). For example, a respondent with a migrant husband shared:

I cannot sleep when my husband is not at home. I am thinking about him all night. I worry. How they are, what do they have to do in India.

(Focus group with lower caste women)

As mentioned above, respondents all shared that going to India was their only option, despite the risks involved.

In turn, labor migration to India appears to offer men an opportunity to fulfill an important aspect of their masculinity: acting as the financial provider and the breadwinner for their family. However, the migration experience also highlights the constraints of their social mobility; many of the migrants join the ranks of a large and transitory group of low-paid workers that provide “cheap, disposable labour for various

employers” and they spoke openly of the constant threat of exploitation and dangers of living in India (Maycock 2017, 186).

Despite these dangerous conditions, respondents also mentioned that access to basic facilities in India were much better than in Maulali. In India, men reported that they have access to better health facilities, as well as diverse and affordable foods (meat, fruit, and green vegetables). We were told that India is where men went to “fatten up and get big bellies.” Men were able to eat three meals a day (compared to just two in Maulali), seek affordable health care if sick, and wear “nice clothes.” However, respondents also mentioned challenges to adapting to a different life: as a young male respondent explains, “In India, they look down upon us. They also scold us.” Additional difficulties included having trouble crossing streets in large cities, learning a new language, becoming accustomed to different food, and not being able to cook for themselves.

Interestingly, many male respondents reported that caste discrimination did not exist in the same ways in India. Men from both higher caste and Dalit households migrated to India. Once in India, even if asked during hiring, respondents shared that their Indian supervisors could not discern their caste given the difference between the Nepali and Indian systems. Respondents also shared that caste among Nepalese migrants was less strictly enforced once they reached India. Migration to India offers some freedom away from the strict cultural norms observed in Maulali (Sharma 2008). Men identified more strongly with their identity as fellow villagers than their caste affiliations; in a foreign place, they were the same. A Dalit male said:

Among Nepali/other non-Dalit villagers, caste is less practiced than here in the village. For example, here we cannot go inside the non-Dalits’ house, but in India we can go inside their kitchens. India is a different place, so they don’t practice as in the village.

(Focus group with low caste men)



However, once men returned to Maulali, the caste-discrimination and strict social norms were reinstated.

Frequency of return

Migrants return to Maulali with varying frequency, ranging from once every few months to never. Most migrants stay away from Maulali for extended periods of time; our research suggests that only 35.9% of migrants return to Maulali at least every six months, and 28.1% have not returned in over three years. Though rare, respondents shared that men sometimes abandoned their family in Maulali after migrating. Their wives and children were left to their own devices and often relied on handouts and loans

to survive, at least until any sons were old enough to migrate themselves. Some of these men reportedly started second families in India. Others may have died but word was never delivered to their families back home. A few respondents' husbands and sons died under suspicious circumstances, often on trains, but there was little recourse for these families to find out more or seek reprisals.

While our interviews and discussions with men were limited to those who had gone to India and returned,⁴ there was an overwhelming sense that migration to India—even if it is for 20 years—is temporary. This was confirmed by several informal conversations we had with Nepali migrants in Delhi and Bangalore. On numerous occasions, respondents shared that

⁴ The first data collection trip coincided with men's return from India for the holidays (October – November 2016) and allowed us to capture male perspectives in discussions; however, the sample was in turn biased to those who were able to return for the holidays. The second data collection trip took place between harvest and planting season (February – March 2017) to ensure that our interviews and discussions were not placing an undue burden on women's busy fieldwork schedule.

they wanted to raise their children in “their village” (even if these children were born and raised in India). There is a strong pull for migrants and their families to return to Maulali, despite the lack of employment opportunities, productive land, and basic facilities. PAHAL and other programs should recognize that most respondents do not want to migrate to India. There is a strong preference to stay in Maulali if local and viable economic opportunities were to become available.

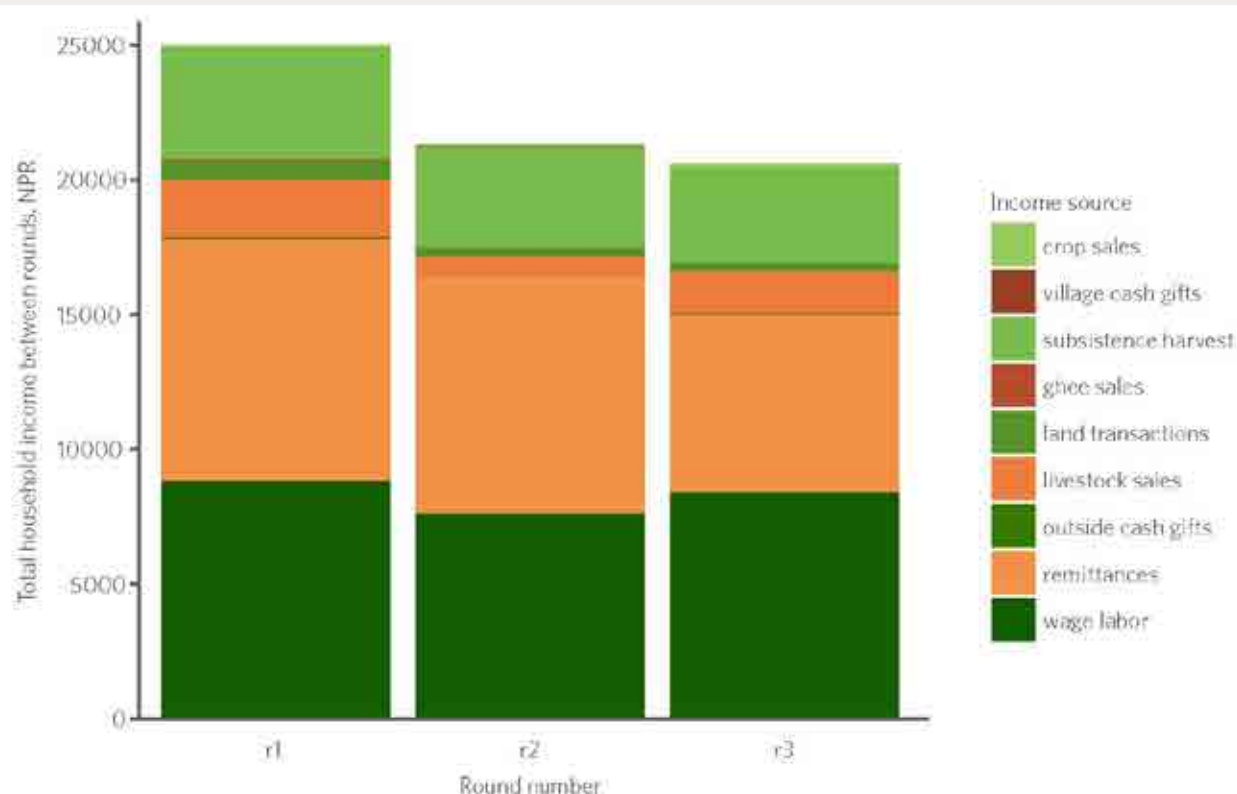
Remittances

In Maulali, many families rely heavily on money from migrants in India to make ends meet (Figure 24).

Households use remittances to meet daily consumption needs including food, school fees, clothing, and paying back loans. This heavy reliance on remittances may explain why *quantitatively* (as indicated through CSI and FCS) households appear to be generally food secure: remittances are helping them avoid negative coping strategies and meet consumption needs. The balance between coping and being food insecure is, however, a precarious one, especially given unstable and infrequent remittance flows. A woman in Maulali explained:

Every year he would send 5-6000 (INC). This was not enough. I used to carry load and cut grass. It was still not enough. If we had money, we would eat twice. If we had no money, we would eat just

Figure 24. Sources of income in Maulali.



one time. With this money, I would buy clothes, slippers, things to eat.

(Interview with low caste woman, widowed)

Hence, while migration and remittances from India help households to meet their *immediate* needs, as suggested by the quantitative analysis in Section 3, it is unclear if migration is contributing to household resilience to shocks (including food insecurity) in any substantial or sustainable manner. A group of high caste men explained the extent of dependence on remittances, and highlighted the limited investment options for these funds:

When money is sent back people spend on food, clothes. Everything we need in our belly. We don't have anything else. It's all money from India. We depend 100% on money from India. We don't have employment here. People who have migrated have taken loans.

(Focus group with high caste men)

Moreover, the remittance amount appears insufficient to contribute to longer-term productivity through savings or investments in assets. Remittances are often sent infrequently and in small amounts. Most remittances were sent back by hand (by the household member themselves or through their contacts) but increasingly, respondents shared that they used the international monetary exchange (IME) in Chaudari to avoid having to pay bribes at border crossing or being accosted in transit. While IME offers a more secure option to transfer remittances back to Maulali, some respondents noted that it was challenging for women—who are usually financially illiterate and inexperienced in navigating such a system—to collect the remittances on their own. Women describe having to rely on the IME staff to fill out the paperwork on their behalf. Moreover, there is a fee for migrants to remit via IME, which, though small, diminishes the already small amount migrants are able to send back home. Such fees, nevertheless, are likely to be less than those extracted through shake-downs by border

guards when migrants attempt to cross, as described in a focus group discussion with high caste men:

At the border, they check too much. Why do you go to India? Why are you coming to our country? It is very difficult to talk to Indian police. They take 2-3000, 4000 IC. It is all up to them. They just take our money.

(Focus group with high caste men)

Remittance amounts were dictated by the migrants' earnings and ability to save, rather than the situation back at home. In addition, most respondents mentioned that remittances were often not enough to cover all expenses (including food, education fees, medical care, and other cultural expenses) while others noted that it was just enough to feed themselves and the children.

When remittances were insufficient, many respondents had to take up casual labor opportunities to make ends meet. In Maulali, both men and women transport goods from the nearby small market of Mauribagar, located on the Dadeldhura-Chainpur road, earning 6-7 NPR/kg. (Shopkeepers use slightly more expensive mules when porters are not available or loads are too heavy.) Both men and women also work as casual construction workers. These opportunities are *ad hoc* and not formally advertised.

Dalit respondents shared that they were often not informed of casual labor opportunities. Women, regardless of caste, noted that they were paid about sixty per cent of men's wages for construction jobs (carrying stones); they did not find this to be problematic as they felt that men are more physically capable and should be compensated accordingly. Payment from these types of work, whether in cash or in kind, was still often not enough to make ends meet. Loans fill the remaining gaps, and almost all respondents in the study population reported taking out loans with regularity. Taking a loan was also a common response to an emergency.

4.2 Migration's effect on food security

In addition to migration's economic effect, via remittances, on food security, male out-migration in Maulali appears to affect household food security in several other ways.

Labor and production

Agriculture is the main productive activity in Maulali, whether working on one's own fields or as hired labor. The majority of the men who out-migrate are able-bodied young men, creating a large void in the agricultural labor force in Maulali and contributing to what some have referred to as a "feminization" of agriculture, as women taken on more significant roles in agricultural activities (Tamang et al. 2014; Maharjan, Bauer, Knerr 2013). However, despite women's increased role in agriculture, division of labor in Maulali remains highly gendered.⁵ For example, respondents all noted that it is taboo for women to plow with oxen, even though ox plows are widely used in preparing fields for planting. If a woman plows with oxen, it is believed that she will curse the land and bring drought to the area.⁶ Women are permitted to plow only with their hands and tools.

Women who had migrant husbands but had other adult male family members (such as sons or other relatives) still residing in Maulali were often able to get help to plow their fields. Those without male relatives have to rely on male neighbors they are not related to. For these women without male relatives, many shared that it was a challenge to request help, and they often had to ask multiple times. Having to find someone to plow their field was an additional task added to their already over-burdened day. Additionally, men help women plow in exchange for future help, such as with weeding or carrying manure. However, given the limited number of men

available in Maulali, respondents shared that men now expect a fee of 1500 rupees for a day's work. In turn, women must dedicate a large proportion of their remittances from India to hire help in the planting season. A high caste woman whose husband was in India explained:

We have to ask people to plow for pay. It is difficult to find people to help. They are all in India. 500 for ox, 500 for labor, 500 for plow. 1500 a day. This is not enough to get things done. It takes five days to finish. We are using a lot of the money husband sends back.

(Interview with high caste woman with migrant husband in Tamil-Nadu)

Female respondents complained that the men who were hired to plow fields only did so after finishing their own work and often completed the task carelessly. In some instances, these delays and careless plowing led to decreased production. Women in turn had to purchase a greater portion of food from the markets. Men discussed the problem in a focus group:

Of course, production is affected (all agree, everyone nods). If we are here, we care about our field. If we just send money, others don't care. They don't do work carefully. They just do the work they're paid to do. Production goes down. We have to give more to produce less.

(Focus Group Discussion #3, High caste men)

While the effects of male out-migration on agricultural yield remain inconclusive, these qualitative results echo the findings in a few other studies in Nepal; for example, a nationally representative analysis in Nepal found that migration significantly and adversely affected paddy production (Tuladhar, Sapkota, Adhikari 2014).

As discussed above, a high percentage of lower caste men migrate to India. The Dalit women left behind have very few men they can turn to for help,

as higher caste men are normally unwilling to do work, given social norms, for a Dalit household. Female Dalit respondents explained that they must either plow by hand on their own or get help from other Dalit women who are willing and able to help. A group of Dalit men discussed the changes in production caused by migration and the role of caste:

Yes [everyone agrees], production changes when men go to India. If husband is not here, women plow field by hand. It gives less production. No one (men) is here to plow. Higher caste will not plow our field [everyone laughs]. There is long discrimination, generations between higher caste and us. They don't even let low caste touch their land. Now there is less discrimination, but still happens. [Another respondent:] Dalits, we are treated worse than dogs. We are not even allowed in their homes.

(Focus group with lower caste men)

However, as overall the lower caste households had less land to plow (and sometimes no land at all), the added work burden is not as substantial as for their higher caste female counterparts.

Loans/credit and consumption

Having a migrant member in India made it easier for households to acquire loans and credit in Maulali. Lenders felt more assured that they would be paid back in time when they knew that a household member was abroad. This was only the case if the migrant was regularly sending remittances and not “misbehaving” (normally described as drinking, playing cards, taking on second families, using prostitutes). Women reported that they also felt more confident taking loans if they had a male migrant in India:

When my husband was away, he would send money every 3-5 months after 1 year away. 2000, 3000, 5000 (INC) each time. This was not enough but

we could use it. If he would send late, we would get loans. It was easier to get loans when he was in India. Husband can send money to pay back quickly... People feel hesitant to give loans to us, they worry we cannot pay them back. I feel easier to get loan when he is in India. I feel more secure. I would ask to take loan, he would give me permission. I feel obviously more at ease when he is in India.

(Interview with high caste woman with former migrant husband)

While most respondents preferred to first take out loans in Maulali, others also got loans from fellow villagers or in rare cases their employers in India:⁷

If [men] have no money, they get loan in India to send. They ask friends or people who they know from our village for loan with no interest. It is just for 1-2 months. But if it is for longer then it is with interest, 5%.

(Focus group with high caste men)

A few respondents also noted that they asked their Indian employers for a loan (however it is not clear if this is common practice; this question requires further inquiry):

If we have (money), then we can send. If we don't have then it'll take some time. We get loans from Indians. They (their Indian employers) are earning more and they can give with interest 4-5% in IC. But we feel very difficult asking for loan. We have to share everything with them. We have to tell very personal things to them. They also do not believe our stories. We try to get loan from Maulali first, interest is less 2-3% in Nepali rupees. We get from shopkeepers and teachers. It is easier to get loan if someone is in India. They believe us to pay them back. Otherwise, they have insecurity about the money. If no employment, no loan.

(Focus group with low caste men)

⁷ More information is needed on how men choose to sequence loans between Indian and local lenders. Taking loans from India is only mentioned by lower caste men in the data at this point, but this does not necessarily mean that this is exclusively a lower caste practice.

Even in their absence, men generally maintained the decision-making authority about when and how much to take out and pay back for loans and credit. By phone, men negotiated the rates with the lender and asked their wives to carry out the deal. Women shared that playing this “messenger” role was very stressful, with some not feeling comfortable dealing with money. Some female respondents reported that lenders demanded a higher interest rate once the husband was off the phone, and the women felt powerless to negotiate without their husbands’ assistance. Both men and women noted these challenges faced by women:

If it is women, they give 10 rupees/100 [10% interest] If it is man, they give 5 rupees/100 [5% interest]. There is no option for women. We have to take it. Husbands would call for us but even if he calls, they change when they see us to collect loans. But if husband goes in person, then they give correct rate.

(Focus group with high caste women)

Men would call shopkeepers and ask for loan. Then we tell wives to pick up. Women cannot ask. They cannot say. They ask husbands to ask shopkeepers. If women do not have husbands, they have to manage on their own and decide to take loan on their own. But if they have husband, they have to get husband's permission. It is his decision.

(Focus group with low caste men)

Among female respondents who purchased goods on credit (as opposed to cash loans), shopkeepers at times charged items at a higher rate and increased the total amount due when they returned to pay off their debt. A few women also noted that they were not familiar with market prices and that hence it was challenging for them to make purchases. Men explained that this was a problem for women that cut across caste lines and was exacerbated by women’s low financial literacy:

Women feel difficulty when purchasing food at the market. They don't know the rate. Shopkeepers also give different change. If women are owed 50, they only get back 10. Men know. My wife would take credit for 5000 and return to pay back, he tells her that it is now 10,000. It is because they are women. All women are victims, not just Dalit women. We cannot do anything. Women have to pay whatever they say. Even if women say something, we are afraid that shop won't give women credit later

(Focus group with low caste men)

Through our qualitative data analysis, we sought to understand why standard measures of food insecurity as assessed through quantitative means were relatively stable in Maulali. The coping strategies index (CSI), for instance, showed very few households regularly engaging in measures such as cutting back on portion size, not purchasing vegetables, etc. Through the qualitative data, we found that nearly all respondents report only changing food consumption behavior *after* taking out a loan or getting food on credit. Most felt that their diets were already so limited that cutting back on meals or amounts consumed would be detrimental to their well-being. A group of women explained that the foods they ate were already limited in their diet:

We eat bhat, roti, daal, soybeans. We eat 3-4 times. We have roti for breakfast. We have bhat for lunch, the remaining bhat as snack. Then we have roti for dinner. We have this with radishes, potatoes, and peppers. Before taking out loan, we don't change anything about what we eat. Should we stop eating? If we don't eat, how can we work?

(Focus group with high caste women)

In addition, it appears that remittances from migrants allowed households to preempt negative coping behaviors by providing additional income to spend on food and/or having easier time getting loans and credit. However, it does not appear that remittances change the type of food households are buying; for example, many respondents shared that

fruit was still too expensive and not readily available to purchase at the market, a fact reflected in the FCS quantitative data.

Anxiety and worry

Many respondents—both male and female of both lower and higher castes—shared that they worried or felt anxious about having enough food to eat. Their concerns about having enough to eat were heightened during the pre-harvest months, especially in the summer monsoon season. Some women talked about lying awake at night, worried about what to feed the children. A respondent said:

Our flesh has gone due to our worry. We never get flesh on our body. We're skinny because we're worried. We worry about what should we eat. What should our children eat? What should our cows eat?

(Focus group with high caste women)

Having a migrant in India appears to significantly alleviate women's anxieties and worries about having enough to eat. Female respondents repeatedly referred to a sense of "hope" and "expectation" they had from having a migrant household member who might be able to send money home. One woman explained,

Having someone in India reduces my worry about having enough to eat. I hope that when he is in India, he will send money for us. I live in hope.

(Interview with high caste woman with former migrant husband in Bangalore)

It appears that it is not whether or not a household has a migrant member but the amount and frequency with which he sends remittances that determines the "success" of the migration experience (Maycock 2017). Men in a focus group discussion reported that these expectations from their families to send regular remittances put a great deal of pressure on them:

People worry less if there is a migrant. There is a psychological effect. Wife feels more at ease. Husband can take care of loans. It doesn't matter if husband is earning or not, just the expectation. The hope. If there is a need, they can take out loans more easily, they say 'my husband is in India and will send money.' This puts a lot of pressure on us. [Other men all agree, nod and laugh.] Men worry about their family. Worry about them getting enough food.

(Focus group with high caste men)

However, once their husbands or sons returned to Maulali, female respondents noted that they worried again about having enough to eat. A high caste woman whose husband had returned from Bangalore a year before shared: "When my husband was in India, I worried less about having enough to eat. Now I worry. I worry about other things too like clothes, children." This was likely due both to the discontinuation of remittances and the presence of an extra mouth to feed. As such, we see that migration offers only a temporary reprieve to households' food insecurity and does not contribute to sustained food security resilience or longer-term consumption smoothing. This is due in large part to the fact that remittances only cover basic daily needs and are rarely invested in longer term productive asset growth or savings.

4.3 Migration's effect on family

In Maulali, many men migrate to India alone, leaving behind their family as they earn wages abroad. As part of the qualitative research, we examined the effect of migration on the family left behind to understand the experiences of women, children, and older parents remaining in Nepal. We conducted iterative interviews with women, stratified by husband's migration status, to explore the impact of male out-migration on intra-household roles, responsibilities, and decision-making and to understand perceptions of these effects.

Children's education and inter-generational migration

Many respondents noted that men's absence had a direct negative impact on children's education. The role of fathers within households appears to include discipline and helping children with their school work; women noted that they were illiterate or were too busy with existing domestic work to do take on these roles. Teachers shared that children seemed less motivated and focused without their fathers' supervision. Moreover, respondents noted that once a father had migrated, older children were more likely to be pulled out of school to take care of their younger siblings while their mothers worked in the field. These issues weighed heavily on female respondents, as evident in the narrative of a woman whose husband had migrated to Mangalore:

When my husband is not at home, I have many more work to do. I have to do more in his absence. There was a project in the village [and they requested that at least one person from each home come and help], I had to go myself. I had to carry poles for electricity. He'd go if he was here. I have to do all household and outside work and look after children. I had to leave children for three days for electricity work. If I have to go outside, I leave the children. Sometimes for 3-5 hours or whole day. They remain hungry. If husband is here, he would watch them. The children also do not listen to me. If my husband was here, they would listen to him. I would tell my husband that children were misbehaving and ask him to scold them on the phone. If he calls to yell at them, the children deny doing anything wrong. My oldest son doesn't go to school. They don't read books. If father was here, they would be afraid of his father and go to school. If my husband was here, he would go to school with them. He would bring books for them. He would pay fees on time. I feel worried about work when he is not here. I worry about how to take care of the children alone. I have to take responsibility for all the work.

(Interview with high caste woman with migrant husband in Mangalore)

With limited opportunities at home, several respondents shared that many children aspire to go to India from a young age. Children grow up watching men migrate to India and return with new clothes and money; they feel inspired to also migrate. A few respondents reported that their sons ran away to India; Sharma (2008) referred to this phenomenon as *bhagne* (adolescent boys escaping the strict controls of their village to explore life beyond). Boys often leave school after 10th grade to join their older brothers or fathers in India, as reported by a group of high caste men:

In Maulali, only few students [continue] after 10th class because fathers or others are in India. While someone comes from India, they see their new clothes, they see the money. And they get excited. They are inspired to go.

(Focus group with high caste men)

Labor migration, in turn, appears to perpetuate the inter-generational cycle of low skilled labor: growing up without their fathers, children are motivated to migrate themselves and fail to get the education required to help them to break out of this cycle.

Once my husband left to India, it was very difficult. I had no phone. I had no contact with him. There was no food to feed the children. I had to carry stones and [goods] and manage on my own to feed the children. I always cried, my eyes always had tears. I used to be scared of thieves. My children also used to worry. 'Why is father there and we are here? Let's go with him.' When they're grown up, elder son went to meet his father in Bangalore. I could not afford to go visit him.

(Interview with low caste woman with former migrant husband in Bangalore)

Grandparents and older parents left behind

It appears that many older parents rely heavily on the remittances their adult children send from India to make ends meet. A few of these older

respondents lamented that their children would or could not send them money; they suffered financial hardship as a result. Older parents who relied on their children's remittances were often not able to engage in the physical labor required of agrarian livelihoods and relied primarily on charitable handouts and loans to make ends meet. An elderly woman explained that remittances—which she had previously depended upon—were no longer coming from India:

My sons have been in India for 7 years [eldest], 7 years [2nd son], 3 years [3rd son], and 2 years [4th son]. I don't know what they are doing there. They are not sending any money. We depend completely on the money from India. We are not getting pension yet...Though my sons have asked us to come, I don't want to leave my home. They say 'from where can we send you money?' So how can we go to India? How can they take care of us if they cannot even send money for us? We gave them all high education [9th, 8th, 6th, 5th class respectively]. Now they are whistling there. Now they are enjoying there. How much money we have spent on them. I can't hear, I can't see. My slippers are finished. I have four sons, look at my condition. If they would have sent money, we would have eaten. We would buy clothes. They have not sent anything. I can't sleep at night. I think about loans and they are not sending money. We are parents but now they are not giving importance to us. We have to carry load but I cannot do it. They are in India, they will put on lipstick, powder, and go see cinema.

(Interview with low caste woman with four migrant sons in South India)

Some of these respondents were also tasked with taking care of the grandchildren in instances when both their son and daughter-in-law out-migrated. A

woman explained the hardship but also the joy she receives from caring for her young grandchild:

I live with my granddaughter, she is 2. I don't know how old I am. Maybe 44? My granddaughter is the only one I have. I feel very good with her. She only sleeps if she is on my lap. My sons have grown and they are far from me, I have her with me now... [They] have not sent me anything. Her grandfather [her estranged husband who migrated years ago and abandoned the family] has sent 5000 (INC) for me. We used to not speak to each other. Once he called me, I told him that all the sons have gone and that I have my granddaughter with me. He sent 5000 one month ago, he sent the money by hand with someone else who was returning from Bangalore. Though this is not enough, it is okay. I last saw my husband 23 years ago. My elder son was 2 years old when he went to India, now he is 25. I was pregnant with my younger son.

(Interview with high caste woman, abandoned by migrant husband, with three sons living in Kathmandu)

Insecurity and long-term family separation

Many migrant family members are separated for extended periods while men earn wages in India and women and children live in Maulali. In focus groups, migrant husbands said that they worried about the safety and well-being of their families back home. A respondent shared:

I miss our family. I wonder about them. Are the children going to school or not? I call once a day to hear them. Hearing their voice—it makes me feel better. I feel relaxed after hearing children's voices.

(Focus group with high caste men)

Men shared that it was difficult to be separated from their wives and children but that they had to migrate to India to make ends meet. Some men even made excuses to return home:

Everybody wants to stay here (Maulali); we go [to India] but everyone returns home. I make reasons to come home. 'Oh I have to plow the field.' I know we can find someone but I still want to come.

(Focus group with high caste men)

Similarly, women expressed the emotional toll of being separated from their husbands for extended periods. A woman whose husband had migrated to Bangalore a year before shared:

I feel bad. Though I feel for him, he doesn't seem like he is in pain. He is so fat, not in pain. His face has become red (gotten color). But when he is not in front of me, I think he is in pain. I feel very bad. I feel love for him. If he would be here, I could share my life with him. We do what we can do, we have children. We have to provide for them. I wish he was here.

(Interview with high caste woman with migrant husband in Bangalore)

Many children grow up without their fathers and several respondents noted that this separation took a mental and emotional toll on the children (in addition to the educational toll noted above). For example, a respondent with a migrant husband in Bangalore shared that her husband had not even met his daughter and that her sons only recognized him by his voice:

My elder son remembers his father. The other two children only recognize his voice. Younger son only saw him when he was young and my husband left when I was pregnant with my daughter.

(Interview with high caste woman with migrant husband in Bangalore)

Respondents also shared that women and children often felt insecure and unsafe without

their husbands at home. A few women expressed feeling afraid to venture outside and worried about other men behaving inappropriately, especially after drinking.

When someone goes to India, women become insecure. There are negative eyes on the women. (Other men look at her sexually). It is not good.

(Focus group with high caste men)

When husband is away and he is not at home, children become insecure. They worry about their mother being able to do everything on her own. If husband was here, children would feel relaxed and not worried about life.

(Interview with low caste woman with migrant husband in Andhra Pradesh)

Social status of migrant households

While respondents noted depending heavily on migrants to make ends meet and to meet consumption needs, they did not believe that having a migrant improved a household's social status in Maulali. In fact, a female respondent noted that those who were able to get a job in the area often looked down upon those who were unable to acquire a job in the area and had to migrate:

There is no change in social status of a household if men migrate—everyone has gone. If highly educated, people can work here. People who are here dominate those whose husbands have left. People who have migrated are looked down upon by those who can get jobs here. Only those who are not educated cannot get jobs here. They don't say anything directly but you can tell by their behavior.

(Interview with high caste woman with migrant husband in Uttar Pradesh)

Additionally, those households with a male migrant who was away for an extended period were less likely to get help from other men in the area. Often labor exchanges occur under the promise

of reciprocity; when it did not seem like a migrant would be returning in the foreseeable future, other men were not incentivized to help his family. A respondent shared:

There is no change in how others think of house if someone has migrant. It depends, if husband does not come home for a long time, others don't want to help. They think they won't get help in return. They won't get their share. They won't get help in the future. Since we help in exchange.

(Focus group with high caste men)

4.4 Intra-household roles and responsibilities

We examined in-depth the effect of male out-migration on intra-household roles, responsibilities, and decision-making. We conducted focus groups with men and women and interviews with women left behind to collect data on household divisions of labor and decision-making, perceptions of these divisions, and the effect of migration on these roles and responsibilities.

Household division of labor

Respondents—both men and women— unanimously reported that women's workload increased when their husbands migrated. As a high caste man in a focus group discussion put it: "When we leave, everything comes on the head of women." Men used to help carry goods from the market, take care of children, and manage all aspects of household decisions (such as taking loans and selling livestock). Men also normally took the lead in market interactions due to their greater financial literacy. All household responsibilities fell to women in their husbands' absence. However, it appears that there is nevertheless a certain maintenance of the gendered

division of labor and decision-making even without the physical presence of male household members.

As discussed earlier, cultural norms prohibit women from plowing with oxen and also from climbing onto roofs to make repairs. Finding men in the area to complete these tasks often required asking multiple times for help, which added yet another burden to women's heavy workload. With regard to time management, women reported that once their husbands departed, they worked from early morning until late in the evening, with little time for child care and leisure. They explained that these added burdens were both physically and mentally taxing. One woman described the extent of her new workload:

Workload is more now. My husband used to help with fetching firewood and water but now I have to do everything myself. I have to go to the mill on my own; before my husband used to go. It is too much work for me. I don't have time for myself. I have more work now. I don't have time for sanitation. I don't even have time to comb my hair, take a bath.

(Interview with high caste woman with migrant husband in Mangalore)

There were large seasonal effects on women's workload, with women feeling especially spread thin during harvest and plantation time. During these work-intensive periods, women shared that they would wake up before sunrise and work until 9 or 10 pm, often not getting a chance to eat throughout the day. The emotional toll of the exhausting labor is apparent in one woman's narrative:

My father-in-law helps me to plow with ox. Other work I have to do myself. No one helps me. I don't have anybody to help me with the house work. I myself cry, no one is there to console me. Sometimes I become so tired, I am unable to cook and eat. There isn't anybody who can help me. I have small children, how can they help me. I tell my husband that our children don't have clothes, food, slippers. He'll say,

okay I'm sending 1500 buy some slippers for them. In winter season, we have some vegetables and I go to sell them, I can earn little to buy rice. Now it is dry, so what should I do? I have no money.

(Interview with high caste woman with migrant husband in Bangalore)

Women rely heavily on their daughters, neighbors, and/or relatives to help with household and fieldwork. Those who do not have these social connections feel especially burdened by their husbands' absence. A high caste woman with a migrant husband in Uttar Pradesh notes the importance of her social network in alleviating her house and fieldwork:

I do not have difficulty doing field work, our relatives are our neighbors. Our fields are attached to theirs. They work in our field and I help out in theirs, they don't work in our field for money. If relatives are here, there are no problems. But otherwise, it is a challenge to find help. People want to finish their own work, it is then too late to work elsewhere. Relatives do our fieldwork at the same time as theirs since fields are connected to each other. ... My sister in law (husband's sister) helps me with the household work. When it is working season, my husband's elder sister also helps with the fieldwork. I don't have to work too much because many people, my relatives – neighbors – help me.

(Interview with high caste woman with migrant husband in Uttar Pradesh)

Household decision-making roles

Even in their extended absence, men maintain decision-making authority in their households.⁸ Women shared that they could freely make decisions about day to day expenditures and household work, but they preferred if men decided about

more substantial things like taking loans and credit, children's marriages, and selling or buying livestock. Some women noted that their husbands sometimes consulted them to solicit their views on these more substantial matters but that the final decision was made by men.

Household structure appears to play a role in determining the extent of a woman's decision-making role; this is similar to findings from other studies conducted in Nepal (N. Gartaula, Niehof, and Visser 2010). When daughters-in-law live in extended households with their in-laws, household-level decisions are made—sometimes exclusively—by the parents-in-law, the tulo manche, or the more senior members of the household. A lower caste male focus group participant described the limited rights and roles of daughters-in-law in decision-making processes:

It (who decides/has final say) depends on the type of household. If it is extended, then those who are older or parents-in-law make the decisions. We have to ask the older person, whether it is good or not. Even if the sons don't agree with the parents, we have to follow the parents. It all depends on them (parents). Daughter-in-law, she is told about the decision but doesn't have rights to decide. She has to do whatever parents-in-law say. Daughter-in-law just takes care of the children, household work in extended homes.

(Focus group with lower caste men)

Cellphones play a large part in allowing men to retain their decision-making authority during their absence. Previously, women communicated with their migrant husbands by letter, and months could elapse between sending a letter and receiving a reply. Women therefore often made time-sensitive decisions on their own (such as selling livestock), at times with the help of other men in the family or village due to their financial illiteracy and lack

⁸ This is similar to the findings of a study in the mid-Hills of Nepal where male labor out-migration was associated with women's increased role in "operational" domains of decision-making (ex. day to day activities) but not in more "strategic" domains such as major household purchases, marriages, and acquiring or giving loans (Maharjan, Bauer, Knerr 2012)

of experience. However, with the introduction of cellphones, women are able to communicate readily with their husbands and defer decision-making to them even in their physical absence. A group of men explained how decision making has changed with the introduction of technology:

Before phones, we used to send letters. If it was a fast decision, [our wives] would ask their relatives (men or women). If they cannot send letters on time, they could buy goats on their own. Now we have phones in their hands. They can call their husbands. Even if they have money, they still call us. Sometimes they ask out of courtesy and they respect their husbands. They call to show that they respect their husbands. Some women are afraid of their husbands.

(Focus group with high caste men)

The research team observed a woman handing her cell phone directly to the shopkeeper so that her husband could negotiate loan rates. Although men retained the decision-making authority in absentia, women still had the added burden of having to carry out the decision (such as going to pay back the loan or selling livestock at agreed upon rates). Men explained:

They phone us if they don't have money—whether to borrow, where to get loans from. She calls us and gives the phone to the person and we discuss. If they need to buy food on credit, she gives phone to the shopkeeper. When and where to send children to school? If there is no food to eat. Women manage household work and work in the field and take care of animals.

(Focus group with high caste men)

It appears that cellphones may be eroding the limited decision-making authority women used to have in men's absence. However, many women seem to prefer this arrangement whereby men act as the primary decision-maker *in absentia*. Citing their illiteracy, lack of experience, and existing work burden, women shared that they prefer that men make and carry out major decisions, like the terms of loans. When these decisions lay in women's hands they report feeling stress and that it is another addition to their already heavy workload. Women were also afraid of making mistakes (such as selling livestock for the wrong price) and the potential repercussions that might follow, such as beatings by their husbands. Women noted that they were economically dependent upon their husbands who were in India. Men were the breadwinners, and women felt that the men therefore had the authority to make household decisions. In a focus group, a high caste woman participant shared:

If our husbands are here, they do all the things themselves. What to buy, how to buy. We like it when they decide. We like it when they take this responsibility. We don't like to do this. The work we do, we don't ask anybody else—feeding children, taking care of animals, getting water. We make decisions about these things. Our husbands have to earn and do other work.

(Focus group with high caste women)

5. Conclusion: Programmatic Implications

In this section, we discuss the programmatic implications this research has for PAHAL. We focus on the topic of migration, which is the central fact of economic life in rural Nepal, with effects on food security, intrahousehold equality, resources for local agricultural livelihoods, and other aspects of well-being.

Mass male migration—whether seasonal, temporary or long-term—is a reality in much of rural Nepal, including many PAHAL locations. It should be understood as a central component of food security and resilience at the household level. PAHAL and other programs should work to support informed migration decisions and to create safer migration experiences for both those who migrate and those who remain behind. This could be through creation of information hubs for migrants, helping migrants and their families set up bank accounts that facilitate transfer of wages earned abroad, training potential migrants on how to negotiate for fair wages, starting migrant assistance programs in receiving areas and cities inside and outside of Nepal, providing vocational trainings for migrants to build their skills, and other programs. Women are a smaller portion of the total migrant population, but some women (and children) do migrate for work and/or accompany their husbands to India, and should not be left out of programming. In addition, programmers should prioritize ways to support the women, children, and elderly family members who remain behind, while also recognizing that women are not necessarily empowered by the absence of their male relatives.

Our in-depth study of Maulali shows the importance of male out-migration in helping households smooth consumption. However, women and men overwhelmingly reported that they would prefer for

men not to migrate, but feel that they have no other option due to the lack of viable options to support their families in their rural community. Male out-migration can benefit the household members left behind—for example, by making it easier to access credit, alleviating anxiety about having enough to eat, and receiving remittances to help cover basic expenses. But it also comes at a high cost. These include economic negatives, such as women having to pay to replace male agricultural labor and resulting drops in production and increases in market expenditures for basic commodities. In addition, while migration may provide a temporary relief from food insecurity through remittances, the process of inter-generational chain migration creates a cycle of international low-skilled migration, early departure from school, and the perpetuation of a debt cycle to make ends meet between remittances. As such, migration may also serve as a pathway into food insecurity and entrenched poverty in areas with high rates of male out-migration.

This report also details many negative social impacts, including separation of family members and added physical and psychological burdens for the women left behind. The advent of widely-available cell phone technology in rural areas means that women who once may have experienced increased autonomy and decision-making power when their husbands were away today rely on male permission and involvement in even mundane decisions. Furthermore, the migratory cycle perpetuates discriminatory intra-household gendered roles and responsibilities. For example, to be a man is to earn and to financially support one's family, even if this means being absent from the family for long periods of time and engaged in demeaning, low-paid, and insecure labor. To be a woman is to stay at home,

raise the family, and take care of the homestead and field, all the while still succumbing to the will of an absent husband, in-laws, or other male relatives.

Migration and the decision to migrate entail making many trade-offs within the household and around household livelihood decisions. PAHAL and other programs should recognize both the costs and benefits of male out-migration in their activities. As such, we recommend that Mercy Corps and other stakeholders adopt a dual approach to programming. Such an approach would seek to support, improve and facilitate migration for those who feel that migration is their best option, while simultaneously working to bolster the outcomes of, options for, and value in the livelihoods of both women and men who remain in rural Nepal on a temporary or permanent basis.

Supporting and Improving Migration

The first approach, supporting and improving migration, recognizes that migration will, for the foreseeable future, remain a major source of income for many rural Nepali households. Interventions to improve this situation might be grouped into the categories of i) informed labor migration, ii) safer working conditions for migrants, and iii) facilitating remittance transfers.

Informed labor migration

Men rely heavily on their social networks, on family members and friends who have previously migrated, for informal leads when migrating. Chain migration from Maulali, whereby a sizeable portion of migrants end up in the same location, is common. Currently, there is no formal information source for men who are considering migrating to India. Many of the young men and adolescents contemplating migrating for the first time have little to no information, or largely inaccurate information, about distances,

conditions, wages, ease of finding work, life in India, and so forth. Mercy Corps and other organizations are already engaged in safer migration programming; these efforts should be expanded and their impact evaluated. In particular, incorporating feedback from migrants as to what they wish they had known or understood prior to migration might be particularly helpful.

Safer working conditions for migrants

Most Nepali migrants work in unregulated, undignified, and often dangerous conditions in India. They work long hours for low pay and have limited recourse to lobby for improved wages, rights, or conditions. Many of the “security guards” live on their employers’ property and rely heavily on their goodwill to ensure continued payment and decent conditions. Others do heavy manual labor, such as construction, and are often assigned the riskiest jobs. Recognizing the centrality of migration to rural livelihoods, organizations like Mercy Corps and donors like USAID should invest in urban programs, gather evidence and disseminate research regarding conditions, and support advocacy efforts to improve workers’ rights in the informal and migrant-dominated sectors.

Facilitating remittance transfers

Our data showed a range of methods used to transmit and receive remittances, from carrying cash by hand to sending through new wire transfer systems. Much more effort is needed to alleviate the costs associated with sending and receiving remittances, whether these costs be transfer fees, risk, women’s time spent picking up money, or the intimidation of women who fear that they do not understand the system or have the correct documents. The expansion of cell phone technology and the ubiquitous nature of mobile payment systems in India means that an investment to enable fast, very low cost, and safe trans-border transactions should be a relatively

simple intervention, with likely buy-in from private sector companies.

To improve migration, more information will first be needed from the perspective of migrants themselves. What, for instance, makes migration “successful” in the eyes of migrants and/or their families? What are the benchmarks that lead men to decide it is time to return to Nepal and stop working in India? Importantly, what skills did men acquire during their time abroad that might be transferable to a diversified and sustainable livelihood activities in Nepal? From the perspective of families left behind, were there aspects that made migration “worth it,” and what were these? How could remittance flows be improved? Without evidence regarding the perspectives and experiences of migrants and their families, efforts to improve migration systems will fall short.

Improving Local Livelihoods

The second approach includes interventions in Nepal’s rural communities to improve local livelihood opportunities and support the transnational migration experience for those left behind, namely women, children, and elderly family members. These interventions are grouped into the following categories: i) agrarian livelihoods, ii) vocational training, and iii) support for those left behind.

Agrarian livelihoods

Based on our data and observations in Far West Nepal, the notion of sustainable agrarian livelihoods on smallholder plots should be examined in more depth. There may be ways to support this as a viable livelihood strategy, but more likely small-scale agriculture will be one component of a more diversified household approach. In Maulali, we observed that households are already diversifying because they are unable to survive based purely

on agriculture, and the struggle to survive on cultivation alone is not unique to Maulali. Agriculture does remain an important component for many households, however, and hence should be supported in the most constructive way possible. This could be through the introduction of and training on specific cash crops (for locations where market access is possible), training regarding post-harvest storage (if appropriate), encouraging greater diversification of crops across a community, facilitating trade and exchange in local markets, and improving the efficiency of input use for existing crops and agricultural practices. Services such as water taps and improved roads would also benefit all residents. Information regarding crops and planting, price data, and transport costs would be useful for producers. Program implementers are likely to encounter numerous challenges, however, such as the lack of water for farming in Maulali. Such issues should not disqualify these locations from interventions, but rather lead to community discussions regarding the ways that local livelihoods can best be supported within the program’s parameters. Guidelines for PAHAL and partners on this process may be helpful in this regard.

Vocational training

Given poor production and lack of (lucrative) employment opportunities, men are forced to migrate to India to make ends meet. Men overwhelmingly shared that they would prefer to stay in Maulali, though, and they voiced the need for vocational training and workshops in cooking, house wiring, plumbing, mobile repair, plastering, furniture making, etc.

With such capacity building opportunities, Mercy Corps and other partner organizations can help bolster livelihood options for the men who remain in the rural area. Additionally, livelihood opportunities for women are severely limited in Maulali. Limited to construction support and transportation of goods from market, these casual opportunities often pay discriminatory wages. There is ample opportunity



for PAHAL to provide vocational training and develop women's livelihoods in Maulali. However, given the already heavy household and childcare responsibilities of women, Mercy Corps should first engage with women to understand the types of livelihood opportunities that they desire and can perform without placing undue burden on them. Moreover, there should be careful consideration of the social norms at play (e.g., men's traditional role as "breadwinner").

Supporting those left behind

Migration from Maulali is highly gendered, with many men migrating alone and leaving their families behind. For women, male out-migration brings about many hardships, including the burden of greater household, agricultural, and childcare work. Women noted feeling especially spread thin during harvest

and plantation time. PAHAL should support the women left behind to offset the psychological and physical burden they take on due to men's extended absences. There may be an opportunity to facilitate women's empowerment through male out-migration: both men and women expressed interest in women taking on a greater role in household decision-making processes. However, many women expressed that they prefer the current set-up, in which men continue to act as the primary decision-makers *in absentia*, facilitated by use of cell phones. Citing their illiteracy, lack of experience, and existing work burden, women shared that they preferred for men to make and carry out major decisions like the terms of loans. It is critical that Mercy Corps and partner organizations first support women so that they feel prepared to take on these additional responsibilities (e.g., through financial literacy training, alternative livelihood opportunities) and second, avoid

inadvertently burdening women further in an effort to “empower” them. Feedback from men and women will be essential to understand the specifics of how programs can facilitate women’s empowerment in a context of mass male out-migration.

Many older parents rely heavily on the remittances their adult children send from India to make ends meet. Given unstable and infrequent remittance flows, it appears that the elderly often face financial hardships and lack alternative income sources like casual labor opportunities due to their physical conditions. Additional information is needed about the level of dependence of the elderly on precarious income sources, such as remittances. Mercy Corps and partner organization should support these older parents to help facilitate alternative income sources.

In Maulali, male labor out-migration encourages children’s early departure from school, perpetuating an inter-generational cycle of low-skilled labor: growing up without their fathers, children are themselves motivated to migrate, and fail to get the education needed to break out of this cycle. Even among those who remain in school, a majority terminate their education around the 10th grade (after which point parents are required to pay a school fee). Mercy Corps and its partners can help families break out of this inter-generational cycle of low-skilled labor by promoting continued education and providing support to help retain children in school beyond the 10th grade. It is critical that both boys and girls be supported in this endeavor. While it is culturally taboo for women to seek employment outside of Maulali, continued education can promote women’s literacy, including financial, to allow them to seek livelihood opportunities in place.

To improve access to and attainment of livelihoods and support those left behind, more information will be needed from the perspective of those who remain in the rural areas, temporarily or permanently. What activities will best support agrarian livelihoods on smallholder plots? Which skills are in the highest demand and can create livelihood opportunities for both men and women, not just to make ends meet but to thrive? In what ways do those left behind wish to be supported? How can programs facilitate women’s greater role in household decision-making roles in a culturally-nuanced way without adding undue burden to women? How can the inter-generational cycle of limited educational attainment and low skilled male labor migration be broken?

Finally, we stress that action to improve household well-being in the face of stressors and shocks depends on a nuanced understanding of resilience. Such understanding depends on research efforts that obtain data that is both highly resolved in space—able to disaggregate the trajectories of districts, communities, households, and even individuals—as well as in time—able to understand the influence of both structural and random forces in determining well-being. Data-intensive research efforts, such as that described in this report, represent one approach to gathering this data; new digital technologies may perhaps facilitate such work in the future, reducing logistical burdens and costs.

References

- Barrett, C., and M. Constanas. 2014. Toward a Theory of Development Resilience for International Development Applications. *Proceedings of the National Academy of Sciences* 111 (4): 14625-14630.
- Bengtsson, L., J.Gaudart, X. Lu, S. Moore, E. Wetter, K. Sallah, S. Rebaudet, and Piarroux, R. 2015. Using mobile phone data to predict the spatial spread of cholera. *Scientific reports* 5.
- Blumenstock, J., G. Cadamuro, and R. On. 2015. Predicting Poverty and Wealth from Mobile Phone Metadata. *Science* 350 (6264): 1073-1076.
- Central Bureau of Statistics, Nepal. 2011. Nepal Living Standards Survey 2010/11, vol2. Central Bureau of Statistics, Kathmandu.
- Deville, P., C. Linard, S. Martin, M. Gilbert, F.R. Stevens, A.E. Gaughan, V.D. Blondel, and A.J. Tatem. 2014. Dynamic population mapping using mobile phone data. *Proceedings of the National Academy of Sciences* 111 (45): 15888-15893.
- Food Security Information Network, Resilience Measurement Technical Working Group (FSIN). 2014. Toward an Agenda for Measurement Design, Technical Series.
- Gartaula, H.N., A. Niehof, and L. Visser. 2010. Feminisation of Agriculture as an Effect of Male Out-Migration: Unexpected Outcomes from Jhapa District, Eastern Nepal. *International Journal of Interdisciplinary Social Sciences* 5 (2).
- GSMA. 2017. GSMAi data December 2016, <https://www.gsma.com/mobileeconomy/>, accessed on the 21 st of July 2017.
- Hancock, K., and S. Richardson. 1985. Discount Rates and the Distribution of Lifetime Earnings. *The Journal of Human Resources* 20 (3): 346-360.
- Maharjan, A., S. Bauer, and B. Knerr. 2013. Migration for Labour and Its Impact on Farm Production in Nepal. Working Paper 4. Centre for the Study of Labour and Mobility, Kathmandu.
- Maxwell, D., and R. Caldwell. 2008. *The Coping Strategies Index: Field Methods Manual*, Second Edition.
- Maycock, M. 2017. Masculinities, Remittances and Failures: Narratives from Far-West Nepal. *South Asia Research* 37 (2): 179-193. <https://doi.org/10.1177/0262728017700204>
- Njuguna, C., and P. McSharry. 2017. Constructing spatiotemporal poverty indices from big data. *Journal of Business Research* 70: 318-327.
- Seddon D., J. Adhikari, G. Gurung. 2002. Foreign labor migration and the remittance economy of Nepal. *Critical Asian Studies* 34 (1).
- Sharma, J.R. 2008. Practices of Male Labor Migration from the Hills of Nepal to India in Development Discourses: Which Pathology? *Gender, Technology and Development* 12 (3): 303-23. <https://doi.org/10.1177/097185240901200302>.
- Steele, J.E., P.R. Sundsøy, C. Pezzulo, V.A. Alegana, T.J. Bird, J. Blumenstock, J. Bjelland, et al. 2017. Mapping Poverty Using Mobile Phone and Satellite Data. *Journal of the Royal Society Interface* 14(127): 20160690.

- Sundsøy, P., J. Bjelland, B.A. Reme, E. Jahani, E. Wetter, and L. Bengtsson. 2017. Towards Real-Time Prediction of Unemployment and Profession. In *International Conference on Social Informatics*: 14-23. Springer, Cham.
- Tamang, S., K.P. Paudel, and K.K. Shrestha. 2014. Feminization of Agriculture and Its Implications for Food Security in Rural Nepal. *Journal of Forest and Livelihood* 12(1): 20-32. [http://www.forestaction.org/app/webroot/js/tinymce/editor/plugins/filemanager/files/JFL%20VOI%2012%20\(1\)/tamang%20et%20al.pdf](http://www.forestaction.org/app/webroot/js/tinymce/editor/plugins/filemanager/files/JFL%20VOI%2012%20(1)/tamang%20et%20al.pdf).
- Tuladhar, R., C. Sapkota, and N. Adhikari. 2014. Effects of Migration and Remittance Income on Nepal's Agriculture Yield. <https://openaccess.adb.org/handle/11540/1287>
- Vaitla, B., J. Coates, L. Glaeser, C. Hillbruner, P. Biswal, and D. Maxwell. 2017. The measurement of household food security: Correlation and latent variable analysis of alternative indicators in a large multi-country dataset. *Food Policy* 68: 193-205. <http://doi.org/10.1016/j.foodpol.2017.02.006>
- Vaitla, B., J. Coates, and D. Maxwell. 2015. Comparing Household Food Consumption Indicators to Inform Acute Food Insecurity Phase Classification. FHI 360/Food and Nutrition Technical Assistance III Project (FANTA), Washington, DC.
- Vulnerability Analysis and Mapping Branch (ODAV), World Food Program (WFP). (2008). *Food Consumption Analysis: Technical Guidance Sheet*. WFP, Rome.
- Wilson, R., E. zu Erbach-Schoenberg, M. Albert, D. Power, S. Tudge, M. Gonzalez, S. Guthrie, et al. 2016. Rapid and near real-time assessments of population displacement using mobile phone data following disasters: the 2015 Nepal Earthquake . *PLoS Currents* 8.
- World Health Organization (WHO). 2016. *Global Health Observatory Data Repository: Nepal*.

The Feinstein International Center is a research and teaching center based at the Friedman School of Nutrition Science and Policy at Tufts University. Our mission is to promote the use of evidence and learning in operational and policy responses to protect and strengthen the lives, livelihoods, and dignity of people affected by or at risk of humanitarian crises.

Twitter: @FeinsteinIntCen

fic.tufts.edu

