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Evaluation of the "Supporting Deforestation-Free Cocoa in Ghana" Project Bridge Phase: Baseline Report

Communications, Evidence, and Learning (CEL) Project Work Assignment – E3 Land and Urban Office

May 5, 2020

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Communications, Evidence and Learning (CEL) Project

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USAID Contract Number: GS00F061GA

Developed under the Communications, Evidence and Learning (CEL) Project

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Suggested Citation: Persha, L., Haugan, G., Mittelberg, T., Wendt, R., and Protik, A. (2020) *Evaluation of the 'Supporting Deforestation-Free Cocoa in Ghana' Project Bridge Phase: Baseline Report.* Washington, DC: USAID Communications, Evidence and Learning (CEL) Project.

CONTENTS

ACRONYMS

CEL	Communications, Evidence, and Learning
CFI	Cocoa and Forests Initiative
Cocobod	Ghana Cocoa Board
CREMA	Community Resource Management Area
CSA	Climate-Smart Agriculture
CSSVD	Cocoa Swollen Shoot Virus Disease
DID	Difference-in-Difference
E3	Bureau for Economic Growth, Education, and Environment (USAID)
ECOM	ECOM Agroindustrial Corp
EDR	Evaluation Design Report
GD	Group Discussion
GHG	Greenhouse Gas
GOG	Government of Ghana
ILRG	Integrated Land and Resource Governance Task Order
IP	Implementing Partner
KII	Key Informant Interview
LU	Office of Land and Urban (USAID/E3)
MDES	Minimum Detectable Effect Size
MDI	Minimum Detectable Impact
NTFP	Non-timber Forest Product
PE	Performance Evaluation
RCT	Randomized Controlled Trial
SOW	Statement of Work
STARR II	Strengthening Tenure and Resource Rights II
TGCC	Tenure and Global Climate Change
TOC	Theory of Change
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

This report provides baseline context for the mixed-methods impact evaluation (IE) of the "Supporting Deforestation-Free Cocoa in Ghana" project Bridge Phase activity that has been commissioned by the United States Agency for International Development's (USAID) Office of Land and Urban in the Bureau for Economic Growth, Education, and Environment (USAID/E3/LU). The evaluation aims to provide an evidence base for outcomes of the Bridge Phase activities with respect to strengthening land rights and land governance, reducing deforestation, increasing carbon sequestration and cocoa productivity, and enhancing local livelihoods. The evaluation is led by NORC at the University of Chicago, under the Communications, Evidence and Learning (CEL) Project.

This document provides findings from the baseline data collection for the evaluation, including background context on key demographics, household characteristics, and baseline measures on outcome variables. The report also examines balance across Bridge Phase and comparison group villages for the IE components of the evaluation, revisits power calculations from the Evaluation Design Report (EDR) using parameters from the baseline data, and provides an update on the viability of evaluating the farm rehabilitation component of the Bridge Phase activity, given a reduction in the number of beneficiaries receiving this intervention as learned at baseline.

BRIDGE PHASE ACTIVITY DESCRIPTION

The Integrated Land and Resource Governance (ILRG) Task Order under the Strengthening Tenure and Resource Rights II (STARR II) Indefinite Delivery/Indefinite Quantity (IDIQ), is supporting work on sustainability of deforestation-free cocoa through the "Supporting Deforestation-Free Cocoa in Ghana" (SDFC) project Bridge Phase. The ILRG program is implemented by an international consortium including the prime contractor, Tetra Tech, and core subcontractors, including Winrock.

The ILRG activity seeks to refine three interventions through a "Bridge Phase" period, and then scale up a financially viable farm rehabilitation and land tenure strengthening model for the Ghanaian cocoa sector. In combination with land use planning, the scaled activity aims to result in: reduced deforestation and greenhouse gas (GHG) emissions and increased carbon sequestration in the cocoa landscape, increased cocoa farm productivity and resilience, diversified farmer incomes, and improved livelihoods. Implementation of the Bridge Phase is through a partnership across ILRG and three private sector partners: Ecom Agroindustrial Corp. (ECOM), the Hershey Company (Hershey), and Meridia. The Bridge Phase activity has three intervention components: (1) cocoa farm rehabilitation led by ECOM that is provided to a small group of registered farmers; (2) farm mapping and provisioning of tenure documentation to all interested farmers in the four Bridge Phase communities; and (3) landscape governance and land use planning activities implemented at village and district levels.

EVALUATION QUESTIONS

Table 1 lists the six questions addressed by the SDFC Bridge Phase evaluation. The evaluation questions, which the team developed in collaboration with USAID, focus on meeting USAID's priority learning interests for this activity and were derived from the SDFC Bridge Phase theory of change.

TABLE 1: EVALUATION QUESTIONS AND THEMATIC AREAS OF INVESTIGATION

THEME	EVALUATION QUESTION
Tenure Documentation Effects on Tenure Security	1. What are the effects of land tenure documentation on tenure security for cocoa farmers in Bridge Phase villages, and key reasons why? a. What was the extent of mapping and provisioning of land tenure documentation? b. Were there any challenges encountered with respect to participation in tenure documentation activities, and how were these resolved? c. How did Bridge Phase tenure documentation activities affect household perceptions of tenure security, and anticipated investment and livelihood follow-on outcomes? d. What types of households and farmers were more likely to pay for and obtain farm-level documentation? For what types of farm holdings?
Tenure Security and Farm Rehabilitation Linkages	2. How does farmer tenure security relate to interest, uptake and outcomes of cocoa farm rehabilitation services? a. Controlling for other household and farm-level factors, were farmers who received farm tenure documentation during the Bridge Phase more likely to participate in a second round of farm rehabilitation services offered at the end of the Bridge Phase? b. How does tenure documentation increase interest in and ease the ability for farmers to participate in farm rehabilitation services? c. What are the effects of higher tenure security on farm rehabilitation intermediate outcomes (farm investments, productivity, revenues, amount of new land clearing)?
Farm Rehabilitation and Secondary Forest Clearing Linkages; impacts on GHG emissions	3. To what extent and in what ways does cocoa farm rehabilitation lead to reduced deforestation and greenhouse gas (GHG) emissions in secondary forests and increased carbon sequestration in rehabilitated cocoa farms? a. What is the effect of farm rehabilitation on cocoa farm carbon stocks and sequestration projections, fallowing decisions, amount of secondary forest clearing and broader household land use decisions, for farmers engaged in farm rehabilitation during the Bridge Phase timeframe? b. What are reasons for observed changes in land use decisions?
Land Use Planning and Secondary Forest Clearing Linkages	4. To what extent and in what ways does spatially-based territorial land use planning (LUP) at multiple scales lead to reduced deforestation and greenhouse gas (GHG) emissions in secondary forests? This includes a focus on the following sub-question: a. What is the effectiveness of the Eco Game as a tool to elicit land use planning behavior change and actions? b. If not as effective as anticipated, what alternative tools and approaches might future programs consider piloting?
Influence of Context Characteristics on Outcomes	5. How are key individual farmer, farm-level, household and village context characteristics associated with Bridge Phase tenure security, farm rehabilitation, and land use outcomes? Characteristics to be examined include: a. Farmer: Age, gender, tenancy status (indigene or *asidee* vs. *abunu*), education. b. Farm-level: Cocoa farm age, farm size. c. Household: Total farm holdings; wealth status. d. Village: Secondary forest scarcity, social and governance dynamics, market context.
Key Lessons to Inform Potential Scale-Up	6. What are the key learning lessons on financial, technical and governance barriers (or enabling conditions) that must be overcome to enable effective scale-up of the integrated Bridge Phase activities, and likelihood of achieving landscape-scale improvements on: strengthening land rights, increasing cocoa productivity, reducing deforestation, increasing carbon stocks, and enhancing local livelihoods? This includes a focus on: a. What are reasons that households or farmers chose not to participate in any of the Bridge Phase activities? To what extent can future activities address these barriers? b. Did Bridge Phase activities reach intended targeted populations, and key sub-groups of interest? (less tenure secure, farmers with declining cocoa productivity) c. What do the Bridge Phase evaluation findings on intermediate results for each of the three program sub-components suggest with respect to longer term opportunities for improved tenure security, effects on cocoa productivity and livelihoods, and forest land use decisions? d. What external factors, if any, positively or negatively influenced the ability for Bridge Phase activities to achieve intended results?

EVALUATION DESIGN

The Bridge Phase activities vary in scope, geography, selection criteria for beneficiaries, and the anticipated timeframe for maturation of key outcomes. As a result, this mixed-methods evaluation is designed to use different analytic approaches to assess the effects of each of the three Bridge Phase interventions. The three interventions focus on: (1) cocoa farm rehabilitation; (2) tenure documentation; and (3) village-level land use planning. At USAID's request, the evaluation aims for as rigorous a quasi-experimental design as possible, within available budget, recognizing that the small scale of implementation for the Bridge Phase activities limits the evaluation design options and study power.

The evaluation was designed to collect qualitative and quantitative data at baseline and endline from farmers in the four Bridge Phase villages and in eight comparison group villages. The comparison group consists of households in eight villages in Asankrangwa where ECOM also offered the cocoa farm rehabilitation service to farmers but the tenure documentation and village-level land use planning interventions will not be implemented. The evaluation was designed to assess the effects of cocoa farm rehabilitation via a regression discontinuity approach, but this became inviable after the number of farmers participating in this component fell below a minimum threshold for sufficient statistical power. The effects of farm tenure documentation will be assessed via a quasi-experimental matched comparison design. The effects of the village-level land use planning component, implemented in four villages, will be assessed via pre-post qualitative analysis informed by household survey data.

The household sample in each community comprised three groups of survey respondents: (1) any farmers in the community who were registered into ECOM's farm rehabilitation service; (2) a sample of farmers who were eligible for but did not enroll in ECOM's farm rehabilitation program (including a small number of program drop-outs identified by ECOM); and (3) a random sample of other cocoa farmers in the village. A full listing of all households in each surveyed community was compiled prior to survey. The survey sample was drawn from the listing data together with farm rehabilitation enrollment data provided by ECOM.

BASELINE HOUSEHOLD SAMPLE

Baseline findings in this report draw from the full baseline sample of 714 households, comprised of 273 households surveyed in the four Bridge Phase communities and 441 households from seven comparison group communities. The household survey was administered to the household head or to the main cocoa farmer in the household if that person was different from the household head. Male-headed households comprised 84 percent of households in the sample, and 15 percent were female-headed. Due to the small number of implementation villages, baseline findings are reported for the sample overall, and also disaggregated by households in the four Bridge Phase communities and in the seven comparison group communities.

FINDINGS 1: HOUSEHOLD LIVELIHOODS, ACCESS TO CREDIT, FOOD SECURITY

- **Farm activities:** Household livelihoods were almost entirely dependent on cocoa, with few secondary sources of income. Cocoa was the most important source of income for approximately 90 percent of Bridge Phase households and 88 percent of comparison households. Of all Bridge Phase households, 26 percent reported they had no secondary source of income. Among those who did, the most common secondary income source was from cultivation of other crops, followed by income derived from self-owned businesses.
- **Access to credit:** Over the year prior to survey (2018), 45 percent of all respondents took a loan. Banks were the most common loan source, followed by licensed buying companies or purchasing clerks. Among all households, the average amount borrowed was $248.59. Households most commonly used loans to buy agricultural inputs, followed by household basics.

Among those who did not take out a loan, the most common reasons were not having any need for a loan or a desire to avoid debt.

- **Food security:** While food insecurity was relatively uncommon, 18 percent of Bridge Phase households suffered from moderate to severe hunger, based on the Household Hunger Score (HHS). Most households that reported experiencing food deprivation said the frequency was rare to infrequent.
- **Non-farm activities:** Households in the sample were heavily reliant on cocoa farming, but 46 percent also engaged in non-farm activities. Approximately 12 percent of households in Bridge Phase villages participated in gold mining activities over the prior year.

FINDINGS 2: AGRICULTURAL PRODUCTION OVERVIEW

- **Crops produced:** Respondents reported cultivating 4.5 different crops per household and selling 2.1 crops per household. Cocoa, cassava, and plantain were the most common crops produced and sold by households.
- **Land holdings:** On average, households in Bridge Phase villages cultivated 2.7 farms per household, and owned 2.8 hectares of land (self-reported). Just 3 percent of all households leased out any of the land they owned. Most households cultivated cocoa on one or two farms, and their total area of land under cocoa production was under 3 hectares, on average.
- **Change in household land under cocoa:** Approximately half of all households reported no change in the amount of land they cultivated cocoa on over the past five years. Over the same time period, 36 percent reported increasing the amount of land their household cultivated cocoa on, while 14 percent reported decreasing the amount of land under cocoa.
- **Reasons for change:** Approximately 40 percent of all households who increased their land under cocoa over the past five years acquired the additional land by entering into a new *abunu* arrangement to farm someone else's land. A smaller percentage of households reported inheriting (22 percent) or purchasing (11 percent) the land. Some of this cocoa expansion came from land that was newly cleared: 16 percent expanded their cocoa cultivation by clearing forest or fallow land already held by the family, and 7 percent cleared other forest or fallow land.
- **Land documentation:** Of all surveyed households, 47 percent had some type of land documentation that recognized their right to use any of their cocoa farms.
- **Cocoa production:** Half of all households reported their cocoa crop yield to be less than 350 kg per hectare during 2018-2019. Most households in the sample had been engaged in cocoa cultivation for many years: 49 percent of all households had been growing cocoa for 16 years or more, and 24 percent had been growing cocoa for 25 years or more.
- **Shade trees:** Most households (84 percent) reported having at least one cocoa farm with shade trees, but only 51 percent reported having planted shade trees. Having cocoa farms with naturally occurring shade trees was more common, at 66 percent of households. Almost no households planted shade trees before the year 2000, and there has been a substantial uptick since 2009.
- **Land clearing for cocoa:** Approximately 37 percent of all households reported clearing some area of *bush* for new cocoa during the year prior to survey, while 15 percent of Bridge Phase households cleared bush for other crop cultivation. Only 8 percent of all households reported clearing *forest* for new cocoa or any other purpose over the past year.
- **Labor for cocoa harvesting:** Nearly all households (87 percent) harvested cocoa on their own farms. While 59 percent of households relied solely on household labor, 36 percent used hired labor, and 12 percent relied solely on hired labor. Use of communal labor was reported by just 5 percent of all households. In terms of gender, 41 percent of households reported using labor provided solely by men, while harvesting solely by women was very uncommon, reported by only 3 percent of households.

- **Cocoa revenue:** On average, households in the sample reported earning $1,647.12 in cocoa revenue the year prior (2018-19). A quarter of all households earned less than $450 in cocoa revenue, and half earned less than $900. On a per hectare basis, average household cocoa revenue for the sample was $909.70 per hectare. A quarter of households reported earning $209 per hectare or less, while half reported earning $398 or less per hectare.
- **Cocoa training:** The share of respondents who reported any training related to cocoa farming over the past year was 48 percent. Only 5 percent (N=20) of respondents reported receiving more than ten days of training on cocoa farming over the past three years.
- **Cocoa replanting:** Overall, 40 percent of households in the sample (N=287) reported ever having replanted cocoa trees on any of their farms. Almost no replanting occurred until 2004, and the vast majority of cocoa replanting has occurred since 2015. Most of the replanting to date was reported as individual efforts, and not part of a cocoa farm rehabilitation program.
- **Reasons farmers have not replanted:** the most common reasons farmers gave for not replanting their cocoa trees were: not being able to afford to replant (30 percent); lack of access to new cocoa seedlings (16 percent); not having permission from their landlords (11 percent); and insufficient knowledge to replant (9 percent).
- **Cocoa farm rehabilitation interest:** If a new farm rehabilitation program was offered in their village, 44 percent of households reported they would be interested in participating. Among farmers who reported not being interested in rehabilitation, the main reasons were: trees were too young to replant (48 percent); farmer could not afford to replant (23 percent); and farmer would need more information about the program (10 percent).
- **Right to cut and replant cocoa:** Overall, 75 percent of households (N=527) said they had the right to cut and replant their cocoa farms if they wanted to. Among households that said they did not have the right to replant their farms, 67 percent (N=118 households) also reported having no type of land documentation recognizing their right to use their farms.

FINDINGS 3: FARM ACQUISITION AND TENURE SECURITY

FARM CHARACTERISTICS / FARMS OVERVIEW

- Among the 1,794 farms in the sample, the average farm size was 1.4 hectares (farmer self-reported). Of all farms, 21 percent were less than 0.5 hectares in area, and 23 percent were between 0.5 and 1 hectare. Just 10 percent of all farms were larger than two hectares.
- In Bridge Phase and comparison villages, the percentage of farms that were acquired between 1970 and 1990 was low. Acquisition rates increased during 1990-2019. Half of all farms in the baseline sample were acquired in 2008 or later.

MODE OF ACQUISITION

- In both Bridge Phase and comparison villages, households most commonly acquired their farms through *abunu* customary land arrangements with another individual or family. Approximately 38 percent of all farms in the sample were acquired through *abunu* agreements.
- Other common modes of farm acquisition included: inheriting the farm through the father's line (20 percent of all farms); inheriting through the mother's line (9 percent); through rights as a landowning family member (11 percent); and through direct purchase of the land (10 percent).
- Four percent of farms were acquired through *abusa* agreements, one percent were acquired through *asidee* agreements, and three percent acquired through another type of land agreement.

TENURE SECURITY

- For over 95 percent of farms in the sample, households reported it was either impossible or highly unlikely that someone from their extended family, or the village chief, would take over the farm without their agreement during the next one to three years.

- For farms under *abunu*, *abusa*, or *asidee* customary arrangements, households reported it was impossible or highly unlikely that the landlord would take over the farm without their agreement in the next one to three years for 88 percent of such farms.
- Overall, 39 percent of farms under *abusa* agreements were perceived as likely (17 percent) or very likely (22 percent) to be taken over by the landlord, while just 4 percent of *abunu* farms were seen as likely (3 percent) or very likely (1 percent) to be taken over. For farms under *asidee* agreements, 19 percent were perceived as likely or very likely to face landlord encroachment.
- For 86 percent of farms, households reported it was impossible or highly unlikely someone else would claim the farm without their permission if the household cut and replanted cocoa trees.
- In terms of households' perceived rights to cut and replant cocoa trees by how the farm was acquired, perceived tenure security was lower for farms under *abunu*, *abusa*, and *asidee* agreements, than for farms acquired by other means:
    - Households reported the right to cut and replant cocoa trees for 94 percent of farms acquired through the household's rights as a landowning family, and for 91 percent of farms acquired through direct purchase, compared to just 42 percent of farms acquired by *abunu*, *abusa*, or *asidee* agreements.
    - Households reported it was impossible or highly unlikely someone would claim the farm without their permission if they cut and replanted cocoa trees for 98 percent of farms acquired through rights as a landowning family, direct purchase, or inheritance, compared to 72 percent of farms acquired through *abunu*, *abusa*, or *asidee* agreements.
- Farms under *abusa* agreements comprised only four percent of the sample, but appeared to be less secure than those under *abunu* agreements:
    - While households reported the right to cut and replant cocoa for 47 percent of *abunu* farms, they reported the same for just 10 percent of *abusa* farms.
    - Similarly, 73 percent of *abunu* farms were perceived to be impossible or highly unlikely to be claimed by someone else if the household were to cut and replant the cocoa trees, compared to 60 percent of *abusa* farms in the sample.
- Of farms acquired through inheritance or landowning family rights, 91 percent would not need permission from anyone to cut and replant, compared to 37 percent of farms under *abunu*, *abusa*, or *asidee* arrangements.
    - Fifty-five percent (N=334) of *abunu* and 89 percent (N=64) of *abusa* farms would need permission from a landlord to cut and replant.
- For 25 percent of all farms in the sample, households reported being either somewhat or very worried they could lose the rights to the farm against their will within the next three years.
- Households were least worried about losing rights to farms acquired through their rights as a landowning family. There was little variation on this across other modes of farm acquisition.
- Among farms for which households were worried about losing rights, the most common reasons were: the landlord might ask the household to leave (27 percent; N=120); disagreements with family or relatives (24 percent; N=105); and issues with local or customary authorities such as village chiefs, elders or other officials (14 percent; N=64).
- On average, households believed they could leave their farm to fallow for 1.9 years without worrying the farm would be reallocated to another household.
- For 63 percent of farms, households did not believe they could leave the land fallow for any period of time without worrying the farm would be reallocated.

LAND DOCUMENTATION

- Of farms in the sample, 36 percent (N=649) had any type of documentation for the household's rights to use the farm. Of these, 33 percent had a written *abunu* or *asidee* agreement, 17

percent had a farm management plan, 41 percent had some type of customary land certificate, and 7 percent said they had a FarmSeal document.

- Presence of farm documentation varied slightly among Bridge Phase communities: approximately 38 percent of farms in Domeabra had any type of paper documentation, compared to 47 percent in Suresu Nkwanta, 30 percent in Yirase, and 50 percent in Nyame Nnae.
- Obtaining documentation of rights to use a farm is a recent phenomenon: 50 percent of all farms with any type of documentation reported the document was acquired in 2011 or later.
- Households reported they would be interested in obtaining documentation for 83 percent of farms that are currently undocumented.
- Household familiarity with customary land certificates is fairly low: only 31 percent of households in the sample reported familiarity with such documents, including Meridia's FarmSeal.
- For 37 percent of farms, households reported they did not know how much they would be willing to pay to receive such a document. For farms where households were able to estimate their willingness to pay, the mean estimate was $78.2 and the median was $47.5.
- Households reported that 22 percent of Bridge Phase farms in the sample had been part of a previous mapping and certification process. Among Bridge Phase villages, this percentage varied from 17 percent of farms in Nyame Nnae to 32 percent of farms in Suresu Nkwanta.
- The timing of these earlier efforts varied somewhat by village but generally took place in the recent past few years: In Domeabra and Suresu Nkwanta, the earlier mapping and certification activity took place during 2014-2018 for over 75 percent of farms that had been part of an earlier effort. In Yirase, 64 percent of farms that participated in an earlier effort did so during 2014-2018 and 19 percent did so during 2007-2009. In Nyame Nnae, 77 percent took place during 2017-2018, and 9 percent took place in 2016. Among comparison villages, 80 percent of farms that were reported to have participated in an earlier such effort did so during 2016-2019.
- Of the farms that had been part of an earlier mapping and certification process, only 48 percent of them were reported to have received a land certificate through that earlier process. For Bridge Phase villages, this ranged from 33 percent of such farms in Yirase to 75 percent of such farms in Nyame Nnae.

LAND DISPUTES

- Overall, 5.3 percent of households in the sample (N=38 households) reported having had a land dispute on any farm over the past three years. In Bridge Phase villages, land disputes were reported by 7.4 percent of households.
- Across all reported disputes, 56 percent were over boundary issues, 15 percent were over inheritance, and 15 percent were over current land ownership. Disputes over tree cutting comprised 8 percent of all disputes.
- The other party to the disputes was fairly evenly distributed across neighbors (33 percent, N=16), landlords (27 percent, N=13) and extended family members (27 percent, N=13). Chiefs were reported as the main party for three disputes (6 percent).
- Farm tenure status was associated with whether the farm had experienced a land dispute. Of farms that were reported to have had a land dispute, most of them were acquired via *abunu* agreements (42 percent, N=19), while 27 percent (N=12) were inherited through the father's line. 13 percent of farms (N=6) that had experienced a land dispute in the last three years were acquired through the farmer's rights as a landowning family.

FINDINGS 4: COCOA AND OTHER CROP PRODUCTION

COCOA AGE, DISEASE AND PRODUCTION

- Farmers reported that trees on cocoa farms in the sample were 12.9 years of age, on average. Approximately 23 percent of all farms had trees that were 20 years old or older.

- The distribution of tree age varied by farm acquisition type. Cocoa trees on farms acquired as a gift were the oldest, with an average age of 17 years old and a median age of 15 years old.
- The baseline data suggested that cocoa farm productivity varied by tree age, as expected, but also by means of farm acquisition:
    - Cocoa farms acquired through direct purchase were most productive, on average, with a mean yield of 490 kg per hectare.
    - Farms acquired through *abunu*, *abusa*, or *asidee* agreements were the second most productive, yielding 473 kg per hectare on average. This productivity appeared driven by farms under *abusa* agreements, with an average yield of 585 kg per hectare and 50 percent of *abusa* farms yielding 474 kg per hectare or more.
    - Tree age also helps to explain the comparative productivity of *abusa* farms. Cocoa trees on farms under *abusa* agreements were 16 years old on average, near peak productivity, while relatively few such farms were aged 10 years or less (38 percent) and no *abusa* farms were aged 30 years or more. The average age of farms under *abunu* agreements was 13 years old, with a large share of farms aged 10 years or less (57 percent). Very few (2 percent) of farms under *abunu* agreements were aged 30 years or more.
- Farmers were highly concerned about cocoa diseases and pests. The most common disease farmers reported was black pod disease (64 percent, N=1007 farms), followed by blight thread disease (36 percent, N=567), and cocoa swollen shoot virus disease. In terms of pests, *akate* was most commonly reported (77 percent; N=1223), followed by *atee* (59 percent; N=936), and termites (28 percent; N=444).
- Across the qualitative sample, farmers reported they now must cut and replant cocoa trees after10-20 years due to diseases, while in the past, trees remained healthy for much longer.

SHADE TREE CONTEXT

- Approximately 77 percent of all farms were reported to have shade trees. Across all farms, 36 percent had naturally occurring shade trees but no planted shade trees, while 16 percent had planted shade trees but no naturally occurring shade trees. Finally, 25 percent of farms had both planted and naturally occurring shade trees.
- The prevalence of farms with any shade tree was similar, irrespective of farm acquisition type.
- GD participants viewed shade trees positively and wanted to plant trees like mahogany (*Swietenia mahagoni*), cedar, *emery*, and *flambo*. Some participants said that government extension officers had discouraged them from allowing certain species to grow, such as odum (*Milicia excelsa*), wawa (*Triplochiton scleroxylon*), silk cotton (*Ceiba pentandra*), cola (*Cola nitida*) and avocado (*Persea americana*), because of adverse effects on cocoa production.
- The presence of shade trees was positively correlated with cocoa productivity in the baseline sample. Cocoa farms with no shade trees had average productivity of 202 kg per hectare, compared to 310 kg per hectare for farms with only naturally occurring shade trees, 336 kg per hectare for those with only planted shade trees, and 346 kg per hectare for farms with both naturally occurring and planted shade trees. The difference in productivity between farms with no shade trees and those with any shade trees was highly statistically significant.

COCOA FARM REHABILITATION AND COCOA TREE REPLANTING

- Households reported just 2.8 percent of farms (N=44) had been part of a previous cocoa farm rehabilitation program.
- Of the farms that were part of a rehabilitation program, 27 percent (N=12) were acquired through *abunu*, *abusa*, or *asidee* agreements, and 11 percent (N=5) were acquired through other land agreements. The remainder were acquired through direct purchase, gifting, inheritance, or landowning family rights.
- Replanting individual cocoa trees was much more common than wholesale farm rehabilitation, and was reported for 20 percent of farms in the sample.

- Of the 362 farms that had some previous cocoa tree replanting effort, 80 percent were financed via farmer self-financing, 11 percent used family or friends, 3 percent used a licensed buying company or purchasing clerk, and 4 percent were financed by a bank.
- Farmer confidence in their rights to cut and replant cocoa was much higher for farms they acquired through their landowning family rights, direct purchase, inheritance, or by gifting, at 90 percent, than for farms acquired through *abunu*, *abusa*, *asidee* or other agreements, at 40 percent.

OTHER CROP PRODUCTION

- Among all farms in the sample, just eight percent (N=141) were reported to be planted with a main crop other than cocoa. Of these farms, the largest proportion, 38 percent (N=53), were acquired through *abunu* arrangements.

FINDINGS 5: LAND USE PLANNING AND GOVERNANCE, FALLOWING AND SECONDARY FOREST CONTEXT

FOREST AND OTHER LAND USE RULES

- In five of the eleven villages surveyed, at least 50 percent of surveyed households reported the presence of rules regulating or restricting entry into secondary forests in their community.
- Of the four Bridge Phase villages, only Nyame Nnae had a majority of surveyed households reporting the presence of rules restricting entry to secondary forests.
- With respect to rules that regulate or restrict the collection or harvesting of specific forest products, 26 percent of households (N=172) reported such rules were present in their village.
- Among the Bridge Phase villages, Nyame Nnae again had the highest percentage of respondents who said secondary forest harvesting restrictions existed in their village (38 percent; N=28).
- For Bridge Phase and comparison villages, the most common forest product reported to be regulated by harvesting rules was fuelwood, followed by raffia palm, mushrooms, and cola nut.
- Overall, 43 percent of respondents said there were rules regulating the cutting of trees in secondary forests in their village.

MEETINGS, PARTICIPATION AND SOCIAL CAPITAL

- Across all households, 57 percent said their village held general meetings to discuss land use or rules around land use planning.
- Among Bridge Phase villages, Suresu Nkwanta had the highest percentage of respondents saying the village held such meetings. Other Bridge Phase villages each had a similar share of respondents saying the village held land use planning meetings, varying between 46 and 49 percent of respondents.
- Across all villages, 66 percent of households (N=451) said someone in the household participated in land use planning meetings in the village.
- Among Bridge Phase villages, between 63 and 70 percent of respondents in each village reported that at least one household member participated in these meetings. However, frequency of their participation in such meetings over the course of a year was generally rare, reported as once or twice at most.
- Measures of social capital were similar across the villages in the sample, and do not suggest unusually high or low levels of social capital in the communities.

FALLOWING AND SECONDARY FOREST CONTEXT

- Households reported that 4.5 percent of farms (N=78) in the baseline sample had ever been left to lie fallow, and that 1.4 percent of farms had ever been left to revert fully to secondary forest.
- Among the 1.4 percent of farms previously left to revert to secondary forest, the year they were re-cleared for farming ranged from 1989 to 2018.

- At the household level, 17 percent of households reported having some land under fallow during the year prior to survey, ranging from 0.02 to 9.3 hectares in size.
- Households reported fallowing and leaving larger areas of land they control under fallow, compared to secondary forest.
- Among households that reported having land under fallow in the year prior to survey, the average area of fallow was 2.8 hectares (household self-reporting).
- Three percent of households reported having some land as secondary forest during the year prior to survey, ranging from 0.3 to 15 hectares in area.
- Among households that reported having any secondary forest land in the year prior to survey, the average size of forest land they controlled was 4.3 hectares (household self-reporting).

FINDINGS 6: CARBON STOCK MEASUREMENTS ON FARMS

- The estimated mean total tree biomass carbon pool was 45.2 t C/ha (95 percent CI: 40.4 – 50.2 t C/ha). The shade tree component comprised 60.0 percent of the total tree biomass carbon pool, at 27.2 t C/ha (95 percent CI: 22.9 – 31.4 t C/ha). The estimated mean cocoa tree component was 18.1 t C/ha (95 percent CI: 16.3 – 19.9 t C/ha).
- The team recorded 78 species of shade trees across the 123 individual plots measured.
- The most common tree species recorded were: *Musanga cecropioides* (Odwuma), *Newbouldia laevis* (Sesemasa), *Terminalia superba* (Ofram), *Rauvolfia vomitoria* (Kakapenpen), *Milicia excelsa* (Odum), *Cola nitida* (Bese), *Citrus sinensis* (Paya Ankaa), *Persea americana* (Paya), and *Morinda lucida* (Konkroma).
- Several species recorded on farms are valued as medicinal, timber, or non-timber forest products. Species with local medicinal value included: *Newbouldia, Rauvolfia* and *Morinda*. *Terminalia, Milicia*, and *Cola* are valued in the region for timber or non-timber forest products.

INTRODUCTION

This report provides baseline context for the mixed-methods impact evaluation (IE) of the "Supporting Deforestation-Free Cocoa in Ghana" project Bridge Phase activity that has been commissioned by the United States Agency for International Development's (USAID) Office of Land and Urban in the Bureau for Economic Growth, Education, and Environment (USAID/E3/LU). The evaluation aims to provide an evidence base for outcomes of the Bridge Phase activities with respect to strengthening land rights and land governance, reducing deforestation, increasing carbon sequestration and cocoa productivity, and enhancing local livelihoods. NORC at the University of Chicago leads the evaluation under the Communications, Evidence and Learning (CEL) Project.

This document provides findings from the baseline data collection for the evaluation, including background context on key demographics, household characteristics, and baseline measures on outcome variables. The report also examines balance across Bridge Phase (treated) and comparison groups for the IE components of the evaluation, revisits power calculations from the Evaluation Design Report (EDR) using parameters from the baseline data, and provides an update on the viability of evaluating the farm rehabilitation component of Bridge Phase activity, given a reduction in the number of beneficiaries receiving this intervention as learned at baseline.

EVALUATION PURPOSE AND EVALUATION QUESTIONS

LAND TENURE, COCOA AND DEFORESTATION BACKGROUND

The long-term viability of cocoa farming is at risk in many parts of Ghana, with many small-scale farmers facing declining productivity. Farmers and communities lack the funding, labor, technical knowledge, and related resources to replace diseased cocoa trees using best practices, and they struggle to rehabilitate older cocoa farms to obtain increased yields and resiliency. In addition, many farmers have insecure land tenure arrangements that prevent or discourage them from replanting older or more diseased cocoa farms.

Approximately 80% of land in Ghana is governed under customary tenure arrangements, which can take a number of different forms. In cocoa frontier landscapes, family acquisition of land under customary arrangements often follows a typical pattern: occupation of uncultivated land by a settling family and subsequent allocation to relatives, extended families, and/or new migrants to the area.[1] Farmers' perceived tenure security over their farms is strongly linked to how they acquired the land, their demographic characteristics, and village-level factors. Migrant farmers and women in female-headed households express lower perceived tenure security over their farms, while tenure security may be lower in villages with higher economic activity and more active land markets.[2] In many contexts, farmers' perceived tenure security over fallow land has been shown to be lower than that for actively farmed or managed plots, though the risk of outright loss of the land is often mediated by the farmer's social status and the specific dynamics of land pressures and scarcity in the locality.[3]

[1] Lambrecht, I. & Asare, S., 2016. The complexity of local tenure systems: A smallholders' perspective on tenure in Ghana. Land Use Policy, 58, 251 - 263.
[2] Ghebru, H. & Lambrecht, I., 2017. Drivers of perceived land tenure (in)security: Empirical evidence from Ghana. Land Use Policy, 66, 293 - 303.
[3] Goldstein, M. & Udry, C., 2008. The profits of power: land rights and agricultural investment in Ghana. Journal of Political Economy, 116(6), 981 - 1022.; Ghebru, H. & Lambrecht, I., 2017. Drivers of perceived land tenure (in)security: Empirical evidence from Ghana. Land Use Policy, 66, 293 - 303.

Farmer tenure security, mode of farm acquisition and fallowing practices are inter-related in Ghana's cocoa landscapes. Prior studies have found that tenant farmers under customary arrangements were more likely to practice intensive cultivation and have shorter fallow times on their farms, relative to land obtained through inheritance.[4] Forest fallows are a long-standing component of traditional farming systems in Ghana, where they are valued by small-scale farmers for subsistence and economic benefits derived from timber and non-timber forest products (NTFPs), and as a means to restore soil fertility and obtain related ecosystem services.[5] However, several studies have suggested that increased land use pressures are leading to decreased fallow times in cocoa landscapes in Ghana, which in turn is linked to lower soil fertility restoration[6] and changes to the nature of fallow-agricultural mosaics in the landscape. Farmers' perceived tenure security over their landholdings is thus also important for efforts to retain forest fallows and expand secondary forests in such landscapes.

Smallholder cocoa has been the leading agricultural commodity driving deforestation in Ghana for many years. Deforestation occurs not only from outright conversion of primary forests to cocoa farms and loss of secondary forests from the landscape, but also from on-farm cocoa intensification activities that remove remnant tree cover or reduce shade tree density on cocoa farms. Informal rules on farming practices, such as those pertaining to farmers' rights to plant or retain trees under some tenure arrangements, are also linked to more intensive cultivation and shorter fallow periods. In turn, this also contributes to reduced secondary forest cover and discourages tree-planting and the maintenance of remnant forest trees on farms.[7]

BRIDGE PHASE ACTIVITY BACKGROUND AND OVERVIEW

The Integrated Land and Resource Governance (ILRG) task order under the Strengthening Tenure and Resource Rights II (STARR II) Indefinite Delivery/Indefinite Quantity (IDIQ) is supporting work on sustainability of deforestation-free cocoa through the "Supporting Deforestation-Free Cocoa in Ghana" (SDFC) project Bridge Phase. The ILRG program is implemented by an international consortium including the prime contractor, Tetra Tech, and core subcontractors, including Winrock.

The ILRG activity seeks to refine three interventions through a "Bridge Phase" period, and then scale up a financially viable farm rehabilitation and land tenure strengthening model for the Ghanaian cocoa sector that, in combination with land use planning, will result in reduced deforestation and GHG emissions and increased carbon sequestration in the cocoa landscape, increased cocoa farm productivity and resilience, diversified farmer incomes, and improved livelihoods.[8] Implementation of the Bridge Phase is through a partnership across ILRG and three private sector partners: Ecom Agroindustrial Corp. (ECOM), the Hershey Company (Hershey), and Meridia. The Bridge Phase activity has three intervention components: (1) cocoa farm rehabilitation led by ECOM that is provided to a small group of registered farmers; (2) farm mapping and provisioning of tenure documentation to all interested farmers in the four Bridge Phase communities; and (3) landscape governance and land use planning activities implemented at village and district levels.

[4] Damnyang, L., Saastamoinen, O., Appiah, M. & Pappinen, A., 2012. Role of tenure insecurity in deforestation in Ghana's high forest zone. Forest Policy and Economics, 14, 90 - 98.
[5] Anglaaere, L. C., Cobbina, J., Fergus, S. L. & McDonald, M. A., 2011. The effect of land use systems on tree diversity: farmer preference and species composition of cocoa-based agroecosystems in Ghana. Agroforest Syst, 81, 249 - 265.
[6] Otsuka, K., Quisumbing, A.R., Payongayong, E., Aidoo, J.B., 2003. Land tenure and the management of land and trees: the case of customary land tenure areas of Ghana. Environ. Dev. Econ. 8 (1), 77–104.; Goldstein, M. & Udry, C., 2008. The profits of power: land rights and agricultural investment in Ghana. Journal of Political Economy, 116(6), 981 - 1022.
[7] *Ibid.*
[8] O'Sullivan, R. et al. 2019. *Supporting Deforestation Free Cocoa in Ghana: Implementation Plan.* Washington, DC: USAID Integrated Land and Resource Governance Task Order under the Strengthening Tenure and Resource Rights II (STARR II) IDIQ.

COCOA FARM REHABILITATION SERVICE

At the time of evaluation design, ECOM anticipated funding farm rehabilitation for 51 farmers on approximately 187 acres of cocoa farms in Asankrangwa during 2019. By the time of baseline data collection for the evaluation, this service had been reduced to a sample of 32 farmers on approximately 115 acres, of which 96 acres were registered into the program (three acres per farm). ECOM offered the service in the four communities targeted by the Bridge Phase and an additional eight communities in the district. Registered farmers were selected on the basis of ten eligibility criteria. Of the cohort of farmers registered into the service at baseline, seven farmers were located in Bridge Phase communities. ECOM registration records indicated than an additional 18 farmers indicated interest in the service but did not meet the selection criteria, while six farmers indicated interest but opted out of the program before signing an MoU with ECOM. During the Bridge Phase, ECOM will determine whether a second round of the farm rehabilitation service package may be offered in 2020.

FARM TENURE DOCUMENTATION

Hershey and Meridia, with oversight from ILRG, will lead this fee-for-service component that includes farm mapping and provisioning of Meridia's FarmSeal tenure documentation to interested farmers. The farm tenure documentation intervention will be rolled out in the four Bridge Phase communities and available to any interested farmer. At the time of evaluation design, IPs estimated 1360 farmers would select into this service, or approximately 340 farmers per community. Hershey and Meridia, working as a service provider through ILRG, will work together to further develop and test the business case for farm tenure documentation. This effort will include examining issues of affordability, access, and sustainability, and exploring options to reduce total costs to farmers, along with financing packages and payment recovery by ECOM.

LANDSCAPE GOVERNANCE AND LAND USE PLANNING

ILRG will lead the development of an approach for landscape-scale governance and land use planning at village and district levels that will be implemented in each of the four Bridge Phase communities. This component aims to ensure that GHG emissions from cocoa farms, secondary forests and primary forests are reduced, halted, or reversed (where feasible).[9] The central objective of this activity is to define approaches and strategies for reducing deforestation in primary forests bordering the district and secondary tree stands held primarily on individual family lands. Participatory and inclusive land use planning will likely focus on adapting existing Government of Ghana approaches to spatial land use planning and decentralized governance in cocoa growing regions in Ghana. ILRG anticipates further adaptation of this component based on a Land Use Planning Diagnostic conducted by IPs in May-June 2019 and the results of this evaluation baseline study.

DEVELOPMENT HYPOTHESIS

Figure 1 presents the IP's theory of change (TOC) for the SDFC activity.[10] USAID expects that providing farm-level tenure documentation to cocoa farmers will improve farmers' tenure security, spur greater agricultural investment in their farms, and ease barriers for farmers to access pre-financed cocoa farm

[9] Per O'Sullivan et al (2019), GHG emissions from tree felling in cocoa farms can be halted or reduced when existing shade trees are protected, and reversed when new shade trees are planted. GHG emissions from deforestation and forest degradation in secondary forests can be halted or reduced and reversed if they are not converted to cocoa farms and if carbon stocks are increasing via forest regeneration towards the equilibrium state. GHG emissions from deforestation and forest degradation in primary forest and forest reserves are likely to be reduced or halted only, unless there is scope for reversal via the reduction of degradation pressures such as reduction in timber harvesting.

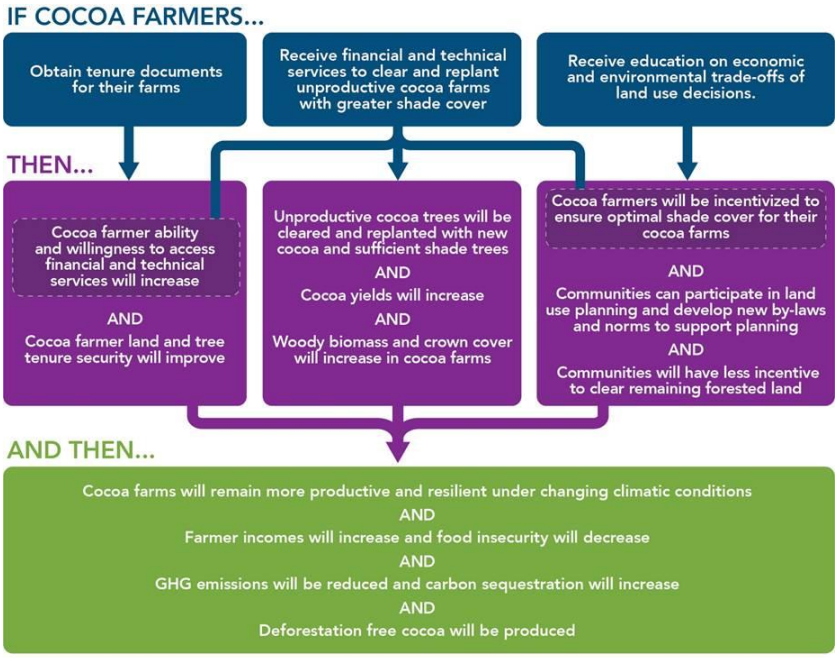
[10] O'Sullivan, R. et al. 2019. *Supporting Deforestation Free Cocoa in Ghana: Implementation Plan.* Washington, DC: USAID Integrated Land and Resource Governance Task Order under the Strengthening Tenure and Resource Rights II (STARR II) IDIQ.

rehabilitation services. In turn, greater farm investments are hypothesized to lead to higher productivity and farm income (via cocoa or food crops), while higher yields on existing farms may reduce pressure to clear additional land for food crops and/or cocoa and potentially alter farmer land-use decisions such that they undertake longer fallowing periods and secondary forest maintenance.

USAID believes that providing a pre-financed model for farm rehabilitation services by private-sector partners will improve cocoa farmers' access and uptake of cocoa farm replanting, which will eventually lead to improved cocoa productivity, farmer income, and carbon storage in cocoa farming systems, while reducing pressure for farmers to clear additional land for conversion to cocoa. In addition, USAID believes that community-wide land use planning will result in identification and consensus on future land-use arrangements in the community, including planning and development of community by-laws for agriculture and forest land uses. In turn, this is expected to lead to reduced clearing of secondary forest in communities and increased carbon sequestration in the landscape.

Lastly, USAID expects that the integration of these three activity components (farm-level tenure documentation, provisioning of pre-financed cocoa farm rehabilitation services, and community-wide land use planning) at scale will result in landscape-scale improvements in secondary forest area, carbon sequestration, farmer livelihoods, and food security.

FIGURE 1: BRIDGE PHASE ACTIVITY THEORY OF CHANGE



ASSUMPTIONS:
Demand for land and land values do not significantly increase; cocoa prices do not decrease to the point of cocoa farming being unviable; extreme weather events, disease or pests do not prevent cocoa farm rehabilitation; and there is political will to put land use plans into effect

ACTIVITY IMPLEMENTATION STATUS

The ILRG partnership began implementing the SDFC Bridge Phase on the ground in May 2019, beginning with a comprehensive Participatory Rural Appraisal (PRA) activity conducted in each of the Bridge Phase communities immediately following baseline data collection for the evaluation.

EVALUATION PURPOSE, AUDIENCE, AND INTENDED USES

To generate evidence on how the SDFC activity affects participating households and to provide learning for future projects, USAID engaged NORC at the University of Chicago to conduct an evaluation of the SDFC project, under the CEL project. The purpose of the Bridge Phase evaluation is (1) to provide an evidence base for outcomes of the Bridge Phase activities with respect to strengthening land rights and land governance, reducing deforestation, increasing carbon sequestration and cocoa productivity, and enhancing local livelihoods; and (2) provide targeted learning on key knowledge and theory of change logic gaps to inform the design of a landscape-scale project that will follow the Bridge Phase.

The primary audiences for the evaluation results are USAID/E3/LU, USAID/E3/GCC, USAID/Ghana, USAID/West Africa, the Bridge Phase implementing partners, the private-sector firms involved in the Bridge Phase, and investors potentially interested in investing in a tested and reliable financed farm rehabilitation model. Key secondary audiences include the broader donor community and interested private sector firms – particularly those working on land policy, land use planning linked to sustainable landscape objectives, and integrating land tenure strengthening activities into cocoa farm rehabilitation services. The evaluation findings are expected to have accountability and learning value to USAID, including the Office of Land and Urban and the Office of Global Climate Change.

EVALUATION QUESTIONS

Table 2 lists the six questions addressed by the SDFC Bridge Phase evaluation. The evaluation questions, which the team developed in collaboration with USAID, focus on meeting USAID's priority learning interests for this activity and were derived from the SDFC Bridge Phase theory of change.

TABLE 2: EVALUATION QUESTIONS AND THEMATIC AREAS OF INVESTIGATION

THEME	EVALUATION QUESTION
Tenure Documentation Effects on Tenure Security	1. What are the effects of land tenure documentation on tenure security for cocoa farmers in Bridge Phase villages, and key reasons why? a. What was the extent of mapping and provisioning of land tenure documentation? b. Were there any challenges encountered with respect to participation in tenure documentation activities, and how were these resolved? c. How did Bridge Phase tenure documentation activities affect household perceptions of tenure security, and anticipated investment and livelihood follow-on outcomes? d. What types of households and farmers were more likely to pay for and obtain farm-level documentation? For what types of farm holdings?
Tenure Security and Farm Rehabilitation Linkages	2. How does farmer tenure security relate to interest, uptake and outcomes of cocoa farm rehabilitation services? a. Controlling for other household and farm-level factors, were farmers who received farm tenure documentation during the Bridge Phase more likely to participate in a second round of farm rehabilitation services offered at the end of the Bridge Phase? b. How does tenure documentation increase interest in and ease the ability for farmers to participate in farm rehabilitation services? c. What are the effects of higher tenure security on farm rehabilitation intermediate outcomes (farm investments, productivity, revenues, amount of new land clearing)?
Farm Rehabilitation and Secondary Forest Clearing Linkages; impacts on GHG emissions	3. To what extent and in what ways does cocoa farm rehabilitation lead to reduced deforestation and greenhouse gas (GHG) emissions in secondary forests and increased carbon sequestration in rehabilitated cocoa farms? a. What is the effect of farm rehabilitation on cocoa farm carbon stocks and sequestration projections, fallowing decisions, amount of secondary forest clearing and broader household land use decisions, for farmers engaged in farm rehabilitation during the Bridge Phase timeframe? b. What are reasons for observed changes in land use decisions?

Land Use Planning and Secondary Forest Clearing Linkages	4.	To what extent and in what ways does spatially-based territorial land use planning (LUP) at multiple scales lead to reduced deforestation and greenhouse gas (GHG) emissions in secondary forests? This includes a focus on the following sub-question: a. What is the effectiveness of the Eco Game as a tool to elicit land use planning behavior change and actions? b. If not as effective as anticipated, what alternative tools and approaches might future programs consider piloting?
Influence of Context Characteristics on Outcomes	5.	How are key individual farmer, farm-level, household and village context characteristics associated with Bridge Phase tenure security, farm rehabilitation, and land use outcomes? Characteristics to be examined include: a. Farmer: Age, gender, tenancy status (indigene or *asidee* vs. *abunu*), education. b. Farm-level: Cocoa farm age, farm size. c. Household: Total farm holdings; wealth status. d. Village: Secondary forest scarcity, social and governance dynamics, market context.
Key Lessons to Inform Potential Scale-Up	6.	What are the key learning lessons on financial, technical and governance barriers (or enabling conditions) that must be overcome to enable effective scale-up of the integrated Bridge Phase activities, and likelihood of achieving landscape-scale improvements on: strengthening land rights, increasing cocoa productivity, reducing deforestation, increasing carbon stocks, and enhancing local livelihoods? This includes a focus on: a. What are reasons that households or farmers chose not to participate in any of the Bridge Phase activities? To what extent can future activities address these barriers? b. Did Bridge Phase activities reach intended targeted populations, and key sub-groups of interest? (less tenure secure, farmers with declining cocoa productivity) c. What do the Bridge Phase evaluation findings on intermediate results for each of the three program sub-components suggest with respect to longer term opportunities for improved tenure security, effects on cocoa productivity and livelihoods, and forest land use decisions? d. What external factors, if any, positively or negatively influenced the ability for Bridge Phase activities to achieve intended results?

EVALUATION DESIGN AND METHODS

DESIGN OVERVIEW

The Bridge Phase activities vary in scope, geography, selection criteria for beneficiaries, and anticipated timeframe for maturation of key outcomes. Therefore, this mixed-methods evaluation is designed to use different analytic approaches to assess the effects of each of the three Bridge Phase interventions (Table 3)[11]. The evaluation is designed to collect qualitative and quantitative data at baseline and endline from farmers in the four Bridge Phase villages and in eight comparison group villages. The comparison group consists of households in eight villages in Asankrangwa where ECOM also offered the cocoa farm rehabilitation service to farmers, but the tenure documentation and village-level land use planning interventions will not be implemented. The sample size for the quantitative component was targeted at 960 households, consisting of 80 households surveyed in each of 12 villages. Annexes A and B present an overview of the anticipated timeline of Bridge Phase activities, evaluation timeline for the Bridge Phase, and expected outputs and impact-level outcomes that are measurable by endline.

[11] Evaluation design details are provided in Persha, L. and A. Protik. (2019) *Evaluation of the "Supporting Deforestation-Free Cocoa in Ghana" Project Bridge Phase: Evaluation Design Report. USAID* Communications, Evidence and Learning Project.

TABLE 3: EVALUATION DESIGN OVERVIEW

BRIDGE PHASE INTERVENTION	EVALUATION DESIGN AND ANALYTIC APPROACH	KEY ISSUES
Farmer-level cocoa farm rehabilitation intervention	Quasi-experimental analyses using a regression discontinuity approach	• Feasible if at least 51 farmers are registered into this service and a sufficient number of non-rehabilitation farmers in the baseline sample score similarly to the rehab cohort on ECOM's eligibility criteria; • IPs were not able to enroll their anticipated target number of farmers into this intervention, resulting in a reduction in the planned Bridge Phase sample size from 51 farmers to 32 farmers. As a result, the evaluation analyses are no longer powered to detect policy-relevant effect sizes through a rigorous IE design.
Farmer-level farm tenure documentation intervention	Quasi-experimental analyses using a Difference-in-Difference approach with statistical matching	• To generate a viable pool of comparable but non-treated households for statistical matching and quasi-experimental analyses of the farm tenure documentation activity, the evaluation design extends data collection to the additional eight communities in Asankrangwa where ECOM offered the rehabilitation service, but will not receive tenure documentation services during the Bridge Phase; • Analysis of tenure documentation effects is powered to detect relatively small-scale effect sizes; • Matching at baseline confirms the sample is viable for the intended impact analysis.
Village-level land use planning component	Pre-post qualitative analyses informed by complementary household survey data	• Land use planning component is not amenable to quasi-experimental analysis due to the small number of implementation villages; • Evaluation cannot definitively attribute land use planning outcomes to the Bridge Phase activities; • Pre-post analyses of the household survey sample across the four Bridge Phase villages and the comparison group villages will inform on general relationships between land use planning activities, outcomes, and beneficiary perceptions; • Qualitative data collection at baseline and endline enables triangulation of results.

To test the effect of tenure documentation, the household sample for this evaluation renders it possible to construct a viable comparison group from farmers in the non-Bridge Phase villages in the household sample. These are farmers who were not offered and did not receive the tenure documentation service, but have similar farm, farmer and household characteristics to those who did.

To test the effect of cocoa farm rehabilitation on outcomes, ECOM's use of specific selection criteria to identify farmers who are eligible for the service (Table 4) presented an opportunity to use a regression discontinuity approach. Non-selected farmers can be scored on these same eligibility criteria using the household baseline survey data. Under this approach, selected and non-selected farmers alike in the household sample would be scored on the eligibility criteria, resulting in a quantifiable score distribution that relates to treatment. Scores for the selected farmers should be clustered at the higher end of the scale. Non-selected farmers are expected to have scores across the distribution of potential values, with an available pool of farmers who score close to but do not fully meet all of the selection criteria (and were not selected for the rehabilitation service). Such farmers, if sufficient in number, present a viable comparison group to examine rehabilitation service outcomes. However, this approach became inviable due to a reduction in the anticipated number of farmers participating in the farm rehabilitation service by the time of baseline data collection, apparently due to ECOM's stringent selection standards and farmers' lower interest to participate.

TABLE 4: ECOM SELECTION CRITERIA FOR FARM REHABILITATION SERVICES

FARM LEVEL CHARACTERISTICS	FARMER LEVEL CHARACTERISTICS
• Farm site slope < 3 percent; • Farm soil type is sandy loam; • Farm site cannot be mangrove, swampy, or water-logged; • Farm site should not be in the middle of a forest, and at least 30m from any reserves; • Farms should be over 25 years old with a focus on highly unproductive farms (i.e. farms producing below 200 kg/ha).	• Farmers should be prepared to cut cocoa for complete rehabilitation and be willing to pay off investment with proceeds from the farm; • Farmer has the right to cut and replant cocoa farm; • Farmers have land documentation or signed up for Meridia's service;[12] • Farmers should have at least one year of ECOM training; • Farmers endorsed by purchasing clerks, franchise holders and field officers; • Farmers with multiple farms considered as an added advantage.

INDICATORS AND OUTCOME MEASURES

The Bridge Phase evaluation focuses on measuring anticipated farm-, farmer-, household-, and community-level outcomes across each of the three Bridge Phase sub-components: farm-level tenure documentation, cocoa-farm rehabilitation, and community land use planning. Key outcomes are shown in Table 5, with the hypothesized direction of change at endline.

TABLE 5: EVALUATION INDICATORS AND OUTCOMES MEASURES

COCOA FARM REHABILITATION OUTCOMES INDICATED BY*	TENURE DOCUMENTATION OUTCOMES INDICATED BY	LUP OUTCOMES INDICATED BY (HH OR COMMUNITY-LEVEL)
• Cocoa productivity & revenue (-) • Cocoa farm carbon stock, measured as aboveground cocoa and shade tree components (Mg/ha)* (-) • Other crop productivity & revenue (+) • Area of new land cleared for farming (self-reported) (-) • Area of fallow land (acres, self-reported) (+)	• Perceived tenure security (scale) (+) • Ongoing or recent land dispute (Y/N) (-) • Possession of land documentation recognizing use rights (Y/N) (+) • Farm investments (inputs, tree-planting) (+) • Credit Access (Y/N) and Amount (cedis) (+) • Crop productivity & revenue (+) • Area of new land cleared for farming (acres, self-reported) (-) • Area of fallow land (acres, self-reported) (+) • Cocoa farm rehabilitation round 2 uptake (Y/N) (+)	• Perceived legitimacy & participation village-wide planning (+) • Perceived inclusive decision-making (+) • Perceived motivations for household land use decisions (+) • Mean fallow time (+) (self-reported; community-wide) • Mean area of secondary forest clearing (-) (self-reported; community-wide) • (at EL): Total area of secondary forest loss 2018-2020 (RS-derived LCLUC)

* Note that because the first cocoa harvest on rehabilitated cocoa farms is not expected to occur until late 2023, several years after the Bridge Phase evaluation endline data collection, outcomes for rehabilitated cocoa farms and farmers at the evaluation endline will be interim measures of intervention effects. Change during the Bridge Phase evaluation time frame is expected to be negative, due to the loss of cocoa trees and associated revenue during the Bridge Phase timeframe.

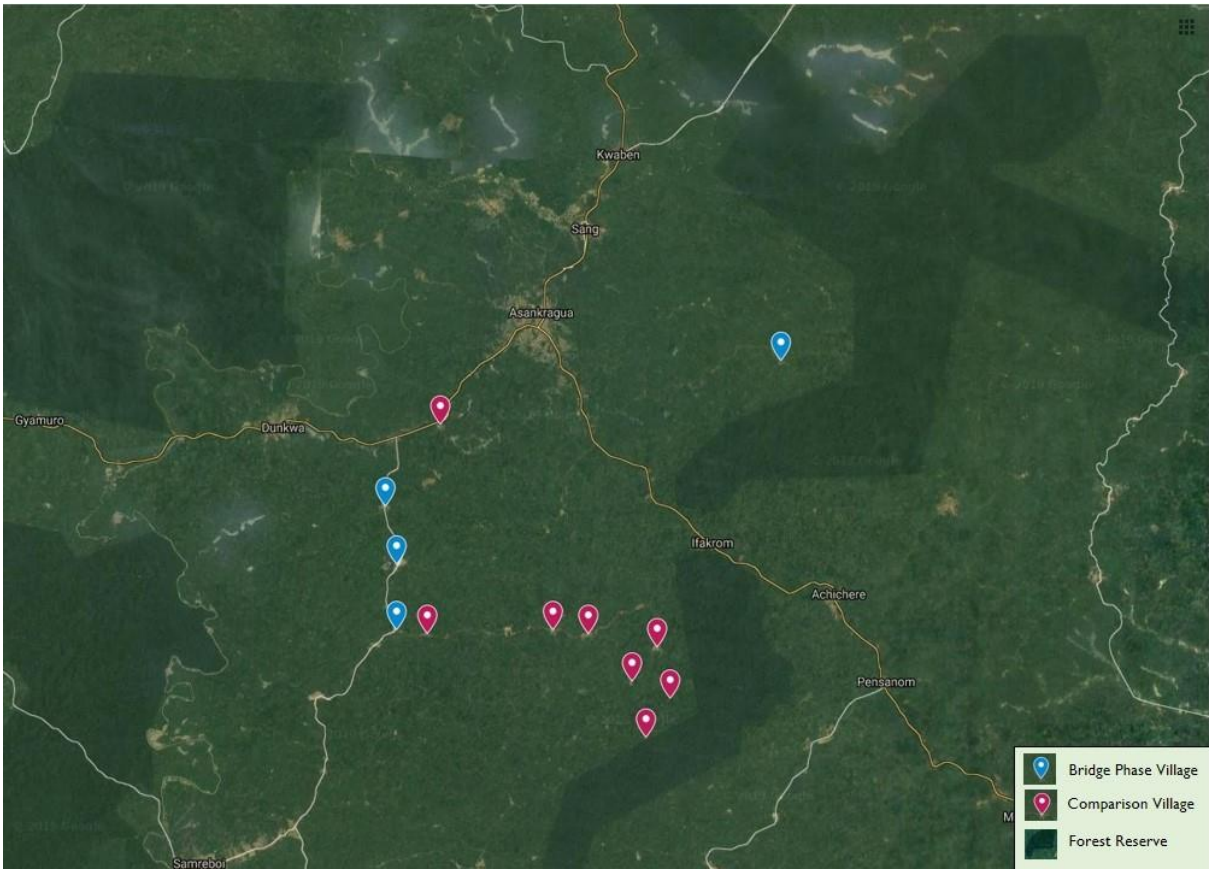
[12] Later downgraded to "farmer interest in obtaining land document", as ECOM found that many eligible farmers did not have land documentation, and the Meridia service was not explicitly included in the service package description provided to farmers.

BASELINE DATA COLLECTION

HOUSEHOLD QUANTITATIVE SAMPLE

Household survey data collection at baseline took place during May 22 – June 9, 2019, shortly before the start of Bridge Phase implementation. The household survey sample for the evaluation was designed to consist of 80 households per village across 12 villages, for a total of 960 households. Households were selected for survey through a household listing process conducted in each village. The village sample included the four Bridge Phase communities (Domeabra, Suresu Nkwanta, Yirase, and Nyame Nnae), and eight additional communities in Asankrangwa where ECOM offered the farm rehabilitation service. Figure 2 shows a map of the data collection area in Wassa Amenfi West District. The locations of the four Bridge Phase villages are shown by the blue markers, while the comparison villages are shown by the red markers. Forest reserves are shaded with dark green.

FIGURE 2: MAP OF BRIDGE PHASE AND COMPARISON VILLAGES

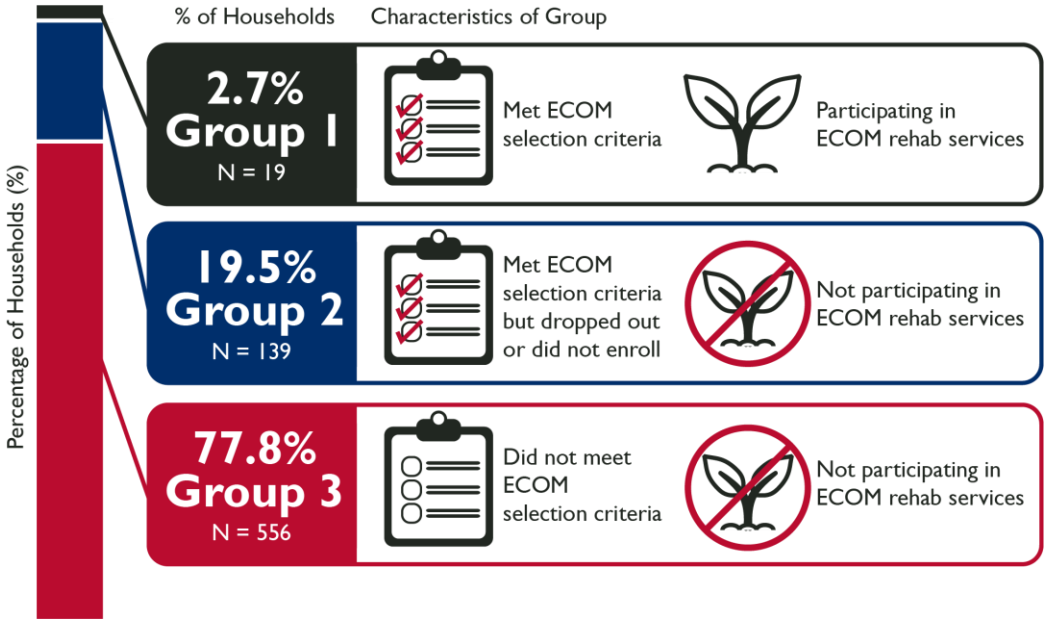


The baseline sample aimed to maximize the number of households surveyed per implementation village, within evaluation budget constraints. The household sample per village was designed to include all farmers who were registered into ECOM's farm rehabilitation service, farmers who dropped out of the registration process after expressing initial interest to ECOM, and a remaining set of households selected via stratified random sampling, to reach 80 households (or the total number of households listed for the village, if smaller than 80).[13]

[13] Households selected via stratified random sampling consisted of up to 15 households who met ECOM selection criteria for eligibility into the farm rehabilitation service but did not enroll, and the remainder as needed to reach 80 households.

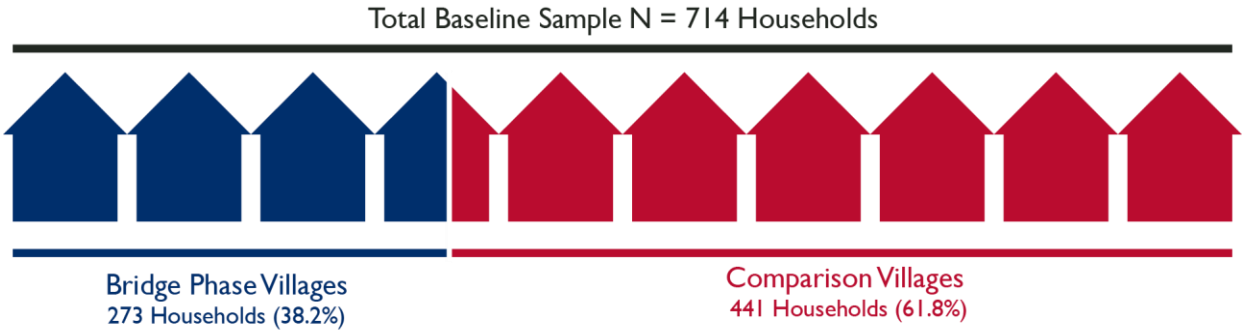
The household sample thus consisted of three groups, as shown in Figure 3, to ensure coverage across cocoa farming households participating in the ECOM farm rehabilitation program (Group 1), households who met the selection criteria but either dropped out of the process before completing registration or did not enroll (Group 2), and other cocoa-farming households[14] (Group 3).

FIGURE 3: ECOM FARM REHABILITATION ELIGIBILITY AND PARTICIPATION ACROSS THE BASELINE SAMPLE



The final baseline sample consisted of 714 households surveyed across 11 villages. In line with the evaluation design, households in Bridge Phase villages comprised 38 percent of the sample (Figure 4). The number of villages at baseline was reduced by one, because one comparison group village where ECOM offered the farm rehabilitation service was found to be a satellite community of another village in the sample, so the two were combined. The final household sample was smaller than 960 because four communities had household populations that were smaller than estimates provided by the District Planning Office prior to listing, and had fewer than 80 households. Due to smaller village size, the number of households surveyed reaches nearly a full census for six of the 11 communities in the sample.

FIGURE 4: BASELINE SAMPLE



[14] Three percent (N=17) of Group 3 households also met the ECOM eligibility criteria according to their baseline survey data.

QUALITATIVE SAMPLE

Group Discussion in a Bridge Phase Village

PHOTO BY LAUREN PERSHA

Qualitative data collection took place concurrently with household survey data collection and consisted of one mixed-gender GD conducted in each of four selected comparison group communities. Communities were selected from comparison group villages that had at least three farmers enrolled in ECOM's farm rehabilitation program, to ensure coverage on this topic. The selection of villages was based on IP data on number of farmers enrolled in the farm rehabilitation service by village. The selected villages for qualitative data collection contained the majority of farmers enrolled in the rehab service (21 out of the final tally of 32 rehab farmer enrollees, according to IP-provided information at the time of survey). GDs for two of the selected villages were combined, because one of the villages (Sefahkrom) was found to be a satellite community of the other (Meteameba) and had a very small household population.

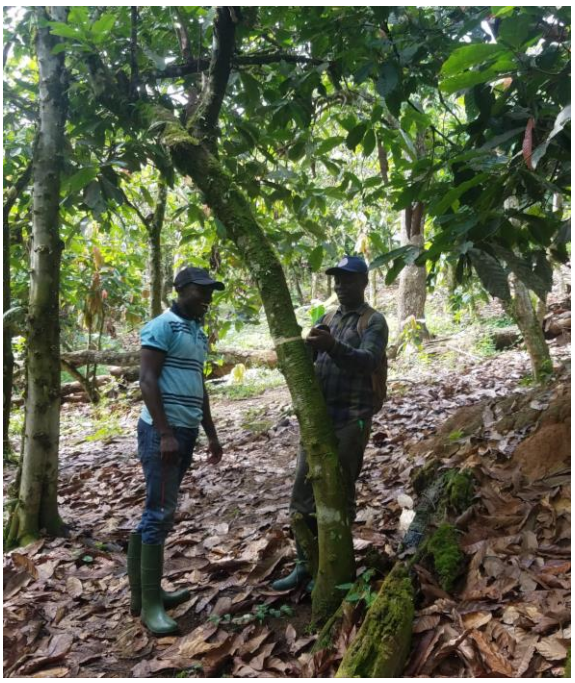
GDs were conducted with a total of 56 participants, of which 19 were female and 37 were male. Participants in each GD comprised a mix of *abunu*[15] farmers and customary landowners, and sought to include cocoa farmers with a range of farm ages, including those with older cocoa trees. Short discussions were also held with the village chief of each community prior to holding the GD. The GDs utilized semi-structured instruments and were conducted by a moderator from the evaluation team (see Annex C for instrument). The GDs were conducted in Twi and transcribed and translated to English for analysis.

Bridge Phase villages were not included in the baseline qualitative sample to avoid duplication of effort with an IP-conducted Participatory Rural Appraisal (PRA) activity in the four Bridge Phase villages during the evaluation baseline data collection. This was done to avoid respondent fatigue, and also because the evaluation team had conducted similar GDs in each of the Bridge Phase villages during a November 2018 scoping trip, which had also provided substantive baseline context for those villages.

[15] This report discusses three forms of customary land arrangements that are common to Ghana's cocoa sector. *Abunu* farm tenancy is a form of customary tenancy in which a usufruct holder or allodial titleholder enters into an agreement with a tenant migrant (also referred to as non-local, non-indigenous, or stranger) farmer to clear the land (typically of forest), establish a farm and bring the farm to maturity. Once the farm matures, it is divided in half between the tenant farmer and the landlord. Through this arrangement, the tenant farmer gains exclusive and nearly perpetual rights over his/her portion of the cocoa farm, subject to the condition that the land must remain in cocoa. However, once land is cleared, the landlord retains the right to reclaim the land, although landlords and tenants can and do widely disagree on the validity of this claim. *Abusa* is another form of customary tenancy that is akin to a sharecropping arrangement. The landlord contributes the land and resources such as labor or other inputs to create a cocoa farm. Upon maturity, the harvest is shared annually in halves between the tenant farmer and the landlord, but the farm is not divided. The tenant farmer is expected to vacate the land once the cocoa farming operations cease. *Asideɛ* arrangements are a third form of customary tenancy in Ghana, in which a migrant farmer gains perpetual customary rights to land from indigenous landholders (Roth, M., Antwi, Y., & O'Sullivan, R. (2017). *Land and Natural Resource Governance and Tenure for Enabling Sustainable Cocoa Cultivation in Ghana*. Washington, DC: USAID Tenure and Global Climate Change Program; Antwi, A., Roth, M., O'Sullivan, R. Dogbe, R. & Feglo, E. (2017). *Training of trainers manual on land and tree tenure*. Washington, DC: USAID Tenure and Global Climate Change Program).

CARBON STOCK MEASUREMENTS ON FARMS

At baseline, on-farm carbon stocks were estimated from a total of 123 individual plots measured across 61 farms held by households that were part of the baseline survey. The 61 farms were distributed across six villages, of which three were comparison group villages and three were Bridge Phase villages (Domeabra, Sureso Nkwanta, and Yirase). Selection of farms for carbon stocks measurements aimed for approximately ten farms per community. One farm was measured per household, with the exception of three households from Kramokrom, where two farms were measured for each. In accordance with the Winrock sampling protocol[16], the team aimed to measure two non-overlapping 40 x 40 meter plots per selected farm to estimate shade tree carbon stocks, with each plot containing a nested 10 x 10 meter plot for measurement and estimation of cocoa tree carbon stocks.



The CEL Evaluation Team measures the diameter of a cocoa tree (*Theobroma cacao)* for farm carbon stocks calculations

PHOTO BY TARA MITTELBERG

On-farm carbon stock measurements were conducted concurrently with household survey data collection, with a five-day lag to enable the farm measurement field team to contact and schedule follow-up visits with each of the selected households in a given community. Households and farms were randomly selected by the CEL evaluation team, using ECOM's farm-level selection criteria to participate in the farm rehabilitation program to identify eligible farms for measurement. These farm and farmer characteristics were obtained from the household survey data, and consisted of: farm slope, soil type, site type, distance from nearest forest reserve, cocoa tree age, farm area (self-reported by farmer), and number of farms held by farmer. All farms selected for carbon stocks measurements were at least 15 years old, and were acquired by farmers under a range of ownership or tenancy arrangements.

Plot data were recorded on paper sheets in the field and entered into an Excel database provided by Winrock, which calculates per-plot carbon stocks in tonnes of carbon per hectare. In addition to the standard outputs provided through Winrock's tool – such as disaggregated tree biomass carbon stocks by cocoa, shade tree and standing dead wood components[17] (where applicable) – the CEL evaluation team examined differences in carbon stocks by farm age and other farm attributes.

Carbon stock measurements and per-plot summaries followed protocols established by Winrock and used Winrock's calculation tools, to enable consistency with companion data collection conducted by IPs in March-April 2019 on farms enrolled in the farm rehabilitation service. The Winrock tool calculates total tree biomass in kilograms, including aboveground and belowground tree biomass for non-cocoa trees. A scaling factor is then used for the nested plot size to obtain total biomass and biomass carbon

[16] Walker, S. M., et al. 2019. *Standard Operating Procedures for Terrestrial Carbon Measurement: Cocoa Agroforestry Systems.* Washington, DC: USAID Integrated Land and Resource Governance Task Order under the Strengthening Tenure and Resource Rights II (STARR II) IDIQ.

[17] The carbon pools calculated by Winrock's tool are: Non-cocoa shade trees $\geq$ 5cm DBH (t C/ha); Cocoa trees $\geq$ 3 cm DBH (t C/ha); and Dead wood (standing dead wood) (t C/ha).

in Kg/ha. The tree biomass equation follows that of Chave et al (2005)[18] for non-cocoa species. A cocoa-specific allometric equation provided by Mohammed et al. (2016)[19] is used for the cocoa trees in each plot. Per Winrock's SOP, the CEL team obtained shade tree biomass estimates via the Chave et al. (2005) equation using an average wood density value rather than species-specific wood densities for each of the observed non-cocoa tree species. The total estimate for each plot (in t C/ha) is obtained by summing the estimate for each of the three carbon pools. The cocoa, shade tree, and total carbon pools were obtained by taking the mean of the plot-level estimates (in t C/ha) across all of the plots. The sampling protocol only measures the biomass carbon pool; the soil carbon and litter pools are not estimated.

HOUSEHOLD SURVEY

The household survey used at baseline consisted of eight modules, as listed in Table 6. The survey was administered to the household head or to the main cocoa farmer in the household if that person was not the household head (see Annex D for a link to the full household survey instrument).

TABLE 6: HOUSEHOLD SURVEY MODULES

SECTION	COVERAGE	KEY NOTES
A	Household Identification and Consent	n/a
B	Household Roster	n/a
C	Assets and Well-being	n/a
D	Food Security	n/a
E	General Agricultural Production	n/a
F	Farm Roster and Sub-rosters : Farm Overview Tenure Security Land Disputes Cocoa Farm Roster Other Crop Farm Roster	This module is administered for each farm that the household controls. At the end of the module, either the Cocoa Farm Roster or Other Crop Farm Roster is applied, depending on how the farm is used by the household.
G	Non-farm Activity and General Land Governance	n/a
H	Conclusion	n/a

CHALLENGES ENCOUNTERED DURING DATA COLLECTION

Two main challenges were encountered with the household survey data collection at baseline. First, the data firm was unable to survey all Group 1 households because several of these households were found to have relocated out of their various communities after turning their cocoa farm over to ECOM for management. In these cases, farms had been left with caretakers. The inability to locate these farmers resulted in a total baseline sample of 19 farmers enrolled in the ECOM farm rehabilitation program, rather than the anticipated 32 farmers. Second, the lack of reliable village population data in the area impacted planning for the evaluation sample size. The survey firm conducted reconnaissance in each of the survey villages prior to listing, and worked with the district planning office to obtain estimates of village populations. This work indicated that all villages except for one (Suresu Nkwanta) had

[18] J. Chave, C. Andalo, S. Brown, et al. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145(1):87-99.

[19] Mohammed, A. M., Robinson, J. S., Midmore, D. & Verhoef, A., 2016. Carbon storage in Ghanaian cocoa ecosystems. Carbon Balance and Management, 11(6).

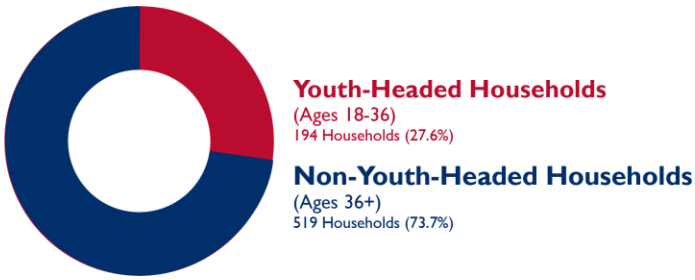
populations well above the 80 households planned for the evaluation, but six of the villages in the sample were found to have populations of fewer than 80 households during the household listing, resulting in a reduction in the evaluation sample size. In some cases this divergence was because villages contained satellite communities for which allegiance to the core community was unclear or disputed, which made them ineligible for the baseline sample. These sample size reductions did not substantially affect the evaluation power. Updated power calculations based on the baseline sample are provided in this report.

The fieldwork to measure carbon stocks did not encounter major challenges. However, the time to complete this work was longer than anticipated due to the onset of rains and because many farms were located far from households. No major challenges were encountered with the qualitative data collection.

BASELINE SAMPLE CHARACTERISTICS

Bridge Phase households comprised 38 percent of the overall baseline survey sample.[20] Overall, 16 percent of households in the sample were headed by a female (13 percent of Bridge Phase households had a female head), and 28 percent were headed by an adult aged 18-35 years old (Figure 5; 32 percent of Bridge Phase households were youth-headed). Approximately 15 percent of households in the sample were customary landowners referred to locally as indigenes, as identified by having acquired land through their rights as a landowning family.

FIGURE 5: BASELINE SAMPLE DEMOGRAPHICS



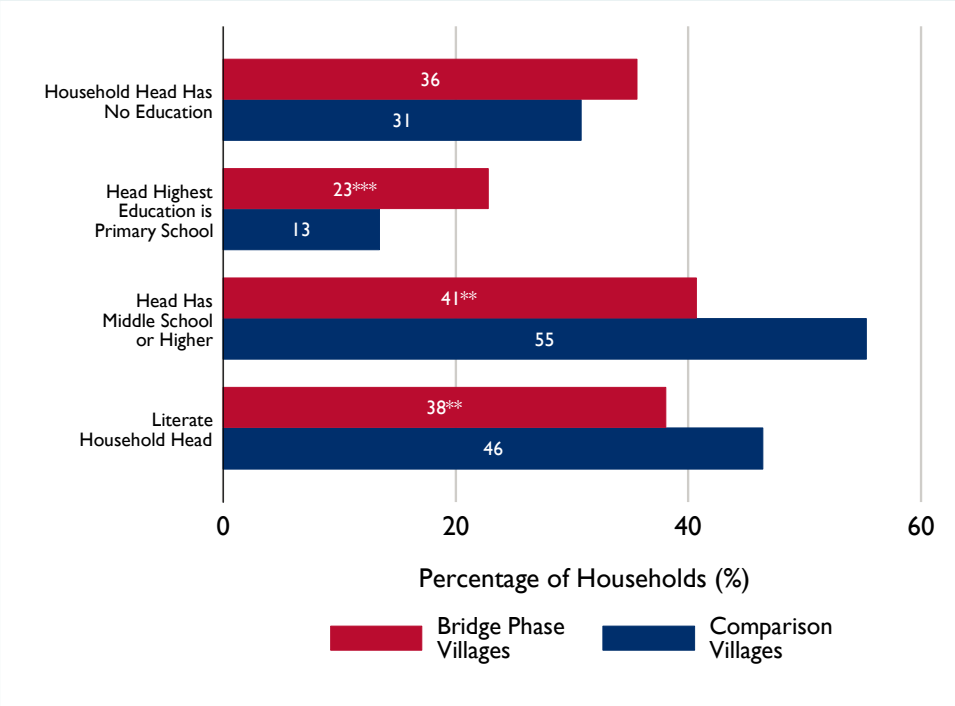
The average household in the baseline sample had 5.4 members, while households in Bridge Phase villages were slightly larger, with 5.8 members per household. Heads of household in the sample were 45.6 years old, on average. Household head age in Bridge Phase villages averaged 2.9 years younger than in comparison villages, a difference that is statistically significant (Table 7).[21]

[20] Descriptive statistics for the baseline data are summarized in Annex E.
[21] Throughout the document, "statistically significant" refers to p-values below 0.05.

TABLE 7: AVERAGE AGE OF HOUSEHOLD HEAD AND HOUSEHOLD SIZE

	Overall		Bridge Phase Villages		Comparison Villages		
Outcome	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff.**
Household Head Age (in years)	45.56	704	43.75	269	46.67	435	-2.93***
Household Size (members)	5.44	713	5.79	273	5.23	440	0.56**

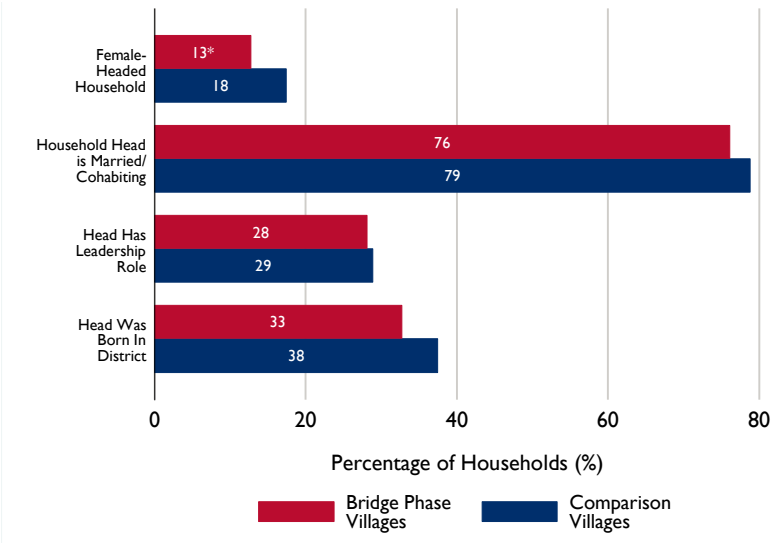
FIGURE 6:[22] EDUCATION LEVELS OF HOUSEHOLD HEADS



Household heads in comparison villages were better educated, on average (Figure 6). In Bridge Phase villages, 23 percent of household heads stopped formal schooling after primary school, compared to 13 percent in comparison villages. In comparison villages, 55 percent of heads had a middle school education or higher, compared to 41 percent of heads in Bridge Phase villages. The difference in education levels was also reflected in literacy, as heads in comparison villages were approximately eight percentage points more likely to be able to read a phrase in English.

[22] For all figures and tables, statistical significance of results is indicated as follows: *p<0.10, **p<.05, ***p<0.001.

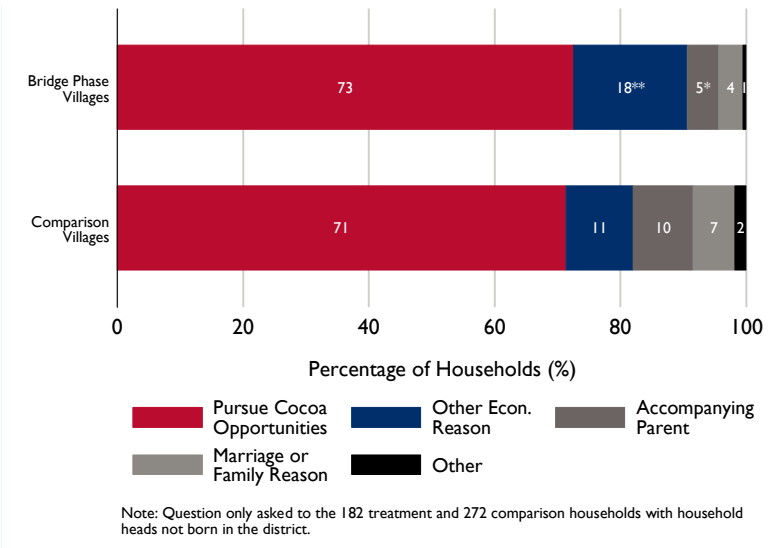
FIGURE 7: BASIC HOUSEHOLD CHARACTERISTICS



At baseline, households in Bridge Phase and comparison villages were more similar on other basic characteristics (Figure 7). Household heads in comparison villages were slightly more likely to be married or cohabiting, have a leadership role, and be born in Wassa Amenfi West district, though none of these differences were statistically significant. Female-headed households were fairly common across villages in the baseline sample, but households in comparison villages were five percentage points more likely to be female-headed.

The evaluation team asked household heads not born in the current district of residence why they came to live in the current village. Across the Bridge Phase and comparison group villages, the vast majority of non-native residents indicated they had migrated to Wassa Amenfi West district to pursue cocoa farming opportunities (Figure 8). Heads in Bridge Phase villages who were not native to the district were more likely to have migrated to pursue other economic opportunities, while heads in comparison villages were more likely to have moved to the district as a child accompanying their parents.

FIGURE 8: REASONS FOR MIGRATING TO THE CURRENT VILLAGE OF RESIDENCE

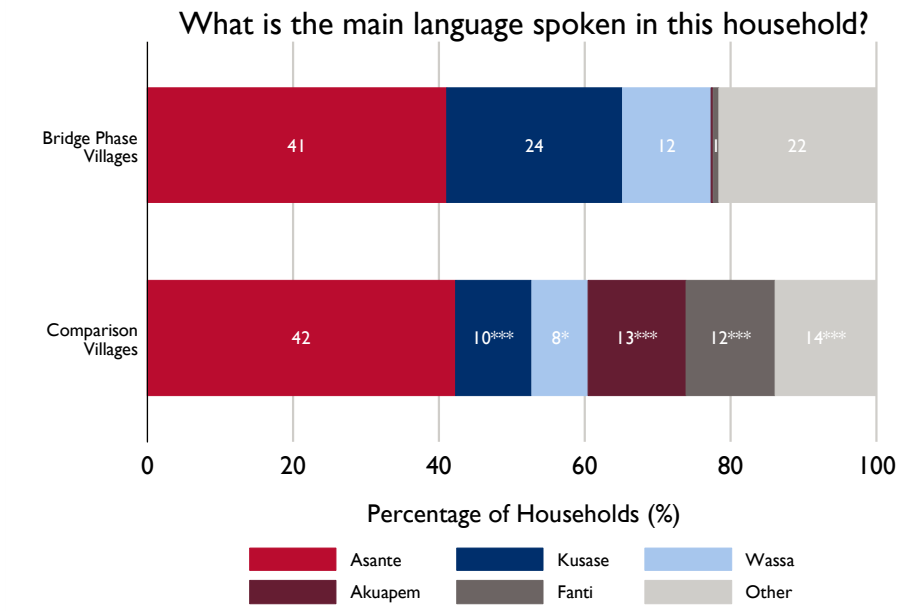


Note: Question only asked to the 182 treatment and 272 comparison households with household heads not born in the district.

As shown in Figure 9, Bridge Phase and comparison households were similar in terms of the percentage of households who mainly spoke Asante in the household. The two groups differed in terms of the percentage of households who mainly spoke other Akan dialects (Akuapem, Fanti, or Wassa), all of which are common in southern regions of Ghana. Of greater note is that 24 percent of Bridge Phase households spoke Kusase, compared to 10 percent of comparison households. As Kusase is commonly spoken in some northern regions of Ghana, this difference suggests that a greater proportion of the non-native households in the Bridge Phase villages had migrated from northern Ghana.[23]

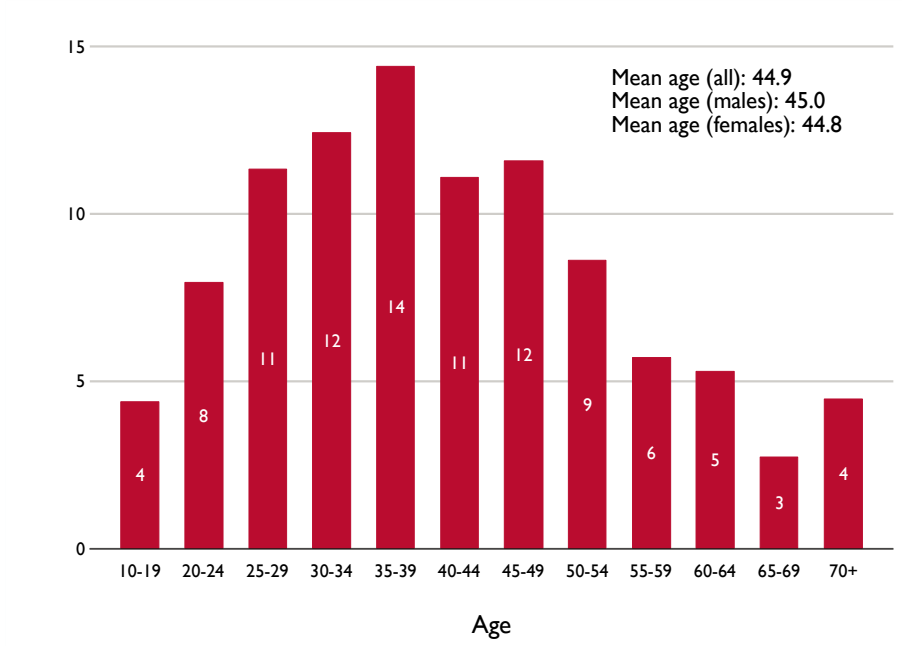
[23] ILRG's Land Use Planning Diagnostic, conducted in parallel to this baseline data collection, also confirmed that migrants in the Bridge Phase villages primarily came from Ghana's northern Volta or eastern regions of the country (Jiekak and Freudenberger 2019).

FIGURE 9: MAIN LANGUAGES SPOKEN



Across all households, the survey identified 1,218 household members engaged in cocoa farming activities. Forty percent of farming household members were female. Figure 10 shows the age distribution of these farmers. The average farmer was 44.9 years old, and mean age was nearly identical for male and female farmers.

FIGURE 10: AGE DISTRIBUTION OF FARMERS



FINDINGS 1: HOUSEHOLD LIVELIHOODS, ACCESS TO CREDIT, FOOD SECURITY

LIVELIHOODS

The survey asked respondents how satisfied they felt with their financial wellbeing, cocoa yield, and cocoa income. Responses ranged from one (Not satisfied at all) to four (Fully satisfied). For each indicator, the distribution of responses was similar between Bridge Phase and comparison villages, and across the different dimensions of satisfaction (Figure 11). Respondents reported average satisfaction of approximately 2.05, 2.07, and 2.07 on financial wellbeing, cocoa yield, and cocoa income dimensions (Table 8), corresponding to a level of satisfaction near the "Less Than Satisfied" point on the scale.

FIGURE 11: SATISFACTION WITH FINANCIAL WELLBEING AND COCOA FARMING

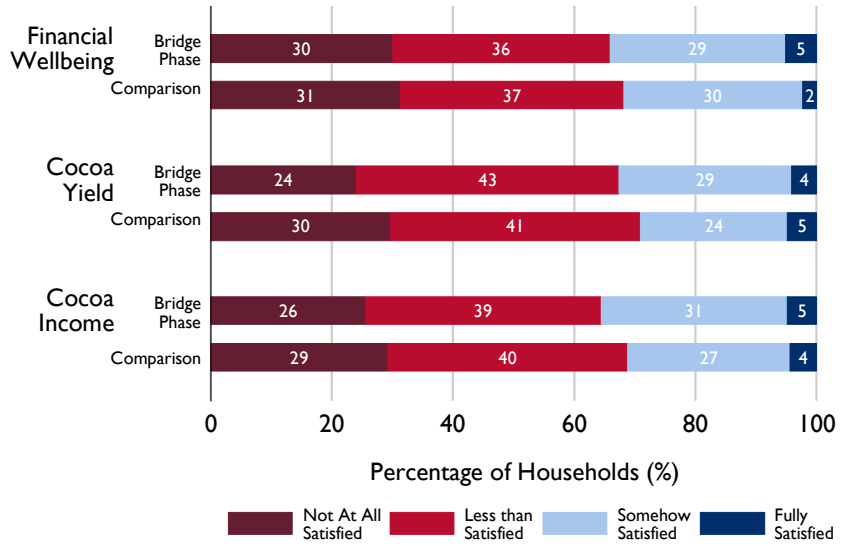
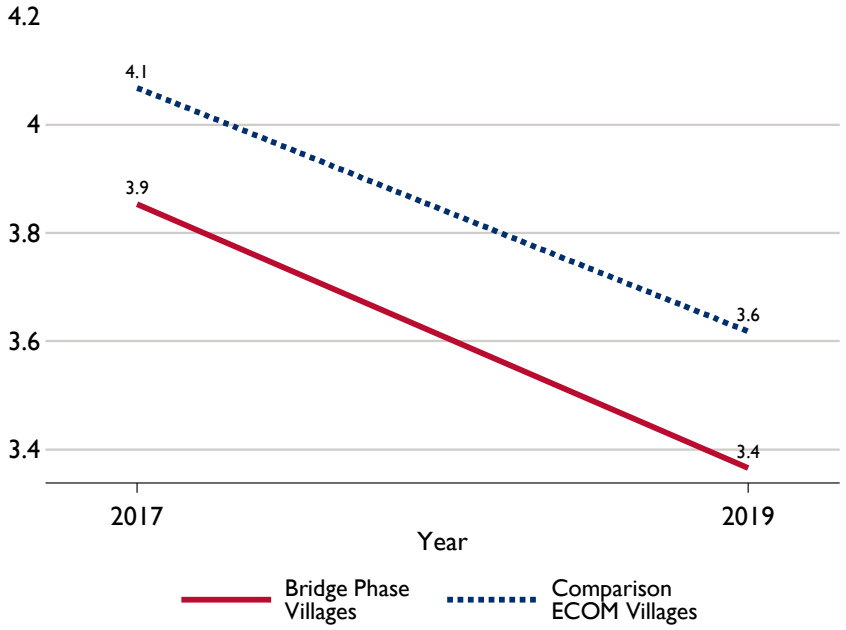


TABLE 8: BALANCE ON SATISFACTION AND LIKELIHOOD OF POVERTY

	Overall		Bridge Phase Villages		Comparison Villages		
Outcome (over the last year, during 2018)	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff**
Satisfaction with financial wellbeing	2.05	713	2.09	273	2.03	440	0.06
Satisfaction with cocoa yield	2.07	707	2.13	270	2.04	437	0.08
Satisfaction with cocoa income	2.09	707	2.15	270	2.06	437	0.09
Likelihood of Poverty at the $1.25/day level (2005 PPP)	11.45	713	13.21	273	10.36	440	2.85***

Additional questions on the survey asked about respondents' overall levels of wellbeing and examined the trend in wellbeing over the last two years prior to survey. Respondents were asked to imagine a ten-step ladder where the poorest people are on the first step, and the richest are on the tenth step. Respondents were then asked where they stand on the ladder and where they stood on the ladder two years prior to survey (in early 2017). As shown in Figure 12, the average respondent in the Bridge Phase villages placed themselves at 3.4 on the ladder, compared to 3.6 among respondents in the comparison group, a difference that is statistically significant at the 10 percent level. Bridge Phase respondents placed themselves on step 3.9 in 2017, while comparison respondents placed themselves at 4.1, a difference that is not statistically significant. Responses across both groups indicated that respondents perceived an overall decline in self-reported wellbeing over the period, and the magnitude of the decline was similar.

FIGURE 12: OVERALL WELLBEING TRENDS, 2017-2019



Figures 13-15 show the most important sources of income for households in the sample. Cocoa was the most important source of income for approximately 90 percent of Bridge Phase households and 88 percent of comparison households. Households whose primary source of income derived from sources other than cocoa were distributed relatively evenly across other income sources. Approximately 26 percent of Bridge Phase households and 21 percent of comparison households did not have any secondary source of income. Among those who did, the most common secondary income source was the cultivation of other crops, followed by income derived from self-owned businesses. Cocoa was also a prominent source of secondary income, suggesting that it was the second-most important income source for the majority of the approximately 10 percent of households for whom cocoa was not the primary source of income.

FIGURE 13: MOST IMPORTANT SOURCE OF INCOME

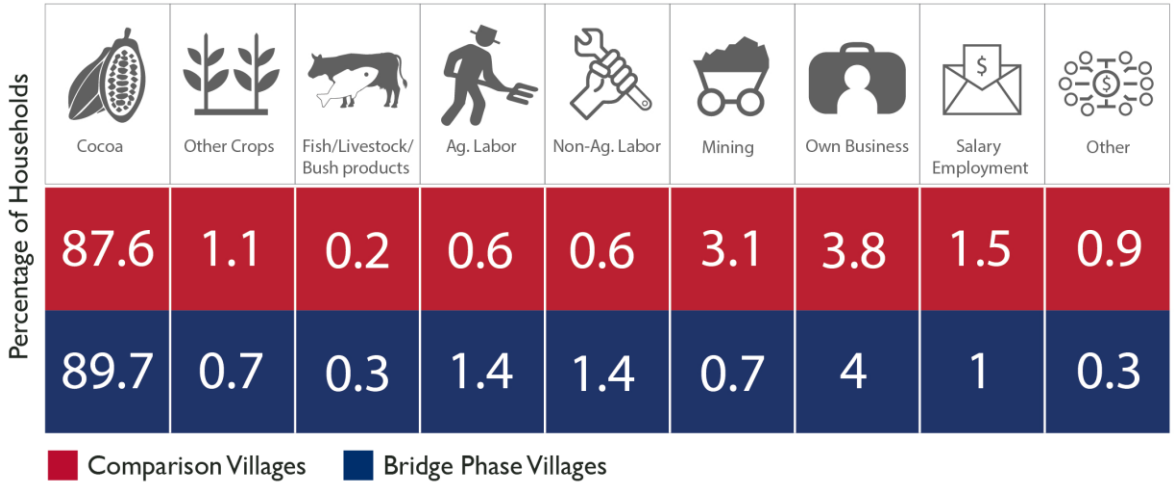


FIGURE 14: SECOND MOST IMPORTANT SOURCE OF INCOME

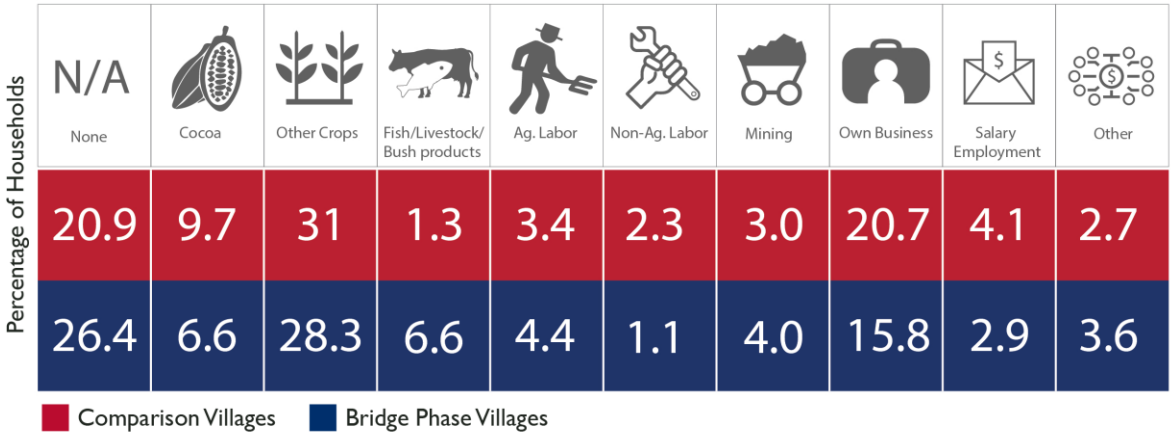
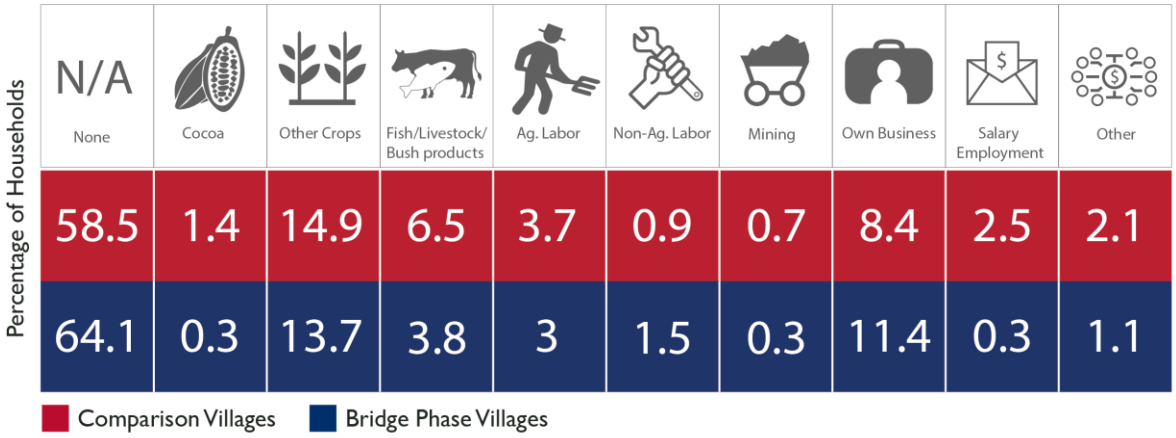


FIGURE 15: THIRD MOST IMPORTANT SOURCE OF INCOME



ACCESS TO CREDIT

Table 9 shows that approximately 45 percent of all respondents took a loan over the year prior to survey, a figure that was higher in Bridge Phase (53 percent) than comparison villages (40 percent). Among all households, the average amount borrowed was $248.59.[24] The average Bridge Phase household borrowed $111.94 more than the average comparison household, a difference that was statistically significant. The average loan size among households who took loans was $558.94, and the difference between Bridge Phase and comparison villages was not significant. Approximately 83 percent of households who took loans were able to repay the loan on time, with no significant differences between Bridge Phase and comparison households.

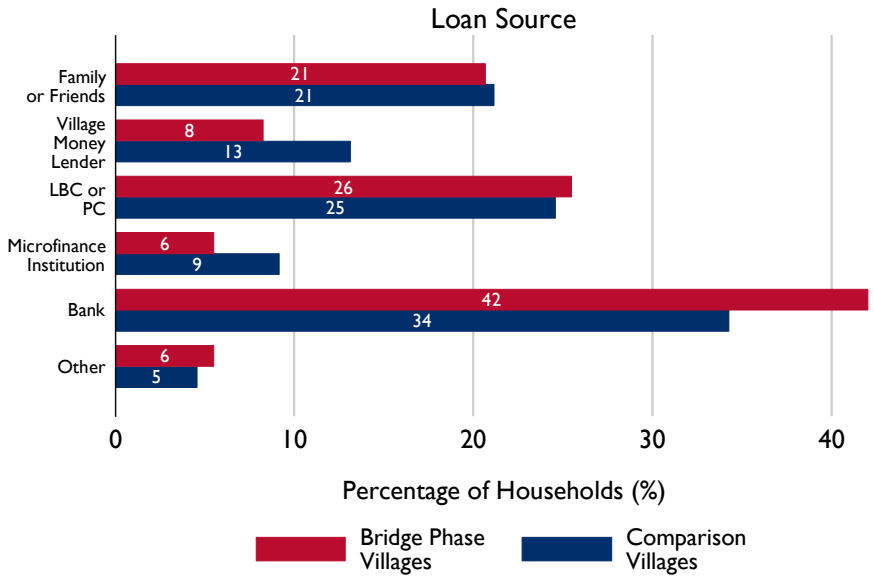
[24] $1 = 5.35 Ghanaian cedis.

TABLE 9: LOAN TAKE-UP, SIZE, AND REPAYMENT

	Overall		Bridge Phase Villages		Comparison Villages		
Outcome	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff**
Over the last year, did you or another household member borrow any money from anyone?	0.45	712	0.53	273	0.40	439	0.13***
Amount borrowed (USD) - All HHs	248.59	706	317.88	269	205.94	437	111.94***
Amount borrowed (USD) - Only HHs who took a loan	558.94	314	606.45	141	520.21	173	86.24
Were you able to repay the loan within the agreed repayment period?	0.83	239	0.81	105	0.84	134	-0.03

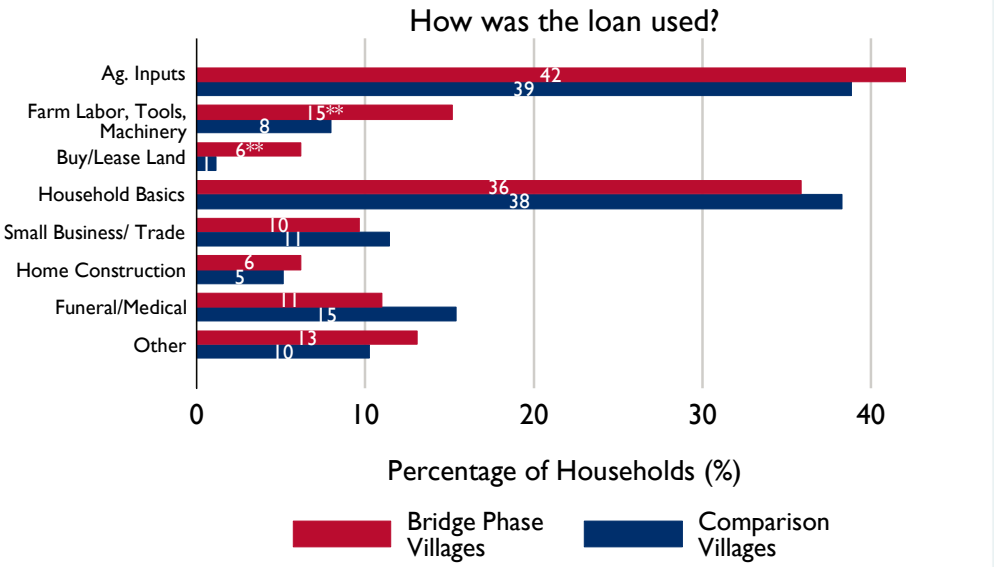
Figure 16 shows banks were the most common source of loans for both Bridge Phase and comparison households. Licensed buying companies or purchasing clerks were the second-most common loan source, followed by family and friends. Differences between Bridge Phase and comparison households in the prevalence of these loan sources, among those who took loans, were not statistically significant.

FIGURE 16: LOAN SOURCE



Note: Question only asked to the 145 treatment and 175 comparison households who reported taking out loans over the last year.

FIGURE 17: LOAN USE

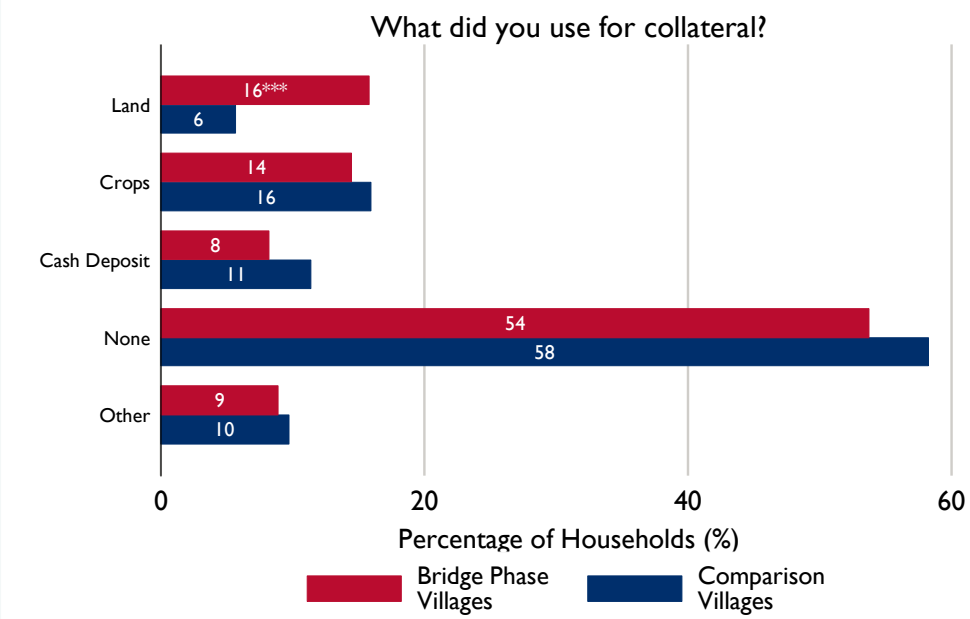


Note: Question only asked to the 145 treatment and 175 comparison households who reported taking out loans over the last year.

Loans were most commonly used to buy agricultural inputs, including seedlings, fertilizer, pesticide, and herbicide (Figure 17). This is followed by household basics, including food, transport, clothing, and school supplies or fees. Of those who took out loans, most households did not provide any collateral for the loan, as shown in Figure 18. For those who did provide collateral, crops were the most common form (15 percent of all households who took out loans). Approximately 16 percent of Bridge Phase households who took out loans used land as collateral, compared to 6 percent of comparison households, a statistically significant difference. There was some indication that loans from formal lenders were more likely to have required some form of collateral from the household. For example, loans that households received from banks were 31 percentage points more likely to have involved any type of collateral compared to loans from other sources, a difference that is statistically significant.

Among the 320 households who took out loans, those using land as collateral were approximately 12.8 percentage points more likely to have had documentation for at least one of their farm plots, compared to households who did not use land as collateral, but the difference was not statistically significant. However, only 33 households used land as collateral, which limited the ability to conduct robust statistical analysis on this issue. In terms of links to perceived tenure security, households that had used land as collateral were approximately 14.2 percentage points less likely to report being either somewhat or very worried they could lose rights to any farm in the next three years (statistically significant at the 90 percent confidence level (p=0.095)).

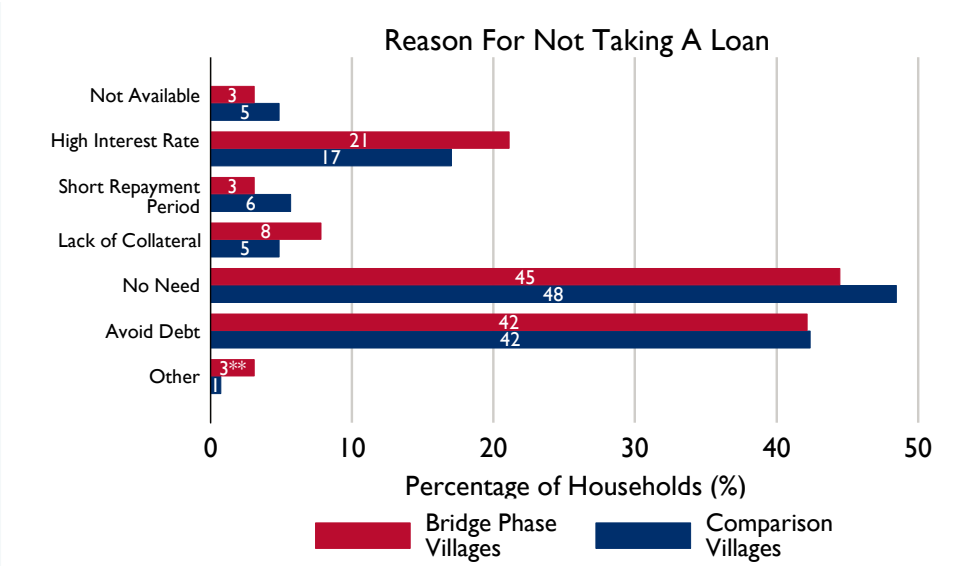
FIGURE 18: SOURCES OF LOAN COLLATERAL



Note: Question only asked to the 145 treatment and 175 comparison households who reported taking out loans over the last year.

Among those who did not take out a loan over the previous year, the most common reasons were not having any need for a loan or a desire to avoid debt (Figure 19). Approximately 21 percent of respondents in Bridge Phase villages cited high interest rates as the reason for not taking a loan, while 8 percent cited a lack of anything to use as collateral and 3 percent cited concerns about short repayment periods. Lack of access to loans does not appear to be especially problematic, as just 3 percent of households in Bridge Phase villages and 5 percent in comparison villages said they did not take loans because loans were not available in their communities.

FIGURE 19: REASONS FOR NOT TAKING OUT LOANS

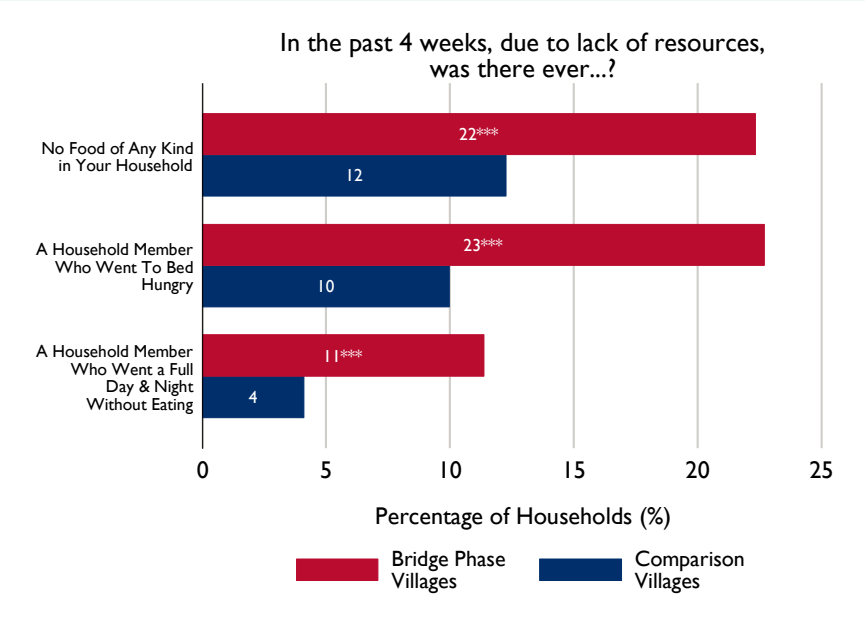


Note: Question only asked to the 128 treatment and 264 comparison households who reported not taking out loans over the last year.

FOOD SECURITY

Households were asked several questions related to food scarcity over the four weeks prior to the interview, to generate a standard measure of food insecurity. Figure 20 shows that food scarcity appeared significantly more problematic in Bridge Phase villages, where respondents were 10 percentage points more likely to report having no food of any kind at home at some point during the period, 13 percentage points more likely to report that some individuals in the household had gone to bed hungry, and 7 percentage points more likely to report someone had gone a full day and night without eating because there was nothing to eat. These differences were all statistically significant. Most households that reported experiencing food deprivation situations said the frequency was rare to infrequent.

FIGURE 20: PREVALENCE OF FOOD SCARCITY



Using these responses, combined with additional responses about the frequency with which these three hunger situations occurred over the past four weeks (rarely, sometimes, or often), we calculated each household's score on the Household Hunger Scale (HHS[25]). The HHS is a food deprivation scale that measures the percent of households experiencing hunger. The scale takes values from 0 to 6, where 0-1 equates to little to no hunger, 2-3 denotes moderate hunger, and 4-6 corresponds to severe hunger. Table 10 shows that respondents tended to be at the lower end of the HHS, on average, though households in Bridge Phase villages had a significantly higher degree of hunger than those in comparison villages. Based on the HHS, the percentage of households that experienced moderate to severe hunger was 18 in Bridge Phase villages and 9 percent in Comparison group villages, a difference that was also statistically significant.[26]

TABLE 10: HOUSEHOLD HUNGER SCALE

	Overall		Bridge Phase Villages		Comparison Villages		
Outcome	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff**
Household Hunger Scale, HHS	0.43	713	0.66	273	0.29	440	0.37***

[25] USAID, 2019. *USAID Food for Peace: Indicators for Emergency Program Performance Indicator Reference Sheets.* Washington, DC.
[26] For reference, five percent of Ghana's population has been estimated to be food insecure, but there is substantial variation by region and rural areas of Western region have also shown fairly low levels of food insecurity in previous studies. Analyses by the World Food Programme has shown much greater vulnerability to food insecurity in Ghana's northern regions, where the population of food insecure people has been estimated as high as 34 percent in some regions (WFP, 2009. "*Comprehensive Food Security and Vulnerability Analysis, Ghana.* World Food Programme").

NON-FARM ACTIVITIES

Households in the sample were heavily reliant on farming, but Table 11 shows that slightly less than half (46 percent) also engaged in non-farm activities. Additionally, eight percent of all households received income from remittances or pensions. This percentage was higher for comparison households (ten percent) than for Bridge Phase households (five percent).

TABLE 11: INCOME FROM NON-FARM SOURCES

	Overall		Bridge Phase Villages		Comparison Villages		
Outcome (over the past year)	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff**
Did any member of your household engage in off-farm activities?	0.46	713	0.44	273	0.47	440	-0.02
Did any member of your household receive income from remittances or pension?	0.08	713	0.05	273	0.10	440	-0.05***
Did any member of your household earn income from mining or trading gold?	0.09	713	0.12	273	0.08	440	0.04*
Household income from mining or trading gold (USD)	28.45	680	41.75	256	20.42	424	21.33

Figure 21 shows the percentage of households in Bridge Phase and comparison villages who fell into different brackets for income from non-farm activities. Approximately two-thirds of households in both groups did not earn any income from off-farm activities, either because they did not engage in off-farm activities or because the activities they engaged in failed to generate income. Overall, households in comparison villages generated slightly higher income from off-farm activities than households in Bridge Phase villages, but the difference was not statistically significant.

Households earning more from off-farm activities tended to derive their income from different sources than those earning less from off-farm activities. For those earning more than $200 from off-farm activities, their biggest source of income was more likely to be from owning a small business (6 percent, compared to 2 percent of households earning less than $200 from off-farm activities), or salaried employment (8 percent, compared to 0.4 percent). Households earning more than $200 from off-farm activities were also more likely to have a secondary income source (97 percent, compared to 70 percent of households earning less than $200 from off-farm activities). The secondary source of income was again more likely to be from owning a small business (37 percent of households earning more than $200 from off-farm activities, compared to 10 percent of households earning less), and salaried employment (12 percent, compared to 1 percent of households earning less than $200 from off-farm activities).

FIGURE 21: INCOME FROM OFF-FARM ACTIVITIES

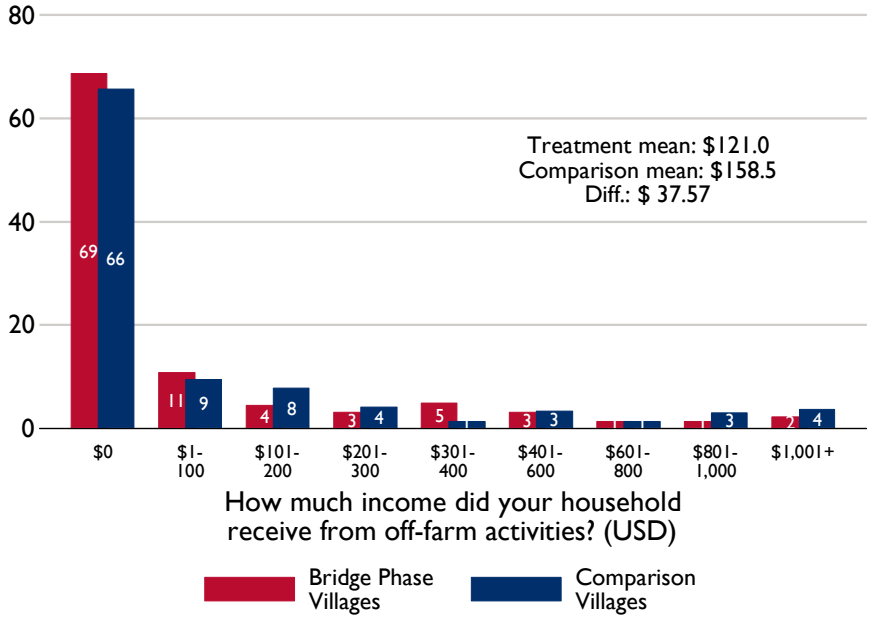
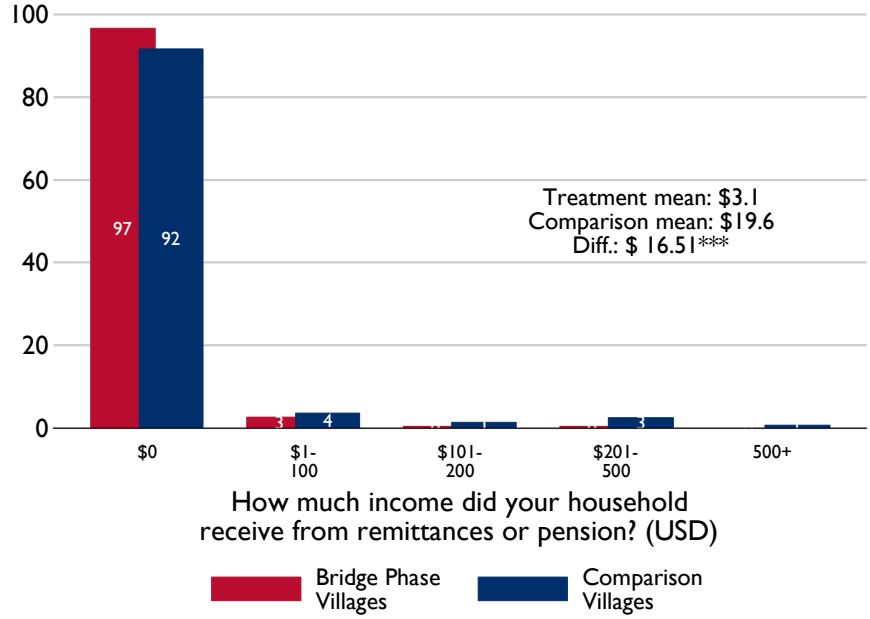


Figure 22 shows the percentage of households in Bridge Phase and comparison villages who fell into different brackets for income from remittances and pensions. Over 90 percent of households in both groups did not earn any income from remittances and pensions. Overall, households in comparison villages received higher income from remittances and pensions than households in Bridge Phase villages, and the difference was statistically significant. On average, households in comparison villages received $16.51 more from remittances and pensions than Bridge Phase villages in the year prior to survey.

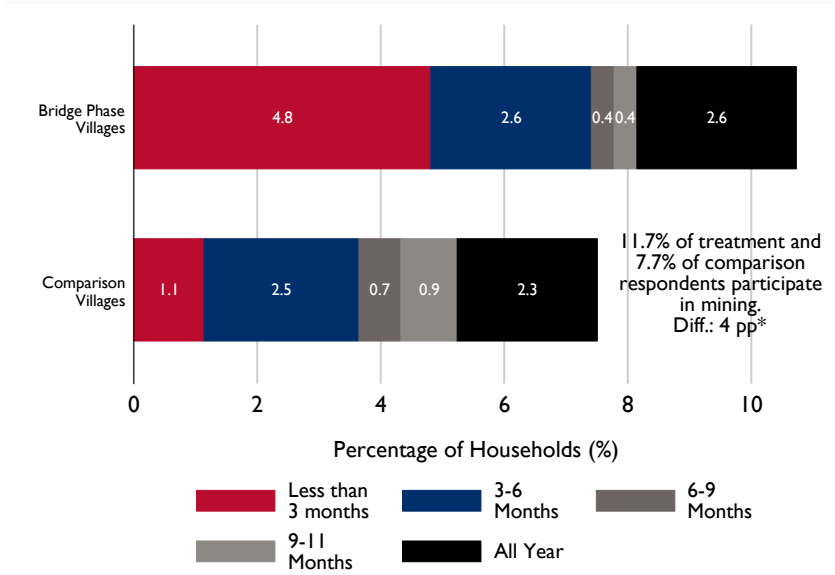
FIGURE 22: INCOME FROM REMITTANCES



Approximately 12 percent of households in Bridge Phase villages participated in gold-mining activities,

compared to 8 percent of households in comparison villages (Table 8). Figure 23 expands on this by showing the intensity of gold-mining activities among households. Approximately 4.8 percent of households in Bridge Phase villages engaged in mining activities for less than three months per year, compared to 1.1 percent of households in comparison villages. On the other hand, the percentage of households who engaged in mining year-round was similar across both groups. GD participants in comparison villages reported that mining activities were not common in their villages, although it is recognized that sensitivity on discussing mining issues could have led participants to downplay its prevalence. Household participation in gold-mining activities was negatively correlated with the amount of land the household owned, cultivated, and used for cocoa.

FIGURE 23: ANNUAL INTENSITY OF GOLD MINING ACTIVITIES



Approximately 13 percent of households said at least one member had engaged in a new livelihood activity over the past year. Table 12 shows the most common new livelihood activities for these households. The same new livelihood activities were found with similar prevalence across Bridge Phase and comparison villages. For both groups, small business or trading activities were the most common new activity a member had engaged in over the past year, followed by the sale of cocoa, the sale of other crops, and the sale of livestock or livestock products. In qualitative group discussions, some participants mentioned additional livelihoods activities, such as tapping palm wine, harvesting and selling snails from the forest, raising livestock, or cultivating subsistence crops. Female respondents in one GD said they wished to engage in trading but were hindered by poor road quality to access towns.

TABLE 12: MOST COMMON NEW INCOME GENERATING ACTIVITIES

Rank	Crop	Bridge Phase Villages N (%)	Comparison Villages N (%)
1	Small business or Trading	40 (43%)	17 (38%)
2	Sale of Cocoa	30 (33%)	12 (27%)
3	Sale of Other Crops	24 (26%)	10 (22%)
4	Sale of Livestock or Livestock Products	14 (15%)	6 (13%)

FINDINGS 2: AGRICULTURAL PRODUCTION OVERVIEW

CROPS PRODUCED

On average, respondents in the sample reported cultivating 4.5 different crops per household and selling 2.1 crops per household. Cocoa was clearly the dominant force in the economic lives of respondents, with 63.2 percent of all household income coming from the sale of cocoa, on average, while 9.7 percent of household income came from the sale of other crops. There were no statistically significant differences between Bridge Phase and comparison households for these variables, as shown in Table 13.

TABLE 13: CROP DIVERSIFICATION

	Overall		Bridge Phase Villages		Comparison Villages		
Outcome	Mean	N	Mean	N	Mean	N	Diff
Total Number of Different Crops Produced by Household	4.45	714	4.22	273	4.59	441	-0.38
Total Number of Different Crops Sold by Household	2.14	714	2.07	273	2.18	441	-0.11
Percent of household total income from sale of cocoa	63.19	698	64.84	269	62.15	429	2.69
Percent of household total income from sale of other crops	9.67	666	9.60	248	9.72	418	-0.11

Table 14 shows the most common crops produced and sold in Bridge Phase and comparison villages. Cocoa, cassava, and plantain clearly dominate, with each produced by over 70 percent of households. The same crops comprised the five most common crops produced in both Bridge Phase and comparison villages, and there was little difference in the percentage of households producing each of these crops. Cocoa, cassava, and plantain also dominated the list of most common crops sold. However, while the percentage of households who sold cocoa was nearly unchanged from the percentage of households who produced it (suggesting that all households that produce cocoa sell it), the percentage of households who sold the other crops on the list was well below the percentage of households who produced them. This disparity highlights the importance of cocoa as a cash crop, while the other main crops listed are most commonly consumed directly by households rather than sold at markets.

TABLE 14: MOST COMMON CROPS PRODUCED AND SOLD

	MAIN CROPS PRODUCED				MAIN CROPS SOLD			
Rank	Bridge Phase Villages		Comparison Villages		Bridge Phase Villages		Comparison Villages	
	Crop	N (%)	Crop	N (%)	Crop	N (%)	Crop	N (%)
1	Cocoa	235 (86.1%)	Cocoa	381 (86.5%)	Cocoa	223 (81.7%)	Cocoa	349 (79.3%)
2	Cassava	207 (75.8%)	Cassava	314 (71.4%)	Plantain	99 (36.3%)	Plantain	176 (40.0%)
3	Plantain	196 (71.8%)	Plantain	312 (70.9%)	Cassava	81 (29.7%)	Cassava	144 (32.7%)
4	Cocoyam	94 (34.4%)	Cocoyam	179 (40.7%)	Maize	21 (7.7%)	Maize	38 (8.6%)
5	Maize	70 (25.6%)	Maize	135 (30.7%)	Tomato	18 (6.6%)	Cocoyam	36 (8.2%)

Across villages in the baseline sample, cocoa was clearly at the center of households' economic lives. Approximately 85 percent of all households said cocoa was their most important crop, as shown in Figure 24. Figure 25 shows the second most important crop mentioned by households. Just under a third of households (33 percent) said their second most important crop was plantain, and an additional 32 percent said their second most important crop was cassava. Approximately 15 percent of households said they did not have any second most important crop. Among households that reported no second most important crop, 95 percent said their most important crop was cocoa, showing that a sizeable minority of households are exclusively or nearly exclusively reliant on cocoa.

FIGURE 24: MOST IMPORTANT CROP

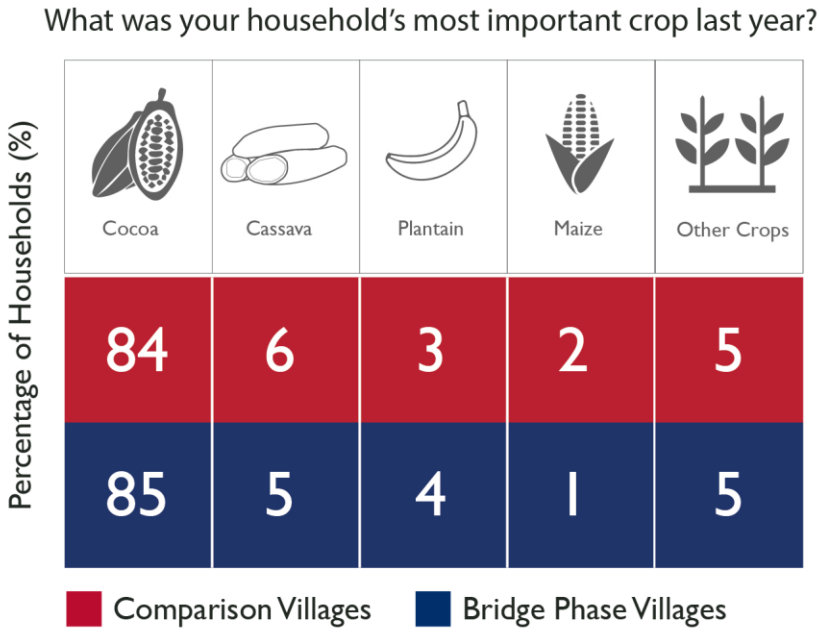
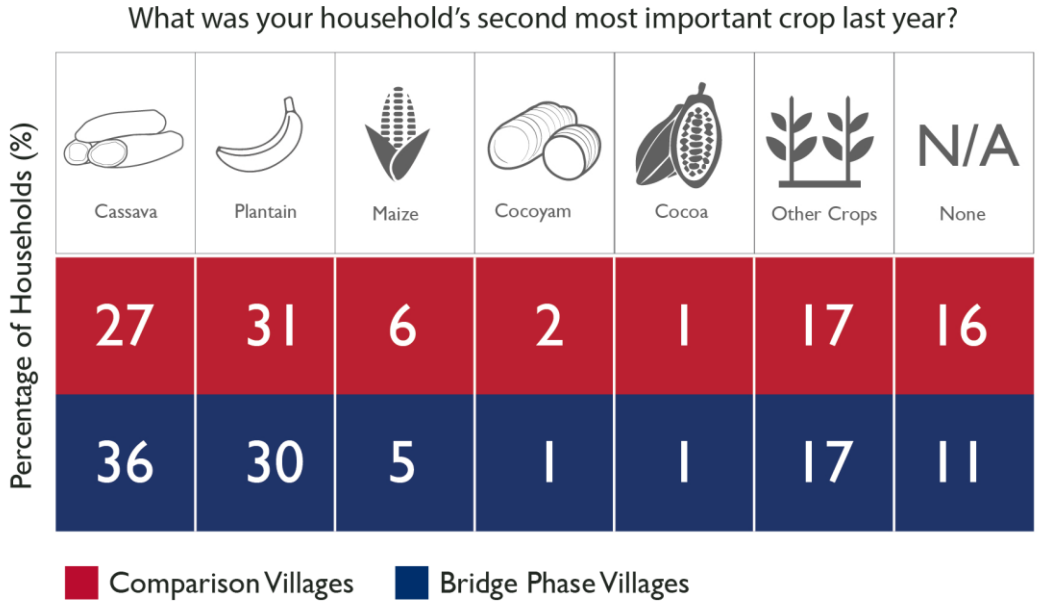
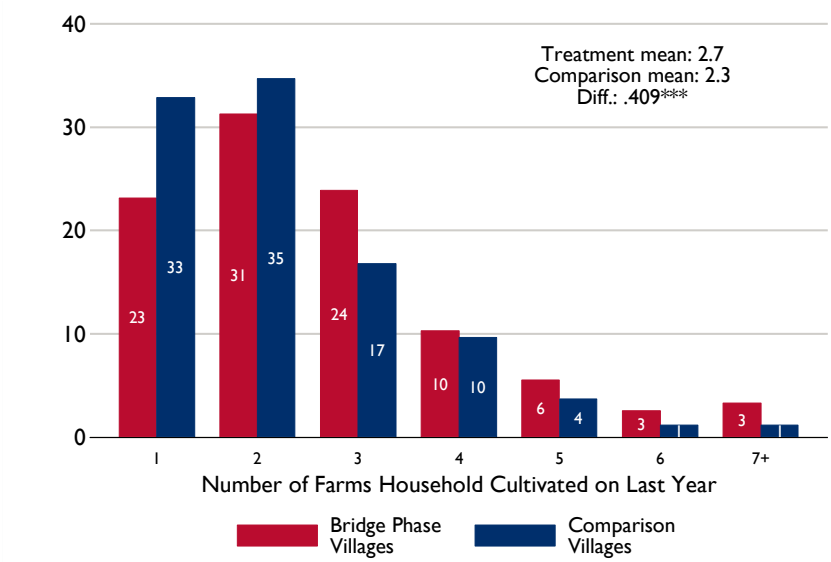


FIGURE 25: SECOND MOST IMPORTANT CROP



LAND HOLDINGS

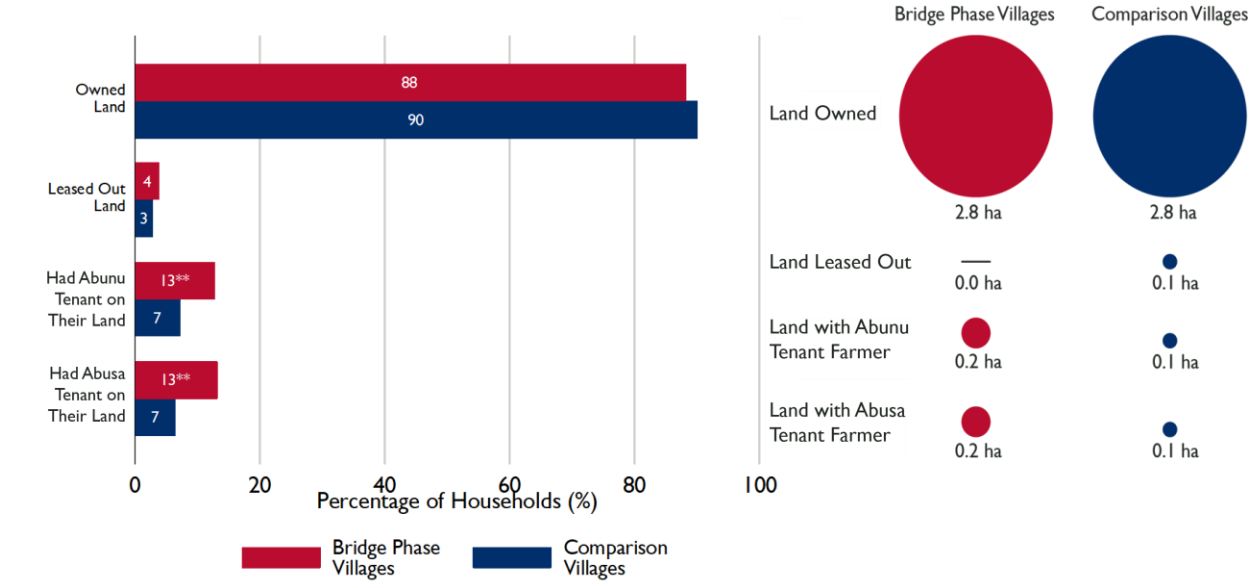
FIGURE 26: NUMBER OF FARMS (ALL CROPS)



On average, households in Bridge Phase villages farmed 2.7 farms per household, compared to 2.3 farms per household in comparison villages, a difference that was statistically significant. Figure 26 shows the distribution of farms per household in Bridge Phase and comparison villages. The figure shows that 23 percent of Bridge Phase households cultivated on just one farm, compared to 33 percent of comparison households.

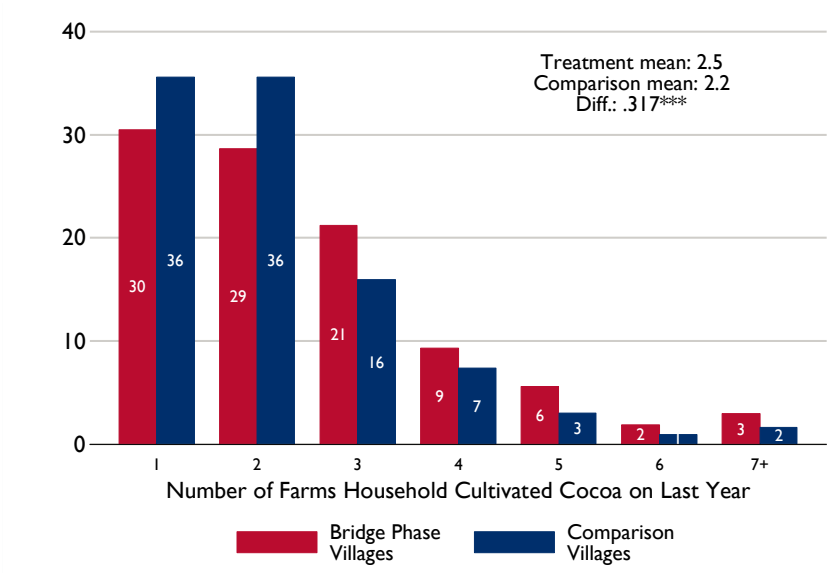
Figure 27 shows the land ownership and different tenancy regimes held by households on land they own. In terms of the ownership status of the land households cultivate, 89 percent of all households said they owned at least one of the farms they cultivated, with no statistically significant difference between Bridge Phase and comparison households. Just three percent of all households leased out any of the land they owned, again with no significant difference between the Bridge Phase and comparison groups. On the other hand, nine percent of households reported having an *abunu* tenant farmer on any of the land they owned, and nine percent reported having an *abusa* tenant farmer. A statistically significant higher percentage of Bridge Phase households (13 percent) reported engaging in *abunu* or *abusa* contracts with tenant farmers on land they owned compared to comparison households (7 percent).

FIGURE 27: LAND OWNED AND LEASED OUT UNDER VARIOUS TENANCY REGIMES



On average, households in both Bridge Phase and comparison villages owned 2.8 hectares of land, as self-reported by the respondent. Of the land they owned, households leased out 0.05 hectares, on average, with no significant difference between Bridge Phase and comparison groups. Approximately 0.2 hectares of owned land per household was leased out to *abunu* tenant farmers in Bridge Phase villages, compared to 0.1 hectares in comparison villages, though the difference was not statistically significant. On the other hand, approximately 0.2 hectares of owned land per household was leased out to *abusa* tenant farmers in Bridge Phase villages, compared to 0.1 hectares in comparison villages, and this difference was significant at the 10 percent confidence level.

FIGURE 28: NUMBER OF COCOA FARMS



Households cultivated cocoa on just one or two farms, and Bridge Phase households cultivated on slightly more farms per household than comparison households. This difference was statistically significant. Comparing Figure 28 to Figure 26, the number of cocoa farms that households reported was similar to the overall number of farms they cultivated on.

While Bridge Phase households cultivated cocoa on a greater number of farms per household than comparison households, the total area of cocoa cultivated, measured in hectares, was more similar between Bridge Phase and comparison groups. Figure 29 shows that comparison households cultivated cocoa on slightly more hectares per household than Bridge Phase households, though the difference was not statistically significant. The distribution in the figure shows that most Bridge Phase and comparison households cultivated cocoa on under three hectares of land. The percentage of households cultivating cocoa on three hectares or more quickly drops off as the size of landholdings increases. For example, 23 percent of Bridge Phase households cultivated cocoa on a total of between two and three hectares, while just 10 and 11 percent cultivated cocoa on three to four and four to five hectares of land, respectively. Only ten percent of Bridge Phase households cultivated cocoa on more than six hectares of land.

FIGURE 29: EXTENT OF COCOA CULTIVATION

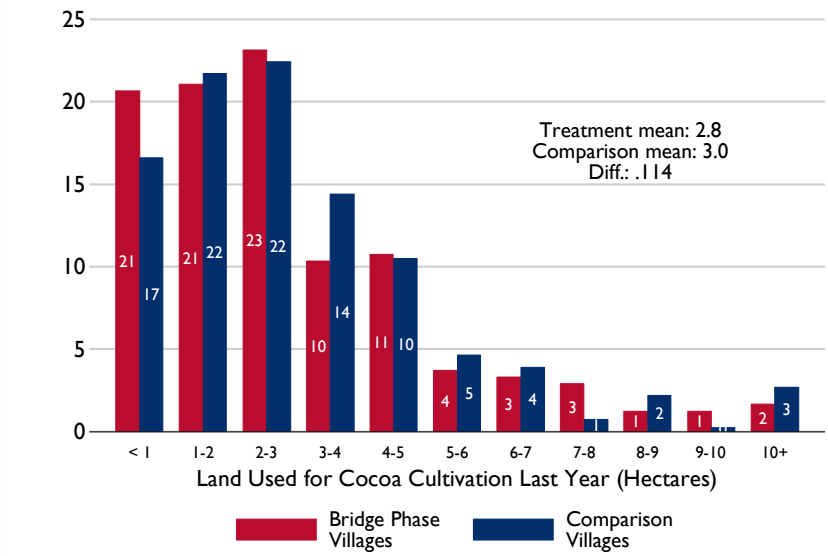
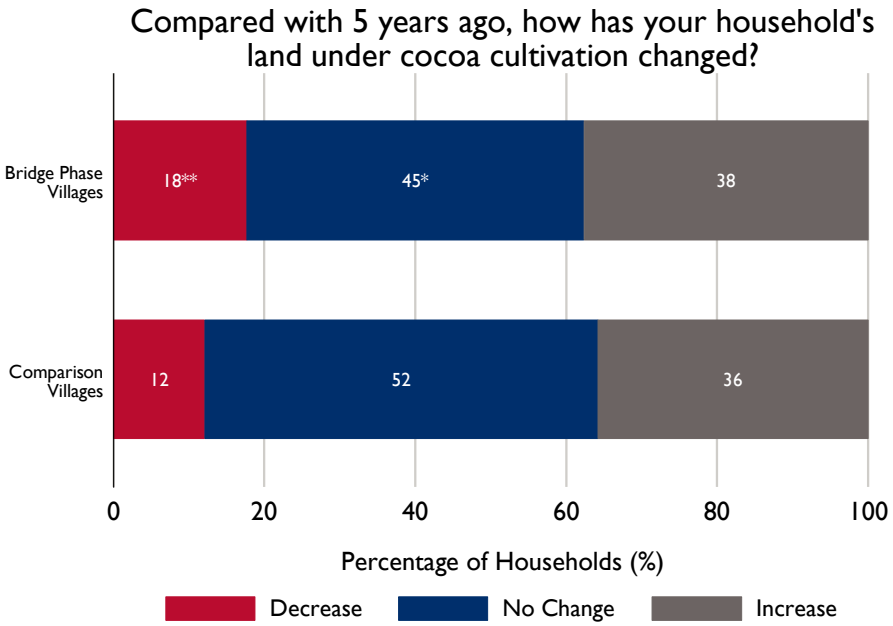


FIGURE 30: COCOA EXPANSION

Approximately half of all households reported no change in the overall amount of land they farmed cocoa on over the past five years. Slightly more than a third (36 percent) reported increasing the amount of land under cocoa cultivation, while 14 percent reported they had decreased the amount of land under cocoa over the past five years. As Figure 30 shows, these results were roughly similar for Bridge Phase and comparison households. However, 18 percent of Bridge Phase households reported decreasing the amount of land they cultivated cocoa on over this time period, compared to 12 percent of comparison households, a statistically significant difference. The percentage of households who reported increasing their land under cocoa was nearly identical across the Bridge Phase and comparison groups, while a greater percentage of Bridge Phase households reported no change to the area of land they used for cocoa over the past five years.



Households who reported increasing land under cocoa cultivation were asked a follow-up question to determine where the increase in land came from. The most common responses are shown in Table 15. Approximately 40 percent of all households who increased their land under cocoa over the past five years acquired the additional land by entering into a new *abunu* arrangement to farm someone else's land, while 22 percent inherited the land, and 11 percent purchased the land. Some of this cocoa

expansion came from land that was newly cleared; 16 percent of households expanded cocoa cultivation by clearing forest or fallow land already held by the family, and 7 percent cleared other forest or fallow land. The survey question does not allow us to infer whether newly acquired land obtained via a new *abunu* arrangement or through inheritance or purchase was cleared by the acquiring household to establish cocoa at that time, or had already been under cocoa at the time the household obtained the land.

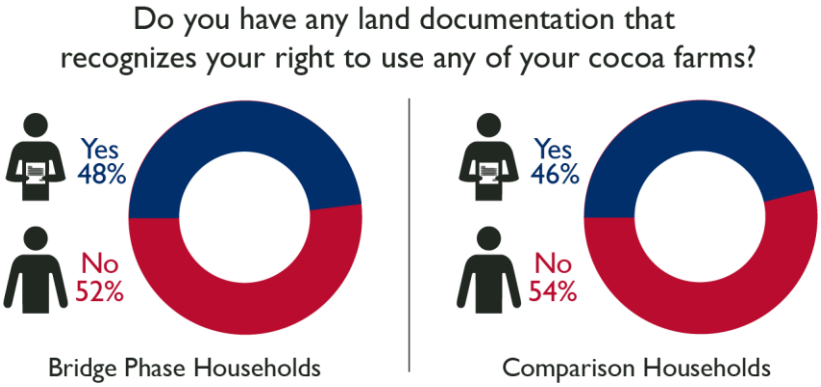
TABLE 15: SOURCE OF COCOA EXPANSION LAND

Rank	Bridge Phase Villages		Comparison Villages	
	Source for Increasing Land Under Cocoa Cultivation	N (%)	Source for Increasing Land Under Cocoa Cultivation	N (%)
1	New *abunu* arrangement to farm someone else's land	44 (44%)	New *abunu* arrangement to farm someone else's land	59 (37.8%)
2	Inherited Land	20 (20%)	Inherited Land	37 (23.7%)
3	Purchased Land	17 (17%)	Cleared existing forest or fallow land already held by family	31 (19.9%)
4	Cleared other forest or fallow land	11 (11%)	Purchased Land	12 (7.7%)
5	Cleared existing forest or fallow land already held by family	9 (9%)	Cleared other forest or fallow land	8 (5.1%)

LAND DOCUMENTATION

Despite that nearly 90 percent of households reported owning at least some of the land they cultivate, over half of all households did not have any documentation to demonstrate their right to use the land on which they cultivate cocoa. Overall, 47 percent of all households had some type of land documentation recognizing their right to use any of their cocoa farms. This is shown separately for Bridge Phase and comparison villages in Figure 31. GD participants described processes for obtaining documentation from village or Paramount chiefs when selling, acquiring, or transferring land. In one community, landowners described seeking permission and receiving documents from both chiefs and government authorities when they sell their properties.

FIGURE 31: LAND DOCUMENTATION FOR COCOA FARMS



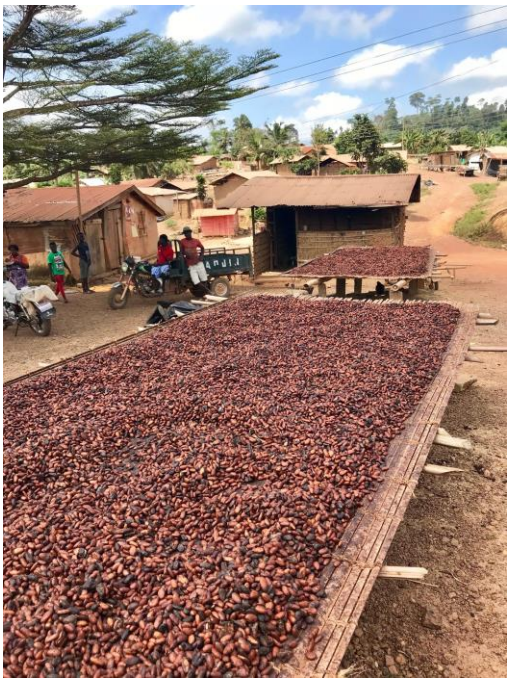
While 48 percent of households in Bridge Phase villages had documentation for any of their farms, the percentage of farms with documentation in these villages was somewhat lower, at 40 percent. Table 16 shows the number and percentage of farms with any type of paper documentation, by village, for villages in the Bridge Phase group. The table shows that documentation of farms was higher in Nyame Nnae and Suresu Nkwanta, and that for all villages most of the documentation occurred since 2014. Though a high percentage of farms obtained land documentation before 2010, it is important to note that this timeframe represents an extended period starting around 1970, and that documentation of farms was

largely dispersed throughout the 1970-2010 period. The data show that widespread documentation of farms, with multiple farms obtaining documentation each year, did not begin in earnest until after 2010.

TABLE 16: BALANCE ON SATISFACTION AND LIKELIHOOD OF POVERTY

	Farms with any type of paper documentation		Year documentation was obtained for this farm (percentage of all farms with documentation)						
Village	N	%	Before 2010	2010-2011	2012-2013	2014-2015	2016-2017	2018-2019	Don't Know
Domeabra	86	37.7	26.7	3.5	7.0	19.8	8.1	11.6	23.3
Suresu Nkwanta	44	46.8	15.9	9.1	4.6	13.6	6.8	11.4	38.6
Yirase	62	29.7	32.3	1.6	4.8	4.8	16.1	1.6	38.7
Nyame Nnae	104	49.8	30.1	3.9	0.0	5.8	23.1	15.4	21.2

COCOA PRODUCTION



Cocoa beans drying in a Bridge Phase community

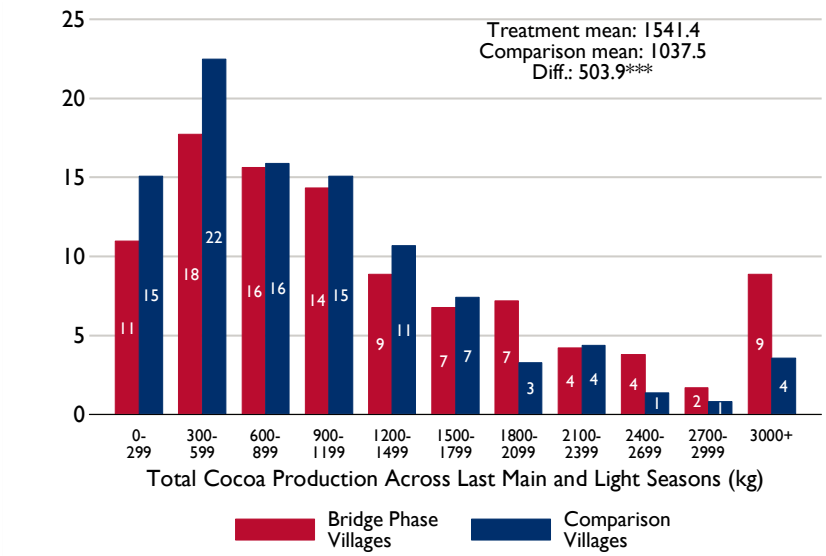
PHOTO BY LAUREN PERSHA

Approximately 50 percent of all households produced less than 900 kg of cocoa during the prior main and light seasons,[27] according to household self-reporting (Figure 32). Households in Bridge Phase villages produced an average of 1541.4 kg of cocoa per household, compared to 1037.5 kg per household in comparison villages. This difference was highly statistically significant, and due in part to the higher percentage of households in Bridge Phase villages reporting high production values over 3000 kg.

Nearly all households (97.2 percent, or 692 households) reported harvesting cocoa during the year prior to survey. Of these, 86.6 percent reported using labor from household members (59 percent used only labor from household members); 36.8 percent used hired labor (11.6 percent used only hired labor); and 4.6 percent used communal labor (1.5 percent used only communal labor). Among households who harvested cocoa, these households used 28.4 worker-days of household labor, 13.5 worker-days of hired labor, and 2 worker-days of communal labor, on average. The average daily rate for cocoa harvesting that was reported by households was $6.59 (34.69 cedis).

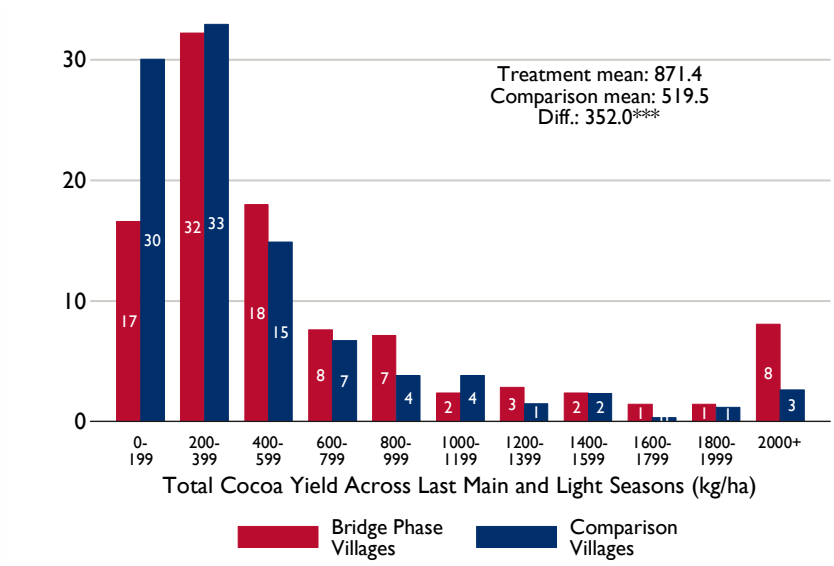
[27] Cocoa harvesting in Ghana occurs during a main crop season, which typically runs from October through December or January, and a light crop season, which typically runs from April through July (with some variation) (Bymolt, R., Laven, M. Tyszler. 2018. *Demystifying the cocoa sector in Ghana and Cote D'Ivoire.* The Royal Tropical Institute (KIT)). The Ghana Cocoa Board announces the official opening of purchases for the main and light crop season annually, and specifies at the same time the fixed price that will be paid to farmers per 64 Kg bag of dried cocoa beans during that season. For example, see: https://www.modernghana.com/news/939978/cocobod-announces-opening-of-2019-cocoa-season.html

FIGURE 32: COCOA PRODUCTION PER HOUSEHOLD



In terms of yield per hectare, 50 percent of all households reported their cocoa crop yield was less than 350 kg/ha across the past main and light seasons. This figure was comparable to recent work, which used the same survey approach as ours and estimated the median cocoa yield for Ghanaian farmers at 369 kg/ha.[28]

FIGURE 33: COCOA YIELD PER HOUSEHOLD

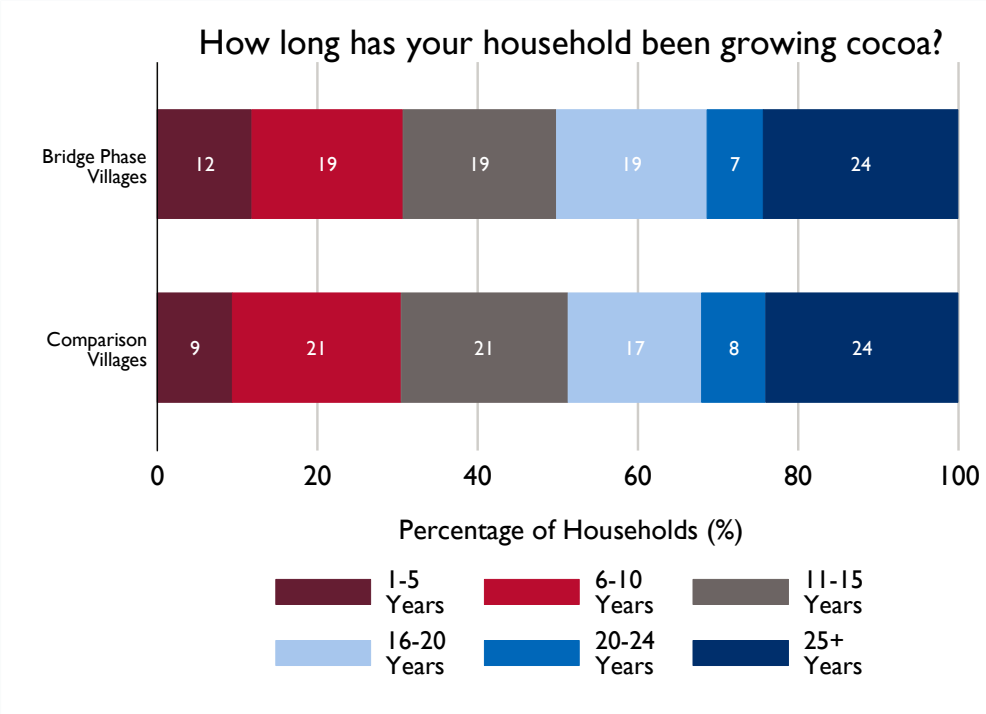


Bridge Phase households reported higher average yields, due in large part to the much higher percentage of households in comparison villages reporting very low yield of between 0 and 200 kg per hectare. Figure 33 shows that, on average, Bridge Phase households reported yields for cocoa that were 352 kg per hectare higher than comparison households.

Most households in the sample had been engaged in cocoa cultivation for many years. Approximately 49 percent of all households had been growing cocoa for 16 years or more, and 24 percent had been growing cocoa for 25 years or more. Just 10 percent of households had been engaged in cocoa cultivation for between 1 and 5 years. Bridge Phase and comparison households were similar in terms of the length of time households had been engaged in cocoa cultivation, as seen in Figure 34.

[28] Bymolt, R., Laven, M. Tyszler. 2018. *Demystifying the cocoa sector in Ghana and Cote D'Ivoire.* The Royal Tropical Institute (KIT).

FIGURE 34: HOUSEHOLD LENGTH OF ENGAGEMENT IN COCOA CULTIVATION



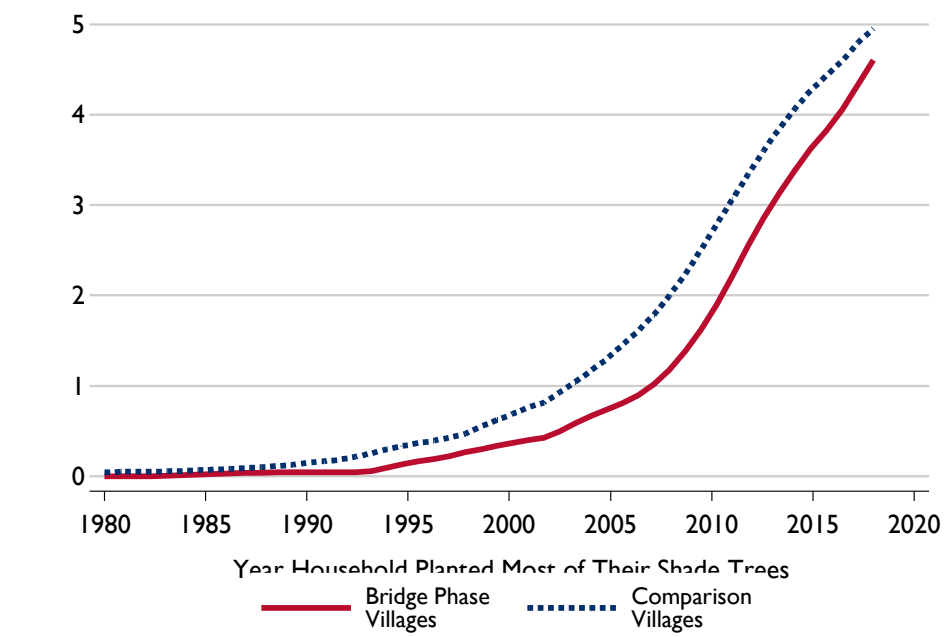
While a high percentage of all households (84 percent) reported having at least one cocoa farm with shade trees, only slightly more than half (51 percent) reported having planted shade trees. Having cocoa farms with naturally occurring shade trees was more common, at 66 percent of households. Table 17 shows that a greater percentage of households in Bridge Phase villages reported having shade trees than comparison village households, a difference that appeared to be driven by households planting shade trees.

TABLE 17: SHADE TREE PRESENCE ON COCOA FARMS

	Overall	Bridge Phase Villages	Comparison Villages	Diff.
Has any cocoa farms with…	**N (%)**	**N (%)**	**N (%)**	**(%)**
Shade trees	597(84.2%)	212(78.2%)	385(87.9%)	9.7 % ***
Naturally occurring shade trees	469(66.1%)	178(65.7%)	291(66.4%)	0.8 %
Planted shade trees	363(51.2%)	118(43.5%)	245(55.9%)	12.4 % ***
Naturally occurring and planted shade trees	236(33.3%)	85(31.4%)	151(34.5%)	3.1 %

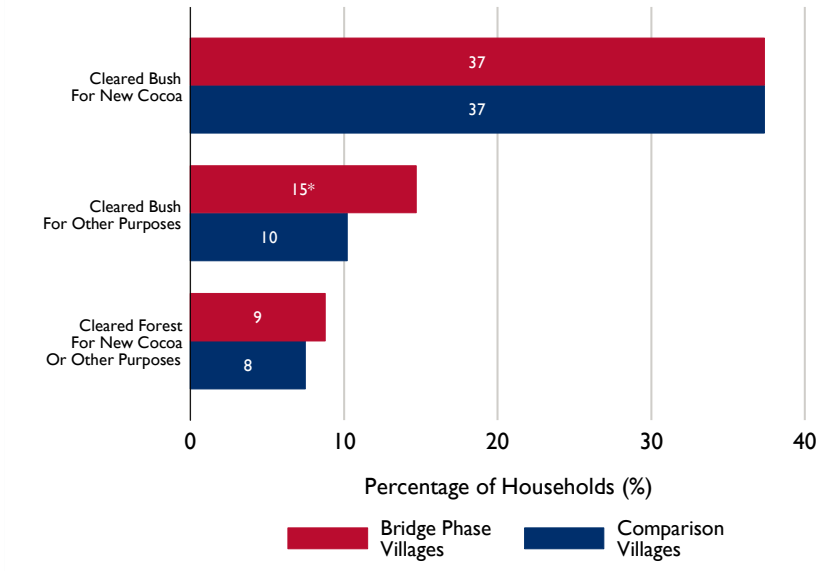
Almost no households planted shade trees before the year 2000, though the practice increased in popularity since then and has taken off since 2009. Figure 35 shows the percentage of households who said they had planted the majority of their shade trees in a given year. The trends run roughly parallel across Bridge Phase and comparison households and clearly indicate an upward trend in recent years.

FIGURE 35: SHADE TREE PLANTING, BY YEAR



As shown in Figure 36, 37 percent of all households cleared bush[29] for new cocoa, with no statistically significant difference between Bridge Phase and comparison households. A slightly higher portion of Bridge Phase households (15 percent) cleared bush for purposes other than cocoa, compared to comparison households (10 percent). The other purposes mentioned for clearing bush related exclusively to other crops, with 42 percent of these households specifically mentioning cassava, plantain, cocoyam, or maize. Approximately 8 percent of all households reported clearing forest for new cocoa or any other purpose, with no significant difference seen between Bridge Phase and comparison groups.

FIGURE 36: FOREST AND BUSH CLEARING



[29] Bush was defined as land which has been disturbed and consists primarily of dense, shrubby vegetation.

Slightly under two-thirds (62 percent) of households reported using any fertilizer on their cocoa farms in the year prior to survey (Figure 37). While use of any fertilizer was approximately equal between Bridge Phase and comparison households, use of granular fertilizer was more common in comparison villages, while liquid fertilizer was more common in Bridge Phase villages.

FIGURE 37: FERTILIZER USE ON COCOA FARMS

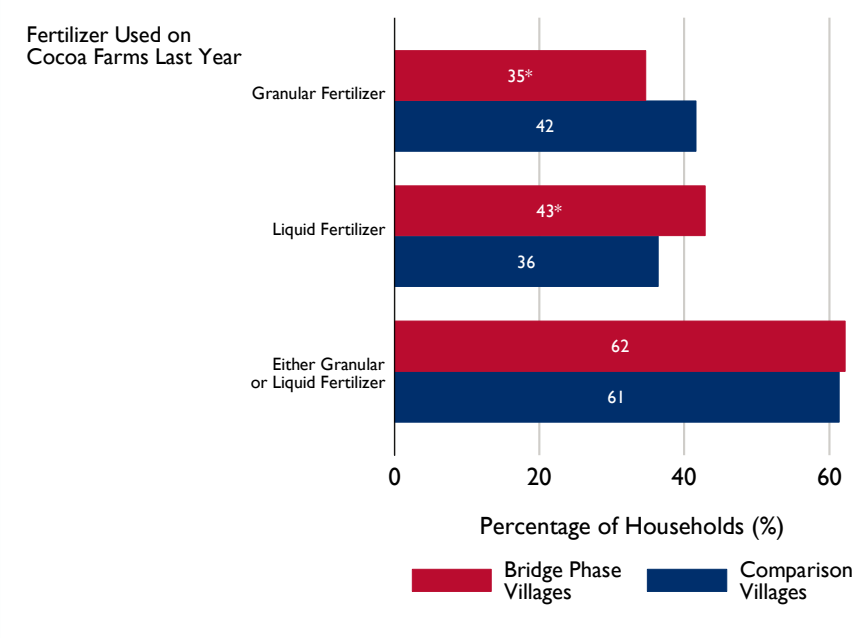
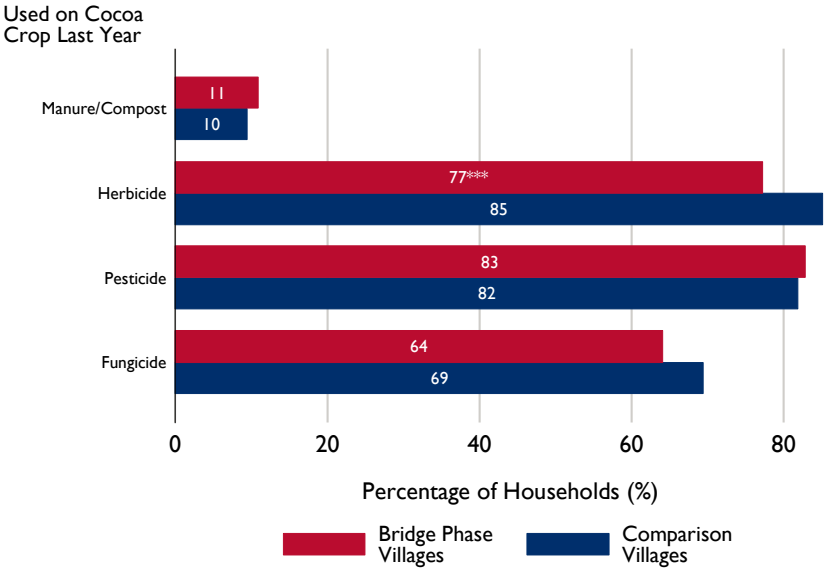


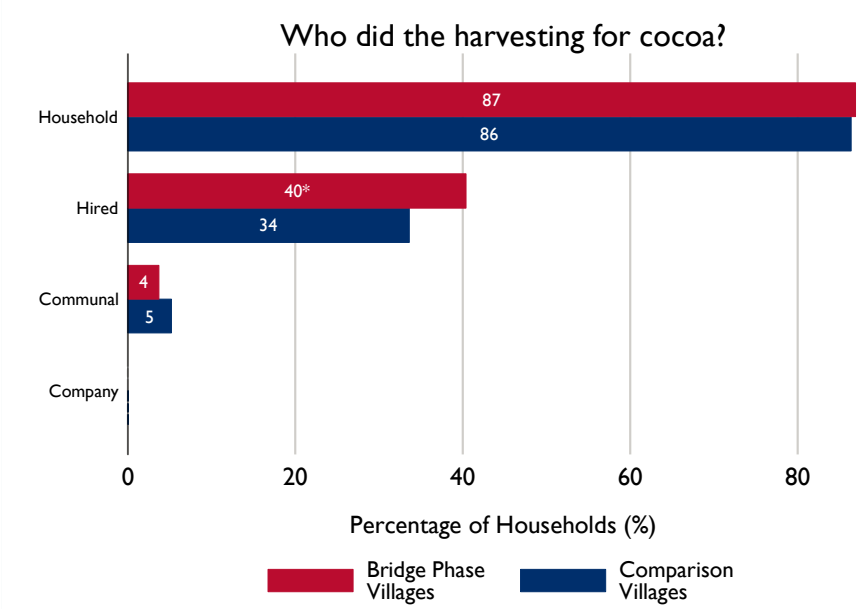
FIGURE 38: MANURE USE AND PEST CONTROL ON COCOA FARMS



Nearly all households in the sample, or 97 percent, reported harvesting cocoa during the year prior to survey, using a combination of household, hired, and communal labor (Figure 39). Most households (87 percent) participated in cocoa harvesting on their own farms, with 59 percent relying solely on household labor. Approximately 36 percent of households used hired labor, and 12 percent relied solely

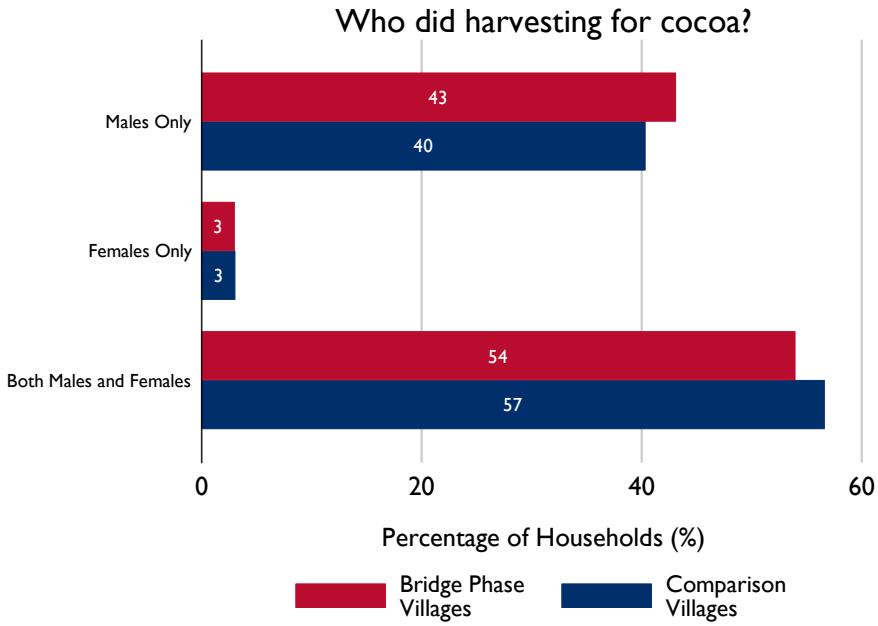
on hired labor. Communal labor was uncommon, reported by just 5 percent of all households; just 1 percent reported they relied solely on communal labor. Only one household in the sample reported using labor from a company to complete the cocoa harvest.

FIGURE 39: LABOR SOURCE FOR COCOA HARVEST



Both men and women contributed labor for cocoa harvesting, with 41 percent (N=286) of households reporting cocoa harvesting labor provided solely by men and 56 percent (N=384) of households reported men and women contributing labor for cocoa harvesting (Figure 40). Harvesting solely by women was very uncommon, reported by only 3 percent (N=21) of households.

FIGURE 40: LABOR SOURCE FOR COCOA HARVEST (GENDER)



On-farm fermentation of cocoa beans in a Bridge Phase Community

PHOTO BY LAUREN PERSHA

COCOA REVENUE

On average, households in the sample reported earning $1,647.12 in cocoa revenue in the year prior to survey (2018-19), with households in Bridge Phase villages reporting significantly higher revenue ($2,208.79) than comparison households ($1,290.87). Figure 41 shows the distribution of cocoa revenue per household. Twenty-five percent of all households earned less than $450 in cocoa revenue, and 50 percent earned less than $900. On a per hectare basis (Figure 42), average household cocoa revenue for the sample was $909.70 per hectare. Twenty-five percent of households reported earning $209 per hectare or less, while 50 percent reported earning $398 or less per hectare.[30] Again, households in Bridge Phase villages appeared to be more productive, earning $701.41 more per hectare from cocoa, on average, than households in comparison villages.

[30] Cocoa income was not significantly correlated with household engagement in gold mining or other non-farm activities (Households with lower cocoa income were not more likely to be engaged in non-farm activities).

FIGURE 41: COCOA REVENUE

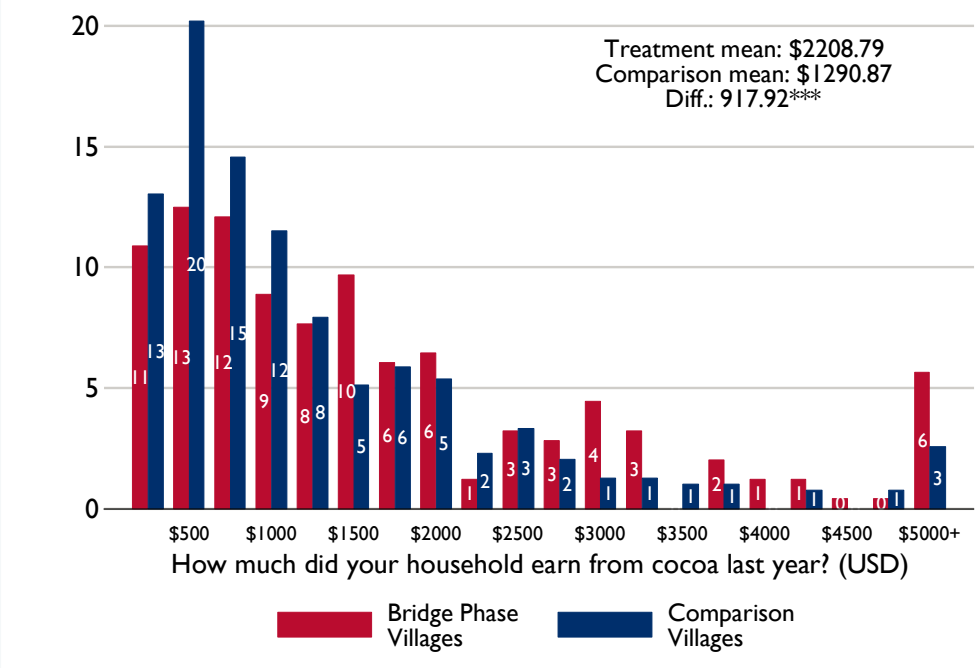
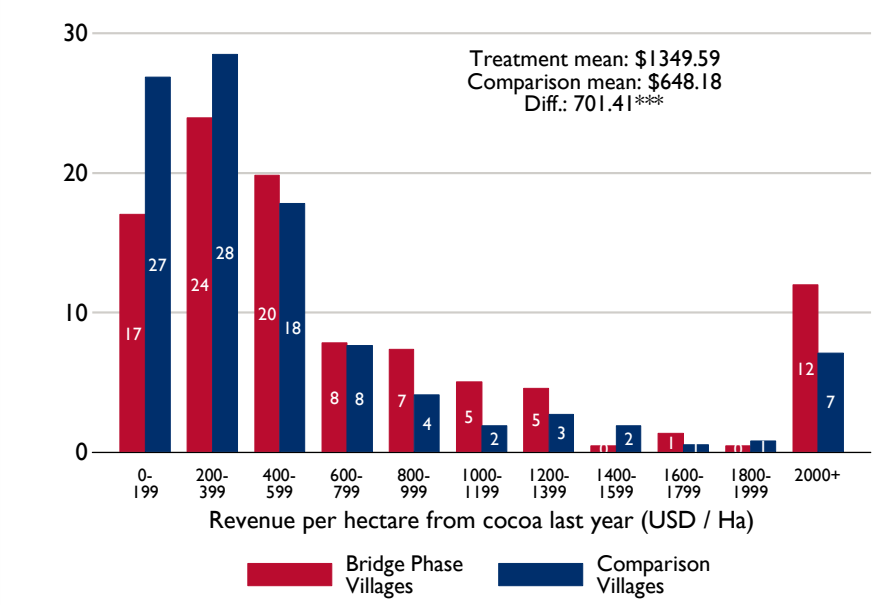


FIGURE 42: COCOA REVENUE PER HECTARE



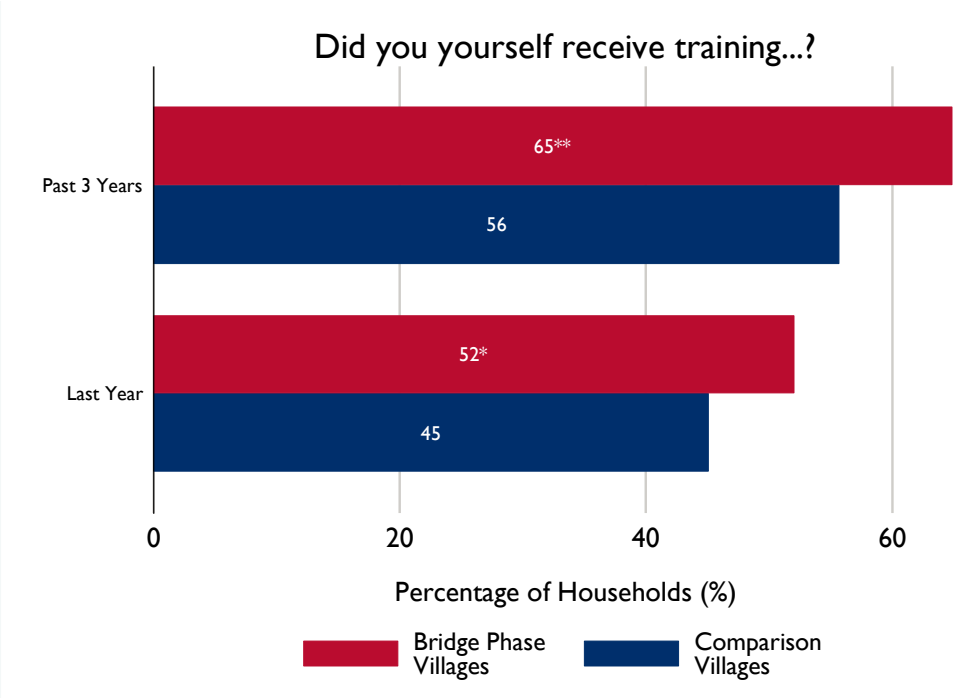
COCOA TRAINING AND REPLANTING

The share of respondents who reported any training related to cocoa farming over the past year alone was 48 percent (N=340 respondents) (Figure 43). For households who were able to report the number of days of training they received over the past three years (N=440, or 62 percent of the household sample), the number of training days received over the past three years was small, with 67 percent (N=294) of respondents reporting one to two days, and another 21 percent (N=94) of respondents reporting three to five days. Only five percent (N=20) of respondents reported receiving more than ten days of training on cocoa farming over the past three years. The topics of these trainings ranged fairly

widely, and were most commonly reported to consist of production practices (10.8 percent of respondents); a combination of production practices, environmental practices, and pest and disease management (10.8 percent of respondents); or a combination of production practices and pest and disease management (13.7 percent of respondents). Multiple sources of these trainings were also reported, with government extension offices (MOFA / Cocoa Health Extension Division) as the most common source, reported by 48 percent of respondents (N=213) who had received any training during this time period. The second most common source of training was COCOBOD, reported by 22 percent of respondents (N=98) who had received any training in the past three years.

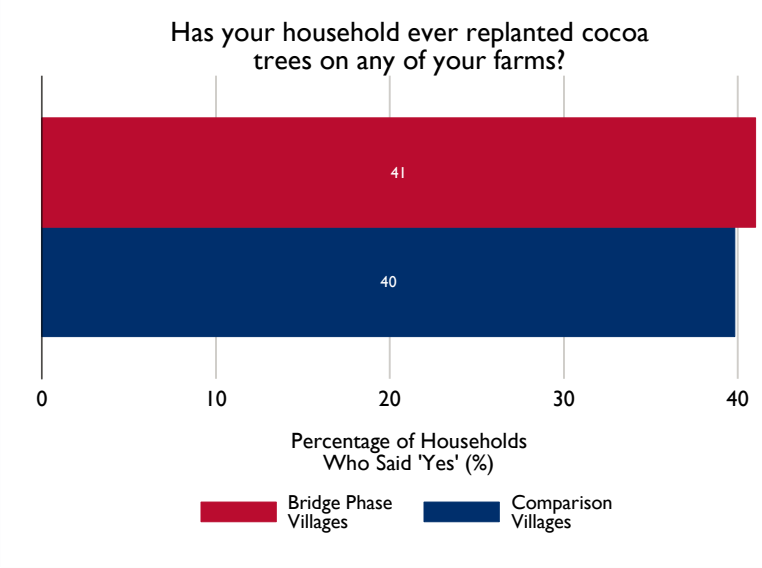
The qualitative fieldwork provided additional context on the perceived state of technical assistance in the area. Farmers mentioned a decline in government technical services in recent years, citing that public extension officers offer faulty advice or no longer pay visits. As one participant put it, *"Farmers in Ghana really suffer. Extension officers come here with promises but we don't see the actuality. We used to have Agricultural [government] extension officers but they are no longer in service"* (Male GD participant, Kramokrom). On at least three farms measured for carbon stocks, farmers said they cut all of their shade trees at the recommendation of government extension officers, who said the trees harbored disease. At least one of these farmers reported that productivity declined after this decision. In response to these declining government services, GD participants in Meteameba said they have begun relying more heavily on private companies such as Abrabopa and FECO for technical advice.

FIGURE 43: TRAINING RELATED TO COCOA FARMING



Overall, 40 percent of households in the sample (N=287) reported ever having replanted cocoa trees on any of their farms. The share of households who have ever replanted cocoa trees was approximately equal across Bridge Phase and comparison villages (Figure 44).

FIGURE 44: COCOA TREE REPLANTING

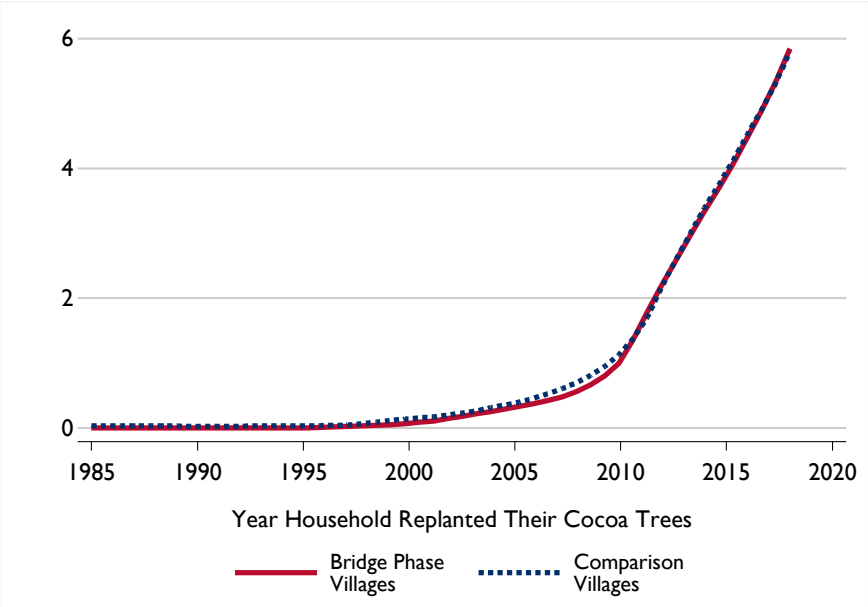


"When you cut the trees down, [then] it means the land [will be] taken from you. So, you cannot cut it down, but [instead just] wait if a single fruit comes on it – then you go and pluck that" (GD participant, Koduakrom)

"You have to cut down the trees because of the disease. That is why its maturity has decreased." (GD participant, Koduakrom)

Figure 45 shows the trends in cocoa tree replanting, plotting the percentage of households who said they had replanted trees in each year. The figure shows that almost no replanting occurred until 2004, and that the vast majority of cocoa replanting had occurred since 2015. There was a clear upward trend in the graph starting around 2009. Replanting trends were parallel for Bridge Phase and comparison households, with very similar percentages reporting replanting in each year across the two groups.

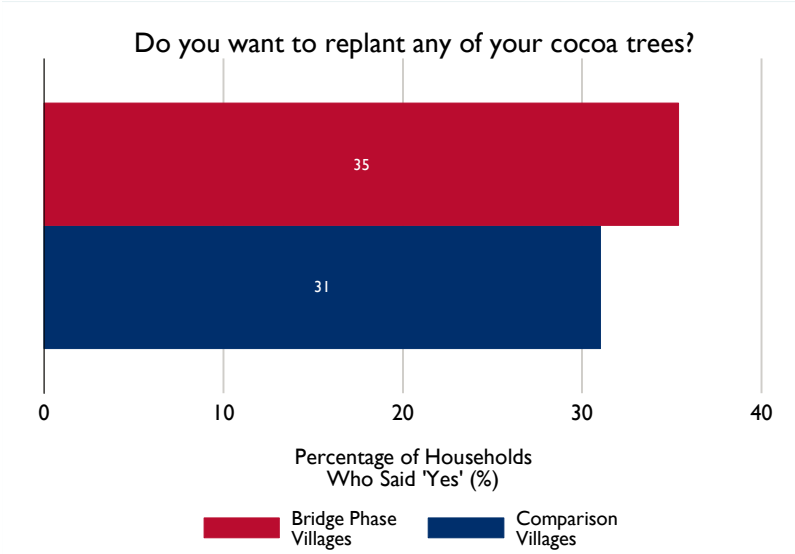
FIGURE 45: COCOA TREE REPLANTING TRENDS



As most replanting was reported to have occurred in the past five years, it is not surprising that only 44 percent (N=124) of households who had replanted reported seeing an improvement in cocoa yield after the replanting. Another 50 percent (N=142) said they had not yet seen an improvement in yields, as the trees were still too young and had not reached production stage. Households reported a variety of ways they had financed the replanting, with the majority of households (76 percent) who had replanted (N=219) reporting the replanting was self-financed. Other common sources of financing for replanting efforts were family or friends (N=32, or 11 percent), and licensed buying companies or purchasing clerks (N=16, or 6 percent). Most of this earlier replanting was reported as not being part of a cocoa farm rehabilitation program. Of the households that reported replanting, 14 percent (N=40 households) said this was part of a cocoa farm rehabilitation program. For the 40 households in the sample who were previously engaged in a cocoa farm rehabilitation program, 39 percent (N=15) reported this was part of a government extension program (MOFA), and 23 percent (N=9) reported being part of a COCOBOD rehabilitation program. Another 23 percent (N=9) reported being part of a farm rehabilitation program through ECOM, beginning in 2016 or onwards.

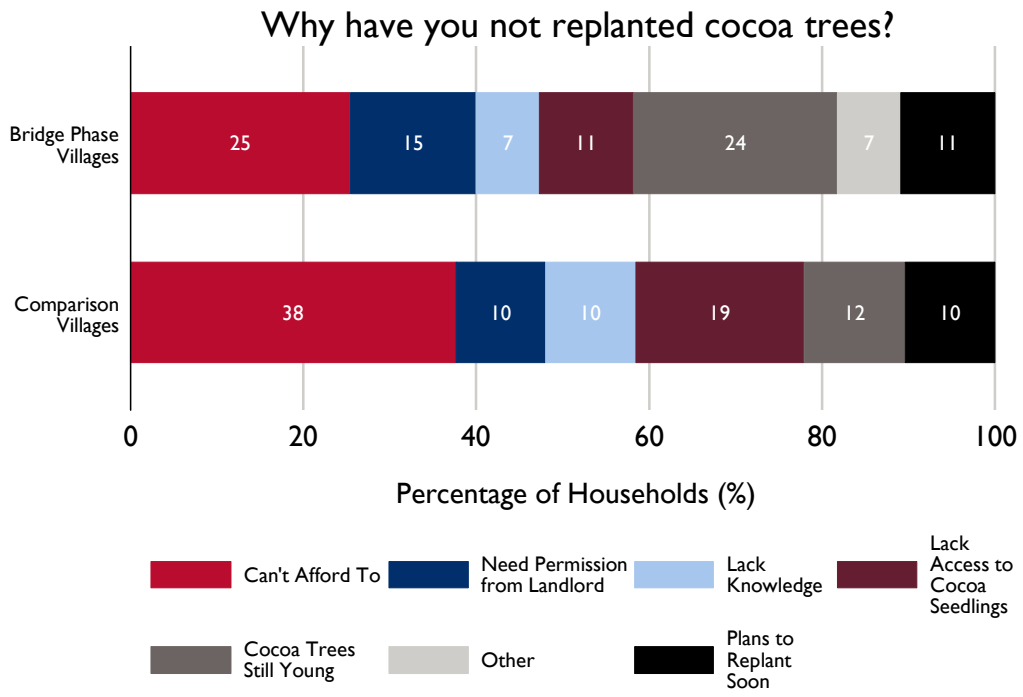
The 425 households (60 percent) who had never replanted cocoa trees were asked whether they would like to replant any of their trees. Approximately 33 percent of these households (N=138) reported a desire to replant cocoa trees. Figure 46 shows that the percentage of respondents expressing this desire was slightly higher in Bridge Phase households (35 percent) than comparison households (31 percent), but the difference was not statistically significant.

FIGURE 46: DESIRE TO REPLANT COCOA TREES



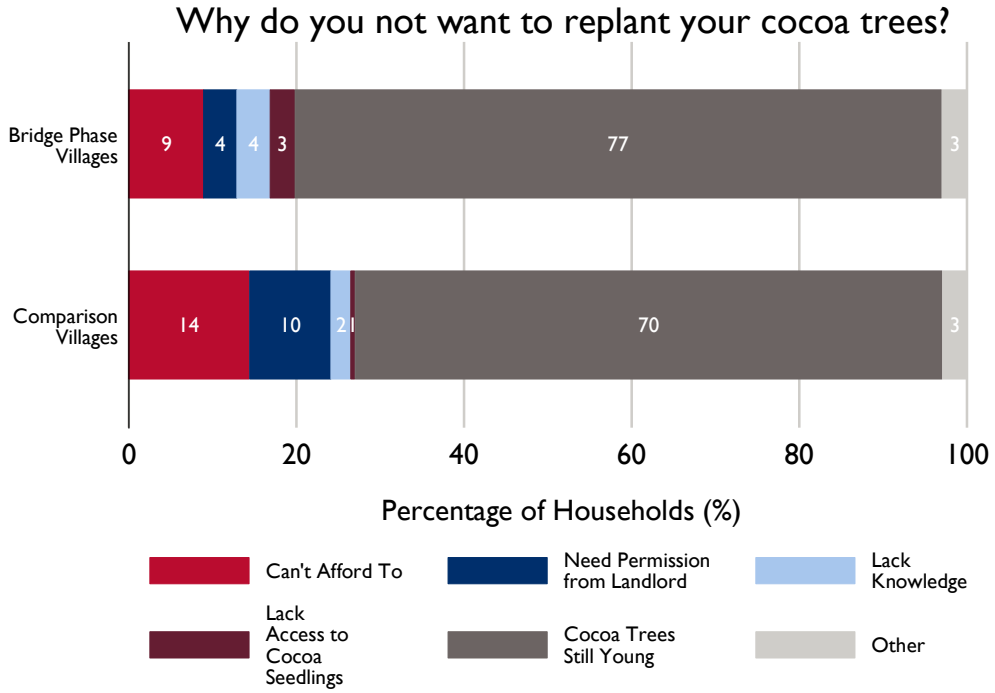
Households who had never replanted cocoa trees but who expressed a desire to replant were then asked why they had not yet replanted any trees. Responses are shown in Figure 47. Approximately 10 percent of these respondents reported that they planned to replant soon. The most common reason for not having replanted was not being able to afford to replant (30 percent), followed by a lack of access to new cocoa seedlings (16 percent), while 11 percent of these respondents reported they did not have permission from their landlords and 9 percent reported not having sufficient knowledge to replant. Some differences were seen across Bridge Phase and comparison households, with a greater share of comparison households reporting they could not afford to replant or lacked access to cocoa seedlings, while a greater share of Bridge Phase households reported they had not replanted because their cocoa trees were still too young to replant.

FIGURE 47: REASONS FOR NOT REPLANTING COCOA TREES



Households who had never replanted cocoa trees and said they did not want to replant were asked their reasons for not wanting to replant. Seventy-three percent (N=200) of these households said their cocoa trees were too young, while 12 percent (N=34) reported they could not afford to do so. As shown in Figure 48, responses were similar across Bridge Phase and comparison households.

FIGURE 48: REASONS FOR NOT WANTING TO REPLANT COCOA TREES



Overall, 44 percent of households reported they would be interested in participating in a new farm rehabilitation program if one was offered in their village. Figure 49 shows that interest was higher in Bridge Phase villages (50 percent of households) than in comparison villages (40 percent of households). The main reasons households reported not being interested were similar to those seen above (Figure 50). Forty-eight percent of these households said their trees were too young to replant, while 23 percent reported they could not afford to replant. Ten percent reported they would need more information.

FIGURE 49: INTEREST IN FARM REHABILITATION PROGRAMS

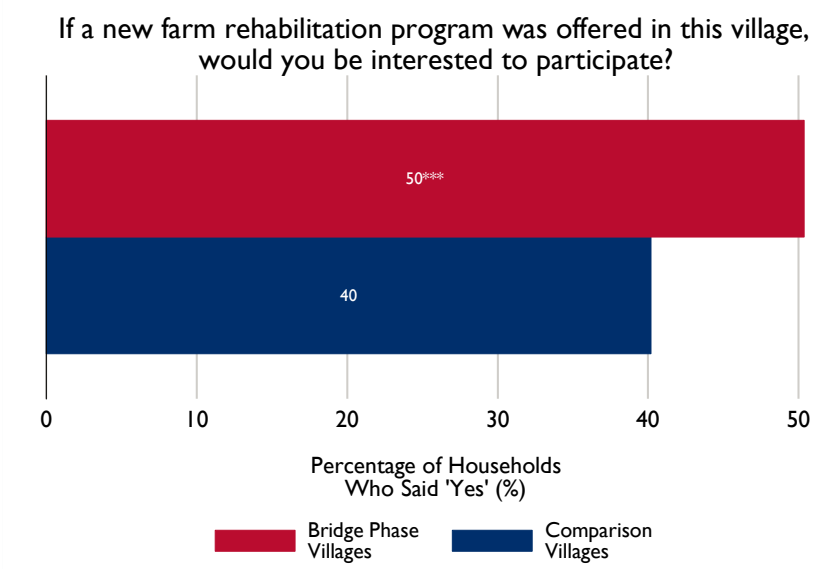
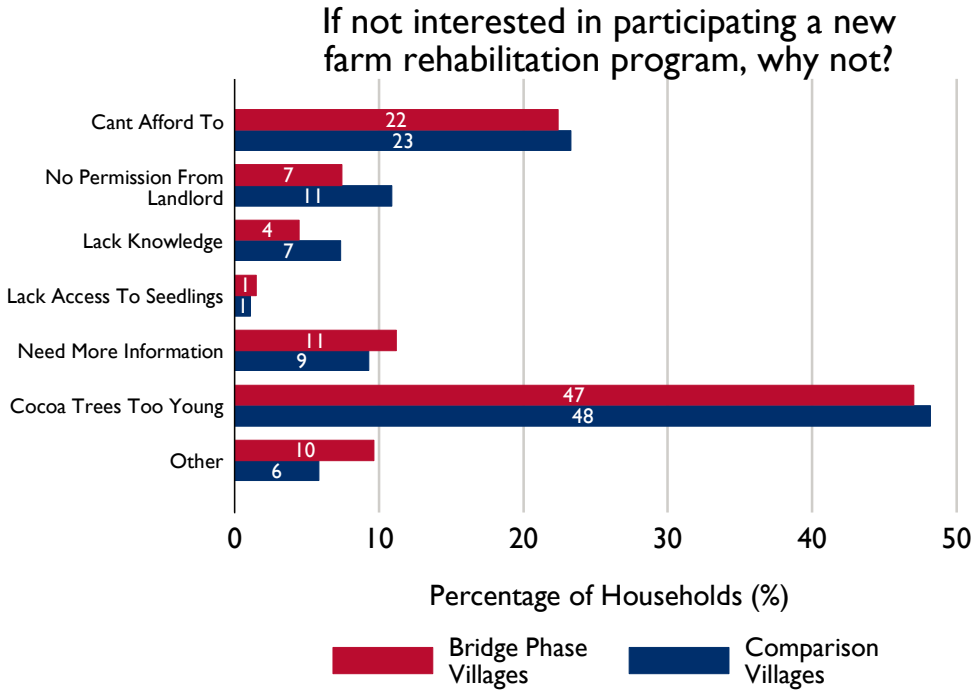


FIGURE 50: REASONS FOR DISINTEREST IN FARM REHABILITATION PROGRAMS



Seventy-five percent of households (N=527) said they had the right to cut and replant their cocoa farms if they wanted to. Among households that said they did not have the right to replant their farms, 67 percent (N=118 households) reported having no type of land documentation recognizing their right to use their farms (Table 18). Chapter 3 provides additional reporting on these issues at the farm-level, including discussion on how the household's mode of farm acquisition related to the respondent's perceived right and expressed interest to engage in future cocoa tree replanting or farm rehabilitation.

TABLE 18: LAND DOCUMENTATION AND REPLANTING RIGHTS

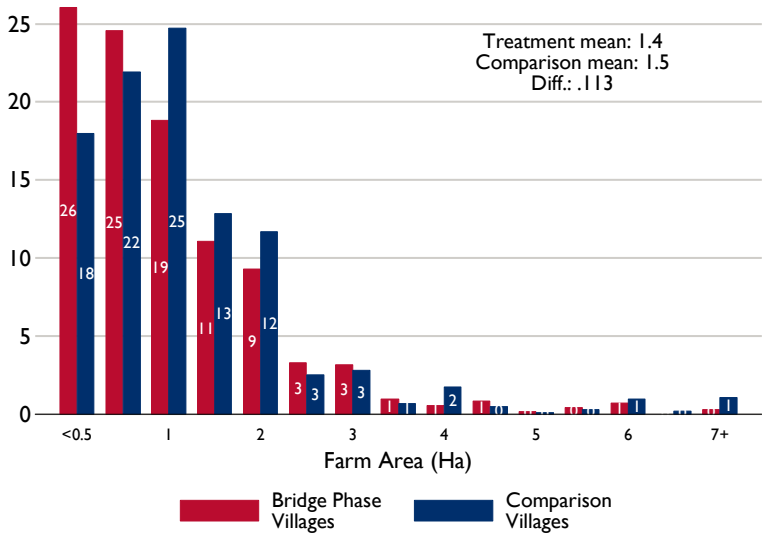
	Do you have the right to cut and replant your cocoa farms, if you wanted to?		
Do you have any land documentation that recognizes your right to use any of your cocoa farms?	**No N (%)**	**Yes N (%)**	**Total N (%)**
No	118 (67.0%)	257 (48.8%)	375 (53.3%)
Yes	58 (33.0%)	270 (51.2%)	328 (46.7%)
Total	176 (100%)	527 (100%)	703 (100%)

FINDINGS 3: FARM ACQUISITION AND TENURE SECURITY

FARM CHARACTERISTICS / FARMS OVERVIEW

The baseline survey asked households a series of questions about the farm plots that households used or controlled in their village in 2018. In total, surveyed households used or controlled 1,794 separate farm plots in 2018, including 746 farm plots in Bridge Phase villages and 1,048 in comparison villages. On average, each household used or controlled 2.5 farms, with an average of 2.7 farms per household in Bridge Phase villages and 2.4 farms per household in comparison villages.[31]

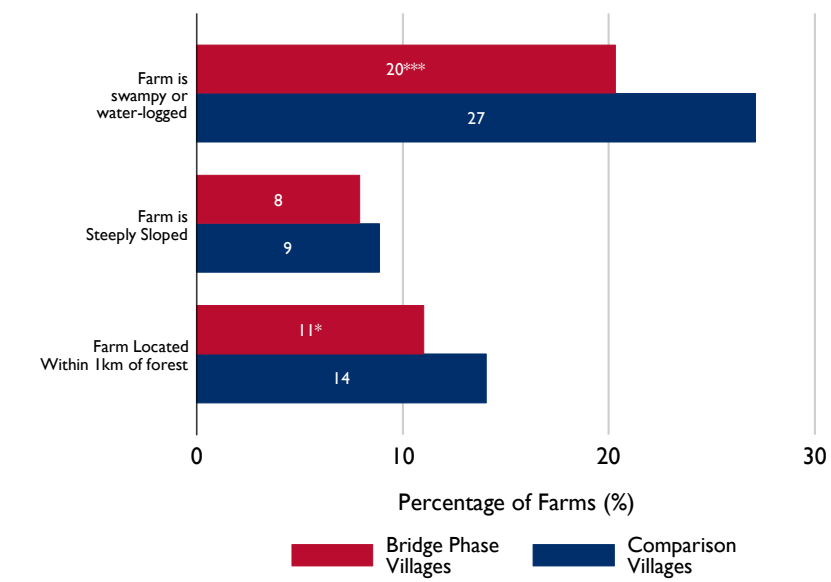
FIGURE 51: FARM AREA



Plots farmed by households in the sample had an average area of 1.4 hectares per farm. A high percentage of farms were small, with 21 percent of farms reported to be less than 0.5 hectares in area, and 23 percent reported between 0.5 and 1 hectare. Just 10 percent of all farms were 2 hectares or greater. Figure 51 shows the distribution of farm size for Bridge Phase and comparison farms. Both groups of farms were similar in size.

[31] Survey enumerators were trained to define farms as a contiguous piece of land held by a member(s) of the household, acquired under the same arrangement, and for which the land use is consistent (for example, crops and/or animals are grown or raised under the same cultural practices across the plot). Where a plot had portions that were obtained under different arrangements and/or time periods, or held by different individuals within the same family, these were defined as separate farms.

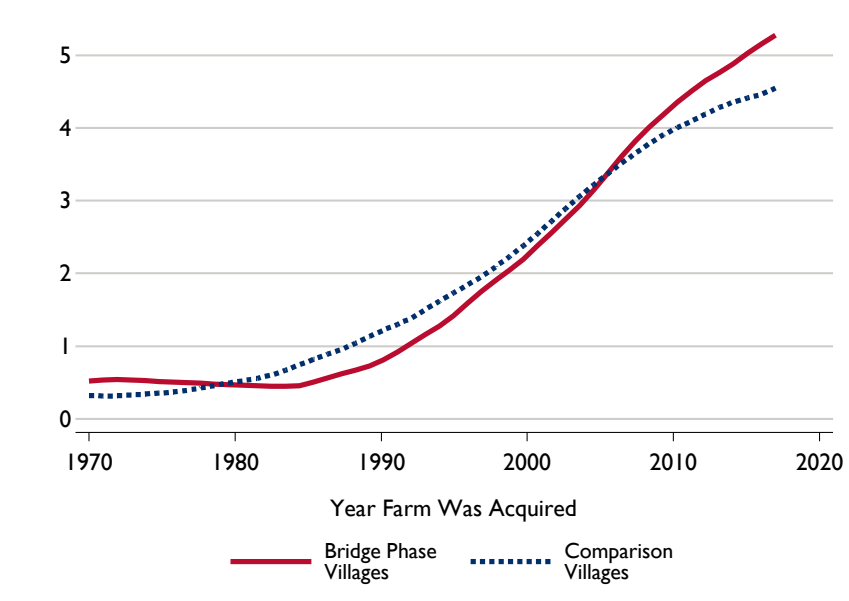
FIGURE 52: FARM SITE CONDITIONS



Approximately 24 percent of all farms were located in a swampy or water-logged area, though such farms were less common in Bridge Phase villages (20 percent) than in comparison villages (27 percent). Eight percent of farms were located on land that was steeply sloped, and 13 percent were located within 1 km of a government forest reserve (Figure 52).

Figure 53 shows the percentage of all farms acquired in each year since 1970, by treatment status. For example, the figure shows that slightly more than two percent of all farms currently held by Bridge Phase households were acquired in 2000. In Bridge Phase and comparison villages, the percentage of farms that were acquired between 1970 and 1990 was low, while acquisition rates increased after 1990 and through 2019. This suggests that many plots held by households in the sample were relatively recent acquisitions. Half of all farms in the baseline sample were acquired in 2008 or later.

FIGURE 53: FARM ACQUISITION TRENDS

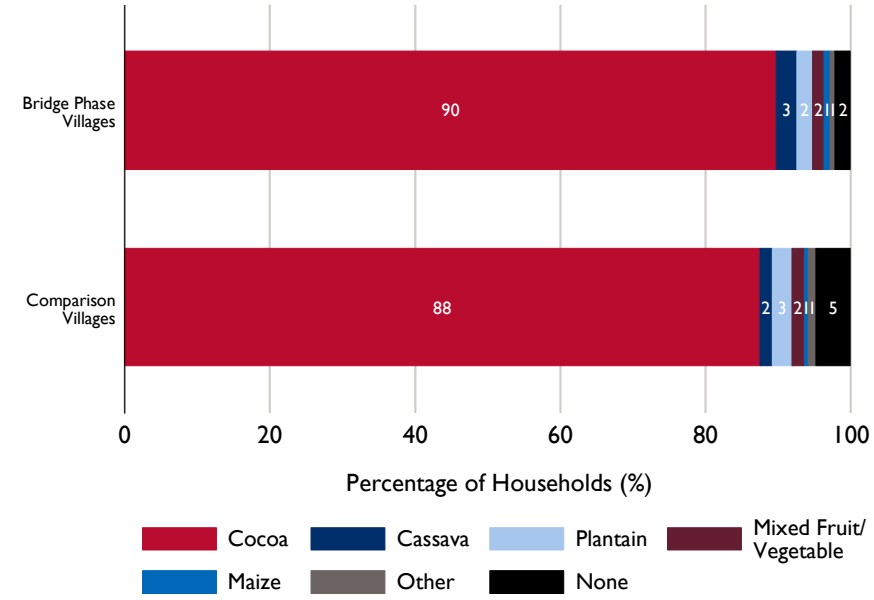


Cocoa was grown on nearly all farms, and was the most important crop on 90 percent of Bridge Phase and 88 percent of comparison farms (Figure 54). Plantain was the most important crop for 2.5 percent of all farms, and cassava was the most important crop grown on two percent of farms. Households said there was no most important crop for 3.5 percent of all farms, a response that could indicate the land

was being left fallow or that the household did not identify one single crop as the most important.

The data provided an indication that households for which cocoa was the most important crop were also better-off economically than households who reported any other crop as their most important crop. However, this correlation should not be taken as evidence that farming cocoa causes households to be better off; for example, poorer households may simply not have the resources required to engage in cocoa farming. Households whose most important crop was cocoa earned $449.43 more in total income, on average, compared to those whose most important crop was any other crop. However, this difference was not statistically significant. The average likelihood of poverty at the $1.25 per day level (2005 PPP) was approximately 2.9 percentage points lower for households whose main crop was cocoa. This difference was statistically significant at the 95 percent confidence level.

FIGURE 54: MAIN CROPS GROWN ON FARMS



MODE OF ACQUISITION

In both Bridge Phase and comparison villages, households most commonly acquired their farms through *abunu* land agreements with another individual or family. Approximately 38 percent of all farms were acquired through *abunu* agreements, and Table 19 shows that this mode of acquisition was more common in Bridge Phase villages (44 percent of farms) than in comparison villages (34 percent). Other common means of acquiring farms included inheriting the farm through the father's line (20 percent of all farms), inheriting through the mother's line (9 percent), and through rights as a landowning family member (11 percent).

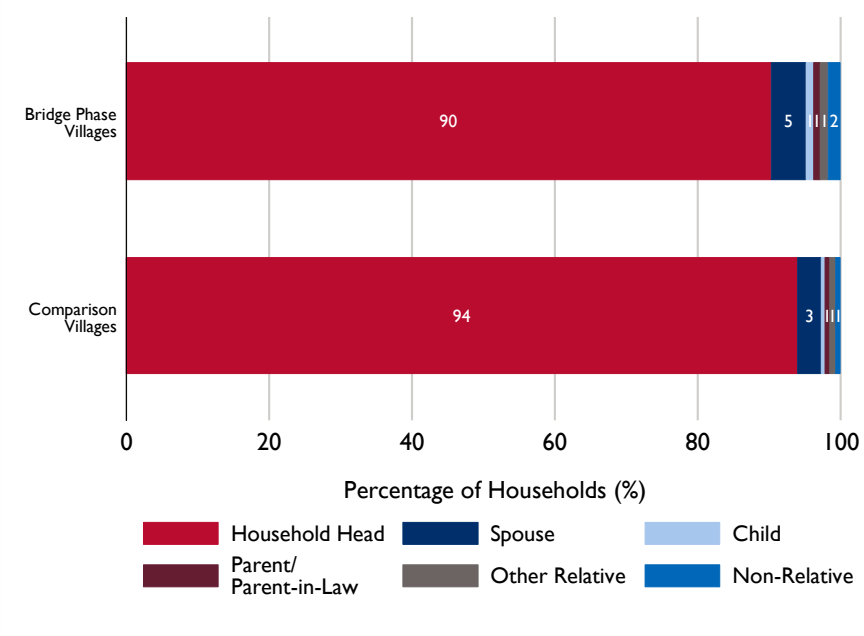
Ten percent of all farms were acquired through direct purchase of the land, with six percent acquired through direct purchase from a village chief and four percent through direct purchase from a landowning family. Non-*abunu* customary land agreements were less common, with four percent of farms acquired through *abusa* agreements, one percent acquired through *asidee* agreements, and three percent acquired through another type of land agreement.

TABLE 19: MODE OF FARM ACQUISITION

	Bridge Phase villages		Comparison villages		Total	
How did your household acquire rights to this farm?	**N**	**(%)**	**N**	**(%)**	**No.**	**(%)**
Through an *abunu* land agreement with another individual or family	327	(44%)	359	(34%)	686	(38%)
Inherited farm through father's line	84	(11%)	279	(27%)	363	(20%)
Through my rights as landowning family member	71	(10%)	117	(11%)	188	(11%)
Inherited farm through mother's line	59	(8%)	96	(9%)	155	(9%)
Through direct purchase from chief	60	(8%)	51	(5%)	111	(6%)
Through direct purchase from landowning family	44	(6%)	29	(3%)	73	(4%)
Through an *abusa* land agreement with another individual or family	38	(5%)	41	(4%)	79	(4%)
Through another type of land agreement	19	(3%)	26	(2%)	45	(3%)
Received farm as a gift	18	(2%)	25	(2%)	43	(2%)
Through an *asidee* land agreement with another individual or family	11	(1%)	5	(0%)	16	(1%)
Inherited from another family member	4	(1%)	6	(1%)	10	(1%)
Direct purchase from another household	1	(0%)	7	(1%)	8	(0%)
Obtained as collateral	3	(0%)	1	(0%)	4	(0%)
Caretaker	3	(0%)	2	(0%)	5	(0%)
Other, specify	1	(0%)	2	(0%)	3	(0%)
Total	**743**	**(100%)**	**1046**	**(100%)**	**1789**	**(100%)**

FARM RIGHTS AND DECISION-MAKING

FIGURE 55: MAIN DECISIONMAKER FOR THE FARM

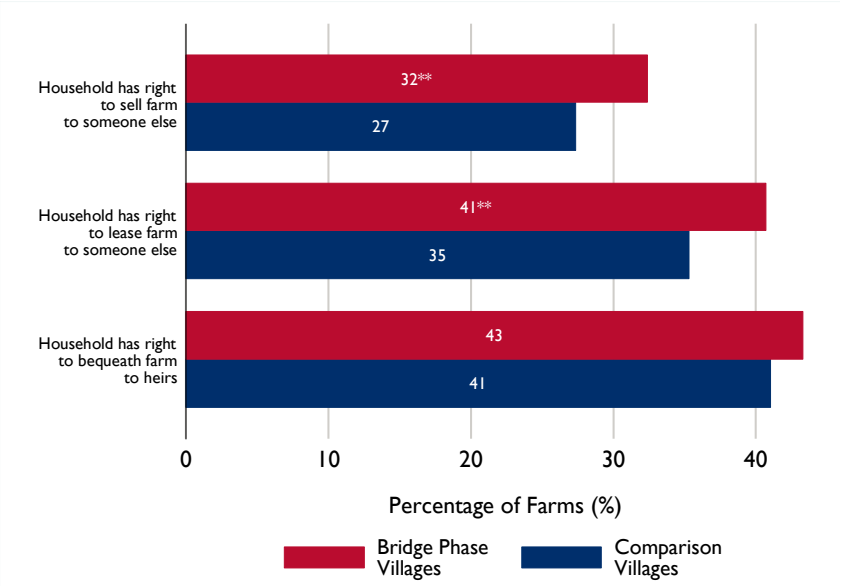


The main decision maker for the farms in the sample was almost universally the household head (92 percent of all farms), as shown in Figure 55. The household head's spouse was the main decision maker for 4 percent of farms. For just 3 percent of all farms, the main decision maker was the household head's child, parent or parent-in-law, or other relative or non-relative.

Households in Bridge Phase villages expressed perceived rights to a higher proportion of their farms than those in comparison villages. As shown in Figure 56, Bridge Phase households reported perceived rights to sell or lease out the farm to someone else for a greater percentage of their farms. In terms of the right to sell the farm to someone else, households in Bridge Phase villages reported having this right for 32 percent of their farms, compared to 27 percent of farms controlled by households in comparison

villages, a difference that was statistically significant. Similarly, there was a statistically significant difference in terms of households' perceived rights to lease out farms, applying to 41 percent of farms controlled by Bridge Phase households, compared to 35 percent of comparison villages.

FIGURE 56: FARM RIGHTS



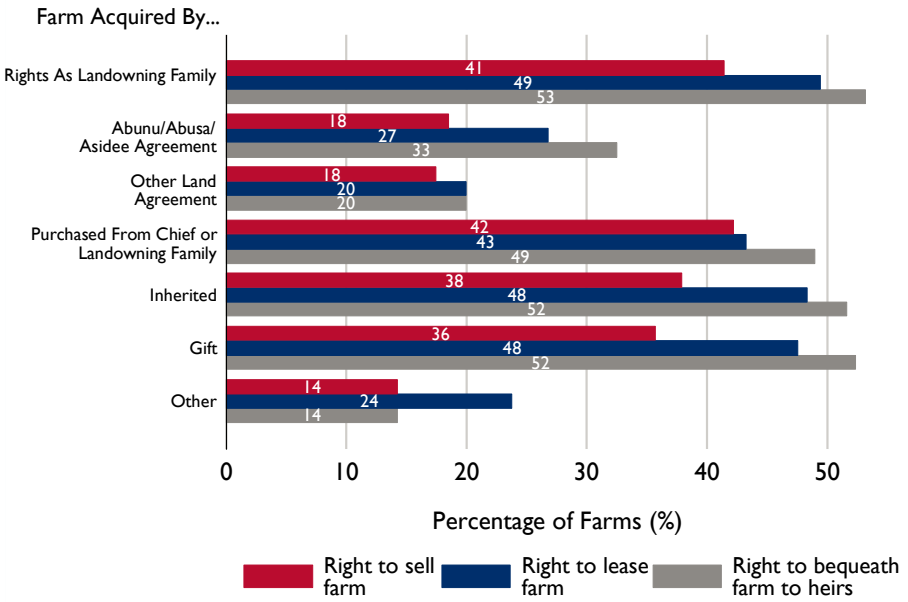
A household's perceived right to sell or lease a farm to someone else, or to bequeath it to heirs, was expected to vary depending on how the household acquired the farm. In particular, households were likely to feel more confident in these rights if the farm was acquired through their position as a landowning family, inherited, or purchased directly, as opposed to farming the plot under an *abunu*, *abusa*, or *asidee* customary arrangement. This contrast is reflected in Figure 57, which shows how the percentage of farms for which households that said they had the rights to sell, lease, or bequeath varies across the different ways that farms were acquired. For example, the figure shows that households said they had the right to sell 41 percent of all farms acquired through the household's rights as a landowning family, but had the same right for just 18 percent of farms acquired through *abunu*, *abusa*, or *asidee* agreements.[32] Overall, households felt more secure in their rights to bequeath a farm to an heir, compared to their perceived rights to sell or lease the farm, regardless of how they acquired the farm. Similarly, households generally felt more secure in their right to lease a farm than in their right to sell it. Across all farm acquisition types, more than half of farms in the sample were held under arrangements where households did not feel they had have the right to sell, lease or bequeath the land. As expected, farms under *abunu*, *abusa*, *asidee*, or other land agreements had a lower percentage of households reporting they have these rights, compared with farms acquired by landowning rights, inheritance, gift, or direct purchase.

The qualitative fieldwork generally supported these findings. Landowning farmers reported having to inform village or stool-level chiefs of their intentions to sell or lease their land, but did not report significant barriers in doing so. These types of sales processes were more likely to be formal and

[32] We group *abunu, abusa and asidee* arrangements together in several charts in this section, as they are the three forms of customary arrangements present in the sample, and because the number of *abusa* and *asidee* farms in the sample are too few to report out on separately. In practice, *asidee* arrangements are generally viewed as more secure than *abunu* or *abusa* agreements. In our sample, *asidee* farms constitute less than one percent of our sample (N= 18 farms) and summarizing them together with the *abunu* and *abusa* farms leads to no material difference in the results.

documented. *Abunu* farmers reported having to obtain permission from landowners before obtaining or transferring land rights, processes that were often informal and less often documented.

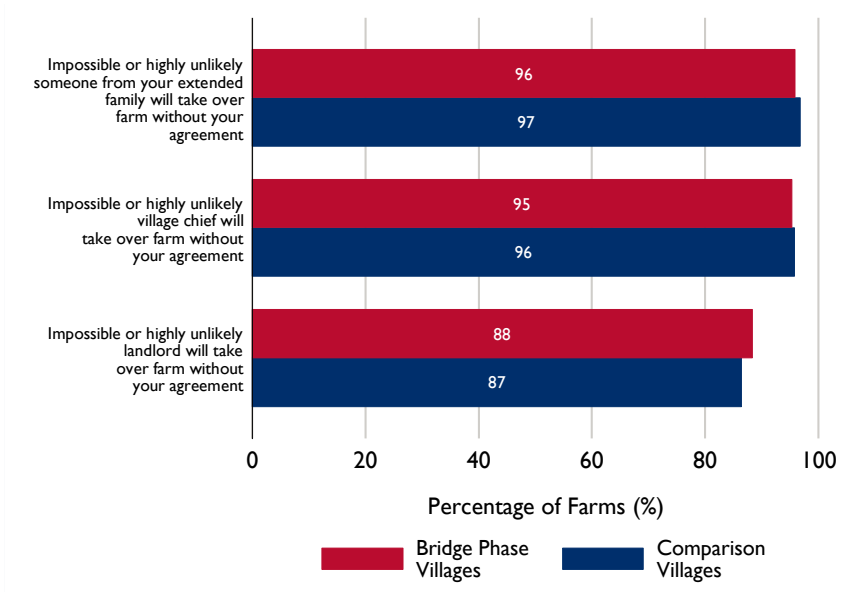
FIGURE 57: FARM RIGHTS, BY FARM ACQUISITION TYPE



TENURE SECURITY

Farms in Bridge Phase and comparison villages were similar in terms of perceived tenure security based on the percentage of households reporting they faced a threat of encroachment by extended family, village chief, or landlord. For over 95 percent of farms, households reported it was either impossible or highly unlikely that someone from their extended family would take over the farm without their agreement during the next one to three years. The same percentage reported it was impossible or highly unlikely the village chief would take over the farm without their agreement during the same time period (Figure 58).

FIGURE 58: TENURE SECURITY, BY TREATMENT STATUS



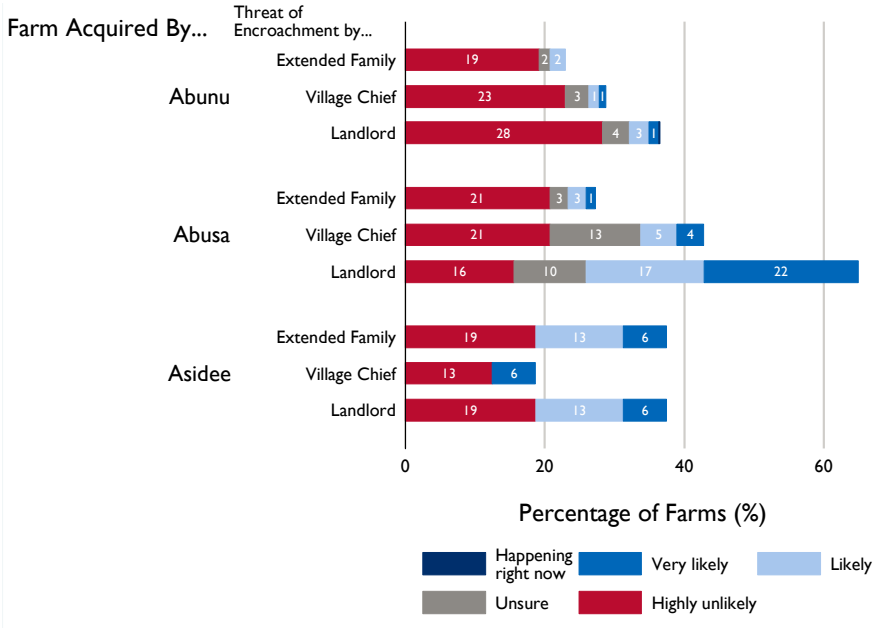
For farms under *abunu*, *abusa*, or *asidee* agreements, households were also asked how likely they

believed it was that the landlord would take over the farm without their agreement in the next one to three years. The percentage of farms where households said this was impossible or highly unlikely was somewhat lower, but still quite high at approximately 88 percent.

Figure 59 looks at these questions in more detail for farms under *abunu*, *abusa*, and *asidee* land agreements, plotting the full distribution of responses to the question on likelihood of expropriation from the household's extended family, the village chief, or the landlord during the next one to three years. The different shades of blue in the graph depict the percentage of farms where households perceived encroachment as likely, very likely, or already happening.

The figure shows that fairly low percentages of farms held by *abunu* farmers were perceived to face a likelihood of encroachment, while the percentages were considerably higher for farms held by *abusa* farmers, particularly for the threat of encroachment by the landlord. Overall, 39 percent of farms under *abusa* agreements were perceived as either likely (17 percent) or very likely (22 percent) to be taken over by the landlord, while just four percent of *abunu* farms were seen as likely (3 percent) or very likely (1 percent) to be taken over. One farm in the sample was reported to have a landlord who was currently encroaching on the farm, and this farm was under an *abunu* agreement. Concerns over expropriation by village chiefs was also greater for farms under *abusa* agreements than for those under *abunu* agreements. For farms under *asidee* agreements, 19 percent were perceived to be likely or very likely to face encroachment by the landlord.[33] However, just 16 households in the sample reported farms under *asidee* agreements, making it difficult to say anything statistically meaningful about these farms.

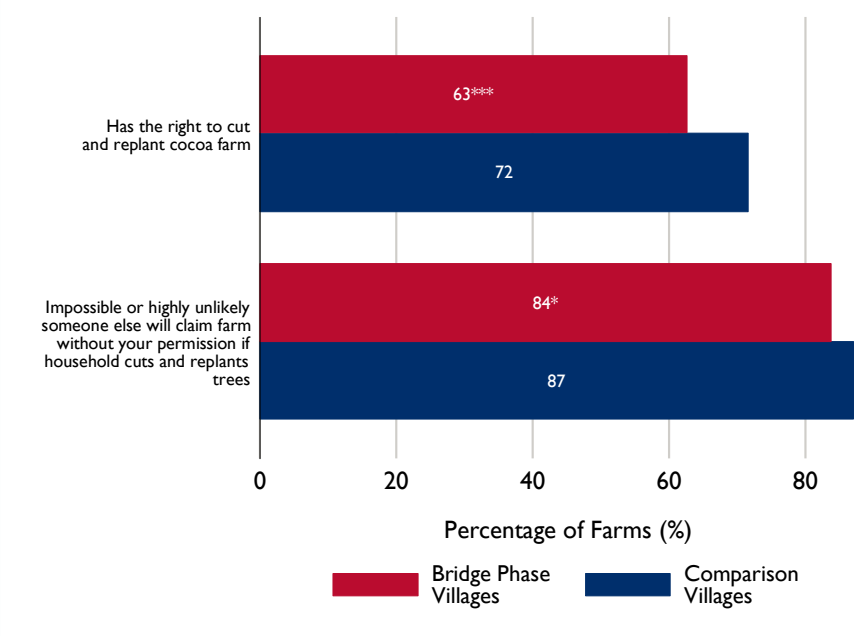
FIGURE 59: TENURE SECURITY (*ABUNU*, *ABUSA*, AND *ASIDEE*)



[33] Though farmers with *asidee* tenancy do not have a landlord in the same sense as *abunu* or *abusa* farmers, they still must pay fees to the divisional chief and have obligations to inform and gain permission from chiefs on land transfers that are not required of Wassa customary landowners (Jiekak and Freudenberger 2019). In the evaluation team's scoping trip group discussions, it was also widely acknowledged that *asidee* arrangements were only made for a small number of farmers at the time of initial village establishment, and it has not been possible to obtain land via an *asidee* arrangement for many years. Chiefs and Wassa landowners have little to gain by giving land away under *asidee* terms, particularly in the current context of land scarcity and loss of Wassa control over land in the area.

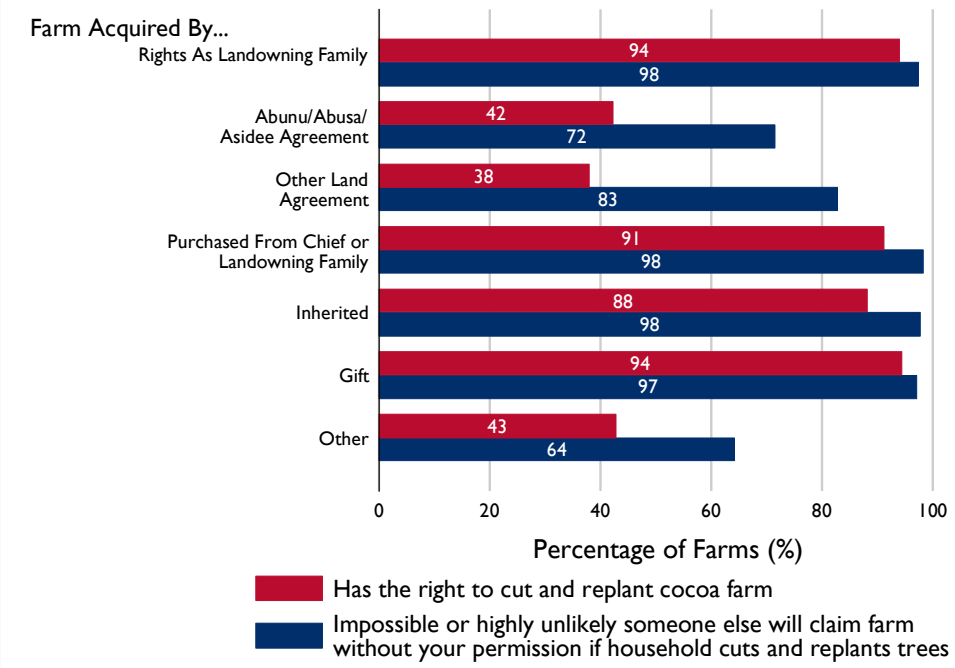
Households reported having the right to cut and replant cocoa trees on 68 percent of farms. For 86 percent of farms, households reported it was impossible or highly unlikely someone else would claim the farm without their permission if the household were to cut and replant the trees. Figure 60 shows that for each of these two questions, perceived rights to replant cocoa trees were slightly lower for farms in Bridge Phase villages than those in comparison villages.

FIGURE 60: REPLANTING RIGHTS, BY TREATMENT STATUS



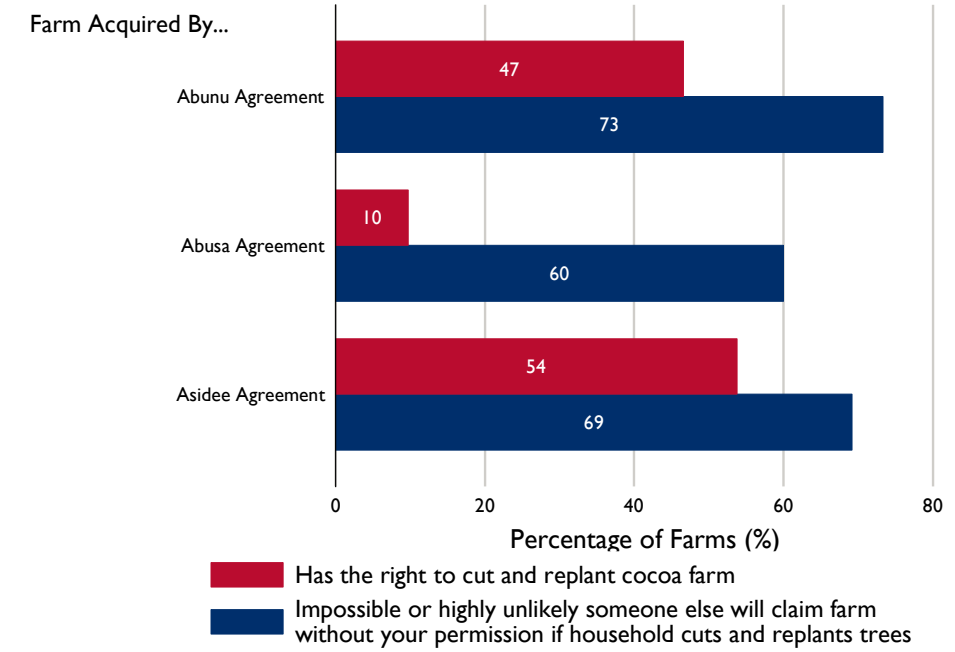
Looking at households' perceived rights to cut and replant cocoa trees by how the farm was acquired, we again see that perceived tenure security was lower for farms under *abunu*, *abusa*, and *asidee* agreements, as well as for those under other land agreements. Figure 61 shows that households reported having the right to cut and replant trees for 94 percent of farms acquired through the household's rights as a landowning family, and for 91 percent of farms acquired through direct purchase, compared to just 42 percent of farms acquired by *abunu*, *abusa*, or *asidee* agreements. Similarly, households reported it was impossible or highly unlikely someone would claim the farm without their permission if they cut and replanted trees for 98 percent of farms acquired through rights as a landowning family, direct purchase, or inheritance, compared to 72 percent of farms acquired through *abunu*, *abusa*, or *asidee* agreements.

FIGURE 61: REPLANTING RIGHTS, BY FARM ACQUISITION TYPE



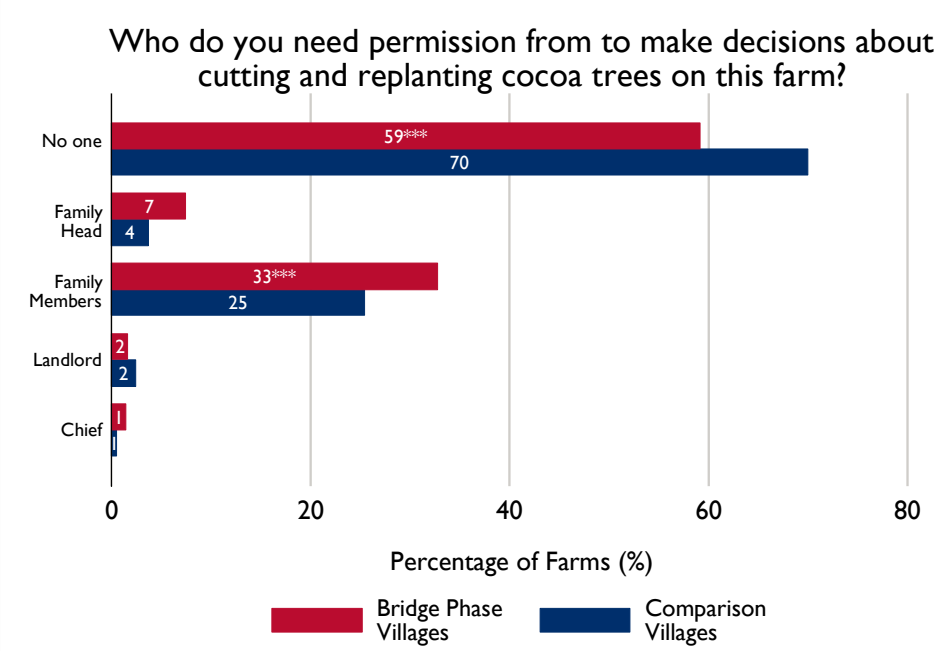
Tenure insecurity related to cutting and replanting cocoa trees was particularly problematic for farms under *abusa* agreements, relative to those under *abunu* agreements. Figure 62 shows that while households reported having the right to cut and replant for 47 percent of *abunu* farms, they reported the same for just 10 percent of *abusa* farms. Similarly, 73 percent of *abunu* farms were perceived to be impossible or highly unlikely to be claimed by someone else if the household cuts and replants the cocoa trees, compared to 60 percent of *abusa* farms.

FIGURE 62: REPLANTING RIGHTS (*ABUNU*, *ABUSA*, *ASIDEE*)



For most farms, households reported they do not need permission from anyone to cut and replant cocoa trees (Figure 63). Farm security appeared higher in comparison villages, where households reported they do not need permission from anyone to cut or replant for 70 percent of farms, compared to 59 percent of farms in Bridge Phase villages. This difference came from a greater percentage of Bridge Phase farms where households say permission to cut or replant was needed from the family head (7 percent, compared to 4 percent of comparison farms) or another family member (33 percent, compared to 25 percent of comparison farms).

FIGURE 63: REPLANTING PERMISSION



Unsurprisingly, a much higher percentage of farms acquired through the household's rights as a landowning family, through inheritance, direct purchase, or as a gift did not need permission from anyone for the household to cut and replant the cocoa trees, compared to farms acquired through *abunu*, *abusa*, or *asidee* agreements. Figure 64 shows that 91 percent of farms acquired through inheritance or landowning family rights did not need permission from anyone to cut and replant, compared to 37 percent of *abunu*, *abusa*, and *asidee* farms. Breaking these farms down further, the pattern was again especially driven by farms under *abusa* agreements, with households saying just 10 percent of these farms did not need permission from anyone to cut and replant, while 40 percent of *abunu* farms said the same. The lower percentage of farms where *abunu* and *abusa* farmers said they could cut and replant without permission was driven by the high percentage of farms for which they said they needed permission from a landlord. Fifty-five percent (N=334) of *abunu* and 89 percent (N=64) of *abusa* farms needed permission from a landlord to cut and replant.

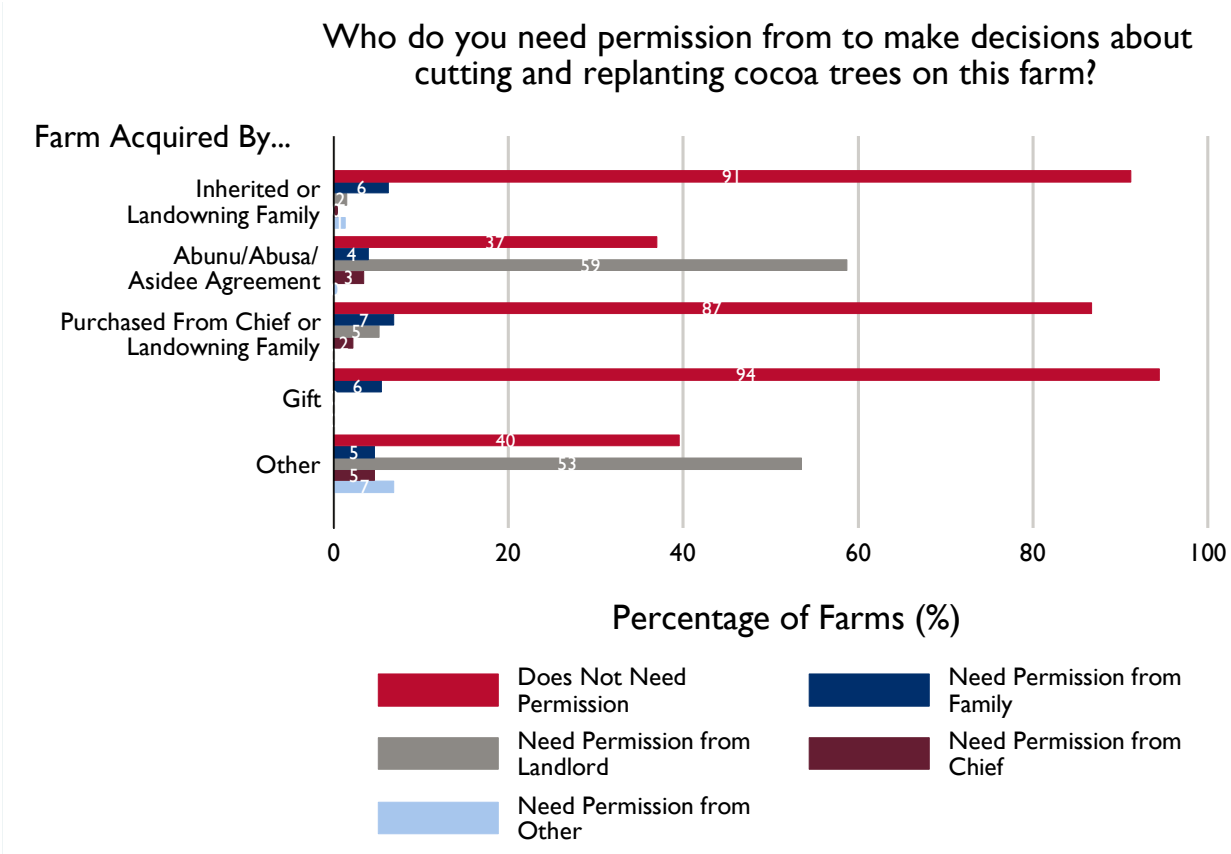
GD participants were also asked whether they are allowed to cut and replant their cocoa trees, and qualitative results largely supported the quantitative findings. In two GDs, respondents said farmers under any tenancy arrangement had the right to cut and replant cocoa trees, though in some cases both landowners and tenant farmers must inform the chief of their intentions. In one GD, however, respondents said tenant farmers did not feel secure cutting trees because landowners would seize the land once it had been cut. This tenure insecurity leaves farmers particularly vulnerable when their trees become unproductive. As one farmer explained:

> "*The land owner won't allow you to manage [unproductive trees]. [He'll say:] 'Let them die and give me back my land…' So because of that, many people are backing out from the cocoa business. Many have left [the community].*" (Male GD participant, Koduakrom)

These disputes can have particularly severe effects on women, who have few alternative sources of income when cocoa yields and associated revenue declines.

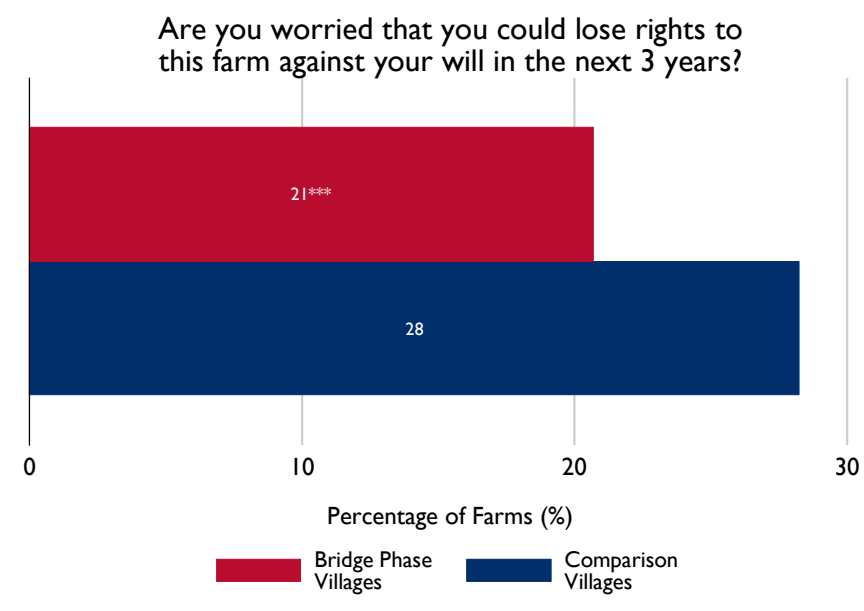
> "*With the cocoa, when the year is due and we harvest the cocoa maybe I have four children, five; it [the income gained] cannot cater for them. And for us women, we are just here, we don't have any other work aside [from] the cocoa which was the reason we followed our husbands [here]. So when the year is due and they don't give us anything, we will just be there doing nothing. For us we have a big problem; we are really suffering.*" (Female GD participant, Koduakrom)

FIGURE 64: REPLANTING PERMISSION, BY FARM ACQUISITION TYPE



Survey questions in the tenure module that were worded in terms of farmer worry over losing rights to their farm against their will suggested a greater level of tenure insecurity than questions framed around likelihood of farms take over by various sources. For a quarter (25 percent) of all farms, households reported being either somewhat or very worried that they could lose the rights to the farm against their will within the next three years. There was a statistically significant difference between Bridge Phase (21 percent) and comparison (28 percent) farms (Figure 65). See Annex F for additional analysis comparing tenure security results for the sample across the different measures of tenure survey that CEL employed on the baseline survey.

FIGURE 65: FARM RIGHTS LOSS - NEXT 3 YEARS



While households were least worried about losing rights to farms acquired through rights as a landowning family, there was relatively little variation across other farm acquisition types. Figure 66 shows that households were worried about 35 percent of farms acquired through land agreements other than *abunu*, *abusa*, or *asidee* arrangements. For farms acquired through *abunu*, *abusa*, or *asidee* arrangements; direct purchase; inheritance; or as gifts, the percentage varied between 25 and 30 percent. Looking in more detail at farms acquired through *abunu*, *abusa*, and *asidee* agreements, however, shows substantial heterogeneity within the group. Again, farms under *abusa* agreements appeared to face the lowest levels of tenure security, with households worried they could lose the rights to 47 percent of *abusa* farms within the next three years. Figure 67 shows that for *abunu* farms, this was only 23 percent.

FIGURE 66: FARM RIGHTS LOSS - NEXT 3 YEARS, BY FARM ACQUISITION TYPE

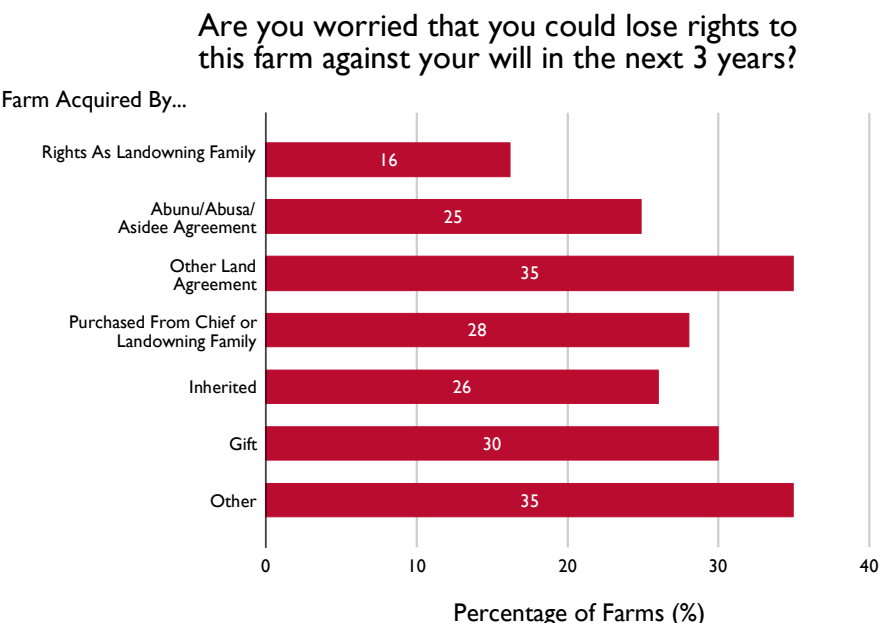
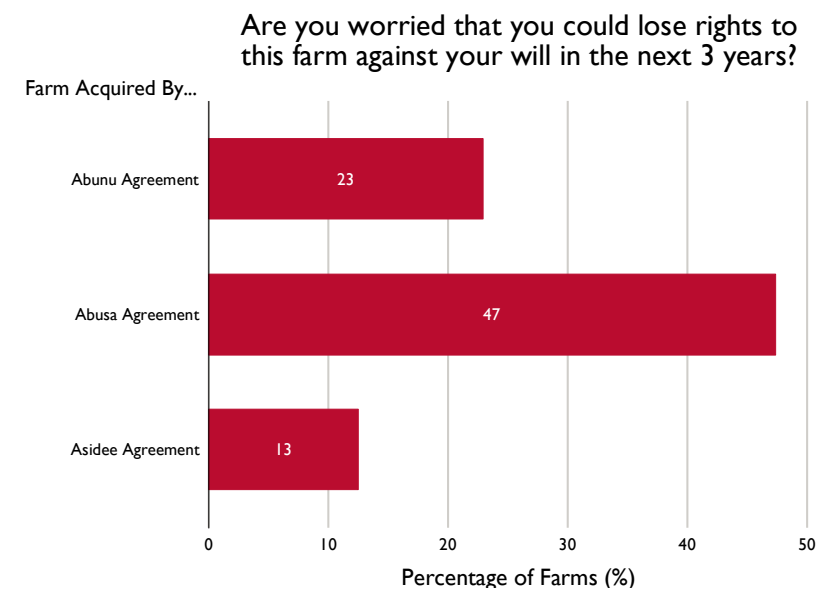


FIGURE 67: FARM RIGHTS LOSS - NEXT 3 YEARS (*ABUNU, ABUSA, ASIDEE*)



For each farm where a household reported they were somewhat or very worried they could lose the rights to the farm against their will within the next three years, respondents were asked the reasons they were worried. These reasons are shown in Figure 68. Among all farms that households were worried about losing rights to, the most common reasons were because the households worried the landlord might ask the household to leave (27 percent; N=120), disagreements with family or relatives (24 percent; N=105), and issues with such local or customary authorities as officials, villages chiefs, or elders (14 percent; N=64). The figure shows some differences between Bridge Phase and comparison villages, with more farms in Bridge Phase villages facing issues with landlords. Family conflicts, farm maintenance costs, and issues with local authorities were more common in comparison villages.

FIGURE 68: FARM RIGHTS LOSS - NEXT 3 YEARS, REASONS

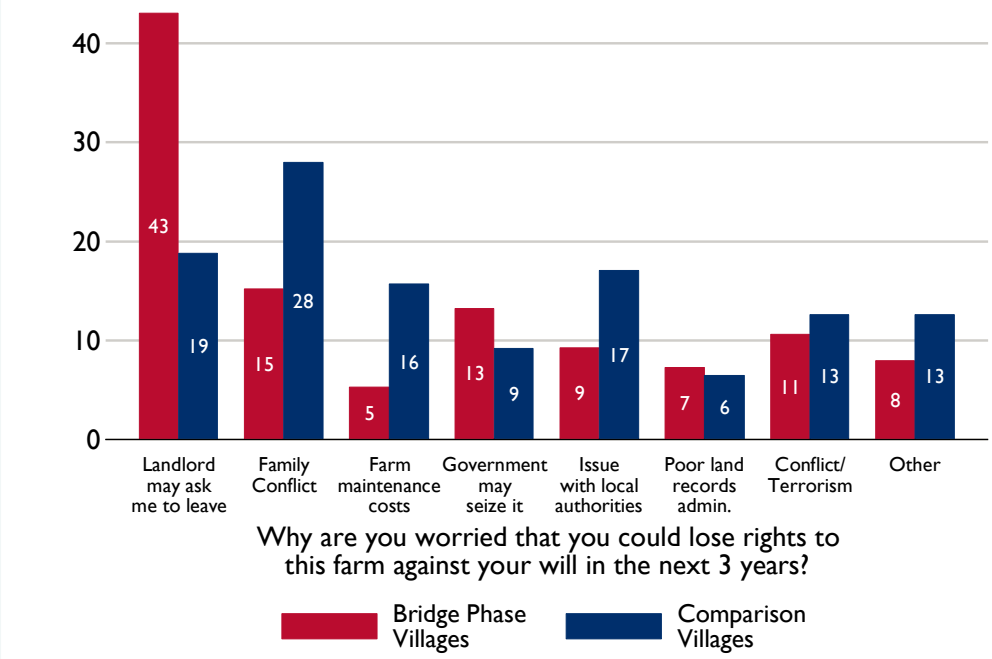
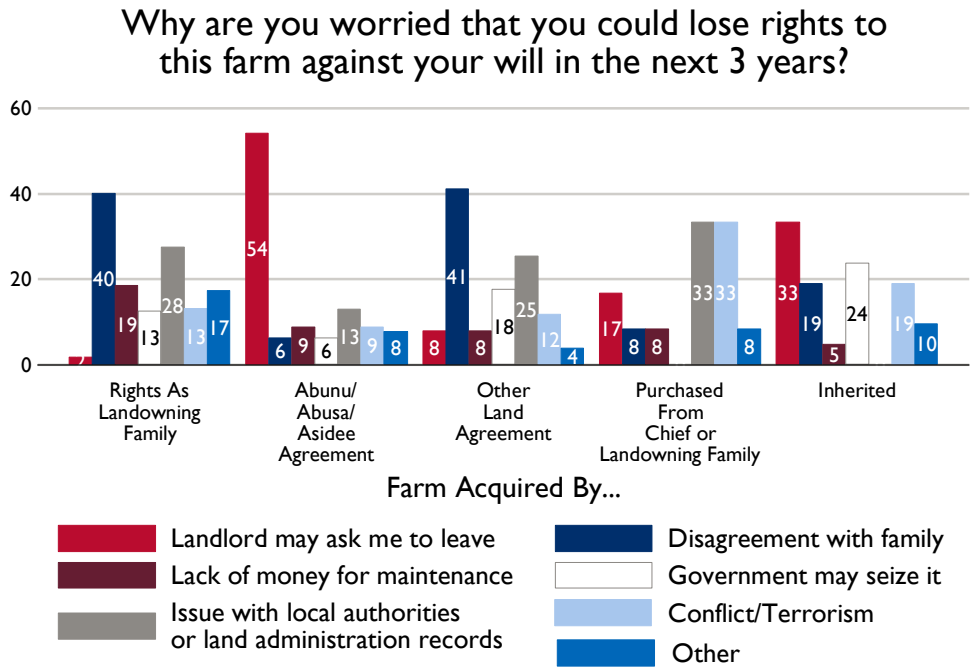


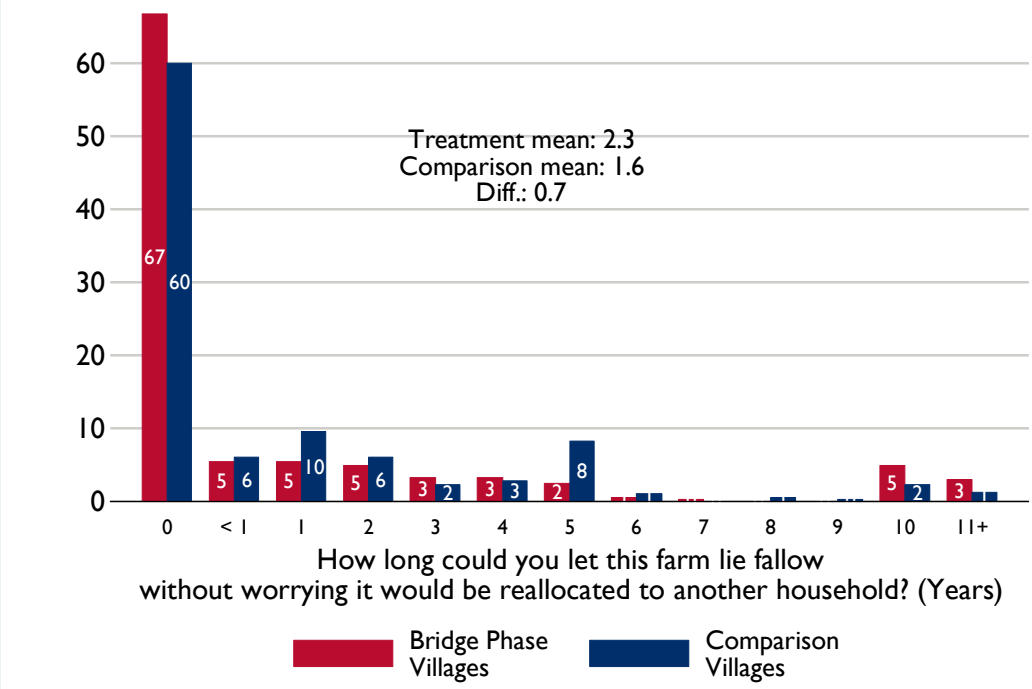
Figure 69 shows clear variation in the main source of concern over farm loss depending on how the farm was acquired. For farms under *abunu*, *abusa*, and *asidee* agreements, farmers were most concerned about farm loss due to issues with landlords. For farms acquired through rights as a landowning family, farmers were most concerned about losing their farm through family disagreements.

FIGURE 69: FARM RIGHTS LOSS REASONS BY FARM ACQUISITION TYPE



For an average farm, households believed they could leave the farm fallow for 1.9 years without worrying the farm would be reallocated to another household. However, the distribution in Figure 70 also shows that 63 percent of households did not believe they could leave the land fallow for any period of time without worrying the farm would be reallocated. Bridge Phase and comparison households demonstrated similar beliefs about the amount of time they could leave land fallow. While Bridge Phase households believed they could leave an average farm fallow for approximately 0.7 years longer than comparison households, the difference was not statistically significant.

FIGURE 70: POTENTIAL FALLOWING DURATION



LAND DOCUMENTATION

In total, 649 farms (36 percent) had any type of documentation for the household's rights to use the farm, according to the survey respondent. Of these 649 farms, 217 had a written *abunu* or *asidee* agreement (33 percent), 110 (17 percent) had a farm management plan, 267 (41 percent) had some form of customary land certificate (CLC), and 43 (7 percent) stated they had a FarmSeal document. Under Ghana's decentralized system for customary land administration, respondents may have considered multiple types of documents to fall under the broad category of customary land certificate, which likely contributes to the higher response rate for this category.[34] The FarmSeal is Meridia's name for the land rights document it provides to farmers as part of its land rights registration service. The FarmSeal document is a type of customary land certificate that is formally recognized by customary land institutions in Ghana.[35] However, responses at baseline which directly mention the FarmSeal could represent some combination of respondent prior sensitization on planned activities, misunderstanding or enumerator error, since Meridia had not yet provided FarmSeals in the area at the time of the baseline survey. Households were not asked to show their document during baseline survey data collection, but enumerators will confirm document type and date of receipt at endline.

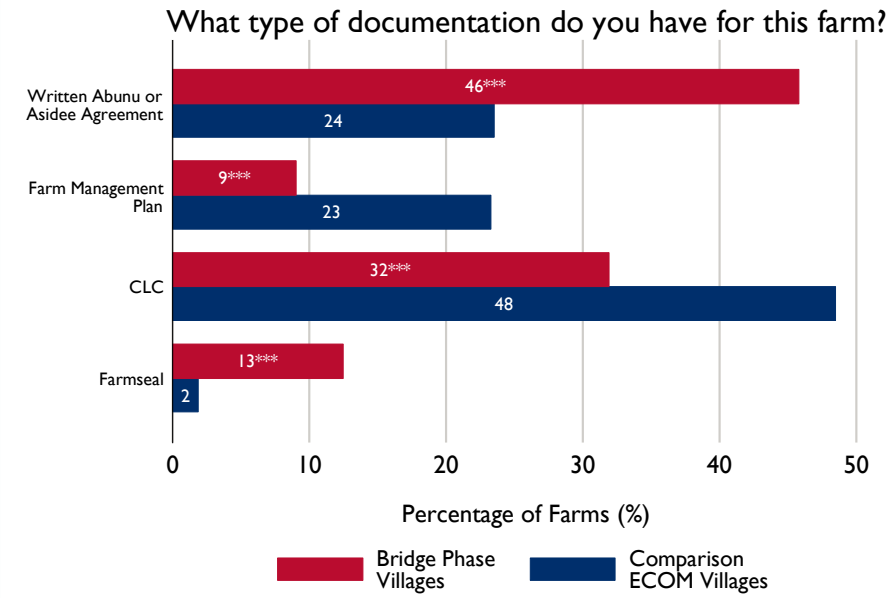
Figure 71 shows the differences by village treatment status, with written *abunu* or *asidee* agreements and references to FarmSeal documents relatively more common in Bridge Phase villages, and farm

[34] For example, the Asankrangwa Divisional Council previously encouraged farmers in the study area, including tenant farmers, to have their farms mapped and bring a farm plan to the council for official signature (Jiekak and Freudenberger 2019). Under Ghana's National Land Policy, Customary Land Secretariats serve as decentralized authorities for customary land administration, and land registry offices are authorized to provide documentation of customary land rights. Customary Land Secretariats are authorized to develop their own certificates or entitlement forms that summarize the terms, conditions and nature of property rights over customary lands (Biitir, S.B., B.B. Nara, and S. Ameyaw. 2017. "*Integrating decentralized land administration systems with traditional land governance institutions in Ghana: Policy and praxis*". Land Use Policy 68:402-424.

[35] Salifu et al. 2019. "*Innovating Along the Continuum of Land Rights Recognition: Meridia's 'Documentation Packages' for Ghana*". Land 8(189).

management plans and other CLC documents more common in comparison villages.

FIGURE 71: LAND DOCUMENTATION TYPE



For those farms with any type of documentation, Figure 72 shows the percentage of farms with different document types, by mode of farm acquisition. Among farms that were documented, having some form of CLC appeared to be most common for all modes of farm acquisition other than those acquired through *abunu*, *abusa*, or *asidee* arrangements, accounting for between 50 and 67 percent of such farms that had some form of documentation. Written *abunu* or *asidee* agreements accounted for 76 percent of all farms under *abunu*, *abusa*, and *asidee* arrangements with any type of documentation. In other words, to date it appears that farmers have either tended to seek or perhaps simply were more readily able to obtain some form of customary land documentation primarily for farms that were already held by their family through their indigene status, or were purchased, inherited, or gifted to them. The main form of written documentation confirming a farmer's right to land for *abunu* farms to date has been the written *abunu* agreement itself.

Although not shown, a small number of farms were reported to have other document types, including a site plan (N=5), hiring certificate (N=3), and purchase agreement (N=2).[36] This equated to 0.8 percent, 0.5 percent, and 0.3 percent, respectively, of farms with any type of documentation.

[36] A site plan is prepared by an official, licensed or qualified surveyor, and describes the development plan for the land. A purchase agreement sets out the terms between the buyer and seller of the land (Gyamera et al. 2018. "*Land acquisition in Ghana; Dealing with the challenges and way forward*". Journal of Agricultural Economics, Extension and Rural Development 6(1):664-672). Respondents' reference to a hiring certificate in this context is less clear, but could potentially refer to a farm where the respondent serves as a hired caretaker.

FIGURE 72: LAND DOCUMENTATION TYPE, BY FARM ACQUISITION TYPE

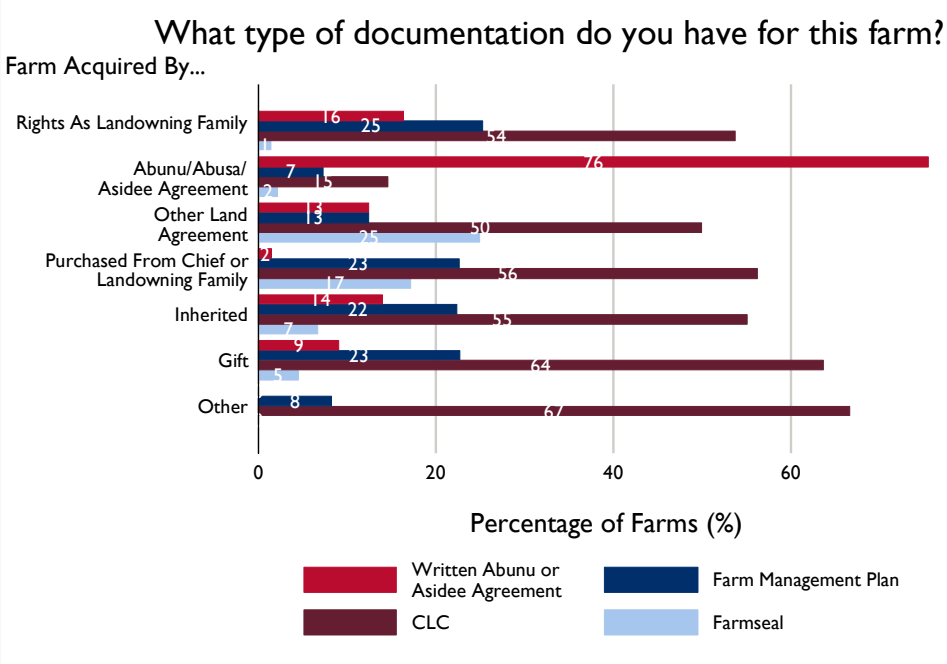
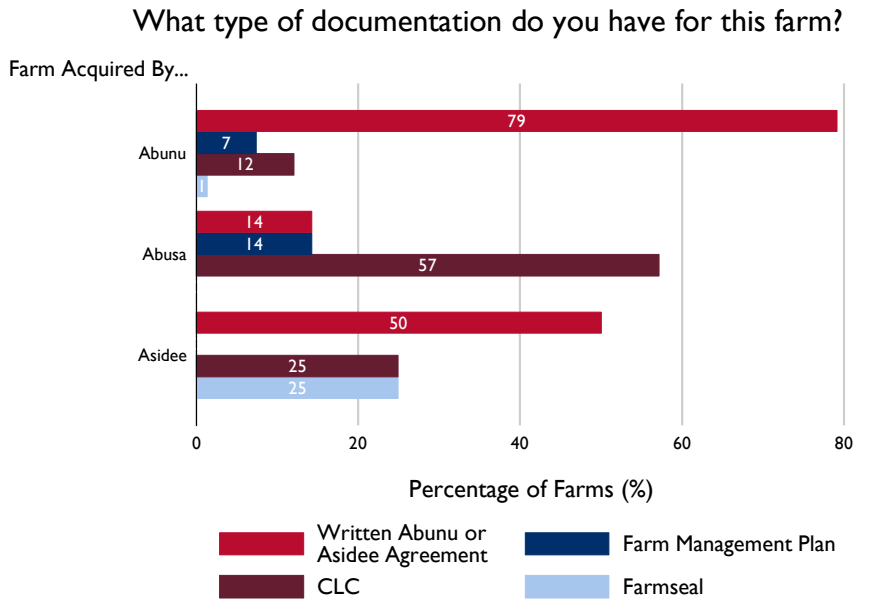


FIGURE 73: LAND DOCUMENTATION TYPE (ABUNU, ABUSA, ASIDEE)



Within the *abunu*, *abusa*, and *asidee* group, some differences were also seen (Figure 73). Written *abusa* agreements account for just 14 percent of *abusa* farms with any type of documentation, while among *abunu* farms with documentation, 79 percent had written *abunu* agreements.

Obtaining documentation for a household's rights to use a farm is a recent phenomenon, with 50 percent of all farms with any type of documentation having obtained it in 2011 or later. In each year between 2009 and 2013, documentation was acquired by two to three percent of farms (of those with any type of documentation currently). In each year between 2014 and 2018, the percentage of farms acquiring documentation increased to over five percent. Figure 74 shows increased documentation over time for both Bridge Phase and comparison households. The trend began earlier in comparison villages, but a higher percentage of farms in Bridge Phase villages acquired documentation in recent years.

FIGURE 74: FARM DOCUMENTATION ACQUISITION TRENDS

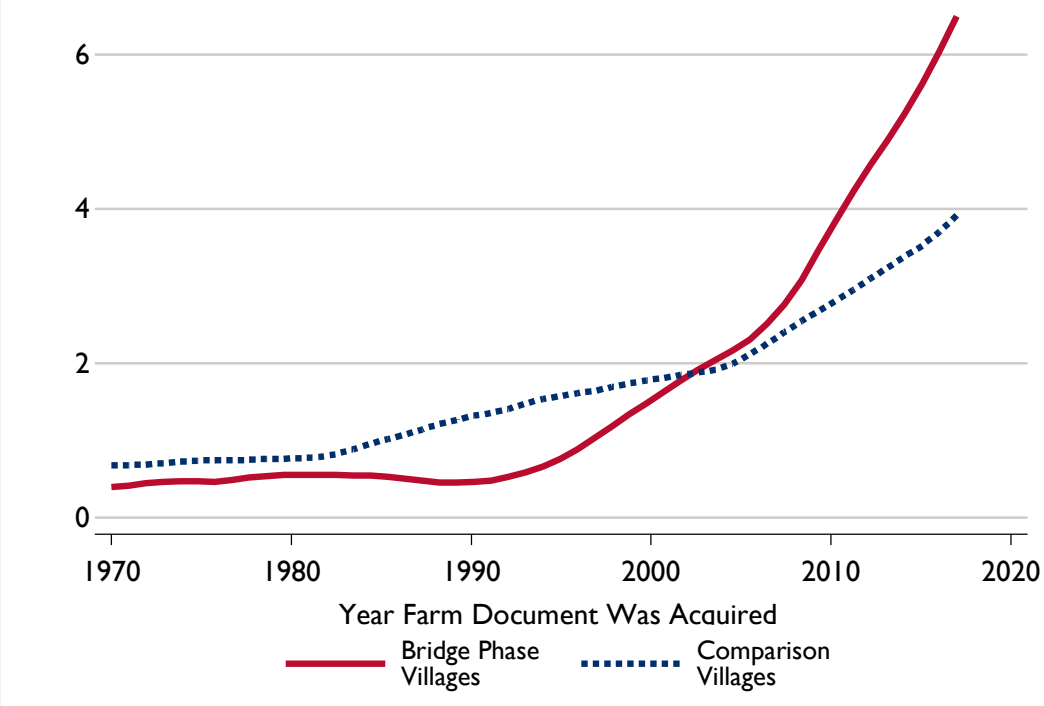
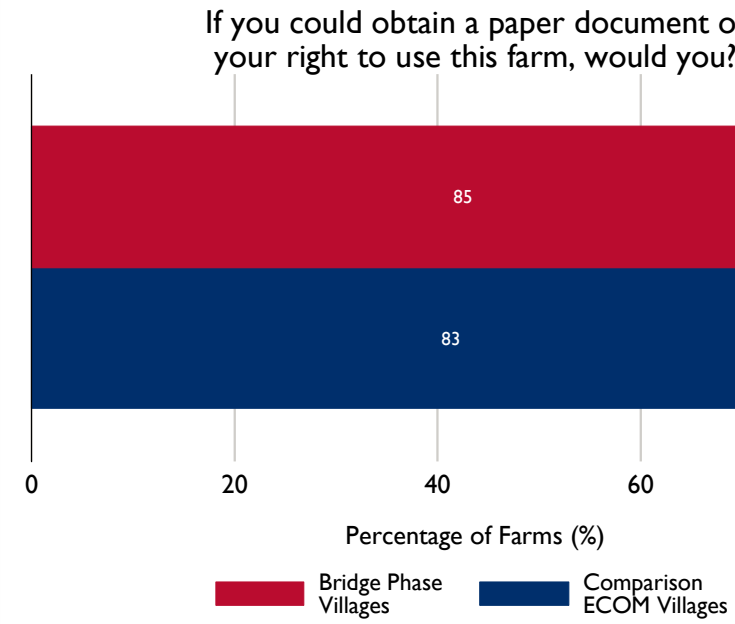


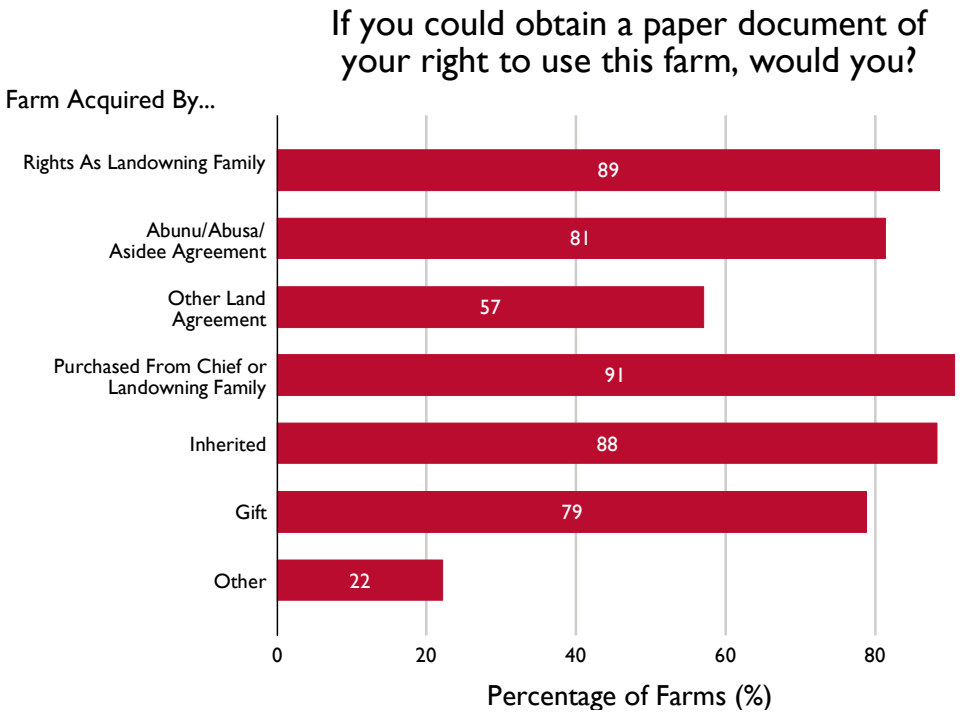
FIGURE 75: INTEREST IN FARM RIGHTS DOCUMENTATION (FARMS WITHOUT DOCUMENTATION)



Households reported they would be interested in obtaining documentation for 83 percent of farms for which they do not currently have documentation. Figure 75 shows that the reported interest in Bridge Phase villages was similar to that in comparison villages, with no statistically significant difference.

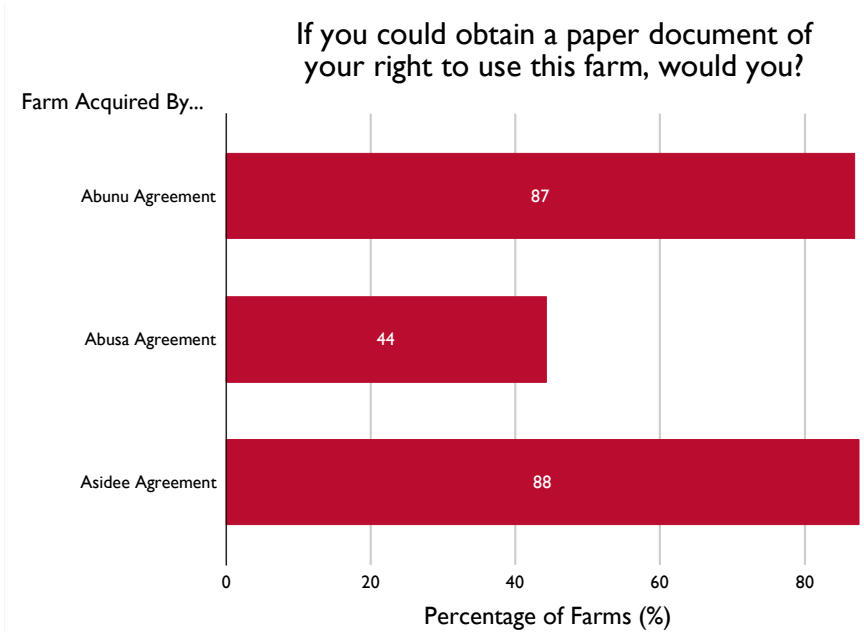
Figure 76 shows that households reported interest in obtaining documentation for between 80 and 90 percent of farms for most types of farm acquisition. For example, households reported interest in obtaining a paper document of their right to use the farm for 89 percent of farms that were acquired through their rights as a landowning family, and for 81 percent of farms acquired through *abunu*, *abusa*, or *asidee* arrangements. Interest was lower for farms acquired through other types land agreements (57 percent of farms), and for farms acquired through other means (22 percent).

FIGURE 76: INTEREST IN FARM RIGHTS DOCUMENTATION FOR FARMS WITHOUT DOCUMENTATION, BY FARM ACQUISITION TYPE



The very low interest in documentation for farms acquired through other means was likely explained by the low sample size (N=21). Also, a number of these farms were under caretakers, or obtained as collateral, where the household was temporarily holding the property to guarantee a loan made to another party.

FIGURE 77: INTEREST IN FARM RIGHTS DOCUMENTATION FOR FARMS WITHOUT DOCUMENTATION (*ABUNU*, *ABUSA*, *ASIDEE*)

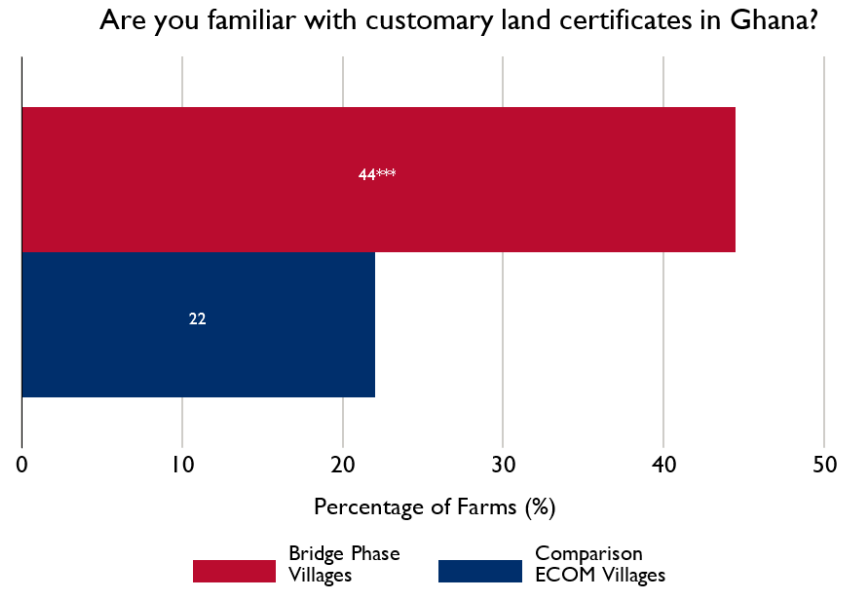


Among farms held under *abunu*, *abusa*, or *asidee* arrangements, there was again important heterogeneity in terms of interest in obtaining documentation (Figure 77). The level of interest for farms under *abunu* arrangements was 87 percent, on par with farms acquired through rights as a landowning family, direct purchase, or inheritance. However, households reported interest in obtaining documentation for just 44 percent of farms under *abusa* arrangements.

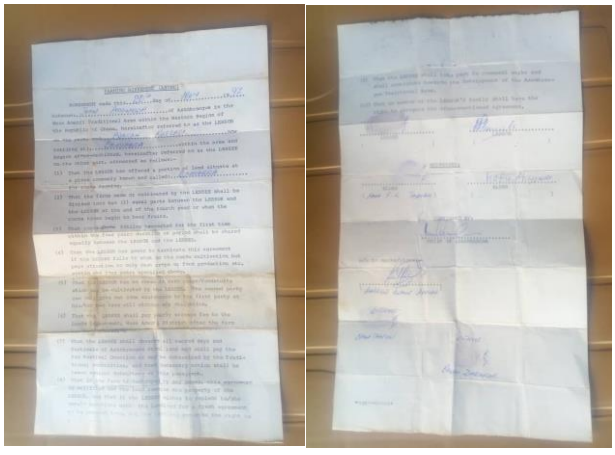
Overall, only 31 percent of households in the sample reported being familiar with customary land certificates in Ghana. Customary land certificates may take several forms under Ghana's decentralized system for customary land administration, and respondents may have had a range of documents in mind when they responded to this question. Meridia's FarmSeal document is a type of customary land certificate that will be provided to interested farmers as part of its land rights registration service through the Bridge Phase. To capture respondent familiarity with FarmSeal documents as a type of customary land certificate, the survey question posed to respondents stated that customary land certificates were sometimes known as a "FarmSeal" document. However this question cannot be used to gauge respondent familiarity with the FarmSeal alone.

There was a statistically significant difference between households in Bridge Phase and comparison villages, with 44 percent of those in Bridge Phase villages reporting they were familiar with these documents, compared to 22 percent of comparison households (Figure 78).

FIGURE 78: FAMILIARITY WITH CUSTOMARY LAND CERTIFICATES



Familiarity also varied somewhat by farm acquisition type (Figure 79). For farms acquired through direct purchase, 57 percent were held by a household who reported being familiar with these land certificates. Familiarity was 46 percent for farms acquired as a gift, and 26 percent for farms acquired through landowning family rights.



An example written *abunu* agreement from a Bridge Phase village

PHOTO BY RENE DOGBE

FIGURE 79: FAMILIARITY WITH CUSTOMARY LAND CERTIFICATIONS, BY FARM ACQUISITION TYPE

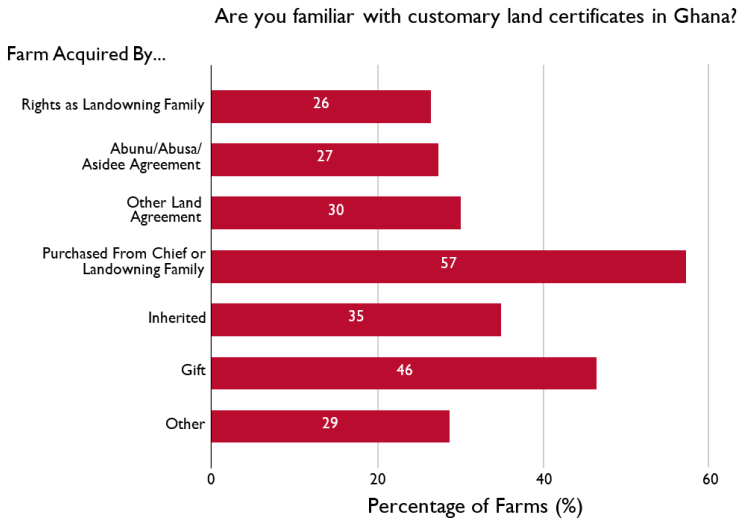
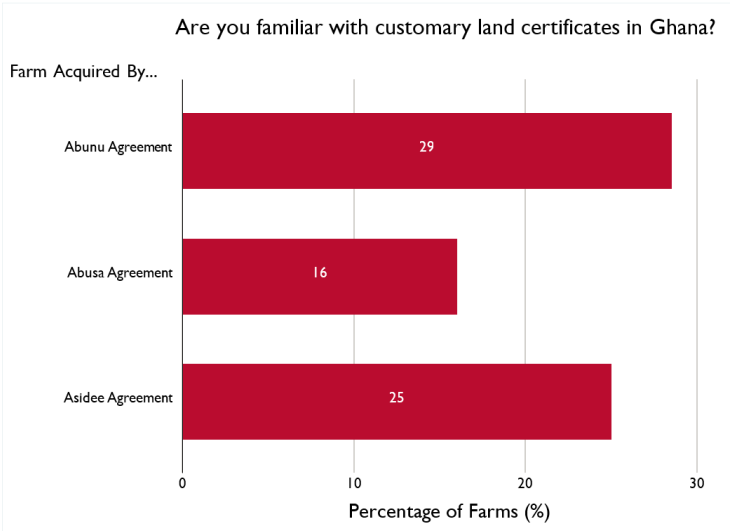


Figure 80 shows that among *abunu*, *abusa*, and *asidee* farms, familiarity with land certificates was lowest for farmers with *abusa* farms, at 16 percent, compared to 29 percent of farms under *abunu* arrangements.

FIGURE 80: FAMILIARITY WITH CUSTOMARY LAND CERTIFICATES (*ABUNU*, *ABUSA*, *ASIDEE*)



The baseline results suggested a fairly low level of familiarity with customary land certificates (CLCs) among farmers in the sample, at 31 percent of households, but also indicated that farmers value having formal documentation of their use rights to their farms. Households reported they would be interested in obtaining documentation for 83 percent of farms that are currently undocumented.

For each farm, households were asked how much they would be willing to pay (WTP) for a land certificate. The responses varied widely, ranging from nearly zero to greater than $200. In addition, many respondents could not estimate their WTP, affecting 37 percent of farms in the sample. This is not surprising given farmers' low level of familiarity with these documents. For farms where households were able to estimate their willingness to pay, the mean response was $78.20 and the median response

was $47.50.[37] On average, households who said they were familiar with CLCs were willing to pay an additional $32.73 (USD) to obtain documentation for a plot. Figure 81 shows the distribution of willingness to pay responses by type of farm acquisition.

The evaluation team conducted additional analyses to identify household and farm-level factors that were associated with farmers' willingness to pay higher and lower amounts for the document. While several household and farm-level characteristics were significantly correlated with WTP on their own, multi-variate regressions suggested that household wealth status and the presence of shade trees on the farm were the two most significant factors associated with the WTP estimates provided by farmers. Poorer households had lower WTP, and each additional percentage point increase in the household's likelihood of poverty was associated with a $0.78 decrease in WTP. In addition, having shade trees on the farm was associated with an additional $8.11 in WTP for a CLC. Overall, the additional analysis of WTP underscored the diverse interests of potential beneficiaries and the complex set of interacting factors that shape farmer decisions in the Bridge Phase context. Importantly, the results highlighted that the overall perceived value and estimated amount a farmer is willing to pay for the CLC document is likely to differ substantially among farmers across the sample and on the basis of the household's unique situation, the various threats to sustained land use that they face, and their expectation for how more formal tenure documentation of their farm rights could benefit them. Moreover, farmers across the Bridge Phase villages likely had a range of understandings or hopes for how a FarmSeal or other form of customary land document may strengthen their use rights and claims to land. See Annex G for full write-up and results, including caveats on reliability of self-reported WTP estimates.

FIGURE 81: HOUSEHOLD WILLINGNESS TO PAY FOR FARMSEAL DOCUMENTS

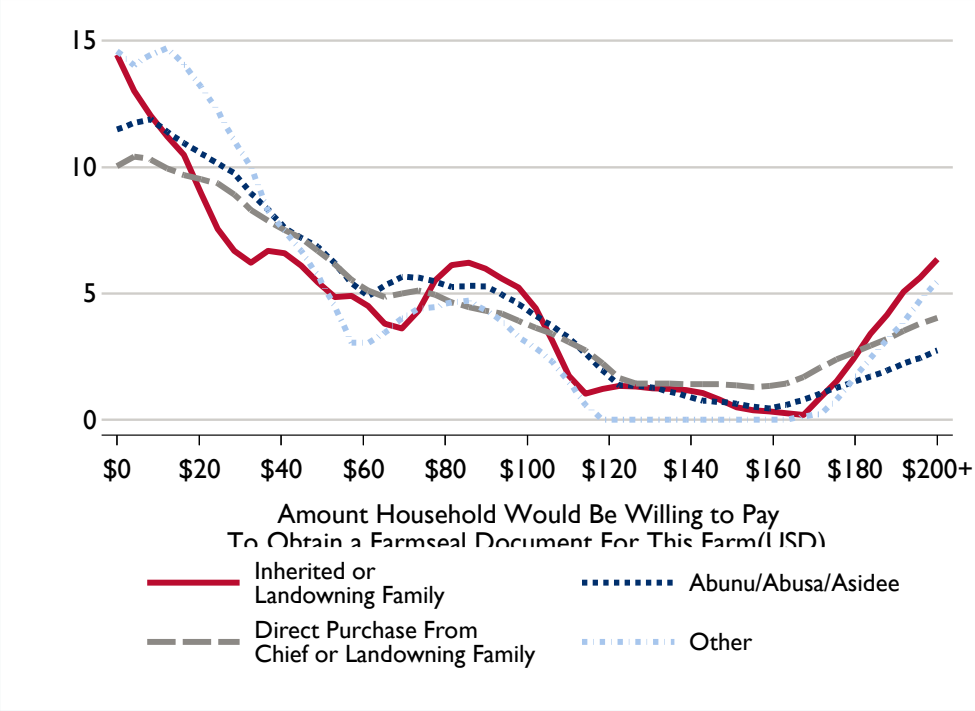


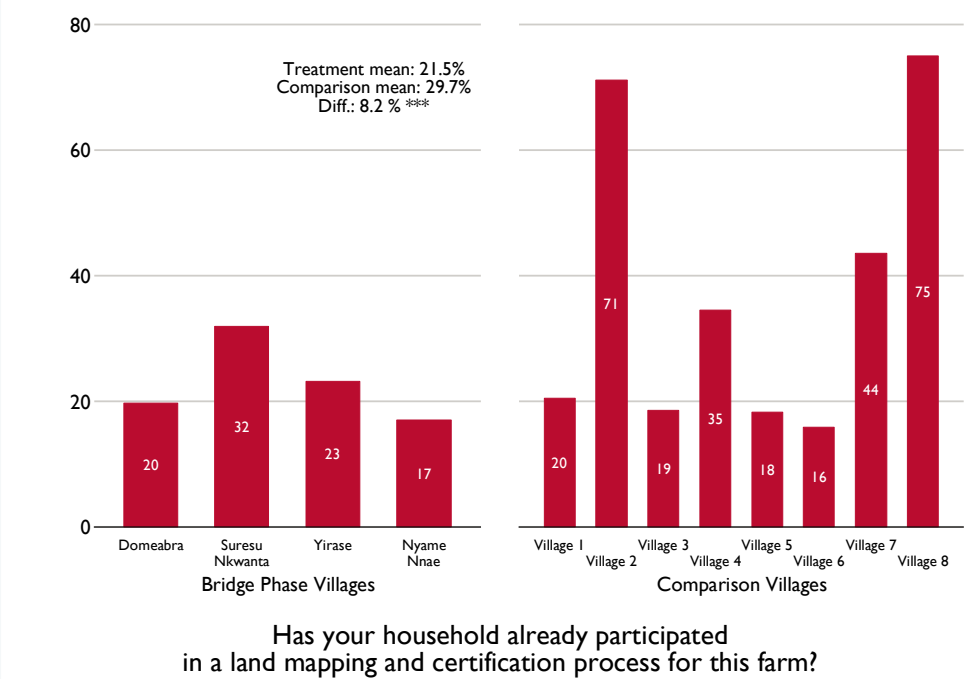
Figure 82 shows the percentage of farms that households reported had previously participated in a land mapping and certification process, with results disaggregated by village. A greater share of comparison farms (30 percent) participated in previous certification processes than Bridge Phase farms (22 percent),

[37] At the time of baseline data analysis, Meridia tentatively planned to sell the FarmSeal document to farmers at a price of 500 cedis ($86.1) for up to a five hectare parcel although the final cost had not yet been determined by Bridge Phase IPs.

and the difference was statistically significant. Among Bridge Phase villages, the percentage of farms that previously participated in a mapping and certification process varied from 17 percent (Nyame Nnae) to 32 percent (Suresu Nkwanta).

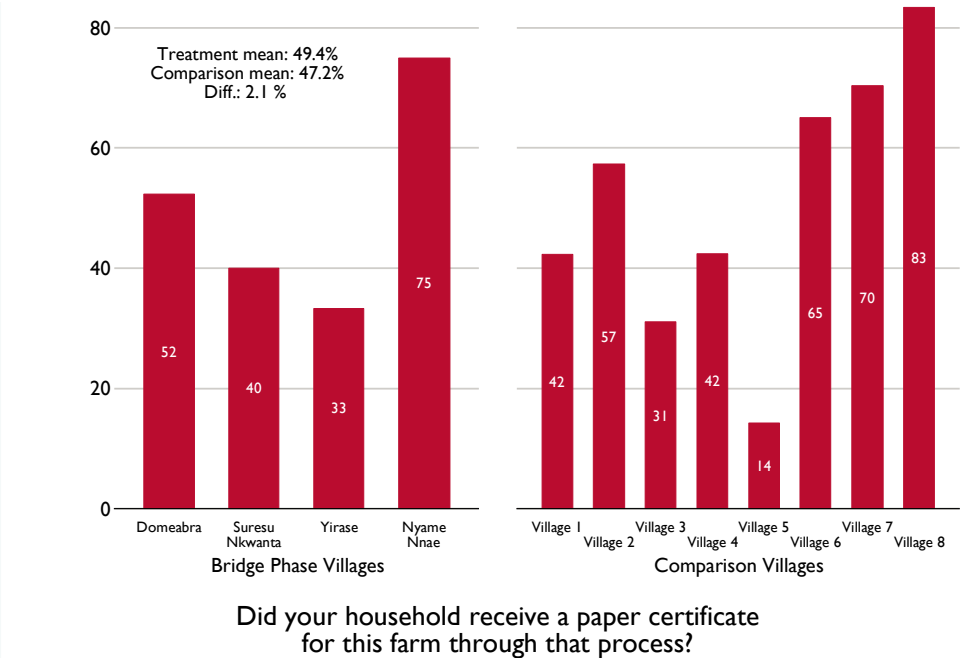
Some clustering can be seen in terms of when these mapping and certification processes occurred. For Domeabra and Suresu Nkwanta, over 75 percent of farms that participated in a mapping and certification process did so between 2014 and 2018. For Yirase, 64 percent took place between 2014 and 2018 and an additional 19 percent took place between 2007 and 2009. In Nyame Nnae, 77 percent took place between 2017 and 2018, and an additional 9 percent took place in 2016. Among comparison villages, 80 percent of all farms who participated in a mapping and certification process did so between 2016 and 2019, with 55 percent having done so in 2018 alone.

FIGURE 82: PAST PARTICIPATION IN LAND CERTIFICATION PROCESSES



Just under half of farms (48 percent; N=223) that participated in a mapping and certification process actually received a land certificate through the process, including 49 percent of such Bridge Phase farms and 47 percent of comparison farms that had been part of an earlier process. Figure 83 shows there was considerable variation on this across villages. For Bridge Phase villages, this ranged from 33 percent of farms that had been part of an earlier mapping and certification effort (Yirase) to 75 percent of such farms (Nyame Nnae). Of those who received a certificate through an earlier process, most (67 percent; N=150) said the process was facilitated by the local chief, while 22 percent (N=48) said it was facilitated by a government authority, and 6 percent (N=14) said it was facilitated by a farmer organization.

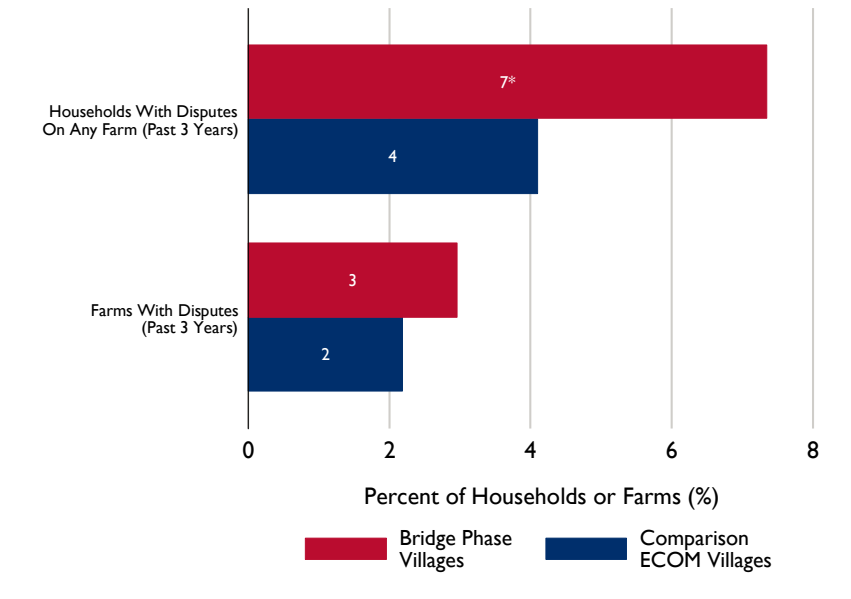
FIGURE 83: ACQUISITION OF LAND CERTIFICATE FOR PARTICIPATING FARMS



LAND DISPUTES

In total, 38 households reported having had a land dispute on any farm over the past three years, corresponding to 5.3 percent of the overall household sample, and including 7.4 percent of Bridge Phase and 4.1 percent of comparison households. Overall, 45 farms experienced land disputes (2.5 percent of all farms in the sample), including 3 percent of farms belonging to Bridge Phase and 2.2 percent of farms belonging to comparison households. This is shown in Figure 84, below.

FIGURE 84: HOUSEHOLDS AND FARMS WITH LAND DISPUTES

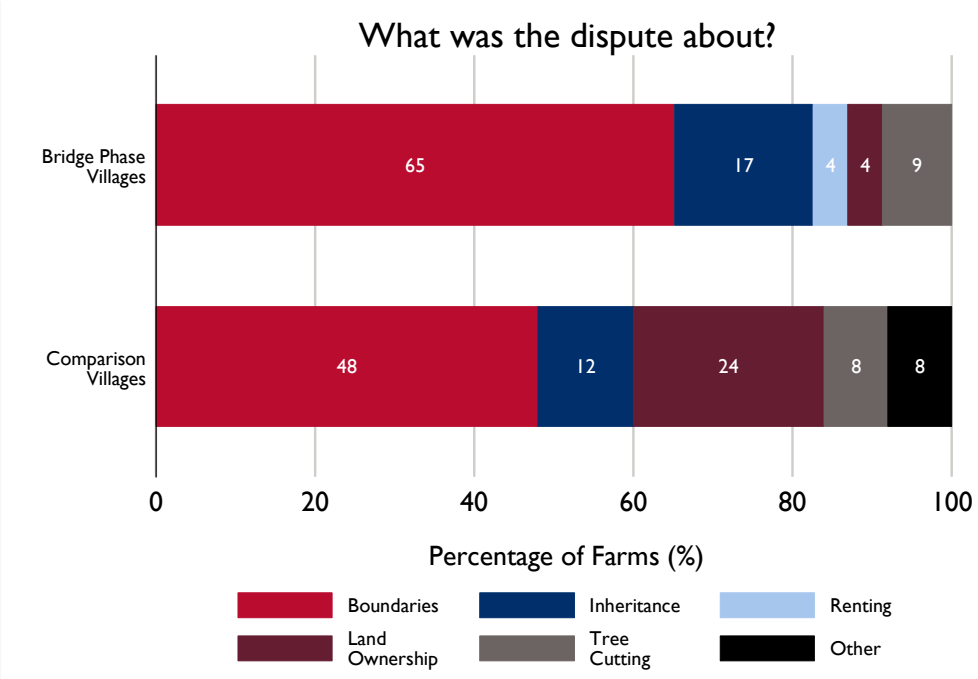


While most farms that experienced any land dispute over the past three years had experienced only one such episode, a small number of farms experienced multiple disputes, for a total of 55 land disputes across all households in the sample. For each farm, the survey asked a series of questions about the first two land disputes reported (N=48), including the reason behind the dispute and who was involved.

Across all reported disputes, 56 percent were over boundary issues, 15 percent over inheritance, and 15 percent over current land ownership. Disputes over tree cutting comprised 8 percent of all disputes. The other party to the disputes was fairly evenly distributed across neighbors (33 percent, N=16), landlords (27 percent, N=13) and extended family members (27 percent, N=13). Chiefs were reported to be involved in three disputes (6 percent). Eighty percent (N=39) of the reported disputes had been resolved and 20 percent (N=10) were still ongoing. Boundary disputes were more common among households in Bridge Phase villages than in comparison villages, while disputes over ownership were more common among households in comparison villages (Figure 85).

The fairly low incidence of disputes was also supported in qualitative GDs, where moderators conducted substantial probing on this issue. In two GDs, respondents said that land disputes were rare, and when they occur can be resolved quickly with assistance from the village chief. However, in the third GD, participants reported tense disputes in which landowners had reclaimed land from tenants when their cocoa trees died. Tenant farmers said there were few mechanisms by which to resolve these disputes with landowners, mentioning that they could not turn to village chiefs to arbitrate because landowners are often part of the chief's council of elders.

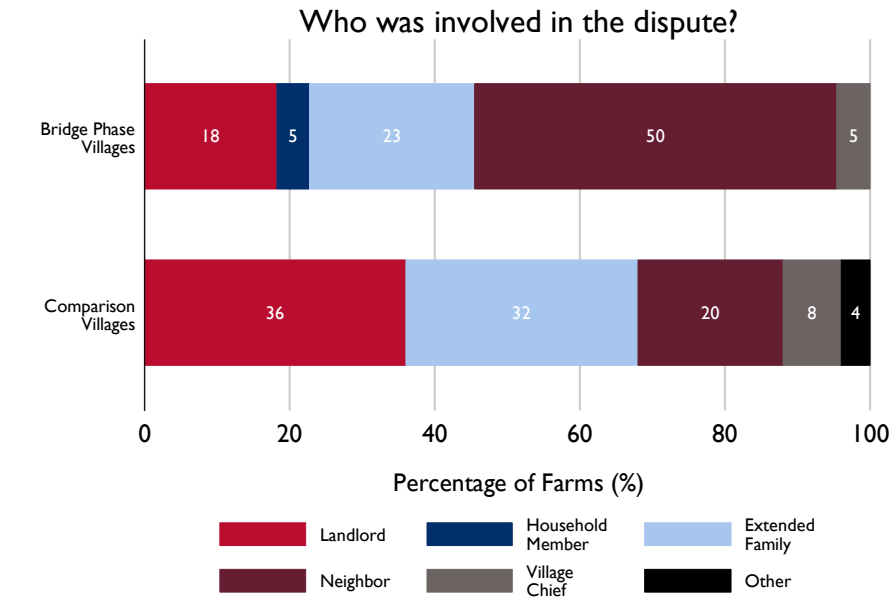
FIGURE 85: TYPES OF LAND DISPUTES



Of the small number of ongoing disputes reported (N=10), all were reported to be with landlords or other extended family members. Ongoing disputes with extended family members were reported across inheritance issues and land ownership. The small number of ongoing disputes with landlords ranged from boundary issues, renting, land ownership, and tree cutting. For disputes that had already been resolved, the majority were rooted in boundary issues (62 percent, N=24).

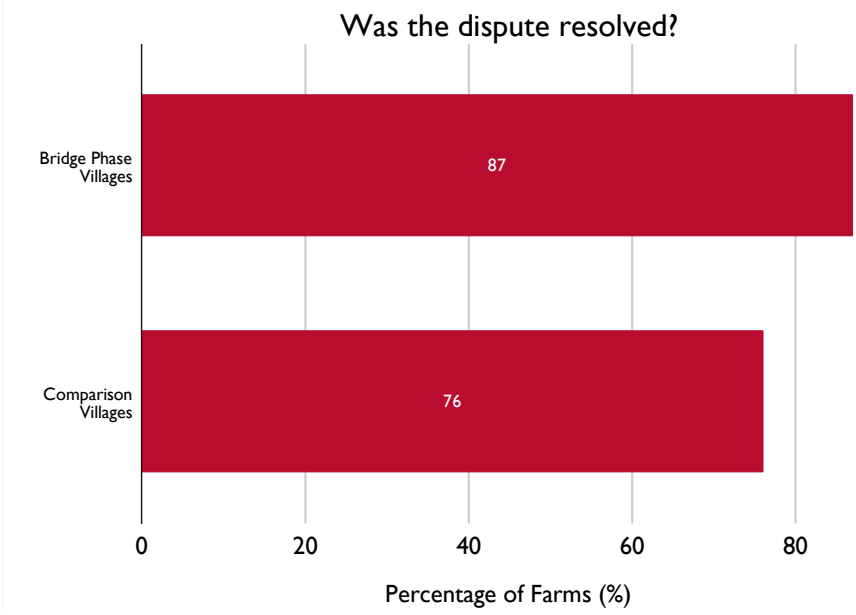
Farm tenure status was associated with whether the farm had experienced a land dispute. Of farms that were reported to have had a land dispute, the majority of them were under an *abunu* arrangement (N=19, 42 percent), while 27 percent (N=12) were inherited through the father's line. Six farms (13 percent) that had experienced a land dispute in the last three years were acquired through the farmer's rights as a landowning family.

FIGURE 86: PARTIES INVOLVED IN LAND DISPUTES



In total, 16 disputes (34 percent) involved a neighbor, 13 involved a landlord, and 13 involved an extended family member. Just one dispute was with a household member, and three were reported to be with the village chief. Figure 86 shows that disputes with neighbors were most commonly reported by Bridge Phase households. Disputes with landlords were most commonly reported by comparison group households.

FIGURE 87: RESOLUTION OF LAND DISPUTES



Overall, households said 81 percent of the disputes (N=39) were resolved (Figure 87). Resolution rates were highest for disputes around boundaries (25 of 27 disputes resolved, or 93 percent). While resolution rates were somewhat lower for other types of disputes, the small number of disputes across other dispute types means the rates reported here were not statistically meaningful. All disputes involving a neighbor (N=16), village chief (N=3), or another household member (N=1) were resolved, while eight of the 13 disputes involving a landlord and nine of the 13 disputes involving an extended family member were resolved.

FINDINGS 4: COCOA AND OTHER CROP PRODUCTION

COCOA AGE, DISEASE AND PRODUCTION

Trees on cocoa farms in the sample were 12.9 years of age, on average. Trees on cocoa farms in Bridge Phase villages were slightly older (13.6 years old) than those in comparison villages (12.4 years old), a difference that was statistically significant. Among all farms, 19 percent had trees that were between zero and four years old, 24 percent had trees between five and nine years old, 17 percent had trees between 10 and 14 years old, and 16 percent had trees between 15 and 19 years old. Approximately 23 percent of all farms had trees that were 20 years old or older (Figure 88).

FIGURE 88: AVERAGE COCOA TREE AGE PER FARM

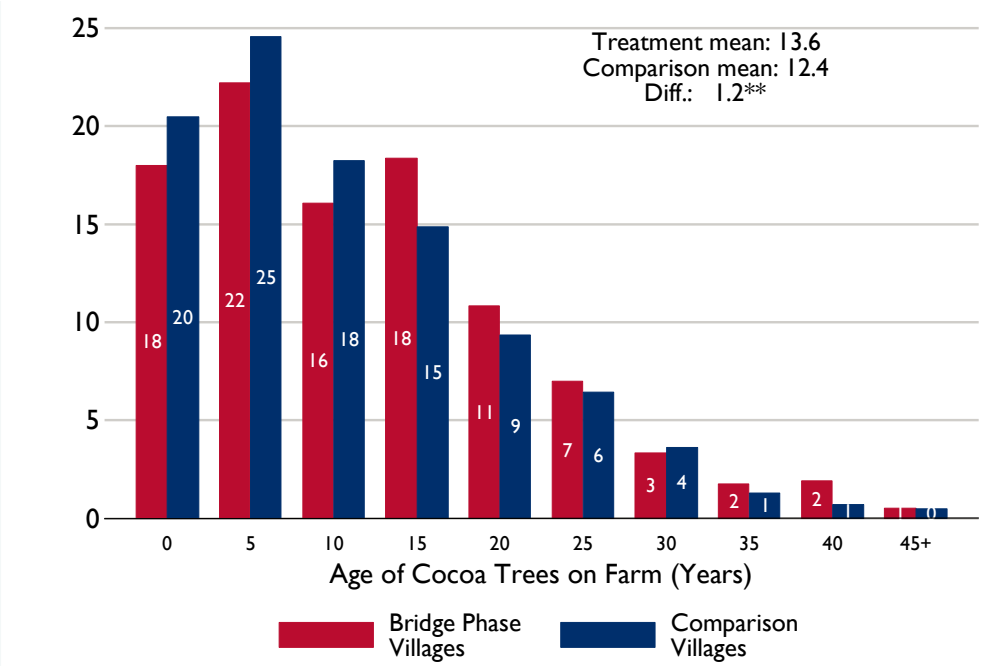
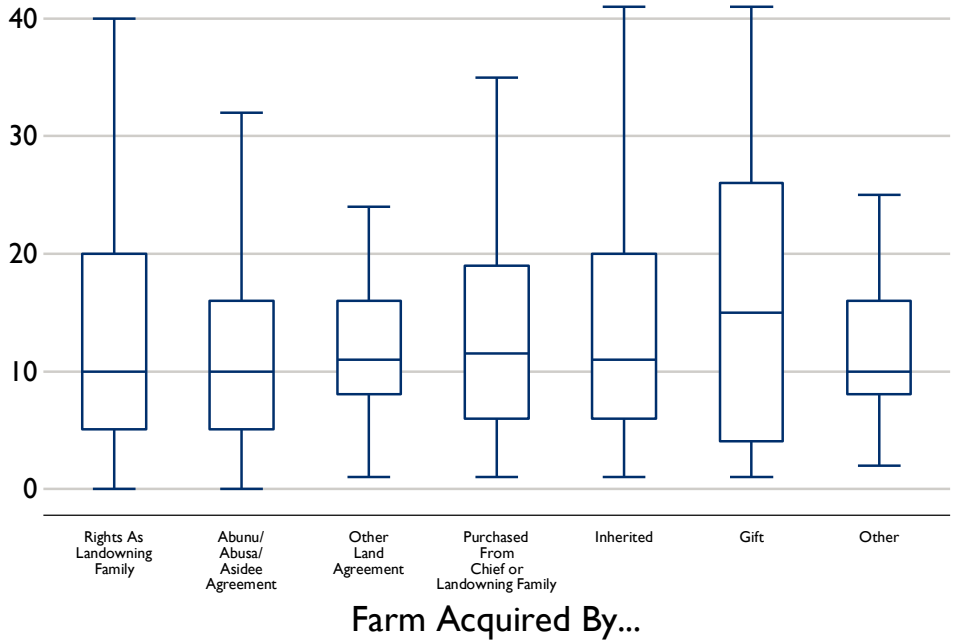


Figure 89 shows how the distribution of tree age varied by farm acquisition type. The whiskers show the minimum and maximum values in the distribution, excluding extreme outliers; the box shows the 25th and 75th percentiles of the distribution; the line inside the box shows the median value of the distribution. For example, looking at the distribution for farms acquired under *abunu*, *abusa*, or *asidee* agreements, we see that the minimum tree age for this acquisition type was zero years old (newly planted trees), and the maximum tree age was 32 years excluding outliers. The 25th percentile, median, and 75th percentile of the distribution were 5, 10, and 16 years, respectively. Cocoa trees on farms acquired as a gift were the oldest, with an average age of 17 years old and a median age of 15 years old. Farms that were acquired through direct purchase or inheritance had similar distributions, with a mean age of 14 years old and a median of 11 years for farms acquired through inheritance, and 11.5 years for those acquired through direct purchase.

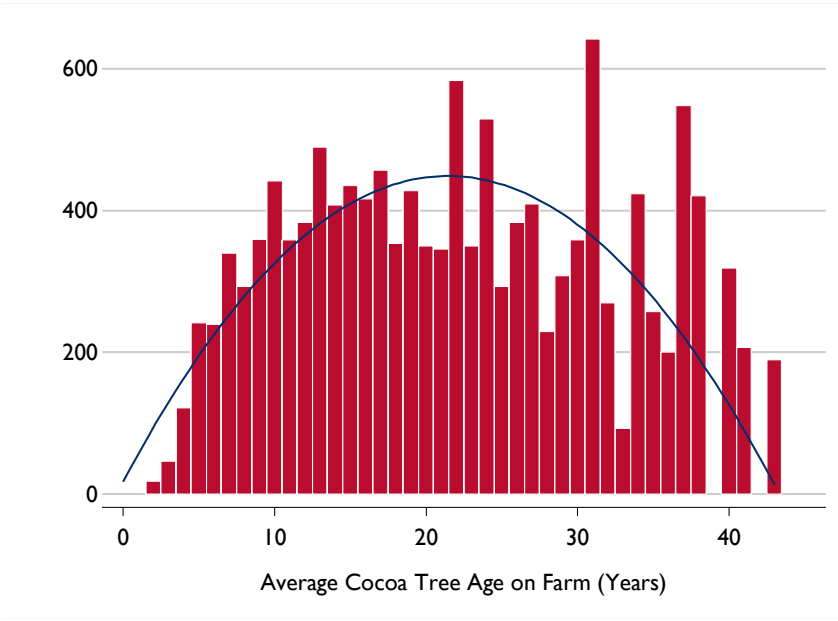
FIGURE 89: AVERAGE COCOA TREE AGE, BY FARM ACQUISITION TYPE



Note: The whiskers show the minimum and maximum values of the distribution, excluding outliers. The box shows the 25th and 75th percentiles of the distribution, and the line inside the box shows the median.

Using data on the average age of cocoa trees on sample farms, farm size, and household responses on total cocoa production for the farm during the prior main and light seasons, Figure 90 plots the average yield per hectare by tree age. This is shown by the red bars, along with predicted values for average yield by tree age using a quadratic regression model. Plotting cocoa yield per hectare against the age of trees on a farm shows an inverted U pattern, as expected, with productivity increasing as cocoa trees get older, and then declining again after a certain age.

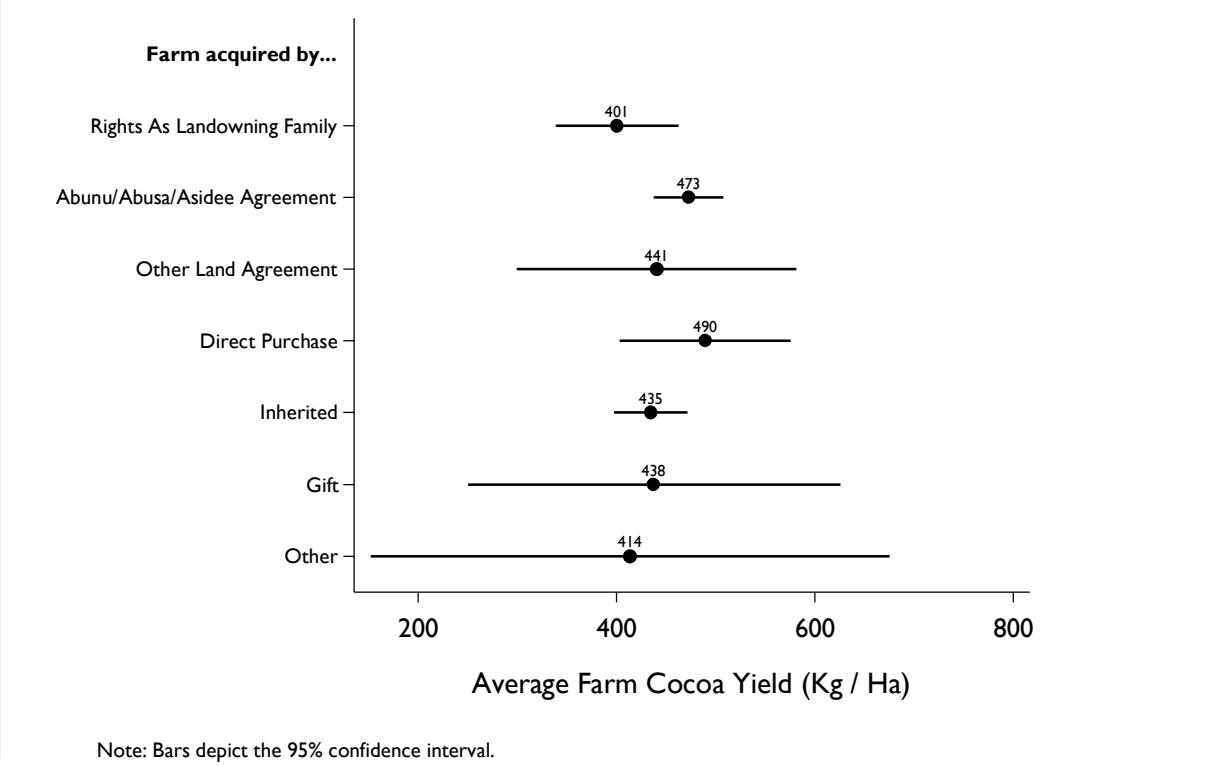
FIGURE 90: COCOA YIELD, BY TREE AGE



Cocoa trees yield little to nothing during the first few years after they are planted. After five years, the baseline data suggest yields of approximately 200 kg per hectare, increasing to 375 kg per hectare 10 years after planting, and 425 kg per hectare 20 years after planting, which is around the point of peak productivity. Approximately 20 years after planting, productivity begins to decline with age, falling below 400 kg per hectare by the time trees hit 30 years of age, and approximately 100 kg per hectare by 40 years of age.

Figure 91 shows average cocoa yield per farm by farm acquisition type, along with the 95 percent confidence interval for the mean. Cocoa farms acquired through direct purchase were the most productive, on average, with a mean yield of 490 kg per hectare. Farms acquired through *abunu*, *abusa*, or *asidee* agreements were the second most productive, yielding 473 kg per hectare on average. This productivity appeared driven by farms under *abusa* agreements, with an average yield of 585 kg per hectare, and 50 percent of *abusa* farms yielding 474 kg per hectare or more. The higher productivity of *abusa* farms is interesting, as this tenancy arrangement is sometimes viewed to more strongly incentivize best farming practices relative to *abunu* or *asidee* tenancy arrangements, since both the tenant farmer and the landlord contribute resources into the farm and the proceeds are split evenly. Trees on farms under *abusa* agreements also had an average age of 16 years, which is near peak productivity. Relatively few trees were 10 years or younger (38 percent) and no trees were 30 years or older. Thus, tree age may also help explain the comparative productivity of *abusa* farms in the sample, as the average age of farms under *abunu* agreements is just under 13 years old, with a large share of farms with trees aged 10 years or less (57 percent) and an additional two percent aged 30 years or more.

FIGURE 91: AVERAGE COCOA YIELD PER FARM, BY FARM ACQUISITION TYPE



Note: Bars depict the 95% confidence interval.

The evaluation team conducted supplemental analysis to better understand the key variables and factors that explain differences in cocoa farm productivity among households surveyed at baseline. The baseline analyses showed a relationship between cocoa yields and cocoa tree age, but also revealed differences in mean productivity depending on disease load, presence of shade trees on the farm, the mode of farm acquisition, and several other factors. Using a linear regression approach to identify key farm-level and household-level determinants of cocoa productivity, the results of the supplemental analysis confirmed the strong association between cocoa tree age and farm productivity, together with farm size, severity of pests and diseases, cocoa variety, presence of shade trees on the farm, and use of agricultural inputs. Significant household-level factors included household wealth status, household size, and whether the household had at least one member who had received farmer training over the past three years. See Annex H for full results and write-up related to determinants of cocoa productivity.

The most common disease affecting cocoa trees on the farms in the sample was reported as black pod disease (N=1007; 64 percent), followed by blight thread disease (N=567; 36 percent), and cocoa swollen shoot virus disease (N=483; 31 percent). In terms of pests, *akate* was the most common reported (N=12223; 77 percent), followed by *atee* (N=936; 59 percent), and termites (N=444; 28 percent). Table 20 shows the prevalence of different diseases and pests on the cocoa farms in the sample.

Respondents in the qualitative sample confirmed they are highly concerned about diseases and pests, such as swollen shoot disease, black pod disease, termites, and mirids. These diseases have worsened in recent years, according to GD respondents, and they feel the problem is exacerbated by a proliferation of counterfeit pesticides in local markets. Farmers reported a need and willingness to purchase pesticides, but an inability to do so due to lack of access to reliable pesticides outside of those provided through annual government spraying. In two GDs, participants mentioned that despite termites killing cocoa trees and lowering productivity, an infestation of the insects can also result in the growth of edible mushrooms that farmers sell as an additional source of income.

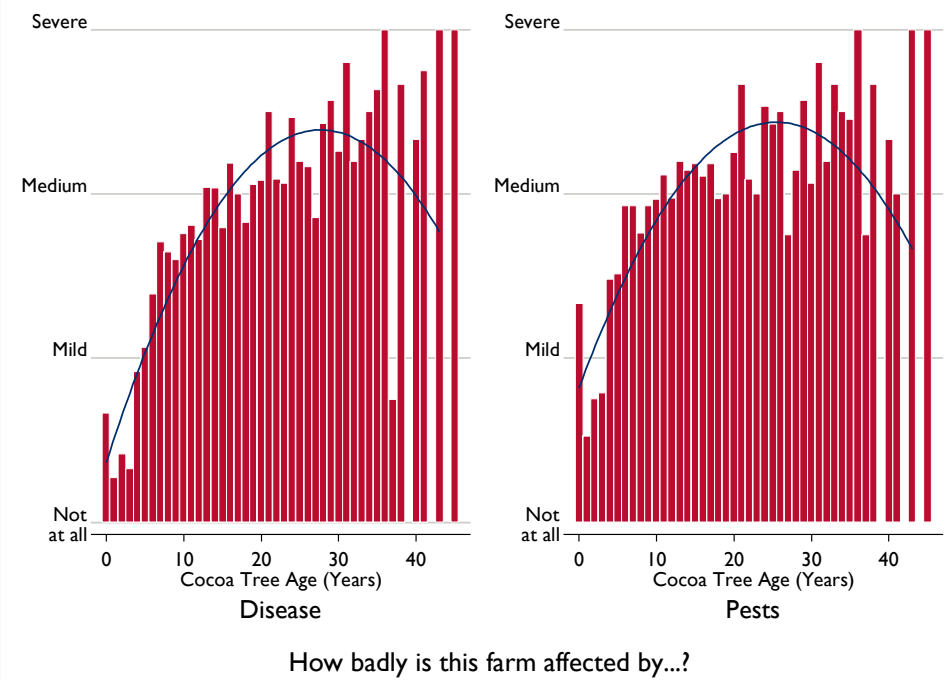
TABLE 20: DISEASES AND PESTS ON COCOA FARMS

Problem Farm Suffers From			
Diseases	**N (%)**	**Pests**	**N (%)**
Cocoa swollen shoot virus disease	483 (30.5%)	Mistletoe	215 (13.6%)
Black pod disease	1007 (63.6%)	Akate	1223 (77.2%)
Blight thread	567 (35.8%)	Mirids	377 (23.8%)
Other	58 (3.7%)	Black ants	252 (15.9%)
None	417 (26.3%)	Termites	444 (28.0%)
		Rodents	100 (6.3%)
		Atee	936 (59.1%)
		Other	16 (1.0%)
		None	245 (15.5%)

"We plant new [cocoa trees after cutting], [but] after a while, the disease will attack them again. … Now the cocoa doesn't mature like it used to. [There were] times when the disease was not there. Before, [the trees] can be there for about forty years but now you have to cut it down by ten years." (Male GD participant, Kramokrom)

Figure 92 plots the severity of disease and pests by the age of trees on a cocoa farm. The blue line on the figure plots the predicted severity from a quadratic regression of severity and tree age. For both diseases and pests, severity tended to be somewhere between "not at all affected" and "mildly affected" for trees between zero and five years. Severity increased with age and by the time trees were around 25 years old the severity by which they were affected with disease and pests tended to be somewhere between "medium" and "severe". The predicted values of severity began to decline after approximately 25 years of age. This trend was likely due to the small number of farms with trees older than 25 years (just nine percent of farms), and the likelihood that among older trees, farmers may be more likely to cut and replant those that are more affected by disease and pests while leaving older trees that are less affected.

FIGURE 92: SEVERITY OF DISEASE AND PESTS, BY TREE AGE

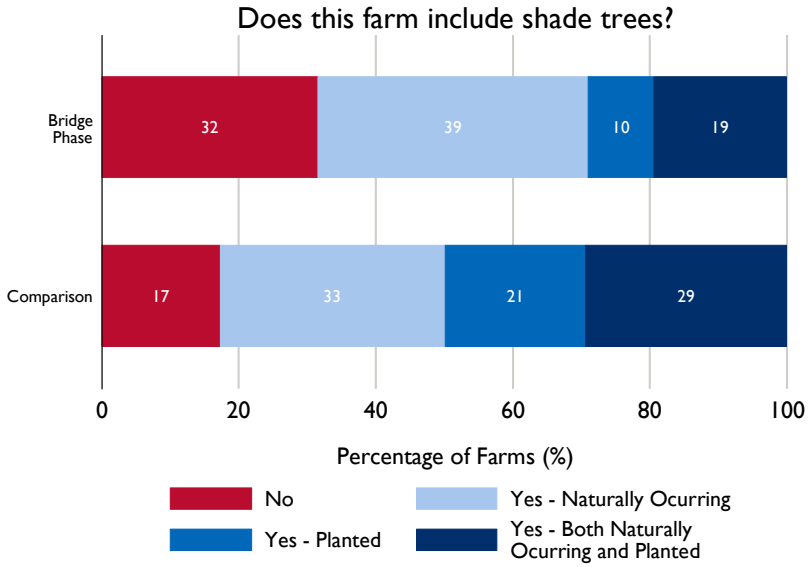


Across the qualitative sample, farmers reported they often now must cut trees prematurely, after 10-20 years, due to diseases. In the past, trees lived to be much older. In one community, the chief attributed premature tree death to the introduction of a new and less disease-resistant cocoa hybrid some 15 years ago. Others blamed lower access to high-quality pesticides.

SHADE TREE CONTEXT

Approximately 77 percent of all farms had shade trees. The percentage of farms with shade trees was higher for comparison farms than for Bridge Phase farms, and the difference was statistically significant (Figure 93). Overall, 36 percent of all farms had naturally occurring shade trees (but no planted shade trees), while 16 percent had planted shade trees but no naturally occurring shade trees. Twenty-five percent had both planted and naturally occurring shade trees. The difference between Bridge Phase and comparison farms in terms of the percentage of farms with shade trees appeared to be driven by the increased prevalence of planted shade trees on comparison farms. A slightly lower percentage of comparison farms had naturally occurring shade trees, while the percentage of farms with either planted shade trees or both planted and naturally occurring shade trees was nearly twice as high on comparison farms (50 percent) as on Bridge Phase farms (29 percent).

FIGURE 93: SHADE TREE CONTEXT



The prevalence of farms with any shade trees was roughly similar across farm acquisition types. Approximately 20 percent of farms acquired through landowning family rights had any shade trees, compared to 26 percent of *abunu*, *abusa*, and *asidee* farms, 38 percent of farms under other land agreements, 21 percent of farms acquired through direct purchase, 22 percent of inherited farms, and 11 percent of farms received as gifts. For nearly half (48 percent; N=582) of all farms with any shade trees, households reported they did not know the number of shade trees on the farm. Among farms that could report the number of shade trees, there were 28 shade trees per farm, on average.

The reported baseline survey data showed a positive correlation between the presence of shade trees and cocoa productivity. Farms with no shade trees saw average cocoa productivity of 202 kg per hectare, compared to average productivity of 327 kg per hectare for farms with any shade trees, a difference that was highly statistically significant. Farms with only planted shade trees were slightly more productive than those with only naturally occurring shade trees (336 kg per hectare compared to 310 kg per hectare), and farms with both planted and naturally occurring shade trees were even more productive (346 kg per hectare).

In GDs, farmers expressed mixed experiences with shade trees. In general, GD participants viewed shade trees positively and said they wanted to plant trees like mahogany (*Swietenia mahagoni*), cedar, emery, and flambo. Some respondents had begun planting shade trees recently after extension officers recommended the practice. On the other hand, some farmers said that government extension officers had discouraged them from allowing certain species to grow, such as odum (*Milicia excels*), wawa (*Triplochiton scleroxylon*), silk cotton (*Ceiba pentandra*), cola (*Cola Nitida*) and avocado (*Persea americana*), because these species were said to have adverse effects on cocoa production. As one Koduakrom farmer explained:

> *"The silk cotton tree extracts too much water so it doesn't give the cocoa much nutrition. Since the mahogany grow tall, the pests – mirids – ascend to the top during the application of the pesticide so they are not destroyed. They come back after the effectiveness of the pesticide had reduced."* (Male GD Participant, Koduakrom)

Discussions with some farmers during the carbon stocks fieldwork revealed that in extreme cases,

farmers cut all their shade trees because they heard that the trees harbored diseases or competed with cocoa trees for light and water. One producer whose farm was included in the carbon stocks data collection told the evaluation team that a government extension officer advised him to cut all of his shade trees because they harbored disease. The farmer cut the trees, saw a decline in productivity, and has now replanted them. Several other farmers also cut all their shade trees because they heard that they hindered growth, while another complained to the evaluation team that trees like odwuma (*Musanga cercropoides*) and nyankyerene (*Ficus exasperate*) took up too much water.

These findings suggest that farmers' knowledge of the value of shade trees varied significantly, and in extreme cases they felt they may have received misinformation by supposedly trusted sources. Respondents across the GD sample said farmers decided whether to plant or cut shade trees, and that government officials would not cut their trees if left on the property.

COCOA FARM REHABILITATION AND COCOA TREE REPLANTING

Across all farms, households reported just 2.8 percent (N=44) were part of a rehabilitation program. Figure 94 shows the percentage of all farms that were part of rehabilitation programs and the program implementers that directed these programs. Across all farms, MOFA was the most common program implementer (N=18 farms), followed by ECOM (N=15), and COCOBOD (N=10). Of the farms that were part of a rehabilitation program, 12 (27 percent of rehab farms) were acquired through *abunu*, *abusa*, or *asidee* arrangements, and 5 (11 percent of rehab farms) were acquired through other land arrangements (not *abunu*, *abusa* or *asidee*). The remainder were acquired through direct purchase, gifting, inheritance, or landowning family rights.

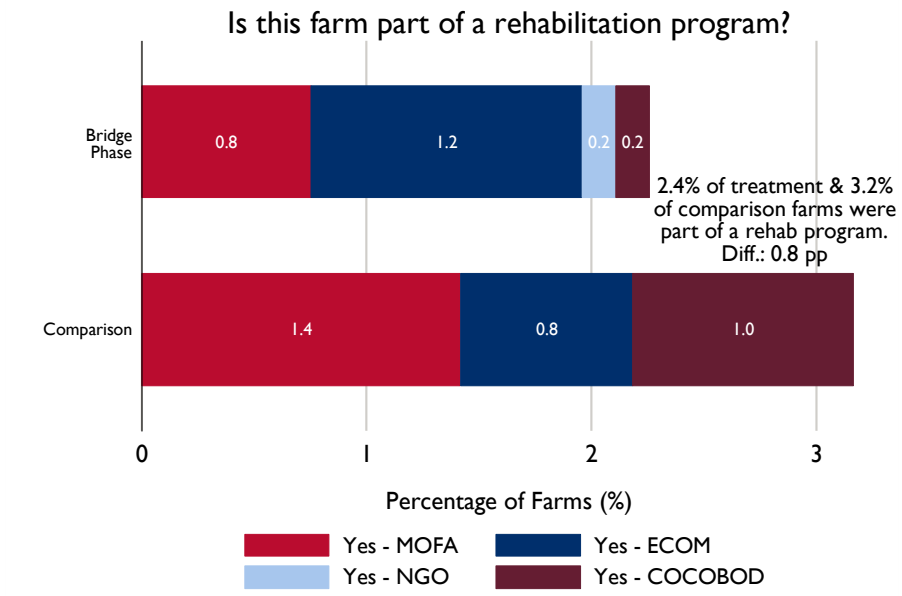
The evaluation team asked GD participants about their current and past experiences with farm rehabilitation programs. In two GDs, respondents only discussed the current ECOM programs. In one community, ECOM had arrived recently and respondents said they knew little about their services. In another community, participants indicated that some community members recently enrolled in ECOM's rehabilitation services and thus far had positive experiences. In the third GD, respondents were hesitant to adopt ECOM's services for several reasons, primarily related to negative experiences with past agricultural development projects. For example, one farmer said he signed over part of his cocoa harvest in exchange for services through a previous program, but in the end did not receive the services and still had to give up his harvest. Other farmers had negative experiences with past rehabilitation services as well, expressing concern that, *"sometimes they will cut down the trees but they will never plant and the land will be left bare again"*.

Farmers were also wary of the structure of the ECOM services, in particular losing access to their farms for five years. As one GD respondent explained:

> *"Assuming I [am] hungry and I have given my farm to them for 5 years and that is the only farm I have, but I have plantain among the cocoa farm. Can I come and harvest some [plantain]? … [The ECOM agents] said [we can't] unless we seek permission from them to harvest some for us because some people may take advantage and always come and harvest some to go and sell. So unless you seek permission… you are restricted from entering the farm."* (Female GD participant, Kramokrom)

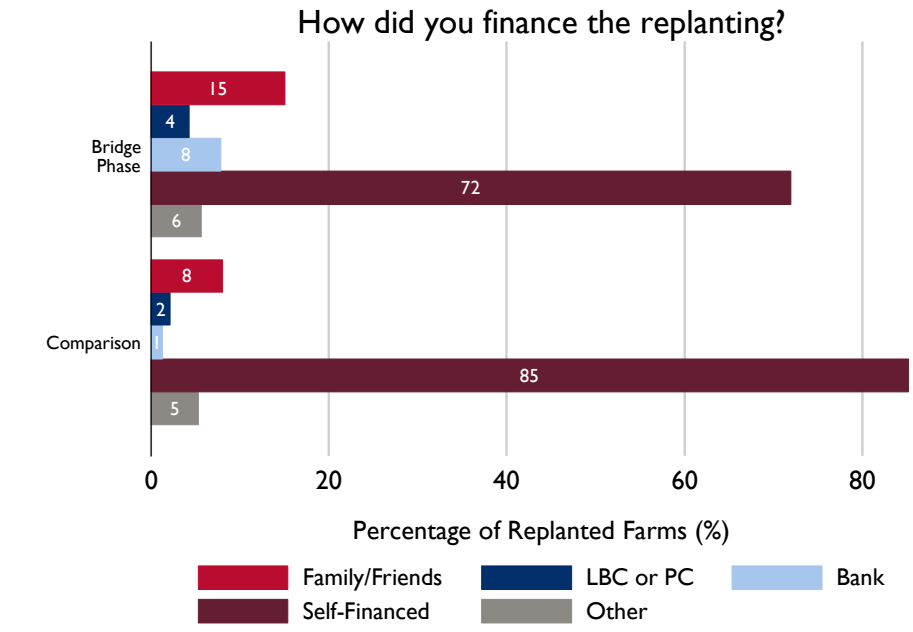
A few residents from this community had signed up for the ECOM services. The rest of the community said they would wait to see how these early adopters experienced the program before signing up themselves, citing a desire for caution due to concerns about losing access to their farms and the negative experiences with previous farm rehabilitation programs in their communities.

FIGURE 94: CURRENT COCOA FARM REHABILITATION PARTICIPATION



Replanting individual cocoa trees was much more common than opting for full farm rehabilitation. Of the 362 farms on which some cocoa trees had been replanted, farmers financed the replanting through a variety of ways. The vast majority of farms (80 percent) were self-financed by the farmers, while 11 percent used family or friends, 3 percent used a licensed buying company (LBC) or purchasing clerk (PC), and 4 percent used a bank (Figure 95).

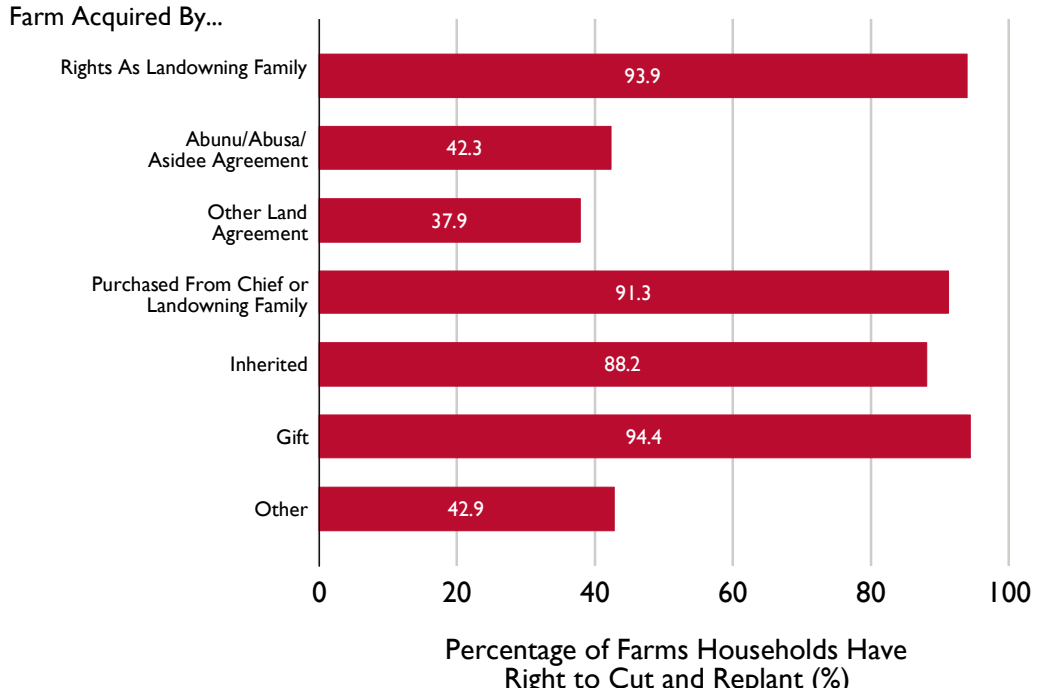
FIGURE 95: COCOA TREE REPLANTING FINANCE OPTIONS



Households reported they had the right to cut and replant cocoa trees on 68 percent of all farms. Figure

96 shows that this right varied by farm acquisition type. Farmer confidence in their rights to cut and replant farms they acquired through their landowning family rights, direct purchase, inheritance, or by gifting was much higher than for farms acquired through *abunu*, *abusa*, or *asidee* agreements, or acquired by other land agreements. While the percentage of farms households who reported having a right to cut and replant was generally near 90 percent or higher for farms acquired through landowning family rights, direct purchase, inheritance or gift, the figure was closer to 40 percent for farms acquired through *abunu*, *abusa*, *asidee* or other land agreements. Within the *abunu*/*abusa*/*asidee* group, confidence in replanting rights was lowest among *abusa* farmers, with households reporting they had the right to cut and replant only ten percent of farms under this arrangement. Confidence in replanting rights was considerably higher on *abunu* farms, with households reporting they had the right to cut and replant on 46 percent of these. Although confidence was highest among *asidee* farmers, with households reporting they had the right to cut and replant on 54 percent of *asidee* farms, this comes with the important caveat that only 16 farms were under *asidee* agreements, which is too small of a sample size to draw meaningful conclusions.

FIGURE 96: PERCEIVED RIGHT TO REPLANT COCOA, BY FARM ACQUISITION



OTHER CROP PRODUCTION

Among all farms in the sample, just 141 were reported by the farmer to have a main crop other than cocoa. Of the 141 farms reported that were planted with a main crop other than cocoa, the largest proportion, 38 percent (N=53), were acquired through *abunu* arrangements. All other modes of farm acquisition were also represented in small but varying proportions. Of the 141 farms where cocoa was not the main crop planted on the farm, just 85 (60 percent) reported selling the main crop harvested from the farm during 2018.

FIGURE 97: INCOME FROM SALE OF NON-COCOA CROPS

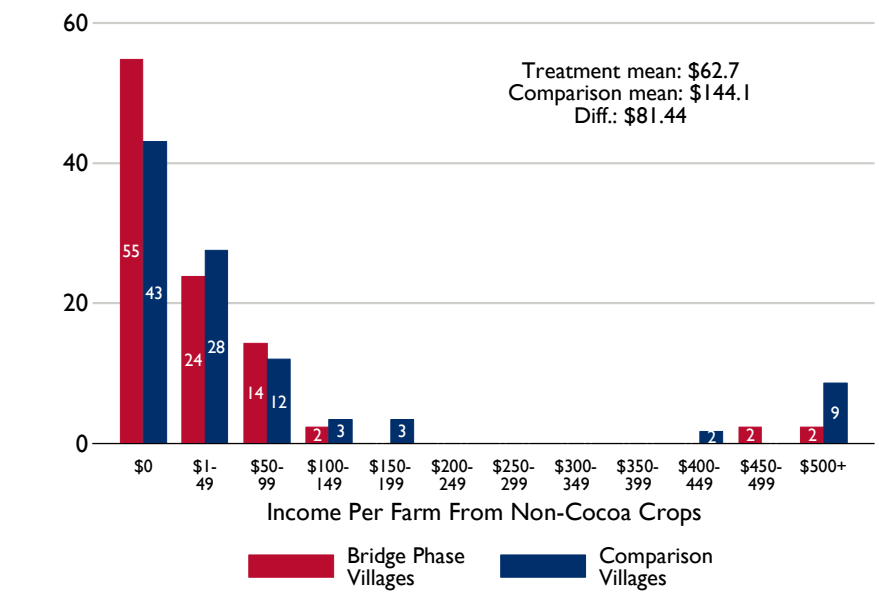


Figure 97 plots the distribution for income generated per farm from the sale of main crops other than cocoa. The figure shows that non-cocoa main crops from comparison farms generated slightly more ($144.10) than Bridge Phase farms ($62.70), but this difference was not statistically significant, in part due to the small sample size of farms with a main crop that was not cocoa.

FINDINGS 5: LAND USE PLANNING AND GOVERNANCE, FALLOWING AND SECONDARY FOREST CONTEXT

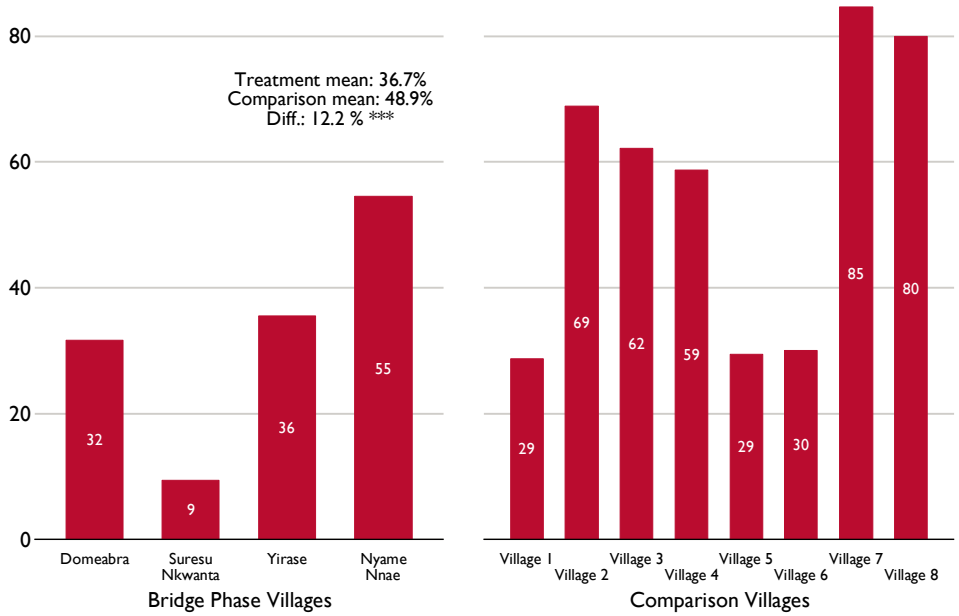
FOREST AND OTHER LAND USE RULES

The baseline survey asked a series of questions around village-level rules and governance of forests and other land-use processes. This module aimed to obtain information on whether communities may have developed rules which restrict entry to secondary forests[38] or regulate the activities that are permitted within secondary forests, such as cutting trees or harvesting various forest products. Respondents were asked whether any such rules were present in their community. Even if such rules were present in a community, we expected some variation in responses across households within a given village, depending for example on the salience of such rules to different members of the community, how well they are communicated throughout a community, and the extent to which a given randomly selected household is knowledgeable about and integrated into such processes. Where at least half of households indicated that such a rule was present, we interpreted this as stronger consensus on the presence of such rules in the community.

In five of the eleven villages surveyed at baseline, at least 50 percent of surveyed households reported the presence of rules regulating or restricting entry into secondary forests in their community. The consensus was strongest in one of the comparison group villages, Meteameba / Sefahkrom, at 84 percent (N=26 of 31 households surveyed). Figure 98 shows that of the four Bridge Phase villages, only Nyame Nnae had a majority of surveyed households reporting the presence of rules restricting entry to secondary forests. In Suresu Nkwanta, only 9 percent of households reported such rules. In Yirase and Domeabra, about a third of surveyed households thought there were such rules in their village (36 percent (N=27 households), and 32 percent (N=25 households), respectively.

[38] Secondary forest was defined as younger forests that have regenerated largely through natural processes after significant disturbance or removal of the original forest vegetation, and where woody vegetation has taken over and trees have begun to regenerate. Secondary forests have a different structure and species of tree composition than primary forests.

FIGURE 98: PREVALENCE OF ENTRY RULES FOR SECONDARY FORESTS



Are there any rules in this village which regulate or restrict entry into secondary forests?

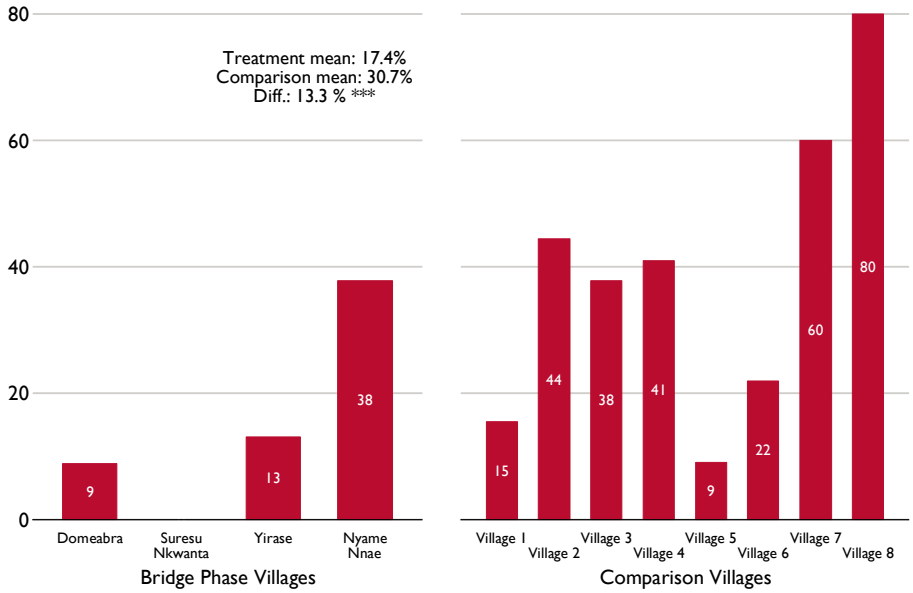
With respect to rules that regulate or restrict the collection or harvesting of specific forest products, 26 percent of households (N=172) reported such rules to be present in their village. Of the 11 villages in the sample, only Meteameba / Sefahkrom again had strong consensus among respondents affirming that their village has rules that regulate collecting or harvesting products from secondary forests (63 percent; N=19) (Figure 99). While 26 percent of the overall sample said their village had such rules, the share of respondents in comparison villages who said so (31 percent) was considerably higher than the share who said so in Bridge Phase villages (17 percent), and the difference was statistically significant. Among the Bridge Phase villages, Nyame Nnae again had the highest percentage of respondents who said secondary forest harvesting restrictions existed in their village (38 percent; N=28). The percentage of respondents in other Bridge Phase villages who said their village had secondary forest harvesting restrictions was very low, with just nine percent of respondents in Domeabra (N=7), no respondents in Suresu Nkwanta, and 13 percent of respondents in Yirase (N=10).

In sum, the survey data appeared to suggest stronger rule processes over forest entry and use in Nyame Nnae than in the other Bridge Phase villages, while such processes did not appear to be active in Suresu Nkwanta. In GDs, respondents in Meteameba / Sefahkrom and Koduakrom both confirmed that CREMAs[39] have been established in their communities, and they implement forest and watershed conservation activities like restricting forest clearing and planting trees along riverbanks. Participants in Meteameba / Sefahkrom said that their CREMA association has been active for approximately five years,

[39] Community Resource Management Areas (CREMAs) are the primary institutional mechanism that Ghana's Forestry Commission uses to implement collaborative natural resource management outside of protected areas. Where they are implemented, community members serve on CREMA committees and work with the Forestry Commission and District Assembly to create natural resource management plans and bylaws for designated areas. CREMAs are viewed as a feasible mechanism for communities to participate in and receive benefits from REDD+ programs. Although CREMA implementation, capacity and sustainability continue to be of concern in Ghana, in theory the ability for a community to eventually receive payments for forest conservation activities through a REDD+ program could serve as an incentive for communities to develop and adhere to stronger forest management and use rules in a community. This could help explain why forest entry and use rules appear to be stronger in the two villages in the baseline sample where CREMAs have already been established.

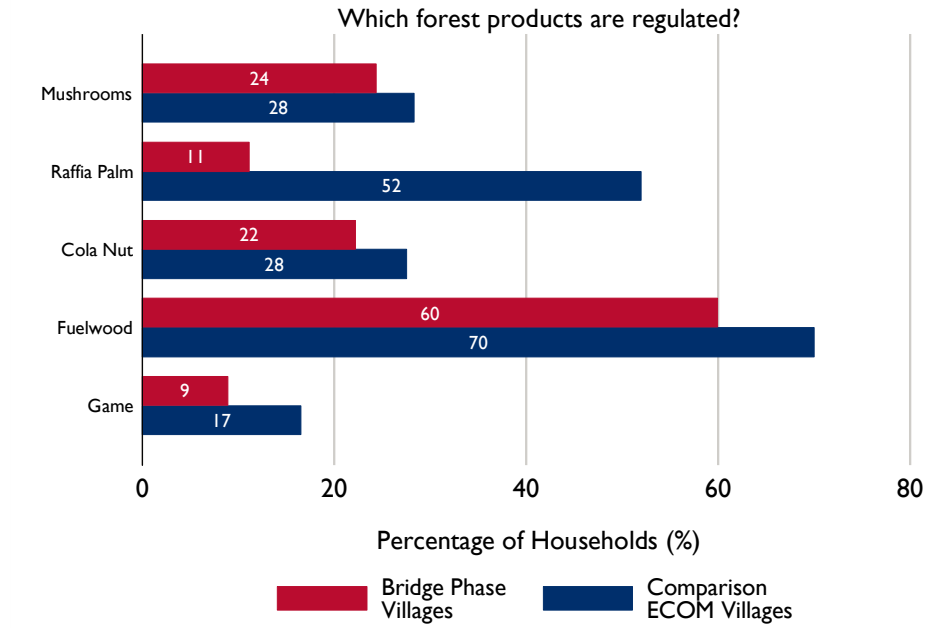
before which the community implemented its own forest conservation activities. An NGO supports the CREMA by offering trainings on conservation and alternative livelihood activities like beekeeping. Community members also said they make and enforce conservation rules, such as limiting burning during the dry season, restricting entering and cutting trees in the forest reserve, and banning fishing with chemicals. GD participants said the community generally accepts the CREMA's rules and follows the trainings provided by the NGO.

FIGURE 99: PREVALENCE OF SECONDARY FOREST PRODUCT HARVESTING RULES



For the 172 respondents who said their village had rules regulating the collection or harvesting of secondary forest products, the household questionnaire asked which products were regulated. Figure 100 shows that for both Bridge Phase and comparison villages the most common response was fuelwood (67 percent; N=116). Among all villages, the second most common response was raffia palm (41 percent; N=71), though the percentage was considerably higher for comparison villages than for Bridge Phase villages. A similar percentage of respondents said that their village regulated the harvesting or collecting of mushrooms (27 percent; N=47) and cola nut (26 percent; N=45).

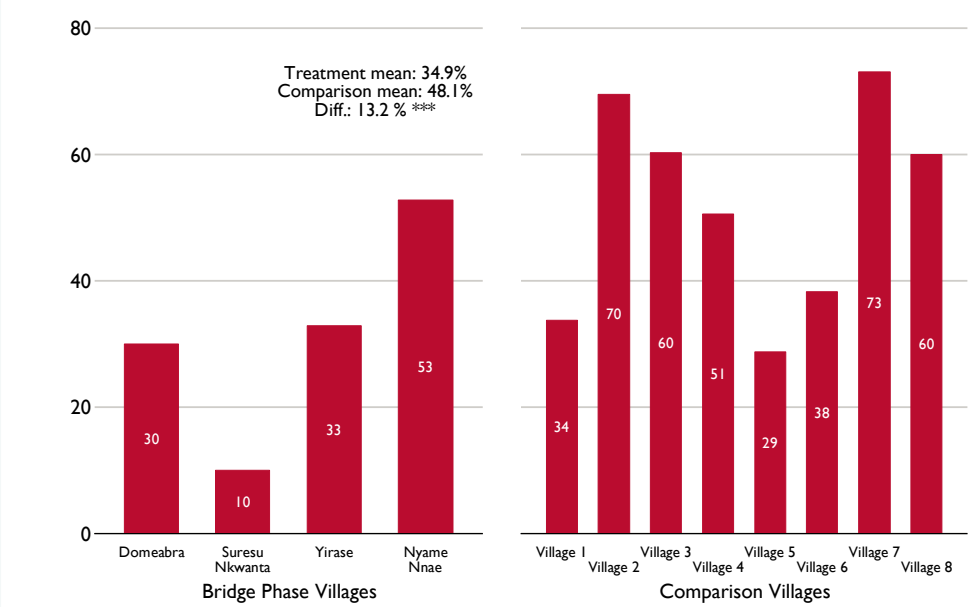
FIGURE 100: REGULATED SECONDARY FOREST PRODUCTS



Respondents across the qualitative sample reported that there were few restrictions on secondary forest use. According to GD participants, members of their communities are permitted to enter secondary forests to gather products like firewood, mushrooms, medicinal herbs, and snails. Respondents in Koduakrom and Kramokrom said they are allowed to enter such forests to hunt. In Meteameba / Sefahkrom, the community with a CREMA, respondents said they are not allowed to harvest from secondary forests due to recent restrictions they have imposed.

Overall, 43 percent of respondents said they had rules regulating tree cutting in secondary forests in their village. Again, we saw a statistically significant difference between Bridge Phase and comparison villages, with a higher share of comparison households (48 percent) saying their village had such rules than Bridge Phase households (35 percent). Similar to the results for secondary forest entry and harvesting, Meteameba / Sefahkrom had the highest share of respondents (71 percent) saying the village had rules about tree cutting in secondary forests in their community (Figure 101). Results among Bridge Phase villages were also similar to those seen previously for other secondary forest rules. Nyame Nnae had the highest share of respondents saying tree cutting rules existed in their community (53 percent). Suresu Nkwanta again had the lowest share of respondents saying rules on tree cutting in secondary forests existed in the village (10 percent). The results for Domeabra and Yirase were similar in terms of other rules related to secondary forests (30 percent and 33 percent, respectively).

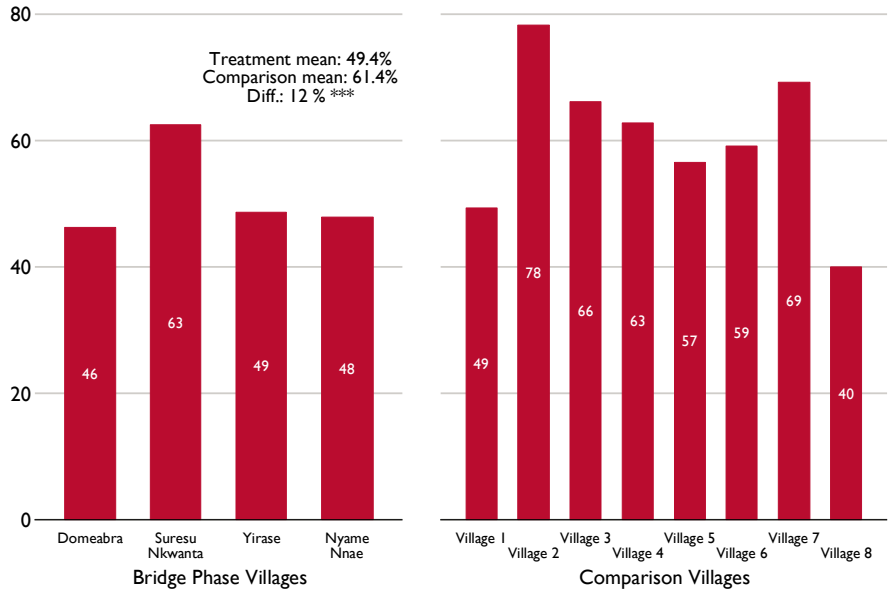
FIGURE 101: PREVALENCE OF TREE CUTTING RULES IN SECONDARY FORESTS



MEETINGS, PARTICIPATION AND SOCIAL CAPITAL

Across all villages, 57 percent said their village held general meetings to discuss land use or rules around land use planning. Figure 102 shows that the share of households in comparison villages who said their village held such meetings (61 percent) was higher than the share in Bridge Phase villages who said the same (49 percent). Among Bridge Phase villages, the village with the highest percentage of respondents who said the village held such meetings was Suresu Nkwanta (63 percent). The other Bridge Phase villages all had a similar share of respondents who said the village had land use planning meetings, varying between 46 and 49 percent of respondents. In general, survey results suggested that villages across the sample met to discuss land-use issues, and land-use meetings appeared to be more common than meeting to discuss secondary forests.

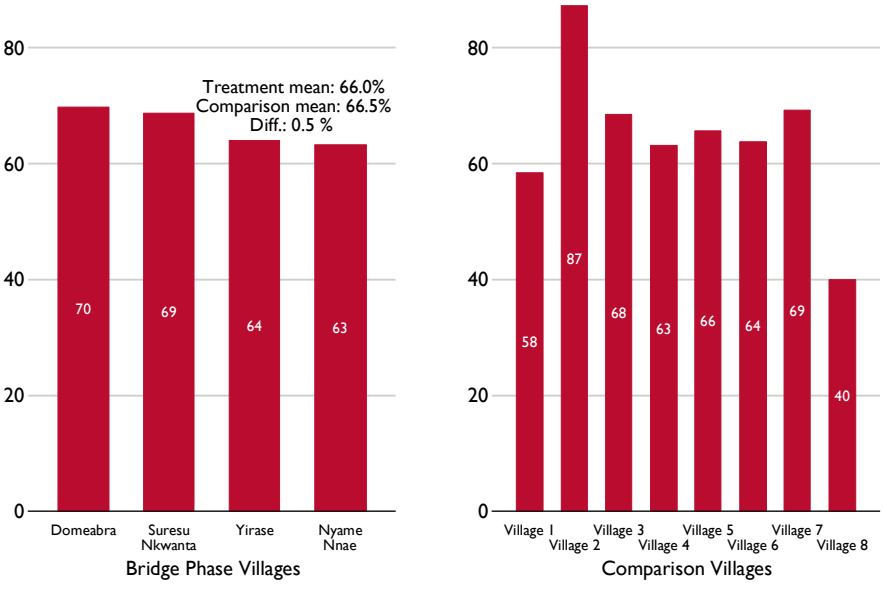
FIGURE 102: PREVALENCE OF LAND USE PLANNING MEETINGS



Does your village hold any general meetings to discuss land use or rules/regulations around land use planning?

Figure 103 shows the percentage of households in each village who participated in land use planning meetings. Across all villages, 66 percent of households (N=451) said someone in the household participates in such meetings. Among Bridge Phase villages, there was relatively little variation. Between 63 and 70 percent of respondents in each village said at least one household member participated in these meetings. However, across most surveyed villages, 45 percent of households reported that the frequency of their participation in such meetings over the course of a year was rare (1-2 times at most).

FIGURE 103: HOUSEHOLD PARTICIPATION IN LAND USE PLANNING MEETINGS

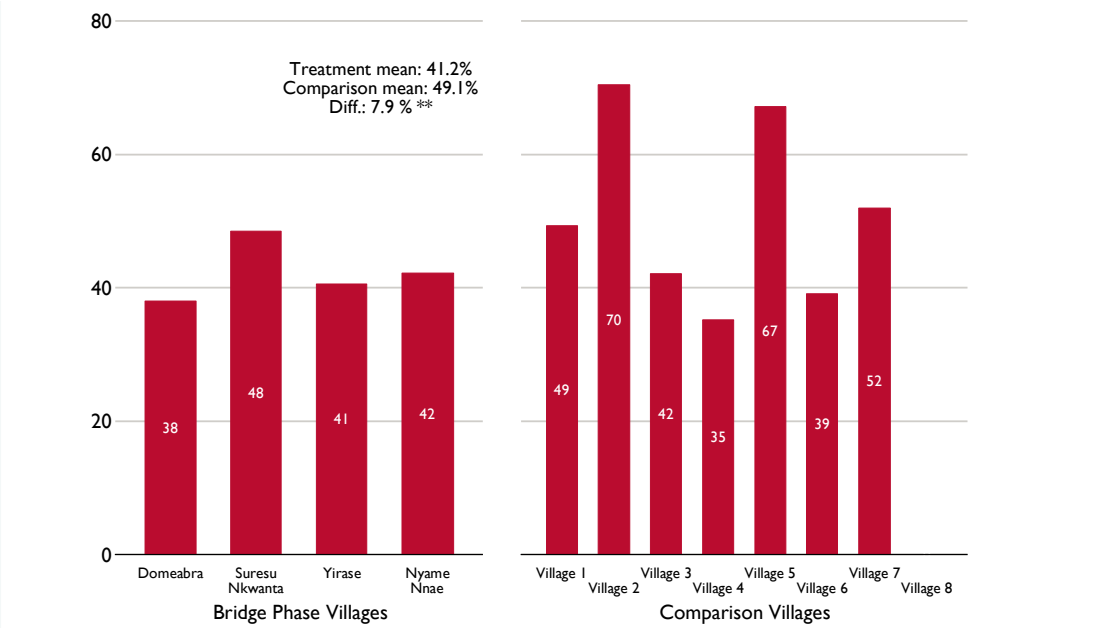


Does anyone in your household participate in meetings in this village to discuss land use?

35 percent of households said they participated in meetings between three and ten times per year, and 20 percent said they participated more than ten times per year. For all Bridge Phase villages, at least half of respondents said their participation was rare, with the exception of Domeabra (at 45 percent).

Figure 104 shows the percentage of households in each village who said the village had bylaws regulating how people use land in the village. Across all villages, 46 percent of households said their village had such bylaws, with a higher share of comparison households (49 percent) than Bridge Phase households (41 percent) saying so. Among Bridge Phase households, between 38 percent (Domeabra) and 48 percent (Suresu Nkwanta) of respondents in each village said the village had land-use bylaws.

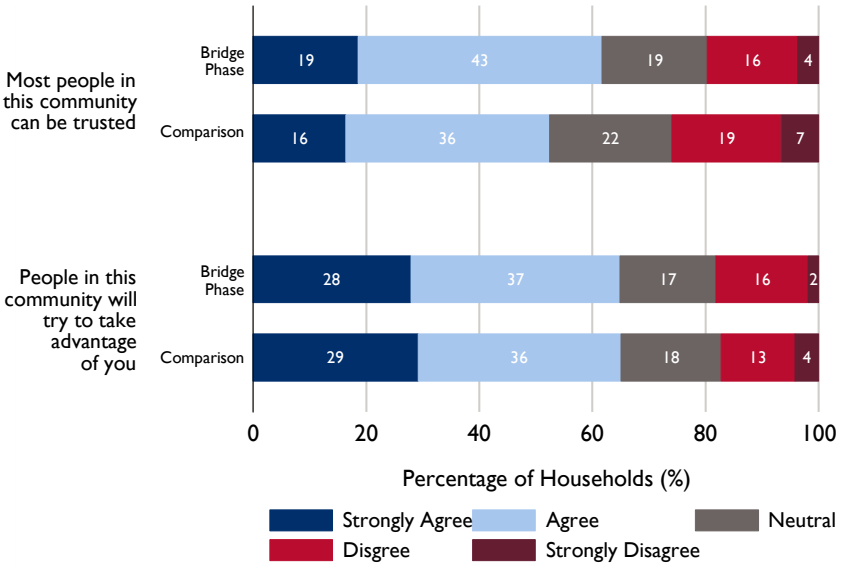
FIGURE 104: PREVALENCE OF BYLAWS FOR REGULATING LAND USE



Does your village have any bylaws that regulate how people use land?

Lastly, respondents were asked two questions to measure social capital and trust in the village. Figure 105 shows the extent to which respondents agreed with the statements, "Most people in this community can be trusted" and "In this community, you have to be alert or people will try to take advantage of you". Distributions for both questions are similar for Bridge Phase and comparison villages.

FIGURE 105: SOCIAL CAPITAL



Overall, 56 percent of respondents agreed or strongly agreed with the statement that most people in their community could be trusted. At the same time, 65 percent agreed or strongly agreed that people in their community will try to take advantage of them. These results were at odds with each

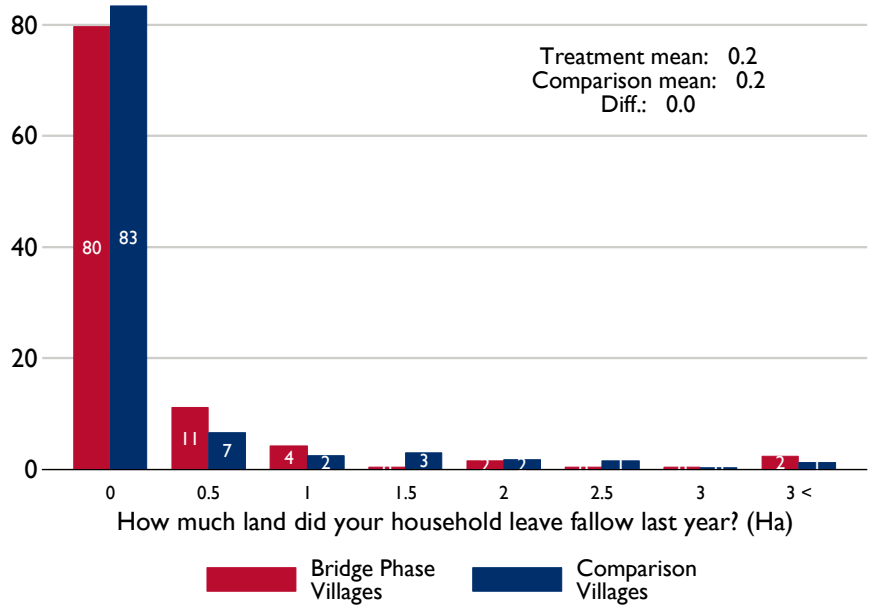
other[40], but the results do not suggest unusually high or low levels of social capital in the communities.

FALLOWING AND SECONDARY FOREST CONTEXT

Across all farms in the baseline survey sample, 97 percent were currently being farmed, while two percent were currently under fallow and less than one percent were reported to be used currently as secondary forests. Households reported that 4.5 percent of farms (N=78) in the baseline sample had ever been left to fallow, and that 1.4 percent of farms had ever been left to revert fully to secondary forest. Among farms previously left as secondary forest, the year they were cleared for farming ranged from 1989 to 2018. Households reported fallowing and leaving larger areas of land they control under fallow, compared to secondary forest.

At the household level, 17 percent of households reported having some land under fallow during the year prior to survey, ranging from 0.2 to 23 hectares in size. According to household self-reporting, the average area of land households left as fallow in the year prior to survey was 0.20 hectares, across all households in the sample, with no significant difference between Bridge Phase and comparison group households (Figure 106). Among the 17 percent of households that reported having some land under fallow in the year prior to survey, the average area of fallow land they held was 2.8 hectares.

FIGURE 106: HECTARES OF LAND LEFT FALLOW PER HOUSEHOLD



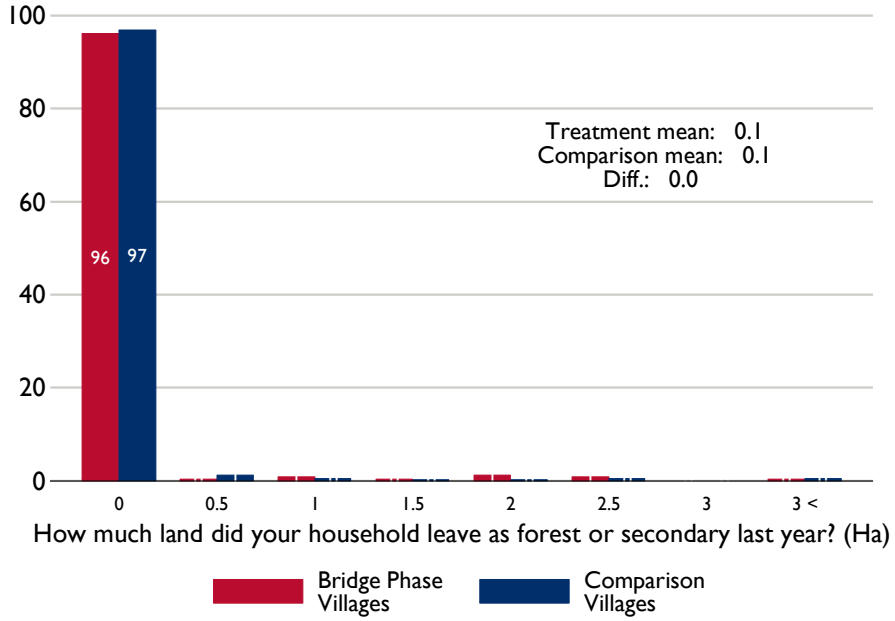
Three percent of households reported having some land as secondary forest during the year prior to survey, ranging from 0.3 to 15 hectares in area. Across all households, the average area of land households left as secondary forest was 0.10 hectares (Figure 107). Among households that reported having any secondary forest in the year prior to survey, the average size of forest land they controlled was 4.3 hectares.

Qualitative data collection at baseline added additional context to these quantitative findings. GD participants across all GDs reported that members of their communities still leave portions of their farms to fallow and eventually revert to secondary forest. This was also confirmed through the carbon stocks fieldwork, where secondary forest patches were encountered by the measurement team in each

[40] The contradictory results could be an indication of survey fatigue, as these questions came at the end of the survey and the second question in this series used a scale in reverse order to that used for the first question.

village of data collection. In one of the comparison group communities, GD participants said the typical age of secondary forests in their community is 5-10 years. In another, the maximum age for secondary forests was said to be around 20 years.

FIGURE 107: HECTARES OF LAND LEFT AS SECONDARY FOREST PER HOUSEHOLD



GD participants confirmed that landowners themselves decide when to clear or leave secondary forests. GD participants framed this decision as determined by the household's cocoa farming needs rather than an explicit forest conservation interest. Respondents noted that they leave their land fallow when cocoa trees become unproductive, when farmers are no longer able to maintain their farms (often due to old age), or when the family has more land than they are able to actively farm. The main reason that households clear secondary forests is to convert the land to cocoa farms.

Participants in one GD said they were more likely to leave farms to fallow when there is an abundance of land. As one respondent explained:

> *"Somebody may be too old so his children will have to do the weeding because at that time, the person may be weak. There are divisions [to the farm] so every [child] has a possession. You can't take somebody's own. The person may be too weak to work, that is the reason [for leaving a farm fallow]. And [here] we have land in abundance."* (Male GD Participant, Kramokrom)

GD participants agreed that as land has become scarcer, so have secondary forests. Community members use secondary forests to hunt or gather products like firewood, snails, mushrooms, and medicinal herbs for household consumption. However, respondents across the qualitative sample noted that the availability of these forest products is declining as farmers cut secondary forests to farm cocoa. As one farmer put it: "*When the forest becomes bushy, it attracts animals, [but] now the animals are no more because of the weeding [cutting]".* (Male GD Participant, Kramokrom)

Respondents universally agreed that there is little or no primary forest left in the area outside of the nearby Forest Reserves. In Koduakrom and Kramokrom, participants said there was no primary forest left in their communities. In Meteameba / Sefahkrom, GD respondents reported that four households in their community have older and better-condition forest on their land, totaling approximately four

hectares. According to participants, they had been instructed by an NGO to leave this forest untouched, to preserve it for the future:[41]

> *"They [an NGO] told us that, those of us with forests that have not been weeded, we shouldn't weed it, [because] they should be reserved. Because there will come a time that they will come and work in them. That is why they have left those forests." (*Male GD Participant, Meteameba / Sefahkrom)

FINDINGS 6: CARBON STOCK MEASUREMENTS ON FARMS

The CEL evaluation team's carbon stock measurements and per-plot summaries followed protocols established by Winrock, to ensure comparability with additional data collected by IPs in March-April 2019 on some forty farms that were enrolled in the ECOM farm rehabilitation service. Here, we report the standard outputs of CEL's data collection obtained using Winrock's calculation tool, including carbon stocks disaggregated by cocoa and shade tree components. The evaluation team is undertaking additional analysis to examine differences in carbon stocks by farm age and other farm attributes as part of separate work under this evaluation.

Overall, the data suggested fairly high shade tree diversity and the presence of several forest tree species. In general, the carbon stocks measurement team noted wide variation in the state of cocoa farms they sampled, ranging from well-maintained farms with little undergrowth to over-grown farms with secondary forest patches characterized by emergent tree species such as *Musanga cercropoides.*[42] The team also observed wetlands and riparian vegetation in the landscape and on some of the surveyed cocoa farms, and riparian areas that were being actively converted to farmland.

TREE BIOMASS CARBON STOCKS

The overall estimated mean total tree biomass carbon pool was 45.2 t C/ha (95 percent CI: 40.4 – 50.2 t C/ha). The shade tree component comprised 60.0 percent of the total tree biomass carbon pool, at 27.2 t C/ha (95 percent CI: 22.9 – 31.4 t C/ha). The average estimated cocoa tree component was 18.1 t C/ha (95 percent CI: 16.3 – 19.9 t C/ha). The cocoa tree carbon pools measured by the CEL team were in the range of values reported from published studies from Ghana, while the shade tree component measured by CEL was somewhat higher (noting there are few studies from Western region which report on this, and the farm N from existing work from Ghana is quite small). For example, from their study of 12 cocoa farms across Eastern and Western regions of Ghana, which ranged in age from 7 to 28 years old, Mohammed et al (2016) reported a range of 11.8 – 16.9 Mg[43] C/ha for cocoa trees, and 10.2 – 16.4 Mg C/ha for the shade tree component[44]. They also found that the biomass carbon stock was nearly twice as high in shaded agroforestry systems compared to non-shaded cocoa farms. Isaac et al. (2005) reported the carbon stocks in the cocoa tree component at 10.3, 16.8, and 15.9 Mg C/ha for 8-year, 15-year and 25-year cocoa systems in Ghana, respectively.[45]

By village sample, the mean estimated carbon pool per farm was highest in Koduakrom, at 53.9 t C/ha, and lowest in Domeabra, at 38.7 t C/ha. The shade tree component of the total carbon pool was highest

[41] GD participants did not mention any incentivizes households may have received or been promised to maintain these secondary forests (such as future REDD+ payments, for example).
[42] E. Danquah, 2019. CEL Cocoa Farm Carbon Measurements Baseline Data Collection Report.
[43] 1 Mg is equivalent to 1 tonne.
[44] Mohammed, A. M., Robinson, J. S., Midmore, D. & Verhoef, A., 2016. Carbon storage in Ghanaian cocoa ecosystems. Carbon Balance and Management, 11(6).
[45] Isaac M, Gordon A, Thevathasan N, Oppong S, Quashie-Sam J. 2005. Temporal changes in soil carbon and nitrogen in West African multistrata agroforestry systems: a chronosequence of pools and fluxes. Agroforestry Systems 65(1):23–31.

in Sureso Nkwanta, at 35.7 t C/ha (95 percent CI: 21.8 – 49.7 t C/ha), and lowest in Domeabra, 17.9 t C/ha (95 percent CI: 11.7 – 24.2 t C/ha).

ON-FARM SHADE TREE SPECIES RICHNESS, USE VALUE AND CONSERVATION STATUS

Across the 123 individual plots measured, the team recorded 78 species of shade trees, including timber and non-timber species (Annex I). This list excludes two common banana family (*Musa*) species that were abundant across the cocoa farms: *Musa acuminate* and *Musa paradisiaca*. The most common tree species recorded were *Musanga cecropioides* (Odwuma), *Newbouldia laevis* (Sesemasa), *Terminalia superba* (Ofram), *Rauvolfia vomitoria* (Kakapenpen), *Milicia excelsa* (Odum), *Cola nitida* (Bese), *Citrus sinensis* (Paya Ankaa), *Persea americana* (Paya), and *Morinda lucida* (Konkroma). Some of these species have local medicinal value, such as *Newbouldia, Rauvolfia* and *Morinda*, while others such as *Terminalia, Milicia*, and *Cola* are valued in the region for timber or non-timber forest products.[46]

In terms of tree species diversity on cocoa farms, the Kramokrom cluster of farms had the highest number of tree species (N = 51 tree species), Domeabra had the lowest (N=35 tree species), while the average number of tree species recorded across all villages was 39.

In terms of conservation concern, several of the tree species recorded were considered under moderate to serious pressure from exploitation, hence warranting additional conservation concern. These were: *Tieghemella heckelli, Albizia ferruginea, Entandrophragma angolense, Danielia ogea, Nauclea diderrichii, Khaya ivorensis, Milicia excelsa, Entandrophragma cylindricum,* and *Triplochitin scleroxylon.*

BALANCE AND POWER

The evaluation team used the baseline data to revisit statistical assumptions related to the methodology proposed for this evaluation. The evaluation team conducted balance tests to examine and confirm the comparability of Bridge Phase and comparison groups for the matched comparison component of the evaluation design. In addition, the evaluation team re-ran power calculations from the evaluation design report, using the parameters obtained from the baseline data. This enabled the team to re-confirm statistical power, given the sample size and parameters of the baseline data.

BALANCE TESTS

The evaluation team examined normalized differences in baseline means on key outcome variables and covariates to assess balance between Bridge Phase and comparison groups. The selected variables spanned a wide range of outcome categories and covariates of interest for the evaluation. The normalized difference statistic falls below 0.25 for nearly all of the variables tested, indicating adequate balance.[47] The evaluation team also used entropy-balancing as a form of matching to improve comparability of Bridge Phase and comparison groups using the baseline data and confirm the ability to mitigate observable bias through matching. The aim of pre-processing the data via entropy-weighting is to improve covariate balance between the Bridge Phase and comparison groups, so that the comparison group has a more similar distribution to the Bridge Phase group on observed characteristics that may influence outcomes. This helps to overcome the confounding effects of potential selection bias, particularly in terms of villages selected for interventions and household self-selection into participation into program activities.

[46] Anglaaere, L. C., Cobbina, J., Fergus, S. L. & McDonald, M. A..2011. The effect of land use systems on tree diversity: farmer preference and species composition of cocoa-based agroecosystems in Ghana. Agroforestry Systems, 81, 249 - 265.
[47] An absolute value of 0.25 or less indicates strong balance.

To test this at baseline, the evaluation team matched on a set of household-level characteristics that could relate both to a household's interest to participate in intervention activities and their baseline starting point on key outcome indicators of interest. The household-level covariates included a wide range of variables, as listed in Table 21 below. The results, shown in Table 21, confirmed the ability to achieve balance on several key covariates and baseline values of outcomes across the Bridge Phase and comparison group household samples. In other words, households in the comparison group form a viable pool to serve as a counterfactual for Bridge Phase households, to measure the effects of the tenure strengthening component of the Bridge Phase intervention as planned through the evaluation.

TABLE 21: BALANCE CHECKS ACROSS BRIDGE PHASE AND COMPARISON GROUP

	Overall		Bridge Phase Villages		Comparison Villages			Matched Comparison Villages		
Outcome or Covariate	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff**	**Mean**	**N**	**Diff**
Basic Household Characteristics										
Head Age (in years)	45.56	704	43.75	269	46.67	435	-2.93***	43.55	435	0.19
Head Gender	0.16	713	0.13	273	0.17	440	-0.05*	0.13	440	-0.00
Head level of education==None	0.33	710	0.36	272	0.31	438	0.05	0.38	438	-0.03
Head level of education==Primary	0.17	710	0.23	272	0.13	438	0.09***	0.12	438	0.11***
Household head can read a phrase in English	0.43	712	0.38	273	0.46	439	-0.08**	0.38	439	-0.00
Household Size (members)	5.44	713	5.79	273	5.23	440	0.56**	5.79	440	0.00
Household Head Has Leadership Role in Village	0.29	713	0.28	273	0.29	440	-0.01	0.28	440	-0.00
Household head was born in this district	0.36	709	0.33	272	0.38	437	-0.05	0.33	437	-0.00
Head reason to migrate== cocoa farming	0.72	454	0.73	182	0.71	272	0.01	0.70	272	0.03
Head reason to migrate==Other economic	0.14	454	0.18	182	0.11	272	0.07**	0.14	272	0.03
Household livelihoods and wealth status										
Satisfaction with financial wellbeing (2018)	2.05	713	2.09	273	2.03	440	0.06	1.89	440	0.20***
Satisfaction with cocoa yields (2018)	2.07	707	2.13	270	2.04	437	0.08	2.05	437	0.07
Satisfaction with cocoa income (2018)	2.09	707	2.15	270	2.06	437	0.09	2.07	437	0.07
Wellbeing ladder (2019)	3.52	713	3.37	273	3.62	440	-0.25*	3.36	440	0.00
Wellbeing ladder (2017)	3.99	713	3.85	273	4.07	440	-0.21	3.85	440	0.00
Likelihood of Poverty at $1.25/day level (2005 PPP)	11.45	713	13.21	273	10.36	440	2.85***	13.08	440	0.14
Household access to credit										
Household borrowed money last year	0.45	712	0.53	273	0.40	439	0.13***	0.53	439	0.00
Amount borrowed (USD) - All HHs	248.59	706	317.88	269	205.94	437	111.94***	245.04	437	74.02*
How much did you borrow?	2941.8	314	3191.8	141	2737.9	173	453.9	2433.7	173	758.2**
Household able to repay the loan	0.83	239	0.81	105	0.84	134	-0.03	0.82	134	-0.01
Food Security										
Household Hunger Scale, HHS	0.43	713	0.66	273	0.29	440	0.37***	0.65	440	0.00
Household had no food to eat	0.16	713	0.22	273	0.12	440	0.10***	0.25	440	-0.03
Household member went to sleep hungrydays	0.15	713	0.23	273	0.10	440	0.13***	0.22	440	0.00
Household member went a whole day and night without eating	0.07	712	0.11	272	0.04	440	0.07***	0.10	440	0.01
Non-Farm Activities (over past year)										
Household engaged in off-farm activities ar	0.46	713	0.44	273	0.47	440	-0.02	0.39	440	0.06
Household income from off-farm activities (USD)	144.11	581	120.96	223	158.54	358	-37.57	108.83	358	12.67
Household received income from remittances	0.08	713	0.05	273	0.10	440	-0.05***	0.07	440	-0.03
Household received remittances	13.24	701	3.07	269	19.58	432	-16.51***	8.61	432	-5.54**
Household engaged in a new livelihood activity	0.13	713	0.16	273	0.11	440	0.06**	0.14	440	0.03

	Overall		Bridge Phase Villages		Comparison Villages			Matched Comparison Villages		
Outcome or Covariate	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Diff**	**Mean**	**N**	**Diff**
Household earned income from gold mining activities	0.09	713	0.12	273	0.08	440	0.04*	0.08	440	0.04
Household income from mining or trading gold (USD)	28.45	680	41.75	256	20.42	424	21.33	24.96	424	16.95
Months household members engaged in gold mining	0.55	709	0.56	270	0.54	439	0.02	0.52	439	0.05
Crop Production										
Total Number of Different Crops Produced	4.45	714	4.22	273	4.59	441	-0.38	4.74	440	-0.52**
Total Number of Different Crops Sold	2.14	714	2.07	273	2.18	441	-0.11	2.16	440	-0.08
Sale of cocoa	63.19	698	64.84	269	62.15	429	2.69	64.84	429	-0.14
Sale of other crops	9.67	666	9.60	248	9.72	418	-0.11	9.51	418	0.13
Land Holdings										
Household has any farms acquired through rights as a landowning family	0.14	714	0.13	273	0.15	441	-0.02	0.13	440	-0.00
Hectares of land household used to cultivate all crops last year	3.14	694	3.17	264	3.12	430	0.05	3.33	430	-0.17
Hectares of land household owned in total last year	2.82	694	2.83	262	2.82	432	0.01	2.82	432	0.01
Hectares of others' land household did abunu farming on last year	0.57	680	0.65	266	0.52	414	0.13	0.67	414	-0.01
Hectares of others' land household did abusa farming on last year	0.18	675	0.20	266	0.16	409	0.03	0.22	409	-0.02
Number of separate farms household cultivated crops on last year	2.42	707	2.67	272	2.26	435	0.41***	2.69	435	-0.01
Household had ABUNU tenant farmer on any of household's land last year	0.09	711	0.13	273	0.07	438	0.06**	0.07	438	0.06***
Hectares of household land under abunu tenant farmer last year	0.17	711	0.20	273	0.14	438	0.06	0.12	438	0.08
Household had ABUSA tenant farmer on any of household's land last year	0.09	710	0.13	272	0.07	438	0.07***	0.07	438	0.07***
Hectares of household land under abusa tenant farmers last year	0.17	709	0.24	271	0.13	438	0.11*	0.15	438	0.09
Hectares of land household used for cocoa last year	2.91	652	2.84	242	2.96	410	-0.11	3.23	410	-0.38*
Number of separate farms household cultivated cocoa on last year	2.30	702	2.49	269	2.18	433	0.32***	2.49	433	0.01
Household decreased their cocoa land holdings in past 5 years	0.14	702	0.18	266	0.12	436	0.06**	0.12	436	0.06**
Household did not change their cocoa land holdings in past 5 years	0.49	702	0.45	266	0.52	436	-0.07*	0.47	436	-0.03
Household increased their cocoa land holdings in past 5 years	0.36	702	0.38	266	0.36	436	0.02	0.41	436	-0.03
Land Disputes, Documentation, Tenure Security, Cocoa Yield										
Household had a dispute on any farm in the past 3 years	0.05	711	0.07	272	0.04	439	0.03*	0.04	439	0.04**
Total Number of Disputes Per Farm, last 3 years	0.04	707	0.05	272	0.03	435	0.02	0.03	435	0.02
Household reported presence of disease on cocoa farms	0.80	712	0.78	273	0.81	439	-0.03	0.78	439	-0.00
Household has right to cut and replant your cocoa farms, if wants so	0.75	707	0.70	271	0.78	436	-0.07**	0.72	436	-0.01
Household is worried of losing rights to any farms	0.31	714	0.28	273	0.32	441	-0.04	0.28	440	-0.00
Household has land documentation recognizing right to use cocoa farms	0.47	709	0.48	272	0.46	437	0.02	0.48	437	-0.00
HH has any farms they are likely to lose (or currently losing) if they cut and replant cocoa	0.18	714	0.22	273	0.15	441	0.07**	0.22	440	-0.00
Cocoa Yield Last Main and Light seasons (Kg/Ha)	653.51	554	871.43	211	519.45	343	351.97***	531.52	343	339.91***

POWER CALCULATIONS

The evaluation team also used the baseline sample to update the power calculations for the land mapping and documentation component of the IE. Compared to power expectations at the IE design stage, the updated calculations confirmed that the evaluation remains well-powered to detect key outcomes of interest under the tenure documentation component of the Bridge Phase intervention. However, due to the smaller-than-planned sample size of treated households for the cocoa farm rehabilitation component of the intervention, it is no longer viable to detect impacts of the cocoa farm rehabilitation through a regression discontinuity design.

Table 22 presents illustrative minimum detectable impact (MDI) calculations for selected outcomes for both the farm rehabilitation intervention and the tenure documentation intervention. MDIs indicate the smallest impact for a given outcome that we are able to detect given the impact evaluation design, sample size, and a number of other parameters such as the confidence level of the hypothesis test (95 percent), the level of power (80 percent), and the amount of variation in the outcome explained by the covariates included in the regression analysis (30 percent). The smaller the MDI, the larger is the power of the design. We first calculated the minimum detectable effect size (MDES) for each intervention, which is expressed in terms of standard deviation units (same across all outcomes). We then calculated the MDI for each outcome by multiplying the MDES with the baseline standard deviation of the given outcome.

For the tenure documentation component, the reduction in the sample size from the planned 960 households to 714 households resulted in a small increase in the MDES over what was anticipated at evaluation design, from 0.207 to 0.235. This change in household sample size had minimal impacts, and the evaluation remains well-powered for the tenure documentation intervention. In terms of outcomes, the evaluation is powered to detect changes ranging from 16 to 31 percent of the baseline mean for key outcomes, across a range of key effects that are anticipated from the receipt of farm tenure documentation (Table 22). This is a very small difference from the MDIs estimated at evaluation design, which ranged from 12 to 31 percent of the anticipated baseline means. Results from prior land sector evaluations suggest that the MDIs for the tenure documentation component for this evaluation are in the range of impacts that may be feasible to achieve through the type of tenure strengthening intervention that Bridge Phase IPs are providing.

The loss of treated households from the cocoa farm rehabilitation component had a much greater impact on the evaluation's power to detect impacts through the regression discontinuity design planned at evaluation design. Table 19 shows that the MDES had increased from 0.718 as estimated at evaluation design under a planned treated sample of 51 households[48], to 1.159 under the actual sample size at baseline of 19 treated households. In terms of units of outcome, this corresponds to very large MDIs. For example, for the proportion of households leaving some land under fallow, the minimum impact that the evaluation will be able to detect at Bridge Phase endline is about 43.4 percentage points or a 257 percent change from the baseline value. Similarly, 37.4 percent of households cleared new land for cocoa production at baseline and the MDI for the evaluation is 56.1 percentage points or 150 percent of the baseline value. For cocoa productivity, the MDI is 151 percent of the baseline value. The primary reason for such low power to detect impacts of the farm rehabilitation intervention is the very low number of farmers who stayed enrolled in the farm rehabilitation service during the Bridge Phase.

[48] This number was itself a reduction from the roughly 70 households that IPs initially planned to enroll into the farm rehabilitation component during the earlier stages of evaluation design. By the time of baseline data collection, the number had dropped further, as some farmers were later disenrolled by ECOM for eligibility reasons, while others dropped out voluntarily or chose to leave the village after turning their farms over to ECOM for management.

TABLE 22: MINIMUM DETECTABLE IMPACTS FOR SELECTED OUTCOMES

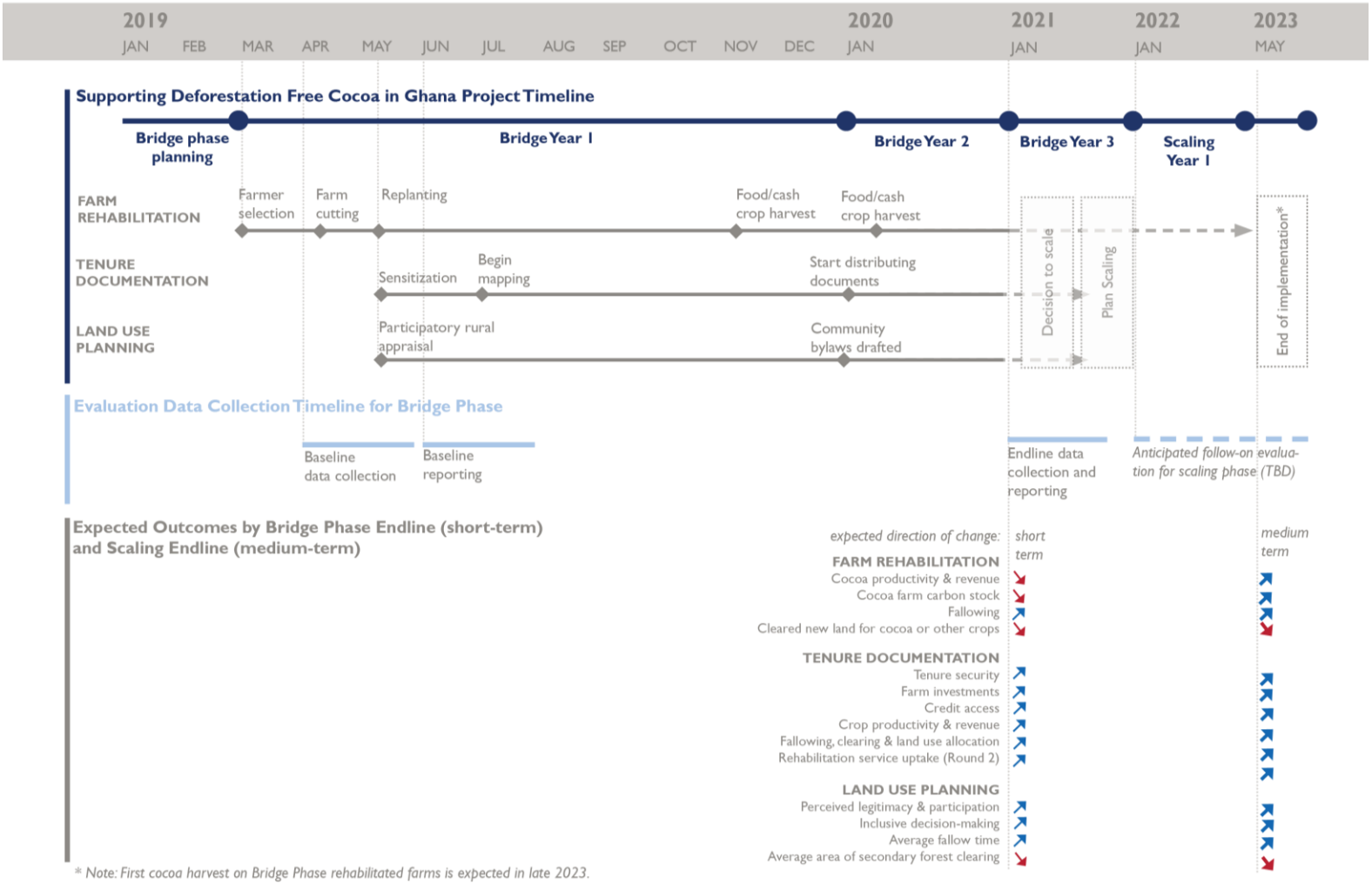
Analysis unit	Outcome	Evaluation design[a]	Baseline values[b]		Source	Sample size	MDES[c]	MDI[d] (in units of outcome)	MDI (% change from mean)[e]
			mean	SD					
Cocoa Farm Rehabilitation									
Household	Whether left land fallow (%)	RD	16.9	37.5	Baseline	714	1.159	33.9	257%
Household	Whether cleared new land for cocoa (%)	RD	37.4	48.4	Baseline	714	1.159	35.7	150%
Household	Cocoa productivity (kg/h)	RD	653.6	853.6	Baseline	714	1.159	612.5	151%
Tenure Documentation									
Household	Had (perceived) tenure security (%)	DID-MCG	69.0	46.2	Baseline	714	0.235	10.9	16%
Household	Had access to credit (%)	DID-MCG	44.9	49.7	Baseline	714	0.235	11.7	26%
Household	Cocoa income (USD)	DID-MCG	1415.7	1874.0	Baseline	714	0.235	441.3	31%

Notes:

a. RD=Regression discontinuity; DID-MCG=Difference-in-difference with matched-comparison group;
b. Baseline means and standard deviations are calculated from the evaluation baseline data.
c. MDES=Minimum detectable effect size, expressed in standard deviation units;
   Calculations assumed a confidence level of 95 percent, two-tailed tests, 80 percent power, 10 percent non-response rate, 25 percent correlations between outcome across baseline and follow-up surveys, and that covariates explain 30 percent of the variation in outcome.
d. MDI=Minimum detectable impact, expressed in units of outcome.
e. Percent change is relative to baseline mean.

ANNEX A: OVERVIEW OF BRIDGE PHASE ACTIVITY AND EVALUATION TIMELINE

FIGURE A-1: OVERVIEW OF BRIDGE PHASE ACTIVITY AND EVALUATION TIMELINE



ANNEX B: TIMELINE FOR BASELINE EVALUATION ACTIVITIES

TABLE B-1: TIMELINE OF BASELINE EVALUATION ACTIVITIES

	CEL Project Year 1 (Sept 2018–May 2019)									PY 2 (2019)		
	S	O	N	D	J	F	M	A	M	J	J	A
Phase I: Scoping and Evaluation Design												
SOW / WA development and finalization												
Desk review of IP documents, survey dataset exploration and analyses, scoping trip site selection, instruments development												
Ghana scoping trip												
Develop draft EDR (draft EDR submitted: 21 December, 2018)												
Deliverable 1: Scoping report												
Deliverable 2: Draft Evaluation Design Report												
Phase II: BL Data Collection, Analyses and Reporting												
Deliverable 3: Final Evaluation Design Report (submission of final EDR o/a 14 days after receipt of consolidated comments by USAID and any external reviewers on 2nd draft EDR)												
Data collection firm solicitation & contracting												
Draft qualitative and quantitative instruments and sampling protocols												
Deliverable 4: Final qualitative and quantitative instruments												
Instruments translation and IRB preparation												
Survey programming												
Preparation of enumerator training materials												
Enumerator training - HH survey + pilot test												
Enumerator training - Qualitative + Pilot test												
Quantitative HH survey data collection												
Qualitative data collection												
Deliverable 5: Weekly production reports during data collection												
Quantitative data cleaning & analyses												
Qualitative data transcription (by firm)												
Qualitative data coding and analyses												
Deliverable 6: Data cleaning plan & final training materials												
Preliminary Results synthesis & discussion with AID												
Follow-up analyses and report writing												
Dataset preparation												
Year 2 Deliverable: Draft baseline report (September 3, 2019)												
Year 2 Deliverable: Baseline presentation (**Target:** TBD)												
Year 2 Deliverable: Final baseline report (**Target:** TBD)												
Year 2 Deliverable: Submit quantitative datasets (**Target:** TBD)												

ANNEX C: QUALITATIVE DATA COLLECTION PROTOCOL

Group Discussion and KII Sample

Respondent Categories	KII or GD	Target total number of GDs and KIIs
1. Community leaders: Chiefs and elders	Group Discussion (combined with cocoa farmers)	1 KII x 4 villages = 4 KIIs
2. Men and women cocoa farmers	Group Discussion	1 GD x 4 villages = 4 GDs

Introduction and Consent

The Moderator should read the following consent script prior to the start of the discussion:

Hello and thank you for agreeing to talk with us. My name is [name of interviewer]. Together with me is [names]. We are working with a research organization in the United States, NORC at the University of Chicago. The United States Agency for International Development (USAID) has hired us to conduct an independent evaluation of its Supporting Deforestation-Free Cocoa Project in Ghana, which aims to provide cocoa farm rehabilitation and land documentation services in some areas of Asankragwa District.

This project is not currently operating in this community. The aim of our discussion today is to learn about your experiences with cocoa farming, forest use and management, and related livelihoods activities taking place in this community. Our role here is to ask questions and listen to your opinions and experiences. Your identity will be kept confidential and it will not be possible for you to be identified in our study report. Please note that there are no "right" or "wrong" answers in this discussion. We would like everyone to share their experience and give feedback, either positive or negative. Your replies will not influence whether a project comes here in the future, but will help to inform USAID about designing such types of projects and how they can be effective in future. We ask that everyone here respect each person's privacy and confidentiality, and not repeat what is said during this discussion. But, please remember that other participants in the group may accidentally share what was said.

Your participation is completely voluntary and you can choose to not answer any question or stop participating at any time. You are not obligated to answer any question that you are not comfortable with. This discussion will last approximately 1 hour. The information you give will be stored safely and shared anonymously with USAID.

If you have any questions about the study, you may contact Lauren Persha on this phone number: [phone number].

Do you agree to participate in today's discussion?

May we begin?

[Facilitator: Remember to fill out the GD or KII participant form and note-taking form for each GD or KII conducted]

TABLE C-1: THEMES / TOPICS OF INQUIRY FOR GDS:

Broad theme	Key information to be collected

A. Village background, history and demographic characteristics	• Description of locality
	• Main sources of livelihoods and overall wealth status
	• Demographic characteristics (population size, age, socioeconomic status, resident vs. migrants, major changes)
	• Details of farm characteristics
	  ○ Type of documentation that is common in the community (e.g., farm plans, written deed of transfers, leases, abunu tenacy agreements, others)
	  ○ Whether and when replanting has occurred
	  ○ Presence and nature of any shade cocoa practices in the community
	  ○ Other crops commonly grown

B. Land and tree tenure and documentation	• Nature of farm tenancy arrangements in the community • Land and tree use decision-making and change dynamics • Perceived tenure security • Common causes of land disputes by group, within the community and in nearby areas • Dispute resolution processes and available institutions • Documentation of prevalent tenure regimes in the community. Includes: ○ Brief summary of history, tree and land rights, stages (where applicable) and obligations for each arrangement present in the community (for example, usufruct rights held by indigenes; stranger landowner; abunu arrangements). • Estimated proportion of abunu farmers in the community

C. Land governance and forest governance issues	• Understanding of local governance customary norms and formal practices (customary or otherwise) in place in the community with respect to:
	  a. Acquiring new land for cocoa or other farming
	  b. Use and clearing of secondary forests land held by customary landowner, customary protected forests, and/or any other forest land types present in the community
	  c. Use and clearing of gazetted forests
	• Secondary, remnant, and gazetted forest access, rules, monitoring and enforcement processes in the community

D. Land use and deforestation pressures	• Types and severity of land use pressures • Prevalence and types of competing land uses to cocoa farming in the community and nearby areas • Forest clearing, forest uses. forest-based employment activities, forest-related income
E. Cocoa farm rehabilitation history	• Where and when any previous rehabilitation has happened in the community, and how supported • Previous types of cocoa farming support received in the community, including how, when and by whom

A. OVERVIEW OF VILLAGE BACKGROUND, DEMOGRAPHICS AND LAND USE HISTORY

1. Please tell us a brief history of this community? *Facilitator probes:*

    a. How did most people come to have farmland here?
    b. For how long have people in this community been practicing cocoa-farming?
    c. What are the common ways that people currently acquire land for cocoa farms in this community?

2. Please tell us about how typical land and farm tenancy arrangements work in this community, for each type of arrangement that is present in this community.

    a. What is the history for how people came to have land under this arrangement in this community?
    b. What are the typical land rights for the holder of this arrangement, especially for renting, selling, transferring or bequeathing the land to others? Are there any key stages?
    c. Who has rights to make decisions about trees on this land, for example to cut down existing trees or plant new ones?
    d. What obligations, such as payments or fees, does the holder of this arrangement have? To whom?
    e. Have there been any changes to how these arrangements work in this community, in recent years? How, and what were the reasons?

	Q B1. Farm Tenancy arrangements – Supplemental Table					
	Tenure category	**History**	**Rights**	**Stages (if applicable)**	**Obligations (e.g., payments, fees,**	**Recent changes**
1	Customary freehold (typically held by Indigenous farmers)					
2	Abunu					
3	Stranger landowner (Asidee)					
4	Other (specify)					

3. What is the total number of households in this community, if known (estimated) ? _____.

4. What percentage of households in this community practice cocoa farming (estimated) ? _____.

    a. Of these households, what percentage are indigenous families? _____

    b. What percentage are farming cocoa under an abunu arrangement? _____

5. What type of written farm documentation is common in this community? Please indicate if each documentation type listed below is common, uncommon, or not present at all?

Q4. Documentation Type	Common in this community	Uncommon in this community	Not present at all in this community
A. Farm Plan			
B. Written deed of transfer			
C. Leases			
D. Abunu tenancy agreement			
E. Other type of documentation (specify):			
F. Other type of documentation (specify):			

6. What are the main sources of livelihoods in this community, for the majority of households that live here?
    a. Have there been any major changes to household livelihoods in this village over the past five years? If yes, what are the reasons for these changes?

    b. Are there any other types of activities that people engage in here in this village for income, apart from cocoa farming?

    c. How important are gold mining activities or trading gold to livelihoods in this community? Have gold-mining activities increased or decreased here in the past year? What are the reasons?

B. LAND AND TREE TENURE AND SECURITY

Now we would like to discuss on issues related to land and tree tenure in this community, including common types of land disputes and how they are usually resolved here.

7. What are the common types and causes of land disputes in this community? How are these disputes usually resolved? Is it easy or difficult to resolve each of these types of disputes? (*Facilitator: probe for each dispute type mentioned, and reasons for difficulties resolving them.*)

    a. Do women have more challenges experiencing or resolving these types of disputes? What do you think are the main reasons for this?
    b. Are there any other groups (for example: women, recent migrants, etc) or types of people who face more of these types of land disputes, or have greater challenges resolving them? Why?
    c. Are the institutions or processes available here generally able to resolve disputes over land in this community?

8. In this community, are there any common types of land disputes over the use of forest land? What about with respect to the use of trees specifically?

9. Have people here in this group, or others you are familiar with here in this community, lost land because it was claimed or taken by someone else?

    a. What were the reasons for this?
    b. Was the situation able to be resolved? If yes, how?
    c. Is this common here in this area, or is it uncommon?

C. FOREST LAND GOVERNANCE

10. Why types of forests are present here in this community? How common are they?

a. Gazetted forest reserve land with natural forest – either in the community or neighboring
b. Primary or secondary forest remnants on private family land
c. Customary protected forest on communal land
d. Any other forest types – please describe?

11. In what ways do people in this community use these different types of forests? How easily can people from this community access this forest land in practice, without concern for penalties?

12. (if not covered above) For each forest type present in the community, what type of rules exist here for how people use these forest areas to:
    e. Collect wood for fuel and other household uses
    f. Harvest other forest products, such as mushrooms, raffia palm, or cola nuts?
    g. Practice logging, for small-scale household uses and larger commercial activities
    h. Clear forest land, such as conversion of forested areas to farmland or other uses
    i. Other activities that change forest density, tree cover or area (general forest condition)?

13. Who predominantly makes these rules? (*Facilitator: Remember to probe on state, customary authorities, community responsibilities and relationships)*
    j. Are these rules established by law or forest regulations? Or, are they informal rules that are typically followed by people in this community, even if not established by law or formal regulations?
    k. How are these rules about forest lands created?
    l. Who enforces the rules established for forest use here in this community? Are there any penalties for those who violate these rules?
    m. Are these rules regarding forest use respected by people here in this community? What about outsiders to the community?

14. What is the process by which forest management and land use decisions are made here in this community? Have there been any major changes to *who makes decisions* about forest use and management in this community in the past 5 years, or *how those decisions are made*?

D. Forest Land use and Deforestation Pressures

15. What are the most important forest products for people in this community? Which products are most important for household subsistence? Which products are most important for cash or commercial activities?
    a. Who primarily collects these products?
    b. How has the availability of these products changed in the past five years, from the areas where they are mainly collected or harvested? What are the reasons?

16. Have there been any major changes to the condition of natural forest areas in your community and in nearby areas, over the past 5 years? If yes, what are the main reasons for these changes? *(Facilitator: Examples could include increased demand for products, reduced forest access, reduced forest area, new rules or restrictions, changing climate or growing conditions).*

17. Are there any groups or members of this community who do not have any access to forest areas (for example: new migrants; abunu farmers who do not have forest on their land)? What are the reasons?

18. Over the past 5 years, what was the extent of forest clearing in this community, and in nearby areas?
    c. What are the main reasons that people clear forests in this area?
    d. Are there some groups or types of people who clear forests more than others? Why?
    e. What type(s) of forest are usually cleared? (*Primary forest, secondary forest, shrubland, etc)*
    f. Are there any types of forests in this community or nearby areas that are never cleared? What are the reasons?
    g. How difficult is it for people in this community to clear forest land in practice, without concern for penalties?

19. Does your community participate in any forest conservation activities? If yes, please describe.

20. Are there any forest conservation or management activities that households here or the community as a whole would like to implement, but are not able to? Which activities, and why?

E. COCOA FARM REHABILITATION HISTORY

21. What are the main challenges that you experience for cocoa productivity on your farms?

22. How do people here decide to cut down, plant or rehabilitate cocoa trees on your farms?

23. What are the main reasons that farmers in your group do not engage in rehabilitation activities, including cocoa tree replanting, on your cocoa farms? Does this vary by different farming arrangements, such as abunu farmers? (*Facilitator: probe specifically on financial constraints and tenure insecurity as potential constraint to cocoa farm replanting, drawing on discussion information from Section B).*

24. Have there been any projects to support cocoa farm rehabilitation or productivity in this community in the past 10 years?
    a. What type of assistance was provided, and by whom?
    b. What year did this activity start and end?
    c. What were the main benefits experienced?
    d. Did participants experience any challenges that could not be resolved?
    e. Approximately how many cocoa farmers participated in that activity here in this community?

F. CONCLUSION

Thank you for discussing these issues with us today. We asked a lot of questions and learned a lot from you. Is there anything that you want to add, or would like to ask us?

ANNEX D: BASELINE HOUSEHOLD SURVEY INSTRUMENT

The baseline household survey instrument is available on LandLinks at the following URL: https://www.land-links.org/evaluation/supporting-deforestation-free-cocoa-in-ghana-project-bridge-phase-evaluation/

ANNEX E: SUPPLEMENTAL SUMMARY STATISTICS

The baseline summary statistics tables are available on LandLinks at the following URL: https://www.land-links.org/evaluation/supporting-deforestation-free-cocoa-in-ghana-project-bridge-phase-evaluation/

ANNEX F: COMPARISON OF TENURE SECURITY RESULTS BASED ON UNDERLYING QUESTIONS USED TO MEASURE PERCEIVED TENURE SECURITY

BACKGROUND, CONTEXT AND APPROACH

BACKGROUND

A key area of land sector research and learning focuses on understanding relationships between perceived tenure security, possession, and demand for documentation of land rights, and the decisions landholders make about how they use and invest in their land. Understanding these relationships is important for ongoing efforts to validate and improve on theories of change for land sector programming, including further refining the often complex pathways by which land programming can lead to positive development impacts. For example, land sector scholars recognize that perceived tenure security may not always be strongly correlated with demand for formal documentation. Context strongly matters, and formal documentation may not always be seen by households as the primary solution to their tenure insecurity, for a variety of reasons.[49]

Measures of tenure security aim to get beyond a respondent's formal property status under the law, to understand how secure they feel in practice to use and make decisions over land – their perceived tenure security. Despite its importance, methodological challenges and differences in preferences on how to reliably measure perceived tenure security also contribute to broader uncertainty in the field.

In this supplemental analysis, we drew on planned redundancies in how we asked about perceived tenure security on our baseline survey to compare results and examine if and how each approach might yield different inferences for the surveyed population. We looked at responses for our sample of 1,790 farms across three related sets of issues: perceived tenure security, possession of and interest in formal documentation of land use rights, and prior experience with a land dispute. Where possible, we further disaggregated the responses by gender of respondent and mode of farm acquisition. Our aim in this annex was to present an initial set of simple comparisons and explore the implications, recognizing this suggests some additional possibilities for more in-depth analysis.

We compared three different question sets[50] on tenure security that were included in our baseline survey. These questions drew from (1) the current PRINDEX survey,[51] (2) World Bank LSMS add-on modules on tenure security, drawing on the example of the 2018 Zambia Labor Force Survey[52] and (3) prior USAID-supported land-sector evaluations, which have used their own consistent approach to measuring tenure security via perceived expropriation risk across various sources. Each of these question sets aimed to capture perceived tenure security at the farm level. However, they focused on slightly different issues, used different question wording, and in some cases used different response sets.

In addition to simple comparisons, we were also interested in understanding if and how the relationship between perceived tenure security and other key household context conditions may have changed depending on which question(s) were used to derive the indicator of tenure security. To do so, we

[49] Deininger, K., and G. Feder. 2009. Land Registration, Governance, and Development: Evidence and Implications for Policy. World Bank Research Observer 24(2): 233-266.
[50] We did not replicate the entire land tenure module across each survey. Instead, we included select questions from each survey that use different constructs to achieve the same overall aim of measuring perceived tenure security.
[51] https://www.prindex.net/data/
[52] https://www.zamstats.gov.zm/phocadownload/Labour/2018%20Labour%20Force%20Survey%20Report.pdf

analyzed the relationships between tenure security, possession of or interest in formal documentation of land use rights, and prior experience with a land dispute.

RELATED WORK

Getting to a reliable measure of perceived tenure security has been a long-standing interest for the land sector, with some movement towards stronger consistency on this over the past decade. Prior efforts have catalogued different approaches to indicate tenure security, and some have also focused more specifically on the question wording itself. There appears to be growing consensus that measures of tenure security via perceived risk of loss or expropriation are stronger than those which assume tenure security or insecurity on the basis of type of land ownership or documentation possessed.[53] Survey questions focused on expropriation risk are often expressed in terms or "risk", "worry", or "fear" of losing land.[54] Other approaches to measuring tenure security instead focus on the respondent's perceived right to property, typically focusing on the five classic elements of property rights: access, withdrawal or use, management, exclusion and alienation.[55]

In 2019, Prindex undertook a comparison of efforts to measure tenure security perceptions across the 33 countries they had surveyed to date.[56] They found that different sampling approaches and methods used across the different surveys rendered it difficult to reliably compare results. Their review highlighted that efforts to measure perceptions of tenure security tend to fall into four common baskets of phrasing (with minor variations in wording). These focus on: (1) Risk of expropriation ("*likelihood"* of losing land over some time period); (2) Worry of expropriation (how *"worried"* is the respondent about losing land if a given event occurred); (3) Fear of expropriation (how *afraid* is the respondent about losing their land); and (4) Cataloging property rights protections (for example, whether the respondent has any of classic elements of property rights, such as the right sell or transfer the land to others). The Prindex analysis found that questions phrased in terms of perceived risk of expropriation were most commonly used. This is also in line with Arnot et al.'s (2011) recommendation and perhaps reflects growing adoption of this construct (Arnot et al. suggested that measures based on expropriation risk were a stronger approach, but were less commonly used at the time of their review).

The answer choices available to respondents are as important as careful question wording, and also differed across some of the questions we compared. Prindex's 2019 comparison considered how using a four-point or five-point Likert scale for the response set affects conclusions about tenure security. To do so, they took advantage of Prindex's own shift from a five-point scale to a four-point scale between survey rounds. In doing so, they dropped a neutral "middle ground" category from the response set. Four-point Likert scales are sometimes referred to as a "forced" scale, because by dropping the neutral category, the respondent is forced to provide their opinion even if they don't have a strong feeling in either direction or simply not answer the question. In some cases, the loss of a neutral category can introduce a distortion into the results.

When Prindex moved to a four-point scale, the loss of the neutral response option indeed appeared to have pushed respondents to choose a more opinioned category. The loss of the neutral category was not accompanied by an increase in respondents who refused to answer the question. Instead, respondents provided a more opinioned response in either a positive or a negative direction. For the Prindex case, their 2018 results using a four-point scale with no neutral category showed a slight increase in tenure secure respondents (from 58 to 66 percent) and an even larger increase in tenure

[53] Arnot, C.D., M.K. Luckert, and P.C. Boxall. 2011. What is Tenure Security? Conceptual Implications for Empirical Analysis. Land Economics 87(2):297-311.
[54] https://www.prindex.net/news-and-stories/reviewing-existing-evidence-perceived-tenure-security-why-consistency-matters/
[55] Ostrom, E. and E. Schlager. 1992. Property-Rights Regimes and Natural Resources: A Conceptual Analysis. Land Economics 68(3):249-262.
[56] *Ibid.*

insecure respondents (from 10 to 20 percent). One explanation for this shift is that respondents who felt fairly neutral about their tenure security were more likely to respond in the negative direction once the neutral category was not an option. However, the surveyed households were different for each year of the survey, a factor that could have also contributed to the differences Prindex observed.

Instances where a single survey effort has applied several different approaches to measuring tenure security on the same survey population do not appear to be common. For this reason, our supplemental analysis for the Ghana baseline data may present a useful opportunity to contribute on this issue.

APPROACH FOR COMPARISONS

At USAID's request, our baseline survey included five different and commonly used approaches to measure tenure security perceptions in smallholder farming and customary land contexts. This design enabled us to construct measures of perceived tenure security using each of the different question framings and approaches, and to examine potential implications for conclusions about tenure security in the sample depending on which indicators are used. Three of the five approaches asked about expropriation risk in various ways, and one is based on confirming the household's bundle of property rights over the farm. We also included a framing based on how long the respondent feels comfortable leaving their land fallow without being worried of reallocation.

All questions are asked at the farm-level and designed with the objective of obtaining an indicator of the respondent's perceived tenure security. The questions, sources and variable/data types are summarized in Table F-1. They differ with respect to wording and focus, but also in terms of the framing of responses and resulting variables for analysis. To avoid too much redundancy and potential respondent confusion over similarly worded questions, our baseline survey did not include another measure of perceived tenure security via expropriation risk from the ZLFS. This omitted measure is framed in terms of *"likelihood"* of involuntary land loss like the prior USAID land-sector IE questions, but also directly mentions loss of use rights to the land, like the Prindex question.[57]

TABLE F-1: BASELINE SURVEY QUESTIONS FOR ASSESSING TENURE SECURITY

Comparison	Survey Question	Variable	Construct	Question Source
1	Does anyone in this household have the right to sell this farm to someone else, either alone or with someone else?	Binary (Yes/No)	Confirms bundle of property rights – may be used to assume tenure security based on formal rights	Zambia 2018 Labor Force Survey Land Tenure Module[e]
1	Does anyone in this household have the right to lease this farm to someone else, either alone or with someone else?	Binary (Yes/No)		
1	Does anyone in this household have the right to bequeath this farm to your heirs?	Binary (Yes/No)		
2	In the next 1-3 years, how likely is it that someone from within your extended family will take over the use of this farm without your permission or agreement?	6-point Likert scale[a] (ordinal, but can be treated as continuous)	Perceived tenure security via expropriation risk stated in terms of *"likelihood of loss"*	Prior USAID Land-sector IEs
2	In the next 1-3 years, how likely do you think it is that the chief in this village may take this farm without your permission or agreement?			
2	In the next 1-3 years, how likely is it that your landlord will take over the use of this farm without your permission or agreement[c]?			
3	If you cut the cocoa trees on this cocoa farm, such as to replace them, how likely is it that	6-point Likert scale (as above)	Perceived tenure security via expropriation risk	Context-specific wording for the SDFC IE, but modeled from

[57] For reference, that question was worded as "On a scale from 1 to 5, where 1 is not at all likely and 5 is extremely likely, how likely are you or another member to involuntarily lose ownership or use rights to any of the [LAND] you or another member own or hold use rights to in the next 5 years?" (GoZ, 2018 Zambia Labor Forest Survey Report).

Comparison	Survey Question	Variable	Construct	Question Source
	someone else will claim this farm without your permission or agreement?		stated in terms of *"likelihood of loss"*	and similar to prior USAID Land-sector IEs
4	How *worried* are you that you could lose the right to use this farm, or part of this farm, against your will in the next 3[d] years?	4-point Likert scale[b] (ordinal)	Perceived tenure security via expropriation risk stated in terms of *"worry of loss"*	PRINDEX
5	For how many years could you let this farm lie fallow or as bush/secondary forest without being worried about the farm being reallocated to another household?	Continuous (years)	Inferred tenure security based on how long respondent feels comfortable leaving land unused	Prior USAID Land-sector IEs

[a] 6-point scale: [impossible, highly unlikely, unsure/don't know, likely, very likely, happening right now; refused to answer].
[b] 4-point scale: [not worried at all, not worried, somewhat worried, very worried; refused to answer].
[c] This question is only asked for plots under tenancy arrangements, so we do not consider it as part of our comparisons.
[d] Note the Prindex survey asked this for a 5-year rather than 3-year period (the time frame was modified for SDFC IE needs). The Prindex survey also contains questions phrased in terms of "*how likely or unlikely is it* that you could lose the right to use [ ] against your will?" These questions also aim to get at expropriation risk but we did not include them on the Ghana BL survey to minimize redundancy, as they are more similar in construct to the perceived tenure security questions asked across USAID land-sector IE household surveys.
[e] Draws on a SDG land tenure module that was designed for inclusion in household surveys run by National Statistical Agencies by an inter-agency expert working group (see FAO et al. 2018 and Ali et al. 2019).

Our analysis had four objectives:

1. Examine and compare the distribution of responses across the different question sets.
2. Generate a binary indicator of tenure security based on each of the different question sets, and compare the proportion of farms that are tenure secure. How does the proportion of tenure secure farms differ depending on which set of questions are used to indicate tenure security?
3. How does conclusions about the relationship between tenure security and three key respondent characteristics (possession of land documentation; interest in obtaining land documentation; recent experience with a land dispute) change depending on which set of questions are used to indicate tenure security?
4. Examine whether there are any key differences in results across sub-groups of interest: gender of household head/respondent; mode of farm acquisition; and age group of respondent.

How we designated farms as tenure secure: We first examined the distribution of responses for each question, and then followed standard approaches for each question set to code each farm as tenure secure or not. The ZLFS questions asked about whether someone in the household has the right to sell, lease, or bequeath a particular farm. The responses were binary Yes/No answers. We took the total number of "yes" responses across these three questions, and divided by three with respect to each plot, giving us a number between zero and one. We then designated any farm that had at least two of these three rights as tenure secure (*i.e.,* scored greater than 0.5).

The USAID land sector IEs (including our SDFC evaluation) and Prindex measures of tenure security used Likert scales. For existing USAID land-sector IE surveys, we drew on two of the questions in this series where respondents rated the likelihood of encroachment by (1) other family members or (2) their village chief. The responses follow a 6-point scale, ranging from one (Impossible) to six (Happening right now). A neutral "unsure/don't know" category was included in this scale. To code a farm as tenure secure, we took the average response across the two questions and then designated any farm with a score below three as tenure secure. In other words, plots with responses of "impossible" or "highly unlikely" to questions about the likelihood of farm loss from different sources were coded as tenure secure. We used the same approach for our more context-specific question for the SDFC IE, which

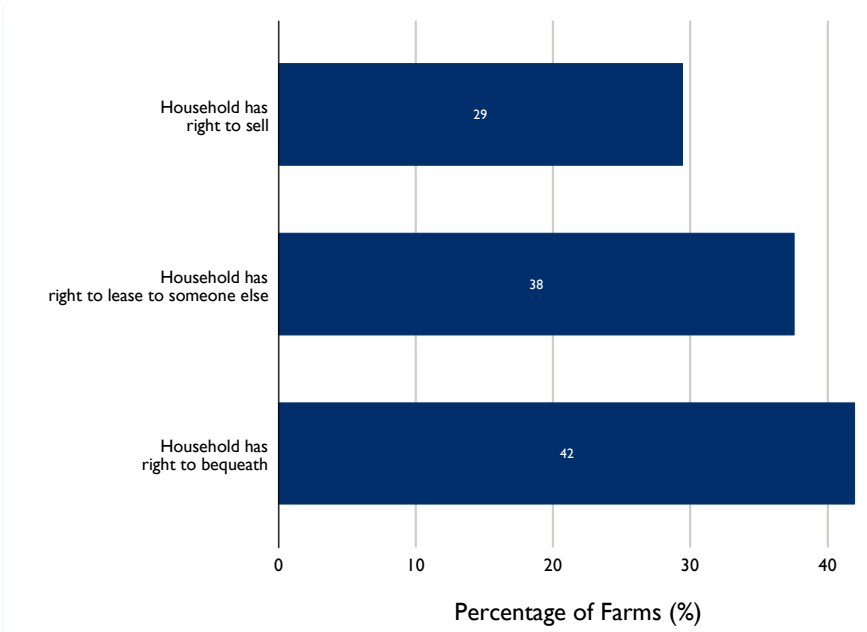
follows a similar construction and the same six-point response scale as the existing USAID land sector IE survey questions. Finally, the PRINDEX survey question asked how worried respondents were about the loss of rights to their farm using a four-point Likert scale which ranges from one (Not worried at all) to four (Very worried). This scale did not include a neutral category. We coded responses less than or equal to two (not worried at all; not worried) as tenure secure.

To facilitate comparisons, we show the percentage of plots coded as tenure secure according to each measure. We then present a set of figures that further disaggregates the proportion of farms that were tenure secure by different sub-groups of the survey sample and explored how choice of underlying questions relates to the conclusions we drew from these relationships.

KEY FINDINGS

Figures F-1, F-2, F-3, and F-4 present the underlying response distributions for the different survey questions in our comparison. Figure F-1 shows the percentage of farms that households say they have the right to sell, lease to someone else, and bequeath.[58]

FIGURE F-1: ZLFS TENURE SECURITY QUESTIONS BASED ON BUNDLE OF RIGHTS



These questions were drawn from the Zambia Labor Force Survey (ZLFS) and can be used to indicate tenure security via the household's perceived rights to different elements of property rights. In our sample, household confirmation of any of these rights was fairly low overall. Households indicated they had the right to sell just 29 percent of plots, while a greater proportion of plots could be transferred to heirs (42 percent).

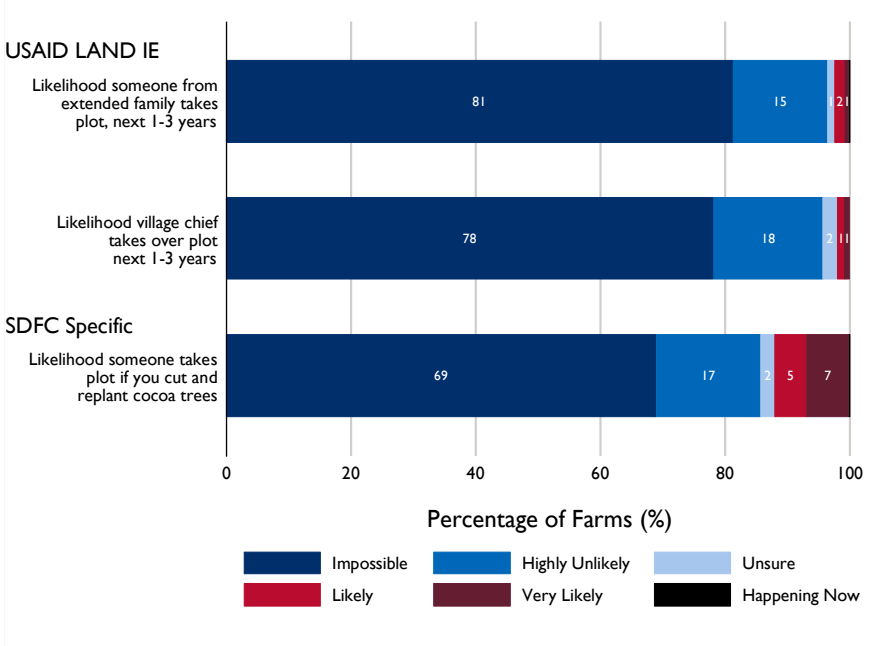
Figure F-2 shows the distributions for the variables drawn from the USAID Land IE and SDFC context-specific tenure security questions, based on the likelihood that someone else would take over the plot against the household's wishes within the next one to three years. These questions had responses ranging from one (Impossible) to six (Happening now).[59] For all three questions, the vast majority of respondents said it was impossible that someone would encroach on the plot, although this percentage was notably higher for the two standard USAID Land IE survey questions than for the more context-specific question added for the SDFC IE. This differentiation alone might be a reason to consider including an additional question tailored to each specific survey and tenure-security context, to

[58] Of 1,790 farms in the sample, respondents did not know or refused to answer the ZLFS survey questions for a negligible portion of the sample (five or six farms depending on the question, or 0.3 percent of the sample).
[59] Refusals were also negligible for this question set, ranging from 0 to 2 refusals, or 0.1 percent of the sample.

complement the more standard indicators.[60] Similarly, a greater percentage of plots were seen as "very likely" to be encroached upon using the SDFC context-specific question (seven percent) than either of the two USAID Land IE questions (one percent each). Figure F-3 shows the distribution for the survey question that served as the base for the PRINDEX tenure security measure.[61]

Less than one percent of plots were said to be experiencing encroachment at the time of the survey according to any of the three questions shown in the figures.

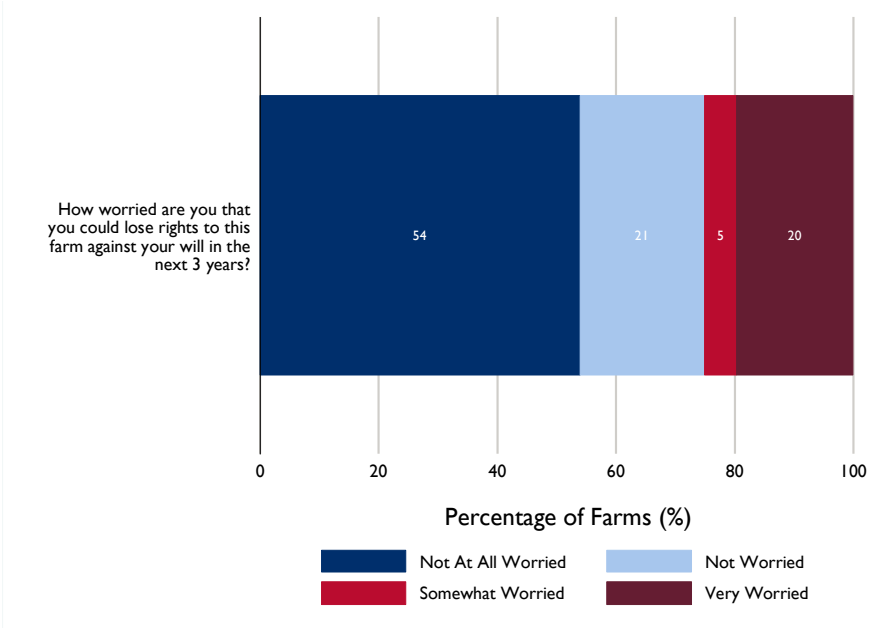
FIGURE F-2: PRIOR USAID LAND IE AND SDFC-SPECIFIC QUESTIONS BASED ON EXPROPRIATION RISK IN TERMS OF "LIKELIHOOD" (6-PT LIKERT SCALE)



The Prindex survey question (Figure F-3) asks how worried the household is that they could lose their rights to the farm, or part of the farm, within the next three years. Approximately 54 percent of respondents were "not at all worried", while another 21 percent were "not worried". On the other hand, households said they were "somewhat worried" about 5 percent of farm plots, and "very worried" about another 20 percent.

[60] Adding complementary context-specific indicators also reflects guidance from related sectors where there is high variability and a lack of a consistent measurement approach for key but complex constructs, such as for women's empowerment.
[61] For the Prindex question, which does not have a neutral category, there were 27 refusals, or 1.5 percent of the sample.

FIGURE F-3: PRINDEX SURVEY QUESTION BASED ON EXPROPRIATION RISK IN TERMS OF "WORRY" (4-PT LIKERT)



Lastly, Figure F-4 shows the length of time households feel they could leave their plots fallow without worrying about the plot being reallocated to another household.[62] This question is employed by many land tenure survey efforts as complementary way to infer tenure security, and in some work has been used as the primary indicator for tenure security. The assumption is that households who are less tenure secure are less likely to be comfortable leaving their land fallow (in other words, in a state that appears unused, which could leave them more vulnerable to expropriation in some contexts). The figure shows that 27 percent of households did not believe they could leave the land fallow for any period of time, while an additional 6 percent believed they could leave the land fallow for some period of time no longer than one year. On the other hand, households believed they could leave 34 percent of plots to fallow indefinitely without worry that the farm would ever be reallocated to another household (would never happen).

[62] A greater proportion of respondents could not answer this question for their farms, at 417 farms or 23 percent of the sample.

FIGURE F-4: PERCEIVED TENURE SECURITY BASED ON FALLOW TIME IN YEARS

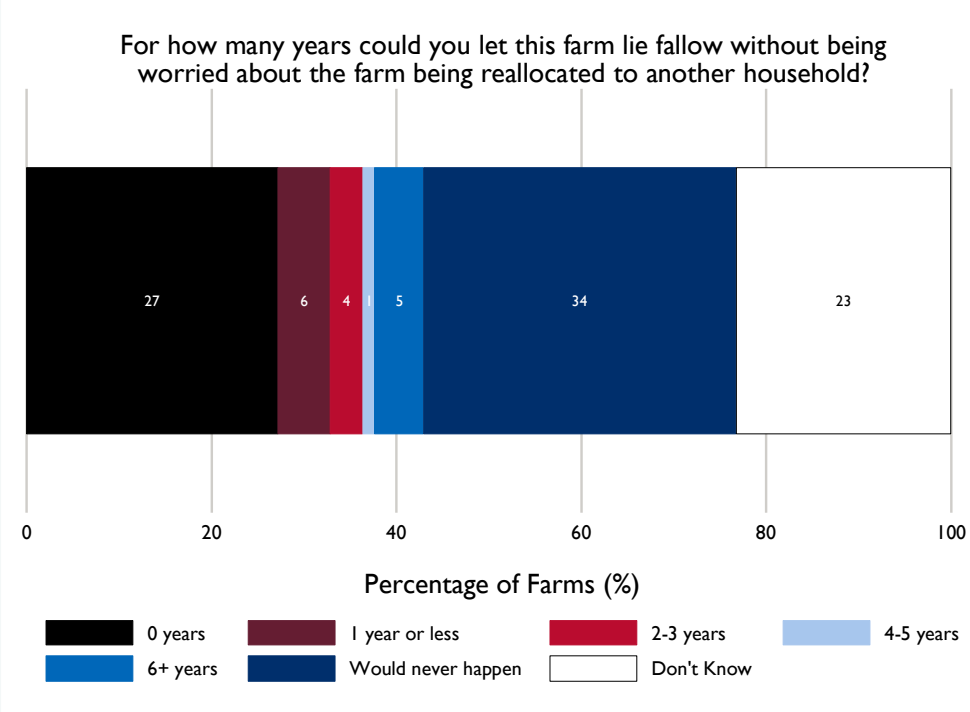


Table F-2 below provides a comparison of the resulting proportion of farms that are deemed tenure secure or insecure across these five approaches. We see that deriving an indicator of tenure security from the standard set of questions on USAID land-sector IEs about likelihood of expropriation from other family members or a village chief yield the most optimistic conclusion on tenure security, suggesting that 96 percent of farms are tenure secure. The similarly worded additional question on expropriation that was designed to be locally context relevant for the study area, and the Prindex question worded in terms of '*worry*' of farm loss both seem to provide more nuanced information, but also suggests that the vast majority of farms are tenure secure (86 percent or 75 percent, respectively). In contrast, deriving an indication of tenure security from the length of fallow time or from a set of questions based on the household's perceived property rights (such as was used on the ZLFS) provide a similarly more negative outlook on tenure security in the study area, suggesting that only 30-40 percent of farms are perceived to be secure.

TABLE F-2: COMPARISON OF INDICES

Question Source	Percentage of farms that are:		
	Tenure secure	Tenure insecure	Don't know
ZLFS	29-42%	58 - 71%	n/a
USAID-supported land sector IEs	96%	1-2%	1-2%
Ghana context-specific question	86%	12%	2 %
Prindex	75%†	25%	n/a
Length of fallow time with worrying about reallocation	34%[a]	27 – 33%[b]	23%

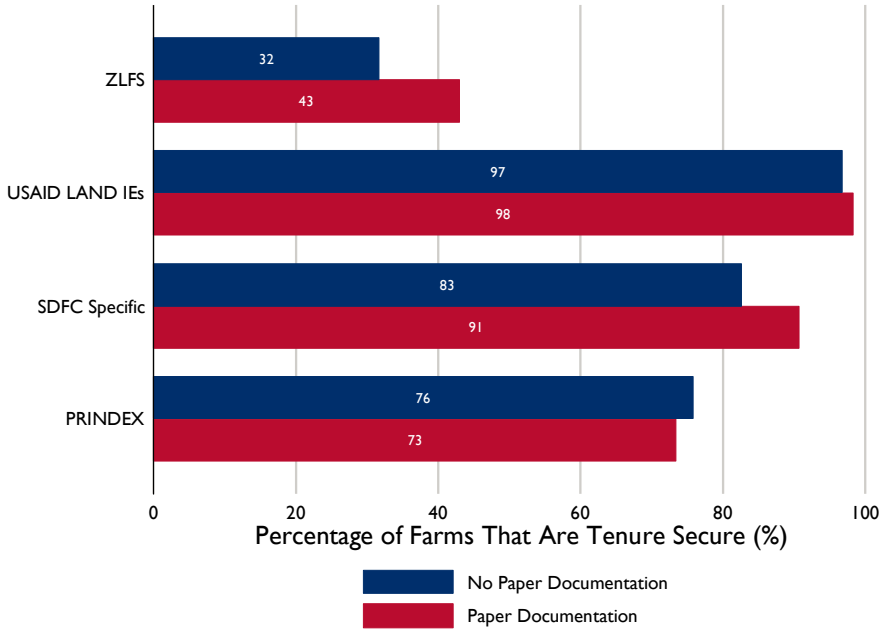
† For reference, the nationally-representative 2018 Ghana-wide Prindex survey reported 62 percent of respondents as tenure secure, 26 percent as tenure insecure, and 12 percent did not know or refused to answer. There was no difference in the proportion insecure by gender of respondent.

[a] Percentage of farms that could be left as fallow indefinitely.

[b] 27 percent of farms could not be left fallow for any period of time; an additional 6 percent of farms could be left fallow for less than 1 year.

We next examine how the four different tenure security measures correlated with different land tenure characteristics for the farmer, including their possession of documentation confirming their land rights, desire to obtain such documentation, history of disputes, and mode of acquisition for the plot (Figures F-5 to F-11 below). Figure F-5 compares the percentage of farms that were tenure secure by each of the four measures, for farms that already had some form of paper documentation and those that did not. In theory, we expected that farmers would have stronger perceived tenure security over farms for which they had formal documentation of their rights. We saw some support for this association when the measure of perceived tenure security was derived from the ZLFS questions or the context-specific indicator included for the Ghana IE, but not when using either the Prindex question or the more general perceived tenure security questions used in USAID land sector IEs. Unlike the other indicators, the Prindex measure for tenure security actually had a small negative correlation with possession of paper documentation.

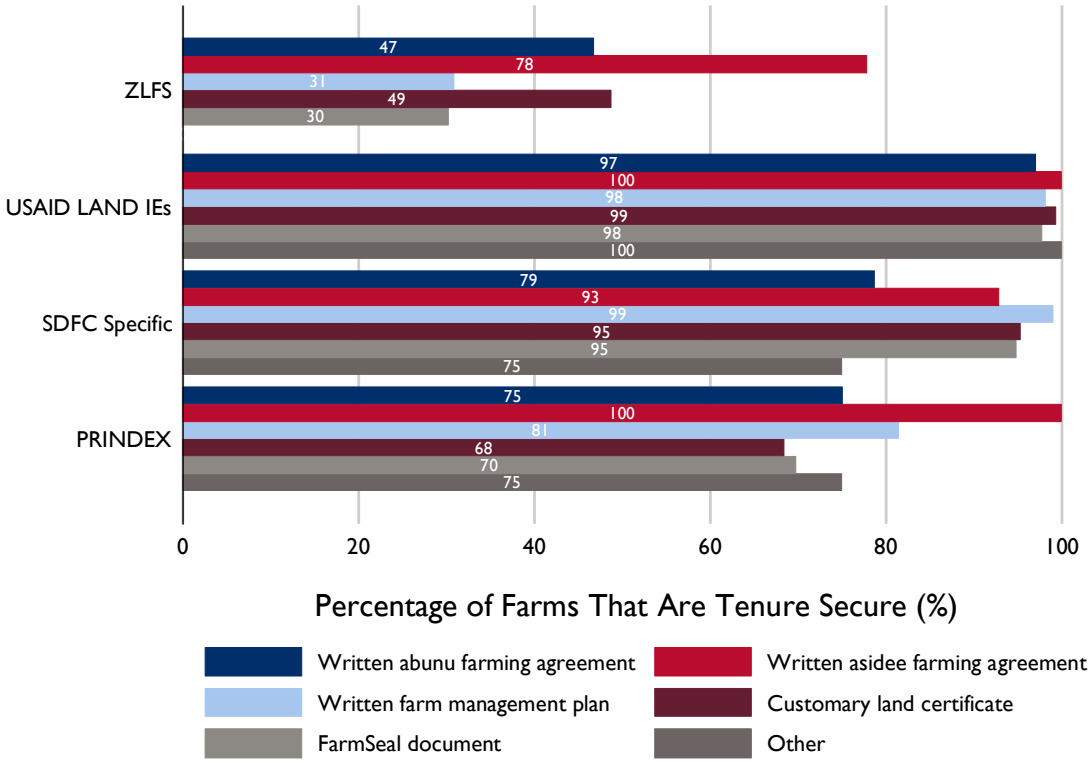
FIGURE F-5: TENURE SECURITY AND POSSESSION OF DOCUMENTATION



Note: N=669 Farms (37.5 percent) with paper documentation; N= 1,113 (62.5 percent) with no documentation.

Figure I-6 further breaks down the documentation type for the 669 farms in the sample that already had documentation. No clear differences emerged across the different tenure security indicators (apart from obtaining a less tenure secure outlook overall, as reported above, if one used the ZLFS questions to derive tenure security). Plots with written *asidee* agreements tended to have the highest tenure security irrespective of which measure was used, though it is important to note that just 18 plots had this type of documentation, making it difficult to draw firm conclusions. There were small variations in relative tenure security between farms with written *abunu* agreements, FarmSeal documents, or another form of Customary Land Certificate across the different tenure security definition.

FIGURE F-6: TENURE SECURITY BY DOCUMENTATION TYPE



Note: N=199 Farms (30.7 percent) with written *abunu* agreement; N=18 (2.8 percent) with *asidee* agreement; N=110 (17.0 percent) with farm management plan; N= 267 (41.1 percent) with CLC; N= 43 (6.6 percent) with FarmSeal document; N=12 (1.9 percent) with other.

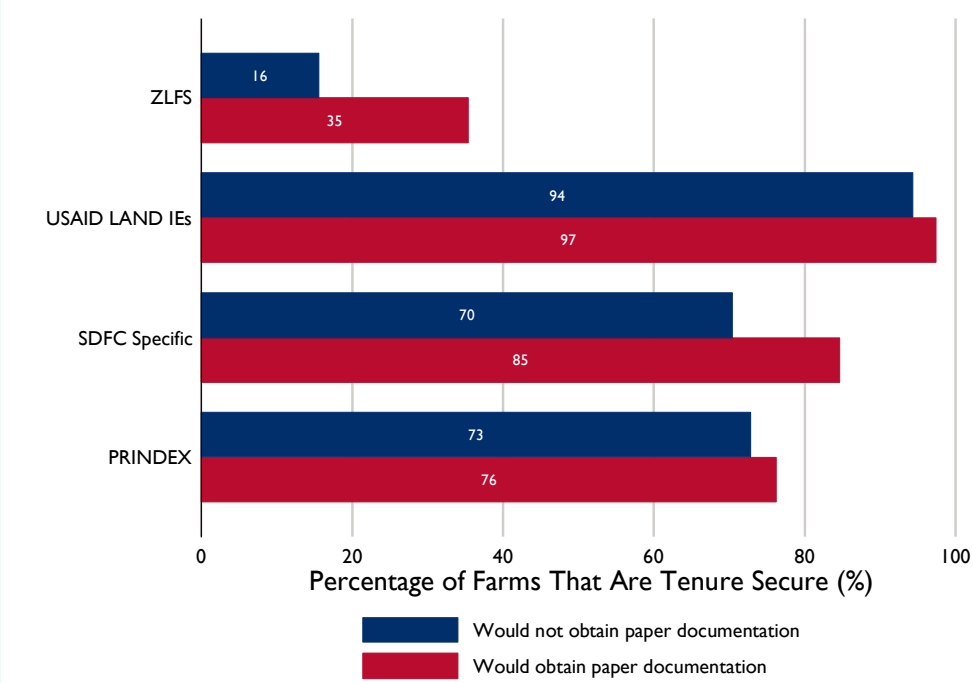
Figure F-7 compares results for the percentage of farms that were tenure secure disaggregated by whether the farmer would like to obtain formal documentation or not. This figure includes only the 1,098 farms for which respondents indicated they did not currently have any paper documentation.

Here, there appeared to be little association between the farmer's perceived tenure security on the plot and his or her desire to obtain documentation (for plots that were not yet documented) when the measure of perceived tenure security was derived from the more general USAID land sector IE questions or the Prindex question. For both of these, a similarly high proportion of undocumented farms appeared to be tenure secure, irrespective of whether the farmer expressed a desire to obtain paper documentation or not.

However, when perceived tenure security was drawn from the Ghana context-specific indicator or the ZLFS questions, a greater proportion of farms for which the farmer expressed a desire for documentation were also tenure secure, compared to the proportion of tenure secure farms where the farmer was not interested in obtaining documentation for the plot. This may seem counterintuitive on its face, since land sector programming often expects a greater desire to obtain documentation in situtations where the land user's perceived tenure security is lower. However, one can think of several alternative explanations as well. For example, households may not always see formal documentation as the solution to their tenure insecurity, while having a document might unlock additional ways to benefit from their land for households who are already tenure secure, such as obtaining a loan or engaging in land markets (Ali et al. 2019; Deininger et al. 2019). It's also possible the question was too broad to adequately capture respondent views in some contexts. Finally, documentation could be seen as a less

relevant means to strengthen tenure security in contexts where multiple forms of documentation are available, when there is low familiarity with land documents, uncertainty over document legitimacy, or low trust in land governance processes generally.

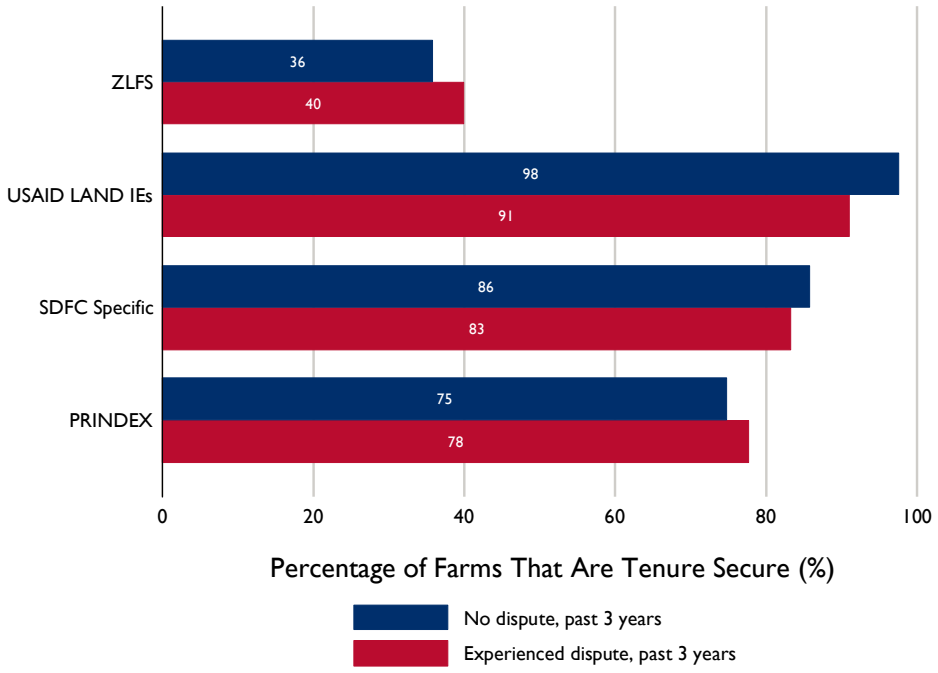
FIGURE F-7: TENURE SECURITY AND DESIRE TO OBTAIN PAPER DOCUMENTATION



Note: N=918 Farms (83.6 percent) expressed dire to obtain documentation; N=180 (16.4 percent) did not.

Figure F-8 shows the percentage of tenure secure plots disaggregated by whether or not the plot experienced a land dispute in the past three years. Land sector theories often expect that farmers will feel less tenure secure over plots for which they have recently experienced a dispute challenging their claim to the land. Thus, we might expect that farms with no recent disputes would be more likely to be tenure secure relative to those that had disputes. However, we did not see an indication of such a relationship in our sample across any of the measures we used to derive the tenure security status for the farm. We also did not see any major differences in the pattern of results on the basis of which set of questions was used to derived tenure security (other than the broad differences we call attention to above, which were also reflected here, such as lower tenure security overall if using the ZLFS questions to construct this indicators). However, we also note that only 2.5 percent of farms (N=45) in our sample experienced a land dispute within the last three years, which was too small sample size to draw firm conclusions.

FIGURE F-8: TENURE SECURITY AND LAND DISPUTES



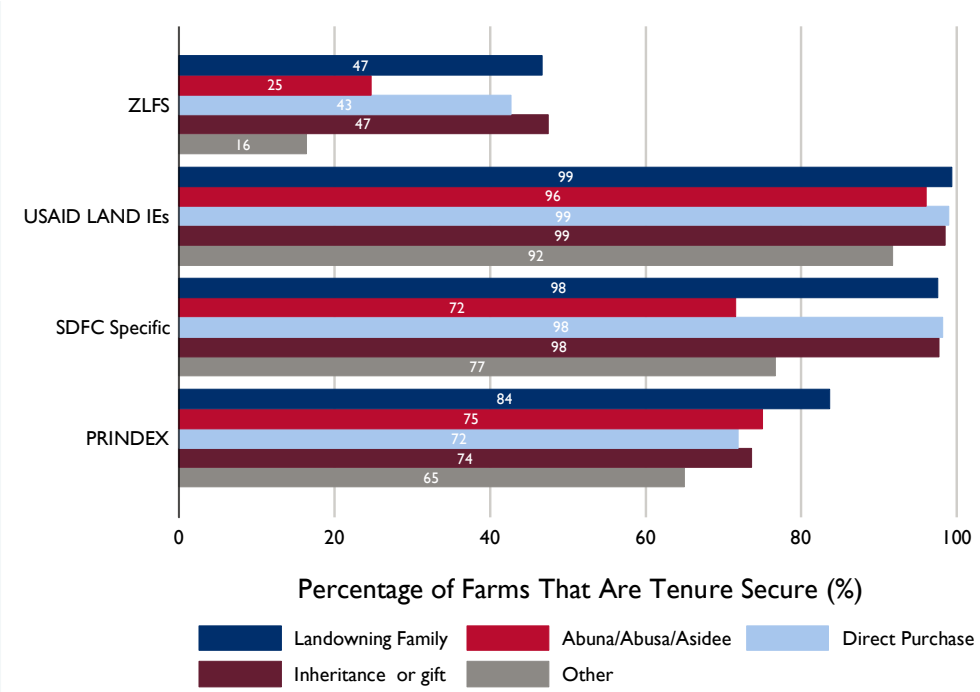
Note: N=1,745 Farms (97.5 percent) experienced no dispute within past 3 years; N=45 (2.5 percent) did experience a dispute.

Figure F-9 shows how tenure security varies by farm acquisition type. In the Ghana study context, we might expect a smaller proportion of farms acquired through *abunu* or *abusa* arrangements to be tenure secure.[63] We also might expect a high and similar proportion of farms acquired through landowning rights, inheritance, or direct purchase to be tenure secure. In comparing results across the different measures of tenure security, we did see some of this expected variation in the proportion of plots that were tenure secure across different categories of farm acquisition, for all measures of tenure security except that derived from the more general tenure security questions from prior USAID land sector IEs.

We also saw that there appeared to be greater differentiation across the farm acquisition categories when the proportion of farms that were perceived to be tenure secure was based on the ZLFS questions or the context-specific tenure security question we included for the Ghana SDFC IE. In general, a greater (and often similar) proportion of plots acquired through landowning family rights, by direct purchase, or inheritance were tenure-secure across all four measures. Plots acquired through *abuna, or abusa* arrangements (or a*sidee,* but this was a negligible portion of the sample), or through other means, tended to have the lowest percentage of tenure-secure plots across the different measures. As for the previous comparisons, we had saturation on tenure security and obtained less information when using the more general questions from prior USAID land sector IEs, hence we also saw very little differentiation in results by farm acquisition type.

[63] We also included farms acquired via *asidee* arrangements in our grouping of customary land arrangements under this category. We recognize that this customary arrangement is likely associated with higher tenure security, but *asidee* farms constituted less than one percent of our sample and removing them did not influence these results.

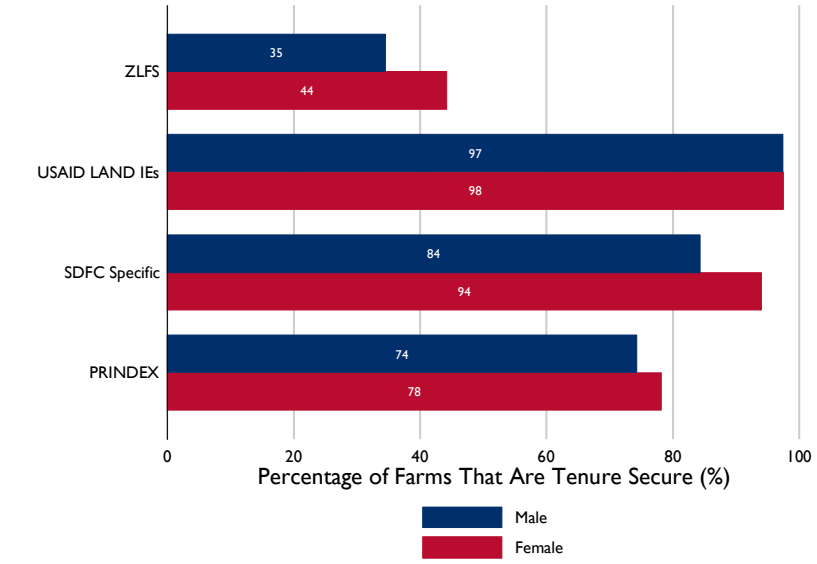
FIGURE F-9: TENURE SECURITY AND FARM ACQUISITION TYPE



Note: N=187 Farms (10.5 percent) were acquired through rights as landowning family; N=781 (43.6 percent) through *abunu, abusa*, or *asidee* arrangements (of which the large majority are *abunu* arrangements; *asidee* arrangements are a very small component of the sample); N=192 (10.7 percent) through direct purchase; N=569 (31.8 percent) through inheritance or as a gift; N=61 (3.4 percent) through other means.

Figure F-10 shows a comparison of the four tenure security measures disaggregated by gender of the household head. In general, a higher percentage of plots from male-headed households were tenure-secure across each of the tenure security measures, but we obtained a wider gender gap when tenure security was derived from the ZLFS questions or the context-specific indicator we added for this IE.

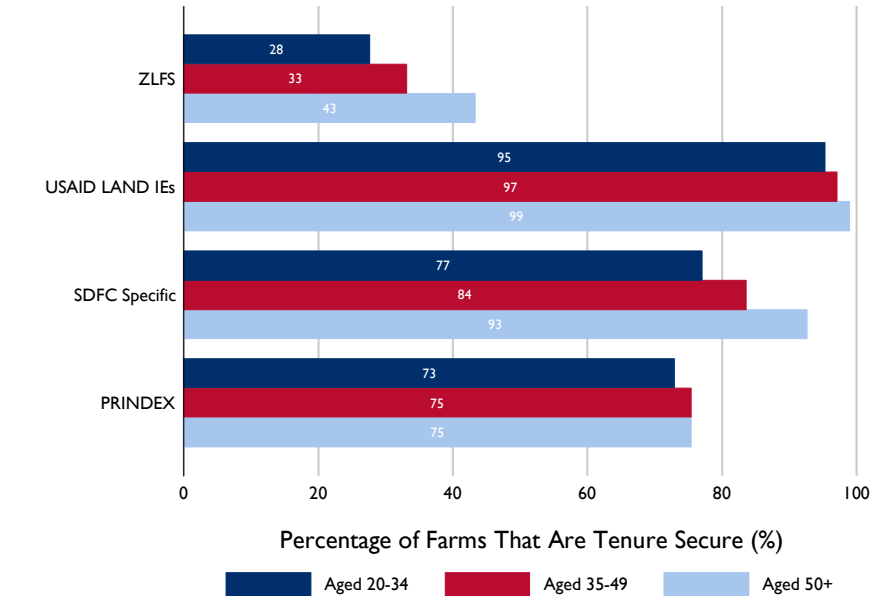
FIGURE F-10: TENURE SECURITY AND GENDER OF HOUSEHOLD HEAD



Note: N=1,548 farms (86.5 percent) were from male-headed households; N=242 (13.5 percent) were from female-headed households.

Lastly, Figure F-11 shows a comparison of the four tenure security measures disaggregated by age group of the household head. As for several of our previous comparisons, we saw a clear, positive correlation between head age and the proportion of plots that were tenure secure when the measure for perceived tenure security was based on the ZLFS questions or the context-specific tenure security question we included for the Ghana SDFC IE. We obtained a different inference when tenure security was drawn from the other two questions, where age of household head did not appear to be strongly related to the perceived tenure security of the plot.

FIGURE F-11: TENURE SECURITY AND AGE OF HOUSEHOLD HEAD



Note: N=387 Farms (21.6 percent) belonged to households with a head in the 20-34 category; N=726 (40.6 percent) belonged to households with a head in the 35-49 category; N=677 (37.8 percent) belonged to households with a head in the 50+ category.

CONCLUSIONS

Our preliminary comparison shows that we obtained quite different inferences on the proportion of farms in our sample that were perceived to be tenure secure – as well as the relationship between perceived tenure security and other key characteristics of the plot or households (mode of plot acquisition; gender and age of the household head) – depending on which set of questions were used to construct the indicator for perceived tenure security. What were the reasons for this variation, and which number is accurate? Though we recognize that it's not a satisfactory answer, we caution that we can't determine this based on our survey data alone, and maintaining a consistent approach to measuring perceived tenure security across survey rounds is generally more important from an evaluation perspective than getting to a definitive "true" proportion of tenure-secure households in the study area.[64]

[64] We also note that obtaining respondent perceptions via household surveys is a well-studied challenge, and a detailed look at the many factors that can contribute to why respondents may answer variations of the same underlying construct differently is beyond our aim here.

Our comparisons do, however, enable greater confidence in statements we make about which approaches appear to be more reliable for this Ghana SDFC survey context. We highlight that although three of the question sets we compared aimed to measure perceived tenure security via expropriation risk and follow fairly similar wording, they yield distinctly different results.[65]

Among these three approaches, perceived tenure security across the sample was lowest via the Prindex question (75 percent of farms), but it is puzzling that we saw fewer associations between tenure security and other key characteristics that we expected should have been present in the sample and were supported by our own qualitative data collection and complementary data from the study area. Perceived tenure security as derived from our context-specific indicator was more optimistic (86 percent of farms) but varied across the sample and was significantly associated with some key characteristics of the survey sample that supplemental data suggested should be present. For this Ghana survey sample we had near saturation on tenure security (96 percent) and obtained little useful information when using the more general questions that prior USAID-supported land sector IEs had used to derive perceived tenure security. Our comparison suggests that those questions yielded less reliable information for this survey sample. We also see value to maintaining the Prindex question in future efforts, but we think our results particularly demonstrate the value in adding a question that is framed with a strongly context-specific example to serve as a complementary measure and enable some triangulation on results.

We obtained a more dire outlook on tenure security when our indicator was based on questions of households' perceived rights across the standard bundle of property rights, using questions from the ZLFS (29-42 percent of farms). However, these questions are typically used in conjunction with more direct measures of perceived tenure security rather than intended to serve as the measure itself, and we do not suggest it should be used as a substitute. Instead, we viewed these questions as providing stronger understanding on the statutory land rights context and how it was understood by respondents. Finally, for the customary land system that characterized our Ghana study context, inferring perceived tenure security from household responses on fallow time without worry of farm reallocation also appeared to provide useful complementary information. The outlook on tenure security based on this measure was also less positive (34 percent of farms) and the proportion of tenure insecure households for this measure (27-33 percent depending on which cut-offs are used) was more in line with that obtained via Prindex and our Ghana context-specific indicator. Still, we should note that the higher proportion of 'don't know' responses for this question may suggest greater respondent difficulty with the question.

Together, we obtained the most nuanced information for our study area with respect to households' perceived tenure security by drawing on the combination of ZLFS questions based on household perceived rights, a continuous indicator based on fallow time, and the context-specific question we added for our evaluation that measures perceived expropriation loss with respect to cutting and replacing cocoa trees on the farm. Finally, we note that our findings on respondents' perceived tenure security and how it was associated with a range of relevant household characteristics appear to generally align with recent related analyses on tenure security in Ghana.[66]

[65] (1) Questions from prior USAID land-sector IEs on expropriation risk from extended family and chiefs (2) our Ghana context-specific indicator on expropriation risk if respondent cuts and replaces their cocoa trees, and (3) the Prindex survey question on worry of losing farm rights (sources of expropriation are not specified).

[66] For example, see Ghebru, H. and I. Lambrecht. 2017. Drivers of perceived land tenure (in)security: Empirical evidence from Ghana. Land Use Policy 66:293-303.

ANNEX G: CORRELATES OF HOUSEHOLD WILLINGESS TO PAY FOR A CUSTOMARY LAND CERTIFICATE

BACKGROUND

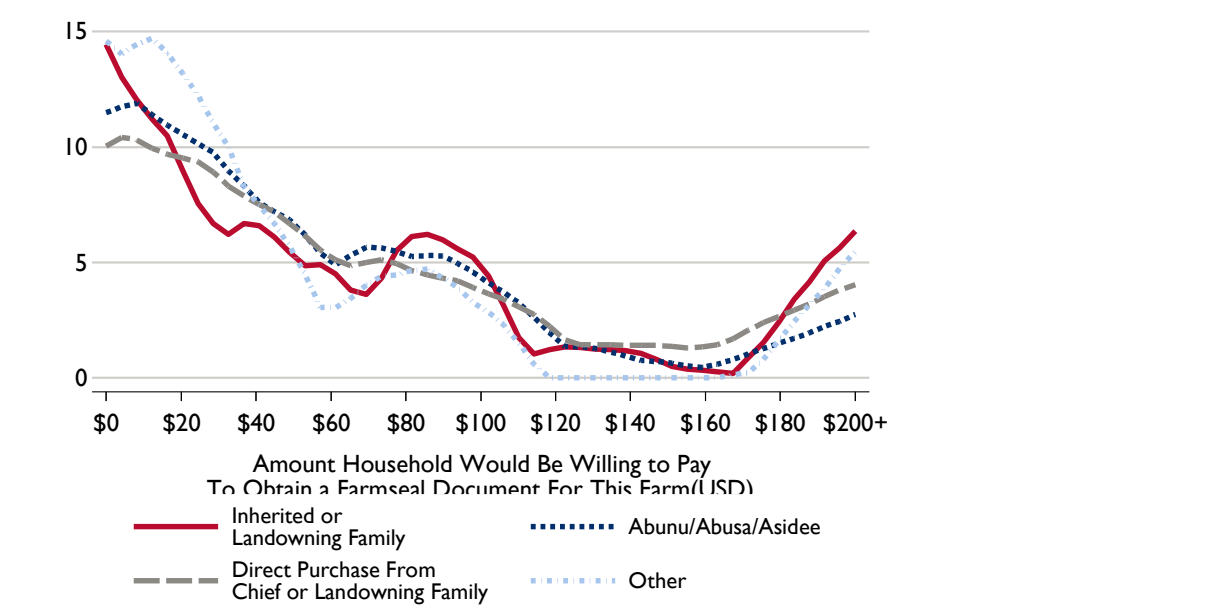
The baseline results suggested a fairly low level of familiarity with customary land certificates (CLCs) among farmers in the sample, at 31 percent of households, but also indicated that farmers value having formal documentation of their use rights to their farms. Households reported they would be interested in obtaining documentation for 83 percent of farms that are currently undocumented. However, the amount farmers said they would be willing to pay (WTP) to receive such a document varied widely, ranging from nearly zero to greater than $200 (Fig G-1). In addition, many respondents could not estimate their WTP, affecting 37 percent of farms in the sample. For farms where households were able to estimate their WTP, the mean estimate was $78.2 and the median was $47.5.

The CEL evaluation team conducted additional analyses to identify household and farm-level factors that were associated with farmers' willingness to pay higher and lower amounts for the document. This analysis aimed to complement IP efforts to determine appropriate price points for the FarmSeal document in Bridge Phase communities. To do so, the CEL team examined correlations among baseline variables that may be expected to relate WTP, and conducted regression analyses to model a household's WTP.

The WTP data at baseline are drawn from the following series of questions on the household survey:

- If you could obtain a paper document of your right to use this farm, would you?
- Are you familiar with customary land certificates in Ghana, sometimes known as a "FarmSeal" document?
- Hypothetically, how much would you be willing to pay (in cedis) to obtain such a document of your right to use this farm?

FIGURE G-1: HOUSEHOLD WILLINGNESS TO PAY FOR FARMSEAL DOCUMENTS



KEY FINDINGS

Several household and farm-level characteristics were significantly correlated with WTP on their own. At the household-level, these factors included higher average WTP for households who: had familiarity with CLCs; already had some type of paper document of use rights to the farm; and had the right to cut and replant cocoa trees on the farm.

Households that had a lower likelihood of being below the poverty line (less poor households), and households that felt they would lose their rights to the farm if they cut and replant cocoa trees also had a higher estimated WTP. Some household demographic characteristics that one might expect to relate to WTP were not correlated with the WTP estimates in our analysis. Specifically, gender of household head, head education level, family size, ethnicity, and total landholdings were not associated with WTP

The results for cutting and replanting cocoa trees suggest that farmers on both ends of this spectrum – those who felt certain of their right to cut and replant trees, and those who felt they would lose their rights to the farm if they did so – saw the CLC as a valuable document. This sentiment may have been present because farmers viewed the CLC as a tool to further strengthen their claims to the land, or solidify their tenant use rights. In other words, it is possible that different types of farmers may value the CLC for a different set of anticipated benefits, reflecting diverse hopes or expectations for CLCs across different types of farmers in the sample. If this is the case, IPs may want to ensure there is strong sensitization and clear communication to farmers on the purpose, limitations and potential benefits of the FarmSeal document.

At the farm level, mode of farm acquisition and cocoa productivity were not associated with WTP. However, farmers were willing to pay $9.43 more on average for a CLC for farms that were not severely diseased. Farmers were also willing to pay substantially more, $19.05 on average, for a CLC for farms located in swampy areas. Given the Bridge Phase context, in which swamp lands are typically on village margins, along waterways, and in areas that may have traditionally been considered a type of open access, it is possible this higher WTP reflects a view that the CLC could strengthen the farmer's claim to such land.

The above correlations on household or farm level factors are informative, however most of these variables do not maintain their significance in multi-variate regression models that control for a range of potentially relevant factors. Using a hierarchical linear regression model, which is a conservative modelling approach with respect to hypothesis testing that takes into account the nested structure of the data (farms within households; households within villages), two factors were significantly associated with the WTP estimates provided by farmers:

(1) ***Household wealth status***, in which poorer households (proxied by household likelihood of being below the poverty time) had lower WTP. Each additional percentage point increase in the household's likelihood of poverty was associated with a $0.78 decrease in WTP.

(2) ***Presence of shade trees on the farm***, in which having shade trees on the farm was associated with an additional $8.11 in WTP for a CLC.

A less conservative OLS modelling approach also suggested higher WTP for households with any type of paper documentation for the farm, while having multiple farms was associated with lower WTP (each additional cocoa farm held by a household is associated with a $4.72 decrease in WTP for a given farm).

Overall, the additional analysis of WTP underscored the complex set of interacting factors that shape farmer decisions in the Bridge Phase context. It highlighted that the overall perceived value and estimated amount a farmer is willing to pay for the CLC document is likely to differ substantially for

farmers across the sample and on the basis of the household's unique situation, the various threats to sustained land use that they face, and their expectation for how more formal tenure documentation of their farm rights could benefit them. The preliminary analysis presented here may be useful for identifying some of those factors that are more salient across many households in the sample, but should still be used with caution, especially for the purposes of establishing price points for the FarmSeal or for identifying groups of farmers who may be able to pay more or less for the document. Finally, it is important to keep in mind that survey responses of farmers' self-reported WTP may not always be reliable, and can differ from their actual willingness or ability to pay the amount that they state.

SUPPLEMENTAL CHARTS AND REGRESSION ANALYSES

Household-level characteristics: Households that are familiar with customary land certificates are willing to pay more for the document.

For approximately 37 percent of farms, households said they did not know how much they would be willing to pay to obtain a CLC for the farm. Familiarity with CLCs had no detectable relationship with whether the household could estimate their WTP (in other words, whether the household could provide an amount in Ghanaian cedis they would be willing to pay). However, familiarity with CLCs had a strong, positive, and statistically significant correlation with willingness to pay. On average, households who said they were familiar with CLCs were willing to pay an additional $32.73 to obtain documentation for a farm.

TABLE G-1: CORRELATION OF HOUSEHOLDS FAMILIARITY WITH CLC AND WTP

VARIABLES	(1) Household Did Not Know WTP for CLC	(2) Willingness to Pay for CLC (USD)
HH Familiarity with CLC = 1	0.0495	17.93**
	(0.0413)	(8.3096)
Constant	0.3512***	64.3536***
	(0.0228)	(4.1949)
Observations	1,785	1,118
R-squared	0.002	0.015

Standard errors clustered at the household-level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Household-level characteristics: Some household characteristics and measures of perceived tenure security were also correlated with higher average WTP. Results suggest that farmers may have a range of understandings or hopes for how a CLC may strengthen their claims to land.

Looking at other household-level correlates of willingness to pay to obtain a CLC, the figure below shows a number of simple correlations for yes/no questions in the baseline survey that related to household tenure security and documentation context. While farmers who were familiar with a CLC were willing to pay more for the document, suggesting the document is seen as beneficial, farmers who already had some type of paper document of their farm rights were also willing to pay for the CLC. This could perhaps reflect a perception that the CLC offers stronger protections than their existing document, further solidifies their claim to that land, or has added-value on other dimensions. Similarly, farmers who said they have a right to cut and replant cocoa trees on the farm were also willing to pay a higher amount for the CLC, on average.

On the other end of the spectrum, farmers who said they would lose their right to the land if they cut and replanted cocoa trees, one measure of stronger tenure insecurity in the Bridge Phase context, were also willing to pay more for the CLC than those who did not have this particular worry. Together with the above, the results appear to indicate that farmers on both ends of this spectrum saw the CLC as a valuable document that could further strengthen their claims to the land. The reasons that farmers WTP was higher among those who already had a document of their rights to the farms (in theory, more tenure secure farmers), and those who felt they would lose their right to the farm if they cut and replanted cocoa (in theory, less tenure secure farmers) is likely quite different, reflecting diverse hopes or expectations of the benefits of CLCs across different types of farmers in the sample. For example, more tenure secure farmers who already have some validation of their land rights through their existing documentation may see the FarmSeal as a way to further leverage their rights to obtain greater amount of formal credit, while less tenure secure farmers may see the FarmSeal as an opportunity to strengthen their tenant rights to the land. If so, IPs may want to ensure there is strong sensitization and clear communication to farmers on the purpose and potential benefits of the document.

Demographic characteristics such as gender of household head, education level, family size, ethnicity, and total landholdings were not correlated with WTP. However, households with a lower likelihood of being below the poverty line were willing to pay $7.85 more for a CLC, on average (Figure G-3).

FIGURE G-2: AVERAGE WTP GIVEN HOUSEHOLD TENURE AND OTHER CONTEXT

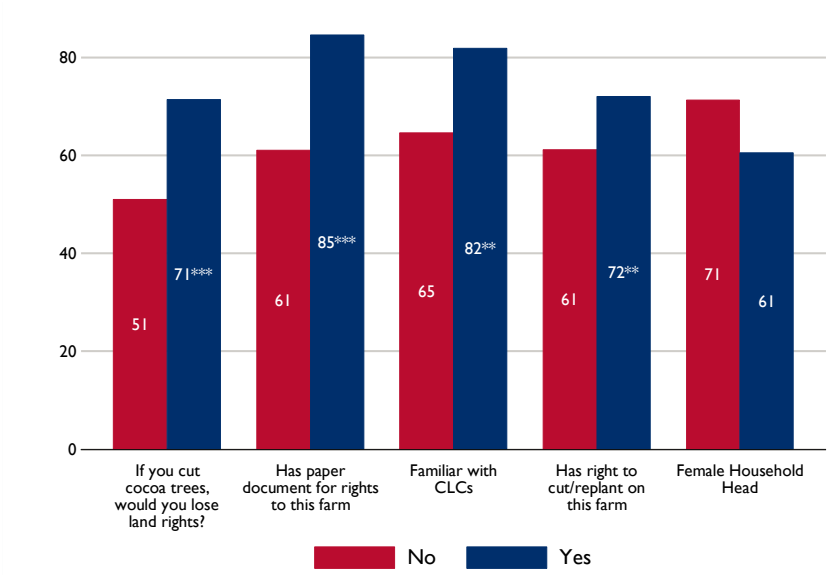
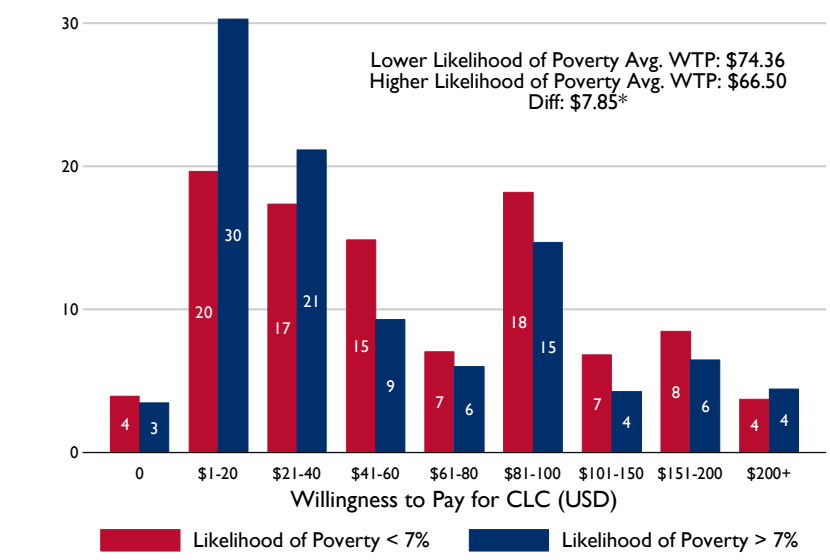


FIGURE G-3: DISTRIBUTION OF WTP FOR POORER AND LESS POOR HOUSEHOLDS



Farm-level characteristics: Mode of farm acquisition and cocoa productivity of the farm were not associated with WTP for a CLC, but farmers were willing to pay more for the document, on average, for farms that have lower disease and pest loads and for farms in swampy areas.

In addition to household and farmer characteristics, the evaluation team found several farm-level factors potentially associated with farmer willingness to pay for a customary land certificate. These factors included cocoa farm productivity, site conditions of the farm, farmer-reported pest and disease load, and the means through which the household acquired the farm (e.g., inheritance, direct purchase, etc.). Mode of farm acquisition and whether the farm had higher or lower cocoa productivity (based on median cocoa productivity across the baseline sample) were not associated with WTP (Figures G-4 and G-5). On the other hand, farmers were willing to pay $9.43 more on average for a CLC for farms that were not badly diseased (Figure G-6; results were similar for pest severity). Farmers were willing to pay a substantially higher amount, $19.05 on average, for a CLC for farms located in swampy areas (Figure G-7). Given the Bridge Phase context, in which swamp lands are typically on village margins, along waterways, and in areas that may have been traditionally considered open access, it is possible this higher WTP reflects a view that the CLC could strengthen the farmer's claim to such land.

FIGURE G-4: AVERAGE WTP BY MODE OF FARM ACQUISITION

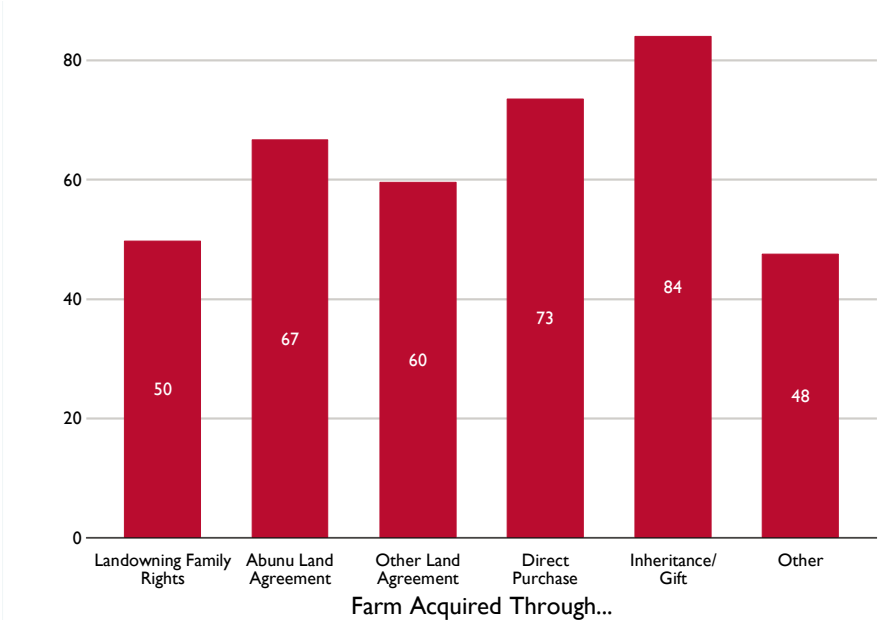


FIGURE G-5: WTP FOR MORE AND LESS PRODUCTIVE COCOA FARMS

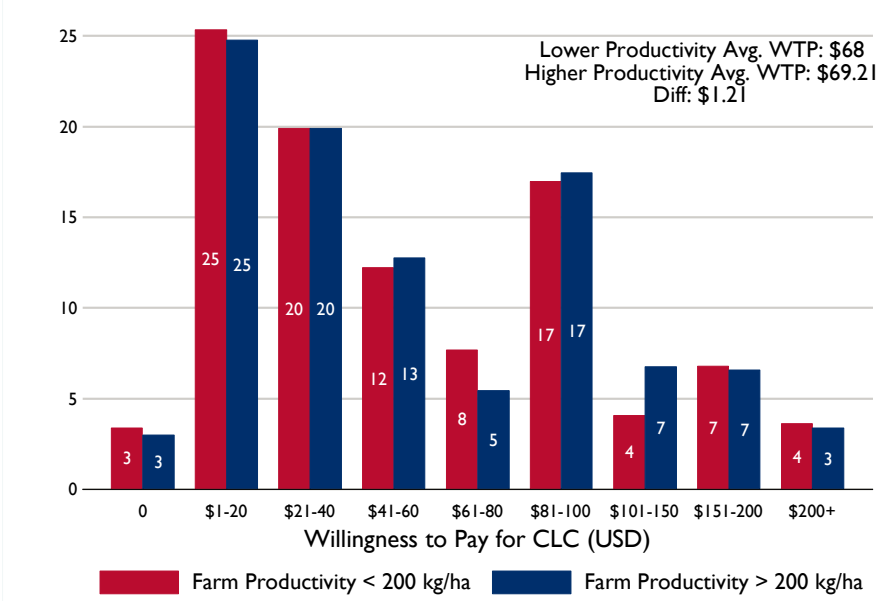


FIGURE G-6: DISTRIBUTION OF WTP FOR COCOA FARMS WITH HIGHER AND LOWER DISEASE SEVERITY

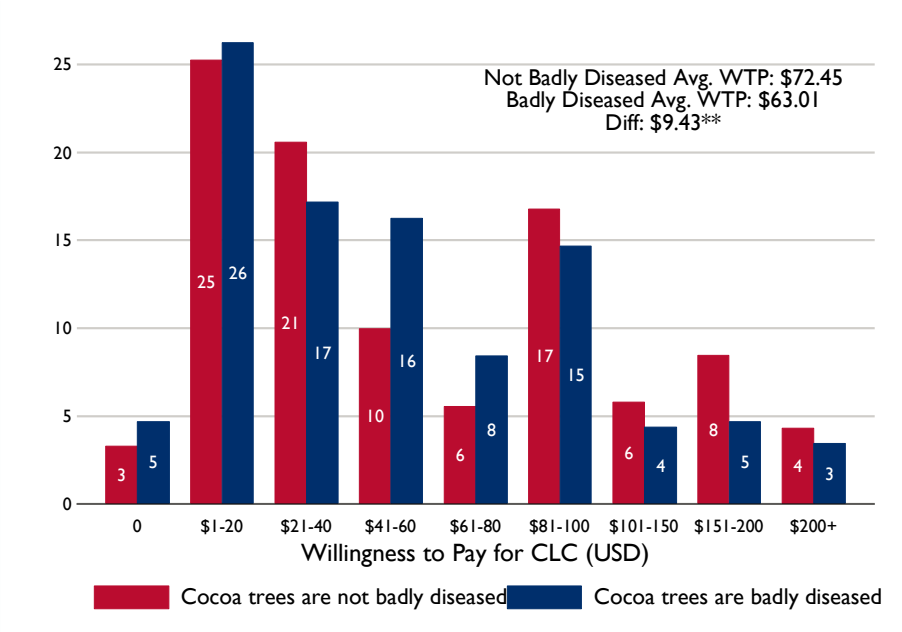
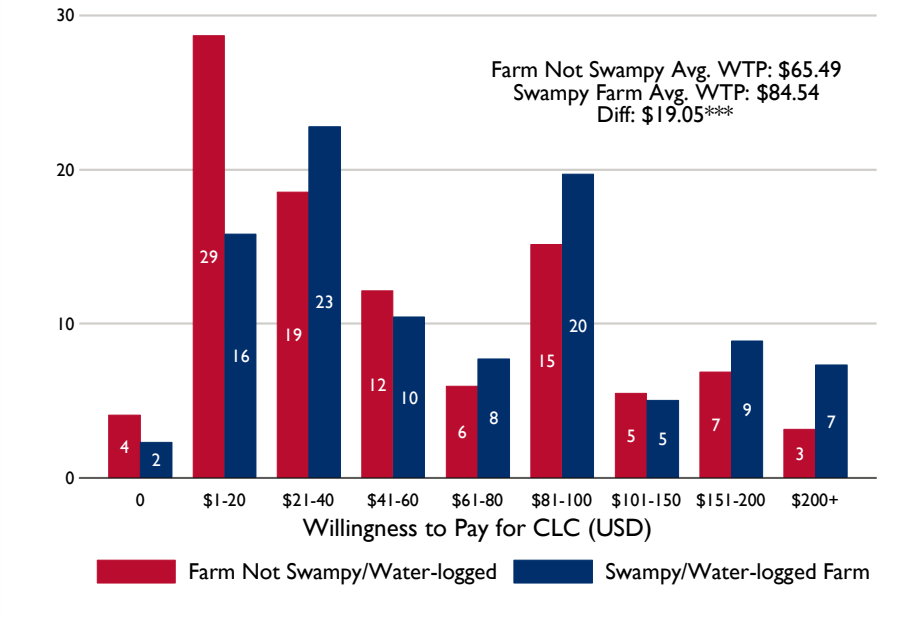


FIGURE G-7: DISTRIBUTION OF WTP FOR COCOA FARMS ON SWAMPY AND NOT SWAMPY SITES



Regression analyses of significant farm and household characteristics associated with WTP.

The evaluation team used a regression analysis approach to model the relationship between WTP and a set of covariates that may predict WTP. The team used a hierarchical linear regression model (HLM) to more directly account for the nested structure of the data, which has observations at farm-, household-, and village-levels. The team also conducted Ordinary Least Squares (OLS) regression. Conceptually, the HLM approach is preferable, although it is more conservative in testing relationships between household and village-level factors and WTP.

The results for both models are reported in Table G-2 below. While the results above show correlations between WTP and several farm and household level factors, most of these factors do not maintain their significance in the multi-variate models that control for a range of factors.

The HLM approach pointed to two key factors that contributed to explaining WTP, controlling for other factors:

- ***Household likelihood of being below the poverty line*** was associated with lower willingness to pay in both models. The results in the HLM model suggested that each additional percentage point increase in the likelihood of poverty was associated with a $0.78 decrease in WTP.

- The ***presence of shade trees*** on the farm was associated with an additional $8.11 in WTP for a land certificate in the HLM model (but note this estimate goes in the opposite direction in the OLS model and is not statistically significant in that model).

The results for household head gender and familiarity with CLCs went in the expected positive direction in both models, but the results were not statistically significant at conventional levels. The results suggested a negative relationship between the number of farms on which households cultivated cocoa last year and WTP, a finding that was statistically significant in the OLS model. The OLS results suggested that each additional farm on which a household cultivated cocoa was associated with a $4.72 decrease in WTP for a given farm, potentially reflecting that households with more farms were less dependent on any one farm.

Farmers reported a higher willingness to pay for a CLC for farms that they already had paper documentation for, but this relationship was statistically significant only in the OLS model. Both models showed a negative relationship between diseased farms and WTP, in line with the simple correlations between these two variables, though the relationship was not statistically significant in either model.

The lack of relationship between cocoa farm productivity and WTP also held when controlling for other factors in the multi-variate models, although it's possible this could also reflect confounding on other factors. While households were expected to express higher WTP for more productive farms, they may have a greater need to obtain documentation for farms where their rights are less clearly defined. It is possible that such farms may be found on more peripheral or less-productive lands.

TABLE G-2:

VARIABLES	(1) Willingness to Pay for CLC (USD)	(2) Willingness to Pay for CLC (USD)
Farm is water-logged or swampy=yes	0.3076	6.8806
	(3.3919)	(6.2918)
Has any paper documentation for this farm=yes	4.0227	13.2396**
	(3.5971)	(6.3915)
Cocoa Farm Productivity (kg/ha)	0.0003	0.0029
	(0.0011)	(0.0019)
Farm has shade trees=yes	8.1079**	-4.3655
	(3.4371)	(7.3400)
Farm is badly diseased=yes	-3.5481	-5.6613
	(4.2342)	(6.7706)
Household Head Gender=female	-17.5783	-15.3363
	(12.0746)	(10.1769)
Familiarity with CLCs=yes	7.1417	9.6783
	(4.9331)	(7.5212)
Likelihood of Poverty at the $1.25/day level (2005 PPP)	-0.7779**	-0.6090***
	(0.3107)	(0.2344)
Number of separate farms household cultivated cocoa on last year	-2.9321	-4.7172**
	(2.4225)	(2.2852)
Observations	823	823
Model	HLM	OLS

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

Standard errors in parentheses. OLS model has standard errors clustered at the household level. All models include farm-level controls for farm area (ha), whether the household farmed the plot during 2018, mode of farm acquisition, age of trees on the farm, whether the household has the right to replant cocoa trees on the farm, and whether the household considers the farm's pest load to be "very bad"; household-level controls include household head marital status, household head age, primary language spoken by the household, household size, amount of land household cultivated for all crops, and years the household has been growing cocoa; the model also includes fixed effects for village.

ANNEX H: SUPPLEMENTAL ANALYSIS ON DETERMINANTS OF COCOA PRODUCTIVITY

BACKGROUND AND APPROACH

The purpose of this supplemental work was to conduct supplemental analysis to better understand what variables and factors explain differences in cocoa farm productivity among households surveyed at baseline. Our baseline analyses showed a relationship between cocoa yields and cocoa tree age (see Figure 90, page 74 in the evaluation baseline report), which was in line with much existing work on determinants of cocoa productivity.[67] Peak productivity among cocoa trees in the baseline sample ranged between 10 to 20 years of age, with declines in productivity after approximately 20 years.

Our initial baseline analysis also revealed differences in mean productivity depending on disease load, presence of shade trees on the farm, and the mode of farm acquisition. Several other factors also influenced or were strongly related to cocoa productivity. Strengthening the knowledge base on the factors that influence cocoa productivity is important because average cocoa yields in Ghana are generally low and well below estimated potential yields. This is the case even in Western region, which is currently the highest producing region in the country.[68] Consequently, several development efforts in Ghana seek to improve farmer knowledge and farm management practices to enable farmers to obtain higher cocoa yields.

In general, high disease loads, old age of cocoa trees, and poor soil nutrients are seen as major contributors to low cocoa yields in Ghana.[69] Existing work has also pointed to several farm management practices and site conditions that are strongly related to cocoa production on farms. In a study of 731 cocoa farmers across Ghana, Kongor et al. (2018) found that farmer management to control capsids and black pod disease, use of fertilizer, and pruning were significantly associated with increased cocoa productivity. Farm size was found to be negatively related to productivity in that study. Asare et al. (2019) found that cocoa yields were significantly higher with increased shade tree canopy, and observed a doubling in yields across a shade tree crown cover spectrum ranging from zero to 30 percent canopy cover.

In perhaps the most comprehensive recent analysis available, Bymolt et al. (2018) found that some household characteristics were also significantly related to cocoa productivity, including having a farmer association member or community leader in the household, having a male household head, and having higher household wealth status. In addition, use of granular fertilizer and pesticides was significantly associated with higher yields. Bymolt et al. (2018) also found that households' total cocoa landholding was negatively associated with cocoa productivity (households with more land had lower productivity). Their study found no association between cocoa productivity and other household characteristics including education level of the household, whether the household head was a migrant, household size, total number of crops produced by the household, whether the farm was owned or under an *abunu* arrangement, whether the household had received any farmer training in the past five years, or whether the household had received certification from a cocoa certification program.

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[67] See: Bymolt, R., Laven, M. Tyszler. 2018. *Demystifying the cocoa sector in Ghana and Cote D'Ivoire.* The Royal Tropical Institute (KIT); Asare, R. et al .2019. *On-farm cocoa yields increase with canopy cover of shade trees in two agro-ecological zones in Ghana*. Climate and Development 11(5):435-445. , Kongor, J.E., et al. 2018. *Constraints for future cocoa production in Ghana*. Agroforestry Systems 92:1273-1385.

[68] *Ibid*.

[69] Wessel, M. and P.M. Foluke Quest-Wessel. 2015. *Cocoa production in West Africa, a review and analysis of recent* developments. NJAS-Wageningen Journal of Life Sciences 74-75:1-7.

Our analysis of factors associated with cocoa productivity followed a similar approach to the above studies. We restricted our baseline sample to cocoa farms with trees that were at least five years old, or that had trees identified by households as having reached harvesting age. Cocoa farm productivity is defined as the total cocoa harvest from the 2018-2019 main and light seasons[70] measured in kilograms, divided by the farm area under cocoa cultivation measured in hectares. Farms were excluded if the household did not know the total cocoa production on the farm during the last main harvesting season. The analysis also excluded a small number of outliers (N=6) with cocoa productivity per hectare greater than three standard deviations above the mean, as they were likely to be reporting errors by the farmer. Our resulting sample for this analysis was 966 cocoa farms,[71] distributed across 533 households in 12 villages. Of these, 123 (12.7 percent) of farms were from female-headed households, and 843 (87.3 percent) were from male-headed households.

We used a linear regression approach to identify key determinants of cocoa productivity. Our approach and the variables we selected to include in the regression analysis was informed by a review of relevant literature on cocoa productivity. The regression included variables at the farm and household levels, along with village fixed effects to control for unobservable characteristics of the village. For variables where the relationship between a covariate and cocoa productivity was not expected to be linear, we transformed these covariates accordingly, defining them as either a natural logarithm or quadratic terms. This was done for three variables: age of cocoa trees on farm, household size and total land cultivated by the household. We ran multiple versions of the regressions to test the robustness of the results to different specifications of the regression model. We began with a regression of cocoa productivity on farm-level covariates, then added the household-level covariates, and next ran the regression including both the farm-level and household-level covariates.

KEY FINDINGS

Figure H-1 shows the distribution of cocoa farm productivity in our sample, measured as kilograms of cocoa per hectare produced across the past main and light harvesting seasons. The graph shows a normal distribution with a right-skew. Productivity was distributed normally around a mean of 506.8 kg per hectare and median of 351.4 kg per hectare. One quarter of the distribution corresponded to farms with productivity below 200 kg per hectare. In summary, the graph shows that most farms had low productivity, while a small number of farms (seen in the long right tail of the figure) had much higher productivity. Ten percent of the distribution corresponded to farms with productivity above 1000 kg per hectare.[72]

[70] These are the two harvest seasons prior to the baseline survey, which was conducted in May-June 2019.
[71] Of the 1,584 cocoa farms in our sample, 352 farms (22.2%) were excluded because tree age was under five or unknown. In addition, 267 farms (16.9%) that had trees of productive age were excluded because farmer could not report production.
[72] In comparable work from Ghana using the same survey approach as ours, Bymolt et al. (2018) estimated the median cocoa yield for Ghanaian farmers at 369 kg/ha. (Bymolt, R., Laven, M. Tyszler. 2018. *Demystifying the cocoa sector in Ghana and Cote D'Ivoire.* The Royal Tropical Institute (KIT).)

FIGURE H-1: DISTRIBUTION OF COCOA FARM PRODUCTIVITY[73]

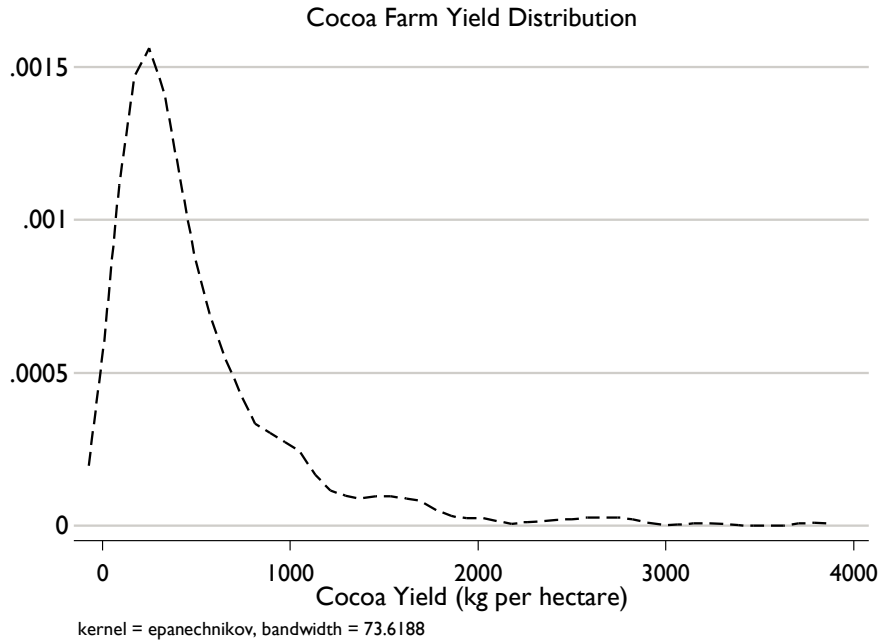

Table H-1 shows the results from our regression analysis to identify key factors associated with cocoa productivity. Columns 1 and 2 show the results from regressions that include only *farm-level* covariates, excluding and including village fixed effects. Columns 3 and 4 show the results from regressions using only *household-level* covariates along with the age of trees on the farm, with and without village fixed effects. Finally, Columns 5 and 6 shows the results using both farm- and household-level covariates, excluding and including village fixed effects. Column 6, which includes both farm-level and household-level covariates and village fixed effects, is the preferred model.

The results confirm strong association between cocoa tree age and farm productivity, and show the expected inverted, parabolic relationship of cocoa tree age with productivity. This is robust across all versions of the model. The positive coefficient on the linear term for cocoa tree age, accompanied by the much smaller, negative coefficient on tree age in years squared, indicates that tree productivity increases with age for farms with trees at least five years old, but this increase in productivity then diminishes with age until a certain point, after which productivity declines with age.

We discuss additional results below, grouped by three categories of factors: farm-level site conditions, farm-level management practices, and household characteristics. We focus on results that tended to be robust across model specifications, both in terms of the direction of the relationship and statistical significance. This gives us a high degree of confidence that the relationships we report existed among the farms in our sample. But, we also highlight that our analysis only indicates associations between key variables and cocoa productivity. The findings expand on our understanding of the complex array of factors that contribute to determining cocoa production on farms, but these relationships are not necessarily causal and should not be interpreted as such.

[73] Potential yields for Ghana are generally thought to range from 1,000 – 1,900 kg/ha (Bymolt et al., 2018). It is likely that our sample, which is based on farmer self-reporting, contains a small number of unrealistically high upper yield estimates.

FARM SITE CONDITIONS[74]

Results indicate that farm size and disease and pest load were strongly related to cocoa productivity.

Farm size was inversely related with productivity in our farm sample (this is also in line with Kongor et al. 2018). The negative coefficient on farm size suggests that larger farms tended to be less productive. Specifically, the interpretation of the result is that farms larger than the median farm size of 1.21 hectares had production that was between 215.9 and 258.1 kg lower per hectare, on average, than smaller farms, once other covariates were controlled for. There are multiple potential explanations for this relationship, including that farmers were better able to provide or afford the amount of inputs and labor required for more intensive production across a smaller area. However, this result should be viewed with some caution since farm size is based on farmer self-reporting and farmers may under- or over-estimate their farm size.[75]

Farms severely affected by *pests and disease* were also less productive, a result that was expected and was consistent across model specifications although not statistically significant across all models.

All else equal, farms that were *acquired through purchase* were estimated to be more productive than farms acquired through other means. This result could indicate that farmers who purchased their farms may be inherently more motivated to engage in more productive farming techniques (for example, to undertake yield-maximizing farm practices and investments), or that plots that are more productive are simply more likely to be targets for purchase. Cocoa productivity is not related to farm acquisition via inheritance, landowning family rights, or through an *abunu* arrangement.

FARM MANAGEMENT PRACTICES

In terms of farm management factors, the results indicate that the cocoa variety used, the presence of shade trees on farm, the use of fertilizer and pesticides, and the amount of weeding and pruning done by the household (whether own or hired labor) were all strongly associated with higher cocoa productivity.

In terms of *cocoa variety*, compared with farms planted with Amazonia, Hybrid, multiple cocoa varieties, or other varieties besides Amazonia and Hybrids, farms planted only with the Tetteh Quarshie variety were estimated to yield between 162 and 257.8 kg less cocoa per hectare. This finding was robust across all model specifications.

The *presence of shade trees* on the farm was also correlated with higher cocoa productivity. Specifically, farms with shade trees had cocoa yields that ranged between 11.8 and 107.4 kg per hectare higher than those without shade trees, on average. However, the result was not statistically significant across all model specifications. Shade tree density varied substantially across farms in the sample, thus our binary variable for presence or not may be too coarse to adequately characterize the relationship.[76]

The *use of agricultural inputs, such as fertilizer, pesticides, and labor for weeding and pruning* was correlated with higher cocoa productivity. Farms belonging to households that used any fertilizer had yields that were between 58.3 and 79.4 kg per hectare higher, on average, than those belonging to households that used no fertilizer, though the difference was not statistically significant. Similarly, households using any

[74] Existing studies also point to soil quality as a key determinant of cocoa productivity. As our baseline data do not include nuanced information on soil quality, we are not able to look at this explicitly.
[75] The relationship between farm size and productivity in sub-Saharan Africa is the subject of much ongoing work and a fair amount of contention. Higher productivity on smaller farms could result from farmers being able to apply higher amounts of inputs and labor per unit area on small plots. However, some studies also suggest that farmers tend to systematically under-estimate the size of smaller farms and over-estimate the size of larger farmers, which could also contribute to a result in which smaller farms appear more productive.
[76] CEL is conducting further analysis on this as part of ongoing work under this evaluation.

pesticide, herbicide, or fungicide saw yields 214.6 to 261.2 kg per hectare higher, on average, and this was statistically significant across all model specifications.

Intercropping on cocoa farms had no relationship to farm productivity in our sample.

HOUSEHOLD CHARACTERISTICS

In terms of household factors, household wealth status, amount of farmer training received, and household size were key factors associated with higher cocoa productivity.

Household wealth status was a significant determinant of cocoa productivity in our analysis, as was also found by Bymolt et al. (2018). A household's likelihood of poverty is negatively correlated with cocoa productivity, and this result was statistically significant across all models. However, there was no clear relationship between cocoa farm productivity and the *education level of the household head*.

Farmer training was also an important factor for farm productivity. All else equal, households with at least one member who had received training over the past three years had farms that were approximately 59.2 to 103.5 kg per hectare more productive than those from households that received no training.

As expected, *household size* was correlated with higher productivity. Results showed that a one-percent increase in household size was correlated with a productivity increase ranging between 64.5 and 75.0 kg per hectare. This result is not surprising, since household size is typically linked to farm labor availability within the household, production costs, and overall farm income. As was the case with cocoa farm size, a household's *total land area under cultivation* (across all crops) was negatively correlated with cocoa farm productivity. The results suggest that a one-percent increase in total land area under cultivation in the year prior to survey corresponded to a 82.6 to 117.5 kg decrease in cocoa productivity per hectare. Given previous studies, we also expected the total number of labor days the household spent on cocoa harvesting would be related to productivity, however we have a high percentage of missingness on this variable in our survey data and could not include it in the model. However, household size may serve as a coarse proxy for labor availability, especially given that 59 percent of households in our sample relied solely on household labor for cocoa harvesting (and only 12 relied solely on hired labor).

We also included households' *perceived tenure security over the farm* (based on how worried the farmer was about losing rights to the farm[77]) and whether the *household had paper documentation for the farm* in our analysis. Both variables had a negative relationship with cocoa productivity (farms that were tenure secure and farms that had paper documentation were associated with lower productivity); however, the results were not statistically significant.

Lastly, neither the *gender of household head* nor *head age* were related to cocoa farm productivity. These findings were contrary to those of Bymolt et al. (2018), which found that male-headed households had significantly higher yields than female-headed households. In that analysis, this yield difference was explained by male-headed households applying good agricultural practices (GAP) and receiving farmer training at a higher rate than female-headed households, which amounted in higher yields. We did not see evidence of a disproportionate training or application of GAP by gender of household head in our sample.[78] Similarly, whether any *household member held a leadership position* in the village was also not related to farm productivity in our sample.

[77] The responses "not worried at all" and "not worried" were coded as tenure secure.

[78] In addition, farms in female-headed households were not more likely to have been excluded from our analytic sample due to not knowing production or not having trees at least five years of age. Similarly, there was no relationship between head age and the farm exclusion criteria. There were 123 farms in the sample located in female-headed households. The median age of households heads was 45 years old, mean was 47.2 years old, and the age distribution of heads was normally distributed.

TABLE H-1: DETERMINANTS OF COCOA PRODUCTIVITY

VARIABLES	(1) Cocoa Farm Prod. (kg/ha)	(2) Cocoa Farm Prod. (kg/ha)	(3) Cocoa Farm Prod. (kg/ha)	(4) Cocoa Farm Prod. (kg/ha)	(5) Cocoa Farm Prod. (kg/ha)	(6) Cocoa Farm Prod. (kg/ha)
Age of cocoa trees on farm (years)	27.6***	22.8***	26.5***	21.2***	28.6***	23.1***
	(7.9)	(7.9)	(7.3)	(7.1)	(8.5)	(8.4)
Age of cocoa trees on farm squared	-0.5***	-0.4**	-0.6***	-0.5***	-0.5**	-0.4**
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Farmer used any fertilizer = Yes			75.6	58.3	79.4*	70.1
			(49.0)	(47.3)	(47.1)	(45.0)
Farmer used any pesticide, herbicide, fungicide = Yes			261.2***	249.9***	214.5***	219.9***
			(68.9)	(68.6)	(72.0)	(70.0)
ln(Times household did weeding on cocoa trees)			61.4	41.3	46.3	37.4
			(44.8)	(43.6)	(45.6)	(44.2)
ln(Times household did pruning on cocoa trees)			48.2	29.9	47.5	27.0
			(57.9)	(56.1)	(58.1)	(56.1)
ln(Likelihood Household is Poor)			-41.2**	-37.8*	-41.4**	-38.8*
			(20.3)	(20.7)	(20.2)	(20.6)
HH Head Sex = female			-74.0	-35.9	-62.6	-13.7
			(69.1)	(66.0)	(67.8)	(66.2)
HH Head Age (in years)			7.1	6.9	11.5	8.6
			(10.2)	(9.9)	(10.4)	(10.1)
HH Head Age Squared			-0.1	-0.1	-0.1	-0.1
			(0.1)	(0.1)	(0.1)	(0.1)
HH Head Highest Completed Education = Primary			6.1	2.0	33.2	21.0
			(73.1)	(71.3)	(71.8)	(70.5)
HH Head Highest Completed Education = Middle School			-80.1	-36.7	-80.8	-56.1
			(67.8)	(69.2)	(68.1)	(69.0)
HH Head Highest Completed Education = Secondary			-88.2	-21.5	-58.6	-22.3
			(76.3)	(77.5)	(77.6)	(76.1)
HH Head Highest Completed Education = Post-Secondary			-95.5	-0.6	-36.7	13.0
			(115.8)	(108.0)	(112.0)	(106.4)
HH Head Highest Completed Education = Koranic/Other			-138.6	-148.1	-60.2	-62.1
			(101.3)	(113.8)	(85.7)	(91.6)
HH received training, past 3 years = Yes			103.5**	78.2*	90.2**	59.2
			(43.6)	(43.9)	(42.1)	(42.9)
HH head was born in this district = Yes			69.2	82.0*	74.7	87.3*
			(47.4)	(45.7)	(51.5)	(48.5)
ln(Household Size)			75.0*	64.5	74.2*	68.0*
			(39.3)	(41.3)	(39.1)	(40.5)
ln(Hectares used to cultivate all crops last year)			-117.5***	-107.6***	-92.4***	-82.6**
			(32.3)	(32.6)	(35.1)	(36.7)
Years HH has been growing cocoa = 6-10 years			-86.9	-45.8	-116.9	-79.8
			(116.5)	(109.3)	(110.9)	(105.4)
Years HH has been growing cocoa = 11-15 years			-114.5	-86.1	-137.2	-117.0
			(112.2)	(103.1)	(106.3)	(99.7)
Years HH has been growing cocoa = 16-20 years			-32.0	-1.8	-74.5	-60.1
			(116.6)	(108.0)	(110.6)	(105.2)
Years HH has been growing cocoa = 20-24 years			-149.2	-102.5	-181.5	-145.9
			(133.8)	(127.6)	(134.2)	(131.1)
Years HH has been growing cocoa = 25 years or more			-56.9	-59.7	-103.0	-112.5
			(120.1)	(110.9)	(111.3)	(104.2)
HH has member with leadership role in community = Yes			9.7	17.5	16.1	23.0
			(49.5)	(45.4)	(48.0)	(44.6)
HH borrowed any money over the last year = Yes			-31.6	-37.2	-31.8	-29.0
			(48.2)	(43.3)	(44.4)	(41.8)
Variety of cocoa trees on farm = Tetteh Quarshie	-162.0**	-231.3***			-184.6**	-257.8***
	(73.5)	(73.4)			(76.2)	(78.2)
Variety of cocoa trees on farm = Amazonia	-61.0	-65.3			-65.2	-70.0
	(61.1)	(59.9)			(64.1)	(62.1)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Cocoa Farm Prod. (kg/ha)	Cocoa Farm Prod. (kg/ha)	Cocoa Farm Prod. (kg/ha)	Cocoa Farm Prod. (kg/ha)	Cocoa Farm Prod. (kg/ha)	Cocoa Farm Prod. (kg/ha)
Variety of cocoa trees on farm = Hybrid	-100.2*	-70.5			-108.7*	-89.0
	(58.7)	(56.1)			(61.7)	(60.1)
Farm is intercropped with other crops = Yes	22.1	-3.4			33.1	-4.4
	(41.1)	(40.1)			(44.4)	(42.4)
Mode of farm acquisition = Inheritance or Landowning	54.0	42.1			36.6	28.8
	(55.3)	(58.5)			(59.4)	(60.0)
Mode of farm acquisition = Purchase	110.9	72.9			169.6*	135.9
	(88.8)	(85.2)			(91.5)	(90.8)
Mode of farm acquisition = *Abunu* Agreement	78.0	35.9			80.5	55.3
	(54.8)	(57.3)			(56.6)	(60.2)
Farm is badly diseased = Yes	-32.8	-22.0			-38.4	-42.8
	(46.9)	(44.2)			(46.8)	(45.2)
Farm is badly affected by pests = Yes	-77.0*	-41.4			-71.9	-33.9
	(44.9)	(42.8)			(45.3)	(44.6)
Large Farm (farm area > median of 1.21) = Yes	-258.1***	-254.6***			-234.3***	-215.9***
	(36.6)	(37.0)			(43.4)	(42.5)
Cocoa trees on farm have ever been replanted = Yes	-61.1	-64.4			-67.5	-66.5
	(40.6)	(39.8)			(42.5)	(41.3)
Cocoa Farm is Tenure Secure = Yes	-47.2	-32.5			-58.4	-49.1
	(50.5)	(47.8)			(53.7)	(51.4)
Cocoa farm has shade trees = Yes	48.6	107.4*			11.8	55.3
	(61.9)	(59.7)			(64.0)	(62.8)
Farm has any paper documentation = Yes	-11.9	-10.3			-1.8	-7.2
	(39.3)	(42.6)			(41.2)	(44.3)
Farm location swampy or water-logged = Yes	4.9	17.5			24.4	37.6
	(42.4)	(42.7)			(47.6)	(47.8)
Constant	411.6***	411.8***	-125.7	-90.1	-35.6	24.1
	(104.5)	(105.8)	(267.4)	(265.7)	(264.2)	(265.5)
Observations	944	944	874	874	869	869
R-squared	0.108	0.163	0.099	0.149	0.178	0.218
Included Variables	Farm-Level	Farm-Level	Household-Level Variables & Tree Age	Household-Level Variables & Tree Age	Farm & Household-Level Variables	Farm & Household-Level Variables
Village FE	NO	YES	NO	YES	NO	YES

Robust standard errors clustered at the household level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

SUPPLEMENTAL CHARTS

FIGURE H-2: COCOA YIELD DISTRIBUTION ACROSS LOW, MEDIUM AND HIGH LIKELIHOOD OF HOUSEHOLD POVERTY

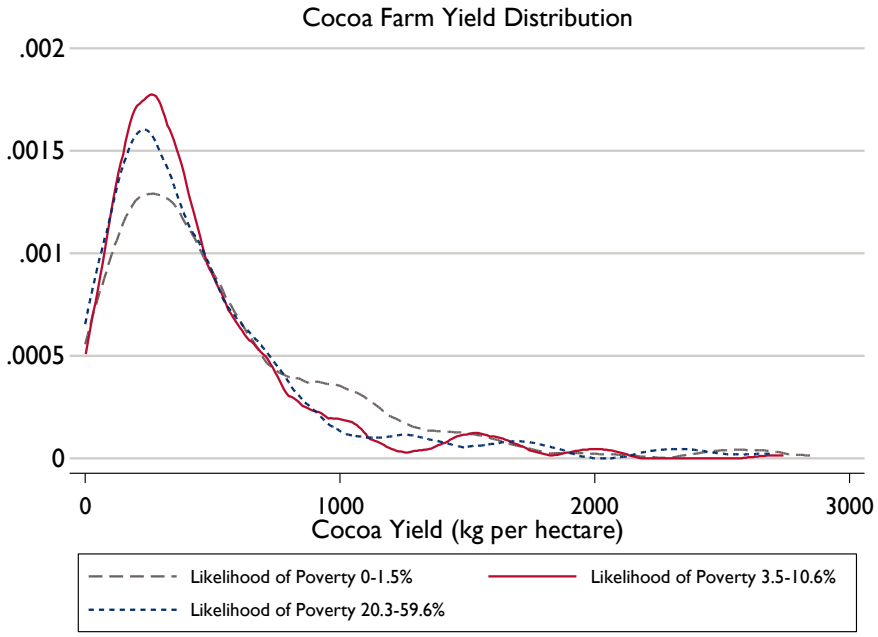

FIGURE H-3: COCOA YIELD DISTRIBUTION BY HOUSEHOLD RECEIPT OF TRAINING

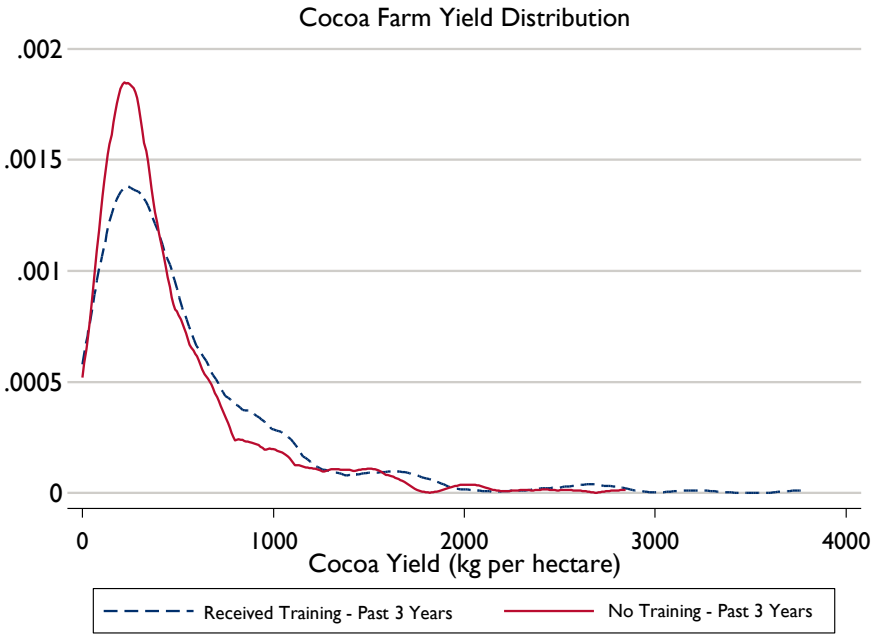

TABLE H-2: SUMMARY DESCRIPTIVE STATISTICS

Variable	Mean	Standard Deviation	N
Cocoa Yield (kg/ha)	506.83	502.979	951
Variety of cocoa trees on farm = Other / Mixed	0.196	0.397	966
Variety of cocoa trees on farm = Tetteh Quarshie	0.084	0.277	966
Variety of cocoa trees on farm = Amazonia	0.326	0.469	966
Variety of cocoa trees on farm = Hybrid	0.394	0.489	966
Age of cocoa trees on farm (years)	14.973	8.962	965
Farm is intercropped with other crops = Yes	0.517	0.500	966
Mode of farm acquisition = Other	0.106	0.307	966
Mode of farm acquisition = Inheritance or Landowning Family	0.415	0.493	966
Mode of farm acquisition = Purchase	0.101	0.302	966
Mode of farm acquisition = *Abunu* Agreement	0.378	0.485	966
Farm is badly diseased = Yes	0.371	0.483	966
Farm is badly affected by pests = Yes	0.417	0.493	966
Large Farm (farm area > median of 1.21 hectares) = Yes	0.417	0.493	957
Cocoa trees on farm have ever been replanted = Yes	0.245	0.431	966
Cocoa Farm is Tenure Secure = Yes	0.727	0.446	966
Cocoa farm has shade trees = Yes	0.819	0.385	966
Farm has any paper documentation = Yes	0.372	0.484	962
Farmer used any fertilizer = Yes	0.720	0.449	966
Farmer used any pesticide, herbicide, fungicide = Yes	0.949	0.220	966
Farm is located in a mangrove, swampy, or water-logged = Yes	0.233	0.423	964
How many times did your household do weeding for cocoa last year?	3.193	2.826	913
How many times was pruning done on your cocoa trees last year?	1.419	0.919	756
Likelihood of Poverty at the $1.25/day level (2005 PPP)	11.266	12.221	966
Household Head Sex = female	0.127	0.334	966
Household Head Age (in years)	47.190	13.615	958
Household Head Highest Completed Education = None	0.289	0.454	964
Household Head Highest Completed Education = Primary	0.158	0.365	964
Household Head Highest Completed Education = Middle School	0.320	0.467	964
Household Head Highest Completed Education = Secondary School	0.186	0.389	964
Household Head Highest Completed Education = Post-Secondary	0.035	0.185	964
Household Head Highest Completed Education = Koranic/Other	0.012	0.111	964
Household received training, past 3 years = Yes	0.687	0.464	966
Was the household head born in this district? = Yes	0.368	0.483	964
Household Size (number of members)	5.760	2.858	966
Total land household used to cultivate all crops last year (Hectares)	3.745	2.986	952
For how many years has your household been growing cocoa? = 1-5 years	0.050	0.217	966
For how many years has your household been growing cocoa? = 6-10 years	0.177	0.382	966
For how many years has your household been growing cocoa? = 11-15 years	0.216	0.412	966
For how many years has your household been growing cocoa? = 16-20 years	0.201	0.401	966
For how many years has your household been growing cocoa? = 20-24 years	0.078	0.268	966
For how many years has your household been growing cocoa? = 25+ years	0.278	0.448	966
Household has member with leadership role in community = Yes	0.359	0.480	966
Household borrowed any money over the last year = Yes	0.486	0.500	965

ANNEX I: SHADE TREES SPECIES LIST[79]

			Communities sample for on-farm carbon measurement: Number of individuals recorded by community					
	Local Name	**Scientific Name**	**Kramokrom** 13 farms sampled	**Sureso Nkwanta** 7 farms sampled	**Yirase** 9 farms sampled	**Koduakrom** 9 farms sampled	**Domeabra** 13 farms sampled	**Meteameba/ Sefahkrom** 9 farms sampled
1	Abako	*Tieghemella heckelli*	*0*	1	0	0	0	0
2	Abe	*Elaeis guineensis*	*8*	2	1	1	6	0
3	Abesebuo	*Irvingia robur*	*2*	0	2	2	0	1
4	Abootre	*Senna siamea*	*3*	6	1	0	0	0
5	Abrofonkatie	*Terminalia catappa*	*0*	0	0	1	0	0
6	Adwea	*Dacryodes klaineana*	*0*	0	0	0	0	1
7	Afena	*Strombosia glaucescens*	*1*	0	0	0	0	1
8	Aguava	*Psidium guajava*	*0*	1	0	0	1	0
9	Akosuatuntum	*Dialium guineense*	*2*	3	0	0	0	0
10	Akye	*Blighia sapida*	*1*	1	0	0	0	0
11	Amango	*Magnifera indica*	*0*	0	0	6	1	1
12	Ankaa	*Citrus sinensis*	*13*	12	1	12	5	5
13	Asanfra	*Amphimas pterocarpoides*	*0*	0	1	0	0	0
14	Asewbegyewoba	*Hymenostegia afzelii*	*0*	0	0	1	0	0
15	Awiemfosamina	*Albizia ferruginea*	*2*	0	4	5	0	2
16	Bese	*Cola nitida*	*18*	10	9	8	3	9
17	Bofre	*Carica papaya*	*6*	5	5	1	2	4
18	Bompagya	*Mammea africana*	*4*	0	0	0	0	0

[79] E. Danquah, 2019. CEL Cocoa Farm Carbon Measurements Baseline Data Collection Report.

			Communities sample for on-farm carbon measurement: Number of individuals recorded by community					
	Local Name	**Scientific Name**	**Kramokrom** 13 farms sampled	**Sureso Nkwanta** 7 farms sampled	**Yirase** 9 farms sampled	**Koduakrom** 9 farms sampled	**Domeabra** 13 farms sampled	**Meteameba/ Sefahkrom** 9 farms sampled
19	Brodie	*Musa paradisiaca*	*83*	41	63	40	57	55
20	Dahoma	*Pipterdeniastrum africanum*	*0*	0	3	2	0	0
21	Deeball	*Artocarpus altilis*	*0*	1	0	0	1	0
22	Doka	*Raphia hookeri*	*1*	0	0	0	0	0
23	Doma	*Ficus carpensis*	*0*	0	5	5	0	1
24	Domini	*Ficus sur*	*6*	0	0	0	0	0
25	Duabankye	*Dialium aubrevillei*	*0*	0	0	0	0	1
26	Duamoko	*Drypetes aubrevillei*	*0*	0	2	1	4	0
27	Dubrafo	*Mareya micrantha*	*1*	0	0	0	0	0
28	Edinam	*Entandrophragma angolense*	*1*	0	0	1	1	3
29	Emire	*Terminalia ivorensis*	*2*	1	3	4	8	16
30	Entedua	*Copaifera salikounda*	*0*	0	3	0	0	0
31	Epro	*Nesogordonia papaverifera*	*1*	0	0	0	0	0
32	Esa	*Celtis mildbraedii*	*8*	2	5	9	7	0
33	Foto	*Glyphaea brevis*	*3*	0	0	0	0	0
34	Funtum	*Funtumia elastica*	*3*	2	1	4	0	0
35	Hohoroto	*Cecropia cecropiodes*	*12*	2	0	2	2	1
36	Hyedua	*Danielia ogea*	*3*	0	1	1	0	1
37	Kakapenpen	*Rauvolfia vomitoria*	*10*	0	4	17	3	44
38	Kokoanisua	*Spathodea campanulata*	*0*	0	3	0	0	0
39	Konkroma	*Morinda lucida*	*8*	23	3	3	2	7

			Communities sample for on-farm carbon measurement: Number of individuals recorded by community					
	Local Name	**Scientific Name**	**Kramokrom** 13 farms sampled	**Sureso Nkwanta** 7 farms sampled	**Yirase** 9 farms sampled	**Koduakrom** 9 farms sampled	**Domeabra** 13 farms sampled	**Meteameba/ Sefahkrom** 9 farms sampled
40	Kotreanfo	*Ficus sp*	*5*	0	1	0	0	0
41	Kroma	*Klainedoxa gabonesis*	*0*	1	0	0	0	0
42	Kube	*Cocos nucifera*	*1*	1	0	2	3	5
43	Kusia	*Nauclea diderrichii*	*0*	0	0	5	1	2
44	Kwadu	*Musa acuminata*	*135*	57	54	44	78	20
45	Kwakuobese	*Carapa procera*	*1*	0	0	1	0	0
46	Kyenkyen	*Antiaris toxicaria*	*1*	0	0	0	0	1
47	Mahogany	*Khaya ivorensis*	*2*	1	0	0	1	7
48	Nsoko-nua	*Garcinia epunctata*	*0*	0	0	0	1	0
49	Nufutene	*Kigelia africana*	*1*	0	0	0	0	0
50	Nyamedua	*Alstonia boonei*	*2*	3	13	0	8	1
51	Nyankyerene	*Ficus exasperata*	*2*	3	3	8	4	0
52	Odoma	*Ficus carpensis*	*3*	0	0	0	0	0
53	Odum	*Milicia excelsa*	*16*	11	2	14	6	10
54	Odwuma	*Musanga cecropioides*	*14*	25	34	40	8	3
55	Ofram	*Terminalia superba*	*5*	2	1	28	2	53
56	Okoro	*Albizia zygia*	*2*	0	2	9	5	0
57	Onyina	*Ceiba pentandra*	*1*	1	0	10	5	7
58	Opam	*Macaranga barteri*	*6*	8	5	0	4	2
59	Otie	*Pycnanthus angolensis*	*2*	1	2	2	3	2
60	Ototim	*Treculia africana*	*2*	0	0	0	0	0

			Communities sample for on-farm carbon measurement: Number of individuals recorded by community					
	Local Name	**Scientific Name**	**Kramokrom** 13 farms sampled	**Sureso Nkwanta** 7 farms sampled	**Yirase** 9 farms sampled	**Koduakrom** 9 farms sampled	**Domeabra** 13 farms sampled	**Meteameba/ Sefahkrom** 9 farms sampled
61	Owudifokete	*Vernonia conferta*	*0*	0	0	2	0	0
62	Oyaa	*Zanthoxylum leprieurii*	*4*	1	0	0	0	0
63	Paya	*Persea americana*	*19*	4	7	6	8	10
64	Pepea	*Margaritaria discoidea*	*3*	4	1	1	1	0
65	Punum	*Casearia barteri*	*1*	0	0	0	0	0
66	Sapele	*Entandrophragma cylindricum*	*0*	0	0	0	0	1
67	Sawere	*Acacia Kamerunensis*	*0*	0	5	0	0	0
68	Sesea	*Trema orientalis*	*2*	0	1	0	0	0
69	Sesemasa	*Newbouldia laevis*	*5*	9	33	9	32	8
70	Sofo	*Sterculia tragacantha*	*0*	0	0	0	1	0
71	Sonkyi	*Allanblackia parviflora*	*0*	0	0	4	0	2
72	Subaha	*Hallea lerdermannii*	*0*	2	4	0	0	0
73	Sudua	*Pachystela brevipes*	*0*	0	0	2	0	0
74	Tanuro	*Trichilia monadelpha*	1	1	1	0	0	0
75	Wama	*Ricinodendron heudelotti*	2	0	0	0	0	0
76	Wawa	*Triplochitin scleroxylon*	*0*	0	2	0	2	1
77	Wawabima	*Sterculia rhinopetala*	*0*	1	0	0	0	0
78	Yaya	*Amphimas pterocarpoides*	0	0	2	2	1	1
79	Cocoa	*Theobroma cacao*	384	209	203	310	465	304
Total Number of Individuals			***568***	**458**	**496**	**625**	**742**	**594**
Total Number of Species			***50***	**36**	**40**	**40**	**36**	**36**